RV SONNE SO245
Cruise Report / Fahrtbericht

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SO245 - *UltraPac:*
Process oriented biogeochemical, microbiological and ecological investigations of the ultraoligotrophic South Pacific Gyre

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TOC / Inhaltsverzeichnis

1. Cruise summary / Zusammenfassung

1.1 Zusammenfassung

Das Oberflächenwasser des südpazifischen Subtropenwirbels ist aufgrund seiner extremen Abgelegenheit von jeglichen Kontinenten das nährstoffärmste Gebiet des Weltozeans, was sich in den klarsten Gewässern und den niedrigsten Chlorophyll *a*-Konzentrationen widerspiegelt. Jüngste Studien deuten darauf hin, dass die mikrobiellen Nährstoff- und Kohlenstoffkreisläufe sich speziell an diese nährstoffarmen Gewässer angepasst haben, und dass der südpazifische Subtropenwirbel zudem ein Gebiet signifikanter Stickstofffixierung ist. Während eines Transektes durch den Subtropenwirbel haben wir die Regulierung der Stickstoff-, Phosphor- und Kohlenstoffkreisläufe, die Geochemie der Spurenelemente, und die mikrobielle Ökologie in der Wassersäule und den oberflächlichen Sedimenten an acht Haupt- und sieben Neben-Stationen untersucht. Der Transekt verlief von Osten nach Westen in drei Abschnitten: a) entlang 25°30‘ S an der nördlichen Kante des Subtropenwirbels von 84°33’ W bis 110°00‘ W, b) durch das Herz des Subtropenwirbels bis nach 39° S 140° W, und c) weiter westwärts entlang 39° S bis 170° W, wo wir die Station GR11 des GeoTraces-Programms aufgesucht haben. Die Beprobung beinhaltete die intensive Nutzung der CTD-Niskin-Flaschen-Rosette, des Planktonnetzes, der hochauflösenden Pump-CTD (Oberfläche bis 200 m), das Aufzeichnen von optischen Profilen, und das Sammeln von Sedimenten mittels eines Kastengreifers und eines Schwerelotes. Über den gesamten Transekt wurden ausserdem bei verschiedenen Tiefen insgesamt vierundsechzig Filter für die geochemische und molekularökologische Analyse mittels In-situ-Pumpen gesammelt.

Ein besonderer Schwerpunkt der Expedition waren die ‚Prozess‘-Studien, bei der mithilfe von stabilen und Radio-Isotopen die biogeochemischen und mikrobiologischen Prozesse experimentell untersucht wurden. In nahezu Echtzeit wurde die Anzahl der Bakterien gemessen und deren Identifikation durch Fluoreszenz-In-Situ-Hybridisierung (FISH) und 16S-rDNA Tag-Sequenzierung durchgeführt. Zusätzliche, teils automatisierte Messungen des Salzgehaltes, der Temperatur, der Fluoreszenz und der Anzahl der Bakterien des Oberflächenwassers wurden kontinuirlich bewerkstelligt. Untersuchungen zu kleinsten Kunststoffteilchen sowie Vogelbeobachtungen wurden im Verlauf der Reise ausgeführt. Um die Verteilung der verschiedenen Wassermassen und Partikelflüsse zu charakterisieren, wurden Proben für die Bestimmung der Seltenen-Erden und der U-Th-Isotope genommen.

Die ersten Ergebnisse der Expedition zeigen eine durchmischte Oberflächenschicht von 40 m und ein breites und ausgeprägtes Chlorophyll (Chl) *a*-Maximum in etwa 100 m Wassertiefe westlich von 84° W. Die Konzentration von gelöstem Sauerstoff nahm unterhalb des Dichtegradienten bis auf 20% Sättigung ab. Dies zeigt den Einfluss der Sauerstoffminimumzone, die sich vom Kontinentalrand von Südamerika bis in die offenen Gewässer dehnt. Das Chl *a*-Maximum, dort wo die meiste photosynthetische Aktivität und Produktion von organischen Kohlenstoff erfolgt, hat sich von etwa 70 m an den ersten Stationen nahe Chile auf etwa 190 m unterhalb der Oberfläche an den Stationen im Subtropenwirbel, Stationen SO245-04 (100° W) bis SO245-06 (110° W) vertieft. Im Subtropenwirbel bildete das Chl *a* eine dicke Schicht zwischen 150 und 250 m Wassertiefe. Die Intensität des Chl *a*-Maximums, gemessen über die Fluoreszenz-Sonde der CTD, blieb entlang des Ost-West-Transektes bei 23°30‘ S konstant, obwohl sich das Chl *a*-Maximum vertiefte. Weiter südwestwärts und entgegen des äußeren Randes des Subtropenwirbels, beginnend bei Station SO245-11, wurden die Chl *a*-Gehalte wieder flacher mit messbaren Fluoreszenzen in der oberen, 40-m durchmischten Schicht in Gewässern der Stationen SO245-11 und SO245-12. Entlang des 39° S Abschnittes, zeigten uns Chl *a*-reichere Gewässer zwischen der Oberfläche und 112 m Wassertiefe mit einem Maximum bei 55 m und die Ansammlung von Diatomeen auf den Filtern und in den Planktonnetzen, dass wir dort aus dem Subtropenwirbel heraus waren.

Die optischen Profile bestätigten das Vorkommen von ultra-klaren Gewässern im südpazifischen Subtropenwirbel, bei dem das UV-Licht in weit über 50 m Wassertiefe reicht. Dies wurde durch die Messung der Secchi-Tiefe sowie eines Forel-Ule-Index von bis zu 1, was indigoblaue Gewässer mit höchster Lichtpenetration andeutet, bekräftigt. Tiefenprofile der Absorption und Fluoreszenz von farbigem gelöstem organischen Material (cDOM) zeigten eine niedrige Absorption, welche typisch für den offenen Ozean ist. Die niedrige bis nicht-messbare Fluoreszenz von Huminstoffen im Oberflächenwasser verdeutlicht die starke Bleichung durch die Sonneneinstrahlung.

Die Verteilungen von anderen photoaktiven Verbindungen ko-variierten mit den entsprechenden, lichtdurchfluteten Tiefen und waren übereinstimmend mit den außergwöhnlichen Effekten der Klarheit des Wassers auf diese photochemisch-produzierten Verbindungen. DIe Photochemie spielt eventuell eine Rolle in der Reduzierung von Jodat und der Aufrechterhaltung von hohen Jodidmengen, ungeachtet der geringen Mengen von cDOM im Südpazifik. Innerhalb des Subtropenwirbels wurden signifikante Konzentrationen von Wasserstoffperoxid (H_2O_2) bis zu einer Tiefe von 300 m gefunden. Dies ist im Gegensatz zu den Stationen außerhalb des Subtropenwirbels, wo H_2O_2 in etwa auf die oberen 150 m beschränkt war.

Das Mitbringen der gesamten Ausstattung für die Analyse von 16S-rDNA Tag-Sequenzen war eine Premiere auf der UltraPac SO-245-Expedition. Hiermit war es möglich, eine Momentaufnahme der mikrobiellen Diversität in der Wassersäule innerhalb von 48 Stunden nach der Beprobung zu erhalten. Die so gewonnenen Diversitätsprofile über den gesamten südpazifischen Subtropenwirbel waren bemerkenswert ähnlich derer, die in anderen großen Subtropenwirbeln herrschen und zeigen die typische Zweiteilung der mikrobiellen Gemeinschaft: Die oberen 100-250 m wurden von Mitgliedern der Gruppe *Prochlorococcus* und der SAR11-Klade beherrscht, während Tiefen unterhalb von 500 m von Mitgliedern der Kladen SAR202 and SAR324 dominiert wurden (FIG. 1). Die Dominanz dieser Gruppen wurde mithilfe von FISH schon an Bord bestätigt. Assoziationen von Diatomeen mit Stickstofffixierern (DDA) wurden ebenfalls in Planktonnetzproben in der Mitte des südpazifischen Subtropenwirbels gefunden. Interessanterweise waren die bakteriellen Zellzahlen und die Konzentration von organischem Kohlenstoff am höchsten in Tiefen überhalb des Chl *a*-Maximums.

Anthropogener Eintrag von Nährstoffen in den Ozean hat einen zunehmenden Einfluss auf die Subtropenwirbel. Der südpazifische Subtropenwirbel mag der letzte, unberührte Subtropenwirbel der Weltozeane sein, wo man die Funktionen der (mikrobiellen) Gemeinschaften untersuchen kann. Die UltraPac-Expedition bietet grundlegende Daten und ein Verständnis der chemischen und mikrobiologischen Struktur und Funktion dieses enorm großen und wichtigen, aber kaum untersuchten Ökosystems.

1.2 Summary

Due to its extreme remoteness from any continents, the surface waters of the South Pacific Subtropical Gyre (SPG) are the most oligotrophic in the global ocean, with the clearest waters and lowest sea surface chlorophyll a concentrations. Recent studies indicate that microbial nutrient and carbon cycling is especially adapted for these ultraoligotrophic waters, and SPG may be a significant region of nitrogen fixation. We conducted a cross-gyre transect to investigate the controls on nitrogen, phosphorus and organic carbon cycling, trace element isotope geochemistry, and microbial ecology in the water column and surface sediments at 8 main stations, and 7 intermediate stations. The transect proceeded east to west over three sections: a) 25°30' S along the northern side of the gyre from 84°33'W to 110°00'W, b) southwest to 39°S 140°W through the heart of the gyre, and c) further westward along 39°S to 170°W where we linked up with GeoTraces station GR11. Sampling included extensive CTD-Niskin bottle sampling casts throughout the water column, in situ pump deployments at all main stations, plankton net sampling, high-resolution pumpcast sampling of the surface 200 meters, optical properties profiling, and box and gravity coring of the sediments. We also successfully collected a total of 64 *in situ* pump filter samples from various depths across the entire transect for geochemical and molecular ecological analysis.

A special focus of the expedition was on process studies, using radio-labeled and stable isotope tracer experiments to experimentally examine biogeochemical and microbiological processes. Bacterial cell counts, identification of cells with high throughput fluorescent in situ hybridization (FISH), and onboard 16S rDNA tag sequencing was performed at near to real-time pace. Additional underway sampling of salinity, temperature, fluorescence, aerosol measurements, dust collection, surface bacterial counts, microplastics and bird observations were also made. Rare earth element and U-Th series isotope samples were obtained to address water mass provenance and particle fluxes.

First results of the expedition showed a 40 m surface mixed layer and a broad and distinct chlorophyll a maximum centered around 100 meter water depth west of 84°W. Below the pycnocline, dissolved oxygen concentrations dropped to 20% saturation, reflecting the influence of the oxygen minimum zone that extends offshore from the South American continental margin. The chlorophyll a maximum, the layer where most photosynthetic activity and organic carbon production occurs, deepened from 70 meters near our first sites closer to Chile to depths of 190 meters below the sea-surface in the latter stations SO245-04 to SO245-06 (100° to 110° W respectively). In the gyre the Chl *a* formed a thick layer of between 150 to 250 meters water depth. Even though the Chl *a* max deepens it’s intensity as measured by the downcast CTD fluorescence remained constant along our 23°30’ S east to west transect. Southwestward and towards the outer edge of the gyre beginning with Station SO245-11, chlorophyll contents began to shoal, with detectable fluorescence in the upper mixed 40 meters of water at Stations SO245-11 and SO245-12. Along the 39°S section, chlorophyll rich waters between the surface and 112 meters with a peak at around 55 meters, abundant diatoms on filters and micronet samples indicated that we were out of the oligotrophic gyre.

Optical profiling measurements confirmed the existence of ultra-clear waters in the SPG with penetration depths of UV light far exceeding 50 m. This was further supported by Secchi Disc depths in the same range as well as Forel-Ule Indices up to 1, representing indigo blue waters with the highest light penetration. Vertical profiles of Colored Dissolved Organic Matter (CDOM) absorbance and fluorescence were typical of the open ocean with low absorbance attributalble to strong bleaching .

Distributions of other photoactive compounds co-varied with the apparent euphotic depths and were consistent with the extraordinary effects of the water clarity on photochemically produced species. Photochemistry may play a role in reducing iodate and maintaining high iodide levels in the South Pacific despite the low CDOM levels. Significant H_2O_2 concentrations were found down to 300 m in contrast to stations outside the SPG where H_2O_2 was restricted to the upper 150 m or so.

A premiere on the UltraPac SO-245 Expedition was to bring a complete 16S rRNA gene tag sequencing pipeline on board and to obtain a snapshot of the microbial diversity present in the water column within 48 h after sampling. The obtained diversity profiles across the entire SPG were remarkable similar to other major ocean gyres and show the typical separation into two major communities. The top 100 – 250 m are dominated by members of the genus *Prochlorococcus* and the SAR11 clade, whereas the depths below 500 m are dominated by members of the uncultured clades SAR202 and SAR324 (FIG 1). Dominance of these clades was confirmed by fluorescence in situ hybridization (FISH), which was also done onboard. Diazotroph-Diatom Associations (DDA) were also observed in samples from plankton net tows the middle of the SPG. Interestingly, bacterial cell counts and total organic carbon contents were also greatest above the chlorophyll peak surface waters.

Anthropogenic nutrient loading continues to impact sub-tropical gyres and the South Pacific Gyre may be the last, pristine gyre system in the world ocean, where ultra-oligotrophic (microbial) community function might be studied. UltraPac provides baseline data and understanding of the chemical and microbiological structure and function of this vast,important but rarely studied ecosystem.

2. Participants / Teilnehmer

2.1 Principal investigators / Leitende Wissenschaftler

2.1.1 Project Proponents and Institutes

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2.3 Scientific party / wissenschaftliche Fahrtteilnehmer

1.	Timothy G. Ferdelman	Chief Scientist	MPI
2.	Gaute Lavik	N&P Biogeochemistry	MPI
3.	Gabriele Klockgether	N&P Biogeochemistry	MPI
4.	Wiebke Mohr	N&P Biogeochemistry	MPI
5.	Clara Martinez-Perez	N&P Biogeochemistry	MPI
6.	Julia Dürschlag	N&P Biogeochemistry	MPI
7.	Patrick Downes	N&P Biogeochemistry	MPI
8.	Nina Heinzmann	N&P Biogeochemistry	MPI
9.	Candie Thorstensen	N&P Biogeochemistry	MPI
10.	Nico Stoll	Student Assist. /Dust Sampling	MPI/NIOZ
11.	Helena Osterholz	Dissolved Organic Matter	ICBM
12.	Dominic Sebastian Storey	Dissolved Organic Matter	ICBM
13.	Claudia Ehlert	Marine Isotope Geochemistry	ICBM/MPI
14.	Mathias Rehbein	Marine Isotope Geochemistry	ICBM/MPI
15.	Daniela Voß	Marine Sensors	ICBM
16.	Rohan Henkel	Marine Sensors	ICBM
17.	Bernhard Fuchs	Molecular Ecology	MPI
18.	Joerg Wulff	Molecular Ecology	MPI
19.	Sandi Oric	Molecular Ecology	MPI
20.	Greta Reintjes	Molecular Ecology	MPI
21.	Halina Tegetmeyer	Molecular Ecology	MPI
22.	Frank Pavia	Marine Isotope Geochemistry	LDEO
23.	Sebastian Vivancos	Marine Isotope Geochemistry	LDEO
24.	Peter Croot	Marine Chemistry	NUIG
25.	Allan Grassie	Marine Chemistry	NUIG
26.	Alina Wierczorek	Marine Chemistry	NUIG
27.	Sara Nicolas	Marine Chemistry	NUIG
28.	Mike Zubkov	Prokaryote Biogeochemistry	NOC
29.	Nina Kamennaya	Prokaryote Biogeochemistry	NOC
30.	Moritz Machelett	Prokaryote Biogeochemistry	NOC
31.	Ivo Tews	Prokaryote Biogeochemistry	NOC
32.	Juan Serratosa	Ornithology	UCNC
33.	Diego Bravo	Observer/ Chile	

Figure 2.1: The scientific crew of TFS Sonne *UltraPac* Expedition SO245

2.4 Crew / Mannschaft

1. Lutz Mallon	Captain
2. Niels-Arne Aden	Chief Mate
3. Jens Goebel	1st Mate
4. Hans-Ulrich Büchele	2nd Mate
5. Sabine Heuser	Surgeon
6. Achim Schüler	1st Engineer
7. Tim Stegmann	2nd Engineer
8. Roman Horsel	2nd Engineer
9. Hendrik Schmidt	Electrical Engineer
10. Henning deBuhr	Electrical Engineer
11. Jörg Leppin	Chief Scientific Technical Service (WTD)
12. Hermann Pregler	Electronics (WTD)
13. Matthias Großmann	System Manager
14. Volker Blohm	Fitter
15. Robert Suhr	Motorman
16. Sebastian Thimm	Motorman
17. Frank Tiemann	Cook
18. Andre Garnitz	Cook's Mate
19. Rene Lemm	Chief Steward
20. Luis Royo	2nd Steward
21. Mario Montevergin	2nd Steward
22. Maik Steep	2nd Steward
23. Thorsten Bierstedt	Boatswain
24. Arnold Ernst	Deck
25. Ingo Fricke	Deck
26. Frank Heibeck	Deck
27. Oliver Eidam	Deck
28. Stefan Koch	Deck
29. Reno Ross	Deck
30. Sascha Fischer	Deck

3. Narrative of the cruise / Ablauf der Forschungsfahrt

On Wednesday the 16th of December, all scientific members of the SO245 *UltraPac* expedition to the South Pacific Gyre (SPG) arrived and boarded the *TFS Sonne* in Antofagasta, Chile. The scientific crew of 33 souls representing seven institutes and nine nationalities were ready embark on a trans-Pacific expedition to investigate the geochemistry, biology, microbiology, optical properties, molecular ecology and biogeochemistry of the Earth's largest and most ultra-oligotrophic gyre system.

The scheduled sailing date was originally set for Thursday 17th of December. Unfortunately, and for reasons beyond our control and understanding, only a small fraction of the critical scientific and ship's spares necessary for scientific program and safe operation of the vessel had arrived in Antofagasta. Furthermore, a service technician who was supposed to repair the malfunctioning liquid scintillation counter (LSC) in the isotope container failed to appear. A second LSC brought by the NOC scientists also suffered a catastrophic detector failure, thus severely compromising our plans for radio-isotope experiments during the expedition. After nearly six days delay *Sonne* cleared the harbour entrance at 2 AM in the morning on the 23rd of December. Despite these initial set-backs, the *SO-245 UltraPac Expedition* was finally underway.

Later in the morning of Decmber 23rd having cleared Chilean territorial waters we activated the hydrosweep (EM122), Parasound, ADCP and underway surface seawater supply pumps. Sampling of the underway seawater for Ferry Box temperature and salinity measurements, collection surface microplastics, dust collection, and automated collection of water for bacterial counts began in the course of the day. Bird and surface ocean litter monitoring by a scientist from the U. of Coquimbo, Chile also commenced from atmospheric chemistry lab deck (Deck 8). The MPI container with lab supplies was unpacked and laboratory set-up began as we steamed westwards towards our first station.

We arrived at our first station SO245-01 on Christmas Day (See Figure 5.1). We combined our first two planned shallow water stations (to 500 meter water depth) into one somewhat larger station (SO245-01) in order to test equipment and sampling protocols for the expedition. This first station also allowed us to estimate the influence of the Humboldt Upwelling region on the eastern boundary of the South Pacific Gyre.

With the first station behind us, we settled into a routine of mid-day intermediate stations followed by 40 - 42 hour main stations. The intermediate stations typically included two CTD-bottle casts through the deep Chl a maximum to 500 meters, a shallower CTD-bottle cast for collecting water for incubation experiments, a Go Flo bottle deployment and the UV and optical profiling program. Science meetings to discuss data and upcoming plans were held on a regular basis with the entire science crew a day or two before arrival at each main station.

Main stations work typically commenced operations with short 15-25 nautical mile Parasound and Multibeam (EM 122) surveys of the area to evaluate seafloor bathymetry. The information was used to estimate CTD maximum depths as well as determine suitable site for later geological coring operations. Water column sampling included five to six CTD Nisken Bottle Rosette sampling over the entire water column. A Secchi Disk/Forel-Ule Ocean Color deployment was included with the UV and Optical Stalantic profiler program in order characterize ocean optical properties. Continuous flow pumpcast CTD, Go-Flo Bottles and Micronet deployments to 250 meters were made on a plastic coated cable run off the starboard stern of the ship. Eight McLane in situ Pumps via the CTD cable for the collection of particles for U-Th, rare earth element isotope distributions and microbial populations were deployed throughout the entire water column. Pump deployment time was set for six hours (except at Station SO245-15 where pumps were deployed for three hours over the upper 1250 m). At all eight main stations, the eight in situ pumps performed flawlessly, pumping 200 to 1500 liters of water at various depths. Overall we obtained 64 priceless filters sampled *in situ* from across the entire South Pacific that are now available for particulate bound isotope and molecular ecology studies.

The first CTD traces west of 84°W showed a 40 m surface mixed layer and a broad and distinct chlorophyll a maximum centered around 100 meter water depth (see Figure 7.1) Below the pycnocline, dissolved oxygen concentrations dropped to 20% saturation, reflecting the influence of the oxygen minimum zone that extends offshore from the South American continental margin. In the first week of January we had reached the first hinge point where we turned southwest away from the 23°30'S transect and headed through the heart of the SPG. The chlorophyll a maximum, the layer where most photosynthetic activity and organic carbon production occurs, deepened from 70 meters near our first sites closer to Chile to depths of 190 meters below the sea-surface in the latter stations SO245-04 to SO245-06 (100° to 110° W respectively). In the gyre the Chl *a* formed a thick layer of between 150 to 250 meters water depth. Even though the Chl *a* max deepened its intensity as measured by the downcast CTD fluorescence remained constant along our 23°30' S east to west transect. Interestingly, bacterial cell counts and total organic carbon contents were greater above the chlorophyll peak.

Southwestward and towards the outer edge of the gyre beginning with Station SO245-11, chlorophyll contents began to shoal, with detectable fluorescence in the upper mixed 40 meters of water at Stations SO245-11 and SO245-12. Along the 39°S section, chlorophyll rich waters between the surface and 112 meters with a peak at around 55 meters, abundant diatoms on filters and micronet samples indicated that we were out of the oligotrophic gyre. Ongoing, bacterial cell counts, identification of cells with high throughput fluorescent in situ hybridization (FISH), and onboard 16S rDNA tag sequencing were also carried out onboard at a near to real-time pace by the MPI Molecular Ecology group. These onboard analysis yielded unique insights into the changing microbial community structure as we moved out of the gyre into more productive waters.

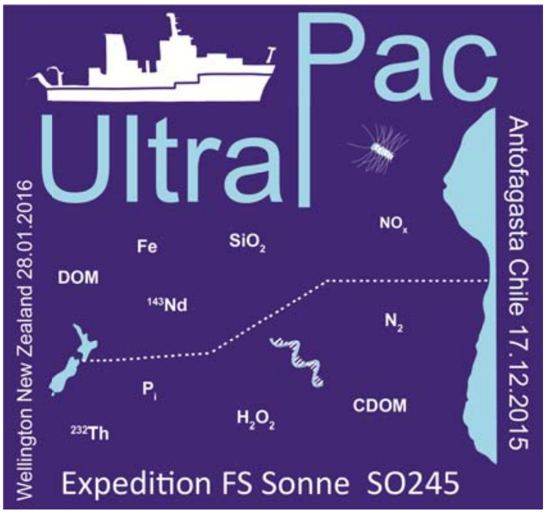
Approximately halfway through the expedition we also crossed the East Pacific Rise, the impressive north-south range that divides the South Pacific Ocean seafloor into eastward and westward moving ocean crust. In doing so we also crossed the *Biosope* Expedition transect (from Tahiti to Valparaiso, Chile, 2004) and reoccupied the "GYR4" station of the *Biosope* expedition at our intermediate Station SO245-07. Due to various time-saving measures and the excellent 13 knot sailing speeds of the *Sonne*, we decided to pursue our original plans to address diurnal variation in the microbial populations at gyre station (SO245-08). The extra 12 hours of station time included four extra high resolution CTD-bottle casts through the upper 250 meters of water throughout the night of January 6 throughout the following day, where sun-driven peroxide production throughout the upper water column was documented. A small boat foray was also launched to obtain uncontaminated surface seawater trace element samples away from the ship.

Box coring operations were successful at all eight main stations; gravity coring less so. At SO245-02 box coring yielded a thin 20 cm layer of brown clays overlying a stiff carbonate layer at SO245-02. At the next main SO245-04 we recovered excellent box and gravity cores containing fine brown clays of 50 and 375 cm length respectively. The box core at Site SO245-10 returned with pebble sized manganese nodules scattered randomly across the surface, whereas the box cores at SO245-12 though SO245-15 were covered with 3-7 cm diameter manganese nodules. Cores and sediment samples were processed and stored for curation at the MARUM GeoB Core Repository in Bremen.

The *UltraPac* expedition was generally blessed with good weather. Only at Station SO245-11 did the weather and sea-state take a turn for the worse. Long period swells and wave heights of up to 5 m and winds from the south slowed transit speeds to 11 knots and caused some deployments to be cancelled. Although we had gained considerable time over the initial science plan with increased ship speeds and shortened station times, the loss of days at the beginning of the cruise and the uncertain weather situation in latitudes south of 40°S led us to move the last main and intermediate stations northwards along 39°S. At Station SO245-15 we were still able to link up with a *GeoTraces* north-south transect station (GR12). As the UltraPac expedition is listed as a *GeoTraces* Data Compliance and Process Expedition, we were pleased to have adequate time to sample this site, especially for the rare earth element and U-Th isotope studies.

On January 25, the last coring operations were completed and at 06:00 we turned our course for Wellington, marking the end of our approximately 4600 nautical mile scientific transect through the South Pacific Subtropical Gyre. After fifteen stations and nearly 200 sampling events over fifteen and one-half days of station time, laboratory operations ceased on the evening of January 26th. Final packing of airfreight and six containers of laboratory equipment and samples on January 28, 2016 in Wellington Harbor, concluded the shipboard activities the *TFS Sonne UltraPac Expedition SO245*.

A post-cruise meeting for shipboard and shore-based scientists to discuss the first results of the SO245 *UltraPac* Expedition has been scheduled to take place on September 22-23, 2016 at the Max Planck Institute for Marine Microbiology, in Bremen.



4. Aims of the Cruise / Zielsetzung der Forschungsfahrt

4.1 General Aims

Due to its extreme remoteness from any continents, the surface waters of the South Pacific Subtropical Gyre (SPG) are the most oligotrophic in the global ocean, with the clearest waters and lowest sea surface chlorophyll a concentrations. Recent studies indicate that microbial nutrient and carbon cycling is especially adapted for these ultraoligotrophic waters, and SPG may be a significant region of nitrogen fixation. Anthropogenic nutrient loading continues to impact sub-tropical gyres and the South Pacific Gyre may be the last, pristine gyre system in the world ocean, where ultra-oligotrophic (microbial) community function might be studied. Thus, *UltraPac*, a cross-gyre transect to investigate the controls on nitrogen, phosphorus and organic carbon cycling, trace element isotope geochemistry and microbioal ecology in the water column and surface sediments was undertaken. *UltraPac* should provided baseline data and understanding of the the chemical and microbiological structure and function of this vast, important but rarely studied ecosystem.

A special focus of the expedition was on process studies, using radio-labeled and stable isotope tracer experiments to experimentally examine biogeochemical and microbiological processes. Bacterial cell counts, identification of cells with high throughput fluorescent in situ hybridization (FISH), and onboard 16S rDNA tag sequencing was performed at near to real-time pace. Additional underway sampling of salinity, temperature, fluorescence, aerosol measurements, dust collection, surface bacterial counts, microplastics and bird observations were also made. Rare earth element and U-Th series isotope samples were obtained to address water mass provenance and particle fluxes.

4.2 Major Themes of Proposed Research

4.2.1 The Dissolved Organic Matter (DOM) Paradox

Even though dissolved organic matter (DOM) in the SPG may have a marine microbial origin and contain significant amounts of nitrogen, this DOM appears not to be involved in active cycling by heterotrophic and autotrophic microorganisms. We addressed the DOM Paradox by taking samples to characterize the DOM pool, examine the impact of labile compound on DOM turnover, and examine photolytic reactions on DOM.

4.2.2 Diversity and function of the microbial community

We aimed at a comprehensive description of the structure and function of the microbial community with up-to-date molecular biological tools in the Southern Pacific Ocean

This included investigation of the vertical and horizontal distributions of the microbial community throughout the oligotrophic SPG across biological gradients and from surface waters to the deep, dark “twilight zone“, and finally into the sediment surface.

A goal was to experimentally test the concept that mixotrophic protists in the oligotrophic waters control the dominant bacterioplankton populations, and compete for depleted inorganic Fe. A combination of on-board isotopic tracer (^{55}Fe, ^{14}C, ^{35}S, ^{3}H, ^{33}P, ^{32}P) experiments plus high resolution mapping of spatial distributions of dominant planktonic prokaryotes and protists was to be pursued.

4.2.3 Nitrogen, Phosphorus and Trace Element Biogeochemistry

Earlier observations of complex N_2-fixing communities in the SPG suggest that we have underestimated the activities and diversity of the diazotrophic communities in the world’s oceans. Generally it is thought that rates N_2-fixation are more closely associated with the oligotrophic waters. We tested the spatial distribution of N_2-fixation rates across the entire

SPG and across the rims of the SPG at both the southwestern and eastern ends of the transect.

Biogeochemical processes and the microbiology of the deep SPG waters are even more poorly understood than that of the surface waters. The deep pelagic waters of the SPG are key sites for organic carbon mineralization and associated processes, which will be experimentally investigated.

4.2.4 Water Mass Transport and Dust Provenance

The controls on Nd isotope signatures in the SPG were investigated in order to characterize the Nd isotope signature of northward flowing Subantarctic Mode Water (SAMW) and Antarctic Intermediate Water (AAIW), and of th

e main return flow of Pacific Deep Water (PDW) to the Southern Ocean. Neodymium isotopes in authigenic Fe-Mn oxide precipitates in marine sediments are used to reconstruct the past seawater isotopic composition, which provides insight into past circulation changes.

Dust input to the ocean plays an important role in the delivery of micronutrients and ballast for sinking particles in the SPG. Aerosols from the atmosphere using dust collectors and their major-, trace-, rare-earth elements (REE), minearalogical and Nd isotope signatures will yield information on provenance and geochemistry of aeolian particle inputs to the SPG.

Samples were collected to examine the near absence of particle scavenging on REE concentrations and Nd isotopes in an area of low dust flux and low biological productivity. The low supply of dust to the South Pacific gyre region in combination with low biological productivity presents a unique and extreme situation under which the sources, sinks and cycling (reversible scavenging, bottom release/scavenging, lateral transport) of Nd can be tested and quantified. We will combine this with particle fluxes estimated from U-Th disequilibria.

5. Agenda of the cruise / Programm der Forschungsfahrt

5.1 Cruise track

A cross-Pacific transect was undertaken that proceeded east to west over three sections: a) 25°30' S along the northern side of the gyre from 84°33'W to 110°00'W, b) southwest to 39°S 140°W though the heart of the gyre, and c) further westward along 39°S to 170°W where we linked up with GeoTraces station GR11. Sampling included extensive CTD-Nisken bottle sampling casts throughout the water column, in situ pump deployments at all main stations, plankton-net (micronet) sampling, high-resolution pumpcast-CTD sampling of the surface 200 meters, optical properties profiling, and box and gravity coring of the sediments.

Station locations for the interim sites were selected underway so that arrival time on station would occur over the middle of the daylight hours.

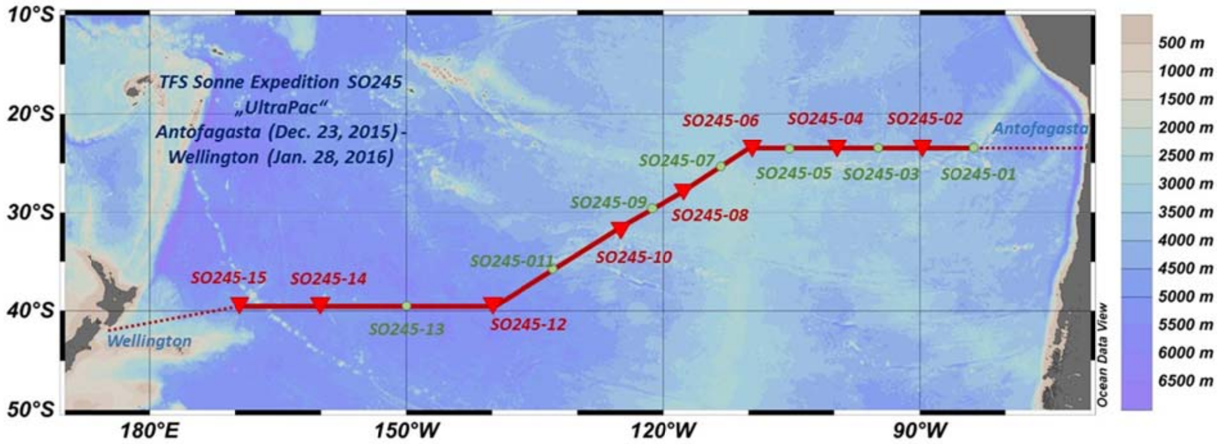


Figure 5.1: Cruise track of TFS Sonne *UltraPac* Expedition SO245. Red triangles mark Main Stations, whereas Intermediate Stations are indicated with green circles.

5.2 Main and Interim Station Sampling

Eight main stations with sampling from surface waters to the sediment were planned and fully executed. At Station SO-245-08 (27°44.5'S; 117°37.2'W), which was considered to be in the middle of the gyre, we ran an extended program designed to capture diurnal variability in various microbiological and biogeochemical processes.

Station operations at all main and interim stations began with “clean ship” conditions on the approach to the station, typically at distance of 3 nautical miles before the station. Clean ship operations were active at all times for the intermediate stations. Main stations were approached at 6 knots starting 3 nautical miles at which point a short profile with Multibeam and Parasound were run for ca. 2 to 3 hours to map the seafloor. The goal of the mapping was to ascertain seafloor topography for the following deep CTD cast and to identify optimal coring sites.

5.2.1 Main Station Deployments

A CTD-Nisken Bottle cast through the entire water column to 50 to 100 meters above the seafloor always constituted the first deployment of equipment over the side of the ship. Based on the water column salinity, temperature and fluorescence (as an indication of autotrophic biomass) profiles, 15 to 20 depths were chosen for water sampling on the upcasts and later CTD-Nisken bottle casts. Generally, another 4 to 5 bottle casts were made over the course of the time on Station. Samples were taken for dissolved gases, carbonate and water isotopes, nutrients, dissolved organic matter, particulate C,N,P&S, trace element chemistry, U-Th distributions, rare earth elements, chl a, total cell counts, fluorescent in situ hybribridization (FISH), gene expression, and metagenomics. Water samples were also obtained for various productivity and N2-fixation experiments.

Water samples for trace metal clean experiments were also collected over the upper 200 meters of the water column by deployment of single Go-Flo bottles off the starboard stern of the ship. These bottles were hung on a plastic-coated wire and fired at depth with plastic coated wireline-messengers. High resolution water samples were also obtained using the same wire and a Pumpcast-CTD system, in which water was pumped from exactly characterized depths (as determined from the CTD unit attached to the pump) through plastic tubing into the Wet Laboratory I. In addition to the high-resolution sampling of the pumped water, continuous monitoring of chemical properties such as fluorescence and dissolved oxygen could take place. Micronet sampling for the collection of plankton also proceeded over the same wire with tows from approximately 200 meters to the surface. Deployment of equipment over this stern wire often occurred simultaneously with operations on the main CTD wire.

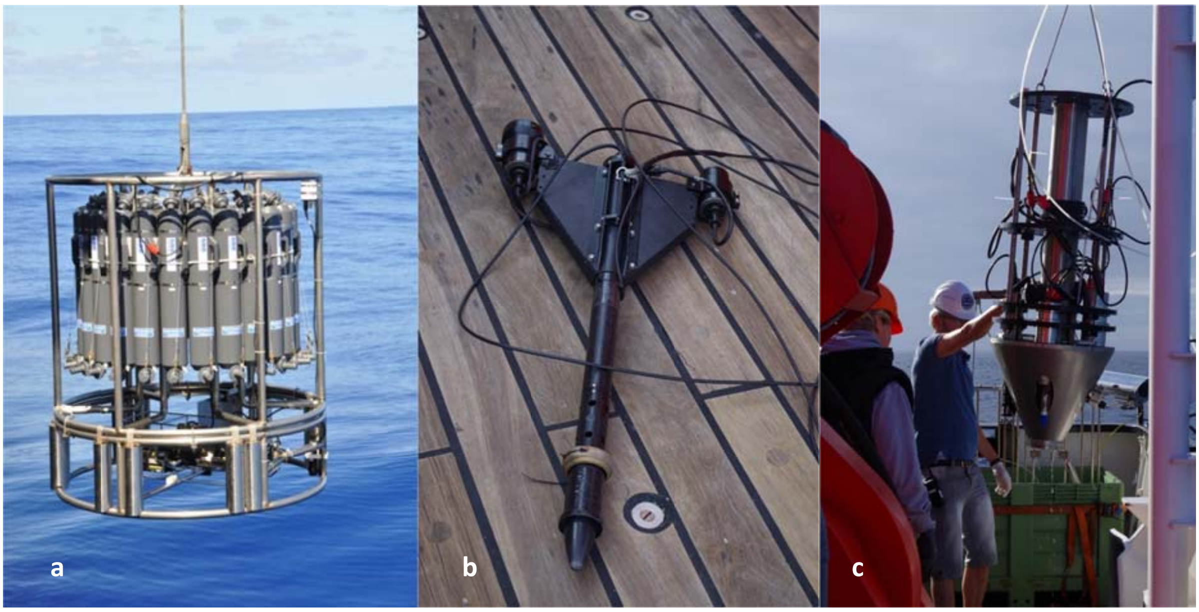


Figure 5.2 (a) Onboard device Seabird 'sbe911+' CTD probe with sampling rosette (24 x 10L). *(b)* A HyperPro II profiling system (Satlantic, Halifax, Canada) was used to acquire bio-optical data for different parameters. The profiler consists of one hyperspectral irradiance and one hyperspectral radiance sensor, as well as fluorescence and backscatter sensors and an integrated CTD. *(c)* Pumpcast-CTD being deployed off the starboard stern.

At Station SO245-08 in the middle of the gyre, an expanded set of bottle casts and micronet deployments were made to allow for a diurnal study. Additionally, a small boat foray away from the ship was undertaken to obtain contamination free surface samples.

On all main and intermediate stations, optical properities of the upper water column were investigated. This involved deployment of Secchi Disk, Forel-Ule estimates of ocean color, and the deployment of UV and Optical free-fallling profilers between the hours of 09:00 and 16:00. The profilers were set out from the stern portside to 50 and 200 meters respectively in free-falling mode as the ship gently moved forward.

Eight McLane Research Laboratories WTS-LV Standard Model in-situ pumps were deployed over the entire depth of the water column on the CTD wire at each of the eight main stations to collect suspended particles for microbiological (molecular) and geochemical analysis. Six of the eight pumps were fitted with MnO_2 cartridges on the outflow to collect Actinium and Radium isotopes. Pumping time was set for six hours, and total deployment and retrieval time consumed approximately 12 hours. All 64 pump deployments were successful. Water samples from the CTD-Nisken Bottle Rosette were also collected during retrieval.

With the completion of water column sampling activities, clean ship conditions were ended and geological coring operations commenced. This consisted of one box core deployment and one gravity core deployment per main station. Gravity core deployments were not always successful, and given the time constraints, were not repeated. Box core deployments were successful at all eight main stations. Box cores were sub-sampled on deck subsequent to retrieval. Gravity cores were sectioned into one meter lengths, labelled and stored for shipment back to Bremen. In addition to sampling and analysis onboard, box core and gravity core samples will be curated in the MARUM GeoB Core Repository.

5.2.2 Interim Station Deployments

Operations at the interim station sampling (typically one station between the main stations) were restricted to CTD Nisken and Go-Flo bottle sampling down to 500 meter water depth and optical property measurements. The only exception to this plan was at the very first station SO245-01, where a slightly expanded set of operations was conducted to gain handling experience with the micronet and pumpcast-CTD.

5.2.3 Underway Measurements

In addition to shipbased underway data (e.g. weather condition, incident light, EM122 Multibeam, Parasound, etc..) additional underway scientific samples and data particular to the UltraPac Expedition were obtained.

A FerryBox is a flow-through system deployed as an underway device for ship expeditions and for attendant measurements during stationary operations. The system provided basic data at high spatial and temporal resolution for salinity, temperature (at the intake and inside the system), Chl *a* -fluorescence, turbidity, and dissolved oxygen.

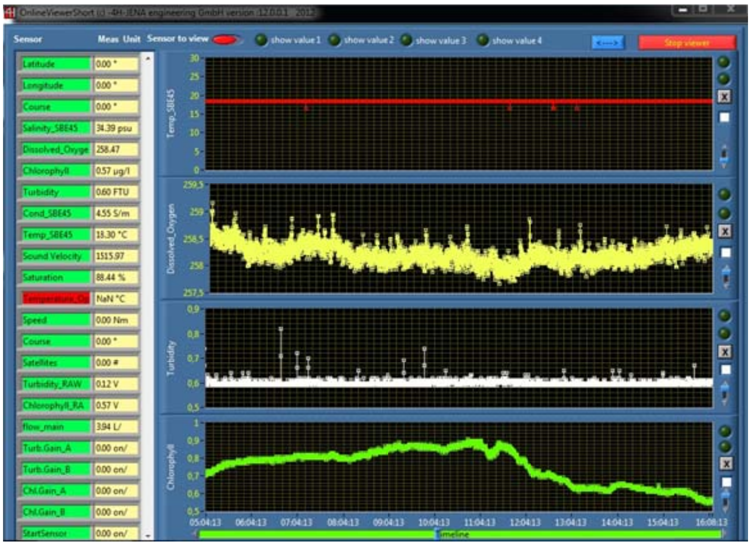


Figure 5.3 Screenshot of the FerryBox system for multi-parameter sensing on the 16.01.2016 from UTC 05:04 until UTC 16:08 for temperature, dissolved oxygen, turbidity, and chlorophyll fluorescence

The underway surface seawater supply was sampled every 30 mins to monitor bacterioplankton abundance. Sampling commenced on the 26th December 2015 and finished on the 25th January 2016. Underway samples were drawn from the ship's non-toxic seawater supply, using the Kreiselpumpe. After the 2nd January, the Membrane pump was used for sampling. Samples were also taken from this system for Nd isotope studies.

Large volume samples for the collection of microplastics were obtained from the ships underway pumping system by pumping the water through a flow meter and into a micronet.

The distribution of seabirds and marine debris was continuously monitored by a scientific observer positioned at the flying bridge (Deck 8) of the ship.

Collection of airborne dust particles underway using was done by the installation of two Anderson high-volume dust samplers equipped with glass- fibre filters on Deck 9.. Dust collection started on the 25th of December 2015 at 12:27 (UTC) 23°29,998' S and 84°16,723' W. Both units were in almost constant use until the end of lab work at 05:09 (UTC) on the 26th of January 2016. Discrete Aerosol Optical Thickness (AOT) measurements were made using a handheld MICROTOPS II instrument kindly loaned by the NASA/Goddard Space Flight Centre in conjunction with the AERONET Maritime Aerosol Network program .

6. Settings of the working area / Beschreibung des Arbeitsgebiets

The ocean sub-tropical gyres are considered marine biological deserts, with low primary productivities linked to the low availability of nutrients. Nonetheless, ocean basin gyre ecosystems have a large and important impact on the biogeochemical cycles of the world ocean, in part due their vast size. Accumulating evidence, moreover, suggests that the biology and chemistry of sub-tropical ocean gyres are increasingly impacted by anthropogenic activities (Duce et al, 2008).

Of all of the main ocean gyre systems, the South Pacific Gyre (SPG) is by far the largest and most remote. Due to its size and extreme distance from continental land masses, the SPG is also the most oligotrophic of all marine environments. The SPG contains the absolute lowest concentrations of chlorophyll-a (an indirect measure of biomass) and the clearest natural waters in the world (Morel et al., 2007). Satellite images from outer space show the South Pacific Ocean completely dominating the view of the Earth (Figure 6.1), yet the SPG is one of the least studied marine ecosystems in the world. This is particularly striking deficit, given the potentially large role of the South Pacific may play in a number of global biogeochemical cycles, in particular those of carbon, nitrogen, phosphorus, and iron (C, N, P and Fe).

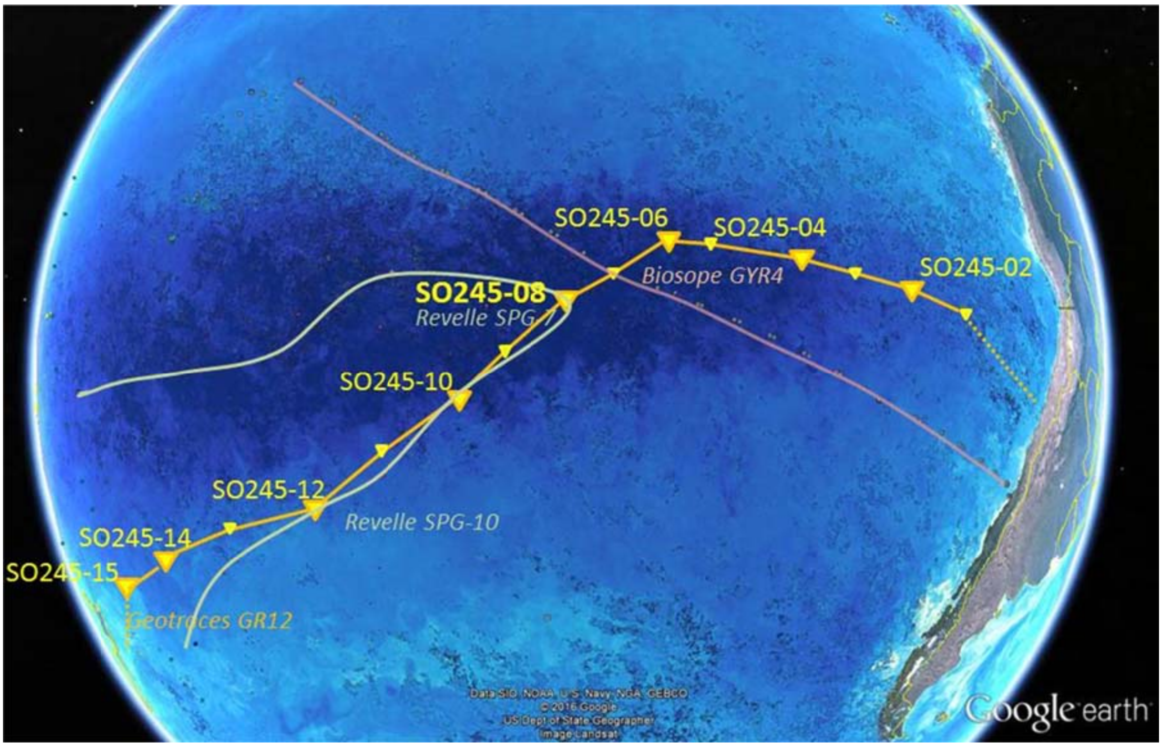


Figure 6.1: Cruise track of TFS Sonne Expedition SO-245 UltraPac overlaid on ocean color distribution in Google Earth.Dark blues indicate areas of low to not detectable chl a as estimated from satellite. Also indicated are the cruise tracks from the 2004 *BIOSOPE* (light red) and 2006-07 *RV Revelle* “Knox02-RR” (light green) expeditions. The GeoTraces GR N-S transect lies along the western edge of this view.

Over the past two decades only a few research expeditions have investigated what factors (both abiotic and biotic) limit the biomass, and ultimately the primary production of the SPG. Results from the French *BIOSOPE* expedition in 2004 indicate that the SPG surface waters are characterized by extremely low nutrient concentrations and very low primary productivity (Wambeke et al. 2008; Masquelier and Vaulot, 2008; Obernoster et al., 2008). It was observed that surface dissolved Fe concentrations vary across the ocean basin with depletion in the center gyre; dissolved iron concentrations are also depleted to a greater depth (ferricline) than nitrate. Moutin et al. (2008) suggested that either iron or temperature, but not dissolved P, limits primary productivity and N_2 fixation in the central gyre. Iron is important to phytoplankton since cofactors of photosynthesis require Fe (Kustka et al. 2002), and Fe is needed for nitrogenase of N_2-fixers (diazotrophs) (Berman-Frank et al. 2001, Falkowski 1997, Kustka et al. 2002).

The "Integrated Ocean Drilling Program (IODP) Site Survey" Expedition onboard the *R/V Roger Revelle (Knox02-RR)* to the ultraoligotrophic regions of the SPG in support for the IODP Drilling Expedition 329 South Pacific Microbiology (October-December 2010 onboard *D/V Joides Resolution*) also examined productivity and nitrogen fixation in the upper 200 meters of the gyre water column (Halm et al., 2012). The authors proposed that a tight coupling between heterotrophic and/or photoheterotrophic N_2-fixation and the excretion of dissolved organic matter (DOM) by phyotoplankton exists. Interestingly, the SPG waters, although oligotrophic, contain relatively high concentrations of dissolved organic carbon (DOC), (Raimbault et al. 2008, Hansell et al. 2009).

The flux of particles to the deep waters of the SPG is extremely low. Sediment accumulation rates in the SPG are typically far less than 1 m Ma^{-1} (D'Hondt et. Al., 2009; D'Hondt et al., 2015). The deep "dark" ocean is a key site for organic carbon mineralization and may still represent a significant term of overall chemoautotrophy in the global ocean). Although extremely low, the flux of particles and their subsequent impact on the microbiology and biogeochemistry of the deep pelagic zone of the SPG has not been studied, in particular the chemoautotrophy (Arestgui et al., 2009). The microbiology and trace element scavenging within this zone may also be more likely to be affected by hydrothermal input. Hydrothermal inputs of iron have recently been shown to impact the deep South Pacific Ocean over basin scales (Fitzsimmons et al., 2014; Resing et al., 2015).

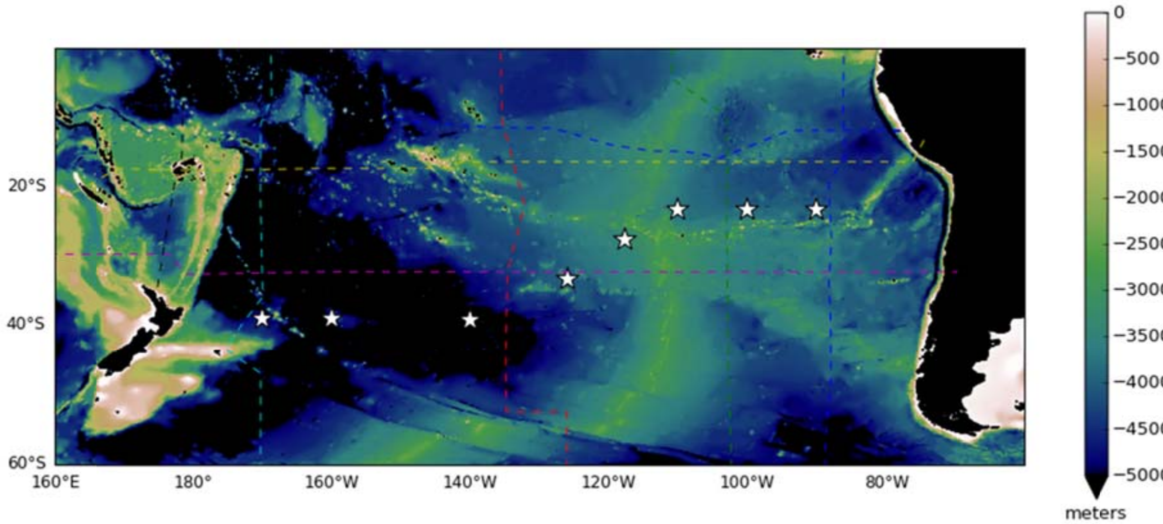


Figure 6.2 The UltraPac cruise track (white stars) compared with locations of WOCE sections (colored dashed lines). Gridded seafloor bathymetry is shown in color. *UltraPac* fills a gap between WOCE transects at 15 ºS and 30 ºS, and will be of great use in determining the circulation regimes of the deep South Pacific.

Sediments in the investigated area lie in water depths ranging from 3470 to 5695 meters and on ocean crust with ages of 13.5 Ma off the western axis of the East Pacific Rise and rising to up to >70Ma at westwards and southwestwards at Sites (U1366 and U1371 respectively). The dominant sediment lithology along the deep water sites (U1365 – U1367) is a zeolitic metalliferous clay (D'Hondt et al., 2011). Manganese nodules are common on and near the surface at these sites. A shift to carbonate lithology is observed in shallowest water depths along the East Pacific Rise. Organic carbon fluxes to the heart of the SPG range from 1 to 10 nmol C cm^{-2} a^{-1} (D'Hondt et al, 2009). Thus, the sediments of the SPG seafloor are completely oxic to the ocean crust (D'Hondt et al, 2009; Fischer et al., 2009; D'Hondt et al., 2015). Surface sediment cell counts are some of the lowest recorded for the Ocean (D'Hondt et al., 2009).

7. Work details and first results / Beschreibung der Arbeiten im Detail einschließlich erster Ergebnisse

7.1 Ocean Physics (R. Henckel, D. Voß; PI: O. Zielinski)

7.1.1 Oceanographic parameters from the ship's CTD

CTD casts were performed with a Seabird 'sbe911+' CTD probe with sampling rosette (onboard device) at each station, as an initial activity at the station to determine further key discrete sampling depths, e.g. to locate chlorophyll maxima. Live data acquisition was carried out via CTD-client onboard (Seasave V7.23.2) and data post-processing with Seasoft V2. Salinity and depth were calculated from pressure values (UNESCO, 1983), and temperature was corrected to ITS-90 (Preston-Thomas, 1990). The CTD was equipped with additional sensors for turbidity, fluorescence, oxygen, and PAR. All CTD data will be published via Pangaea® (www.pangaea.de). CTD data are under process and will be published as soon as possible linked to cruise track and cruise identifier SO245.

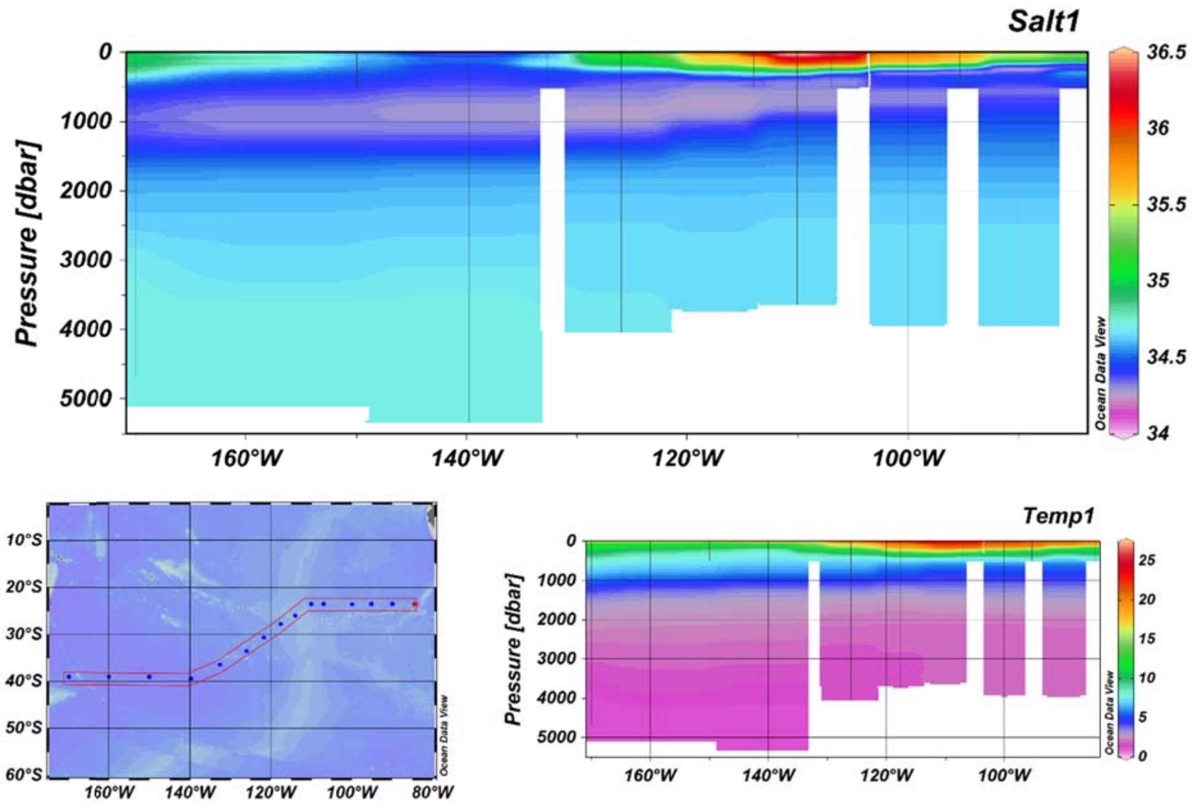


Figure 7.1 CTD derived parameters mapped out over the transect from *TFS Sonne SO245 UltraPac* expedition: a) salinity (units ppt), b) cruise track,and c) temperature (units, °C).

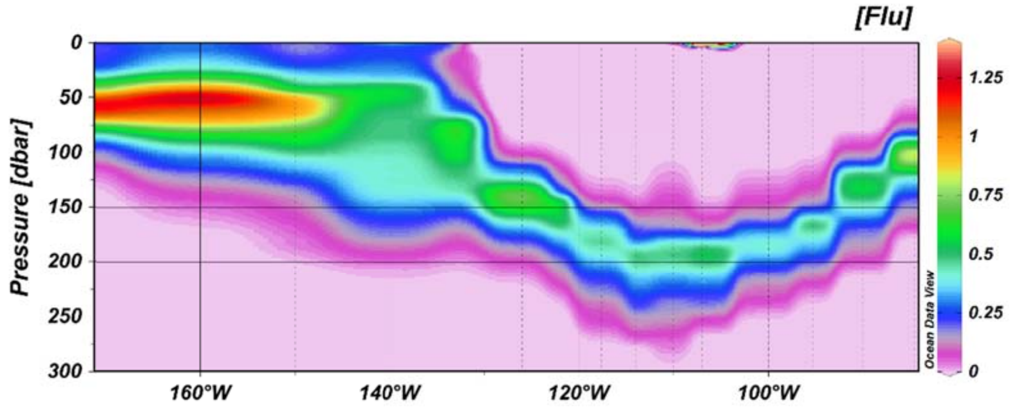


Figure 7.2 CTD derived fluorescence as measure of chlorophyll a content (units µg chl a kg^{-1} seawater).

7.1.2 FerryBox Underway measurements

A FerryBox is a flow-through system deployed as an underway device for ship expeditions and for attendant measurements during stationary operations. The system provides basic data at high spatial and temporal resolution for various parameters, e.g. salinity, temperature (at the intake and inside the system), Chl *a* -fluorescence, turbidity, and dissolved oxygen. For multi-parameter sensing and validation of the ships flow-through system (equipped with thermosalinograph and bbe FluoroProbe sensor), the FerryBox was fed by water from the ship system via a bypass. Measurements were performed at a sampling interval of 1 min starting at the 23.12.2015 at 17:46 (UTC), running continuously until the 25.01.2016 at 01:46 (UTC). Once a day, a salinity reference sample was taken (glass bottle, 250ml) to validate the salinity sensor of the FerryBox as well as the salinity probe of the thermosalinograph of the ships system. Analysis of the salinity samples is ongoing.

7.2 Ocean Optics (D. Voß, R. Henkel; PI: O. Zielinski)

7.2.1 Satlantic Profiler (Bio-Optic Profiling)

Light is crucial for most marine organisms, especially for primary producers that serve as the base of the ecological food chain. To better understand the characteristics of underwater light, in-situ observations are essential for the development of effective remote sensing algorithms. Nowadays, in-situ light field measurements are commonly utilized to validate satellite data, covering vast areas of the northern and southern hemispheres. However, less optical data exists for the South Pacific Subtropical Gyre (SPG). Here, the surface waters are known to be the most oligotrophic in the global ocean, characterized by the clearest waters and lowest sea surface chlorophyll a concentrations anywhere.

A HyperPro II profiling system (Satlantic, Halifax, Canada) was used to acquire bio-optical data for different parameters. The profiler consists of one hyperspectral irradiance and one hyperspectral radiance sensor, as well as fluorescence and backscatter sensors and an integrated CTD. A second hyperspectral irradiance sensor was mounted on the research vessel for reference measurements. On the profiler, the irradiance sensor measures downwelling and the radiance sensor upwelling light. The fluorescence sensors measure chlorophyll, CDOM, phycoerythrin and phycocyanin fluorescence signals. The backscatter sensor retrieves data at 470 nm and 700 nm. Profiler measurements were conducted at selected stations depending on sea and weather conditions. At these stations, three casts at the back of the ship were typically performed in free-falling mode (1x full depth, 2 x 50 m). At each cast, the profiler was lowered until the downwelling light values were of the same order of magnitude as the background noise level of the sensor. Besides the VIS version a second UV profiling system (Satlantic, Halifax, Canada) was used at each station to determine the penetration of UV light in the water column. On the profiler, 2 irradiance sensors (selected wavelengths) measure the downwelling light. A second hyperspectral irradiance sensor was mounted on the research vessel for reference measurements of the full light availability. Three casts at the back of the ship were typically performed in free-falling mode (1x full depth, 2 x 50 m).

Data confirm ultra-clear waters in the SPG with penetration depths of UV light far exceeding 50 m. This was further supported by Secchi Disc depths in the same range as well as Forel-Ule Indices up to 1, representing indigo blue waters with the highest light penetration. Processing and modeling is still ongoing, an example of photosynthetically active radiation measurements from the UV profiling casts of selected stations is shown Figure 7.2.

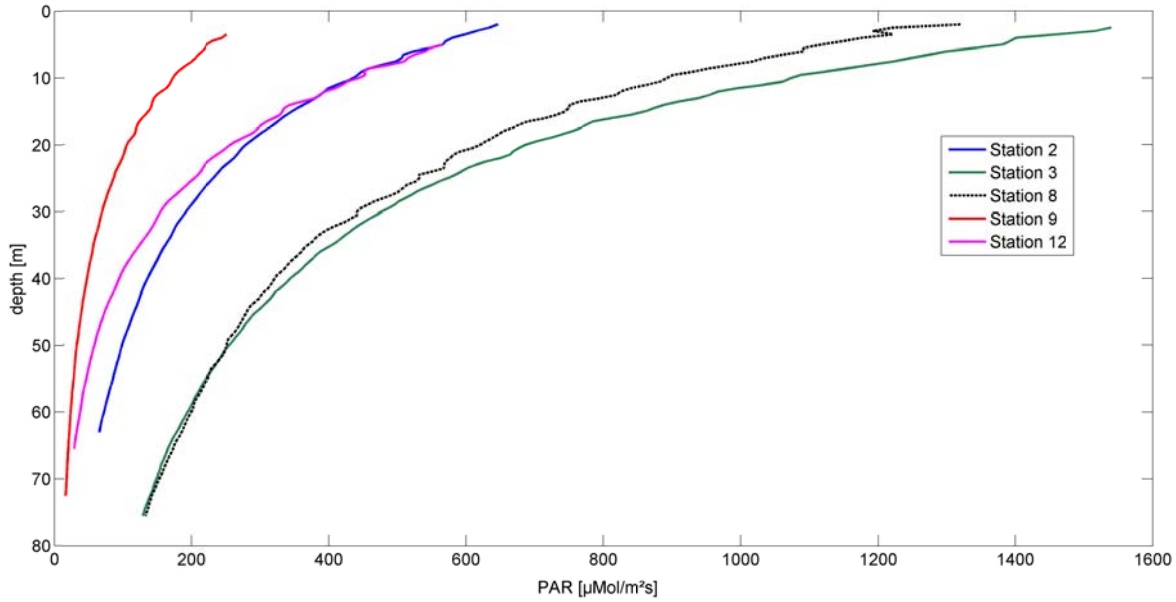


Figure 7.3. Photosynthetically active radiation [µmol/m²s] from UV profiler measurement at selected stations.

7.3 Marine Inorganic Chemistry

7.3.1 Trace Elements (P.L. Croot, S. Nicholas)

For the contamination prone elements (e.g. Fe and Zn) it is common practice now to use a Class 100 clean container and a trace metal clean CTD equipped with trace metal clean GO-FLO or Niskin-X bottles for sampling. However for logistical reasons on this cruise, these facilities were unavailable and it was planned to use the pump CTD, as a similar one had been used for sampling Fe in the Baltic [*Strady et al.*, 2008]. As the pump CTD was limited to only the upper 250 m this meant a more restricted program for sampling of elements that are not contaminated by the Niskins of the CTD.

Aspects of the work performed during SO245 contribute to the international GEOTRACES program (www.GEOTRACES.org) and is considered to be a GEOTRACES data compliant expedition.

7.3.1.1 Crustal elements (Titanium)

Objectives: To determine the distribution of Titanium across the South Pacific Gyre.

Introduction: Titanium is a major crustal element, but it is found only at pM levels in seawater [*Orians et al.*, 1990] due to its relatively low solubility and apparent ease of scavenging by particles. Previous work by the PI in the Atlantic has shown that Ti is present as soluble species with no appreciable colloidal phase [*Dammshäuser and Croot*, 2012; *Dammshäuser et al.*, 2011]. Large scale gradients in the distribution of Ti in the water column may indicate primarily processes of aeolian input to the open ocean. Finer scale changes in the Ti concentration in the open ocean may indicate information about water mass formation and mixing and remineralization of Ti from sinking particulate matter (e.g. diatom opal).

Sampling: Samples for Titanium were collected from the normal CTD and were run unfiltered using an existing catalytic enhanced voltammetric method [*Croot*, 2011]. Previous work has shown that particulate Titanium is not analysed by this method and that it is equivalent to soluble Titanium (as there is no significant colloidal component).

Work at Sea: 8 full depth profiles were collected during SO245 from all 7 major stations and the GEOTRACES crossover.

*Preliminary Results:*These are the first known shipboard measurements of Ti at sea in the South Pacific Gyre (SPG). This new data set complements earlier work by the PI in the upper 100 m along 85° 50' W in the Eastern Tropical South Pacific (ETSP) with the Meteor (M90) from 2° N to 23° S and includes a crossover station for comparison. All vertical profiles showed a minimum in the surface with an increase in depth to a maximum at mid depth. Overall surface water concentrations were lowest in the SPG. Deep water concentrations appeared to vary with water mass across the transect and also indicated potential losses due to scavenging by hydrothermal iron – though this finding is very preliminary at this stage.

7.3.1.2 Other trace elements

Objectives: To determine the distribution of Fe, Cu, Co, Cd, Mn and Ni across the South Pacific Gyre (SPG).

Sampling: Shipboard measurements of Fe were made using a flow-injection system incorporating the luminol chemiluminescence detection method for iron [*de Jong et al.*, 1998; *Obata et al.*, 1993]. The FIA was run inside a class 100 laminar flow bench in the constant temperature room on the Sonne. A few samples for Co and Ni were measured at sea using voltammetric methods.

Work at Sea: Samples were collected from the Pump CTD at 6 stations over a range of depths (0 to 250 m). Unfortunately it was discovered that the Pump CTD was contaminating samples for iron, though the source of this contamination could not be pinpointed and removed during the course of the expedition. Sample analysis onboard worked well with good agreement between concentrations determined at sea with consensus values of the SAFe and GEOTRACES standards. Samples run at sea for Co and Ni however did not appear to be contaminated.

Preliminary Results: Due to the shipboard iron contamination issues there are no shipboard results to report. However water samples were also taken at selected stations for later analysis back in the laboratory in Galway for the analysis of other trace metals that are less prone to contamination (principally Cd, Mn and Ni). Filtered seawater samples for analysis of Ca, Mg and Sr isotopes were also taken from the CDOM filtrates (7.6.X) for Dr Mario Lebrato (GEOMAR).

7.3.2 Redox sensitive species (Iodide, H_2O_2 and O_2^-) (P.L. Croot, S. Nicholas)

7.3.2.1 Iodide

*Objectives:*Research into Iodine chemistry in the ocean is focused on its potential influence on climate change through the emission of Iodine from the ocean resulting in the formation of new aerosol particles with impacts on cloud formation and radiative balances [*McFiggans et al.*, 2000]. The source and mechanism of iodine emissions from the ocean are poorly understood, as are other more fundamental aspects of iodine biogeochemistry in seawater such as the cycling between the major iodine species; Iodate and iodide. Currently there is very little data on Iodine speciation from the open ocean and no reported data for the South Pacific Gyre (SPG). The present work addresses this knowledge gap by obtaining data from the SPG and combining this with other information collected during SO245 on the biomass and UV attenuation to determine whether photochemical or biochemical reduction is the main pathway for iodate reduction in the SPG..

Analytical Measurements: Seawater samples (unfiltered) were obtained using Niskin bottles on the standard CTD rosette from the intermediate stations at all depths (5-500 m). Samples were drawn into 250 mLbrown LDPE bottles and stored in the dark until analysis (usually within 2 hours of sampling). Samples for iodide were analyzed by cathodic stripping square wave voltammetry [*Luther et al.*, 1988], using a µAutolab III (Ecochemie) combined with a VA663 electrode (Metrohm), within 24 hours of collection. Samples were not analyzed for Iodate or Dissolved Organic Iodide (DOI), as we have done previously due to logistical and time constraints but some were collected for analysis of total iodine back in the laboratory in Galway.

Work at Sea: Iodide profiles were measured at 5 of the intermediate stations during the course of SO245 (S7, S9, S11, S13 and S15). All sample analysis was performed at sea.

Preliminary Results: Iodide concentrations in surface waters were highest in the centre of the SPG and decreased westwards despite increasing phytoplankton biomass and CDOM. A This indicates the potential role of photochemistry in reducing iodate and maintaining high iodide levels in the South Pacific despite the low CDOM levels. Though an alternative, or additional, explanation is the potentially slow rate of biological oxidation of iodide to iodate under low biomass conditions. Work post cruise will focus on modeling these processes in the SPG.

7.3.2.2. H_2O_2 and O_2^-

Objectives: H_2O_2 and O_2^- are formed in surface seawater due to photochemically induced reactions between organic matter and oxygen. To our knowledge neither species has been measured as yet in the clear ‘blue’ waters of the SPG. With this in mind we undertook measurements of these species to examine the following hypotheses:

1) High concentrations of H_2O_2 are anticipated due to the high irradiances experienced in the SPG and in spite of the low concentrations of CDOM as decay rates are low due to the low biomass present there.

2) That H_2O_2 concentrations will mirror the UV attenuation in the water column as sunlight is the primary source.

3) That there is no negative impact on *Prochlorococcus* abundance from H_2O_2 despite their lack of catalase, as they have other systems for dealing with H_2O_2. This is in contrast to a recent laboratory study [*Morris et al.*, 2011] and resulting hypothesis [*Morris et al.*, 2012] which suggests that bacteria are required to detoxify H_2O_2 for *Prochlorococcus.*

4) Biological production of O_2^- is a small source of H_2O_2 in the South Pacific, as photochemistry predominates.

5) Maximum biological production of O_2^- is associated with bacterial activity below the deep chlorophyll maximum.

Introduction: Superoxide (O_2^-) is an important short lived transient reactive oxygen species (ROS) in seawater. The main source of O_2^- in the ocean is believed to be through photochemical reactions with biological processes important below the euphotic zone. Sink terms for O_2^- include redox reactions with bioactive trace metals, including Cu and Fe, and to a lesser extent organic matter. Information on the source fluxes, sinks and concentration of superoxide in the open ocean are crucial to improving our understanding of the biogeochemical cycling of redox active species. As O_2^- is a highly reactive transient species present at low concentrations it is not a trivial task to make accurate and precise measurements in seawater.

Hydrogen peroxide (H_2O_2) is the most stable intermediate in the four-electron reduction of O_2 to H_2O and may function as an oxidant or a reductant in reactions with organic matter and trace metals. H_2O_2 is principally produced in the water column by photochemical reactions involving coloured dissolved organic matter (CDOM) and O_2 [*Powers and Miller*, 2014; *Zhang et al.*, 2012], though recent work has suggested a biological source also via O_2^- production [*Diaz et al.*, 2013]. Open ocean H_2O_2 concentrations show a distinct exponential profile with a maximum at the surface consistent with the photochemical flux [*Croot et al.*, 2004]. Concentrations can reach up to 300 nmol L^{-1} in Equatorial and Tropical regions with high CDOM concentrations such as in the Amazon plume in the Atlantic [*Yuan and Shiller*, 2001]. In regions with low CDOM and low sunlight, surface H_2O_2 levels are much lower with values in the Southern Ocean of 10-20 nmol L^{-1} [*Sarthou et al.*, 1997]. Rainwater is a major potential source for H_2O_2 to surface seawater as it is preferentially removed from the atmosphere, relative to other peroxides, during convective events. H_2O_2 is decomposed by a number of different pathways, including redox reactions in solution and diffusion across cell membranes and subsequent decomposition by intracellular peroxidases and catalases. The latter pathway is considered to be the dominant one in the euphotic zone of the open ocean, while the former is critical for the redox cycling of trace metals.

Sampling: During SO254 we measured H_2O_2 and O_2^- using a single flow injection instrument (Waterville Analytical) by splitting the reagent injection into two separate loops; in which each loop was optimized for the chemiluminescence induced by O_2^- (MCLA) and H_2O_2 respectively (Luminol). The exact same system compromising a flow cell and photon counter had been used previously on M77-4 and M-90 for measuring Fe(II) and H_2O_2. Improvements in the software (Labview) since M90 saw a significant reduction in data dropouts due to problems with the Bluetooth serial connections between photon counter and computer.

H_2O_2 measurements: In the present work H_2O_2 was measured using a flow injection chemiluminescence (FIA-CL) reagent injection method [*Yuan and Shiller*, 1999]. In brief, the chemiluminescence of luminol is catalysed by the reaction of H_2O_2 present in the sample with Co^{2+} at alkaline pH. H_2O_2 standards were made by serial dilution from a primary stock solution (30% Fluka - Trace Select). The concentration of the primary and secondary standards were determined by direct spectrophotometry of the solution (ε = 40.9 mol L^{-1} cm^{-1}, [*Hwang and Dasgupta*, 1985]) using either a 1 or 100 cm pathlength cell.

O_2^- measurements: O_2^- reacts with the reagent MCLA to produce chemiluminescence [*Pronai et al.*, 1992] and we modified an existing seawater method [*Heller and Croot*, 2010a; *Heller and Croot*, 2010b] for use in a dual FIA setup. Due to the short lifetime of O_2^- in seawater and the strong temperature dependence of the MCLA background and sensitivity to O_2^- standardization was complicated and in general referred to room temperature. Further lab work is planned to examine the overall temperature dependence in more detail.

Work at Sea: All 15 Stations were sampled for H_2O_2 and 11 for O_2^-. Additionally the opportunity was taken at station 8 in the SPG to undertake a study over a diurnal cycle (4 casts to 300 m over 24 hours). Continuous profiling for H_2O_2 (Stations 12 and 14), or O_2^-

(Station 15), was performed by connecting a FIA system to the outflow of the pump CTD and using the appropriate reagent.

Preliminary Results: In general H_2O_2 concentrations were dominated by surface irradiation with highest concentrations at the surface and in the mixed layer, with concentrations decreasing exponentially with depth. In the SPG significant H_2O_2 concentrations were found down to 300 m in contrast to stations outside the SPG where H_2O_2 was restricted to the upper 150 m or so. In terms of light penetration however the distributions were equivalent to the apparent euphotic depths indicating the special conditions of the SPG on photochemically produced species. O_2^- concentrations were at or below the detection limit in the euphotic zone mostly, this was expected, as the photo-produced O_2^- would decay rapidly in the Niskin bottles once closed. However some samples from the deep chlorophyll maxima or below did exhibit higher signals and may be related to biological production of O_2^-. Latter work will look to link the bacterial community present to the observed production rates.

7.4 Marine Organic Chemistry

7.4.1 Dissolved Organic Matter

(H. Osterholz, D. S. Storey; PI T. Dittmar)

Even though dissolved organic matter (DOM) in the SPG may have a marine microbial origin and contain significant amounts of nitrogen, this DOM appears not to be involved in active cycling by heterotrophic and autotrophic microorganisms. We address this paradox by characterizing the DOM pool, and together with the characterization of other physical and biological parameters, i.e. the microbial community, performed on this cruise we will be able to shed light on underlying mechanisms of DOM preservation. Additional examination of DOM photolytic reactions will increase our understanding of the cycling of dissolved black carbon (DBC) compounds constituting the oldest fraction of marine DOM with a lifetime of ~ 40,000 years (Hansell 2013).

For the bulk dissolved organic matter characterization, water samples (4 L) from selected depths of all main and intermediate stations were passed through GF/F glass fiber filters (precombusted 400°C, 4 h, Whatman, Maidstone, UK) and acidified to pH 2. Duplicate subsamples for dissolved organic carbon (DOC) and total dissolved nitrogen (TDN) will be analyzed as non-purgeable organic carbon by high temperature catalytic combustion using a Shimadzu TOC-VCPH/CPN instrument equipped with a TNM-1 module in the home lab. In order to desalt and concentrate the marine DOM for the analysis of the molecular composition, the remaining sample was solid-phase extracted using commercially available modified styrene divinyl benzene polymer columns after Dittmar et al. 2008 (PPL, Agilent, Santa Clara, CA, USA). After extraction, columns were rinsed with ultrapure water (pH2) to remove remaining salts, dried by a stream of nitrogen gas and eluted with 6 mL of methanol (HPLC-grade, Sigma-Aldrich, USA). The obtained DOM extracts will be analyzed upon arrival in the home lab on a 15 tesla Solarix Fourier-Transform Ion Cyclotron Resonance Mass Spectrometer (FT-ICR-MS, Bruker Daltonics, Billerica, MA, USA) equipped with an electrospray ionization source (Bruker Apollo II).

Additional samples (0.5 L) from the Pump CTD upcasts were taken to achieve a higher resolution in the upper 275 m of the water column, where microbial activity is increased. The samples were treated as described above.

Samples for amino acid and carbohydrate quantification were obtained at stations 2, 6, and Duplicate samples were filtered through 0.2 µm filters (GHP, Pall GmbH, Dreieich, Germany) and frozen. Samples will be analyzed for dissolved free amino acids (DFAA) and after acid hydrolysis for dissolved combined amino acids (DCAA). Hydrolysis and derivatization of samples will be carried out following established protocols (Lindroth and Mopper 1979) with modifications for small sample volumes. Separation and quantification of fluorescent amino acid derivatives will be carried out on a Waters Acquity UPLC (Ultra Performance Liquid Chromatography) system equipped with a fluorescence detector. Samples will be analyzed for dissolved free carbohydrates (DFCHO) and after acid hydrolysis for dissolved combined carbohydrates (DCCHO) following established protocols (Mopper et al. 1992). Separation and quantification of carbohydrates will be performed by anion exchange HPLC and pulsed amperometric detection (ICS-5000 Thermo Fisher, Waltham, MA, USA).

At station 4, water from four water depths was used to set up an incubation experiment to study the photodegradation of DOM components. Water from surface, deep chlorophyll maximum, Antarctic Intermediate Water and Lower Circumpolar Deep Water was filtered through 0.2 µm polycarbonate filters to remove most microorganisms and distributed into plexi glass tubes. The tubes were incubated on deck in direct sunlight in a continuous flow of surface water for X days and replicates were sampled after 2, 5, 13, and 20 days. Samples for DOC/TDN quantification and organic matter characterization via ultrahigh-resolution mass spectrometry were processes as described above. CDOM analyses were performed by Allan Grassie (National University of Ireland Galway) on board. Bacterial cell numbers were determined by Ivo Tews (National Oceanographic Centre, University of Southampton).

Filtered water from the same depths used for the photodegradation experiment and 8 additional surface water samples from the main stations were filtered, frozen, and shipped to Aron Stubbins and Leanne Powers at Skidaway Institute of Oceanography (Savannah, Georgia, USA). Apparent quantum yield (AQY) spectra, defined as moles DBC lost per moles photons absorbed by colored dissolved organic matter will be obtained. These describe the efficiency of DBC loss and can be used in ocean color based models to estimate its loss on regional/global scales. Coupling the photochemical model with a physical model will allow for a better assessment of the supply (upwelling of deep DBC rich waters) and subsequent photochemical loss in the sunlit waters.

7.4.2 Chromophoric Dissolved Organic Matter (CDOM)

(A. Grassie and P.L. Croot)

Objectives: Overall there is currently a lack of data worldwide for the CDOM (Coloured dissolved organic matter) properties of the different oceanic regions [*Röttgers and Doerffer*, 2007] and in particular the South Pacific is under sampled. As CDOM contributes to the attenuation of light in seawater it has an impact on satellite retrievals for ocean colour and in particular the estimation of chlorophyll a in seawater. The South Pacific Gyre (SPG) is an important region for separating the contribution of CDOM t the observed signal in this respect as it is the region with the lowest surface chlorophylls observed by satellite [*Morel et al.*, 2007] and also the lowest CDOM absorbance's reported [*Bricaud et al.*, 2010]. For SO254 CDOM data were collected to examine four main questions:

- (i) Can protein or humic components be identified in CDOM fluorescence from the SPG or is the water truly photo bleached?
- (ii) Does borohydride reduction of SPG waters lead to a significant change in absorbance and fluorescence properties?
- (iii) What CDOM parameters are linked to it's role in the production of H_2O_2 in the sunlit surface waters and can this be used to assess possible changes in CDOM optical properties in the SPG (e.g. spectral slope)?
- (iv) What is the relationship between CDOM and in situ chlorophyll in the South Pacific?

Coloured dissolved organic matter (CDOM) plays an important role in many oceanic processes. CDOM strongly absorbs light, most notably in the biologically damaging ultraviolet (UV) B wavelengths (280–320 nm), and thus provides some protection for phytoplankton and other biota. CDOM can also attenuate the photosynthetically active radiation available to phytoplankton, resulting in decreased primary production. Information on the high CDOM absorption in the blue region of the spectrum can also help improve the accuracy of satellite derived phytoplankton chlorophyll estimates [*D'Sa et al.*, 1999]. Changes in CDOM properties throughout the water column may indicate phenomena such as photo-bleaching or changes in the sources of the CDOM [*Helms et al.*, 2008]. Overall increasing our knowledge of the processes influencing CDOM distributions and its influence on optical properties of oligotrophic waters are important for understanding the role of light in biogeochemical cycles.

Sampling: Samples from the CTD Niskins were filtered (0.2 µm Sarstedt) and analysed for CDOM absorbance and fluorescence. CDOM absorbance was measured using a 2 m pathlength liquid waveguide capillary cell (LWCC) coupled to an Ocean Optics USB4000 or MAYA spectrophotometer. CDOM fluorescence was measured by obtaining 3D Excitation Emission Matrix (EEM) spectra using an Aqualog (Horiba Scientific) fluorometer. EEMs are constructed from a matrix of measurements spanning a range of excitation and emission wavelengths. All spectra were corrected automatically for internal absorption and for Rayleigh and Raman scattering. Post processing of the data will be performed using PARAFAC (Parallel Factor Analysis) analysis with either the software supplied with the Aqualog (Special PARAFAC analysis software in the program SOLO) or via existing Matlab™ routines [*Murphy et al.*, 2013; *Stedmon and Bro*, 2008]. All CDOM absorbance and fluorescence signals were normalized to ultrapure water supplied from a Direct 8 Milli-Q unit (Millipore). Borohydride reductions of seawater samples was performed with minor modifictions to and existing method [*Ma et al.*, 2010] .

Work at Sea: CDOM measurements (absorbance and fluorescence) were made throughout the water column at all 15 stations during the course of SO245. $NaBH_4$ reductions were made on a small subset of samples throughout the expedition. The opportunity was taken to sample some porewaters obtained via Rhizon extraction from the box corer at the main stations.

Preliminary Results: This work marked the first application of 3DEEM techniques to the 'Blue' waters of the South Pacific Gyre and initial results showed that vertical profiles of CDOM absorbance and fluorescence were typical of the open ocean with low absorbance but high spectral slopes coupled with low, to non-detectable, humic fluorescence (ex/em 320/420) in surface waters illustrating strong bleaching due to solar irradiation. Previously we have observed in OMZ waters of the South Pacific that the humic fluorescence appeared to co-vary with the apparent oxygen utilization (AOU), this was not so readily seen during SO245. In the SPG surface waters, protein like signals appeared to dominate and appeared to be partly immune to photo bleaching. A frequent problem during this expedition was the apparent negative absorbance by seawater, relative to the ultrapure water onboard the ship, this was also noted in the SPG previously during BIOSOPE [*Bricaud et al.*, 2010] and is related to the difference in refractive index between seawater and ultrapure water. Efforts to construct a seawater or NaCl reference standard to use instead of ultrapure water were attempted and are ongoing. Experiments with $NaBH_4$ reduction showed the typical loss of absorbance in the visible with increase in the UV and the increase in the fluorescence as observed for terrestrial humics at significantly higher concentrations. Porewater (see Section 7.9) sampling showed South Pacific porewaters to be very clear though the presence of a unique humic signal was observed. However an associated protein like signal appeared to be an artefact of the Rhizon sampling and this will be investigated further.

7.5 Nutrient Biogeochemistry

7.5.1 Nutrient concentrations (G. Lavik, G. Klockgether, P. Downes)

Concentrations of dissolved inorganic phosphate (PO_4^{3-}), nitrite (NO_2^-), nitrate (NO_3^-), and silicate (Si) were measured with the QuAAtro39 autoanalyser (Seal Analytical) using the method based on Strickland and Parsons, 1972. OSIL Seawater Low-Nutrient Standards were used as a secondary standard to test primary standard calibrations.

Low concentrations of dissolved phosphate (<300 nM) were determined with a long waveguide capillary cell (LWCC) set-up, which included a Traacs 800 pump and autosampler, a World-Precision 100 cm LWCC, an HL 2000 Lamp from Ocean Optics and a STS-VIS Miniatur Spectrophotometer from Ocean Optics.

A pump-CTD system equipped with a fluorimeter (Cyclops7™, Turner designs) was used to collect chlorophyll and nutrient samples profile at an interval of 2 – 3 m. Water was pumped through an Membrane Inlet Quadrapole Mass Spectrometer (In Process Instruments GAM200 for the determination of dissolved gases such as oxygen and argon.

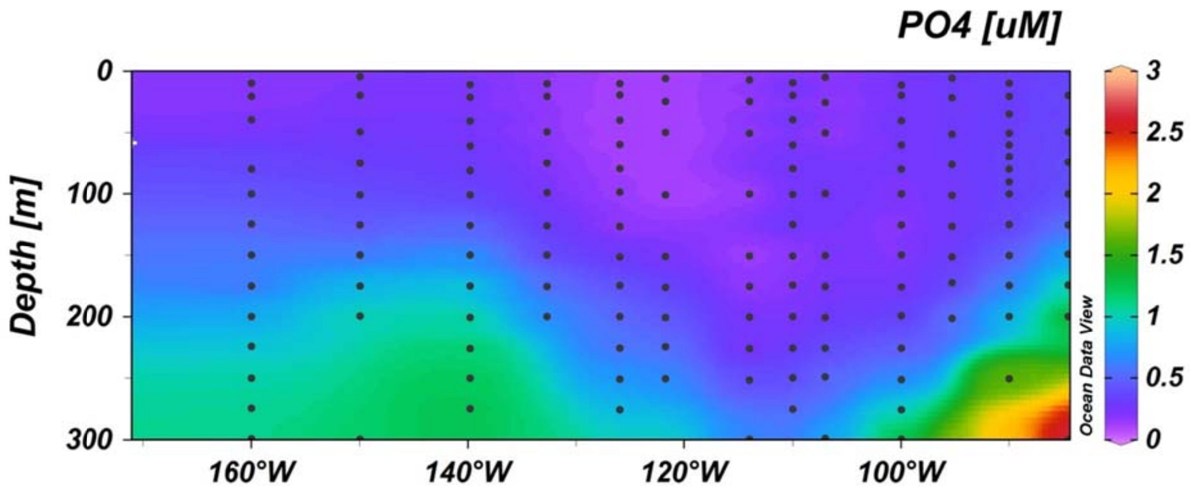


*Figure 7.4*Dissolved inorganic phosphorus concentrations. Gray dots show the sampling depths from the Nisken bottle casts and Pump-cast CTD samples.

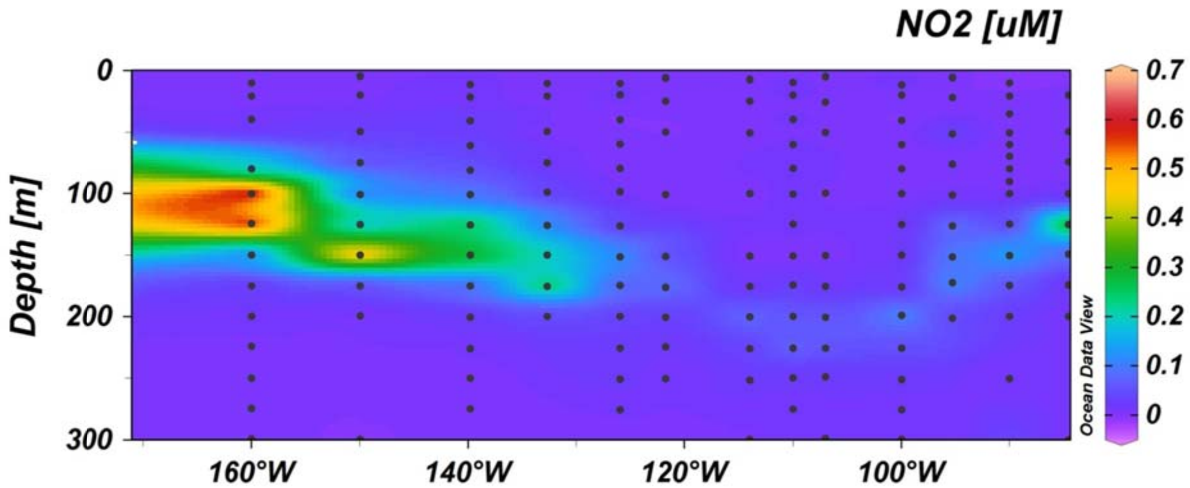


Figure 7.5 Dissolved nitrite concentrations. Gray dots show the sampling depths from the Nisken bottle casts and Pump-cast CTD samples.

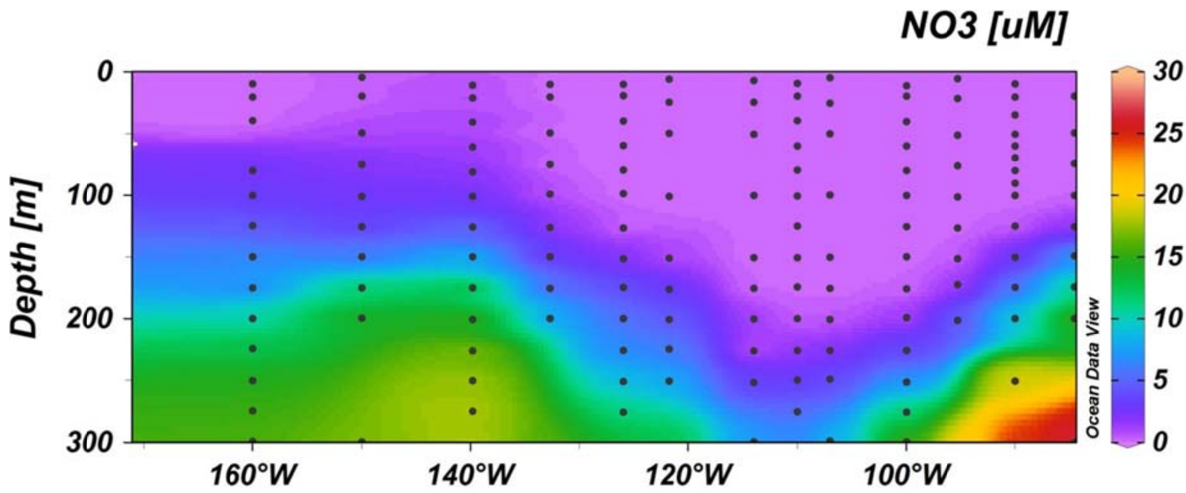


Figure 7.6 Dissolved nitrate concentrations. Gray dots show the sampling depths from the Nisken bottle casts and Pump-cast CTD samples.

Total dissolved phosphorus (TDP) concentrations were measured using the persulfate oxidation method of Menzel & Corwin (1965) with the following modifications. Persulfate solution was added to 4 mL sample to reach a final concentration of 1.25% K2S2O8. Samples were then heated at 80°C for 2 hours. The pH was then corrected to between pH 7 – 7.5 using H2SO4 (0.005 mol L-1). The resulting phosphate was subsequently determined using an auto-analyser as stated previously. Assuming the persulfate oxidation liberated all organically bound phosphorus, the DOP was calculated by the following, TDP – DIP.

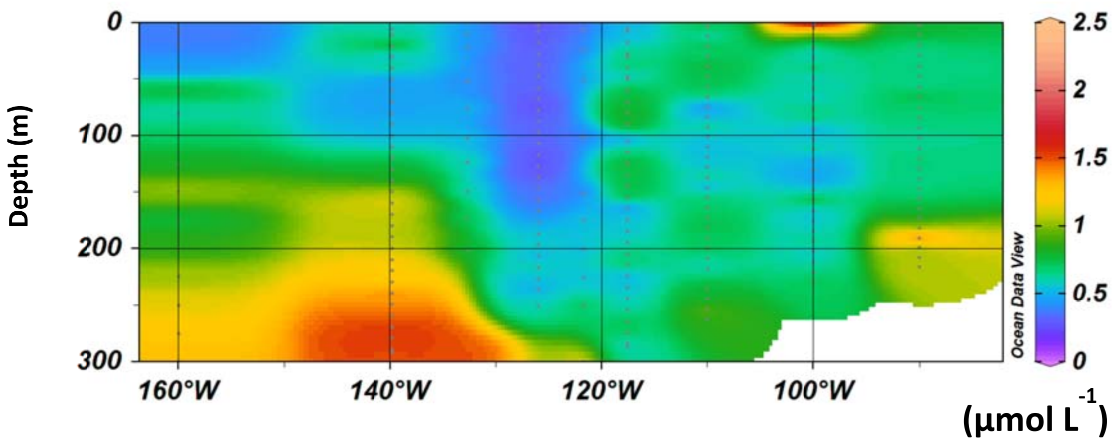


Figure 7.7 Dissolved Total Dissolved Phosphorus concentrations. Gray dots show the sampling depths from the Nisken bottle casts and Pump-cast CTD samples.

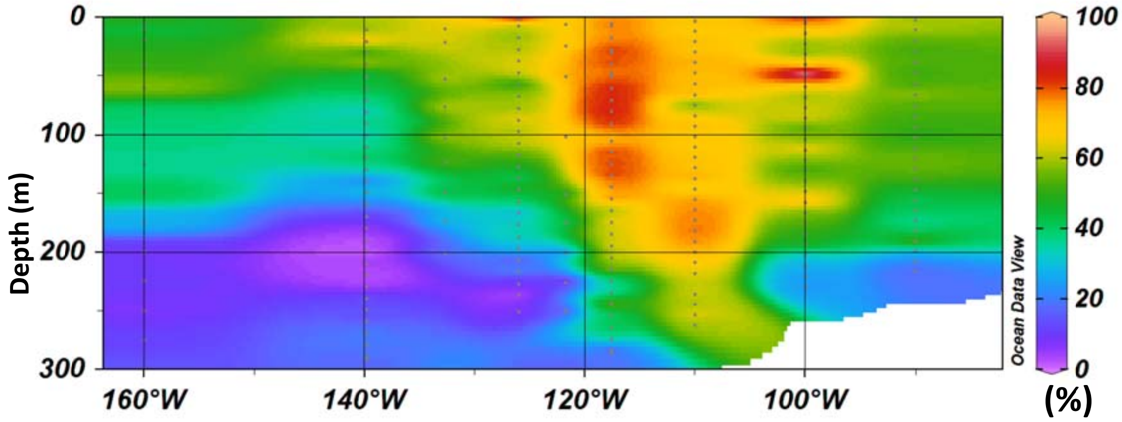


Figure 7.8 Percentage of Total P estimated to be DOP.

7.5.2 Elemental analysis of particulate organic matter (G. Lavik, G. Klockgether, C. Thorstenson, T. Ferdelman)

This project aimed at measuring particulate organic carbon (POC), nitrogen (PON), sulfur (POS), and phosphorus (POP) concentrations (and the resulting C:N:P:S ratios) in the seawater at stations throughout the cruise transect in the Subtropical South Pacific.

Work at sea: Seawater samples were collected from every station throughout the water column. The particles were filtered onto a pre-combusted GF/F filter and oven-dried at 55 deg C. Prior to analysis, the filters were acidified overnight to remove inorganic carbon. The elemental composition was then analyzed using a flash-combustion elemental analyzer on board.

Packed samples were analyzed for POC, PON, and POS content with an Elemental Analyzer (EA) in CHNS mode (vario MICRO cube, Elementar). The EA has a two-reactor system – a combustion reactor (oven) and a reduction reactor. Combustion of the sample takes place in an oxygenic atmosphere in the oven to produce CO2, NOx, and SO2. The oven temperature is normally set between 900 to 1050°C, but combustion with tin capsules in an oxygenic environment raises the temperature to roughly 1800°C. Reduction of NOx to N2 takes place at 850°C in the reduction reactor. The carrier gas, helium, pushes the combustion gases through the analyzer. C and S are trapped in separate columns and then released sequentially. The N2 gas is not trapped and flows straight through the columns. The N and C gases are measured by a thermal-conductivity detector (TCD), and the SO2 is measured with an infrared detector (IR). The TCD uses a Wheatstone bridge circuit to compare the relative thermal conductivity differences between the helium and the sample gases.
The EA reports the amount of C, N, and S (the CO2, N2, and SO2) as the area underneath the measured peak. S data from the first six stations and SO245-08-10 is unavailable since these filters still had considerable seawater sulfate on them which is indistinguishable from POS using the EA.

Preliminary results: Across the SPG transect, POC and PON concentrations are considerably lower (2-3 μM and 0.2-0.4 μM respectively) in the central and eastern parts of the gyre, especially when compared to the southwestern transect.

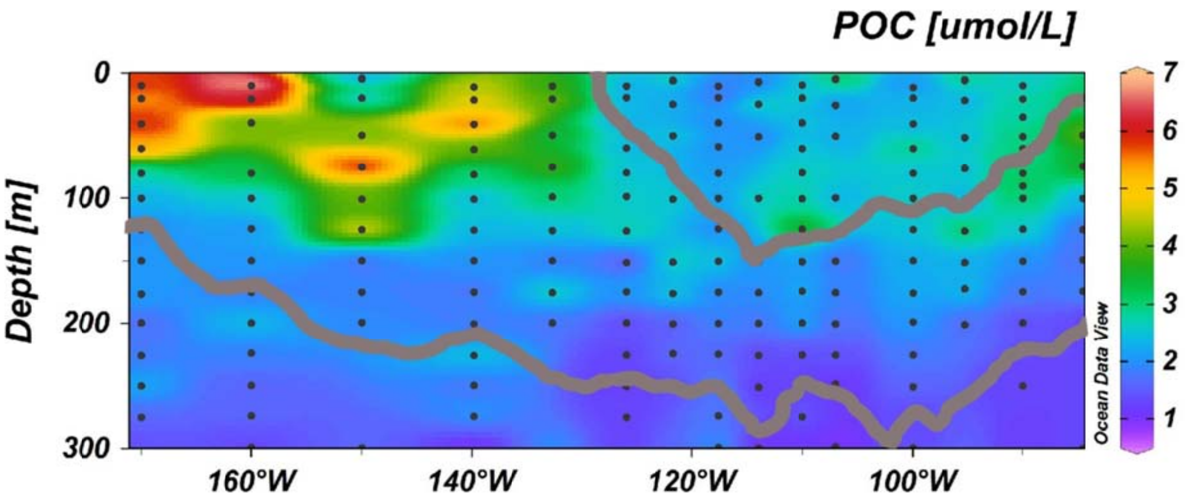


Figure 7.9 Concentrations of total particulate organic carbon in the upper 300 meters of the water column of the SPG. Dark gray lines outline the extent of the Deep Chlorophyll Maximum.

Particulate organic carbon is constant (on average +/- 0.5 µM) in waters below 500-1000 m. Exceptions were observed at SO245-06 and SO245-08, where there a secondary POC maxima around 2000 m depth are present. SO245-08 POC had a maximum concentration of ~3 µM in surface water but stays close to 2 µM in deeper waters. At SO245-08 and SO245-14 there was another peak in POC concentrations of ~3 µM and 2.5 µM respectively around 1000 m depth.

The PON concentration depth profiles follow similar trends as the POC concentration profiles for the majority of the stations, with fluctuations (of ~0.25 µM) in PON as depth increases. Particulate organic nitrogen concentrations also have a secondary maximum around 2000 m depth for SO245-06 (B) and SO245-08(C). Particulate organic carbon and nitrogen are closely correlated (R^2 = 0.8) throughout the water column of the SPG. The slope of POC versus PON (y = 0.1509x - 0.1088) gives us a C: N ratio close to the canonical RF ratio of 6.6 (1/0.1509 =6.63).

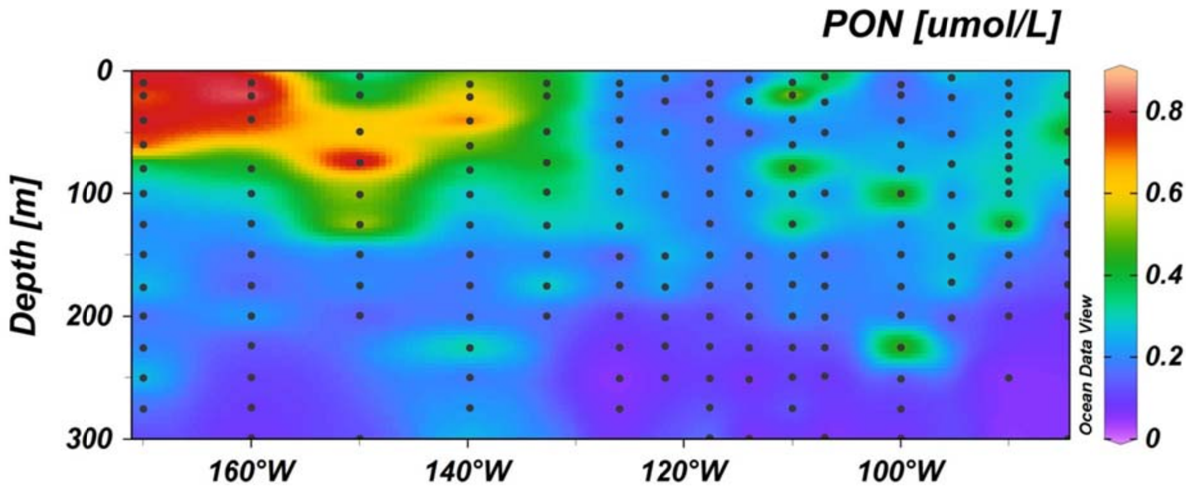


Figure 7.10 Concentrations of total particulate nitrogen in the upper 300 meters of the water column of the SPG. Dark gray lines outline the extent of the Deep Chlorophyll Maximum.

7.5.3 Phosphorus turnover (P. Downes, G. Lavik, G. Klockgether, T. Ferdelman)

Much of the primary production in the South Pacific, and in particular the South Pacific Gyre, has been estimated via satellite-derived chlorophyll (chl) *a* fluorescence from surface waters. However, throughout most of the South Pacific a deep chl *a* maximum is present which is usually not accounted for in satellite-derived estimates. This project aims at determining primary productivity within the water column including deeper depth in order to investigate the overall productivity in the Subtropical South Pacific. In addition, the microbial turnover of phosphate will be analyzed as a proxy for the overall productivity of the microbial ecosystem and its potential limitation by phosphorus.

Work at sea: Due to the unavailability of the ship-board scintillation counter, experiments were only carried out for the microbial turnover of phosphorus using ^{33}P (half-life of ~25 days). The phosphorus turnover experiments were started by the addition of trace amounts of ^{33}P-phosphate to seawater collected from depth profiles, run in parallel to the N_2 fixation and primary production experiments described below. The incubations were kept in on-deck seawater flow-through incubators or in cold rooms (dark). Subsamples for the phosphorus turnover were collected at four to six time points during the 24-hour incubation period. All subsamples necessary to calculate the rates were also collected at various time points. The samples were shipped for analysis the MPI Bremen due to the unavailability of the ship-board scintillation counter. Experiments were carried out at nine stations of the cruise transect.

7.5.4 N_2 fixation and primary production (J. Dürschlag, C. Martinez-Perez, W. Mohr)

The availability of nitrogen to a large extent determines the primary productivity of oceanic waters, and, thus, the (net) uptake of atmospheric carbon dioxide (CO_2). On long time scales, dinitrogen (N_2) fixation is the largest source of nitrogen to the open ocean. Even though the South Pacific should be favorable for N_2 fixation due to a slight excess of phosphate, until to date, there have been very few measurements of N_2 fixation in this oligotrophic area, and particularly very few in deeper waters.

Objectives:

(1) Determine rates of N_2 fixation and primary production throughout the water column and along the transect
(2) Identify organisms potentially involved in N_2 fixation via molecular analysis
(3) Characterize single-cell rates of selected diazotrophic organisms (N_2 fixers)
(4) Determine the nutrient limitation of N_2 fixation and primary production

Work at sea: N_2 fixation and primary production rates are determined through the incubation of collected seawater with stable isotopes, i.e. $^{15}N_2$ and ^{13}C-bicarbonate, respectively. Incubations lasted 24 hours in on-deck incubators which were kept at surface water temperature via seawater flow-through and were adjusted to three different light levels or in cold rooms (and dark) (for the eight different depths incubations). The incubations were started in triplicate 4.7-L bottles by the addition of the stable isotopes using tested and recommended protocols (Klawonn et al. 2015) after methodological difficulties had been identified earlier (Mohr et al. 2010, Grosskopf et al. 2012, Wilson et al. 2012). After the 24-h incubation period, the seawater was filtered onto pre-combusted GF/F filters (0.7µm nominal pore size); the filters were frozen for later analysis of the concentration of particulate organic carbon (POC) and particulate organic nitrogen (PON) as well as the carbon and nitrogen isotopic composition using an elemental analyzer coupled to an continuous-flow isotope ratio mass spectrometer (EA-IRMS) at the Max-Planck-Institute for Marine Microbiology in Bremen

(MPI Bremen). All samples will be shipped back to the MPI after the cruise. Subsamples were taken in order to obtain all parameters needed to calculate the biological rates.

In order to address objectives (2) and (3), subsamples were collected from the seawater either at the beginning of the incubations mentioned above (molecular analyses) or at the end of the incubation (single-cell analyses). Samples for both analyses will be shipped back to the MPI Bremen and analyzed in the home laboratory. For objective (2), nucleic acids will be extracted from the collected samples and the marker gene for N_2 fixation, *nifH*, will be analyzed using high-throughput sequencing technology. Based on the results from objective (1) and (2), subsamples will be selected for single-cell analyses of targeted organism to determine the individual activity of selected organisms as well as their contribution to total N_2 fixation and primary production rates (objective 3). Single-cell analyses will be carried out using a NanoSIMS 50L instrument located at the MPI Bremen. Objective 2 will be further studied by attempting to isolate diazotrophs from the seawater.

Objective (4) was targeted by collecting and incubating seawater with the addition of different nutrients alone or in combination as follows:

Control	no addition
+N	2 µM N (ammonium and nitrate)
+NP	2 µM N and 0.2 µM phosphate (P)
+NFe	2 µM N and 2 nM iron (Fe)
+PFe	0.2 µM P and 2 nM Fe
+NPFe	2 µM N, 0.2 µM P, and 2 nM Fe
+^{13}C-AL	addition of ^{13}C-labeled algal lysate
+DW	addition of 100 ml deep water to 4.7 L bottle

The combination of these treatments will allow determining whether N_2 fixation and primary production were limited by either N, P, Fe or a combination of two or more of these nutrients. The algal lysate treatment was carried out to determine the role of organic carbon/matter in controlling both processes. The addition of deep water was carried out to simulate a more "natural" addition to determine whether any components of deep water other than nitrate, phosphate and iron might be playing a role in controlling N_2 fixation and primary production.

These experiments were also subsampled for molecular analyses and single-cell analyses.

All experiments were subsampled for parameters necessary to calculate the rates of N_2 fixation and primary production as well as multiple subsamples for molecular and microbiological analyses.

During the SO245 cruise, nine experiments were carried out to determine the rates of N_2 fixation and primary production throughout the water column (i.e. stations 01, 02, 04, 06, 08, 10, 12, 14, and 15). The nutrient addition experiments were carried out six times during the transect (i.e. stations 03, 05, 07, 09, 11, and 13). All sampling is indicated in the table at the end of this section.

There are currently no preliminary results available as all analyses will be carried out in the home laboratory at the MPI Bremen.

7.5.5 Phytoplankton community structure and the identification of diazotrophic organisms associated to phytoplankton *(N. Heinzmann, J. Dürschlag, W. Mohr)*

A few previous experiments of N_2 fixation in the South Pacific have indicated measurable rates of N_2 fixation (e.g. Halm et al. 2012). However, it is currently not known which organisms carry out the N_2 fixation. Halm et al. (2012) found that the diazotrophs in the South Pacific region are mostly heterotrophic organisms, i.e. they rely on organic carbon for growth.

A source of (labile) organic carbon lies within the chlorophyll *a* maximum where presumably high primary production rates occur. One diazotrophic lifestyle to exploit this pool of organic carbon would be to live symbiotically with phytoplankton; some organisms are known to do so, in particular diazotrophs associated to diatoms, the so-called diatom-diazotroph associations (DDA). DDAs have been shown to exist in other ocean basins; however, there are so far no reports of DDAs in the region covered by this cruise.

Objectives:

(1) Identify DDAs and determine their distribution in the South Pacific
(2) Identify factors controlling the distribution of DDAs including the surrounding phytoplankton community and chlorophyll *a* distribution
(3) Determine rates of N_2 fixation associated to the larger plankton net community

Work at sea: Objective (1) will be addressed by collecting samples using a plankton net (micronet) followed by the microscopic identification of DDAs. DDAs can be identified by their heterocystous, cyanobacterial symbionts living at or in the diatom host using light and epifluorescence microscopy. This work was done on board the ship and the analyses are on-going. The determine the factors controlling the distribution of DDAs in the South Pacific (objective 2), the occurrence of DDAs will be compared to the hydrography and chemical oceanography, i.e. the distribution and concentrations of nutrients, the elemental composition of dissolved and particulate organic material as well as the concentration and distribution of phytoplankton through pigment analyses (chlorophyll *a* and high-performance liquid chromatography). Further, the phytoplankton community structure will be analyzed as a potential controlling factor using light and epifluorescence microscopy.

In order to determine whether any diazotrophs associated to the larger plankton net size fractions are actively fixing N_2 (objective 3), stable isotope incubations were done as described above including multiple subsamples for later molecular and single-cell analyses. Incubations were also carried out in the on-deck incubators at adjusted light conditions. Sample processing was as described above.

The plankton net was deployed ten times during the cruise (i.e. stations 01, 02, 04, 06, 2 x 08, 10, 12, 14, and 15). The depths of the plankton net tow varied but always went until below the deep chlorophyll *a* maximum. All sampling is indicated in the table at the end of this section.

Preliminary results: DDAs were found in the plankton net tows at an earlier station on the cruise and then again in the middle of the South Pacific Gyre. The numbers of DDAs in the microscopic chamber were quite low though, so that secondary analyses of further subsamples will likely be carried out at the home laboratory at the MPI Bremen. The distribution of chlorophyll *a* varied over the cruise transect. The eastern part of our cruise was dominated by sharp chlorophyll maxima at around 70m water depth. This chlorophyll *a* maximum shifted further down in the water column to 195 m water depth in the middle of the South Pacific gyre but also broadened as we travelled into the gyre. The western region was characterized by much shallower chlorophyll *a* maxima as well as higher chlorophyll *a* concentration in the surface waters.

7.5.6 Urea – links to DON, Ni and HNF (A. Wieczorek and P.L. Croot)

Objectives:

(i) To determine the distribution of urea across the South Pacific Gyre (SPG) and its contribution to the dissolved organic nitrogen (DON) pool.

(ii) To examine the relationship between the distribution of urea and Heterotrphic nanoflagellates (HNF) in the SPG.
(iii) To compare urea distributions with that of Ni, the key metal within urease.

Introduction: Urea ($CO(NH_2)_2$) is produced in the ocean through the action of grazing by zooplankton on bacteria and phytoplankton. In the ocean urea often forms a significant fraction of the DON pool and is comparable to inorganic nitrogen sources [*Remsen*, 1971] and it is utilised by plankton as a source of nitrogen via the Nickel containing urease enzyme. In previous work in the SPG it was noted that there was high DON [*Raimbault et al.*, 2008] but no measurements of urea were made.
HNF are likely responsible for a significant fraction of the grazing on picoplankton and bacteria in the SPG but there is currently very little data on these organisms for the deep chlorophyll maximum found there,

Sampling: We adapted an existing method for urea [*Mulvenna and Savidge*, 1992] which involved filtering the sample through an 0.2µm syringe filter, adding reagents, and then heating to 85° C by incorporating a dry bath optimized for 2 mLs vial and by measuring the absorbance using a 1 m LWCC. A similar method was recently published using large sample volumes [*Chen et al.*, 2015].
HNF were identified by flow cytometer using the stain lysotracker [*Rose et al.*, 2004]. Bacteria were stained using Sybr Green and all counts were performed on a ACCURI C6 flow cytometer.
Dilution series experiments (0, 25, 50 and 75% dilutions with 0.2 µm filtered seawater) were made in duplicate to assess micro grazing rates. Samples were run for 48 hours in a constant temperature incubator equipped with blue lighting simulating the light in the deep chlorophyll maximum. Bacteria, phytoplankton and HNF were counted every 24 hours as described above.
Work at Sea: Samples for urea and HNF were measured at all 15 stations during SO245. Dilution grazing experiments were made at 6 of the 7 large stations.

Preliminary Results: Urea was found to be low in the SPG (0-1 µM) but increased in concentration at the western most stations. HNF numbers were highest in the euphotic zone and not at the deep chlorophyll maximum in the SPG. The dilution grazing experiments indicated a tight coupling between HNF and their prey and further analysis of the data will concentrate on the potential growth rate of HNF during the course of the experiments.

7.6. Molecular Ecology
(B. Fuchs, S. Orlic, G. Reintje, H. Tegetmeyer, J. Wulff)

Molecular Ecology is following the general questions ‘who is out there?’, ‘how many of each kind?’ and ‘what are they doing?’. During our transect across the South Pacific Gyre (SPG), we took samples throughout the water column and answered the first two questions on board. The last question waits to be answered back home at the MPI.

A premiere on this cruise was to bring a complete 16S rRNA gene tag sequencing pipeline on board and to obtain a snapshot of the microbial diversity present in the water column within 48 h after sampling. This involved sample filtration, the extraction of DNA from the filters, the amplification of two variable regions (V3-V4) of the 16S rRNA genes (sequencing library construction), the sequencing on an Ion Torrent PGM machine, the sequence quality check and trimming, and finally the taxonomic affiliation of the 16S sequences using a next-gen classification pipeline adapted from the SILVA-NGS project. After first successful tests we achieved full depth profiles from 11 of the 15 stations sampled during the course of the cruise in a total of 8 Ion Torrent runs and 150 individual samples being sequenced. The stations being sequenced included: 1,2,3,4,5,6,7,8,9,10,12. We successfully showed a proof of concept, that sequencing on board is feasible and first results can be expected within sometimes less than 48 hours.

The diversity profiles across the entire SPG were remarkable similar to other major ocean gyres and show the typical separation into two major communities; the top 100 – 250 m are dominated by members of the genus *Prochlorococcus* and the SAR11 clade, whereas the depths below 500 m are dominated by members of the uncultured clades SAR202 and SAR324 (Figure 7.11).

The dominance of these clades was confirmed by fluorescence in situ hybridization (FISH), which was also done on board (Figure 7.5) More than 780 individual FISH preparations were done in our labs on board and subsequently examined by means of an automated image acquisition microscope (MPISYS) combined with a semi-automated image analysis system (ACME tool), which resulted in more than 70.000 analysed images from FISH preparations. Most of the times the weather conditions were excellent and the microscope was able to produce more than 90% images suitable for further analyses, which is comparable to the performance of the system ashore. On days during stormy weather this rate dropped occasionally down to 50%, which was still more than sufficient for a statistically significant quantification of the FISH signals. Stations covered with FISH analyses were: 1,4,5,6,7,8,9,10,11,13,14 with all depths. Three to 22 different oligonucleotide probes with nested specificities were applied per station.

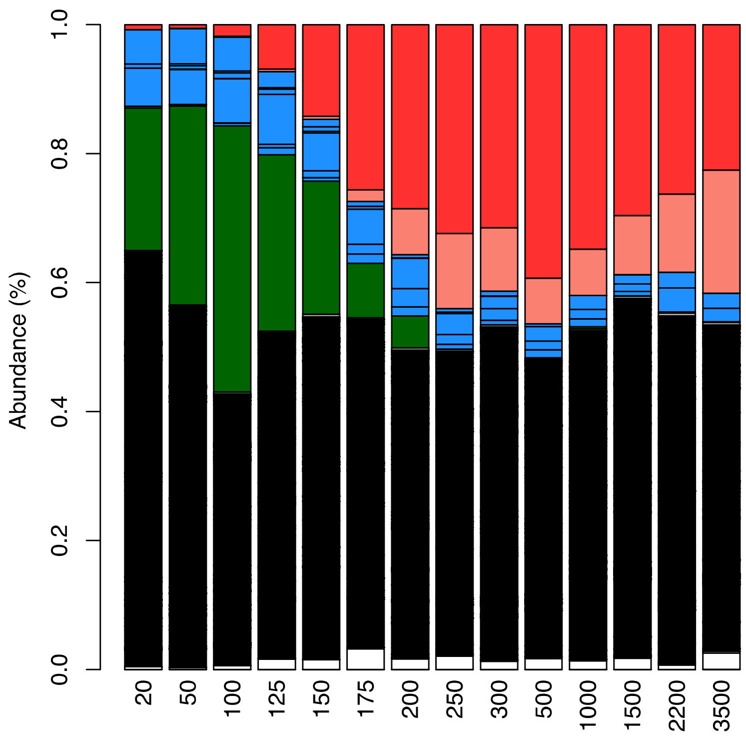


Figure 7.11 Depth profile of tag sequencing results of station 2. Left to right: Top to bottom depth. Green: Prochlorococcus; blue: SAR11; red: SAR324; orange: SAR202; black: other Bacteria; white: Archaea.

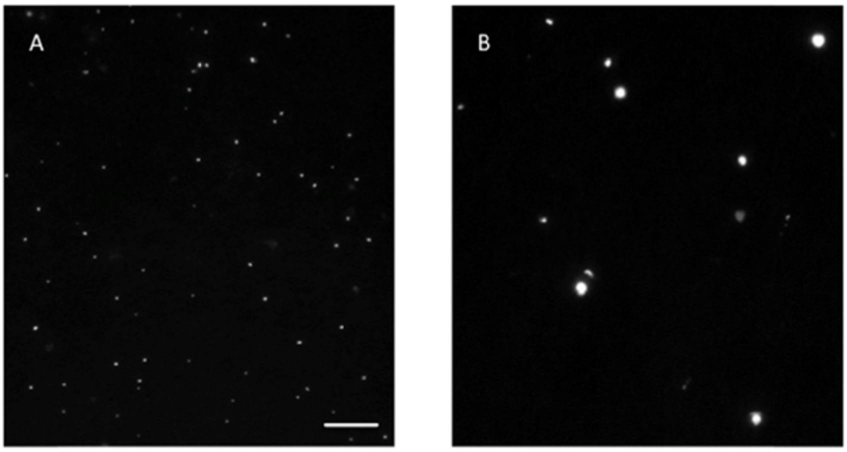


Figure 7.12 a.) SAR11 cells from 20 m depth at station 11; *b.)* SAR202 cells from 3930 m depth at station 10; scale app. 10 µm.

The abundance of the major microbial groups obtained by Ion Torrent sequencing agreed largely with FISH results, although it seemed that for example SAR324 was overestimated by sequencing. FISH showed only a maximum of 9% relative abundance, whereas the sequencing results suggested an abundance of more than 25%. Such discrepancies are well known in the literature and this is the reason to combine both, sequencing and FISH imaging to obtain a comprehensive picture of the microbial community. The latter also allows gaining insights into biomass and morphology of microbes. SAR202 cells for example were approximately 2-5 times larger in diameter than the average bacterium from the same water sample and depth. Considering that they already dominated in numbers, their dominance regarding their share on the microbial biomass in the deep SPG was even more pronounced.

To elucidate the function of the detected microbial groups, biomass has been collected with *in situ* pumps from different water layers for metagenomic analyses. This will be done back at the MPI Bremen.

7.7 Composition and dynamics of microbial plankton

Oligotrophic oceanic gyres are the largest ecosystems on earth and profoundly affect global biogeochemical cycles. The microbial community of these ecosystems is dominated by the SAR11 group of alpha-proteobacteria and *Prochlorococcus* cyanobacteria. Their success in these nutrient depleted habitats is based on a variety of high affinity substrate transporters. Even at nanomolar nutrient concentrations these transporters are capable of a rapid uptake which gives a distinct advantage in the extreme competition for multiple nutrients in oligotrophic systems.

The overarching aim was to examine morphology, composition and metabolic activities of dominant microbes within planktonic communities, inhabiting the euphotic zone of the subtropical South Pacific Ocean, by examining the abundance, phylogenetic composition, metabolic activities and bacterivory of dominant microbial groups within planktonic communities, inhabiting the South Pacific Gyre, and mapping against the transsect Chile/NZ.

7.7.1 Abundance and Composition of Microbial Plankton Communities: flow cytometry (I.Tews)

Objectives:

1. To determine the distribution, abundance and community structure of nano- and picophytoplankton, heterotrophic bacteria and heterotrophic nano- and picoplankton sampling the water colum from predawn CTD casts by flow cytometry.

2.	To determine the distribution, abundance and community structure of nano- and picophytoplankton, heterotrophic bacteria and heterotrophic nano- and picoplankton sampling a 300 m water colum four times during the day at a particular Gyre station from predawn CTD casts by flow cytometry.
3.	To determine the distribution, abundance and community structure of planktonic phototrophic and heterotrophic bacteria from high frequency underway sampling from the ship's pumped seawater supply by flow cytometry.

Microbial plankton was analysed based on their light scattering, DNA staining using SYBR Green I (Sigma), and autofluorescence properties. The data were immediately stored on disk and made available to SO245 scientist. Further data analysis will be carried out back ashore.

Seawater samples were collected in clean 50 mL Falcon tubes from a Seabird CTD system containing a 24 bottle rosette of 10 Niskin bottles from predawn CTD casts, see Table 1. Aliqouts of the samples (1-3 ml typ.) were fixed in 1% paraformaldehyde within half an hour of sampling. Samples were stained with the DNA stain SYBR Green I (Sigma) in order to separate microbial cells based on their DNA content and light scatter.

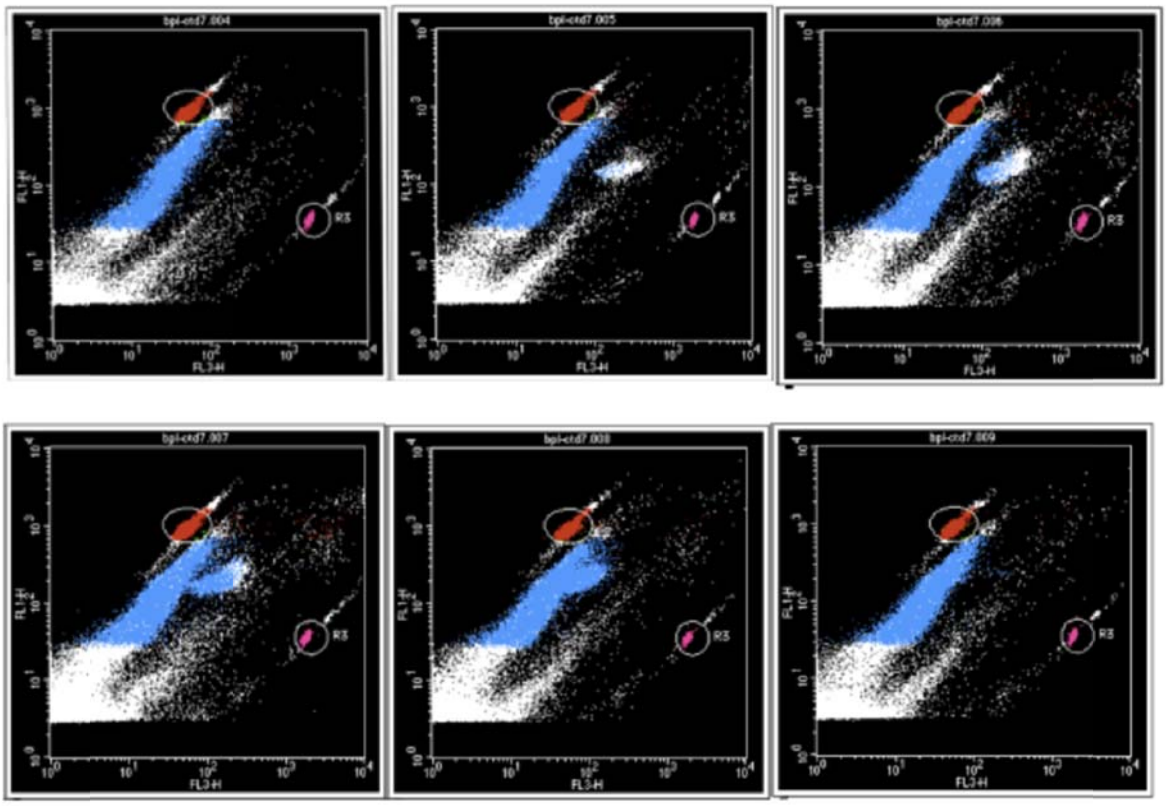


Figure 7.13: Green (FL1H) *vs.* red (FL3H) fluorescence of the depth profile collected at station SO245-7 with a Becton Dickinson FACSort flow cytometer. Depths collected were 300m, 250m, 225m (top row) and 200m, 175m, 150m (bottom row). The prominent populaton in the centre are *Prochlorococcus.* the SYBR Green DNA stain is detected in the FL1-channel, and is constant in all pictures. FL3 detects autofluorescence from pigmentation, changing across the depth profile.

Stained samples were analysied with Becton Dickinson (BD) FACSort flow cytometer (from station SO245-5 on) using two protocols for bacterioplankton and protists to count high nucleic acid (HNA) and low nucleic acid (LNA) containing bacteria, *Prochlorococcus* and *Synechococcus* cyanobacteria, as well as heterotrophic and phototrophic pico-eukaryotes.

Samples were additionally analysed on a BD Accuri flow cytometer for overall bacterial counts.

For Underway-Sampling, 1 ml of seawater was collected by Tecan auto-sampler and fixed with 1% paraformaldehyde. Later, samples were stained with SYBR Green I and flow cytometrically analyzed within 24 hrs using a BD Accuri flow cytometer for overall bacterial counts, as well as abundance of High Nucleic Acid (HNA) and Low Nucleic Acid (LNA) bacteria. A Becton Dickinson FACSort flow cytometer was used for finer characterization.

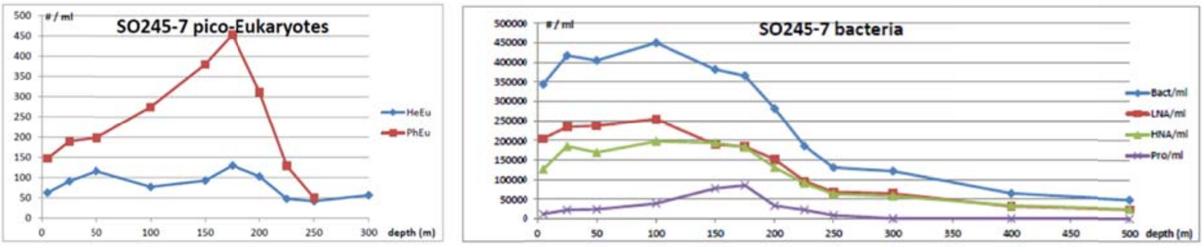


Figure 7.14: Water column bacterial counts and pico-eukaryotic counts for Station SO245-07 with Bact: all bacteria; HNA: High Nucleic Acid containig bacteria; LNA: Low Nucleic Acid containig bacteria; Pro: *Prochlorococcus* sp.; PhE: Phototrophic Eukaryotes; HEu: Heterotrophic Eukaryotes

Underway surface seawater was sampled every 30 mins to monitor bacterioplankton abundance. Sampling commenced on the 26th December 2015 and finished on the 25th January 2016. Underway samples were drawn from the ship's non-toxic seawater supply, using the Kreiselpumpe. After the 2nd January, the Membrane pump was used for sampling.

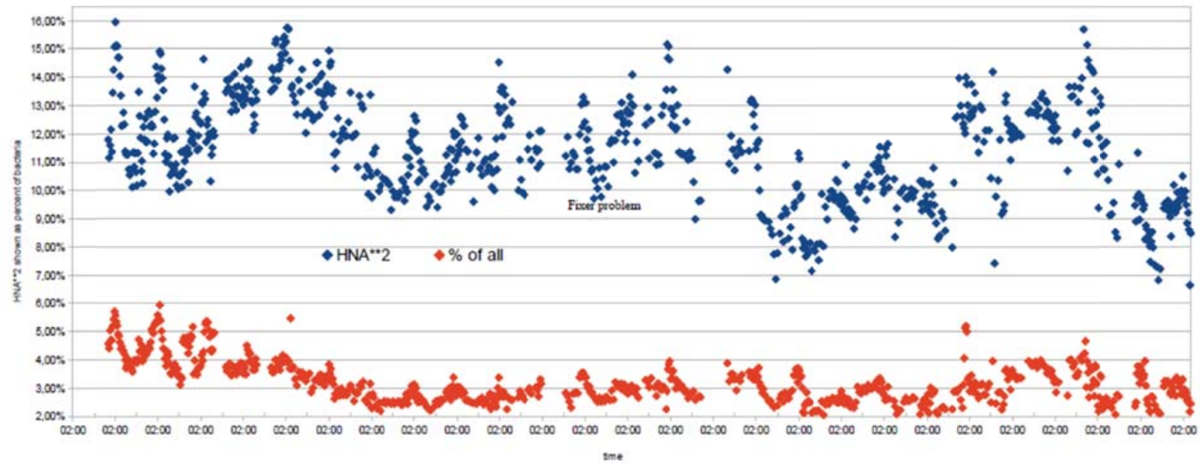


Figure 7.15 Diurnal Rhytmic of surface water samples. Plotted are data covering the time of travel from the 28th of December to the transsect that show a comparison of bacterial counts for High Nucleic Acid content in areas where S-phase bacteria are expected, indicative of cell divison activity. In the surface waters, this occurs after midnight, and dividing *Prochlorococcus* may be a likely cause of this observation.

7.7.2 Microbial turnover of amino acids (M. Machelett)

Aims: Assess metabolic activities of the planktonic community in oligotrophic and eutrophic provinces of the South Pacific Ocean.

Objectives: To estimate turnover rates of amino acids, we used leucine, lysine and methionine tracers.To compare ambient concentrations and microbial uptake of leucine, lysine and methionine in the South Pacific Ocean.

In order to measure ambient concentrations as well as uptake rates of the amino acids leucine, lysine and methionine by total microbial plankton, isotopic dilution time-series incubations were used (Zubkov et al 2004, Zubkov et al 2007).

Microbial uptake of these amino acids in the oligotrophic South Pacific gyre and productive eutrophic provinces of the South Pacific Ocean will be determined after further processing using a low background scintillation counter at NOC Southampton. Ambient concentrations and turnover rates will then be estimated.

7.7.3 Microbial turnover of urea (N. Kamennaya, M. Zubkov)

Aims: Assess metabolic activities of the planktonic community in oligotrophic and eutrophic provinces of the South Pacific Ocean.

Objectives: To estimate turnover rates and compare ambient concentrations and microbial uptake of urea in the South Pacific Ocean using the bioassays..

7.7.4 Turnover of dissolved organic nutrients in dark vs light (M. Machelett, I. Tews)

Aims: To evaluate the effect of light on microbial nutrient uptake.

Objectives: To estimate turnover rates of dissolved amino acids using leucine and methionine.

Light-enhanced uptake rates of leucine and methionine by total microbial plankton were measured using isotopic dilution time-series incubations (see above). Microbial uptake was determined in the nutrient-depleted South Pacific gyre to estimate ambient concentrations and turnover rates of the bioavailable fraction. The relative contributions of the dominant prokaryotic groups were assayed using flow cytometric cell sorting.

7.7.5 Bacterial proteomics (N. Kamennaya, M. Zubkov)

Aim: To assess efficiency of peptide labelling of dominant bacterioplankton populations.

Objectives: To label bacterial populations with heavy stable isotopes for flow sorting.

7.7.6 Morphology and composition of microbes dominant in the surface mixed layer (N. Kamennaya, M. Zubkov)

Microbial samples were collected at a depth representative of the mixed layer as well as at a depth within the deep chlorophyll or DCM in the surface mixed layer (Table 2). Microbes were fixed with paraformaldehyde at 4% final concentration and pre-concentrated using 0.2, 0.6 and 1.0 um nuclepore filters. Concentrated samples were analysed and flow sorted using a fast speed flow cytometer (MoFlo). Sorted cells were collected for spectroscopic and microscopic analyses ashore within the next 15 months.

7.8 Isotope geochemistry

The isotope geochemistry part of the cruise comprises samples for the analyses of radiogenic neodymium isotopes, rare earth element concentrations, stable silicon isotopes,

thorium and protactinium isotopes, helium isotopes, actinium and radium isotopes.
We took water column samples, particle samples from in-situ pumps, and sediment samples from boxcorer. Typically, inorganic isotope measurements are made as part of a large suite of geochemical observations. The UltraPac cruise presents a rare opportunity to interpret our results in the context of the wide range of microbiological and biogeochemical measurements being made on board.

7.8.1 Radiogenic Neodymium Isotope Composition and Rare Earth Element Concentrations (C. Ehlert, M. Rehbein; PI K. Pahnke)

Neodymium isotope ratios ($^{143}Nd/^{144}Nd$, Nd IC) and Rare Earth Element (REE) concentrations are useful tracers of provenance of terrestrial material (dust, ice-rafted debris), as well as water masses and trace element cycling in the ocean (e.g., Piepgras and Jacobsen, 1988; Lacan and Jeandel, 2004; Pahnke et al., 2012). Because seawater Nd isotope signatures are preserved in marine sediments, Nd isotopes have also gained attention as proxies of past ocean circulation changes (Frank, 2002; Pahnke et al., 2008). However, the South Pacific is one of the least characterized regions of the world's oceans with respect to trace element and isotope distributions, and no data exist to date of Nd IC and REE concentrations of seawater in the eastern and central South Pacific.
Samples were taken for analysis of Nd IC and REE concentrations according to GEOTRACES protocols.

Water column sampling for analyses of dissolved Nd IC and REE concentrations was performed at all 15 stations up to 20 depths per station. Station SO245-15 (39°S, 170°W) is a crossover station with the Japanese GEOTRACES transect, which will allow us to compare our measurements over the full water column.
The seawater was filtered gravitationally from the CTD-rosette Niskin bottles into acid pre-cleaned collapsible 10L LDPE containers for Nd isotopes, and into acid pre-cleaned 0.125L HDPE bottles for REE concentration measurements using AcroPak500 cartridges (0.8/0.45µm pore size, Supor® pleated membrane). Each filter was dedicated to a specific depth range and was used for that depth range at each station. Nd is characterized by a nutrient-like concentration profile throughout the water column. Therefore, our collected sample volumes for Nd IC vary according to expected concentrations, i.e. 20 liters in surface waters with low Nd concentrations (0-750m water depth), 10 liters in intermediate waters (ca. 1000m water depth) and 5 liters in deep waters with elevated Nd concentrations (>1000m water depth). In total, we collected ca. 3282 liters of seawater for Nd IC and REE concentration measurements.
After the filtration, the water samples were acidified with Teflon-distilled ultra-clean 6N hydrochloric acid (HCl) to pH of 3.5 for Nd IC and to pH of 2 for REE analyses. Samples collected for REE measurements were stored for onshore treatments. Samples for Nd IC were pre-concentrated onboard using C18 SepPak® cartridges (Waters Inc.) pre-loaded with an REE complexing agent (HDEHP) (modified after Jeandel et al., 1998 and references therein). The C18 cartridges were then stored for further treatment in the shore-based laboratory.

7.8.2 Stable Silicon Isotopes (C. Ehlert)

The silicon isotope composition of dissolved silicic acid (Si IC) is an important tool to investigate the biogeochemical cycling of silicon (Si). Besides nitrate and phosphate, silicic acid ($Si(OH)_4$) Is a major nutrient for diatoms, which require $Si(OH)_4$ to build up their frustules. The Si IC signature not only helps to understand the biogeochemical cycling of Si in the modern ocean but via its incorporation into diatom frustules it is also an important proxy for the reconstruction of $Si(OH)_4$ utilization in the past (e.g., De la Rocha et al., 1998; Pichevin et al., 2009; Ehlert et al., 2013). There are no Si IC data available for the western South Pacific and only very few data exist for the eastern South Pacific (De Souza et al., 2012), where water mass mixing and transport (mostly Antarctic Intermediate Water and Subantarctic Mode Water) seem to have a strong influence.

The seawater samples for the determination of Si IC was filtered directly from the CTD-rosette Niskin bottles into acid pre-cleaned LDPE bottles using AcroPak500 cartridges (0.8/0.45µm pore size, Supor® pleated membrane). Sample volumes were varied throughout the water column according to expected concentrations, i.e. 1.0 liter in highly Si-depleted surface waters, 0.5 liters in intermediate waters and 0.125 liters in Si-enriched deep waters. In total, we collected ca. 86 liters of seawater. After the filtration, samples were stored for further onshore treatments.

7.8.3 Thorium and Protactinium Isotopes (F. Pavia, S. Vivancos, PI R. Anderson)

The isotopes of thorium (^{232}Th, ^{230}Th) and protactinium (^{231}Pa) are unique tracers of particle dynamics and overturning circulation (e.g. Hayes et al., 2014). Produced evenly throughout the water column by the decay of soluble uranium, ^{230}Th and ^{231}Pa are extremely insoluble and rapidly adsorb onto suspended and sinking particles (Bacon & Anderson, 1982). The disequilibrium from production by their parent isotopes make ^{230}Th and ^{231}Pa rare 'clocks' providing rate information associated with scavenging. ^{232}Th is primordial and enters the ocean by partial dissolution of dust, margin sediments, and re-suspended bottom sediments (Deng, et al., 2014; Hayes et al., 2013; Hsieh et al., 2011). The South Pacific is an exceptional location to quantify the input of trace elements and lithogenic material from dust dissolution and scavenging intensity of trace metals by particles using Th and Pa isotopes, since the input rates of dust and particle flux are so low. Finally, we seek to use Th and Pa to quantify the removal of trace elements within the effluent plume of the south East Pacific Rise, one of the fastest spreading mid-ocean ridges in the world.

Samples were taken for analysis of thorium (^{232}Th, ^{230}Th) and protactinium (^{231}Pa) isotopes at all 15 stations according to GEOTRACES protocols. Briefly, 8-10 liter samples were gravity filtered from Niskin bottles through 0.45 µm Acropak™-500 filter capsules connected to the Niskin bottle using acid-cleaned Teflon-lined Tygon tubing and collected in acid-washed 10-liter cubitainers. Samples were immediately acidified to pH=2 using 40 mL of Optima™-grade 6N HCl, double-bagged, and stored for shipment back to LDEO. Samples will then be spiked with ^{229}Th and ^{233}Pa, pre-concentrated by iron co-precipitation, purified by acid digestion and anion exchange column chromatography, and measured by isotope dilution inductively-coupled plasma mass spectrometry.

7.8.4 Helium Isotopes (F. Pavia, S. Vivancos)

Helium isotopes in the ocean have been used for a variety of purposes. The $^{3}He/^{4}He$ ratio of the mantle is 8-10 times higher than that of the atmosphere (Lupton & Craig, 1981). Near the ridge-axis of mid-ocean ridge systems, primordial, high $^{3}He/^{4}He$ helium rises, escapes to the deep ocean via seafloor vents, and rises until neutrally buoyant. Since it is chemically inert, advection and eddy diffusion are the only processes modulating the dispersion of helium from its point source. Our ^{3}He measurements will be used to track the hydrothermal plume emanating from the East Pacific Rise at ~23 ºS (Lupton & Craig, 1981), where geostrophic flow at depth is eastward (Reid, 1986). Due to its conservative nature and point sources at the seafloor, helium isotopes also provide rare observational evidence to validate models of circulation and mixing in the the abyssal ocean (Downes et al., 2013; Faure & Speer, 2012; Gnanadesikan et al., 2015; Reid, 1986). The UltraPac fills a gap between WOCE transects at 15 ºS and 30 ºS (Figure 6.2), and will be of great use in determining the circulation regimes of the deep South Pacific.

Samples for helium isotope analysis were taken at the 7 main stations and the GEOTRACES crossover station. At 5 stations, samples were only taken below 1500 meters depth, and at 3 stations, a few samples were taken in the upper water column as well. Samples were collected immediately upon opening Niskin bottles to minimize helium diffusion. Bottles were first leak-checked to ensure no atmospheric gas had equilibrated with the seawater. Between 1-2 liters of seawater was drawn from the Niskin bottles using tygon tubing and passed through soft copper refrigeration tubing. During flow, the metal housing of the copper tube was tapped using the backside of a wrench to dislodge any air bubbles trapped within the copper. The copper was then crimped at both ends to ensure an airtight seal preventing any diffusion of helium in and out of the sample (Young and Lupton 1983), and stored for shipment back to LDEO. Total sample volume within the copper tube is ~40 mL. Between sampling periods, tygon tubing was immersed in a bucket of seawater, replaced daily, to prevent accumulation of helium on the inside of the tubing. Upon return, samples will undergo quantitative vacuum extraction of gases, which are purified over SAES getters and cryogenically trapped and separated before analysis by VG5400 noble gas mass spectrometer.

7.8.5 Radium and Actinium Isotopes (F. Pavia, S. Vivancos))

The isotopes of radium (^{226}Ra, ^{228}Ra) and actinium (^{227}Ac) are used to trace deep mixing and hydrothermal activity in the ocean. Since their removal by scavenging is orders of magnitude slower than their decay, they are essentially soluble, decaying tracers. Ra and Ac isotopes enter the ocean primarily through diffusion from bottom sediments, where their parent isotopes of Th and Pa accumulate (Ku & Luo, 2008). Profiles of Ra and Ac typically decay moving up through the water column, and can be exponentially fit using 1-d or 2-d advection-diffusion models to solve for deep abyssal vertical mixing rates. It has been recently recognized (Kipp et al., 2015) that hydrothermal vents are an additional source of ^{227}Ac to the water column. During advection of the hydrothermal plume, ^{227}Ac decays, while ^{3}He does not, allowing for the determination of the age of the plume since its emanation using $^{227}Ac/^{3}He$ ratios.

Large volume samples were collected for analysis of actinium (^{227}Ac) and radium (^{226}Ra, ^{228}Ra) isotopes at the 7 main stations and GEOTRACES crossover station (Table xx). A stand with two cartridge holders was mounted on the steel support of six in-situ pumps. Tygothane polyurethane tubing was attached to the exhaust valve of the in-situ pump. The filtered water passed through the tubing and over two MnO_2 cartridges for each sample, which scavenged the Ac and Ra out of solution, then passed the water out through tubing below the bottom of the pump. The second cartridge will be used to check the collection efficiency of the cartridges. A check-valve placed on the tubing leading from the pump exhaust to the cartridges ensured that MnO_2 particles would not backflush from the cartridges and contaminate the underside of the particle filters. Upon return of the pumps, the cartridges were removed from their holders and bagged for shipment back to WHOI (Ra) and

USC (Ac).

7.9 Particle Filters (C. Ehlert, B. Fuchs, F. Pavia, S. Vivancos, PIs R. Anderson, B. Fuchs, K. Pahnke)

Particles are a key vector transporting matter from the surface to the abyss and eventually out of the water column. In the South Pacific Gyre, particulate material is thought to be the lowest of anywhere in the ocean, due to nutrient starvation of microorganisms at the surface and extremely low dust flux. The LDEO group will measure particulate uranium, thorium, and protactinium isotopes to characterize particle sinking rates and study the effect of particle composition on the scavenging efficiency of trace metals. The Pahnke group will measure neodymium isotopes and rare earth element (REE) concentrations to understand the water column behavior of REE when there is extremely low particle flux. Finally, the MPI Molecular Ecology Group will use the biological material on the filters to construct a metagenome of the South Pacific.

Large-volume particulate samples were collected via McLane Research Laboratories WTS-LV Standard Model in-situ pumps. Eight pumps were deployed at each main station and the GEOTRACES crossover station and set to pump for six hours at 3 L/min (one pump, 0.2 µm filter), 5 L/min (three pumps, 2x0.8 µm filters), or 6 (four pumps, 2x0.8 µm filters). At all but the last station, one pump designated for microbiological studies was fitted with a single 0.2 µm polycarbonate filter and set to pump for 6 hours and 3 L/min. The other seven pumps were fitted with 2x0.8 µm Supor™ polyethersulfone filters and set to pump for 6 hours at 5-6 L/min. At the final station, all pumps used 2x0.8 polyethersulfone filters and pumped for 4 hours at 5-6 L/min. The 2x0.8 polyethersulfone filters have an effective pore size of 0.45 µm, and are used instead of a single 0.45 µm filter for better particle loading and more even particle distribution (Bishop et al., 2012). The diameter of all filters was 142 mm.

Upon collection of the pumps, filter holders were immediately covered by a shower cap to reduce contamination. Filter holders were removed and connected to a vacuum pump to remove the excess water on top of the filters and reduce redistribution of particles. Filter holders were then taken to a laminar flow bench, where the filters were photographed, cut, and photographed again to document the distribution of particles on the filter. A 1/8th cut was immediately put into a vial and frozen for microbiological analysis. The other sections (1/2 for neodymium isotopes and rare earth element concentrations, 1/4 for thorium and protactinium isotopes, and 1/8 for archive) were dried for 24 hours before storage in static-free plastic bags for shipment back to MPI-Oldenburg (Nd/REE) and LDEO (U/Th, archive).

Figure 7.16 Examples for filters from station SO245-08. Left: 200 m water depth (=DCM, pumped volume: 1317 liters), right: 2800 m water depth (pumped volume: 1158 liters).

7.10 Sediment

(C. Ehlert,T. Ferdelman, F. Pavia, S. Vivancos, J. Serratosa)

At each location, a geophysical survey was conducted prior to coring operations.Sediment samples were retrieved from the seafloor using a Giant Box Corer (GBC, size 30 x 30 x 60 cm) and a gravity corer (GC, gear length ca. 4 m, 1t weight). Coring operations were performed at each main station SO245-02, -04, -06, -08, -10, -12, -14 and -15 (Table XX).

For storage and archiving of the cores we retrieved a GeoB-number (GeoB204) and followed the GeoB-labelling scheme as in the following example:

GeoB20412-15-02

This corresponds to SO245 station number 12, event number 15 (=GBC) and subcore number 02 (= for pore water analyses).

The GBC worked well at all sites with recovered sediments between 10 cm (station SO245-08) and 46 cm (station SO245-04). For each GBC we siphoned the overlying water, took photos of the surface layout, measured the recovery and took out subsamples if appropriate, e.g. big Mn-nodules. Afterwards we took five subcores: one 7.5 cm-diameter plastic tube for pore water sampling and analyses and four 9 cm-diameter plastic tubes. All cores were transferred to the cool room of the ship, where we measured the recovery for each core, took photos and described the sediment. Two cores were packed as archive cores, one will be stored at and one in Bremen. The two other cores were sliced onboard into 1 cm intervals for the later analyses of Th-Pa (PI R. Anderson) and Nd IC and REE. After retrieving the subcores the remaining sediment was washed over a 1mm-sieve.

Due to relatively limited time for the acoustic survey the GC worked well only at some of the sites. We recovered sediment from stations SO245-04, -10, -12, and -14. At the other stations coring with the GC was not succeful and the core came back empty. The reason was mostly that the core hit a hard layer of sediment in shallow depth below the sediment surface that it could not penetrate. In total we retrieved with the GC 989 cm of sediment. All cores were labeled but not opened and will be transported to Bremen as whole rounds for further processing, subsampling and archiving.

Pore waters from sub-cores from the box cores were collected using Rhizone interstitial water samplers inserted through the pre-drilled holes in a sub-core. Exactly 3.0 ml of pore water was subsequently diluted with OSIL low nutrient seawater and analyzed for the nutrients nitrate, nitrite phosphate, and silicate as described in Section 7.5.1. Pore water nutrient profiles for two typical stations, SO245-06 and SO245-08 from the gyre center are shown in Figure 7.x. Particularly interesting is the very slight dissolved P gradient towards the sediment-water interface, where surface concentrations are approximately 0.5 µM lower than the overlying water, suggesting a trapping of dissolved P at the sediment surface.

CDOM was tested in a couple of pore water samples (see Section 7.4.2) , and the remaining pore waters was stored and will be shipped to Oldenburg for examination of Si-isotopes (see Section 7.8.2).

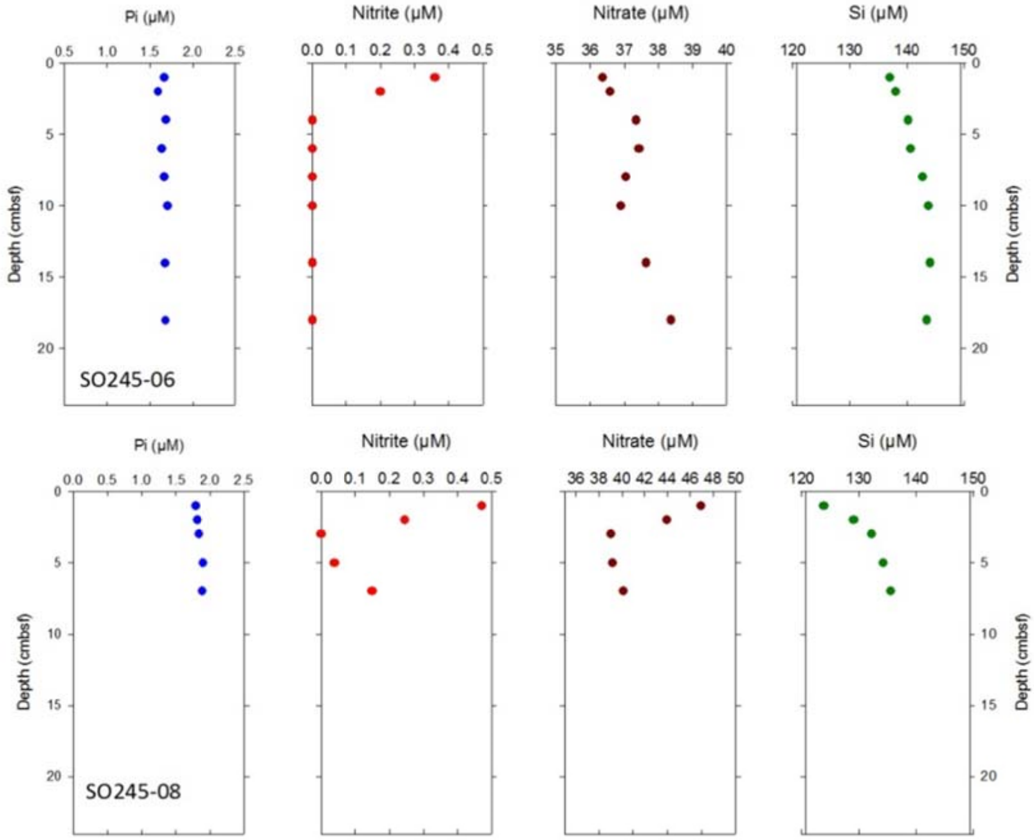


Figure 7.17 Sediment pore water distributions of nutrients dissolved phosphate, nitrite, nitrate and silicate from two gyre stations (cmbsf = cm below sediment surface).

7.11 Aerosol and Aeolian Matter Transport

7.11.1 Dust sampling (N. Stoll, G. Lavik; PI: J.-B. Stuut)

Two outdoor high air volume air samplers, purchased from HI-Q Environmental Products Company – San Diego, USA in 2004, were used. Unit PUF-3000BRL was equiped with glass- fibre filters. The second unit, HVP-3300BRL/230, was equiped with cellulose-acetate filters. Unit 1 and Unit 2 were placed on top of the Peildeck, two decks above the bridge, and a wind vane was attached to prevent sampling smoke from the chimney.

Dust collection was started on the 25th of December 2015 at 12:27 (UTC) at 23°29,998' S and 84°16,723' W. Both units were in almost constant use until the end of lab work at 05:09 (UTC) on the 26th of January 2016.

Sampling was only stopped during intermediate stations due to the short duration of these events. On main stations (more than 40 hours in length), filters were changed at the beginning and the end of each station. In the beginning filters were changed daily, but this interval was slightly changed at Station SO245-03 to better match station planning.

In total, 25 cellulose-acetate filters as well as 25 glass-fibre filters were used during the cruise.Even though there are no final results yet, it is already visible with the naked eye that the amount of dust on the filters is very small, which is not surprising for this area of the Ocean. Filters were transported to Bremen for further analysis at MARUM and NIOZ.

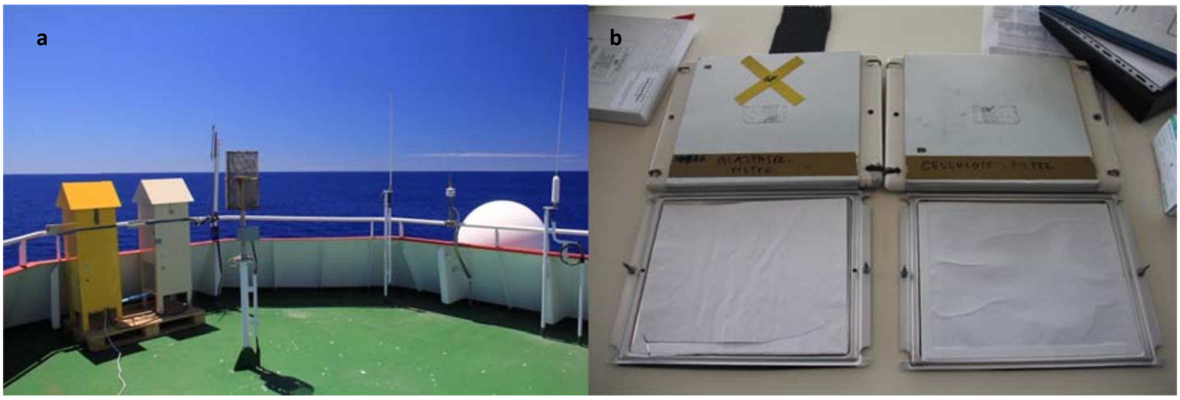


Figure 7.18 a. Placement of filter units on Deck 9. *b.)* Filters from Station SO245-15. The glass-fiber filter is on the left, and a cellulose-acetate is on the right.

7.11.2 Atmospheric Optics: Measurements of AOT (Aerosol Optical Thickness) over the South Pacific Ocean (P.L. Croot and S. Nicholas in cooperation with A. Smirnov and B. Holben NASA/Goddard Space Flight Center)

Objectives: There is a currently a lack of ground truth information for measurements of AOT (Aerosol Optical Thickness) from the South Pacific Ocean. While satellite measurements of AOT are possible at present through a number of dedicated satellites (MODIS AQUA and TERRA) data interpretation is reduced due to persistent cloud cover and reflections from sea ice and waves. Direct measurements of AOT from the surface using the sun as a light source are possible using small handheld devices such as the MICROTOPS and provide a useful dataset to validate retrieval algorithms for satellite estimation of AOT as well as providing instantaneous information for shipboard users. For SO245 we undertook measurements of AOT when the weather permitted to provide baseline data for improving satellite retrievals and for assessment of any contribution from atmospheric dust to the aerosol loading over the South Pacific. This data will also contribute towards atmospheric corrections of Satellite chlorophyll data across the South Pacific Gyre.

Introduction: Transport of airborne dust from the continents provides a route by which Fe and other trace elements can enter remote surface ocean waters. This transport can be of particular importance for supplying iron to HNLC regions where Fe is the limiting nutrient. For the South Pacific it is suspected that much of the dust deposited to surface waters originates from Australia [*Stancin et al.*, 2008] with very little originating from South America.

Sampling: During SO245 discrete AOT measurements were made using a MICROTOPS II kindly loaned by the NASA/Goddard Space Flight Centre in conjunction with the AERONET Maritime Aerosol Network program [*Smirnov et al.*, 2009; *Smirnov et al.*, 2011]:

(http://aeronet.gsfc.nasa.gov/new_web/maritime_aerosol_network.html)

The MICROTOPS II is a handheld instrument that is well characterised for AOT measurements [*Ichoku et al.*, 2002] and is capable of being used on moving platform such as a ship at sea [*Porter et al.*, 2001].

Work at Sea: Over 1200 individual measurements were collected during the course of SO245, corresponding to the periods when the sun was visible and not obscured by clouds. The expedition was lucky with having a number of days of clear skies while transiting through the SPG and south western Pacific where previously there was little data collected.

Preliminary Results: The preliminary data indicated extremely low AOT over the course track most of the time suggesting there was little dust encountered during the cruise as might be expected for this remote region. The collected AOT data was forwarded onto NASA for post-processing and release to the web portal. Post cruise the data will be interpreted with the help of back trajectory analysis (HYSPLIT) to determine the origin of the different airmasses observed during the transect.

7.12 Anthropogenic impacts on the South Pacific Gyre

7.12.1 Seabird Distribution and Marine Debris (J. Serratosa; PI Martin Thiel)

The overall objective of this project is to generate the necessary scientific basis for strengthening strategies for the sustainable management and conservation of biodiversity in the ecoregion of Rapa Nui, which includes Rapa Nui and Salas and Gomez. Both research activities are included in the project; Ecology and Sustainable Management of Oceanic Islands (ESMOI, www.esmoi.cl) run by the Universidad Católica del Norte, in which also forms the basis of doctoral research project.

Marine debris is a major threat to marine ecosystems and topically important in biological conservation (Thompson et al. 2009). The impacts on marine wildlife are varied and the list of different organisms being affected continuous to increase (Gall and Thompson 2015). All this anthropogenic litter tends to concentrate in the subtropical gyres due to currents and marine circulation (Lebreton et al. 2012). Some of these subtropical gyres has been well documented and studied such like the ones from the Northern hemisphere; in the Pacific Ocean (Moore et al. 2001) and in the Atlantic Ocean (Law et al. 2010). In the case of the South-Pacific Subtropical Gyre (SPSG) very little information is available. One of the few samplings so far having place in this gyre is the one done by Eriksen et al. 2013, in which they did a single transect across the gyre. In the last years we have collected data of floating marine debris covering the area between Eastern Island and Continental Chile. A first publication from the ESMOI project came out from this work (Miranda-Urbina et al. 2015), in which the results were consistent with the ones obtain by Eriksen et al. 2013. The SO245 expedition was an opportunity to increase our database in the study area and to cover a bigger crossing through the SPSG. This will allow us to have a more complete and precise picture of the accumulation of marine debris in this part of the world.

The seabird distribution at sea is one of the ecological aspects of seabirds that have been more difficult to elucidate. This is mainly due to the obvious difficulty of covering vast areas of the oceans looking for birds. Recent technical advances such like the satellite transmitters have improve our knowledge of this particular issue, however there is still a gap in our understanding of this aspect of seabird’s ecology (Lewison et al. 2012). This lack of information is even greater when talking about particular species or geographical area. In the case of the South-Pacific Ocean very little information is available. Probably, the best and most complete works are those by Spears et al. 2005, 2007 and 2001 in which gives information about the Eastern Pacific Ocean including a portion of the South-Eastern Pacific Ocean. Even if not specifically from our study area some of the species are common in both areas, so it is an important contribution.

The data obtained during the SO245 expedition will be included in a Ph.D. thesis which aims to clarify the distribution at sea of seabirds present in the South East Pacific Ocean and to determine the environmental factors that influence this distribution. The study area includes a longitudinal gradient which goes from continental Chile until Eastern Island. In this transect three different ecoregions are present; Humboldtian, Juan Fernandez and Desventuradas and Easter Island ecoregions (Spalding et al. 2007). Each one of this has a distinctive and characteristic ensemble of seabird species which will be recorded and characterized. It is the purpose of this study as well to identify how these ensembles of species changes and the factors influencing this. This transect includes an interesting change in many oceanographic and environmental factors that could influence this changes in abundance, richness and composition of seabirds species as one moves from one of the most productive waters in the world, the Humboldt Current, to one of the most oligotrophic waters in Easter Island.

Counting seabirds at sea from ships is one of the most common (and cheapest) ways to obtain information about the distribution and presence of seabirds at sea. The methodology employed in this cruise is based on the recommendations proposed by Tasker et al. 1984. These aim a double objective i) to provide a density estimate by the use of a band transect and ii) to correct the bias caused by the movement of flying birds in the band transect. To summarize, an observer was positioned at the flying bridge of the ship counting all birds while the ship was moving in a constant direction and speed. In our case a 300 m band transect on one side of the ship was used; a viewing arc of 90º from the prow and the sampling unit was of 10 minutes. All the individuals were identified to the lowest possible taxonomic level. Other aspects recorded when possible were age, flying direction, distance to ship and behavior. The geographical position was continuously recorded using a GPS.

In the case of the marine debris a similar methodology was employed, all the marine litter sighted was recorded including the position (GPS), type, number and distance to the vessel of each item according to the methodology described in Thiel et al. 2013 and Miranda-Urbina et al. 2015.

The expected results in relation with the seabirds should show an obvious change in the ensemble of species while moving through the study area. These species ensemble should be characteristic of the specific region. In relation with the abundance of seabirds this should be positive correlated with the ocean productivity, so the lower productivity the lower abundance or seabirds. However, this effect is affected by the closeness to breeding colonies or islands, so the data should show that too (Miranda-Urbina et al. 2015).

In relation with the marine debris, the most common type of material should be plastic and the data should reflect a density gradient throughout the SPSG. According to Eriksen et al. 2013 and Miranda-Urbina et al. 2015, the maximum density of marine litter is around Eastern Island. This pattern is consistent with the computer model developed by Maximenko et al. 2012 to estimate the accumulation zone in the SPGP based on ocean circulation and currents, so our data should show a similar pattern.

7.12.2 Microplastics across the SPG (A. Wieczorek, P.L: Croot)

*Objectives:*To assess the concentration and distribution of microplastics across the South

Pacific Gyre

*Introduction:*Recent work by Chilean colleagues has shown that plastic litter can be found in the Eastern Southern Pacific [*Miranda-Urbina et al.*, 2015] and washed ashore on Easter Island [*Hidalgo-Ruz and Thiel*, 2013] in the South Pacific Gyre [*Eriksen et al.*, 2013]. While the focus so far has been on larger scale plastic litter, attention now is being placed on microplastics and how they may interact with the microbial foodweb. To further this research we are undertaking a comparative study between the South Pacific and the North Atlantic to examine the differences between the extent of this type of pollution and the communities they impact.

*Sampling:*Large volume samples were obtained from the ships underway pumping system by pumping the water through a flow meter and into a micronet. Similar samples were also obtained using the pump CTD.

*Work at Sea:*Over 60 samples were obtained during the course of the expedition and this will be examined in detail back in the lab in Galway.

*Preliminary Results:*There are no results to report at present, though indications are that there was some microplastic material but in general it was mostly absent.

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9. References / Literaturverzeichnis

Aristegui J, Gasol JM, Duarte CM, Herndl, 2009, Microbial oceanography of the dark ocean's pelagic realm. Limnol. and Oceanogr. 54: 1501-1529.

Bacon, M. P., & Anderson, **R. F.** (1982). Distribution of Thorium Isotopes Between Dissolved and Particulate Forms in The Deep Sea. Journal of Geophysical Research, 87(C3), 2045–2056. http://doi.org/10.1111/j.1365-3091.2012.01327.x

Berman-Frank, I, Cullen JT, Shaked Y, Sherrell RM., and Falkowski PG , 2001, Iron availability, cellular iron quotas, and nitrogen fixation in Trichodesmium. Limnol Oceanogr 46: 1249-1260.

Bishop, J.K., Lam, P.J., Wood, T.J. (2012). Getting good particles: Accurate sampling of particles by large volume in-situ filtration. Limnology and Oceanography: Methods, 10, 681-710. http://doi.org/10.4319/lom.2012.10.681

Bluhm, K., P. Croot, K. Wuttig, and K. Lochte (2010), Transformation of iodate to iodide in marine phytoplankton driven by cell senescence, Aquatic Biology, 11(1), 1-15.

Bricaud, A., M. Babin, H. Claustre, J. Ras, and F. Tièche (2010), Light absorption properties and absorption budget of Southeast Pacific waters, Journal of Geophysical Research: Oceans, 115(C8), n/a-n/a.

Chen, L., J. Ma, Y. Huang, M. Dai, and X. Li (2015), Optimization of a colorimetric method to determine trace urea in seawater, Limnology and Oceanography: Methods, 13(6), 303-311.

Croot, P. L. (2011), Rapid Determination of Picomolar Titanium in Seawater with Catalytic Cathodic Stripping Voltammetry, Analytical Chemistry, 83(16), 6395-6400.

Croot, P. L., P. Streu, I. Peeken, K. Lochte, and A. R. Baker (2004), Influence of the ITCZ on H_2O_2 in near surface waters in the equatorial Atlantic Ocean, Geophysical Research Letters, 31, L23S04, doi:10.1029/2004GL020154.

D'Sa, E. J., R. G. Steward, A. Vodacek, N. V. Blough, and D. Phinney (1999), Determining optical absorption of colored dissolved organic matter in seawater with a liquid capillary waveguide, Limnol. Oceanogr., 44, 1142-1148.

Dammshäuser, A., and P. L. Croot (2012), Low colloidal associations of aluminium and titanium in surface waters of the tropical Atlantic, Geochimica et Cosmochimica Acta, 96(0), 304-318.

Dammshäuser, A., T. Wagener, and P. L. Croot (2011), Surface water dissolved aluminum and titanium: Tracers for specific time scales of dust deposition to the Atlantic?, Geophys. Res. Lett., 38(24), L24601.

Deng, F., Thomas, A. L., Rijkenberg, M. J. A., & Henderson, G. M. (2014). Controls on seawater 231Pa, 230Th and 232Th concentrations along the flow paths of deep waters in the Southwest Atlantic. Earth and Planetary Science Letters, 390, 93–102.

de Jong, J. T. M., J. den Das, U. Bathmann, M. H. C. Stoll, G. Kattner, R. F. Nolting, and H. J. W. de Baar (1998), Dissolved iron at subnanomolar levels in the Southern Ocean as determined by ship-board analysis, Analytica Chimica Acta, 377, 113-124.

De La Rocha, C. L., Brzezinski, M. A., DeNiro, M. J., & Shemesh, A. (1998). Silicon-isotope composition of diatoms as an indicator of past oceanic changes. Nature, 395, 680–683.

D'Hondt S, Spivack A, Pockalny R, Ferdelman TG, Fischer JP, Kallmeyer J, Abrams L, Smith D, Graham D, Hasiuk F, Schrum H, Stancin A, 2009, Subseafloor sedimentary life in the South Pacific Gyre. Proc. Nat. Acad. Sci.,106, 11651-11656 doi:10.1073/pnas.o811793106.

D'Hondt S, Inagaki F, Alvarez Zarikian CA and the Expedition 329 Scientists including Ferdelman TG, 2011. Proc. IODP, 329: Tokyo (Integrated Ocean Drilling Program Management International, Inc.). doi:10.2204/iodp.proc.329.2011

D'Hondt et al. including Ferdelman TG, 2015, Presence of oxygen and aerobic communities from sea floor to basement in deep-sea sediments. Nature Geoscience, 8, 299-304.

Duce RA, et al. including Kuypers MM, 2008, Impacts of atmospheric anthropogenic nitrogen on the open ocean. Science, 320: 893-897.

Diaz, J. M., C. M. Hansel, B. M. Voelker, C. M. Mendes, P. F. Andeer, and T. Zhang (2013), Widespread Production of Extracellular Superoxide by Heterotrophic Bacteria, Science, 340(6137), 1223-1226.

Dittmar T, Koch B, Hertkorn N, Kattner G (2008) A simple and efficient method for the solid-phase extraction of dissolved organic matter (SPE-DOM) from seawater. Limnol Oceanogr Methods 6: 230-235

Downes, S. M., Key, R. M., Orsi, A. H., Speer, K. G., & Swift, J. H. (2013). Tracing Southwest Pacific Bottom Water Using Potential Vorticity and Helium-3. Journal of Physical Oceanography, 42, 2153–2168. http://doi.org/10.1175/JPO-D-12-019.1

Ehlert, C., Grasse, P., & Frank, M. (2013). Changes in silicate utilisation and upwelling intensity off Peru since the Last Glacial Maximum - insights from silicon and neodymium isotopes. Quaternary Science Reviews, 72, 18–35. doi:10.1016/j.quascirev.2013.04.013

Eriksen, M., N. Maximenko, M. Thiel, A. Cummins, G. Lattin, S. Wilson, J. Hafner, A. Zellers, and S. Rifman (2013), Plastic pollution in the South Pacific subtropical gyre, Marine Pollution Bulletin, 68(1–2), 71-76.

Falkowski PG ,1997, Evolution of the nitrogen cycle and its influence on the biological sequestration of CO_2 in the ocean. Nature 387**:** 272-275.

Faure, V., & Speer, K. (2012). Deep Circulation in the Eastern South Pacific Ocean. Journal of Marine Research, 70(5), 748–778. http://doi.org/10.1357/002224012806290714

Fischer JP, Ferdelman TG, D'Hondt S, Røy H, Wenzhöfer F, 2009, Oxygen penetration deep into the sediment of the South Pacific gyre. Biogeosciences 6, 1467-1478.

Fitzsimmons, JA, EA Boyle, and WJ Jenkins., 2014, Distal transport of dissolved hydrothermal iron in the deep South Pacific Ocean. PNAS, 11; 16654-16661.

Frank, M. (2002). Radiogenic isotopes: tracers of past ocean circulation and erosional input. Reviews of Geophysics, 40(1). doi:10.1029/2000RG000094

Gall, S. C., and R. C. Thompson. 2015. The impact of debris on marine life. Marine Pollution Bulletin 92:170–179.

Gnanadesikan, A., Pradal, M. A., & Abernathey, R. (2015). Exploring the isopycnal mixing and helium–heat paradoxes in a suite of Earth system models. Ocean Science, 11(4), 591–605.

Grosskopf T, Mohr W, Baustian T, Schunck H, Gill D, Kuypers MMM, Lavik G, Schmitz RA, Wallace DWR, LaRoche J (2012) Doubling of marine dinitrogen-fixation rates based on direct measurements. Nature 488: 361-364.

Halm H, Lam P, Ferdelman TG, Lavik G, Dittmar T, LaRoche J, D'Hondt S, and Kuypers MM, 2012, Heterotrophic organisms dominate nitrogen fixation in the South Pacific Gyre. The ISME J, 6: 1238–1249 doi:10.1038/ismej.2011.182.

Hansell DA, Carlson CA, Repeta DJ, Schlitzer R, 2009, Dissolved organic matter in the ocean. Oceanography 22, 203-211.

Hansell DA (2013) Recalcitrant Dissolved Organic Carbon Fractions. Annual Review of Marine Science 5(1): 421-445

Hayes, C. T., Anderson, R. F., Fleisher, M. Q., Huang, K.-F., Robinson, L. F., Lu, Y., et al. (2014). 230Th and 231Pa on GEOTRACES GA03, the U.S. GEOTRACES North Atlantic transect, and implications for modern and paleoceanographic chemical fluxes. Deep Sea Research Part II: Topical Studies in Oceanography. http://doi.org/10.1016/j.dsr2.2014.07.007

Hayes, C. T., Anderson, R. F., Fleisher, M. Q., Serno, S., Winckler, G., & Gersonde, R. (2013). Quantifying lithogenic inputs to the North Pacific Ocean using the long-lived thorium isotopes. Earth and Planetary Science Letters, 383, 16–25.

Heller, M. I., and P. L. Croot (2010a), Superoxide Decay Kinetics in the Southern Ocean, Environmental Science & Technology, 44(1), 191-196 DOI: 110.1021/es901766r.

Heller, M. I., and P. L. Croot (2010b), Application of a Superoxide (O_2^-) thermal source (SOTS-1) for the determination and calibration of O_2^- fluxes in seawater, Analytica Chimica Acta, 667, 1-13.

Helms, J. R., A. Stubbins, J. D. Ritchie, E. C. Minor, D. J. Kieber, and K. Mopper (2008), Absorption spectral slopes and slope ratios as indicators of molecular weight, source, and photobleaching of chromophoric dissolved organic matter, Limnol. Oceanogr., 53, 955-969.

Hidalgo-Ruz, V., and M. Thiel (2013), Distribution and abundance of small plastic debris on beaches in the SE Pacific (Chile): A study supported by a citizen science project, Marine Environmental Research, 87–88(0), 12-18.

Hsieh, Y.-T., Henderson, G. M., & Thomas, A. L. (2011). Combining seawater 232Th and 230Th concentrations to determine dust fluxes to the surface ocean. Earth and Planetary Science Letters, 312(3-4), 280–290.

Hwang, H., and P. K. Dasgupta (1985), Thermodynamics of the Hydrogen Peroxide-Water System, Environmental Science and Technology, 19, 255-258.

Ichoku, C., et al. (2002), Analysis of the performance characteristics of the five-channel Microtops II Sun photometer for measuring aerosol optical thickness and precipitable water vapor, Journal of Geophysical Research, 107, 4179, doi:4110.1029/2001JD001302.

Jeandel, C., Thouron, D., & Fieux, M. (1998). Concentrations and isotopic compositions of neodymium in the eastern Indian Ocean and Indonesian straits. Geochimica et Cosmochimica Acta, 62(15), 2597–2607.

Jickells, T. D., S. S. Boyd, and A. H. Knap (1988), Iodine Cycling in the Sargasso Sea and the Bermuda Inshore Waters, Marine Chemistry, 24, 61-82.

Kipp, L.E., Charette, M.A., Hammond, D.E., Moore, W.S. (2008). Hydrothermal vents: A previously unrecognized source of actinium-227 to the deep ocean. Marine Chemistry, 177(4), 583-590. http://doi.org/10.1016/j.marchem.2015.09.002.

Klawonn I, Lavik G, Boening P, Marchant H, Dekaezemacker J, Mohr W, Ploug H (2015) Simple approach for the preparation of ^{15}-$^{15}N_2$-enriched water for nitrogen fixation assessments: Evaluation, application and recommendations. Frontiers in Microbiology

Ku, T.-L., & Luo, S. (2008). Ocean Circulation/Mixing Studies with Decay-Series Isotopes. In S. Krishnaswami, J. K. Cochran, coch (Eds.), U-Th Series Nuclides in Aquatic Systems (Vol. 13, pp. 307–344). Elsevier. http://doi.org/10.1016/S1569-4860(07)00009-5

Kustka A, Carpenter EJ, Saňudo-Wilhelmy SA, 2002, Iron and marine nitrogen fixation: progress and future directions. Res Microbiol 153: 255-262..

Lacan, F., & Jeandel, C. (2004). Subpolar mode water formation traced by neodymium isotopic composition. Geophysical Research Letters, 31, L14306. doi:10.1029/2004GL019747

Law, K. L., S. Morét-Ferguson, N. A. Maximenko, G. Proskurowski, E. E. Peacock, J. Hafner, and C. M. Reddy. 2010. Plastic Accumulation in the North. Science 329:1185–1187.

Lebreton, L. C., S. D. Greer, and J. C. Borrero. 2012. Numerical modelling of floating debris in the world ' s oceans. Marine Pollution Bulletin 64:653–661.

Lewison, R., D. Oro, B. J. Godley, L. Underhill, S. Bearhop, R. P. Wilson, D. Ainley, J. M. Arcos, P. D. Boersma, P. G. Borboroglu, T. Boulinier, M. Frederiksen, M. Genovart, J. A. Green, D. Grémillet, K. C. Hamer, G. M. Hilton, K. D. Hyrenbach, W. A. Montevecchi, R. A. Phillips, P. G. Ryan, P. Sagar, W. J. Sydeman, S. Wanless, Y. Watanuki, H. Weimerskirch, and P. Yorio. 2012. Research priorities for seabirds : improving conservation and management in the 21st century. Endangered Species Research 17:93–121.

Lindroth P, Mopper K (1979) High performance liquid chromatographic determination of subpicomole amounts of amino acids by precolumn fluorescence derivatization with ophthaldialdehyde. Anal Chem 51: 1667-1674.

Moore, C. J., S. L. Moore, M. K. Leecaster, and S. B. Weisberg. 2001. A Comparison of Plastic and Plankton in the North Paci ® c Central Gyre 42:1297–1300.

Lupton, J. E., & Craig, H. (1981). A Major Helium-3 Source at 15°S on the East Pacific Rise. Science, 214(4516), 13–18. http://doi.org/10.1126/science.214.4516.13

Leblanc, C., et al. (2006), Iodine transfers in the coastal marine environment: the key role of brown algae and of their vanadium-dependent haloperoxidases, Biochimie, 88(11), 1773-1785.

Luther, G. W., C. B. Swartz, and W. J. Ullman (1988), Direct determination of Iodide in Seawater by Cathodic Stripping Square Wave Voltammetry, Analytical Chemistry, 60, 1721-1724.

Ma, J., R. Del Vecchio, K. S. Golanoski, E. S. Boyle, and N. V. Blough (2010), Optical Properties of Humic Substances and CDOM: Effects of Borohydride Reduction, Environmental Science & Technology, 44(14), 5395-5402.

Masquelier S and Vaulot D, 2008, Distribution of micro-organisms along a transect in the South-East Pacific Ocean (BIOSOPE cruise) using epifluorescence microscopy, Biogeosciences 5 : 311-321.

Maximenko, N., Hafner, J., Niiler, P., 2012. Pathways of marine debris from trajectories of Lagrangian drifters. Marine Pollution Bulletin 65, 51–62.

McFiggans, G., J. M. C. Plane, B. J. Allan, L. J. Carpenter, H. Coe, and C. O'Dowd (2000), A modeling study of iodine chemistry in the marine boundary layer, J. Geophys. Res., 105, 14,371-314,385.

Menzel DW and N Corwin, 1965. The measurement of total phosphorus in seawater based on the liberation of organically bound fractins by persulfate oxidation. Limnol. Oceanog. 10: 280-282.

Miranda-Urbina, D., M. Thiel, and G. Luna-Jorquera. 2015. Litter and seabirds found across a longitudinal gradient in the South Pacific Ocean. Marine Pollution Bulletin 96:235–244.

Mohr W, Grosskopf T, Wallace DWR, LaRoche J (2010) Methodological underestimation of oceanic nitrogen fixation rates. PLoS ONE

Mopper K, Schultz CA, Chevolot L, Germah C, Revuelta R, Dawson R (1992)Determination of sugars in unconcentrated seawater and other natural waters by liquid chromatography and pulsed amperometric detection. Environ Sci Technol 26: 133-138.

Morel, A., B. Gentili, H. Claustre, M. Babin, A. Bricaud, J. Ras, and F. Tieche (2007), Optical properties of the "clearest" natural waters, Limnol. Oceanogr., 52(1), 217-229.

Morris, J. J., R. E. Lenski, and E. R. Zinser (2012), The Black Queen Hypothesis: Evolution of Dependencies through Adaptive Gene Loss, mBio, 3(2).

Morris, J. J., Z. I. Johnson, M. J. Szul, M. Keller, and E. R. Zinser (2011), Dependence of the Cyanobacterium Prochlorococcus on Hydrogen Peroxide Scavenging Microbes for Growth at the Ocean's Surface, PLoS ONE, 6(2), e16805.

Moutin T, Karl DM, P. Rimmelin P, Raimbault P, Van Mooy BAS, and Claustre H, 2008, Phosphate availability and the ultimate control of new nitrogen input by nitrogen fixtion in the tropical Pacific Ocean. Biogeosciences. 5: 95-109.

Mulvenna, P. F., and G. Savidge (1992), A modified manual method for the determination of urea in seawater using diacetylmonoxime reagent, Estuarine, Coastal and Shelf Science, 34(5), 429-438.

Murphy, K. R., C. A. Stedmon, D. Graeber, and R. Bro (2013), Fluorescence spectroscopy and multi-way techniques. PARAFAC, Analytical Methods, 5(23), 6557-6566.

Obata, H., H. Karatani, and E. Nakayama (1993), Automated Determination of Iron in Seawater by Chelating Resin Concentration and Chemiluminescence Detection, Analytical Chemistry, 65, 1524-1528.

Obernosterer I, Catala P, Lami R, Caparros J, Ras J, Bricaud A, Dupuy C, van Wambeke F, and Lebaron P, 2008, Biochemical characteristics and bacterial community structure of the sea surface microlayer in the South Pacific Ocean, Biogeosciences 5 : 693-705.

Orians, K. J., E. A. Boyle, and K. W. Bruland (1990), Dissolved titanium in the open ocean, Nature, 348, 322-325.

Pahnke, K., Goldstein, S. L., & Hemming, S. R. (2008). Abrupt changes in Antarctic Intermediate Water circulation over the past 25,000 years. Nature Geoscience, 1(12), 870–874. doi:10.1038/ngeo360

Pahnke, K., van de Flierdt, T., Jones, K. M., Lambelet, M., Hemming, S. R., & Goldstein, S. L. (2012). GEOTRACES intercalibration of neodymium isotopes and rare earth element concentrations in seawater and suspended particles. Part 2: Systematic tests and baseline profiles. Limnology and Oceanography: Methods, 10, 252–269. doi:10.4319/lom.2012.10.252

Pichevin, L. E., Reynolds, B. C., Ganeshram, R. S., Cacho, I., Pena, L. D., Keefe, K., & Ellam, R. M. (2009). Enhanced carbon pump inferred from relaxation of nutrient limitation in the glacial ocean. Nature, 459, 1114–1117. doi:10.1038/nature08101

Piepgras, D. J., & Jacobsen, S. B. (1988). The isotopic composition of neodymium in the North Pacific. Geochimica et Cosmochimica Acta, 52, 1373–1381.

Porter, J. N., M. Miller, C. Pietras, and C. Motell (2001), Ship-Based Sun Photometer Measurements Using Microtops Sun Photometers, Journal of Atmospheric and Oceanic Technology, 18, 765-774.

Powers, L. C., and W. L. Miller (2014), Blending remote sensing data products to estimate photochemical production of hydrogen peroxide and superoxide in the surface ocean, Environmental Science: Processes & Impacts, 16(4), 792-806.

Pronai, L., H. Nakazawa, K. Ichimori, Y. Saigusa, T. Ohkubo, K. Hiramatsu, S. Arimori, and J. Feher (1992), Time Course Of Superoxide Generation By Leukocytes - The Mcla Chemiluminescence System, Inflammation, 16(5), 437-450.

Raimbault, P., N. Garcia, and F. Cerutti (2008), Distribution of inorganic and organic nutrients in the South Pacific Ocean − evidence for long-term accumulation of organic matter in nitrogen-depleted waters, Biogeosciences, 5(2), 281-298

.Reid, J. L. (1986). On the total geostrophic circulation of the South Pacific Ocean: Flow patterns, tracers and transports. Progress in Oceanography, 16(1), 1–61. http://doi.org/10.1016/0079-6611(86)90036-4

Remsen, C. C. (1971), The Distribution of Urea in Coastal and Oceanic Waters, Limnol. Oceanogr., 16(5), 732-740.

Resing, JA, PN Sedwick, CR German, WJ Jenkins, JW Moffett, BM Sohst, A. Taliabue, 2015, Basin-scale transport of hydrothermal dissolved metals acrooss the South Pacific Ocean, Nature, 523; 200-206.

Rose, J. M., D. A. Caron, M. E. Sieracki, and N. Poulton (2004), Counting heterotrophic nanoplanktonic protists in cultures and aquatic communities by flow cytometry, Aquatic Microbial Ecology, 34(3), 263-277.

Röttgers, R., and R. Doerffer (2007), Measurements of optical absorption by chromophoric dissolved organic matter using a point-source integrating-cavity absorption meter, Limnology And Oceanography-Methods, 5, 126-135.

Sarthou, G., C. Jeandel, L. Brisset, D. Amouroux, T. Besson, and O. F. X. Donard (1997), Fe and H_2O_2 distributions in the upper water column in the Indian sector of the Southern Ocean, Earth and Planetary Science Letters, 147, 83-92.

Schlitzer R, 2012. Ocean Data View, http://odv.awi.de .

Smirnov, A., et al. (2009), Maritime Aerosol Network (MAN) as a component of AERONET Journal of Geophysical Research, 114, D06204, doi:06210.01029/02008JD011257.

Smirnov, A., et al. (2011), Maritime aerosol network as a component of AERONET – first results and comparison with global aerosol models and satellite retrievals, Atmos. Meas. Tech., 4(3), 583-597.

Spalding, M. D., H. E. Fox, G. R. Allen, N. Davidson, Z. A. Ferdaña, M. A. X. Finlayson, B. S. Halpern, M. A. Jorge, A. L. Lombana, S. A. Lourie, K. D. Martin, M. C. Manus, J. Molnar, C. A. Recchia, and J. Robertson. 2007. Marine Ecoregions of the World : A Bioregionalization of Coastal and Shelf Areas 57:573–583.

Spear, L. B., L. T. Balance, and D. G. Ainley. 2001. Response of seabirds to thermal boundaries in the tropical Pacifi c: the thermocline vs. the Equatorial Front. Marine Ecology Progress Series 219:275–289.

Spear, L. B., and D. G. Ainley. 2005. At-sea behaviour and habitat use by tropicbirds (Phaethontidae) in the eastern Pacific. Ibis 147: 391–407.

Spear, L. B., and D. G. Ainley. 2007. Storm-petrels of the eastern Pacifi c Ocean: Species diversity and assembly along habitat gradients. AOU Monograph No. 62.

Spokes, L. J., and P. S. Liss (1996), Photochemically induced redox reactions in seawater .2. Nitrogen and iodine, Marine Chemistry, 54(1-2), 1-10.

Stancin, A. M., J. D. Gleason, S. A. Hovan, D. K. Rea, R. M. Owen, T. C. Moore, C. M. Hall, and J. D. Blum (2008), Miocene to recent eolian dust record from the Southwest Pacific Ocean at 40 degrees S latitude, Palaeogeography Palaeoclimatology Palaeoecology, 261(3-4), 218-233.

Stedmon, C., and R. Bro (2008), Characterizing dissolved organic matter fluorescence with parallel factor analysis: a tutorial, Limnol. Oceanogr. Methods, 6, 572-579.

Strady, E., C. Pohl, E. V. Yakushev, S. Krüger, and U. Hennings (2008), PUMP-CTD-System for trace metal sampling with a high vertical resolution. A test in the Gotland Basin, Baltic Sea, Chemosphere, 70(7), 1309.

Strickland, J. D., & Parsons, T. R. (1972). A practical handbook of seawater analysis.

Tasker, M. L., P. H. Jones, T. I. M. Dixon, and B. F. Blake. 1984. Counting Seabirds at sea fromships: a review of methods employed and a suggestion for a standardized approach. The Auk:567–577.

Thiel, M., Hinojosa, I.A., Miranda, L., Pantoja, J.F., Rivadeneira, M.M., Vásquez, N., 2013. Anthropogenic marine debris in the coastal environment: a multi-year comparison between coastal waters and local shores. Mar. Pollut. Bull. 71, 301– 316.

Thompson, R.C., Moore, C.J., vom Saal, F.S., Swan, S.H., 2009. Plastics, the environment and human health: current consensus and future trends. Philos. Trans. Roy. Soc. B 364, 2153–2166.

Truesdale, V. W. (1974), The chemical reduction of molecular iodine in seawater, Deep Sea Research and Oceanographic Abstracts, 21(9), 761.

Truesdale, V. W., and G. W. Bailey (2002), Iodine distribution in the Southern Benguela system during an upwelling episode, Continental Shelf Research, 22(1), 39-49.

Wambeke FV, Bonnet S, Moutin T, Raimbault P, Alarcon G, and Guieu C, 2008, Factors limiting heterotrophic bacterial production in the southern Pacific Ocean, Biogeosciences 5 : 833-845.

Wong, G. T. F. (1991), The Marine Geochemistry Of Iodine, Reviews In Aquatic Sciences, 4(1), 45-73.

Young, C., Lupton, J.E., 1983. An ultratight fluid sampling system using cold-welded copper tubing. EOS Transactions AGU 64, 735.

Yuan, J., and A. M. Shiller (1999), Determination of Subnanomolar Levels of Hydrogen Peroxide in Seawater by Reagent-Injection Chemiluminescence Detection, Analytical Chemistry, 71, 1975-1980.

Yuan, J., and A. M. Shiller (2001), The distribution of hydrogen peroxide in the southern and central Atlantic ocean, Deep-Sea Research II, 48, 2947-2970.

Zhang, Y., R. Del Vecchio, and N. V. Blough (2012), Investigating the Mechanism of Hydrogen Peroxide Photoproduction by Humic Substances, Environmental Science & Technology, 46(21), 11836-11843.

Zubkov MV, Tarran GA, Fuchs BM (2004) Depth related amino acid uptake by Prochlorococcus cyanobacteria in the Southern Atlantic tropical gyre. FEMS Microbiol Ecol 50:153-161.

Zubkov MV, Mary I, Woodward EMS, Warwick PE, Fuchs BM, Scanlan DJ, Burkill PH (2007) Microbial control of depleted phosphate in the North Atlantic subtropical gyre. Env Microbiol 9:2079-2089.

10. Abbreviations /Abkürzungen

AAIW	Antarctic Intermediate Water
a.D	an Deck/ an Deck
ADCP	Acoustic Doppler Current Profiler
AOT	Aerosol Optical Thickness
BC (GBC)	Box Corer (Giant Box Corer)
CTD	Conductivity Temperature Depth sensor
EM/PS	SIMRAD Multibeam/Parasound
CDOM	Colored Dissolved Organic Matter
DDA	Diatom Diazotroph Association
DOC	Dissolved Organic Carbon
DOM	Dissolved Organic Matter
EA	Elemental Analyzer
FISH	Fluorescent In Situ Hybridization
GC	Gravity Core
ISP	In Situ Pump
LIOP	Light Optics
LT	Lot Tiefe/ Bottom Depth
LWCC	Long waveguide capillary cell
NET	Micronet
nm	nautical mile
PAR	Photosyntheically Active Radiation
PDW	Pacific Deep Water
POC	Particulate Organic Carbon
PON	Particulate Organic Nitrogen
POS	Particulate Organic Sulfur
PUMP	Pumpcast-CTD
REE	Rare Earth Elements
SAMW	Sub-Antarctic Mode Water
Slmax	max. Seillänge/max. wire depth
SL	Seillänge/Wire Depth
SPG	South Pacific Gyre
SPSG	South Pacific Subtropical Gyre
SZ	Seilzug/ Wire Tension
UTC	Universal Coordinated Time
W	Winde/ Winch
WS	Go-Flo Water Sampler
WOCE	World Ocean Circulation Experiment
z.W.	zu Wasser/to water

11. Appendices /Anhänge

A) Station List / Stationsliste

A.1 Abridged List

Station	Start Date / Time UTC	End Date / Time UTC	Latitude	Longitude	Depth (m)
SO245-01	25.12.2015 18:03:30	26.12.2015 04:39:09	23° 30,190' S	84° 33,745' W	2764
SO245-02	27.12.2015 03:29:18	28.12.2015 18:42:21	23° 30,010' S	89° 55,807' W	3900
SO245-03	29.12.2015 18:03:03	29.12.2015 22:08:03	23° 29,964' S	95° 17,718' W	3772
SO245-04	30.12.2015 19:03:26	01.01.2016 09:09:12	23° 30,007' S	100° 0,005' W	3880
SO245-05	02.01.2016 14:30:32	02.01.2016 19:18:56	23° 30,013' S	106° 59,917' W	3878
SO245-06	03.01.2016 09:21:27	05.01.2016 02:30:10	23° 30,006' S	110° 2,968' W	3613
SO245-07	05.01.2016 22:20:33	06.01.2016 03:50:42	25° 57,856' S	114° 1,099' W	2940
SO245-08	06.01.2016 21:40:53	08.01.2016 23:56:02	27° 44,456' S	117° 37,131' W	3698
SO245-09	09.01.2016 21:02:00	10.01.2016 01:17:57	30° 37,897' S	121° 45,803' W	3780
SO245-10	11.01.2016 01:10:25	12.01.2016 16:07:49	33° 30,011' S	125° 59,972' W	4016
SO245-11	13.01.2016 22:07:05	14.01.2016 03:58:18	36° 21,736' S	132° 40,500' W	5069
SO245-12	15.01.2016 10:40:02	17.01.2016 06:16:27	39° 18,569' S	139° 48,565' W	5310
SO245-13	18.01.2016 15:52:03	18.01.2016 22:39:02	38° 59,889' S	149° 59,980' W	5481
SO245-14	20.01.2016 07:00:00	22.01.2016 01:12:48	39° 0,000' S	159° 56,182' W	4981
SO245-15	23.01.2016 09:24:10	24.01.2016 16:17:50	39° 1,694' S	169° 58,286' W	4612

A.2 Full Station Log

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_1-1	25.12.2015 18:03:30	CTD	station start		23° 30,190' S	84° 33,745' W	2764,4
245_1-1	25.12.2015 18:15:32	CTD	in the water		23° 30,186' S	84° 33,741' W	2763
245_1-1	25.12.2015 18:41:05	CTD	max depth/on ground	SLmax: 498m	23° 30,186' S	84° 33,740' W	2764,8
245_1-1	25.12.2015 19:21:43	CTD	on deck		23° 30,185' S	84° 33,748' W	2767,8
245_1-1	25.12.2015 19:22:03	CTD	station end		23° 30,185' S	84° 33,749' W	2767,5
245_1-2	25.12.2015 19:27:23	LIOP	station start	UV Profiler	23° 30,187' S	84° 33,750' W	2765,8
245_1-2	25.12.2015 19:28:12	LIOP	in the water		23° 30,187' S	84° 33,750' W	2765,3
245_1-2	25.12.2015 19:37:42	LIOP	max depth/on ground	SL: 50m	23° 30,221' S	84° 33,712' W	2785,2
245_1-2	25.12.2015 19:39:42	LIOP	at surface		23° 30,222' S	84° 33,714' W	2759,7
245_1-2	25.12.2015 19:41:56	LIOP	max depth/on ground	SL: 50m	23° 30,225' S	84° 33,712' W	2757,9
245_1-2	25.12.2015 19:43:35	LIOP	at surface		23° 30,226' S	84° 33,710' W	2757,9
245_1-2	25.12.2015 19:46:30	LIOP	max depth/on ground	SL: 50m	23° 30,226' S	84° 33,707' W	2757,7
245_1-2	25.12.2015 19:48:34	LIOP	on deck		23° 30,227' S	84° 33,708' W	2757,1
245_1-2	25.12.2015 19:49:28	LIOP	station end		23° 30,227' S	84° 33,709' W	2758,4
245_1-3	25.12.2015 19:50:11	LIOP	station start	Optic Profiler	23° 30,227' S	84° 33,710' W	3001,3
245_1-3	25.12.2015 19:51:46	LIOP	in the water		23° 30,226' S	84° 33,712' W	2758,9
245_1-3	25.12.2015 20:03:52	LIOP	max depth/on ground	SL: 250m	23° 30,287' S	84° 33,646' W	2755,4
245_1-3	25.12.2015 20:14:56	LIOP	at surface		23° 30,291' S	84° 33,648' W	2753,7
245_1-3	25.12.2015 20:22:16	LIOP	max depth/on ground	SL: 50m	23° 30,333' S	84° 33,604' W	2751,8
245_1-3	25.12.2015 20:25:07	LIOP	at surface		23° 30,335' S	84° 33,609' W	2751,7
245_1-3	25.12.2015 20:27:00	LIOP	max depth/on ground	SL: 50m	23° 30,333' S	84° 33,608' W	2752,1
245_1-3	25.12.2015 20:29:45	LIOP	on deck		23° 30,331' S	84° 33,608' W	2752,3
245_1-4	25.12.2015 21:00:50	PUMP	station start	Pump CTD	23° 30,334' S	84° 33,606' W	2751,5
245_1-4	25.12.2015 21:03:09	PUMP	in the water		23° 30,334' S	84° 33,606' W	2751,3
245_1-4	25.12.2015 22:11:46	PUMP	max depth/on ground	SL: 225m	23° 30,331' S	84° 33,600' W	2751,9
245_1-4	26.12.2015 02:11:10	PUMP	on deck		23° 30,328' S	84° 33,605' W	2753,3

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_1-4	26.12.2015 02:12:20	PUMP	station end		23° 30,328' S	84° 33,605' W	2752,7
245_1-5	25.12.2015 22:32:29	CTD	station start		23° 30,333' S	84° 33,606' W	2751,7
245_1-5	25.12.2015 22:33:42	CTD	in the water		23° 30,332' S	84° 33,605' W	2753,9
245_1-5	25.12.2015 22:59:44	CTD	max depth/on ground	maxSL: 497m	23° 30,332' S	84° 33,606' W	2752,2
245_1-5	25.12.2015 23:27:39	CTD	on deck		23° 30,332' S	84° 33,606' W	2752,7
245_1-5	25.12.2015 23:29:21	CTD	station end		23° 30,331' S	84° 33,605' W	2752,1
245_1-6	26.12.2015 00:41:26	CTD	station start		23° 30,331' S	84° 33,609' W	2752,6
245_1-6	26.12.2015 00:45:54	CTD	in the water	EL2 über kl. Schiebebalken	23° 30,329' S	84° 33,606' W	2752,5
245_1-6	26.12.2015 00:54:56	CTD	information	Bei SL: 55 m 1 x Pump-CTD	23° 30,327' S	84° 33,603' W	2753,9
245_1-6	26.12.2015 01:00:34	CTD	information	Bei SL: 97 m 1 x Pump-CTD 2	23° 30,330' S	84° 33,602' W	2752,8
245_1-6	26.12.2015 01:05:47	CTD	max depth/on ground	SL: 197 m	23° 30,330' S	84° 33,604' W	2753
245_1-6	26.12.2015 01:37:48	CTD	information	Pump-CTD 2 an Deck	23° 30,334' S	84° 33,610' W	2752,7
245_1-6	26.12.2015 01:43:27	CTD	information	Pump-CTD 1 an Deck	23° 30,334' S	84° 33,609' W	2752,7
245_1-6	26.12.2015 01:52:17	CTD	on deck	CTD an Deck	23° 30,332' S	84° 33,609' W	2752,8
245_1-6	26.12.2015 01:54:01	CTD	station end		23° 30,332' S	84° 33,609' W	2753,8
245_1-7	26.12.2015 02:18:55	NET	station start	Plankton- / Micro-Netz	23° 30,328' S	84° 33,607' W	2752,3
245_1-7	26.12.2015 02:48:59	NET	in the water	über Winde STB achtern & Kran 3	23° 30,333' S	84° 33,607' W	2753,9
245_1-7	26.12.2015 02:52:43	NET	on deck	(Ende Spülvorgang)	23° 30,333' S	84° 33,605' W	2752,9
245_1-7	26.12.2015 02:55:47	NET	in the water	über Winde STB achtern & Kran 3	23° 30,331' S	84° 33,601' W	2753,1
245_1-7	26.12.2015 03:10:10	NET	max depth/on ground	SL: 250 m	23° 30,327' S	84° 33,604' W	2753,1
245_1-7	26.12.2015 04:08:12	NET	on deck	Micro-Netz an Deck	23° 30,328' S	84° 33,601' W	2753,2
245_1-7	26.12.2015 04:09:27	NET	station end		23° 30,328' S	84° 33,603' W	2753,7
245_1-8	26.12.2015 04:11:58	WS	station start	Go-Flo	23° 30,328' S	84° 33,603' W	2753
245_1-8	26.12.2015 04:12:27	WS	in the water		23° 30,328' S	84° 33,602' W	2753,5
245_1-8	26.12.2015 04:18:01	WS	max depth/on ground	SL: 30m	23° 30,331' S	84° 33,603' W	2752,8
245_1-8	26.12.2015 04:38:49	WS	on deck		23° 30,329' S	84° 33,604' W	2753,3
245_1-8	26.12.2015 04:39:09	WS	station end		23° 30,329' S	84° 33,605' W	2752,5

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_2-1	27.12.2015 03:29:18	PS	station start		23° 30,010' S	89° 55,807' W	3899,9
245_2-1	27.12.2015 03:31:28	PS	profile start	rwK: 270°, d: 6 sm	23° 30,000' S	89° 56,004' W	3935
245_2-1	27.12.2015 04:45:24	PS	alter course	rwK: 043°, d: 4nm	23° 29,959' S	90° 2,655' W	3980,7
245_2-1	27.12.2015 05:30:12	PS	alter course	rwK: 270°, d: 2nm	23° 27,157' S	90° 0,274' W	3905,2
245_2-1	27.12.2015 05:45:25	PS	alter course	rwK: 180°, d: 6nm	23° 27,001' S	90° 1,589' W	3948,2
245_2-1	27.12.2015 06:51:07	PS	profile end		23° 32,376' S	90° 1,773' W	3891,2
245_2-1	27.12.2015 06:51:47	PS	station end		23° 32,426' S	90° 1,789' W	4147,8
245_2-2	27.12.2015 07:25:26	CTD	station start		23° 29,514' S	90° 1,791' W	3890,9
245_2-2	27.12.2015 07:25:41	CTD	in the water		23° 29,516' S	90° 1,790' W	3890,2
245_2-2	27.12.2015 09:11:14	CTD	max depth/on ground	SL: 3867m	23° 29,502' S	90° 1,762' W	3896,1
245_2-2	27.12.2015 10:49:37	CTD	on deck		23° 29,503' S	90° 1,766' W	3905,7
245_2-2	27.12.2015 10:53:25	CTD	station end		23° 29,504' S	90° 1,768' W	3909,1
245_2-3	27.12.2015 10:08:06	WS	station start	GoFlow	23° 29,505' S	90° 1,764' W	3894,9
245_2-3	27.12.2015 10:16:02	WS	in the water		23° 29,504' S	90° 1,768' W	3903,1
245_2-3	27.12.2015 10:34:00	WS	max depth/on ground	SL: 30m	23° 29,502' S	90° 1,769' W	3896,5
245_2-3	27.12.2015 10:39:57	WS	on deck		23° 29,501' S	90° 1,767' W	3890,3
245_2-3	27.12.2015 10:41:56	WS	station end		23° 29,501' S	90° 1,767' W	3890,6
245_2-4	27.12.2015 11:41:43	PUMP	station start	Pump CTD	23° 29,503' S	90° 1,761' W	3900
245_2-4	27.12.2015 11:59:02	PUMP	in the water		23° 29,503' S	90° 1,757' W	3901,5
245_2-4	27.12.2015 13:20:24	PUMP	max depth/on ground	SL: 230 m	23° 29,501' S	90° 1,759' W	3882,3
245_2-4	27.12.2015 13:57:10	PUMP	information	hieven, da Fehlfunktion des Geräts	23° 29,503' S	90° 1,761' W	3902,1
245_2-4	27.12.2015 14:11:27	PUMP	on deck		23° 29,502' S	90° 1,763' W	3898,8
245_2-4	27.12.2015 14:36:36	PUMP	station end		23° 29,506' S	90° 1,764' W	3900,1
245_2-5	27.12.2015 13:27:55	CTD	station start		23° 29,503' S	90° 1,758' W	3899,5
245_2-5	27.12.2015 13:29:11	CTD	in the water	EL2 über kl. Schiebebalken	23° 29,504' S	90° 1,759' W	3898,9
245_2-5	27.12.2015 14:12:29	CTD	max depth/on ground	SL: 1250 m	23° 29,502' S	90° 1,763' W	3891,6
245_2-5	27.12.2015 14:54:08	CTD	on deck		23° 29,503' S	90° 1,764' W	3899,1
245_2-5	27.12.2015 14:56:58	CTD	station end		23° 29,502' S	90° 1,766' W	3879,9
245_2-6	27.12.2015 14:58:08	PUMP	station start	PUMP-CTD, über Winde STB achtern & Kran	23° 29,502' S	90° 1,766' W	3891,7

				3			
Station	**Date / Time UTC**	**Device**	**Action**	**Comment (Action)**	**Latitude**	**Longitude**	**Depth (m)**
245_2-6	27.12.2015 15:06:29	PUMP	in the water		23° 29,504' S	90° 1,766' W	3901,6
245_2-6	27.12.2015 15:15:15	PUMP	information	Bei SL: ca. 110 m hieven	23° 29,503' S	90° 1,765' W	3908
245_2-6	27.12.2015 15:31:46	PUMP	on deck		23° 29,498' S	90° 1,759' W	3908,3
245_2-6	27.12.2015 15:36:22	PUMP	station end		23° 29,498' S	90° 1,760' W	3895,3
245_2-7	27.12.2015 16:04:13	LIOP	station start	UV Profiler	23° 29,503' S	90° 1,770' W	3900,1
245_2-7	27.12.2015 16:05:35	LIOP	in the water		23° 29,503' S	90° 1,770' W	3889,9
245_2-7	27.12.2015 16:10:21	LIOP	max depth/on ground	SL: 50m	23° 29,579' S	90° 1,770' W	3900,9
245_2-7	27.12.2015 16:12:56	LIOP	at surface		23° 29,644' S	90° 1,770' W	3896,3
245_2-7	27.12.2015 16:16:35	LIOP	max depth/on ground	SL: 50m	23° 29,755' S	90° 1,769' W	3890,8
245_2-7	27.12.2015 16:19:15	LIOP	at surface		23° 29,840' S	90° 1,769' W	3885,1
245_2-7	27.12.2015 16:21:21	LIOP	max depth/on ground	SL: 50m	23° 29,902' S	90° 1,769' W	3892,1
245_2-7	27.12.2015 16:23:44	LIOP	on deck		23° 29,966' S	90° 1,768' W	3887,5
245_2-7	27.12.2015 16:24:11	LIOP	station end		23° 29,977' S	90° 1,769' W	3880,3
245_2-8	27.12.2015 16:25:54	LIOP	station start	Optic Profiler	23° 30,016' S	90° 1,768' W	3880,8
245_2-8	27.12.2015 16:26:06	LIOP	in the water		23° 30,020' S	90° 1,768' W	3877
245_2-8	27.12.2015 16:34:28	LIOP	max depth/on ground	SL: 170m	23° 30,252' S	90° 1,768' W	3888,1
245_2-8	27.12.2015 16:46:47	LIOP	at surface		23° 30,600' S	90° 1,769' W	3860,5
245_2-8	27.12.2015 16:48:30	LIOP	max depth/on ground	SL: 50m	23° 30,647' S	90° 1,769' W	3866,6
245_2-8	27.12.2015 16:52:42	LIOP	at surface		23° 30,768' S	90° 1,768' W	3854,3
245_2-8	27.12.2015 16:54:17	LIOP	max depth/on ground	SL: 50m	23° 30,817' S	90° 1,768' W	3856,2
245_2-8	27.12.2015 16:59:06	LIOP	on deck		23° 30,974' S	90° 1,768' W	3884,3
245_2-8	27.12.2015 16:59:19	LIOP	station end		23° 30,981' S	90° 1,768' W	3879,9
245_2-9	27.12.2015 17:04:23	LIOP	station start	Sechi Disk / Forel-Ule	23° 31,038' S	90° 1,768' W	3878,5
245_2-9	27.12.2015 17:04:33	LIOP	in the water		23° 31,038' S	90° 1,768' W	3878,5
245_2-9	27.12.2015 17:07:11	LIOP	max depth/on ground	SL: 50m	23° 31,036' S	90° 1,768' W	3877
245_2-9	27.12.2015 17:09:58	LIOP	on deck		23° 31,035' S	90° 1,766' W	3859,1
245_2-9	27.12.2015 17:10:16	LIOP	station end		23° 31,034' S	90° 1,766' W	3859,2
245_2-10	27.12.2015 17:24:19	CTD	station start		23° 31,036' S	90° 1,767' W	3881,9

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_2-10	27.12.2015 17:27:02	CTD	in the water		23° 31,039' S	90° 1,769' W	3869,2
245_2-10	27.12.2015 17:46:03	CTD	max depth/on ground	SL: 297m	23° 31,033' S	90° 1,766' W	3879,8
245_2-10	27.12.2015 18:11:55	CTD	on deck		23° 31,030' S	90° 1,766' W	3862,5
245_2-10	27.12.2015 18:14:58	CTD	station end		23° 31,034' S	90° 1,767' W	3877,1
245_2-11	27.12.2015 18:39:20	NET	station start	Micronet	23° 31,036' S	90° 1,764' W	3879,7
245_2-11	27.12.2015 18:40:05	NET	in the water		23° 31,036' S	90° 1,764' W	3878,8
245_2-11	27.12.2015 19:06:10	NET	max depth/on ground	SL: 250m	23° 31,039' S	90° 1,766' W	3858
245_2-11	27.12.2015 20:13:19	NET	on deck		23° 31,036' S	90° 1,763' W	3878,3
245_2-11	27.12.2015 20:20:00	NET	station end		23° 31,038' S	90° 1,765' W	3877,1
245_2-12	27.12.2015 20:28:10	CTD	station start		23° 31,042' S	90° 1,764' W	3878
245_2-12	27.12.2015 20:30:00	CTD	in the water		23° 31,039' S	90° 1,764' W	3875
245_2-12	27.12.2015 20:36:39	CTD	max depth/on ground	SL: 100m	23° 31,035' S	90° 1,767' W	3878,2
245_2-12	27.12.2015 20:56:42	CTD	on deck		23° 31,037' S	90° 1,770' W	3877,9
245_2-12	27.12.2015 20:58:00	CTD	station end		23° 31,038' S	90° 1,769' W	3863,8
245_2-13	27.12.2015 23:32:16	CTD	station start	In Situ Pump	23° 29,505' S	90° 1,758' W	3903,2
245_2-13	27.12.2015 23:34:33	CTD	in the water	In Situ Pumpe bei SL: 10m, 600m, 1200m, 1600m, 2600m, 3470m, 3500m, 3580m.	23° 29,505' S	90° 1,759' W	3894,6
245_2-13	28.12.2015 02:02:23	CTD	max depth/on ground	SL: 3600 m	23° 29,501' S	90° 1,761' W	3894,1
245_2-13	28.12.2015 08:40:17	CTD	hoisting		23° 29,498' S	90° 1,760' W	3901,7
245_2-13	28.12.2015 11:11:04	CTD	on deck		23° 29,504' S	90° 1,753' W	3901,2
245_2-13	28.12.2015 11:12:33	CTD	station end		23° 29,502' S	90° 1,757' W	3895
245_2-14	28.12.2015 11:26:07	WS	station start	Go-Flo	23° 29,497' S	90° 1,766' W	3904,3
245_2-14	28.12.2015 11:45:59	WS	in the water		23° 29,504' S	90° 1,760' W	3889,2
245_2-14	28.12.2015 11:58:14	WS	max depth/on ground	SL: 125m	23° 29,504' S	90° 1,756' W	3902,4
245_2-14	28.12.2015 12:02:31	WS	hoisting		23° 29,502' S	90° 1,757' W	3895,1
245_2-14	28.12.2015 12:12:57	WS	on deck		23° 29,501' S	90° 1,762' W	3900,1
245_2-14	28.12.2015 12:20:31	WS	station end		23° 29,494' S	90° 1,761' W	3891,9
245_2-15	28.12.2015 12:26:20	CTD	station start		23° 29,496' S	90° 1,764' W	3891,7
245_2-15	28.12.2015 12:28:56	CTD	in the water	EL2 über kl. Schiebebalken	23° 29,496' S	90° 1,763' W	3901,1

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_2-15	28.12.2015 12:36:38	CTD	max depth/on ground	SL: 720 m	23° 29,497' S	90° 1,763' W	3890,3
245_2-15	28.12.2015 12:40:05	CTD	hoisting		23° 29,495' S	90° 1,760' W	3903,9
245_2-15	28.12.2015 12:49:48	CTD	on deck		23° 29,503' S	90° 1,760' W	3897,5
245_2-15	28.12.2015 12:50:39	CTD	station end		23° 29,503' S	90° 1,759' W	3890
245_2-16	28.12.2015 13:00:58	BC	station start		23° 29,506' S	90° 1,756' W	3896,2
245_2-16	28.12.2015 13:08:53	BC	in the water		23° 29,505' S	90° 1,762' W	3900,1
245_2-16	28.12.2015 13:14:35	BC	information	Bei SL: 100 m 1 x Posidonia	23° 29,504' S	90° 1,763' W	3872,4
245_2-16	28.12.2015 14:21:35	BC	max depth/on ground	SL: 3941 m, SZ: 35 kN	23° 29,505' S	90° 1,759' W	3870,6
245_2-16	28.12.2015 14:24:09	BC	hoisting	SZmax: 44 kN bei SL: 3911 m	23° 29,505' S	90° 1,759' W	3862,8
245_2-16	28.12.2015 15:39:02	BC	information	Bei SL: 100 m 1 x Posidonia an Deck	23° 29,495' S	90° 1,759' W	3865,4
245_2-16	28.12.2015 15:46:29	BC	on deck		23° 29,502' S	90° 1,754' W	3876,1
245_2-16	28.12.2015 15:55:28	BC	station end		23° 29,501' S	90° 1,752' W	3883,8
245_2-17	28.12.2015 15:56:45	GC	station start	GC 5 m, über FW1/SPW1, Schiebebalken	23° 29,501' S	90° 1,753' W	3871,3
245_2-17	28.12.2015 16:00:08	GC	in the water		23° 29,502' S	90° 1,753' W	3876,5
245_2-17	28.12.2015 16:05:21	GC	information	Bei SL: 100 m 1 x Transponder z.W.	23° 29,504' S	90° 1,757' W	3880,6
245_2-17	28.12.2015 17:15:12	GC	max depth/on ground	SLmax: 3939m	23° 29,503' S	90° 1,757' W	3874,8
245_2-17	28.12.2015 17:16:04	GC	hoisting		23° 29,501' S	90° 1,757' W	3879,7
245_2-17	28.12.2015 17:19:23	GC	information	frei vom Grund bei SL: 3897m, SZmax: 44kN	23° 29,500' S	90° 1,756' W	3871,6
245_2-17	28.12.2015 18:38:19	GC	on deck		23° 29,494' S	90° 1,762' W	3880,4
245_2-17	28.12.2015 18:42:21	GC	station end		23° 29,497' S	90° 1,759' W	3880,2
245_3-1	29.12.2015 18:03:03	CTD	station start		23° 29,964' S	95° 17,718' W	3772,3
245_3-1	29.12.2015 18:05:02	CTD	in the water		23° 29,967' S	95° 17,718' W	3763,8
245_3-1	29.12.2015 18:30:01	CTD	max depth/on ground	SL: 500m	23° 29,968' S	95° 17,727' W	3767,4
245_3-1	29.12.2015 19:01:43	CTD	on deck		23° 29,971' S	95° 17,724' W	3766,3
245_3-1	29.12.2015 19:02:57	CTD	station end		23° 29,971' S	95° 17,723' W	3765,6
245_3-2	29.12.2015 19:05:45	LIOP	station start	UV Profiler	23° 29,973' S	95° 17,721' W	3764,8

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_3-2	29.12.2015 19:06:12	LIOP	in the water		23° 29,973' S	95° 17,721' W	3764,8
245_3-2	29.12.2015 19:12:18	LIOP	max depth/on ground	SL: 50m	23° 29,918' S	95° 17,728' W	3779,2
245_3-2	29.12.2015 19:14:16	LIOP	at surface		23° 29,915' S	95° 17,727' W	3777,3
245_3-2	29.12.2015 19:18:06	LIOP	max depth/on ground	SL: 50m	23° 29,915' S	95° 17,726' W	3768,8
245_3-2	29.12.2015 19:20:47	LIOP	at surface		23° 29,901' S	95° 17,728' W	3786,9
245_3-2	29.12.2015 19:23:34	LIOP	max depth/on ground	SL: 50m	23° 29,858' S	95° 17,734' W	3782,1
245_3-2	29.12.2015 19:26:53	LIOP	on deck		23° 29,806' S	95° 17,741' W	3791,4
245_3-2	29.12.2015 19:27:28	LIOP	station end		23° 29,801' S	95° 17,741' W	3795,4
245_3-3	29.12.2015 19:30:03	LIOP	station start	Optic Profiler	23° 29,784' S	95° 17,743' W	3787,7
245_3-3	29.12.2015 19:30:19	LIOP	in the water		23° 29,782' S	95° 17,743' W	3792,6
245_3-3	29.12.2015 19:43:03	LIOP	max depth/on ground	SL: 200m	23° 29,642' S	95° 17,761' W	3762,7
245_3-3	29.12.2015 19:52:52	LIOP	at surface		23° 29,487' S	95° 17,782' W	3724,8
245_3-3	29.12.2015 19:54:28	LIOP	max depth/on ground	SL: 50m	23° 29,459' S	95° 17,786' W	3722,8
245_3-3	29.12.2015 19:57:42	LIOP	at surface		23° 29,407' S	95° 17,793' W	3711,7
245_3-3	29.12.2015 19:59:13	LIOP	max depth/on ground	SL: 50m	23° 29,383' S	95° 17,797' W	3689,3
245_3-3	29.12.2015 20:02:32	LIOP	on deck		23° 29,331' S	95° 17,804' W	3715,5
245_3-3	29.12.2015 20:03:00	LIOP	station end		23° 29,324' S	95° 17,805' W	3698,6
245_3-4	29.12.2015 20:03:40	LIOP	station start	Secchi Disk / Forel-Ule	23° 29,313' S	95° 17,806' W	3709,3
245_3-4	29.12.2015 20:04:26	LIOP	in the water		23° 29,307' S	95° 17,807' W	3714,8
245_3-4	29.12.2015 20:11:59	LIOP	on deck		23° 29,301' S	95° 17,805' W	3706,8
245_3-4	29.12.2015 20:12:07	LIOP	station end		23° 29,301' S	95° 17,805' W	3706,8
245_3-5	29.12.2015 20:20:12	CTD	station start		23° 29,301' S	95° 17,807' W	3712,3
245_3-5	29.12.2015 20:20:49	CTD	in the water		23° 29,301' S	95° 17,806' W	3708,2
245_3-5	29.12.2015 20:33:53	CTD	on deck		23° 29,300' S	95° 17,801' W	3715,9
245_3-5	29.12.2015 20:34:32	CTD	station end		23° 29,301' S	95° 17,800' W	3714,8
245_3-6	29.12.2015 21:20:15	CTD	station start		23° 29,305' S	95° 17,802' W	3705,1
245_3-6	29.12.2015 21:22:39	CTD	in the water		23° 29,304' S	95° 17,803' W	3705,1
245_3-6	29.12.2015 21:44:30	CTD	max depth/on ground	SL: 497m	23° 29,302' S	95° 17,813' W	3710,4

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_3-6	29.12.2015 22:10:37	CTD	on deck		23° 29,299' S	95° 17,803' W	3704,8
245_3-6	29.12.2015 22:12:14	CTD	station end		23° 29,299' S	95° 17,803' W	3710,4
245_3-7	29.12.2015 21:26:58	WS	station start	Go-Flo	23° 29,305' S	95° 17,806' W	3704,3
245_3-7	29.12.2015 21:37:48	WS	in the water		23° 29,300' S	95° 17,813' W	3703,4
245_3-7	29.12.2015 21:47:58	WS	max depth/on ground	SL: 125m	23° 29,301' S	95° 17,812' W	3701,9
245_3-7	29.12.2015 22:02:14	WS	in the water		23° 29,300' S	95° 17,806' W	3705,2
245_3-7	29.12.2015 22:04:24	WS	max depth/on ground	SL: 30m	23° 29,302' S	95° 17,804' W	3703,6
245_3-7	29.12.2015 22:06:39	WS	on deck		23° 29,301' S	95° 17,803' W	3704,1
245_3-7	29.12.2015 22:08:03	WS	station end		23° 29,300' S	95° 17,802' W	3712,6
245_4-1	30.12.2015 19:03:26	CTD	station start		23° 30,007' S	100° 0,005' W	3879,8
245_4-1	30.12.2015 19:05:26	CTD	in the water		23° 30,009' S	100° 0,001' W	3891,2
245_4-1	30.12.2015 20:54:22	CTD	max depth/on ground	SL: 3864m	23° 29,996' S	100° 0,001' W	3891,8
245_4-1	30.12.2015 20:56:54	CTD	hoisting		23° 29,997' S	100° 0,002' W	3892,2
245_4-1	30.12.2015 22:31:29	CTD	on deck		23° 29,996' S	100° 0,000' W	3893
245_4-1	30.12.2015 22:32:45	CTD	station end		23° 29,996' S	99° 59,998' W	3891,7
245_4-2	30.12.2015 23:00:42	WS	station start	Go-Flo	23° 29,997' S	100° 0,003' W	3894,8
245_4-2	30.12.2015 23:10:20	WS	in the water	Flaschen bei 25m, 100m und 150m	23° 30,001' S	100° 0,006' W	3893,2
245_4-2	30.12.2015 23:34:03	WS	max depth/on ground	SL: 150m	23° 30,008' S	100° 0,002' W	3894,1
245_4-2	30.12.2015 23:45:57	WS	on deck		23° 30,006' S	100° 0,000' W	3886,5
245_4-2	30.12.2015 23:47:09	WS	station end		23° 30,006' S	100° 0,000' W	3879,6
245_4-3	31.12.2015 00:16:41	CTD	station start	In Situ Pump-CTD	23° 30,007' S	100° 0,001' W	3889,9
245_4-3	31.12.2015 00:19:16	CTD	in the water	In Situ Pump bei SL: 15m, 600m, 1100m, 1600m, 2600m, 3430m, 3460m, 3580m.	23° 30,007' S	100° 0,001' W	3891,6
245_4-3	31.12.2015 02:52:26	CTD	max depth/on ground	SL: 3600 m, SZ: 23 kN	23° 30,003' S	100° 0,004' W	3893,7
245_4-3	31.12.2015 09:44:35	CTD	hoisting		23° 30,002' S	99° 59,997' W	3891,6
245_4-3	31.12.2015 12:08:03	CTD	on deck		23° 30,001' S	100° 0,001' W	3896,9
245_4-3	31.12.2015 12:09:22	CTD	station end		23° 30,000' S	100° 0,002' W	3888,3
245_4-4	31.12.2015 12:11:24	WS	station start	Go-Flo	23° 30,002' S	100° 0,003' W	3878,9

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_4-4	31.12.2015 12:14:49	WS	in the water		23° 30,005' S	100° 0,006' W	3893,7
245_4-4	31.12.2015 12:28:03	WS	max depth/on ground	SL: 150m	23° 30,006' S	100° 0,006' W	3886,8
245_4-4	31.12.2015 12:37:13	WS	on deck		23° 30,002' S	100° 0,003' W	3893
245_4-4	31.12.2015 12:38:27	WS	station end		23° 30,000' S	100° 0,004' W	3887,2
245_4-5	31.12.2015 12:59:00	PUMP	station start	Pump-CTD	23° 30,006' S	100° 0,006' W	3885,8
245_4-5	31.12.2015 13:08:38	PUMP	in the water	über Winde STB achtern & Kran 3	23° 29,997' S	99° 59,998' W	3894,1
245_4-5	31.12.2015 14:20:16	PUMP	max depth/on ground	SL: 240 m	23° 30,003' S	99° 59,998' W	3881,6
245_4-5	31.12.2015 14:40:56	PUMP	information	hieven Pump-CTD	23° 30,004' S	100° 0,003' W	3896,3
245_4-5	31.12.2015 15:10:29	PUMP	on deck	(Reparatur Schlauch)	23° 30,003' S	100° 0,004' W	3893,4
245_4-5	31.12.2015 15:11:53	PUMP	station end		23° 30,003' S	100° 0,003' W	3893,7
245_4-6	31.12.2015 15:18:41	PUMP	station start		23° 30,005' S	100° 0,005' W	3891,8
245_4-6	31.12.2015 15:28:44	PUMP	in the water	über Winde STB achtern & Kran 3	23° 30,004' S	100° 0,001' W	3893
245_4-6	31.12.2015 16:06:56	PUMP	on deck		23° 30,003' S	100° 0,004' W	3892,8
245_4-6	31.12.2015 16:12:40	PUMP	in the water		23° 30,002' S	100° 0,004' W	3895,3
245_4-6	31.12.2015 16:26:16	PUMP	on deck		23° 30,002' S	100° 0,000' W	3886,6
245_4-6	31.12.2015 16:33:03	PUMP	station end		23° 30,002' S	100° 0,002' W	3893,3
245_4-7	31.12.2015 16:54:32	CTD	station start	CTD über EL2 & kl. Schiebebalken	23° 30,005' S	100° 0,002' W	3890,1
245_4-7	31.12.2015 16:57:34	CTD	in the water		23° 30,001' S	100° 0,000' W	3895,5
245_4-7	31.12.2015 17:40:05	CTD	max depth/on ground	SL: 1248m	23° 30,005' S	100° 0,001' W	3891,1
245_4-7	31.12.2015 18:30:31	CTD	on deck		23° 30,006' S	100° 0,004' W	3892
245_4-7	31.12.2015 18:32:51	CTD	station end		23° 30,001' S	99° 59,999' W	3891,3
245_4-8	31.12.2015 18:37:49	LIOP	station start	UV Profiler	23° 30,005' S	100° 0,003' W	3892,2
245_4-8	31.12.2015 18:38:06	LIOP	in the water		23° 30,005' S	100° 0,003' W	3891,7
245_4-8	31.12.2015 18:43:09	LIOP	max depth/on ground	SL: 80m	23° 30,011' S	99° 59,969' W	3894,6
245_4-8	31.12.2015 18:45:47	LIOP	at surface		23° 30,014' S	99° 59,946' W	3880,7
245_4-8	31.12.2015 18:48:16	LIOP	max depth/on ground	SL: 62m	23° 30,017' S	99° 59,922' W	3880,6
245_4-8	31.12.2015 18:50:29	LIOP	at surface		23° 30,021' S	99° 59,900' W	3879,7
245_4-8	31.12.2015 18:52:37	LIOP	max depth/on ground	SL: 50m	23° 30,023' S	99° 59,879' W	3885,5

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_4-8	31.12.2015 18:56:07	LIOP	on deck		23° 30,027' S	99° 59,840' W	3891,3
245_4-8	31.12.2015 18:56:23	LIOP	station end		23° 30,027' S	99° 59,837' W	3895
245_4-9	31.12.2015 18:57:25	LIOP	station start	Optic Profiler	23° 30,028' S	99° 59,826' W	3888,2
245_4-9	31.12.2015 18:57:53	LIOP	in the water		23° 30,028' S	99° 59,820' W	3893,5
245_4-9	31.12.2015 19:09:16	LIOP	max depth/on ground	SL: 350m	23° 30,037' S	99° 59,720' W	3907,6
245_4-9	31.12.2015 19:19:02	LIOP	at surface		23° 30,045' S	99° 59,632' W	3891,3
245_4-9	31.12.2015 19:20:44	LIOP	max depth/on ground	SL: 45m	23° 30,046' S	99° 59,612' W	3899,2
245_4-9	31.12.2015 19:22:53	LIOP	at surface		23° 30,048' S	99° 59,587' W	3897,3
245_4-9	31.12.2015 19:25:19	LIOP	max depth/on ground	SL: 50m	23° 30,050' S	99° 59,555' W	3896,7
245_4-9	31.12.2015 19:27:52	LIOP	on deck		23° 30,053' S	99° 59,523' W	3909,2
245_4-9	31.12.2015 19:28:07	LIOP	station end		23° 30,053' S	99° 59,520' W	3896
245_4-10	31.12.2015 19:31:21	LIOP	station start	Secchi Disk / Forel-Ule	23° 30,055' S	99° 59,497' W	3896,7
245_4-10	31.12.2015 19:31:36	LIOP	in the water		23° 30,055' S	99° 59,498' W	3883,5
245_4-10	31.12.2015 19:42:02	LIOP	on deck		23° 30,061' S	99° 59,498' W	3891,3
245_4-10	31.12.2015 19:42:23	LIOP	station end		23° 30,061' S	99° 59,499' W	3883,3
245_4-11	31.12.2015 20:04:02	CTD	station start		23° 30,061' S	99° 59,497' W	3887,4
245_4-11	31.12.2015 20:05:05	CTD	in the water		23° 30,061' S	99° 59,498' W	3887,4
245_4-11	31.12.2015 20:24:42	CTD	max depth/on ground	SL: 297m	23° 30,057' S	99° 59,498' W	3889
245_4-11	31.12.2015 20:54:08	CTD	on deck		23° 30,055' S	99° 59,498' W	3901
245_4-11	31.12.2015 20:55:07	CTD	station end		23° 30,055' S	99° 59,498' W	3883,5
245_4-12	31.12.2015 21:07:38	NET	station start	Micronet	23° 30,056' S	99° 59,500' W	3888,1
245_4-12	31.12.2015 21:13:03	NET	in the water		23° 30,058' S	99° 59,498' W	3891,6
245_4-12	31.12.2015 21:28:01	NET	max depth/on ground	maxSL: 250m	23° 30,059' S	99° 59,499' W	3889,2
245_4-12	31.12.2015 22:33:23	NET	on deck		23° 30,061' S	99° 59,502' W	3884,2
245_4-12	31.12.2015 22:34:34	NET	station end		23° 30,060' S	99° 59,502' W	3883,8
245_4-13	31.12.2015 22:37:09	CTD	station start		23° 30,057' S	99° 59,499' W	3893,8
245_4-13	31.12.2015 22:39:06	CTD	in the water	EL2, kl. Schiebebalken	23° 30,056' S	99° 59,498' W	3883,3
245_4-13	31.12.2015 22:48:39	CTD	max depth/on ground	SL: 122 m	23° 30,054' S	99° 59,499' W	3883,7
245_4-13	31.12.2015 23:04:40	CTD	on deck		23° 30,053' S	99° 59,498' W	3890,2

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_4-13	31.12.2015 23:05:55	CTD	station end		23° 30,054' S	99° 59,498' W	3883,1
245_4-14	31.12.2015 23:12:01	PUMP	station start	Pump-CTD	23° 30,056' S	99° 59,499' W	3889,7
245_4-14	31.12.2015 23:19:16	PUMP	in the water		23° 30,061' S	99° 59,497' W	3883,5
245_4-14	01.01.2016 00:13:13	PUMP	on deck	Pump-CTD defekt	23° 30,056' S	99° 59,501' W	3882,7
245_4-14	01.01.2016 00:18:20	PUMP	on deck	Pump-CTD defekt	23° 30,055' S	99° 59,499' W	3894,4
245_4-14	01.01.2016 00:19:22	PUMP	station end		23° 30,054' S	99° 59,499' W	3882,7
245_4-15	01.01.2016 00:30:23	CTD	station start		23° 30,053' S	99° 59,499' W	3882,1
245_4-15	01.01.2016 00:31:29	CTD	in the water		23° 30,054' S	99° 59,499' W	3891
245_4-15	01.01.2016 00:47:24	CTD	max depth/on ground	maxSL: 173m	23° 30,056' S	99° 59,500' W	3888,6
245_4-15	01.01.2016 01:00:03	CTD	on deck		23° 30,061' S	99° 59,499' W	3883,2
245_4-15	01.01.2016 01:05:04	CTD	station end		23° 30,061' S	99° 59,500' W	3890,4
245_4-16	01.01.2016 01:18:06	PS	station start		23° 29,754' S	99° 58,654' W	3916,5
245_4-16	01.01.2016 01:25:07	PS	profile start	rwK: 180°, d: 5 sm	23° 29,991' S	99° 58,220' W	3986,3
245_4-16	01.01.2016 02:10:30	PS	alter course	rwK: 270°, d: 3 sm	23° 34,580' S	99° 58,201' W	4111,9
245_4-16	01.01.2016 02:41:43	PS	profile end	rwK: 090°, d: 2 sm	23° 34,577' S	100° 1,227' W	4020,2
245_4-16	01.01.2016 02:42:28	PS	station end		23° 34,527' S	100° 1,185' W	4016,1
245_4-17	01.01.2016 03:10:52	BC	station start		23° 34,787' S	99° 59,293' W	4136,7
245_4-17	01.01.2016 03:14:08	BC	in the water	Kastengreifer über FW1/SPW1 & Schiebebalken	23° 34,790' S	99° 59,295' W	4148,3
245_4-17	01.01.2016 03:21:12	BC	information	Bei SL: 100 m 1 x Transponder	23° 34,793' S	99° 59,289' W	4120,3
245_4-17	01.01.2016 04:36:35	BC	max depth/on ground	SL: 4191 m, SZ: 40 / 37 kN	23° 34,794' S	99° 59,226' W	4133,9
245_4-17	01.01.2016 04:37:02	BC	hoisting		23° 34,793' S	99° 59,226' W	4130,4
245_4-17	01.01.2016 06:02:59	BC	on deck		23° 34,788' S	99° 59,229' W	4129,9
245_4-17	01.01.2016 06:03:11	BC	station end		23° 34,788' S	99° 59,229' W	4132,3
245_4-18	01.01.2016 06:09:03	GC	station start	L= 5m	23° 34,791' S	99° 59,225' W	4132,5
245_4-18	01.01.2016 06:14:46	GC	in the water		23° 34,794' S	99° 59,223' W	4131,9
245_4-18	01.01.2016 06:15:03	GC	lowering		23° 34,794' S	99° 59,223' W	4129,9
245_4-18	01.01.2016 06:19:27	GC	information	Transponder bei SL: 100m	23° 34,792' S	99° 59,222' W	4133,4
245_4-18	01.01.2016 07:34:17	GC	max depth/on ground	SLmax: 4189m	23° 34,792' S	99° 59,222' W	4129,8
245_4-18	01.01.2016 07:34:42	GC	hoisting		23° 34,792' S	99° 59,222' W	4129,4

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_4-18	01.01.2016 07:35:54	GC	information	frei vom Grund, SL: 4167m, SZmax: 52kN	23° 34,792' S	99° 59,221' W	4131,3
245_4-18	01.01.2016 09:09:12	GC	station end		23° 34,787' S	99° 59,224' W	4130,4
245_5-1	02.01.2016 14:30:32	CTD	station start		23° 30,013' S	106° 59,917' W	3877,6
245_5-1	02.01.2016 14:42:05	CTD	in the water	EL2, kl. Schiebebalken	23° 29,846' S	107° 0,104' W	3913,2
245_5-1	02.01.2016 15:06:01	CTD	max depth/on ground	SL: 497 m, SZ: 7 kN	23° 29,842' S	107° 0,102' W	3913,4
245_5-1	02.01.2016 15:48:27	CTD	on deck		23° 29,838' S	107° 0,102' W	3909,1
245_5-1	02.01.2016 15:50:24	CTD	station end		23° 29,839' S	107° 0,102' W	3908,7
245_5-2	02.01.2016 15:54:23	LIOP	station start	Secci-Disk	23° 29,839' S	107° 0,102' W	3911,5
245_5-2	02.01.2016 15:56:02	LIOP	in the water		23° 29,839' S	107° 0,102' W	3909,9
245_5-2	02.01.2016 16:04:40	LIOP	on deck		23° 29,838' S	107° 0,100' W	3908,3
245_5-2	02.01.2016 16:06:03	LIOP	station end		23° 29,838' S	107° 0,100' W	3910,5
245_5-3	02.01.2016 16:07:58	LIOP	station start	UV Profiler	23° 29,840' S	107° 0,101' W	3912,9
245_5-3	02.01.2016 16:08:20	LIOP	in the water		23° 29,840' S	107° 0,101' W	3915,3
245_5-3	02.01.2016 16:08:36	LIOP	profile start	rwK: 050°, STW: 0,5 kn	23° 29,840' S	107° 0,101' W	3915,4
245_5-3	02.01.2016 16:15:38	LIOP	max depth/on ground	SL: 86 m	23° 29,800' S	107° 0,051' W	3908,4
245_5-3	02.01.2016 16:28:27	LIOP	profile end		23° 29,718' S	106° 59,949' W	3919,4
245_5-3	02.01.2016 16:29:06	LIOP	on deck		23° 29,715' S	106° 59,943' W	3916,8
245_5-3	02.01.2016 16:32:56	LIOP	station end		23° 29,697' S	106° 59,922' W	3921,2
245_5-4	02.01.2016 16:33:06	LIOP	station start	Optic Profiler	23° 29,696' S	106° 59,921' W	3916,5
245_5-4	02.01.2016 16:35:14	LIOP	in the water	BB achtern, manuell	23° 29,680' S	106° 59,901' W	3904,1
245_5-4	02.01.2016 16:36:27	LIOP	profile start	rwK: 050°, STW: 0,7 kn	23° 29,670' S	106° 59,888' W	3895,3
245_5-4	02.01.2016 16:47:07	LIOP	max depth/on ground	SL: 200 m	23° 29,583' S	106° 59,779' W	3880,4
245_5-4	02.01.2016 17:03:27	LIOP	profile end		23° 29,442' S	106° 59,599' W	3929,8
245_5-4	02.01.2016 17:04:50	LIOP	on deck		23° 29,431' S	106° 59,585' W	3909,2
245_5-4	02.01.2016 17:05:08	LIOP	station end		23° 29,428' S	106° 59,582' W	3919,2
245_5-5	02.01.2016 17:06:39	CTD	station start	CTD über EL2, kl. Schiebebalken	23° 29,414' S	106° 59,562' W	3917,4
245_5-5	02.01.2016 17:16:40	CTD	in the water		23° 29,412' S	106° 59,561' W	3890,4
245_5-5	02.01.2016 17:38:22	CTD	max depth/on ground	SL: 500 m, SZ: 7 kN	23° 29,415' S	106° 59,559' W	3889,9

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_5-5	02.01.2016 18:02:41	CTD	on deck		23° 29,413' S	106° 59,555' W	3870,9
245_5-5	02.01.2016 18:05:12	CTD	station end		23° 29,412' S	106° 59,556' W	3892,4
245_5-6	02.01.2016 18:15:17	WS	station start	Go-Flo	23° 29,412' S	106° 59,556' W	3891,7
245_5-6	02.01.2016 18:15:28	WS	in the water		23° 29,412' S	106° 59,556' W	3890,2
245_5-6	02.01.2016 18:36:21	WS	max depth/on ground	SL: 175m	23° 29,410' S	106° 59,560' W	3891,3
245_5-6	02.01.2016 18:51:33	WS	on deck		23° 29,411' S	106° 59,560' W	3881,8
245_5-6	02.01.2016 18:53:49	WS	station end		23° 29,410' S	106° 59,560' W	3882,8
245_5-7	02.01.2016 19:00:11	CTD	station start		23° 29,408' S	106° 59,556' W	3893,1
245_5-7	02.01.2016 19:01:51	CTD	in the water		23° 29,409' S	106° 59,556' W	3891,3
245_5-7	02.01.2016 19:10:29	CTD	max depth/on ground	SL: 18m	23° 29,409' S	106° 59,557' W	3894,6
245_5-7	02.01.2016 19:15:23	CTD	on deck		23° 29,409' S	106° 59,561' W	3893,5
245_5-7	02.01.2016 19:18:56	CTD	station end		23° 29,409' S	106° 59,560' W	3890,4
245_6-1	03.01.2016 09:21:27	CTD	station start		23° 30,006' S	110° 2,968' W	3612,8
245_6-1	03.01.2016 09:22:59	CTD	in the water		23° 30,005' S	110° 2,968' W	3613,3
245_6-1	03.01.2016 11:00:50	CTD	max depth/on ground	maxSL: 3568m	23° 29,997' S	110° 2,961' W	3614,9
245_6-1	03.01.2016 12:30:01	CTD	on deck		23° 30,000' S	110° 2,968' W	3618,2
245_6-1	03.01.2016 12:31:42	CTD	station end		23° 29,999' S	110° 2,968' W	3612,5
245_6-2	03.01.2016 12:38:54	WS	station start	Go-Flo	23° 29,999' S	110° 2,966' W	3613,3
245_6-2	03.01.2016 12:40:06	WS	in the water		23° 29,998' S	110° 2,965' W	3616,1
245_6-2	03.01.2016 12:59:08	WS	max depth/on ground	maxSL: 170m	23° 29,997' S	110° 2,961' W	3615,6
245_6-2	03.01.2016 13:25:36	WS	on deck		23° 30,002' S	110° 2,964' W	3612,9
245_6-2	03.01.2016 13:27:06	WS	station end		23° 30,001' S	110° 2,965' W	3612,7
245_6-3	03.01.2016 14:26:07	CTD	station start		23° 30,001' S	110° 2,967' W	3614,6
245_6-3	03.01.2016 14:27:03	CTD	in the water	über EL2, kl. Schiebebalken	23° 30,000' S	110° 2,966' W	3613,4
245_6-3	03.01.2016 15:04:24	CTD	max depth/on ground	SL: 1250 m, SZ: 10 kN	23° 30,003' S	110° 2,969' W	3613,3
245_6-3	03.01.2016 15:45:34	CTD	on deck		23° 30,003' S	110° 2,961' W	3614,4
245_6-3	03.01.2016 15:46:43	CTD	station end		23° 30,002' S	110° 2,961' W	3614
245_6-4	03.01.2016 15:48:34	LIOP	information	Secci-Disk, über Heck, manuell	23° 30,002' S	110° 2,961' W	3614,5
245_6-4	03.01.2016 16:09:17	LIOP	in the water	über Heck, manuell, SL: 56	23° 29,999' S	110° 2,960' W	3613

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Station	**Date / Time UTC**	**Device**	**Action**	**Comment (Action)**	**Latitude**	**Longitude**	**Depth (m)**
245_6-4	03.01.2016 16:21:11	LIOP	on deck		23° 30,001' S	110° 2,962' W	3612,6
245_6-4	03.01.2016 16:22:03	LIOP	station end		23° 30,001' S	110° 2,962' W	3615,1
245_6-5	03.01.2016 16:23:07	LIOP	station start	UV-Profiler	23° 30,001' S	110° 2,961' W	3614,6
245_6-5	03.01.2016 16:27:06	LIOP	in the water	BB Heck, manuell	23° 29,980' S	110° 2,936' W	3604
245_6-5	03.01.2016 16:28:13	LIOP	profile start	rwK: 045°, STW: 0,7 kn	23° 29,978' S	110° 2,935' W	3606,9
245_6-5	03.01.2016 16:38:56	LIOP	max depth/on ground	SL: 50 m	23° 29,883' S	110° 2,832' W	3618,8
245_6-5	03.01.2016 16:48:18	LIOP	profile end		23° 29,794' S	110° 2,737' W	3616,7
245_6-5	03.01.2016 16:49:38	LIOP	on deck	rwK: 045°	23° 29,782' S	110° 2,724' W	3614,4
245_6-5	03.01.2016 16:50:24	LIOP	station end		23° 29,774' S	110° 2,718' W	3628,9
245_6-6	03.01.2016 16:51:24	LIOP	station start	Optic Profiler, über Heck, manuell	23° 29,766' S	110° 2,705' W	3619,9
245_6-6	03.01.2016 16:52:05	LIOP	in the water		23° 29,759' S	110° 2,698' W	3621,2
245_6-6	03.01.2016 16:53:18	LIOP	profile start		23° 29,745' S	110° 2,688' W	3613,1
245_6-6	03.01.2016 17:00:41	LIOP	max depth/on ground	SL: 160 m	23° 29,665' S	110° 2,598' W	3615,2
245_6-6	03.01.2016 17:16:11	LIOP	profile end		23° 29,477' S	110° 2,401' W	3623,5
245_6-6	03.01.2016 17:17:21	LIOP	on deck		23° 29,465' S	110° 2,386' W	3624
245_6-6	03.01.2016 17:18:08	LIOP	station end		23° 29,453' S	110° 2,375' W	3625,1
245_6-7	03.01.2016 17:20:06	PUMP	station start	Pump-CTD über Winde STB achtern & Kran 3	23° 29,431' S	110° 2,351' W	3622,9
245_6-7	03.01.2016 17:31:41	PUMP	in the water		23° 29,428' S	110° 2,339' W	3632,9
245_6-7	03.01.2016 18:51:05	PUMP	max depth/on ground	SL: 270 m	23° 29,419' S	110° 2,339' W	3623,2
245_6-7	03.01.2016 21:36:53	PUMP	on deck		23° 29,422' S	110° 2,338' W	3625,7
245_6-7	03.01.2016 21:42:41	PUMP	station end		23° 29,422' S	110° 2,337' W	3622,9
245_6-8	03.01.2016 22:46:00	CTD	station start		23° 29,421' S	110° 2,345' W	3624,6
245_6-8	03.01.2016 22:49:06	CTD	in the water		23° 29,423' S	110° 2,347' W	3623,9
245_6-8	03.01.2016 23:05:16	CTD	max depth/on ground	maxSL: 298m	23° 29,422' S	110° 2,337' W	3625,8
245_6-8	03.01.2016 23:24:54	CTD	on deck		23° 29,423' S	110° 2,346' W	3623,2
245_6-8	03.01.2016 23:25:12	CTD	station end		23° 29,423' S	110° 2,347' W	3624,3
245_6-9	04.01.2016 00:48:08	CTD	station start	In Situ Pump-CTD	23° 29,891' S	110° 2,837' W	3604,1

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_6-9	04.01.2016 00:50:27	CTD	in the water	In Situ Pumpe bei SL: 10m, 410m, 910m, 1410m, 2410m, 3210m, 3240m, 3390m.	23° 29,998' S	110° 2,958' W	3612,9
245_6-9	04.01.2016 03:17:12	CTD	max depth/on ground	SL: 3410 m	23° 29,995' S	110° 2,960' W	3613,8
245_6-9	04.01.2016 10:02:34	CTD	hoisting		23° 30,000' S	110° 2,959' W	3616,1
245_6-9	04.01.2016 12:20:01	CTD	on deck		23° 29,999' S	110° 2,959' W	3613,3
245_6-9	04.01.2016 12:21:01	CTD	station end		23° 30,000' S	110° 2,958' W	3612,2
245_6-10	04.01.2016 12:28:05	PS	station start		23° 30,054' S	110° 3,107' W	3617,7
245_6-10	04.01.2016 12:30:48	PS	profile start	rwk: 002°, d: 3sm	23° 29,834' S	110° 3,137' W	3637
245_6-10	04.01.2016 12:57:49	PS	alter course	rwk: 091°, d: 5sm	23° 27,131' S	110° 2,813' W	3652,1
245_6-10	04.01.2016 13:49:17	PS	alter course	rwk: 180°, d: 6sm	23° 27,271' S	109° 57,341' W	3646,1
245_6-10	04.01.2016 14:48:10	PS	profile end		23° 33,136' S	109° 57,405' W	3721
245_6-10	04.01.2016 14:49:04	PS	station end	rwK: 295°, d: 6 sm	23° 33,159' S	109° 57,492' W	3725
245_6-11	04.01.2016 15:38:49	CTD	station start		23° 29,995' S	110° 2,972' W	3611,8
245_6-11	04.01.2016 15:41:30	CTD	in the water		23° 29,998' S	110° 2,962' W	3612,4
245_6-11	04.01.2016 15:53:07	CTD	max depth/on ground	SL: 147 m, SZ: 5 kN	23° 30,003' S	110° 2,953' W	3611,8
245_6-11	04.01.2016 16:18:07	CTD	on deck		23° 29,998' S	110° 2,954' W	3612,8
245_6-11	04.01.2016 16:20:21	CTD	station end		23° 29,998' S	110° 2,954' W	3613,2
245_6-12	04.01.2016 16:22:41	NET	station start	Micronet, über Winde STB achtern & Kran 3	23° 29,997' S	110° 2,955' W	3613,7
245_6-12	04.01.2016 16:38:05	NET	in the water		23° 30,004' S	110° 2,964' W	3614,7
245_6-12	04.01.2016 17:04:00	NET	max depth/on ground	SL: 280 m	23° 29,999' S	110° 2,961' W	3615,9
245_6-12	04.01.2016 18:24:00	NET	on deck		23° 30,000' S	110° 2,953' W	3614,4
245_6-12	04.01.2016 18:28:54	NET	station end		23° 29,999' S	110° 2,956' W	3615,2
245_6-13	04.01.2016 18:41:54	CTD	station start		23° 30,001' S	110° 2,964' W	3613,7
245_6-13	04.01.2016 18:47:01	CTD	in the water		23° 30,001' S	110° 2,964' W	3618,5
245_6-13	04.01.2016 18:58:42	CTD	max depth/on ground	SL: 172m	23° 30,001' S	110° 2,959' W	3616,9
245_6-13	04.01.2016 19:25:23	CTD	station end		23° 30,001' S	110° 2,961' W	3613,9
245_6-14	04.01.2016 19:34:56	WS	station start	Go-Flo	23° 29,999' S	110° 2,961' W	3615,3
245_6-14	04.01.2016 19:45:40	WS	in the water		23° 30,002' S	110° 2,962' W	3614,9

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_6-14	04.01.2016 20:08:06	WS	max depth/on ground	SL: 190m	23° 30,001' S	110° 2,957' W	3616,9
245_6-14	04.01.2016 20:46:34	WS	on deck		23° 30,001' S	110° 2,954' W	3616
245_6-14	04.01.2016 20:49:06	WS	station end		23° 30,002' S	110° 2,955' W	3614,6
245_6-15	04.01.2016 21:12:03	BC	station start		23° 29,419' S	110° 3,042' W	3639,3
245_6-15	04.01.2016 21:14:22	BC	in the water		23° 29,419' S	110° 3,043' W	3637,9
245_6-15	04.01.2016 21:19:14	BC	information	Transponer bei SL: 100m	23° 29,425' S	110° 3,045' W	3629,3
245_6-15	04.01.2016 22:27:36	BC	max depth/on ground	SL: 3676m, SZ: 53,6kN	23° 29,409' S	110° 3,032' W	3628,2
245_6-15	04.01.2016 23:47:19	BC	on deck	inkl. Transponder	23° 29,416' S	110° 3,030' W	3629,7
245_6-15	04.01.2016 23:48:04	BC	station end		23° 29,416' S	110° 3,031' W	3627,9
245_6-16	04.01.2016 23:49:03	GC	station start	GC 5m über FW1/SPW1, Schiebebalken	23° 29,416' S	110° 3,031' W	3628
245_6-16	04.01.2016 23:53:06	GC	in the water		23° 29,418' S	110° 3,032' W	3627,3
245_6-16	04.01.2016 23:58:45	GC	information	Bei SL: 100 m 1 x Transponder z.W.	23° 29,414' S	110° 3,033' W	3626,9
245_6-16	05.01.2016 01:04:40	GC	max depth/on ground	maxSL: 3682m, maxSZ: 45,1kN	23° 29,416' S	110° 3,036' W	3627,3
245_6-16	05.01.2016 02:15:04	GC	information	Bei SL: 100 m 1 x Transponder an Deck	23° 29,417' S	110° 3,036' W	3640
245_6-16	05.01.2016 02:25:38	GC	on deck		23° 29,414' S	110° 3,031' W	3636,4
245_6-16	05.01.2016 02:30:10	GC	station end	rwK: 236°, d: 262 sm	23° 29,444' S	110° 3,009' W	3640,7
245_7-1	05.01.2016 22:20:33	LIOP	station start	UV Profiler	25° 57,856' S	114° 1,099' W	2939,9
245_7-1	05.01.2016 22:23:45	LIOP	in the water		25° 57,885' S	114° 1,092' W	3165,9
245_7-1	05.01.2016 22:34:13	LIOP	max depth/on ground	maxSL: 85m	25° 58,013' S	114° 1,021' W	2939,9
245_7-1	05.01.2016 22:36:50	LIOP	at surface		25° 58,063' S	114° 0,992' W	2936,9
245_7-1	05.01.2016 22:38:14	LIOP	max depth/on ground	SL: 50m	25° 58,090' S	114° 0,977' W	2932,7
245_7-1	05.01.2016 22:40:48	LIOP	at surface		25° 58,140' S	114° 0,949' W	2936,2
245_7-1	05.01.2016 22:42:32	LIOP	max depth/on ground	SL: 50m	25° 58,176' S	114° 0,929' W	3183,8
245_7-1	05.01.2016 22:45:55	LIOP	on deck		25° 58,247' S	114° 0,895' W	2925,8
245_7-1	05.01.2016 22:47:01	LIOP	station end		25° 58,269' S	114° 0,884' W	2933,6
245_7-2	05.01.2016 22:48:56	LIOP	station start	Optic Profiler	25° 58,288' S	114° 0,878' W	2933,5
245_7-2	05.01.2016 22:49:48	LIOP	in the water		25° 58,293' S	114° 0,878' W	2935,2

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_7-2	05.01.2016 23:03:52	LIOP	max depth/on ground	maxSL: 180m	25° 58,496' S	114° 0,783' W	2890,2
245_7-2	05.01.2016 23:13:06	LIOP	at surface		25° 58,686' S	114° 0,684' W	2878,7
245_7-2	05.01.2016 23:14:17	LIOP	max depth/on ground	SL: 50m	25° 58,708' S	114° 0,671' W	2881,1
245_7-2	05.01.2016 23:17:38	LIOP	at surface		25° 58,772' S	114° 0,634' W	2891,2
245_7-2	05.01.2016 23:18:53	LIOP	max depth/on ground	SL: 50m	25° 58,797' S	114° 0,620' W	2897,3
245_7-2	05.01.2016 23:22:55	LIOP	on deck		25° 58,881' S	114° 0,571' W	2916,5
245_7-2	05.01.2016 23:23:06	LIOP	station end		25° 58,886' S	114° 0,569' W	2915,3
245_7-3	05.01.2016 23:26:27	LIOP	station start	Secci Disk/Forel-Ule	25° 58,917' S	114° 0,564' W	2923,6
245_7-3	05.01.2016 23:28:27	LIOP	in the water		25° 58,917' S	114° 0,568' W	2912,9
245_7-3	05.01.2016 23:32:39	LIOP	max depth/on ground	SL: 50m	25° 58,919' S	114° 0,566' W	2926,5
245_7-3	05.01.2016 23:34:07	LIOP	on deck		25° 58,919' S	114° 0,566' W	2930,2
245_7-3	05.01.2016 23:35:20	LIOP	station end		25° 58,918' S	114° 0,566' W	2919,9
245_7-4	05.01.2016 23:39:24	CTD	station start		25° 58,916' S	114° 0,562' W	2931,3
245_7-4	05.01.2016 23:40:25	CTD	in the water		25° 58,915' S	114° 0,563' W	2921,3
245_7-4	06.01.2016 00:01:49	CTD	max depth/on ground	SL: 497 m, SZ: 6 kN	25° 58,913' S	114° 0,559' W	2926,2
245_7-4	06.01.2016 00:25:11	CTD	on deck		25° 58,916' S	114° 0,559' W	2922,8
245_7-4	06.01.2016 00:26:26	CTD	station end		25° 58,915' S	114° 0,560' W	2924,6
245_7-5	06.01.2016 01:17:17	CTD	station start		25° 58,912' S	114° 0,563' W	2924,8
245_7-5	06.01.2016 01:19:26	CTD	in the water		25° 58,912' S	114° 0,562' W	2925,7
245_7-5	06.01.2016 01:39:46	CTD	max depth/on ground	maxSL: 497m	25° 58,911' S	114° 0,561' W	2922,8
245_7-5	06.01.2016 02:15:26	CTD	on deck		25° 58,918' S	114° 0,564' W	2929,5
245_7-5	06.01.2016 02:17:13	CTD	station end		25° 58,919' S	114° 0,564' W	2922,5
245_7-6	06.01.2016 02:20:42	WS	station start	Go-Flo	25° 58,918' S	114° 0,565' W	2919,9
245_7-6	06.01.2016 02:28:09	WS	in the water	Gewicht z. W.	25° 58,912' S	114° 0,567' W	2917,8
245_7-6	06.01.2016 02:48:07	WS	max depth/on ground	SL: 200 m	25° 58,913' S	114° 0,563' W	2920,5
245_7-6	06.01.2016 03:23:23	WS	on deck		25° 58,920' S	114° 0,566' W	2919,9
245_7-6	06.01.2016 03:25:33	WS	station end		25° 58,920' S	114° 0,563' W	2932
245_7-7	06.01.2016 03:30:28	CTD	station start	CTD über EL1 & kl. Schiebebalken	25° 58,916' S	114° 0,560' W	2926,1

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_7-7	06.01.2016 03:34:48	CTD	in the water		25° 58,916' S	114° 0,556' W	2920,8
245_7-7	06.01.2016 03:38:23	CTD	max depth/on ground	SL: 18 m	25° 58,914' S	114° 0,562' W	2926,6
245_7-7	06.01.2016 03:47:31	CTD	on deck		25° 58,912' S	114° 0,568' W	2925,2
245_7-7	06.01.2016 03:50:42	CTD	station end		25° 58,915' S	114° 0,567' W	2923,8
245_8-1	06.01.2016 21:40:53	CTD	station start		27° 44,456' S	117° 37,131' W	3697,5
245_8-1	06.01.2016 21:42:47	CTD	in the water		27° 44,461' S	117° 37,134' W	3694,6
245_8-1	06.01.2016 23:22:29	CTD	max depth/on ground	maxSL: 3642m	27° 44,477' S	117° 37,180' W	3692,5
245_8-1	07.01.2016 00:53:38	CTD	on deck		27° 44,480' S	117° 37,174' W	3692
245_8-1	07.01.2016 00:54:01	CTD	station end		27° 44,480' S	117° 37,173' W	3691,6
245_8-2	06.01.2016 21:58:44	WS	station start		27° 44,476' S	117° 37,183' W	3688,5
245_8-2	06.01.2016 22:02:39	WS	in the water	FRB mit 4 Personen z.W., Wasserprobennahme	27° 44,478' S	117° 37,184' W	3690,3
245_8-2	06.01.2016 22:48:57	WS	on deck	FRB an Deck	27° 44,478' S	117° 37,182' W	3692,2
245_8-2	06.01.2016 22:49:17	WS	station end		27° 44,478' S	117° 37,181' W	3691,8
245_8-3	07.01.2016 00:56:13	WS	station start	GoFlo, über Winde STB achtern & Kran 3	27° 44,480' S	117° 37,171' W	3691,8
245_8-3	07.01.2016 01:05:22	WS	in the water		27° 44,479' S	117° 37,179' W	3690
245_8-3	07.01.2016 01:11:29	WS	max depth/on ground	maxSL: 200m	27° 44,474' S	117° 37,180' W	3689,9
245_8-3	07.01.2016 01:25:16	WS	on deck		27° 44,475' S	117° 37,180' W	3692,4
245_8-3	07.01.2016 01:26:26	WS	station end		27° 44,476' S	117° 37,180' W	3699
245_8-4	07.01.2016 02:33:10	CTD	station start		27° 44,476' S	117° 37,173' W	3691,3
245_8-4	07.01.2016 02:34:31	CTD	in the water		27° 44,476' S	117° 37,173' W	3692,7
245_8-4	07.01.2016 02:50:50	CTD	max depth/on ground	maxSL: 297m	27° 44,476' S	117° 37,182' W	3691,1
245_8-4	07.01.2016 03:35:57	CTD	on deck		27° 44,483' S	117° 37,179' W	3692,8
245_8-4	07.01.2016 03:36:22	CTD	station end		27° 44,483' S	117° 37,178' W	3690,1
245_8-5	07.01.2016 04:23:05	CTD	station start		27° 44,476' S	117° 37,177' W	3690,8
245_8-5	07.01.2016 04:26:17	CTD	in the water	über EL1 & kl. Schiebebalken	27° 44,476' S	117° 37,176' W	3692,8
245_8-5	07.01.2016 05:04:49	CTD	max depth/on ground	SL: 1247 m, SZ: 9 kN	27° 44,480' S	117° 37,181' W	3690
245_8-5	07.01.2016 05:54:19	CTD	on deck		27° 44,477' S	117° 37,175' W	3694,1

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_8-5	07.01.2016 05:55:44	CTD	station end		27° 44,477' S	117° 37,176' W	3691,8
245_8-6	07.01.2016 06:00:15	NET	station start	Micronet, über Winde STB achtern & Kran 3	27° 44,478' S	117° 37,175' W	3691,6
245_8-6	07.01.2016 06:08:07	NET	in the water		27° 44,474' S	117° 37,182' W	3691,1
245_8-6	07.01.2016 06:33:49	NET	max depth/on ground	SL: 300 m	27° 44,475' S	117° 37,180' W	3692,7
245_8-6	07.01.2016 07:44:07	NET	on deck		27° 44,483' S	117° 37,179' W	3690,4
245_8-6	07.01.2016 07:45:12	NET	station end		27° 44,482' S	117° 37,178' W	3688,4
245_8-7	07.01.2016 07:57:00	CTD	station start		27° 44,473' S	117° 37,173' W	3692,1
245_8-7	07.01.2016 08:00:22	CTD	in the water		27° 44,474' S	117° 37,177' W	3690,9
245_8-7	07.01.2016 08:14:55	CTD	max depth/on ground	SL: 297m	27° 44,481' S	117° 37,183' W	3689,1
245_8-7	07.01.2016 08:59:10	CTD	on deck		27° 44,482' S	117° 37,182' W	3690,1
245_8-7	07.01.2016 09:00:17	CTD	station end		27° 44,483' S	117° 37,182' W	3690,3
245_8-8	07.01.2016 09:15:01	PUMP	station start	Pump CTD	27° 44,479' S	117° 37,174' W	3691,3
245_8-8	07.01.2016 09:21:29	PUMP	in the water		27° 44,478' S	117° 37,176' W	3693,6
245_8-8	07.01.2016 10:34:46	PUMP	max depth/on ground	SL: 275m	27° 44,481' S	117° 37,183' W	3690,5
245_8-8	07.01.2016 13:41:15	PUMP	on deck		27° 44,485' S	117° 37,181' W	3697,4
245_8-8	07.01.2016 13:45:50	PUMP	station end		27° 44,480' S	117° 37,185' W	3693,3
245_8-9	07.01.2016 13:56:19	CTD	station start		27° 44,479' S	117° 37,183' W	3692,4
245_8-9	07.01.2016 13:57:47	CTD	in the water		27° 44,478' S	117° 37,181' W	3692,6
245_8-9	07.01.2016 14:15:01	CTD	max depth/on ground	maxSL: 297m	27° 44,481' S	117° 37,183' W	3692,5
245_8-9	07.01.2016 14:53:47	CTD	on deck		27° 44,484' S	117° 37,187' W	3690
245_8-9	07.01.2016 14:55:14	CTD	station end		27° 44,483' S	117° 37,186' W	3692,3
245_8-10	07.01.2016 15:48:50	CTD	station start	über EL1, kl. Schiebebalken	27° 44,476' S	117° 37,192' W	3703,4
245_8-10	07.01.2016 15:51:04	CTD	in the water		27° 44,474' S	117° 37,193' W	3691,1
245_8-10	07.01.2016 16:04:08	CTD	max depth/on ground	SL: 147 m, SZ: 5 kN	27° 44,479' S	117° 37,191' W	3690,1
245_8-10	07.01.2016 16:26:51	CTD	on deck		27° 44,484' S	117° 37,191' W	3690,4
245_8-10	07.01.2016 16:27:22	CTD	station end		27° 44,484' S	117° 37,191' W	3691,5
245_8-11	07.01.2016 17:36:54	CTD	station start	über EL1 & kl. Schiebebalken	27° 44,481' S	117° 37,192' W	3690,3
245_8-11	07.01.2016 17:37:42	CTD	in the water		27° 44,481' S	117° 37,192' W	3691

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_8-11	07.01.2016 17:45:28	CTD	max depth/on ground	SL: 17 m, SZ: 4 kN	27° 44,479' S	117° 37,191' W	3689,4
245_8-11	07.01.2016 17:53:12	CTD	on deck		27° 44,477' S	117° 37,194' W	3693,2
245_8-11	07.01.2016 17:54:09	CTD	station end		27° 44,478' S	117° 37,194' W	3692,8
245_8-12	07.01.2016 18:03:30	NET	station start	Micronet über Winde STB achtern & Kran 3	27° 44,483' S	117° 37,184' W	3693,2
245_8-12	07.01.2016 18:05:08	NET	in the water		27° 44,484' S	117° 37,186' W	3694,3
245_8-12	07.01.2016 18:30:00	NET	max depth/on ground	SL: 300 m	27° 44,482' S	117° 37,184' W	3692,8
245_8-12	07.01.2016 19:39:45	NET	on deck		27° 44,483' S	117° 37,186' W	3692,1
245_8-12	07.01.2016 19:43:15	NET	station end		27° 44,483' S	117° 37,187' W	3692,9
245_8-13	07.01.2016 19:49:24	LIOP	station start	UV profiler	27° 44,482' S	117° 37,191' W	3689,3
245_8-13	07.01.2016 19:50:35	LIOP	in the water		27° 44,483' S	117° 37,192' W	3692,9
245_8-13	07.01.2016 19:54:05	LIOP	max depth/on ground	SL: 62m	27° 44,517' S	117° 37,222' W	3687,4
245_8-13	07.01.2016 19:57:39	LIOP	at surface		27° 44,554' S	117° 37,257' W	3688,5
245_8-13	07.01.2016 20:00:14	LIOP	max depth/on ground	SL: 53m	27° 44,584' S	117° 37,283' W	3679,3
245_8-13	07.01.2016 20:03:48	LIOP	at surface		27° 44,621' S	117° 37,316' W	3674,3
245_8-13	07.01.2016 20:05:27	LIOP	max depth/on ground	SL: 50m	27° 44,638' S	117° 37,329' W	3672,8
245_8-13	07.01.2016 20:08:51	LIOP	on deck		27° 44,675' S	117° 37,374' W	3686,1
245_8-13	07.01.2016 20:09:17	LIOP	station end		27° 44,680' S	117° 37,380' W	3682,6
245_8-14	07.01.2016 20:10:05	LIOP	station start	Optic Profiler	27° 44,689' S	117° 37,389' W	3679,1
245_8-14	07.01.2016 20:10:40	LIOP	in the water		27° 44,695' S	117° 37,396' W	3680,5
245_8-14	07.01.2016 20:17:47	LIOP	max depth/on ground	SL: 175m	27° 44,784' S	117° 37,496' W	3676,1
245_8-14	07.01.2016 20:27:10	LIOP	at surface		27° 44,887' S	117° 37,613' W	3654,2
245_8-14	07.01.2016 20:28:52	LIOP	max depth/on ground	SL: 51m	27° 44,905' S	117° 37,632' W	3655,4
245_8-14	07.01.2016 20:34:17	LIOP	at surface		27° 44,959' S	117° 37,691' W	3643,2
245_8-14	07.01.2016 20:36:23	LIOP	max depth/on ground	SL: 50m	27° 44,976' S	117° 37,714' W	3635,6
245_8-14	07.01.2016 20:40:38	LIOP	on deck		27° 45,014' S	117° 37,760' W	3633,6
245_8-14	07.01.2016 20:41:02	LIOP	station end		27° 45,017' S	117° 37,766' W	3635,3
245_8-15	07.01.2016 20:44:04	LIOP	station start	Secchi Disk / Forel-Ule	27° 45,036' S	117° 37,786' W	3630,8

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_8-15	07.01.2016 20:44:20	LIOP	in the water		27° 45,036' S	117° 37,786' W	3630,2
245_8-15	07.01.2016 20:50:23	LIOP	max depth/on ground	SL: 46m	27° 45,039' S	117° 37,787' W	3628,8
245_8-15	07.01.2016 20:54:53	LIOP	on deck		27° 45,040' S	117° 37,788' W	3630,4
245_8-15	07.01.2016 20:55:01	LIOP	station end		27° 45,039' S	117° 37,788' W	3630,4
245_8-16	07.01.2016 21:20:46	CTD	station start		27° 44,480' S	117° 37,176' W	3692,1
245_8-16	07.01.2016 21:22:50	CTD	in the water		27° 44,480' S	117° 37,178' W	3691,4
245_8-16	07.01.2016 21:38:45	CTD	max depth/on ground	SL: 297m	27° 44,483' S	117° 37,182' W	3691,9
245_8-16	07.01.2016 22:29:31	CTD	on deck		27° 44,485' S	117° 37,173' W	3694,2
245_8-16	07.01.2016 22:32:15	CTD	station end		27° 44,480' S	117° 37,179' W	3692,5
245_8-17	07.01.2016 23:06:40	CTD	station start	In Situ Pump-CTD	27° 44,472' S	117° 37,179' W	3693,2
245_8-17	07.01.2016 23:08:34	CTD	in the water	In Situ Pumpen bei SL: 30m, 430m, 730m, 1230m, 2230m, 3030m, 3090m, 3210m,	27° 44,472' S	117° 37,181' W	3691,7
245_8-17	08.01.2016 01:27:40	CTD	max depth/on ground	maxSL: 3230m	27° 44,471' S	117° 37,185' W	3691,6
245_8-17	08.01.2016 08:29:49	CTD	hoisting	Beginn Hieven	27° 44,474' S	117° 37,185' W	3691
245_8-17	08.01.2016 10:51:17	CTD	on deck		27° 44,470' S	117° 37,183' W	3688,7
245_8-17	08.01.2016 10:53:56	CTD	station end		27° 44,472' S	117° 37,187' W	3690,5
245_8-18	08.01.2016 10:54:12	PS	station start		27° 44,472' S	117° 37,187' W	3689,8
245_8-18	08.01.2016 10:54:27	PS	profile start	rwK: 293°, d: 5nm	27° 44,473' S	117° 37,188' W	3691,4
245_8-18	08.01.2016 11:51:00	PS	alter course	rwk: 241°, d: 5sm	27° 42,521' S	117° 42,513' W	3544,7
245_8-18	08.01.2016 12:40:14	PS	alter course	rwk: 090°, d: 12sm	27° 44,969' S	117° 47,137' W	2747,9
245_8-18	08.01.2016 14:38:20	PS	profile end		27° 44,987' S	117° 33,729' W	3628
245_8-18	08.01.2016 14:39:15	PS	station end		27° 44,929' S	117° 33,623' W	3629,3
245_8-19	08.01.2016 15:04:53	CTD	station start		27° 44,524' S	117° 37,243' W	3688
245_8-19	08.01.2016 15:07:51	CTD	in the water	über EL1 & kl. Schiebebalken	27° 44,523' S	117° 37,252' W	3685,6
245_8-19	08.01.2016 15:25:27	CTD	max depth/on ground	SL: 297 m, SZ: 5 kN	27° 44,496' S	117° 37,212' W	3688,2
245_8-19	08.01.2016 15:51:20	CTD	on deck		27° 44,479' S	117° 37,188' W	3691,5
245_8-19	08.01.2016 15:52:56	CTD	station end		27° 44,479' S	117° 37,189' W	3689,3
245_8-20	08.01.2016 15:57:21	WS	station start		27° 44,479' S	117° 37,193' W	3686,7
245_8-20	08.01.2016 16:01:42	WS	in the water	über Winde STB achtern & Kran 3	27° 44,476' S	117° 37,194' W	3689,2

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_8-20	08.01.2016 16:18:25	WS	max depth/on ground	SL: 190 m, (GoFlo bei 20 m, 30 m, 150 m)	27° 44,479' S	117° 37,188' W	3691,4
245_8-20	08.01.2016 16:37:18	WS	on deck	(inklusive 3 x GoFlo & Gewicht)	27° 44,481' S	117° 37,188' W	3691,4
245_8-20	08.01.2016 16:42:19	WS	station end		27° 44,483' S	117° 37,185' W	3693,1
245_8-21	08.01.2016 16:59:26	CTD	station start	über EL1 & kl. Schiebebalken	27° 44,484' S	117° 37,190' W	3692
245_8-21	08.01.2016 17:00:17	CTD	in the water		27° 44,484' S	117° 37,190' W	3692,3
245_8-21	08.01.2016 17:14:11	CTD	max depth/on ground	SL: 173 m, SZ: 5 kN	27° 44,479' S	117° 37,187' W	3691,7
245_8-21	08.01.2016 17:29:12	CTD	on deck		27° 44,481' S	117° 37,189' W	3690,8
245_8-21	08.01.2016 17:30:02	CTD	station end		27° 44,481' S	117° 37,189' W	3692
245_8-22	08.01.2016 17:33:39	LIOP	station start	UV-Profiler über BB Heck, manuell	27° 44,480' S	117° 37,191' W	3690,4
245_8-22	08.01.2016 17:37:43	LIOP	in the water		27° 44,478' S	117° 37,189' W	3690,7
245_8-22	08.01.2016 17:38:21	LIOP	profile start	rwK: 210°, d: 0,7 kn	27° 44,478' S	117° 37,189' W	3689,8
245_8-22	08.01.2016 17:45:23	LIOP	max depth/on ground	SL: 80 m	27° 44,542' S	117° 37,232' W	3685,9
245_8-22	08.01.2016 18:00:53	LIOP	profile end		27° 44,697' S	117° 37,335' W	3676,7
245_8-22	08.01.2016 18:03:10	LIOP	on deck		27° 44,723' S	117° 37,346' W	3676,4
245_8-22	08.01.2016 18:07:00	LIOP	station end		27° 44,757' S	117° 37,371' W	3678,3
245_8-23	08.01.2016 18:08:01	LIOP	station start	Optic Profiler, BB Heck, manuell	27° 44,773' S	117° 37,384' W	3680,4
245_8-23	08.01.2016 18:09:57	LIOP	in the water	rwK: 210°, FdW: 0,9 kn	27° 44,792' S	117° 37,395' W	3676,2
245_8-23	08.01.2016 18:17:10	LIOP	max depth/on ground	SL: 200 m	27° 44,886' S	117° 37,456' W	3675,8
245_8-23	08.01.2016 18:36:32	LIOP	on deck		27° 45,135' S	117° 37,617' W	3646
245_8-23	08.01.2016 18:37:43	LIOP	station end		27° 45,157' S	117° 37,637' W	3657,2
245_8-24	08.01.2016 18:38:09	LIOP	station start	Secci-Disk über BB Heck, manuell	27° 45,158' S	117° 37,639' W	3653,8
245_8-24	08.01.2016 18:39:44	LIOP	in the water		27° 45,157' S	117° 37,640' W	3646
245_8-24	08.01.2016 18:44:50	LIOP	max depth/on ground	SL: 40 m	27° 45,156' S	117° 37,632' W	3649,6
245_8-24	08.01.2016 18:46:50	LIOP	on deck		27° 45,156' S	117° 37,632' W	3648,5
245_8-24	08.01.2016 18:49:01	LIOP	station end		27° 45,159' S	117° 37,635' W	3643,5
245_8-25	08.01.2016 19:45:54	BC	station start		27° 45,009' S	117° 46,864' W	2731,7
245_8-25	08.01.2016 19:48:56	BC	in the water		27° 45,004' S	117° 46,858' W	2732,1
245_8-25	08.01.2016 19:54:36	BC	information	Transponder bei SL: 100m	27° 45,000' S	117° 46,861' W	2729,1

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_8-25	08.01.2016 20:45:20	BC	max depth/on ground	SL: 2768m	27° 45,004' S	117° 46,852' W	2729
245_8-25	08.01.2016 20:45:42	BC	hoisting		27° 45,004' S	117° 46,853' W	2729,3
245_8-25	08.01.2016 20:46:51	BC	information	frei vom Grund, SZmax: 30kN bei SL: 2751m	27° 45,004' S	117° 46,853' W	2728
245_8-25	08.01.2016 21:42:31	BC	information	Transponder a.D.	27° 44,995' S	117° 46,857' W	2728,8
245_8-25	08.01.2016 21:49:10	BC	on deck		27° 44,997' S	117° 46,855' W	2727,8
245_8-25	08.01.2016 21:56:29	BC	station end		27° 44,999' S	117° 46,852' W	2727,9
245_8-26	08.01.2016 21:57:05	GC	station start	L: 5m	27° 44,999' S	117° 46,852' W	2729,4
245_8-26	08.01.2016 22:00:24	GC	in the water		27° 44,998' S	117° 46,853' W	2727,4
245_8-26	08.01.2016 22:05:41	GC	information	Transponder bei SL: 100m	27° 45,000' S	117° 46,852' W	2729,2
245_8-26	08.01.2016 22:54:59	GC	max depth/on ground	SLmax: 2771m	27° 44,995' S	117° 46,855' W	2729,8
245_8-26	08.01.2016 22:55:25	GC	hoisting		27° 44,995' S	117° 46,854' W	2729,9
245_8-26	08.01.2016 22:57:23	GC	information	frei vom Grund bei SL: 2747m, SZmax: 31kN	27° 44,994' S	117° 46,853' W	2730,5
245_8-26	08.01.2016 23:54:38	GC	on deck		27° 44,997' S	117° 46,856' W	2728,8
245_8-26	08.01.2016 23:56:02	GC	station end		27° 44,998' S	117° 46,856' W	2728,3
245_9-1	09.01.2016 21:02:00	CTD	station start		30° 37,897' S	121° 45,803' W	3779,9
245_9-1	09.01.2016 21:03:23	CTD	in the water		30° 37,897' S	121° 45,803' W	3779
245_9-1	09.01.2016 21:11:55	CTD	lowering		30° 37,892' S	121° 45,806' W	3778,2
245_9-1	09.01.2016 21:27:08	CTD	max depth/on ground	SL: 497m	30° 37,900' S	121° 45,804' W	3778,2
245_9-1	09.01.2016 21:28:21	CTD	hoisting		30° 37,900' S	121° 45,805' W	3779,9
245_9-1	09.01.2016 22:03:26	CTD	on deck		30° 37,895' S	121° 45,797' W	3778,6
245_9-1	09.01.2016 22:05:51	CTD	station end		30° 37,896' S	121° 45,797' W	3777,1
245_9-2	09.01.2016 22:09:59	LIOP	station start	UV Profiler	30° 37,896' S	121° 45,801' W	3778,1
245_9-2	09.01.2016 22:10:21	LIOP	in the water		30° 37,896' S	121° 45,801' W	3820
245_9-2	09.01.2016 22:21:17	LIOP	max depth/on ground	SL: 70m	30° 37,981' S	121° 45,919' W	3760
245_9-2	09.01.2016 22:25:23	LIOP	at surface		30° 38,032' S	121° 45,988' W	3768,8
245_9-2	09.01.2016 22:27:21	LIOP	max depth/on ground	SL: 50m	30° 38,055' S	121° 46,019' W	3772,9
245_9-2	09.01.2016 22:30:01	LIOP	at surface		30° 38,086' S	121° 46,062' W	3771,2

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_9-2	09.01.2016 22:32:08	LIOP	max depth/on ground	SL: 50m	30° 38,111' S	121° 46,099' W	3772,8
245_9-2	09.01.2016 22:36:19	LIOP	on deck		30° 38,157' S	121° 46,164' W	3745,8
245_9-2	09.01.2016 22:36:29	LIOP	station end		30° 38,159' S	121° 46,166' W	3742,2
245_9-3	09.01.2016 22:37:03	LIOP	station start	Optic Profiler	30° 38,166' S	121° 46,174' W	3728,8
245_9-3	09.01.2016 22:37:30	LIOP	in the water		30° 38,171' S	121° 46,179' W	3731,2
245_9-3	09.01.2016 22:48:43	LIOP	max depth/on ground	SL: 160m	30° 38,300' S	121° 46,358' W	3740,6
245_9-3	09.01.2016 22:58:54	LIOP	at surface		30° 38,448' S	121° 46,559' W	3736,5
245_9-3	09.01.2016 23:00:51	LIOP	max depth/on ground	SL: 50m	30° 38,471' S	121° 46,591' W	3735,2
245_9-3	09.01.2016 23:04:06	LIOP	at surface		30° 38,515' S	121° 46,644' W	3734,6
245_9-3	09.01.2016 23:06:06	LIOP	max depth/on ground	SL: 50m	30° 38,542' S	121° 46,677' W	3757,7
245_9-3	09.01.2016 23:09:49	LIOP	on deck		30° 38,596' S	121° 46,744' W	3725,9
245_9-3	09.01.2016 23:11:06	LIOP	station end		30° 38,614' S	121° 46,768' W	3718
245_9-4	09.01.2016 23:12:49	LIOP	station start	Secchi Disk	30° 38,640' S	121° 46,799' W	3713
245_9-4	09.01.2016 23:15:11	LIOP	in the water		30° 38,655' S	121° 46,820' W	3707,4
245_9-4	09.01.2016 23:21:49	LIOP	on deck		30° 38,654' S	121° 46,820' W	3708,9
245_9-4	09.01.2016 23:22:05	LIOP	station end		30° 38,654' S	121° 46,820' W	3710
245_9-5	09.01.2016 23:25:10	CTD	station start		30° 38,653' S	121° 46,823' W	3706,9
245_9-5	09.01.2016 23:27:26	CTD	in the water		30° 38,656' S	121° 46,819' W	3707,9
245_9-5	09.01.2016 23:42:02	CTD	max depth/on ground	maxSL: 18m	30° 38,657' S	121° 46,812' W	3709,3
245_9-5	09.01.2016 23:45:24	CTD	on deck		30° 38,659' S	121° 46,816' W	3703,3
245_9-5	09.01.2016 23:46:02	CTD	station end		30° 38,659' S	121° 46,816' W	3703,8
245_9-6	09.01.2016 23:50:22	WS	station start	GoFlo	30° 38,656' S	121° 46,819' W	3705,8
245_9-6	09.01.2016 23:53:22	WS	in the water		30° 38,655' S	121° 46,825' W	3709,8
245_9-6	10.01.2016 00:04:34	WS	max depth/on ground	maxSL: 175m	30° 38,652' S	121° 46,825' W	3708,9
245_9-6	10.01.2016 00:17:55	WS	on deck		30° 38,650' S	121° 46,819' W	3707,7
245_9-6	10.01.2016 00:18:23	WS	station end		30° 38,649' S	121° 46,819' W	3709,2
245_9-7	10.01.2016 00:30:05	CTD	station start		30° 38,651' S	121° 46,822' W	3707,4
245_9-7	10.01.2016 00:31:19	CTD	in the water		30° 38,651' S	121° 46,822' W	3708
245_9-7	10.01.2016 00:52:44	CTD	max depth/on	SL: 497 m, SZ: 7 kN	30° 38,655' S	121° 46,817' W	3707,4

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_9-7	10.01.2016 01:16:45	CTD	on deck		30° 38,656' S	121° 46,813' W	3709,3
245_9-7	10.01.2016 01:17:57	CTD	station end		30° 38,655' S	121° 46,815' W	3709,1
245_10-1	11.01.2016 01:10:25	CTD	station start		33° 30,011' S	125° 59,972' W	4016,2
245_10-1	11.01.2016 01:11:58	CTD	in the water		33° 30,020' S	125° 59,974' W	4015,3
245_10-1	11.01.2016 02:58:42	CTD	max depth/on ground	maxSL: 3955m	33° 30,002' S	125° 59,994' W	4264,1
245_10-1	11.01.2016 04:42:55	CTD	on deck		33° 29,996' S	126° 0,000' W	4015,9
245_10-1	11.01.2016 04:45:35	CTD	station end		33° 29,999' S	125° 59,998' W	4011,1
245_10-2	11.01.2016 04:48:48	WS	station start	GoFlo, über Winde STB achtern & Kran 3	33° 30,001' S	125° 59,998' W	4047,8
245_10-2	11.01.2016 04:55:15	WS	in the water	1 x GoFlo bei SL: 20 m, 125 m,	33° 29,998' S	125° 59,998' W	4016,4
245_10-2	11.01.2016 05:10:45	WS	max depth/on ground	SL: 150 m	33° 30,002' S	125° 59,998' W	4010,9
245_10-2	11.01.2016 05:21:08	WS	on deck		33° 30,002' S	126° 0,000' W	4049,5
245_10-2	11.01.2016 05:22:26	WS	station end		33° 30,001' S	126° 0,002' W	4016,2
245_10-3	11.01.2016 06:00:26	CTD	station start		33° 30,003' S	126° 0,003' W	4015,9
245_10-3	11.01.2016 06:02:41	CTD	in the water	über EL1, kl. Schiebebalken	33° 30,001' S	126° 0,001' W	4014,4
245_10-3	11.01.2016 06:39:52	CTD	max depth/on ground	SL: 1250 m	33° 30,000' S	126° 0,007' W	4015,8
245_10-3	11.01.2016 07:19:07	CTD	on deck		33° 30,001' S	126° 0,000' W	4018
245_10-3	11.01.2016 07:21:24	CTD	station end		33° 30,002' S	125° 59,998' W	4017
245_10-4	11.01.2016 07:22:01	PS	station start		33° 30,003' S	125° 59,997' W	4017,4
245_10-4	11.01.2016 07:23:02	PS	profile start	rwK: 180°, d: 2nm	33° 30,004' S	125° 59,998' W	4014
245_10-4	11.01.2016 07:48:29	PS	alter course	rwK: 360°, d: 8nm	33° 31,558' S	126° 0,538' W	4028,3
245_10-4	11.01.2016 09:12:27	PS	alter course	rwK: 180°, d: 6nm	33° 24,012' S	126° 0,681' W	4076,5
245_10-4	11.01.2016 10:24:10	PS	profile end		33° 29,981' S	125° 59,984' W	4015,9
245_10-4	11.01.2016 10:24:29	PS	station end		33° 29,986' S	125° 59,986' W	4018,2
245_10-5	11.01.2016 10:25:21	PUMP	station start	PumpCTD	33° 29,995' S	125° 59,992' W	4018,7
245_10-5	11.01.2016 10:58:05	PUMP	in the water		33° 29,994' S	125° 59,998' W	4015,4
245_10-5	11.01.2016 12:12:33	PUMP	max depth/on ground	maxSL: 250m	33° 29,998' S	125° 59,996' W	4015,5
245_10-5	11.01.2016 15:19:09	PUMP	on deck		33° 30,001' S	125° 59,994' W	4013,3
245_10-5	11.01.2016 15:23:43	PUMP	station end		33° 30,001' S	125° 59,992' W	4015,9

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_10-6	11.01.2016 15:32:33	CTD	station start		33° 29,997' S	125° 59,996' W	4010,4
245_10-6	11.01.2016 15:35:10	CTD	in the water	über EL1 & kl. Schiebebalken	33° 29,996' S	125° 59,997' W	4014,5
245_10-6	11.01.2016 15:51:54	CTD	max depth/on ground	SL: 298 m, SZ: 5 kN	33° 29,996' S	125° 59,995' W	4014,2
245_10-6	11.01.2016 16:18:09	CTD	on deck		33° 29,996' S	125° 59,997' W	4016,5
245_10-6	11.01.2016 16:19:06	CTD	station end		33° 29,996' S	125° 59,997' W	4014
245_10-7	11.01.2016 16:21:50	LIOP	station start	Secci-Disk, manuell über STB Heck	33° 29,997' S	125° 59,997' W	4015,9
245_10-7	11.01.2016 16:24:23	LIOP	in the water		33° 29,996' S	125° 59,996' W	4014,5
245_10-7	11.01.2016 16:40:19	LIOP	max depth/on ground	SL: 50 m	33° 29,996' S	125° 59,995' W	4014,2
245_10-7	11.01.2016 16:47:54	LIOP	on deck		33° 29,995' S	126° 0,000' W	4015,6
245_10-7	11.01.2016 16:48:10	LIOP	station end		33° 29,995' S	126° 0,000' W	4017,9
245_10-8	11.01.2016 16:49:56	LIOP	station start	UV-Profiler, manuell über BB Heck	33° 29,993' S	126° 0,000' W	4016,4
245_10-8	11.01.2016 16:50:45	LIOP	in the water		33° 29,993' S	126° 0,001' W	4015,8
245_10-8	11.01.2016 16:51:34	LIOP	profile start	FdW: 0,7 kn	33° 29,998' S	126° 0,011' W	4008,7
245_10-8	11.01.2016 16:54:00	LIOP	max depth/on ground	SL: 75 m	33° 30,011' S	126° 0,039' W	4004,1
245_10-8	11.01.2016 17:08:36	LIOP	profile end		33° 30,083' S	126° 0,192' W	4043,9
245_10-8	11.01.2016 17:09:47	LIOP	on deck		33° 30,083' S	126° 0,192' W	4030,6
245_10-8	11.01.2016 17:10:00	LIOP	station end		33° 30,084' S	126° 0,196' W	4034
245_10-9	11.01.2016 17:11:20	LIOP	information	Optic Profiler, manuell über BB Heck	33° 30,091' S	126° 0,212' W	4041,9
245_10-9	11.01.2016 17:12:06	LIOP	in the water		33° 30,096' S	126° 0,220' W	4043,1
245_10-9	11.01.2016 17:13:49	LIOP	profile start	rwK: 240°; FdW: 0,7 kn	33° 30,104' S	126° 0,238' W	4044,9
245_10-9	11.01.2016 17:18:20	LIOP	max depth/on ground	SL: 170 m	33° 30,125' S	126° 0,285' W	4066,4
245_10-9	11.01.2016 17:32:27	LIOP	profile end		33° 30,216' S	126° 0,464' W	4086,6
245_10-9	11.01.2016 17:34:27	LIOP	on deck		33° 30,209' S	126° 0,453' W	4089,3
245_10-9	11.01.2016 17:36:06	LIOP	station end		33° 30,215' S	126° 0,464' W	4084,5
245_10-10	11.01.2016 17:39:44	CTD	station start	CTD über EL1 & kl. Schiebebalken	33° 30,210' S	126° 0,459' W	4085,1
245_10-10	11.01.2016 17:45:52	CTD	in the water		33° 30,212' S	126° 0,460' W	4084,3
245_10-10	11.01.2016 17:56:52	CTD	max depth/on ground	SL: 147 m, SZ: 5 kN	33° 30,205' S	126° 0,458' W	4084,1
245_10-10	11.01.2016 18:13:02	CTD	on deck		33° 30,212' S	126° 0,459' W	4080,8

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_10-10	11.01.2016 18:14:02	CTD	station end		33° 30,213' S	126° 0,459' W	4081,4
245_10-11	11.01.2016 18:18:21	WS	station start	GoFlo, über Winde STB achtern & Kran 3	33° 30,213' S	126° 0,455' W	4085,1
245_10-11	11.01.2016 18:24:36	WS	in the water	1 x GoFlo bei SL: 20 m, 115 m, 125 m	33° 30,209' S	126° 0,454' W	4086,6
245_10-11	11.01.2016 18:39:12	WS	max depth/on ground	SL: 150 m	33° 30,207' S	126° 0,457' W	4083
245_10-11	11.01.2016 18:43:25	WS	hoisting		33° 30,205' S	126° 0,455' W	4093,1
245_10-11	11.01.2016 18:56:35	WS	on deck		33° 30,206' S	126° 0,456' W	4083,7
245_10-11	11.01.2016 18:57:05	WS	station end		33° 30,205' S	126° 0,456' W	4087,2
245_10-12	11.01.2016 19:14:26	CTD	station start		33° 30,204' S	126° 0,458' W	4082,5
245_10-12	11.01.2016 19:15:50	CTD	in the water		33° 30,205' S	126° 0,458' W	4082,5
245_10-12	11.01.2016 19:27:24	CTD	max depth/on ground	SL: 147m	33° 30,206' S	126° 0,458' W	4079,4
245_10-12	11.01.2016 19:44:43	CTD	on deck		33° 30,203' S	126° 0,455' W	4084,7
245_10-12	11.01.2016 19:47:14	CTD	station end		33° 30,206' S	126° 0,456' W	4085,8
245_10-13	11.01.2016 19:55:23	NET	station start	Micronet	33° 30,208' S	126° 0,455' W	4086
245_10-13	11.01.2016 19:56:29	NET	in the water		33° 30,209' S	126° 0,456' W	4079,1
245_10-13	11.01.2016 20:21:34	NET	max depth/on ground	SL: 300m	33° 30,211' S	126° 0,454' W	4081,8
245_10-13	11.01.2016 21:32:12	NET	on deck		33° 30,207' S	126° 0,456' W	4083,1
245_10-13	11.01.2016 21:33:12	NET	station end		33° 30,207' S	126° 0,456' W	4083,6
245_10-14	11.01.2016 21:46:26	CTD	station start	mit ISP	33° 30,207' S	126° 0,457' W	4081,9
245_10-14	11.01.2016 21:48:15	CTD	in the water		33° 30,206' S	126° 0,457' W	4082
245_10-14	11.01.2016 21:56:43	CTD	information	ISP bei SL: 20m	33° 30,207' S	126° 0,457' W	4083,4
245_10-14	11.01.2016 22:26:51	CTD	information	ISP bei SL: 820m	33° 30,210' S	126° 0,458' W	4085,9
245_10-14	11.01.2016 22:44:37	CTD	information	ISP bei SL: 1220m	33° 30,209' S	126° 0,460' W	4084,7
245_10-14	11.01.2016 22:58:16	CTD	information	ISP bei SL: 1620m	33° 30,209' S	126° 0,453' W	4082,6
245_10-14	11.01.2016 23:34:46	CTD	information	ISP bei SL: 2620m	33° 30,206' S	126° 0,454' W	4082,9
245_10-14	12.01.2016 00:02:55	CTD	information	ISP bei SL: 3470m	33° 30,211' S	126° 0,454' W	4085,4
245_10-14	12.01.2016 00:08:03	CTD	information	ISP bei SL: 3520m	33° 30,211' S	126° 0,451' W	4088,6
245_10-14	12.01.2016 00:14:05	CTD	information	ISP bei SL: 3600m	33° 30,210' S	126° 0,454' W	4086
245_10-14	12.01.2016 00:15:25	CTD	max depth/on	maxSL: 3620m	33° 30,210' S	126° 0,454' W	4085,1
245_10-14	12.01.2016 07:02:32	CTD	hoisting		33° 30,211' S	126° 0,457' W	4084,2

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_10-14	12.01.2016 09:36:59	CTD	on deck		33° 30,213' S	126° 0,449' W	4085,2
245_10-14	12.01.2016 09:38:44	CTD	station end		33° 30,211' S	126° 0,449' W	4075,3
245_10-15	12.01.2016 10:21:40	BC	station start	GKG	33° 28,924' S	126° 1,256' W	4105,8
245_10-15	12.01.2016 10:22:28	BC	in the water		33° 28,923' S	126° 1,256' W	4106
245_10-15	12.01.2016 10:27:35	BC	information	Transponder bei SL: 100m	33° 28,922' S	126° 1,258' W	4105,1
245_10-15	12.01.2016 11:38:56	BC	max depth/on ground	maxSL: 4143m, maxSZ: 57,6kN	33° 28,920' S	126° 1,256' W	4107,6
245_10-15	12.01.2016 13:07:02	BC	on deck		33° 28,921' S	126° 1,252' W	4109,3
245_10-15	12.01.2016 13:12:20	BC	station end		33° 28,920' S	126° 1,250' W	4108,6
245_10-16	12.01.2016 13:14:54	GC	station start	GC 5m	33° 28,920' S	126° 1,250' W	4095,9
245_10-16	12.01.2016 13:18:40	GC	in the water	Posidonia bei SL: 100m	33° 28,921' S	126° 1,253' W	4107,6
245_10-16	12.01.2016 14:36:38	GC	max depth/on ground	maxSL: 4145m, maxSZ: 48,2kN	33° 28,920' S	126° 1,253' W	4102,5
245_10-16	12.01.2016 15:58:46	GC	information	Bei SL: 100 m 1 x Transponder an Deck	33° 28,919' S	126° 1,253' W	4092,1
245_10-16	12.01.2016 16:06:14	GC	on deck		33° 28,918' S	126° 1,252' W	4106,8
245_10-16	12.01.2016 16:07:49	GC	station end	rwK: 242°	33° 28,918' S	126° 1,253' W	4109,3
245_11-1	13.01.2016 22:07:05	CTD	station start		36° 21,736' S	132° 40,500' W	5069,2
245_11-1	13.01.2016 22:11:07	CTD	in the water		36° 21,734' S	132° 40,498' W	4847,4
245_11-1	13.01.2016 22:12:07	CTD	information	Draht rausgesprungen , Winde gestoppt	36° 21,731' S	132° 40,496' W	4609,6
245_11-1	13.01.2016 22:47:11	CTD	on deck		36° 21,734' S	132° 40,496' W	4695,5
245_11-1	14.01.2016 00:31:16	CTD	in the water	2. Versuch	36° 21,738' S	132° 40,499' W	5036,1
245_11-1	14.01.2016 00:55:42	CTD	max depth/on ground	maxSL: 496m	36° 21,735' S	132° 40,494' W	4605,1
245_11-1	14.01.2016 01:27:36	CTD	on deck		36° 21,736' S	132° 40,496' W	4602,4
245_11-1	14.01.2016 01:28:51	CTD	station end		36° 21,733' S	132° 40,498' W	4846,8
245_11-2	13.01.2016 23:32:47	WS	station start		36° 21,729' S	132° 40,493' W	4725,1
245_11-2	13.01.2016 23:37:12	WS	in the water		36° 21,732' S	132° 40,493' W	4622,6
245_11-2	13.01.2016 23:54:12	WS	max depth/on ground	SL: 150m	36° 21,737' S	132° 40,495' W	4603,9
245_11-2	14.01.2016 00:20:09	WS	on deck		36° 21,736' S	132° 40,492' W	5025,2
245_11-2	14.01.2016 00:21:51	WS	station end		36° 21,738' S	132° 40,494' W	4605
245_11-3	14.01.2016 02:11:50	CTD	station start		36° 21,733' S	132° 40,504' W	4599,5

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_11-3	14.01.2016 02:13:19	CTD	in the water		36° 21,733' S	132° 40,505' W	4612,5
245_11-3	14.01.2016 02:19:39	CTD	max depth/on ground	maxSL: 16m	36° 21,738' S	132° 40,499' W	5033,8
245_11-3	14.01.2016 02:28:11	CTD	on deck		36° 21,736' S	132° 40,499' W	4610,7
245_11-3	14.01.2016 02:29:09	CTD	station end		36° 21,735' S	132° 40,498' W	5080,6
245_11-4	14.01.2016 03:11:09	CTD	station start		36° 21,729' S	132° 40,493' W	4601,5
245_11-4	14.01.2016 03:13:19	CTD	in the water		36° 21,733' S	132° 40,491' W	4603,4
245_11-4	14.01.2016 03:33:12	CTD	max depth/on ground	maxSL: 496m	36° 21,735' S	132° 40,501' W	5074,4
245_11-4	14.01.2016 03:56:28	CTD	on deck		36° 21,735' S	132° 40,499' W	5059,4
245_11-4	14.01.2016 03:58:18	CTD	station end		36° 21,731' S	132° 40,499' W	5088,1
245_12-1	15.01.2016 10:40:02	PS	station start		39° 18,569' S	139° 48,565' W	5310,2
245_12-1	15.01.2016 10:40:18	PS	profile start	rwK: 270°, d: 9nm	39° 18,575' S	139° 48,633' W	5277,9
245_12-1	15.01.2016 12:07:51	PS	alter course	rwk: 180°, d: 4sm	39° 18,667' S	139° 59,989' W	5433,2
245_12-1	15.01.2016 12:45:29	PS	alter course	rwk: 067°, d: 10sm	39° 22,431' S	139° 59,941' W	5237,3
245_12-1	15.01.2016 14:25:31	PS	profile end		39° 18,641' S	139° 48,117' W	5272,4
245_12-1	15.01.2016 14:26:23	PS	station end		39° 18,608' S	139° 48,014' W	5276,1
245_12-2	15.01.2016 14:40:06	CTD	station start		39° 18,624' S	139° 48,739' W	5281,9
245_12-2	15.01.2016 14:42:11	CTD	in the water		39° 18,629' S	139° 48,736' W	5285,6
245_12-2	15.01.2016 17:04:29	CTD	max depth/on ground	SL: 5222 m, SZ: 25 kN	39° 18,603' S	139° 48,590' W	5280,1
245_12-2	15.01.2016 17:06:35	CTD	hoisting		39° 18,602' S	139° 48,588' W	5278,4
245_12-2	15.01.2016 19:28:11	CTD	on deck		39° 18,596' S	139° 48,596' W	5279,6
245_12-2	15.01.2016 19:30:54	CTD	station end		39° 18,596' S	139° 48,600' W	5279,7
245_12-3	15.01.2016 19:34:43	LIOP	station start	Secci-Disk, manuell, BB Heck	39° 18,595' S	139° 48,597' W	5279,5
245_12-3	15.01.2016 19:41:08	LIOP	in the water		39° 18,596' S	139° 48,595' W	5282
245_12-3	15.01.2016 19:45:41	LIOP	on deck		39° 18,596' S	139° 48,598' W	5280,5
245_12-3	15.01.2016 19:46:41	LIOP	station end		39° 18,598' S	139° 48,597' W	5280,5
245_12-4	15.01.2016 19:47:52	LIOP	station start	UV-Profiler, manuell über BB Heck	39° 18,601' S	139° 48,597' W	5279,2
245_12-4	15.01.2016 19:49:42	LIOP	in the water	FdW: 0,7 kn	39° 18,605' S	139° 48,598' W	5273,4
245_12-4	15.01.2016 19:50:00	LIOP	profile start	rwK: 030°, FdW: 0,7 kn	39° 18,604' S	139° 48,598' W	5276

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_12-4	15.01.2016 19:56:15	LIOP	max depth/on ground	SL: 65 m	39° 18,548' S	139° 48,559' W	5278
245_12-4	15.01.2016 20:05:22	LIOP	at surface		39° 18,477' S	139° 48,506' W	5294,5
245_12-4	15.01.2016 20:08:12	LIOP	max depth/on ground	SL: 30m	39° 18,431' S	139° 48,468' W	5298,3
245_12-4	15.01.2016 20:12:29	LIOP	on deck		39° 18,387' S	139° 48,437' W	5305,1
245_12-4	15.01.2016 20:14:10	LIOP	station end		39° 18,363' S	139° 48,416' W	5314,8
245_12-5	15.01.2016 20:15:05	LIOP	station start	Optic Profiler	39° 18,351' S	139° 48,406' W	5318,8
245_12-5	15.01.2016 20:15:22	LIOP	in the water		39° 18,348' S	139° 48,403' W	5311,4
245_12-5	15.01.2016 20:20:28	LIOP	max depth/on ground	SL: 110m	39° 18,305' S	139° 48,367' W	5321,2
245_12-5	15.01.2016 20:24:53	LIOP	at surface		39° 18,258' S	139° 48,327' W	5335,6
245_12-5	15.01.2016 20:27:04	LIOP	max depth/on ground	SL: 50m	39° 18,232' S	139° 48,304' W	5341,6
245_12-5	15.01.2016 20:31:06	LIOP	at surface		39° 18,171' S	139° 48,255' W	5367,4
245_12-5	15.01.2016 20:33:43	LIOP	max depth/on ground	SL: 54m	39° 18,132' S	139° 48,226' W	5379,8
245_12-5	15.01.2016 20:39:32	LIOP	on deck		39° 18,065' S	139° 48,167' W	5407,5
245_12-5	15.01.2016 20:42:09	LIOP	station end		39° 18,054' S	139° 48,157' W	5420,9
245_12-6	15.01.2016 21:17:21	CTD	station start		39° 18,638' S	139° 48,585' W	5278,4
245_12-6	15.01.2016 21:21:24	CTD	in the water		39° 18,644' S	139° 48,582' W	5275,6
245_12-6	15.01.2016 22:01:42	CTD	max depth/on ground	SL: 1245m	39° 18,617' S	139° 48,605' W	5276
245_12-6	15.01.2016 22:45:22	CTD	on deck		39° 18,616' S	139° 48,614' W	5280,7
245_12-6	15.01.2016 22:45:29	CTD	station end		39° 18,616' S	139° 48,614' W	5280,7
245_12-7	15.01.2016 22:55:23	WS	station start	Go-Flo	39° 18,619' S	139° 48,604' W	5273,1
245_12-7	15.01.2016 22:56:35	WS	in the water		39° 18,620' S	139° 48,602' W	5274,2
245_12-7	15.01.2016 23:04:21	WS	in the water	Kanne 1 bei SL: 50m	39° 18,616' S	139° 48,607' W	5278,5
245_12-7	15.01.2016 23:10:06	WS	on deck	Kanne 1	39° 18,617' S	139° 48,608' W	5278
245_12-7	15.01.2016 23:14:28	WS	on deck		39° 18,622' S	139° 48,608' W	5278,4
245_12-7	15.01.2016 23:15:42	WS	station end		39° 18,619' S	139° 48,612' W	5282,8
245_12-8	15.01.2016 23:55:03	CTD	station start	mit ISP	39° 18,611' S	139° 48,613' W	5275,9
245_12-8	15.01.2016 23:56:42	CTD	in the water		39° 18,612' S	139° 48,613' W	5278,6
245_12-8	16.01.2016 00:05:59	CTD	information	ISP bei SL: 20m	39° 18,616' S	139° 48,610' W	5279,4
245_12-8	16.01.2016 00:41:49	CTD	information	ISP bei SL: 1020m	39° 18,619' S	139° 48,607' W	5272,5

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_12-8	16.01.2016 01:18:53	CTD	information	ISP bei SL: 2020m	39° 18,615' S	139° 48,607' W	5275,8
245_12-8	16.01.2016 01:57:03	CTD	information	ISP bei SL: 3020 m	39° 18,611' S	139° 48,609' W	5274,4
245_12-8	16.01.2016 02:34:30	CTD	information	ISP bei SL: 4020 m	39° 18,611' S	139° 48,610' W	5271,7
245_12-8	16.01.2016 03:01:28	CTD	information	ISP bei SL: 4770m	39° 18,611' S	139° 48,615' W	5273,1
245_12-8	16.01.2016 03:09:13	CTD	information	ISP bei SL: 4940m	39° 18,612' S	139° 48,617' W	5274,3
245_12-8	16.01.2016 03:13:56	CTD	information	ISP bei SL: 4970m	39° 18,612' S	139° 48,621' W	5274,4
245_12-8	16.01.2016 03:16:04	CTD	max depth/on ground	maxSL: 5020m	39° 18,613' S	139° 48,617' W	5273,6
245_12-8	16.01.2016 09:45:07	CTD	hoisting		39° 18,609' S	139° 48,617' W	5275,2
245_12-8	16.01.2016 13:04:49	CTD	on deck		39° 18,611' S	139° 48,620' W	5279,9
245_12-8	16.01.2016 13:06:11	CTD	station end		39° 18,612' S	139° 48,621' W	5274,5
245_12-9	16.01.2016 13:10:36	PUMP	station start	Pump-CTD	39° 18,612' S	139° 48,612' W	5277
245_12-9	16.01.2016 13:21:47	PUMP	in the water		39° 18,618' S	139° 48,607' W	5275,4
245_12-9	16.01.2016 14:41:12	PUMP	max depth/on ground	maxSL: 275m	39° 18,616' S	139° 48,610' W	5278,8
245_12-9	16.01.2016 17:44:11	PUMP	on deck		39° 18,615' S	139° 48,609' W	5274,1
245_12-9	16.01.2016 17:49:20	PUMP	station end		39° 18,616' S	139° 48,612' W	5271,9
245_12-10	16.01.2016 15:21:35	CTD	station start		39° 18,614' S	139° 48,611' W	5276,8
245_12-10	16.01.2016 15:22:39	CTD	in the water		39° 18,615' S	139° 48,610' W	5274,1
245_12-10	16.01.2016 15:40:17	CTD	max depth/on ground	maxSL: 297m	39° 18,613' S	139° 48,607' W	5277,4
245_12-10	16.01.2016 16:09:06	CTD	on deck		39° 18,618' S	139° 48,611' W	5275,2
245_12-10	16.01.2016 16:10:04	CTD	station end		39° 18,618' S	139° 48,614' W	5273,4
245_12-11	16.01.2016 17:53:42	NET	station start	Micro-Net, Winde STB achtern & Kran 3	39° 18,617' S	139° 48,611' W	5274
245_12-11	16.01.2016 18:05:25	NET	in the water		39° 18,615' S	139° 48,605' W	5276,3
245_12-11	16.01.2016 18:24:19	NET	max depth/on ground	SL: 250 m	39° 18,620' S	139° 48,608' W	5275,4
245_12-11	16.01.2016 19:40:39	NET	on deck		39° 18,621' S	139° 48,609' W	5272,8
245_12-11	16.01.2016 19:41:35	NET	station end		39° 18,621' S	139° 48,609' W	5275,8
245_12-12	16.01.2016 19:50:04	CTD	station start	CTD über EL2 & kl. Schiebebalken	39° 18,618' S	139° 48,606' W	5274,6
245_12-12	16.01.2016 19:53:20	CTD	in the water		39° 18,619' S	139° 48,606' W	5273,5
245_12-12	16.01.2016 20:02:40	CTD	max depth/on ground	SL: 73 m, SZ: 6 kN	39° 18,619' S	139° 48,604' W	5273,8

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_12-12	16.01.2016 20:14:01	CTD	on deck		39° 18,614' S	139° 48,610' W	5273,1
245_12-12	16.01.2016 20:17:09	CTD	station end		39° 18,616' S	139° 48,609' W	5271,9
245_12-13	16.01.2016 20:20:51	WS	station start	Go-Flo	39° 18,615' S	139° 48,611' W	5277,1
245_12-13	16.01.2016 20:22:14	WS	in the water	Gewicht	39° 18,617' S	139° 48,611' W	5277,1
245_12-13	16.01.2016 20:29:22	WS	max depth/on ground	SL: 50m	39° 18,615' S	139° 48,613' W	5274,7
245_12-13	16.01.2016 20:36:20	WS	on deck		39° 18,614' S	139° 48,609' W	5272
245_12-13	16.01.2016 20:37:09	WS	station end		39° 18,614' S	139° 48,610' W	5274,2
245_12-14	16.01.2016 21:04:38	CTD	station start		39° 18,619' S	139° 48,613' W	5270,7
245_12-14	16.01.2016 21:06:57	CTD	in the water		39° 18,622' S	139° 48,614' W	5274,2
245_12-14	16.01.2016 21:17:48	CTD	max depth/on ground	SL: 147m	39° 18,613' S	139° 48,606' W	5277,8
245_12-14	16.01.2016 21:44:09	CTD	on deck		39° 18,612' S	139° 48,615' W	5272,8
245_12-14	16.01.2016 21:45:48	CTD	station end		39° 18,613' S	139° 48,614' W	5274,5
245_12-15	16.01.2016 21:59:51	BC	station start		39° 18,620' S	139° 48,615' W	5273,9
245_12-15	16.01.2016 22:01:29	BC	in the water		39° 18,621' S	139° 48,618' W	5266,7
245_12-15	16.01.2016 22:06:30	BC	information	Transponder bei SL: 100m	39° 18,620' S	139° 48,617' W	5274,6
245_12-15	16.01.2016 23:46:15	BC	max depth/on ground	SLmax: 5316m	39° 18,619' S	139° 48,618' W	2261,5
245_12-15	16.01.2016 23:48:03	BC	information	frei vom Grund bei SL: 5299m, SZmax: 60kN	39° 18,620' S	139° 48,618' W	2150,5
245_12-15	17.01.2016 01:33:38	BC	on deck		39° 18,617' S	139° 48,619' W	5259,6
245_12-15	17.01.2016 01:36:24	BC	station end		39° 18,616' S	139° 48,620' W	5255,8
245_12-16	17.01.2016 01:39:14	GC	station start	GC 5m	39° 18,613' S	139° 48,618' W	5255,9
245_12-16	17.01.2016 01:41:14	GC	in the water		39° 18,610' S	139° 48,615' W	5259,3
245_12-16	17.01.2016 03:27:50	GC	max depth/on ground	maxSL: 5321m, maxSZ: 66,4kN	39° 18,616' S	139° 48,621' W	4875,9
245_12-16	17.01.2016 05:24:34	GC	on deck		39° 18,615' S	139° 48,611' W	5272,4
245_12-16	17.01.2016 06:16:27	GC	station end	rwK: 272°	39° 18,618' S	139° 48,612' W	5519,9
245_13-1	18.01.2016 15:52:03	CTD	station start		38° 59,889' S	149° 59,980' W	5481,2
245_13-1	18.01.2016 15:54:10	CTD	in the water		38° 59,892' S	149° 59,981' W	5485,5
245_13-1	18.01.2016 16:17:23	CTD	max depth/on ground	SL: 497 m, SZ: 7 kN	38° 59,888' S	149° 59,986' W	5484,6
245_13-1	18.01.2016 17:00:31	CTD	on deck		38° 59,891' S	149° 59,979' W	5483,3

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_13-1	18.01.2016 17:02:39	CTD	station end		38° 59,894' S	149° 59,977' W	5483,6
245_13-2	18.01.2016 17:03:23	WS	station start	GoFlo über Winde STB achtern & Kran 3	38° 59,894' S	149° 59,976' W	5482,2
245_13-2	18.01.2016 17:06:07	WS	in the water		38° 59,894' S	149° 59,972' W	5482
245_13-2	18.01.2016 17:14:28	WS	max depth/on ground	SL: 75 m	38° 59,895' S	149° 59,975' W	5484
245_13-2	18.01.2016 17:21:08	WS	on deck		38° 59,892' S	149° 59,979' W	5482,8
245_13-2	18.01.2016 17:22:37	WS	station end		38° 59,889' S	149° 59,980' W	5483,4
245_13-3	18.01.2016 20:05:12	CTD	station start	CTD über EL2 & kl. Schiebebalken	38° 59,897' S	149° 59,976' W	5481,3
245_13-3	18.01.2016 20:08:30	CTD	in the water		38° 59,896' S	149° 59,986' W	5482,9
245_13-3	18.01.2016 20:30:06	CTD	max depth/on ground	SL: 497m	38° 59,887' S	149° 59,985' W	5482,6
245_13-3	18.01.2016 21:01:09	CTD	on deck		38° 59,894' S	149° 59,970' W	5481,4
245_13-3	18.01.2016 21:03:30	CTD	station end		38° 59,891' S	149° 59,970' W	5482,9
245_13-4	18.01.2016 21:07:12	LIOP	station start	Secchi Disk	38° 59,893' S	149° 59,972' W	5483
245_13-4	18.01.2016 21:08:25	LIOP	in the water		38° 59,896' S	149° 59,973' W	5483,1
245_13-4	18.01.2016 21:14:03	LIOP	on deck		38° 59,895' S	149° 59,972' W	5482,4
245_13-4	18.01.2016 21:14:27	LIOP	station end		38° 59,895' S	149° 59,972' W	5480,2
245_13-5	18.01.2016 21:16:59	LIOP	station start	UV profiler	38° 59,895' S	149° 59,971' W	5483,3
245_13-5	18.01.2016 21:19:17	LIOP	in the water		38° 59,920' S	149° 59,971' W	5482,5
245_13-5	18.01.2016 21:22:47	LIOP	max depth/on ground	SL: 70m	38° 59,961' S	149° 59,975' W	5484,9
245_13-5	18.01.2016 21:25:53	LIOP	at surface		38° 59,992' S	149° 59,980' W	5483,5
245_13-5	18.01.2016 21:28:57	LIOP	max depth/on ground	SL: 50m	39° 0,031' S	149° 59,988' W	5486,6
245_13-5	18.01.2016 21:31:53	LIOP	at surface		39° 0,065' S	149° 59,995' W	5486,4
245_13-5	18.01.2016 21:35:04	LIOP	max depth/on ground	SL: ungefähr irgendwo, unter Umständen so um die ca. 50m, vielleicht	39° 0,102' S	150° 0,005' W	5484,8
245_13-5	18.01.2016 21:40:50	LIOP	on deck		39° 0,179' S	150° 0,025' W	5484,9
245_13-5	18.01.2016 21:40:56	LIOP	station end		39° 0,181' S	150° 0,026' W	5484,9
245_13-6	18.01.2016 21:44:10	LIOP	station start	Optic profiler	39° 0,227' S	150° 0,042' W	5488,4
245_13-6	18.01.2016 21:45:08	LIOP	in the water		39° 0,242' S	150° 0,047' W	5487,1
245_13-6	18.01.2016 21:50:25	LIOP	max depth/on ground	SL: 120m	39° 0,314' S	150° 0,073' W	5486,7

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_13-6	18.01.2016 21:54:58	LIOP	at surface		39° 0,375' S	150° 0,093' W	5483
245_13-6	18.01.2016 21:57:27	LIOP	max depth/on ground	SL: 50m	39° 0,408' S	150° 0,104' W	5484,6
245_13-6	18.01.2016 21:59:51	LIOP	at surface		39° 0,438' S	150° 0,115' W	5482,2
245_13-6	18.01.2016 22:01:47	LIOP	max depth/on ground	SL: 50m	39° 0,461' S	150° 0,122' W	5480,7
245_13-6	18.01.2016 22:05:24	LIOP	on deck		39° 0,506' S	150° 0,138' W	5478,8
245_13-6	18.01.2016 22:06:06	LIOP	station end		39° 0,514' S	150° 0,140' W	5478,4
245_13-7	18.01.2016 22:21:53	CTD	station start		39° 0,537' S	150° 0,145' W	5478,1
245_13-7	18.01.2016 22:23:36	CTD	in the water		39° 0,539' S	150° 0,143' W	5731
245_13-7	18.01.2016 22:34:20	CTD	max depth/on ground	SL: 17m	39° 0,539' S	150° 0,152' W	5478,7
245_13-7	18.01.2016 22:39:02	CTD	station end		39° 0,534' S	150° 0,148' W	5477,6
245_14-1	20.01.2016 07:00:00	PS	station start	rwK: 270°, d: 3 sm	39° 0,000' S	159° 56,182' W	4981,1
245_14-1	20.01.2016 07:02:12	PS	profile start		39° 0,003' S	159° 56,496' W	4994,9
245_14-1	20.01.2016 07:54:06	PS	alter course	rwK: 142°, d: 4 sm	39° 0,002' S	160° 3,098' W	5043,1
245_14-1	20.01.2016 08:37:05	PS	alter course	rwK: 360°, d: 6 sm	39° 3,279' S	160° 0,249' W	5028,7
245_14-1	20.01.2016 09:39:58	PS	alter course	rwK: 121°, d: 3nm	38° 57,143' S	159° 59,986' W	5407,9
245_14-1	20.01.2016 10:07:55	PS	alter course	rwK: 239°, d: 3nm	38° 58,425' S	159° 56,918' W	5013
245_14-1	20.01.2016 10:42:03	PS	profile end		38° 59,987' S	159° 59,981' W	5032,7
245_14-1	20.01.2016 10:42:23	PS	station end		38° 59,986' S	159° 59,981' W	5034,6
245_14-2	20.01.2016 10:52:28	CTD	station start		38° 59,993' S	159° 59,991' W	5031
245_14-2	20.01.2016 10:54:40	CTD	in the water		38° 59,992' S	159° 59,993' W	5033,6
245_14-2	20.01.2016 13:10:07	CTD	max depth/on ground	SL: 4982m	38° 59,993' S	160° 0,001' W	5031,9
245_14-2	20.01.2016 15:13:40	CTD	on deck		38° 59,991' S	159° 59,991' W	5033,2
245_14-2	20.01.2016 15:15:19	CTD	station end		38° 59,992' S	159° 59,990' W	5032,9
245_14-3	20.01.2016 15:38:26	PUMP	station start		38° 59,997' S	159° 59,988' W	5034,5
245_14-3	20.01.2016 15:45:07	PUMP	in the water		38° 59,999' S	159° 59,994' W	5033,2
245_14-3	20.01.2016 17:18:15	PUMP	max depth/on ground	SL: 270 m	38° 59,995' S	159° 59,986' W	5035,1
245_14-3	20.01.2016 20:09:23	PUMP	on deck		39° 0,000' S	159° 59,993' W	5034,3
245_14-3	20.01.2016 20:14:35	PUMP	station end		39° 0,000' S	159° 59,995' W	5035,9
245_14-4	20.01.2016 19:21:57	CTD	station start		38° 59,999' S	159° 59,988' W	5034,4

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_14-4	20.01.2016 19:24:42	CTD	in the water	über EL2 & kl. Schiebebalken	38° 59,999' S	159° 59,987' W	5035,8
245_14-4	20.01.2016 19:36:21	CTD	max depth/on ground	SL: 147 m, SZ: 5 kN	38° 59,998' S	159° 59,991' W	5034
245_14-4	20.01.2016 20:04:20	CTD	on deck		38° 59,999' S	159° 59,993' W	5035
245_14-4	20.01.2016 20:06:00	CTD	station end		38° 59,999' S	159° 59,993' W	5033,9
245_14-5	20.01.2016 20:16:34	WS	station start	GoFlo, über Winde STB achtern & Kran 3	38° 59,997' S	159° 59,997' W	5034,3
245_14-5	20.01.2016 20:21:56	WS	in the water	Gewicht z. W.	38° 59,995' S	159° 59,997' W	5035,2
245_14-5	20.01.2016 20:25:12	WS	information	Bei SL: 20 m 1 x GoFlo z. W.	38° 59,995' S	159° 59,996' W	5033,7
245_14-5	20.01.2016 20:25:33	WS	information	Bei SL: 40 m 1 x GoFlo z. W.	38° 59,995' S	159° 59,996' W	5033,9
245_14-5	20.01.2016 20:30:46	WS	max depth/on ground	SL: 75 m	39° 0,000' S	159° 59,997' W	5034,1
245_14-5	20.01.2016 20:34:19	WS	information	Bei SL: 40 m 1 x GoFlo a. D.	38° 59,998' S	159° 59,996' W	5034,4
245_14-5	20.01.2016 20:36:48	WS	information	Bei SL: 20 m 1 x GoFlo a. D.	38° 59,998' S	159° 59,995' W	5034,2
245_14-5	20.01.2016 20:37:20	WS	station end	(Gewicht a. D.)	38° 59,998' S	159° 59,995' W	5035,4
245_14-6	20.01.2016 21:09:04	CTD	station start	CTD über EL2 & kl. Schiebebalken	38° 59,997' S	159° 59,988' W	5035,4
245_14-6	20.01.2016 21:12:50	CTD	in the water		38° 59,999' S	159° 59,987' W	5033
245_14-6	20.01.2016 21:56:32	CTD	max depth/on ground	SL: 1247m	38° 59,994' S	159° 59,994' W	5034,3
245_14-6	20.01.2016 22:53:16	CTD	on deck		38° 59,994' S	159° 59,993' W	5034,9
245_14-6	20.01.2016 22:55:12	CTD	station end		38° 59,993' S	159° 59,993' W	5033,9
245_14-7	20.01.2016 22:57:42	LIOP	station start	Secchi Disk	38° 59,992' S	159° 59,995' W	5034,1
245_14-7	20.01.2016 22:57:55	LIOP	in the water		38° 59,993' S	159° 59,995' W	5034,1
245_14-7	20.01.2016 23:04:02	LIOP	on deck		38° 59,993' S	159° 59,994' W	5035
245_14-7	20.01.2016 23:04:33	LIOP	station end		38° 59,994' S	159° 59,994' W	5034,7
245_14-8	20.01.2016 23:07:14	LIOP	station start	UV profiler	39° 0,020' S	160° 0,003' W	5034,4
245_14-8	20.01.2016 23:07:49	LIOP	in the water		39° 0,035' S	160° 0,008' W	5033,4
245_14-8	20.01.2016 23:12:24	LIOP	max depth/on ground	SL: 60m	39° 0,145' S	160° 0,048' W	5035,6
245_14-8	20.01.2016 23:15:15	LIOP	at surface		39° 0,187' S	160° 0,060' W	5287
245_14-8	20.01.2016 23:20:03	LIOP	max depth/on ground	SL: 52m	39° 0,265' S	160° 0,086' W	5037,8
245_14-8	20.01.2016 23:23:21	LIOP	at surface		39° 0,322' S	160° 0,106' W	5043,4
245_14-8	20.01.2016 23:25:39	LIOP	max depth/on ground	SL: 50m	39° 0,353' S	160° 0,116' W	5040,7

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_14-8	20.01.2016 23:29:11	LIOP	on deck		39° 0,395' S	160° 0,131' W	5041,2
245_14-8	20.01.2016 23:29:47	LIOP	station end		39° 0,406' S	160° 0,134' W	5041,7
245_14-9	20.01.2016 23:31:02	LIOP	station start	Optic Profiler	39° 0,430' S	160° 0,143' W	5042,3
245_14-9	20.01.2016 23:32:11	LIOP	in the water		39° 0,458' S	160° 0,152' W	5043,5
245_14-9	20.01.2016 23:40:00	LIOP	max depth/on ground	SL: 110m	39° 0,610' S	160° 0,205' W	5045,8
245_14-9	20.01.2016 23:46:14	LIOP	at surface		39° 0,693' S	160° 0,233' W	5046,8
245_14-9	20.01.2016 23:49:57	LIOP	max depth/on ground	SL: 50m	39° 0,741' S	160° 0,250' W	5045,5
245_14-9	20.01.2016 23:52:11	LIOP	at surface		39° 0,774' S	160° 0,261' W	5047,8
245_14-9	20.01.2016 23:53:58	LIOP	max depth/on ground	SL: 51m	39° 0,807' S	160° 0,272' W	5047,5
245_14-9	20.01.2016 23:58:09	LIOP	on deck		39° 0,917' S	160° 0,310' W	5050,8
245_14-9	20.01.2016 23:58:32	LIOP	station end		39° 0,929' S	160° 0,314' W	5049,5
245_14-10	21.01.2016 00:36:20	CTD	station start	ISP & CTD	39° 0,030' S	160° 0,039' W	5036,1
245_14-10	21.01.2016 00:38:11	CTD	in the water		39° 0,028' S	160° 0,040' W	5034,8
245_14-10	21.01.2016 00:47:22	CTD	information	SL: 20m, 1. ISP	39° 0,023' S	160° 0,047' W	5033,7
245_14-10	21.01.2016 01:19:39	CTD	information	SL: 820m; 2. ISP	39° 0,017' S	160° 0,053' W	5035,1
245_14-10	21.01.2016 01:54:11	CTD	information	ISP # 3 bei SL: 1820m	39° 0,022' S	160° 0,045' W	5033,8
245_14-10	21.01.2016 02:28:43	CTD	information	ISP # 4 bei SL: 2820m	39° 0,019' S	160° 0,050' W	5036,8
245_14-10	21.01.2016 03:06:23	CTD	information	1 x ISP bei SL: 3820 m	39° 0,019' S	160° 0,054' W	5035,8
245_14-10	21.01.2016 03:32:45	CTD	information	ISP # 6 bei SL: 4570m	39° 0,025' S	160° 0,050' W	5036,8
245_14-10	21.01.2016 03:42:36	CTD	information	ISP # 7 bei SL: 4740m	39° 0,021' S	160° 0,039' W	5035,1
245_14-10	21.01.2016 03:45:51	CTD	information	ISP # 8 bei SL: 4770m	39° 0,020' S	160° 0,041' W	5035,5
245_14-10	21.01.2016 03:47:43	CTD	max depth/on ground	maxSL: 4820m	39° 0,020' S	160° 0,041' W	5034,9
245_14-10	21.01.2016 10:31:49	CTD	hoisting		39° 0,022' S	160° 0,044' W	5036,4
245_14-10	21.01.2016 13:54:23	CTD	on deck		39° 0,019' S	160° 0,040' W	5032,7
245_14-10	21.01.2016 13:55:06	CTD	station end		39° 0,018' S	160° 0,041' W	5033,7
245_14-11	21.01.2016 14:00:09	WS	station start	Go-Flo	39° 0,020' S	160° 0,041' W	5034,6
245_14-11	21.01.2016 14:02:35	WS	in the water		39° 0,023' S	160° 0,043' W	5034,5
245_14-11	21.01.2016 14:12:34	WS	max depth/on	maxSL: 75m	39° 0,017' S	160° 0,047' W	5034,9
245_14-11	21.01.2016 14:18:01	WS	on deck		39° 0,014' S	160° 0,042' W	5034,7
245_14-11	21.01.2016 14:19:20	WS	station end		39° 0,013' S	160° 0,043' W	5034,9

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_14-12	21.01.2016 14:46:04	CTD	station start		39° 0,015' S	160° 0,050' W	5035,2
245_14-12	21.01.2016 14:47:47	CTD	in the water		39° 0,014' S	160° 0,048' W	5035
245_14-12	21.01.2016 14:59:24	CTD	max depth/on ground	maxSL: 147m	39° 0,015' S	160° 0,045' W	5035,5
245_14-12	21.01.2016 15:16:46	CTD	on deck		39° 0,017' S	160° 0,048' W	5035,9
245_14-12	21.01.2016 15:18:02	CTD	station end		39° 0,017' S	160° 0,047' W	5034,8
245_14-13	21.01.2016 15:22:22	NET	station start	Micronet	39° 0,017' S	160° 0,045' W	5034,1
245_14-13	21.01.2016 15:25:12	NET	in the water		39° 0,019' S	160° 0,045' W	5034
245_14-13	21.01.2016 15:44:24	NET	max depth/on ground	maxSL: 200m	39° 0,018' S	160° 0,052' W	5034,8
245_14-13	21.01.2016 16:36:29	NET	on deck		39° 0,027' S	160° 0,045' W	5034,9
245_14-13	21.01.2016 16:37:31	NET	station end		39° 0,027' S	160° 0,045' W	5034,4
245_14-14	21.01.2016 16:50:10	CTD	station start		39° 0,022' S	160° 0,044' W	5036,5
245_14-14	21.01.2016 16:51:53	CTD	in the water		39° 0,023' S	160° 0,045' W	5033,2
245_14-14	21.01.2016 17:08:09	CTD	max depth/on ground	SL: 297 m, SZ: 6 kN	39° 0,026' S	160° 0,046' W	5036,1
245_14-14	21.01.2016 17:38:09	CTD	on deck		39° 0,021' S	160° 0,039' W	5034,8
245_14-14	21.01.2016 17:39:41	CTD	station end		39° 0,021' S	160° 0,039' W	5034,9
245_14-15	21.01.2016 17:45:00	BC	station start	KG über FW1/SPW1, Schiebebalken	39° 0,022' S	160° 0,042' W	5032,2
245_14-15	21.01.2016 17:52:39	BC	in the water		39° 0,023' S	160° 0,044' W	5037
245_14-15	21.01.2016 17:57:48	BC	information	Bei SL: 100 m 1 x Transponder z.W.	39° 0,021' S	160° 0,043' W	5028,7
245_14-15	21.01.2016 19:38:07	BC	max depth/on ground	SL: 5080 m, SZ: 48 kN	39° 0,021' S	160° 0,037' W	5031,9
245_14-15	21.01.2016 19:40:13	BC	hoisting	SZmax: 67 kN bei SL: 5058 m	39° 0,022' S	160° 0,037' W	5032
245_14-15	21.01.2016 21:20:55	BC	on deck		39° 0,021' S	160° 0,042' W	5021,3
245_14-15	21.01.2016 21:25:46	BC	station end		39° 0,023' S	160° 0,038' W	5028
245_14-16	21.01.2016 21:27:23	GC	station start		39° 0,023' S	160° 0,037' W	5011,4
245_14-16	21.01.2016 21:32:58	GC	in the water		39° 0,024' S	160° 0,037' W	5022,5
245_14-16	21.01.2016 23:25:58	GC	max depth/on ground	SL: 5084m	39° 0,021' S	160° 0,044' W	5016,4
245_14-16	21.01.2016 23:27:05	GC	hoisting		39° 0,022' S	160° 0,044' W	5030
245_14-16	21.01.2016 23:28:31	GC	information	frei vom Grund bei SL: 5061m, SZmax: 62kN	39° 0,021' S	160° 0,044' W	5034,9
245_14-16	22.01.2016 01:10:10	GC	on deck		39° 0,019' S	160° 0,041' W	5032,9

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_14-16	22.01.2016 01:12:48	GC	station end		39° 0,024' S	160° 0,040' W	5034,4
245_15-1	23.01.2016 09:24:10	PS	station start		38° 59,992' S	169° 55,621' W	4621,7
245_15-1	23.01.2016 09:25:22	PS	profile start	rwK: 270°, d: 6 sm, FüG: 6,0 kn	38° 59,993' S	169° 55,804' W	4630,1
245_15-1	23.01.2016 10:28:03	PS	alter course	rwK: 046°, d: 4 sm	38° 59,935' S	170° 3,809' W	4636,5
245_15-1	23.01.2016 11:08:41	PS	alter course	rwK: 180°, d: 6nm	38° 57,163' S	170° 0,198' W	4574,8
245_15-1	23.01.2016 12:06:12	PS	alter course	rwK: 046°, d: 2nm	39° 2,820' S	169° 59,971' W	4609,9
245_15-1	23.01.2016 12:27:27	PS	alter course	rwK: 314°, d: 2nm	39° 1,519' S	169° 58,073' W	4612,3
245_15-1	23.01.2016 12:56:36	PS	profile end		39° 0,011' S	170° 0,026' W	4635,1
245_15-1	23.01.2016 12:56:52	PS	station end		39° 0,011' S	170° 0,023' W	4633,4
245_15-2	23.01.2016 12:57:23	CTD	station start		39° 0,012' S	170° 0,020' W	4637
245_15-2	23.01.2016 12:59:55	CTD	in the water		39° 0,010' S	170° 0,017' W	4638,6
245_15-2	23.01.2016 13:14:18	CTD	max depth/on ground	SL: 147m	39° 0,009' S	170° 0,007' W	4636,5
245_15-2	23.01.2016 13:37:37	CTD	on deck		38° 59,999' S	170° 0,010' W	4634,3
245_15-2	23.01.2016 13:42:24	CTD	station end		39° 0,005' S	170° 0,008' W	4635,9
245_15-3	23.01.2016 13:48:18	WS	station start	Go-Flo	39° 0,011' S	170° 0,007' W	4633,7
245_15-3	23.01.2016 13:50:36	WS	in the water		39° 0,010' S	170° 0,005' W	4637,1
245_15-3	23.01.2016 14:00:16	WS	max depth/on ground	SL: 75m	39° 0,009' S	170° 0,006' W	4637,3
245_15-3	23.01.2016 14:06:06	WS	on deck		39° 0,004' S	170° 0,013' W	4634,6
245_15-3	23.01.2016 14:07:29	WS	station end		39° 0,004' S	170° 0,014' W	4633,4
245_15-4	23.01.2016 14:31:44	CTD	station start	In Situ Pump-CTD	39° 0,004' S	170° 0,008' W	4634,6
245_15-4	23.01.2016 14:33:32	CTD	in the water		39° 0,006' S	170° 0,007' W	4636,8
245_15-4	23.01.2016 14:49:36	CTD	information	ISP #1 bei SL: 270m	39° 0,007' S	170° 0,006' W	4635,6
245_15-4	23.01.2016 15:00:45	CTD	information	ISP # 2 bei SL: 520m	38° 59,999' S	170° 0,016' W	4634,4
245_15-4	23.01.2016 15:12:00	CTD	information	ISP # 3 bei SL: 770m	39° 0,000' S	170° 0,014' W	4634,7
245_15-4	23.01.2016 15:23:13	CTD	information	ISP # 4 bei SL: 970m	39° 0,001' S	170° 0,011' W	4634,6
245_15-4	23.01.2016 15:29:24	CTD	information	ISP # 5 bei SL: 1070m	38° 59,998' S	170° 0,011' W	4633,9
245_15-4	23.01.2016 15:34:39	CTD	information	ISP # 6 bei SL: 1170m	39° 0,003' S	170° 0,014' W	4634,6
245_15-4	23.01.2016 15:37:22	CTD	information	ISP # 7 bei SL: 1220m	39° 0,003' S	170° 0,015' W	4634,1
245_15-4	23.01.2016 15:41:07	CTD	information	ISP # 8 bei SL: 1250m	39° 0,002' S	170° 0,017' W	4633,8
245_15-4	23.01.2016 15:44:05	CTD	max depth/on ground	maxSL: 1270m	39° 0,001' S	170° 0,015' W	4634,2

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_15-4	23.01.2016 20:25:57	CTD	information	Bei SL: 1250 m 1 x ISP a. D.	39° 0,007' S	170° 0,004' W	4636,2
245_15-4	23.01.2016 20:36:27	CTD	information	Bei SL: 1220 m 1 x ISP a. D.	39° 0,008' S	170° 0,009' W	4635,6
245_15-4	23.01.2016 20:38:06	CTD	information	Bei SL: 1170 m 1 x ISP a. D.	39° 0,009' S	170° 0,010' W	4637,2
245_15-4	23.01.2016 20:42:26	CTD	information	Bei SL: 1070 m 1 x ISP a. D.	39° 0,007' S	170° 0,012' W	4636,3
245_15-4	23.01.2016 20:50:49	CTD	information	Bei SL: 970 m 1 x ISP a. D.	38° 59,999' S	170° 0,014' W	4634,7
245_15-4	23.01.2016 21:00:55	CTD	information	Bei SL: 770 m 1 x ISP a. D.	39° 0,003' S	170° 0,011' W	4636,7
245_15-4	23.01.2016 21:19:25	CTD	information	Bei SL: 520 m 1 x ISP a. D.	39° 0,008' S	170° 0,008' W	4636,4
245_15-4	23.01.2016 21:36:41	CTD	information	Bei SL: 270 m 1 x ISP a. D.	39° 0,009' S	170° 0,010' W	4637,4
245_15-4	23.01.2016 21:48:56	CTD	on deck	CTD a. D.	39° 0,011' S	170° 0,010' W	4635,6
245_15-4	23.01.2016 21:50:51	CTD	station end		39° 0,009' S	170° 0,008' W	4635,4
245_15-5	23.01.2016 16:05:41	PUMP	station start	Pump-CTD	39° 0,003' S	170° 0,009' W	4634,7
245_15-5	23.01.2016 16:12:55	PUMP	in the water		39° 0,001' S	170° 0,008' W	4635
245_15-5	23.01.2016 17:27:04	PUMP	max depth/on ground	maxSL: 275m	39° 0,001' S	170° 0,013' W	4635,7
245_15-5	23.01.2016 18:43:03	PUMP	on deck	(Zur Wartung a.D. wegen Fehlfunktion)	39° 0,010' S	170° 0,006' W	4636,9
245_15-5	23.01.2016 18:57:47	PUMP	in the water		39° 0,009' S	170° 0,011' W	4635,8
245_15-5	23.01.2016 19:08:06	PUMP	max depth/on ground	SL: 150 m	39° 0,003' S	170° 0,006' W	4635,5
245_15-5	23.01.2016 22:00:22	PUMP	on deck		38° 59,998' S	170° 0,010' W	4634,4
245_15-5	23.01.2016 22:01:53	PUMP	station end		38° 59,999' S	170° 0,013' W	4634,1
245_15-6	23.01.2016 22:04:36	LIOP	station start	Secci-Disk manuell übeer BB-Heck	38° 59,999' S	170° 0,014' W	4635,2
245_15-6	23.01.2016 22:05:06	LIOP	in the water		38° 59,998' S	170° 0,013' W	4634,8
245_15-6	23.01.2016 22:09:54	LIOP	on deck		39° 0,000' S	170° 0,012' W	4634,1
245_15-6	23.01.2016 22:10:22	LIOP	station end		39° 0,000' S	170° 0,012' W	4633,4
245_15-7	23.01.2016 22:10:45	LIOP	station start	UV profiler	39° 0,000' S	170° 0,012' W	4633,7
245_15-7	23.01.2016 22:14:21	LIOP	in the water		38° 59,974' S	169° 59,965' W	4635,1
245_15-7	23.01.2016 22:17:48	LIOP	max depth/on ground	SL: 70m	38° 59,945' S	169° 59,911' W	4636,4
245_15-7	23.01.2016 22:20:25	LIOP	at surface		38° 59,925' S	169° 59,874' W	4641,9
245_15-7	23.01.2016 22:22:25	LIOP	max depth/on ground	SL: 50m	38° 59,910' S	169° 59,848' W	4636,3
245_15-7	23.01.2016 22:24:48	LIOP	at surface		38° 59,892' S	169° 59,816' W	4638,4
245_15-7	23.01.2016 22:26:15	LIOP	max depth/on	SL: 50m	38° 59,882' S	169° 59,797' W	4635,9

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_15-7	23.01.2016 22:31:41	LIOP	on deck		38° 59,842' S	169° 59,725' W	4634,3
245_15-7	23.01.2016 22:33:56	LIOP	station end		38° 59,823' S	169° 59,690' W	4632,4
245_15-8	23.01.2016 22:34:15	LIOP	station start	Optic profiler	38° 59,820' S	169° 59,685' W	4633,9
245_15-8	23.01.2016 22:35:02	LIOP	in the water		38° 59,813' S	169° 59,673' W	4664,6
245_15-8	23.01.2016 22:43:15	LIOP	max depth/on ground	SL: 300m	38° 59,744' S	169° 59,547' W	4634,7
245_15-8	23.01.2016 22:53:49	LIOP	at surface		38° 59,661' S	169° 59,396' W	4638,3
245_15-8	23.01.2016 22:56:44	LIOP	max depth/on ground	SL: 50m	38° 59,642' S	169° 59,363' W	4638,3
245_15-8	23.01.2016 22:58:36	LIOP	at surface		38° 59,630' S	169° 59,340' W	4640,4
245_15-8	23.01.2016 23:00:44	LIOP	max depth/on ground	SL: 50m	38° 59,614' S	169° 59,313' W	4638,7
245_15-8	23.01.2016 23:05:12	LIOP	on deck		38° 59,581' S	169° 59,253' W	4638,6
245_15-8	23.01.2016 23:08:06	LIOP	station end		38° 59,566' S	169° 59,226' W	4638,2
245_15-9	23.01.2016 23:32:24	CTD	station start		38° 59,991' S	170° 0,034' W	4666
245_15-9	23.01.2016 23:34:08	CTD	in the water		38° 59,995' S	170° 0,031' W	4853,3
245_15-9	23.01.2016 23:53:00	CTD	max depth/on ground	SL: 297m	39° 0,002' S	170° 0,015' W	4635
245_15-9	24.01.2016 00:33:59	CTD	on deck		39° 0,007' S	170° 0,015' W	4668,4
245_15-9	24.01.2016 00:38:35	CTD	station end		39° 0,010' S	170° 0,011' W	4635,4
245_15-10	23.01.2016 23:40:54	PUMP	station start	PumpCTD	39° 0,008' S	170° 0,017' W	4669,1
245_15-10	23.01.2016 23:41:59	PUMP	in the water		39° 0,007' S	170° 0,015' W	4636,5
245_15-10	23.01.2016 23:45:36	PUMP	max depth/on ground	SL: 5m	39° 0,003' S	170° 0,016' W	4634,6
245_15-10	24.01.2016 01:11:08	PUMP	on deck		39° 0,004' S	170° 0,014' W	4635
245_15-10	24.01.2016 01:11:22	PUMP	station end		39° 0,004' S	170° 0,015' W	4635
245_15-11	24.01.2016 02:15:16	CTD	station start		39° 0,005' S	170° 0,019' W	4635,5
245_15-11	24.01.2016 02:17:15	CTD	in the water		39° 0,007' S	170° 0,019' W	4635,7
245_15-11	24.01.2016 02:32:01	CTD	max depth/on ground	maxSL: 148m	39° 0,000' S	170° 0,022' W	4634,1
245_15-11	24.01.2016 02:58:21	CTD	on deck		39° 0,000' S	170° 0,019' W	4634,8
245_15-11	24.01.2016 03:00:03	CTD	station end		39° 0,002' S	170° 0,018' W	4634,8
245_15-12	24.01.2016 03:07:39	NET	station start	Micronet	39° 0,008' S	170° 0,018' W	4635,6
245_15-12	24.01.2016 03:15:19	NET	in the water		39° 0,008' S	170° 0,016' W	4635,6
245_15-12	24.01.2016 03:27:40	NET	max depth/on	maxSL: 200m	39° 0,008' S	170° 0,011' W	4634,9

Station	Date / Time UTC	Device	Action	Comment (Action)	Latitude	Longitude	Depth (m)
245_15-12	24.01.2016 04:21:21	NET	on deck		39° 0,000' S	170° 0,010' W	4635,3
245_15-12	24.01.2016 04:23:23	NET	station end		39° 0,002' S	170° 0,009' W	4635
245_15-13	24.01.2016 04:30:42	CTD	station start		39° 0,001' S	170° 0,011' W	4634,6
245_15-13	24.01.2016 04:31:54	CTD	in the water		39° 0,002' S	170° 0,011' W	4634,1
245_15-13	24.01.2016 06:40:53	CTD	max depth/on ground	SL: 4589 m, SZ: 23 kN	39° 0,001' S	170° 0,015' W	4635,9
245_15-13	24.01.2016 06:42:24	CTD	hoisting		39° 0,000' S	170° 0,015' W	4634,5
245_15-13	24.01.2016 09:00:32	CTD	on deck		39° 0,000' S	170° 0,020' W	4635,1
245_15-13	24.01.2016 09:03:11	CTD	station end	rwK: 142°, d: 2 sm	39° 0,001' S	170° 0,020' W	4634,2
245_15-14	24.01.2016 09:38:15	BC	information		39° 1,728' S	169° 58,340' W	4612,9
245_15-14	24.01.2016 09:42:57	BC	in the water		39° 1,707' S	169° 58,325' W	4613
245_15-14	24.01.2016 09:49:20	BC	information	Bei SL: 100 m 1 x Transponder	39° 1,709' S	169° 58,317' W	4612,5
245_15-14	24.01.2016 11:18:30	BC	max depth/on ground	SL: 4658m	39° 1,702' S	169° 58,280' W	4611,8
245_15-14	24.01.2016 11:19:11	BC	hoisting		39° 1,702' S	169° 58,280' W	4613
245_15-14	24.01.2016 11:21:03	BC	information	frei vom Grund bei SL: 4634m, SZmax: 68kN	39° 1,700' S	169° 58,278' W	4613,3
245_15-14	24.01.2016 12:59:33	BC	on deck		39° 1,692' S	169° 58,282' W	4613,1
245_15-14	24.01.2016 13:04:49	BC	station end		39° 1,692' S	169° 58,278' W	4612,9
245_15-15	24.01.2016 13:05:11	GC	station start	5m	39° 1,693' S	169° 58,278' W	4611,5
245_15-15	24.01.2016 13:08:22	GC	in the water		39° 1,696' S	169° 58,279' W	4618,6
245_15-15	24.01.2016 13:14:05	GC	information	Transponder bei SL: 100m	39° 1,697' S	169° 58,275' W	4612,7
245_15-15	24.01.2016 14:40:33	GC	max depth/on ground	maxSL: 4655m, maxSZ: 56,6kN	39° 1,694' S	169° 58,284' W	4613,5
245_15-15	24.01.2016 16:16:27	GC	on deck		39° 1,696' S	169° 58,285' W	4613,2
245_15-15	24.01.2016 16:17:50	GC	station end		39° 1,694' S	169° 58,286' W	4612,4