Application for Consent to conduct
Marine Scientific Research

Date: 28 Aug 2015

1. General Information

1.1 Cruise name and/or number:
MSM-53

1.2 Sponsoring Institution(s): *(The Sponsoring Institution is the name of the Institution(s) which initiates, finances and is responsible for the proposed scientific research)*	
Name:	University of Bremen Institute of Environmental Physics (IUP) Department of Oceanography
Address:	Otto-Hahn-Allee 28359 Bremen Germany
Name of Director:	Prof. Dr. Monika Rhein

1.3 Scientist in charge of the Project:	
Name:	Dr. Dagmar Kieke
Country:	Germany
Affiliation:	University of Bremen Institute of Environmental Physics (IUP) Department of Oceanography
Address:	Otto-Hahn-Allee 28359 Bremen Germany
Telephone:	+49-421-218-62154
Fax:	+49-421-218-62165
Email:	dkieke@uni-bremen.de
Website (for CV and photo):	http://www.ocean.unibremen. de/mitarbeiter/dkieke/index_dk_eng. html

1.4 Entity(ies)/Participant(s) from coastal State involved in the planning of the project:	
Name:	
Affiliation:	
Address:	
Telephone:	
Fax:	
Email:	
Website (for CV and photo):	

2. Description of Project

2.1 Nature and objectives of the project:

- to estimate the transport fluctuations of the subpolar gyre as it enters the eastern subpolar North Atlantic at the Mid-Atlantic Ridge (CTDO/LADCP, vm-ADCP, tracers, PIES, moored instruments)
- to quantify the export of deep water in the western boundary current off Flemish Cap at 47°N (moorings, CTOD/LADCP, vm-ADCP, tracers)
- to obtain continuous time series of the variability of the North Atlantic Current (NAC) inflow and recirculation in the Newfoundland Basin at 47°N (PIES, CTDO/LADCP, vm-ADCP, tracers)
- to investigate the variability of water masses and transports in Flemish Pass and their relation to changes observed in the boundary current in the southern Labrador Sea (moorings, CTDO/LADCP,vm-ADCP, tracers)
- to study the variability of water masses and transports in the eastern basin of the subpolar North Atlantic and off the European continental shelf (moorings, CTDO/LADCP,vm-ADCP, tracers)
- to measure concentrations of anthropogenic transient tracers in seawater on selected stations in the Newfoundland Basin and at the Mid-Atlantic Ridge to infer spreading pathways of North Atlantic Deep Water and infer changes in the formation of deep water (tracers, CTDO).

2.2 If designated as part of a larger scale project, then provide the name of the project and the Organisation responsible for coordinating the project:

2.3 Relevant previous or future research projects:

RACE, German Federal Ministry for Education and Research

2.4 Previous publications relating to the project:

Publications in peer reviewed journals, 2010 -2015, related to the proposed cruise

Bold: member of the Bremen oceanography department

Bullister, J., **M. Rhein**, and C. Mauritzen (2013), Deep Water Formation. In: *Ocean Circulation and Climate - Observing and Modelling the Global Ocean, second edition*, Hrsg.: G. Siedler, J. Church, J. Gould and S. Griffies, Academic Press, Oxford, ISBN 978-0-12-391851-2

Fischer, J., J. Karstensen, R. Zantopp, M. Visbeck, A. Biastoch, E. Behrens, C. Böning, D. Quadfasel, K. Jochumsen, H. Valdimarsson, S. Jonsson, S. Bacon, N. P. Holliday, S. Dye, **M. Rhein**, and **C. Mertens** (2015), Intra-seasonal variability of the Deep Western Boundary Current in the western subpolar North Atlantic. *Prog. Oceanogr.*, 132(3), 233-249, doi:10.1016/j.pocean.2014.04.002.

Kieke, D., and I. Yashayaev (2015), Studies of Labrador Sea Water formation and variability in the subpolar North Atlantic in the light of international partnership and collaboration, *Prog. Oceanogr.*, 132(3), 220-232, doi:10.1016/j.pocean.2014.12.010.

Mertens, C., M. Rhein, M. Walter, C. W. Böning, E. Behrens, **D. Kieke, R. Steinfeldt,** and **U. Stöber** (2014), Circulation and transports in the Newfoundland Basin, western subpolar North Atlantic, *J. Geophys. Res.*, 119, 7772-7793, doi:10.1002/2014JC010019.

Rhein, M., D. Kieke, and **R. Steinfeldt** (2015), Advection of North Atlantic Deep Water from the Labrador Sea to the southern hemisphere, *J. Geophys. Res.*, 120(4), 2471-2487, doi:10.1002/2014JC010605.

Rhein, M., D. Kieke, S. Hüttl-Kabus, A. Roessler, C. Mertens, R. Meissner, B. Klein, C. W. Böning and I. Yashayaev (2011**),** Deep-water formation, the subpolar gyre, and the meridional overturning circulation in the subpolar North Atlantic. *Deep-Sea Res. II*, 58(17-18), 1819-1832

Roessler, A., M. Rhein, D. Kieke, and **C. Mertens** (2015), Long-term observations of North Atlantic Current transport at the gateway between western and eastern Atlantic, *J. Geophys. Res.*, 120, doi:10.1002/2014JC010662.

Schneider, L., D. Kieke, K. Jochumsen, E. Colbourne, I. Yashayaev, **R. Steinfeldt,** E. Varotsou, N. Serra, and **M. Rhein** (2015), Variability of Labrador Sea Water transported through Flemish Pass during 1993 - 2013, *J. Geophys. Res.*, 120, doi:10.1002/2015JC010939.

Scholz, P., **D. Kieke,** G. Lohmann, M. Ionita, and **M. Rhein** (2014), Evaluation of Labrador Sea Water formation in a global Finite-Element Sea-Ice Ocean Model setup, based on a comparison with observational data, *J. Geophys. Res.*, 119, 1644-1667, doi:10.1002/2013JC009232.

Stendardo, I., D. Kieke, M. Rhein, N. Gruber, and **R. Steinfeldt** (2015), Interannual to decadal oxygen variability in the mid-depth water masses of the eastern North Atlantic, *Deep-Sea Res. I*, 95(1), 85-98, doi:10.1016/j.dsr.2014.10.009.

Stendardo, I., and N. Gruber (2012), Oxygen trends over five decades in the North Atlantic. *J. Geophys. Res.*, 117, C11, C11004, doi:10.1029/2012JC007909.

Steinfeldt, R., T. Tanhua, J. L. Bullister, R. M. Key, **M. Rhein**, and **J. Köhler** (2010), Atlantic CFC data in CARINA. *Earth System Science Data*, 2, 1-15.

Varotsou, E., K. Jochumsen, N. Serra, **D. Kieke**, and **L. Schneider** (2015), Interannual transport variability of Upper Labrador Sea Water at Flemish Cap, *J. Geophys. Res.*, doi: 10.1002/2015JC010705.

Walter, M., and **C. Mertens** (2013), Mid-depth mixing linked to North Atlantic Current variability, *Geophys. Res. Lett.*, 40(18), 4869-4875, doi:10.1002/grl.50936.

3. Geographical Areas

3.1 Indicate geographical areas in which the project is to be conducted (with reference in Latitude and longitude in decimal degrees, including coordinates of cruise/track/way points/sampling stations). Please provide coordinates in a separate excel spreadsheet.
45°N-53°N, 52°W-10°E, see attached Excel sheet for corner points of hydrographic sections

3.2 Attach chart(s) at an appropriate scale (1 page, high-resolution) showing the geographical Areas of the intended work and, as far as practicable, the location and depth of sampling Stations, the tracks of survey lines, and the locations of installations and equipment.
Chart is shown on the following page.

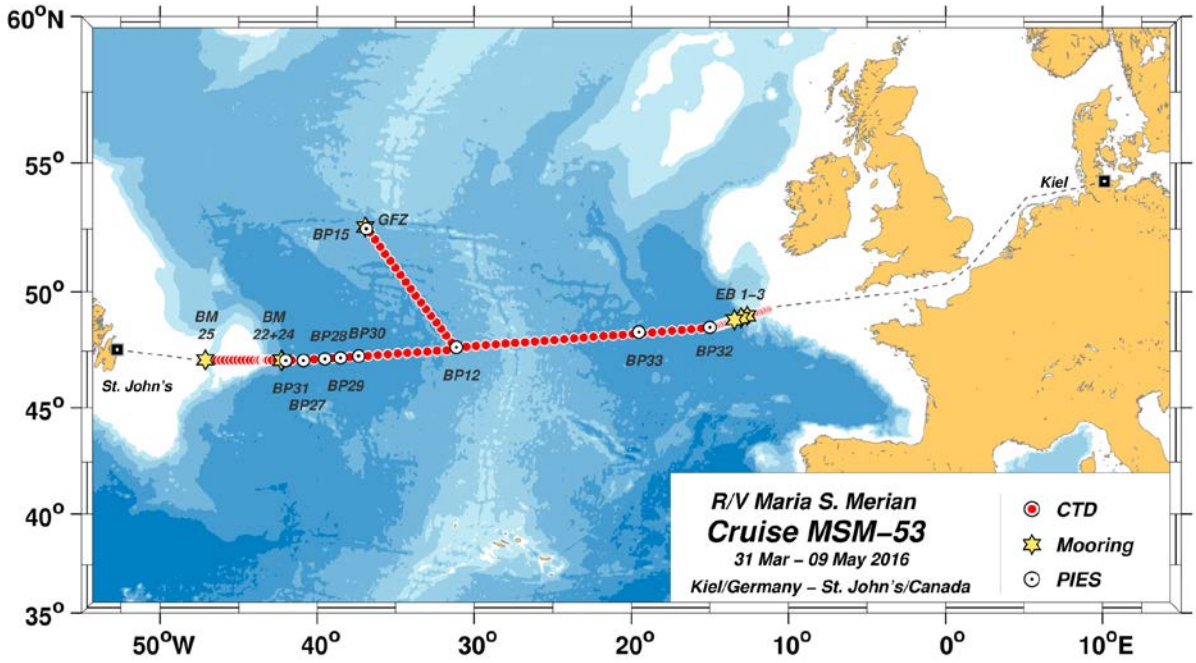

Figure 1. Intended cruise track of cruise MSM-53 with RV *Maria S. Merian*; departure in Kiel/Germany, arrival in St. John's/Canada. CTD: hydrographic stations; PIES: inverted echosounders equipped with pressure sensors.

4. Methods and means to be used

4.1 Particulars of vessel:	
Name:	MARIA S. MERIAN
Type/Class:	Research Vessel
Nationality (Flag State):	German
Identification Number (IMO/Lloyds No.):	IMO-Nr. 9274197
Owner:	Federal State of Mecklenburg-Vorpommern, Germany
Operator:	University of Hamburg, Institute of Oceanography Bundesstraße 53, 20146 Hamburg
Overall length (meters):	94,76 m.
Maximum draught:	6,5 m.
Displacement/Gross Tonnage:	Deadweight 4493t / Gross Tonnage 5573 BRZ
Propulsion:	Diesel Electric
Cruising & maximum speed:	Cruising speed: 12,5 kn Maximum speed: 15 kn
Call sign:	DBBT
INMARSAT number and method and capability of communication (including emergency frequencies):	SAT: 00870-764354964 SAT: 00870-764354967
Name of Master:	Björn Maaß
Number of Crew:	Max. 24
Number of Scientists on board:	Max. 23

4.2 Particulars of Aircraft:	
Name:	
Make/Model:	
Nationality (flag State):	
Website for diagram & Specifications:	
Owner:	
Operator:	
Overall Length (meters):	
Propulsion:	
Cruising & Maximum speed:	
Registration No.:	
Call Sign:	
Method and capability of communication (including emergency frequencies):	
Name of Pilot:	
Number of crew:	
Number of scientists on board:	
Details of sensor packages:	
Other relevant information:	

4.3 Particulars of Autonomous Underwater Vehicle (AUV):	
Name:	
Manufacturer and make/model:	
Nationality (Flag State):	
Website for diagram & Specifications:	
Owner:	
Operator:	
Overall length (meters):	
Displacement/Gross tonnage:	
Cruising & Maximum speed:	
Range/Endurance:	
Method and capability of communication	

(including emergency frequencies):	
Details of sensor packages:	
Other relevant information:	

4.4 other craft in the project, including its use:

4.5 Particulars of methods, full description of scientific instruments to be used(for fishing gear specify type and dimension) and location			
Types of samples and Measurements:	Methods to be used:	Instruments to be used:	To be carried out within 12nm (yes or no):
T,S,O_2	Profiling of CTD	CTD & carousel water sampler	no
velocity	Profiling	Lowered ADCP attached to carousel	no
S,O_2, CFCs, SF_6	Analysing water samples	10L bottles attached to carousel	no
velocity	Vessel mounted ADCP	Vessel mounted ADCP	no
depth	Echo sounder, multibeam echosounder	Echo sounder, multibeam Echosounder	no
Surface T,S; Standard meteorological measurements	Thermosalinograph; Meteorological sensors	Thermosalinograph Meteorological sensors	no

4.6 Indicate nature and quantity of substances to be released into the marine environment:
No substances released into marine environment

4.7 Indicate whether drilling will be carried out. If yes, please specify:
No drilling

4.8 Indicate whether explosives will be used. If yes, please specify type and trade name, Chemical content, depth of trade class and stowage, size, depth of detonation, frequency of Detonation, and position in latitude and longitude:
No explosives

5. Installations and Equipment

Details of installations and equipment (including dates of laying, servicing, method and Anticipated timeframe for recover, as far as possible exact locations and depth, and Measurements):
No mooring operations are planned within British waters.

6. Dates

6.1 Expected dates of first entry into and final departure from the research area by the

research vessel and/or other platforms:
04 Apr 2016, expected entry into research area 08 May 2016, expected departure from research area
6.2 Indicate if multiple entries are expected:
no

7. Port Calls

7.1 Dates and Names of intended ports of call:
Mar 28th to Mar 31st, 2016, Kiel/Germany May 09th to May 12th, 2016, St. John's/Canada

7.2 Any special logistical requirements at ports of call:
- exchange of scientists - loading/discharging of scientific equipment/containers - taking bunkers, provisions, ships spare-parts

7.3 Name/Address/Telephone of shipping agent (if available):

8. Participation of the representative of the coastal State

8.1 Modalities of the participation of the representative of the coastal State in the research Project:
visits to the ship in port by scientists of the coastal state concerned will be acceptable; it will be acceptable to carry on board an observer from the coastal state for any part of the cruise

8.2 Proposed dates and ports for embarkation/disembarkation:
Mar 30th to Mar 31st, 2016, Kiel/Germany May 09th, 2016, St. John's/Canada

9. Access to Data, Samples and Research Results

9.1 Expected dates of submission to coastal State of preliminary report, which should include The expected dates of submission of the data and research results:
cruise report three months after finishing the research cruise

9.2 Anticipated dates of submission to the coastal State of the final report:
Final cruise report one year after finishing the research cruise

9.3 Proposed means for access by coastal State to data (including format) and samples:
No profiling measurements intended within waters of Coastal State, only vessel-mounted systems for underway measurements.

9.4 Proposed means to provide coastal State with assessment of data, samples and Research results:

9.5 Proposed means to provide assistance in assessment or interpretation of data, samples And research results:

9.6 Proposed means of making results internationally available:
scientific publications within the following three years

10. Other permits Submitted

10.1 Indicate other types of coastal state permits anticipated for this research (received or Pending):

11. List of Supporting Documentation

11.1 List of attachments, such as additional forms required by the coastal State, etc.:

Signature:

Contact information of the focal point:	
Name:	Leitstelle Deutsche Forschungsschiffe
Country:	Germany
Affiliation:	University of Hamburg Institute for Oceanography
Address:	Bundesstr. 53 20146 Hamburg
Telephone:	+49 (40) 42838-3640
Fax:	+49 (40) 42838-4644
Email:	leitstelle@ifm.uni-hamburg.de

RV Maria S. Merian, cruise MSM-53
31 Mar to 09 May 2016,
Kiel/Germany to St. John's/Newfoundland/Canada

Corner Points of Hydrographic Sections

Location of Section	**Latitude [°N]**	**Longitude [°W]**
section along ~47°N:		
western end, Flemish Pass	47,1	45,4
eastern end, European Shelf	49,3	11,3
section along Mid-Atlantic Ridge:		
southern end	47,7	31,1
northern end	52,6	36,9