

SHIRSHOV INSTITUTE OF OCEANOLOGY

CRUISE REPORT No. 40

RV *AKADEMIK IOFFE* CRUISE 08 DEC 2012 - 03 MAR 2013

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2013

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ABSTRACT

RV *Akademik Ioffe* Cruise 40 was a contribution to the Russian CLIVAR and World Ocean Research Programme. Underway measurements of the surface temperature, conductivity and currents in the upper 1000 m were designed to enable the ocean circulation in Drake Passage and the Scotia Sea to be mapped and in particular the course and short-term variability of the Subantarctic, Polar and Southern Fronts of the Antarctic Circumpolar Current within the region to be determined. The main goal is austral summer monitoring of the Antarctic Circumpolar Current.

KEYWORDS

CRUISE 40 2012-2013, *AKADEMIK IOFFE*, ANTARCTIC CIRCUMPOLAR CURRENT, POLAR FRONT, SUBANTARCTIC FRONT, BOTTOM RELIEF, SURFACE TEMPERATURE AND SALINITY, DRAKE PASSAGE, SCOTIA SEA, CLIVAR, VMADCP, THERMOSALINOGRAPH SBE21, SBE56

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Technical Personnel

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VMADCP OS-38,
thermosalinograph SBE21,
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1. CRUISE NARRATIVE

1.1 Cruise Details

Expedition Designation: R/V *Akademik Ioffe* Cruise 40, RUSSIA CLIVAR

Principal Scientists: Dr Sergey V. Gladyshev (Shirshov Institute of Oceanology)

Ship: RV *Akademik Ioffe*

Port of Call: Ushuaia (Argentina)

Cruise Dates: 8th Dec 2012 to 3th Mar 2013

1.2 Cruise Summary

1.2.1 Cruise Tracks

The cruise tracks are shown in Fig. 1, 2 where surface temperature and salinity are in color.

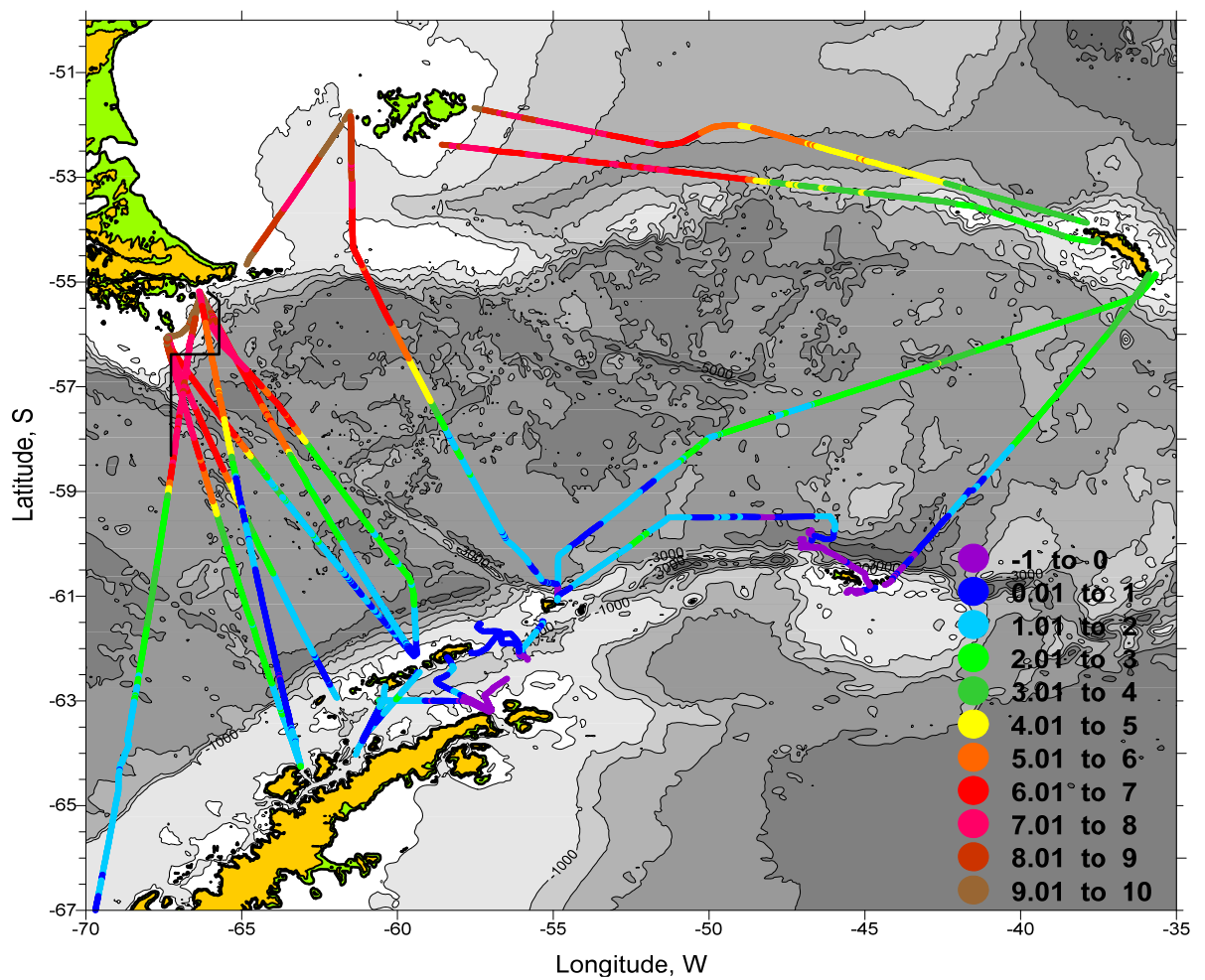


Figure 1. The chart showing R/V *Akademik Ioffe* tracks from 1 to 28. Surface temperature along the tracks is given in different color. The Argentine-Chilean sea border is shown in black.

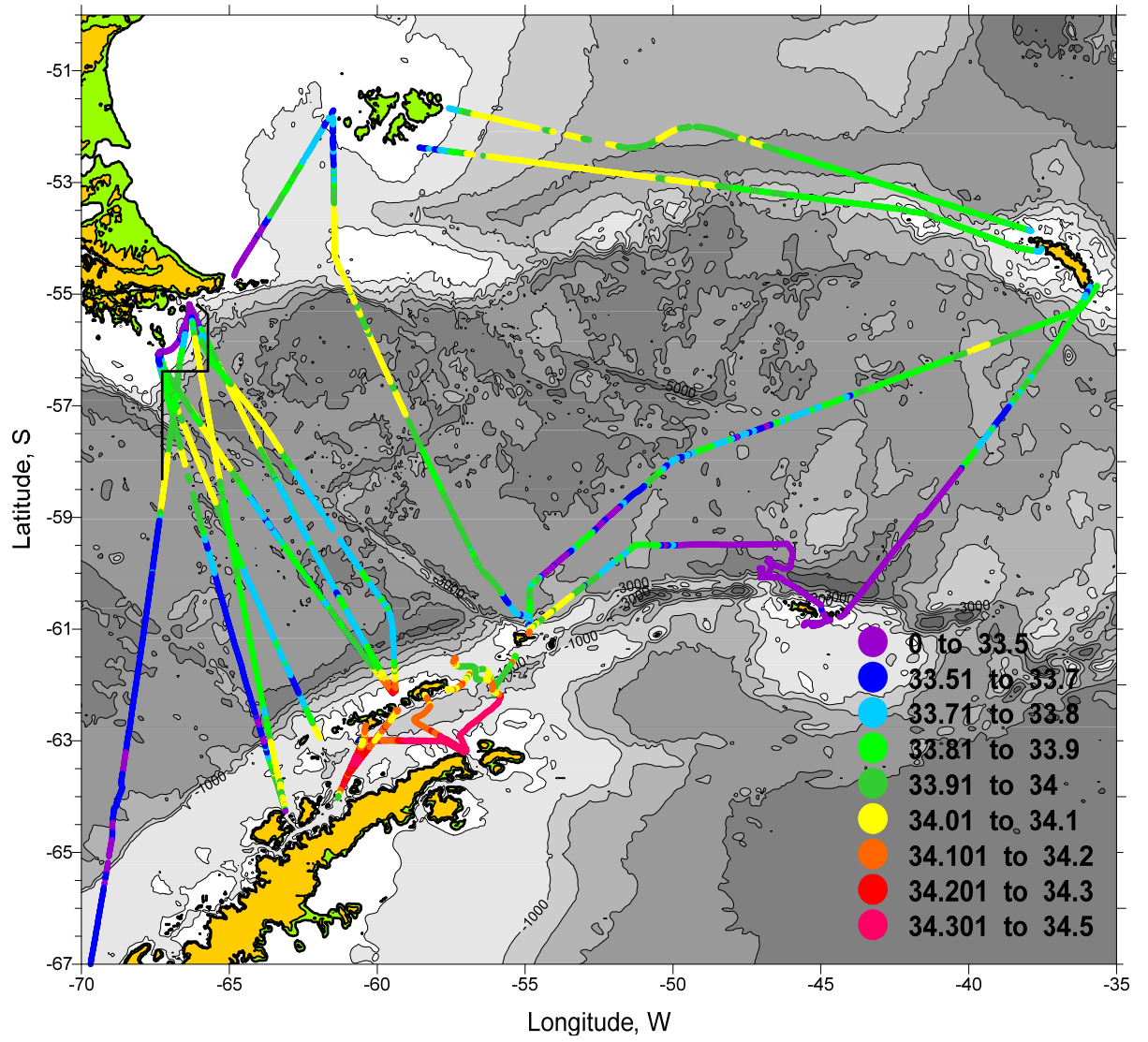


Figure 2. The chart showing R/V Akademik Ioffe tracks from 1 to 28. Surface salinity along the tracks is color coded.

Table 1

Track Num.	Description	Start Date Time (GMT)	End Date Time (GMT)	Start Lat. S	Start Lon. W	End Lat. S	End Lon. W
1	<i>Drake Passage</i> (Nueva I. – Melchior I., South Shetland Is.)	09.12.2012 03:10	11.12.2012 03:46	55°12.8	66°20.7	64°14.7	63°06.5
2	<i>Bransfield St.</i> (Trinity I., Palmer Arch. – Robert I., South Shetland Is.)	15.12.2012 02:00	15.12.2012 11:00	63°44.5	61°06.3	62°27.3	59°22.0
3	<i>Drake Passage</i> (Nelson I., South Shetland Is. – Cape Horn)	16.12.2012 00:30	17.12.2012 14:30	62°07.4	59°30.4	56°04.2	67°21.1
4	<i>Drake Passage</i> (Nueva I. – Nelson I., South Shetland Is.)	19.12.2012 05:30	21.12.2012 03:10	55°16.6	66°16.0	62°07.8	59°27.9
5	<i>Bransfield St.</i> (Deception I., South Shetland Is. – Gourdin I., Trinity I.)	21.12.2012 23:30	22.12.2012 07:05	62°59.6	60°30.9	63°06.5	57°21.0
6	<i>Bransfield St.</i> (Bransfield I., Trinity Peninsula – King George I., South Shetland Is.)	24.12.2012 02:20	24.12.2012 19:12	63°09.6	56°59.5	61°32.0	57°20.5
7	Elephant I., South Shetland I. – Falkland Is.	25.12.2012 17:07	28.12.2012 03:00	60°46.1	54°52.7	51°50.5	61°30.0
8	Falkland Is. – King Haakon Bay, South Georgia	30.12.2012 23:30	02.01.2013 13:10	52°22.8	58°32.3	54°11.8	37°32.6
9	Cooper I., South Georgia – Elephant I., South Shetland Is.	06.01.2013 23:30	09.01.2013 15:45	55°51.4	35°40.0	61°04.5	54°51.9
10	Gibbs I., South Shetland Is. – King George I., S. Shetland Is.	10.01.2013 23:35	11.01.2013 12:00	61°28.9	55°19.8	62°04.6	57°37.3
11	<i>Bransfield St.</i> (King George I., South Shetland Is. – Bransfield I., Trinity I.)	11.01.2013 23:40	12.01.2013 11:00	62°10.6	58°23.6	63°10.3	57°01.5
12	<i>Bransfield St.</i> (Bransfield I., Trinity I. - Deception I., South Shetland Is.)	13.01.2013 00:00	13.01.2013 09:30	63°12.6	57°02.9	62°59.6	60°30.3

13	<i>Bransfield St.</i> (Deception I., South Shetland Is. – Trinity I., Palmer Arch.)	13.01.2013 21:30	14.01.2013 03:10	62°59.8	60°30.8	63°59.6	61°18.53
14	<i>Bransfield St.</i> (Trinity I., Palmer Arch. – Livingston I., South Shetland Is.)	16.01.2013 07:30	16.01.2013 13:00	63°45.4	61°06.5	62°43.6	60°23.2
15	<i>Drake Passage</i> (Smith I., South Shetland Is. – Cape Horn)	17.01.2013 01:30	18.01.2013 13:30	62°56.7	61°55.9	56°04.5	67°22.7
16	<i>Drake Passage</i> (Nueva I. – Nelson I., South Shetland Is.)	20.01.2013 04:30	22.01.2013 00:00	55°12.2	66°21.0	62°07.0	59°29.2
17	<i>Bransfield St.</i> (Deception I., South Shetland Is. – Trinity I., Palmer Arch.)	23.01.2013 22:15	24.01.2013 02:05	62°59.5	60°27.2	63°45.7	61°07.6
18	<i>Bransfield St.</i> (Trinity I., Palmer Arch. – Nelson I., South Shetland Is.)	28.01.2013 20:15	29.01.2013 03:30	63°46.1	61°07.5	62°22.4	59°13.6
19	<i>Drake Passage</i> (Nelson I., South Shetland Is. – Nueva I.)	29.01.2013 04:45	31.01.2013 00:00	62°06.8	59°22.8	55°20.2	66°17.7
20	Estados I. – Falkland Is.	01.02.2013 08:25	02.02.2013 05:30	54°40.2	64°50.2	51°42.9	61°29.2
21	Falkland Is. – West coast of South Georgia	04.02.2013 01:10	06.02.2013 14:30	51°40.4	57°34.2	53°51.1	37°53.9
22	Cooper I., South Georgia – Laurie I., South Orkney Is.	08.02.2013 20:20	10.02.2013 10:30	54°51.1	35°52.8	60°46.9	44°21.0
23	Laurie I., S., Orkney Is.– Elephant I., South Shetland Is.	10.02.2013 17:00	12.02.2013 18:40	60°50.5	44°45.8	61°04.4	54°51.9
24	<i>Bransfield St.</i> (Deception I., South Shetland Is. – Trinity I., Palmer Arch.)	14.02.2013 02:00	14.02.2013 07:40	63°00.0	60°30.6	63°45.2	61°06.4
25	<i>Drake Passage</i> (Melchior I., South Shetland Is. – Cape Horn – Evout I.)	15.02.2013 23:10	17.02.2013 05:00	64°15.0	63°06.1	55°34.1	66°32.2

26	<i>Drake Passage</i> (Nueva I. – Marguerite Bay)	19.02.2013 11:45	22.02.2013 15:15	55°10.9	66°20.6	68°11.3	69°23.4
27	<i>Bransfield St.</i> (Trinity I., Palmer Arch. –Deception I., South Shetland Is.)	28.02.2013 05:40	28.02.2013 11:25	63°45.1	61°06.2	63°00.4	60°29.0
28	<i>Drake Passage</i> (Robert I., South Shetland Is. – Cape Horn.)	01.03.2013 00:10	02.03.2013 13:00	62°08.5	59°28.9	56°04.7	67°25.0

1.2.2. Equipment

Upper-layer currents were measured using vessel mounted ADCP (VMADCP) TRDI OS38 kHz (S/N 1185) installed at the central point of the ship hull at depth 5.8 m. Surface temperature and conductivity were logged every 3 seconds. The equipment consisted of an SBE 21 (S/N 3254) temperature and conductivity sensors mounted in an SBE housing in the pump room located in the central part of the ship. A ship pump was used to provide a constant flow of non-toxic water.

Navigation information was provided by a Trimble SPSx50/SPSx51- Modular GPS receiver and every second was recorded on the PC. Additional measurements were made with an ELAC 12 kHz.

1.3 Scientific Objectives

The cruise objectives were:

1. To collect surface temperature and conductivity underway in Drake Passage and in the Scotia Sea.
2. To collect upper-layer currents underway in Drake Passage and in the Scotia Sea to estimate short-term variability of the Antarctic Circumpolar Current transport and relative contribution of its main jets.
3. To collect depth to refine bottom relief features in the region.

1.4 Narrative

Beginning from January 2010 we started to collect a large data set related to the Antarctic Circumpolar Current (ACC) in Drake Passage, where a few main jets squeezed by continents and flowing over sills strongly meander and detach a number of mesoscale eddies. Our plan to continue these measurements each year when our ships carry out touristic trips crossing Drake Passage up to 20-40 times per austral summer. To date we carried out 103 crossings in Drake Passage for last 3.5 years (in austral summer seasons).

The ACC is a main link of the global interocean circulation in the Southern Ocean. The absence of land barriers in the latitude band of Drake Passage has a profound influence on the dynamics of currents in the Southern Ocean and, more generally, on the earth's climate. Within this band, the strong eastward flow of the ACC connects each of the ocean basins. Sverdrup dynamics in their usual form cannot be applied to flows within a zonally unbounded ocean, and as a consequence the dynamics of the ACC have long been a topic of debate. Eddy fluxes are believed to play a more central role in both the dynamical and thermodynamical balances of the Southern Ocean than in other areas of the world ocean. The interbasin connection provided by the ACC permits a global overturning circulation to exist; the overturning circulation, in turn,

dominates the global transport of heat, fresh water and other properties that influence climate. The vigorous interbasin exchange accomplished by the ACC also admits the possibility of oceanic teleconnections, where anomalies formed in one basin may be carried around the globe to influence climate at remote locations. The fact that no net meridional geostrophic flow can exist across the unblocked latitudes isolates the Antarctic continent from the warmer waters at lower latitudes to some extent, contributing to the glacial climate of Antarctica; what heat does get carried poleward to balance the heat lost to the atmosphere must be carried by eddies.

Processes of air-sea interaction in this region cause the cooling and consequent sinking of surface waters and thus result in formation of the water masses. Complex of the South Atlantic deep waters formed spreads northward. According to the «global conveyor» concept [Broecker, 1991], cold deep waters formed in the South Atlantic, propagate throughout the entire Atlantic ocean and initiate the compensating return flow at shallow levels, which carries warmer water southward. The deep convection intensity variations cause the substantial interannual and long-term changes in properties of the deep and intermediate water masses and thus impact the global overturning circulation, which in turn influences the atmospheric circulation and the state of the climate system. For this reason, annual monitoring of the ACC in Drake Passage and in the Scotia Sea is essential.

RV *Akademik Ioffe* Cruise 40 was a contribution to the RUSSIA CLIVAR Community Research Programme. Underway measurements were designed to enable the ocean circulation in Drake Passage and in the Scotia Sea to be mapped and in particular the course of its main jets (Subantarctic, Polar and ACC Southern Front currents) within the region to be determined. The Drake Passage crossings aimed to provide estimates of the upper layer volume transport and its short-term variability including possible redistribution of mass between the main jets.

1.5 Preliminary Results

The first preliminary results will be received after completing analysis of this data set.

1.6 Major Problems and Goals Not Achieved

There was a problem with power supply unit of the Echosounder PC (ELAC server). The PC should be rebooted regularly. This unit has to be replaced. Meteo cable has to be replaced too to restore meteo station. ADCP data partially missed because of absence of GPS heading data and navigation cable breakdown during Track No 14, Track No 19. TSG data did not collected for about 1 hour to clean the conductivity sensor during Track No 3, for about 2.5 hours to clean the TSG sensors because of low salinity records due to algae (Track No 12), for more than hour because of power cable breakdown during Track No 26. There is no SBE56 data on Track No 8. The sensor did not turn on after programming.

2. CONTINUOUS MEASUREMENTS (underway)

2.1 Navigation

Navigation data from Trimble SPSx50/SPSx51 GPS was recorded every 1 second and was stored on the PC in binary format.

2.2 Meteorological Measurements

The meteorological measurements were not performed this year because of meteo station malfunction (the main cable between sensor arm and deck unit was flooded).

2.3 Thermosalinograph

Underway temperature and conductivity were continuously logged using the SBE acquisition program Seasave. The equipment consisted of an SBE 21 S/N 3254 temperature and conductivity sensors mounted in an SBE housing in the pump room. A ship pump was used to provide a constant flow of non-toxic water.

TSG salinity is usually calculated from the measured conductivity and temperature at the instrument housing. Surface bottle samples from CTD casts taking during previous cruise were used as true conductivity (salinity) from which to calculate an offset to be applied to the TSG salinities. CTD bottle samples were selected from a .btl sample files. We selected only CTD sample data from 0-10 dbars that were fired in the surface mixed layer.

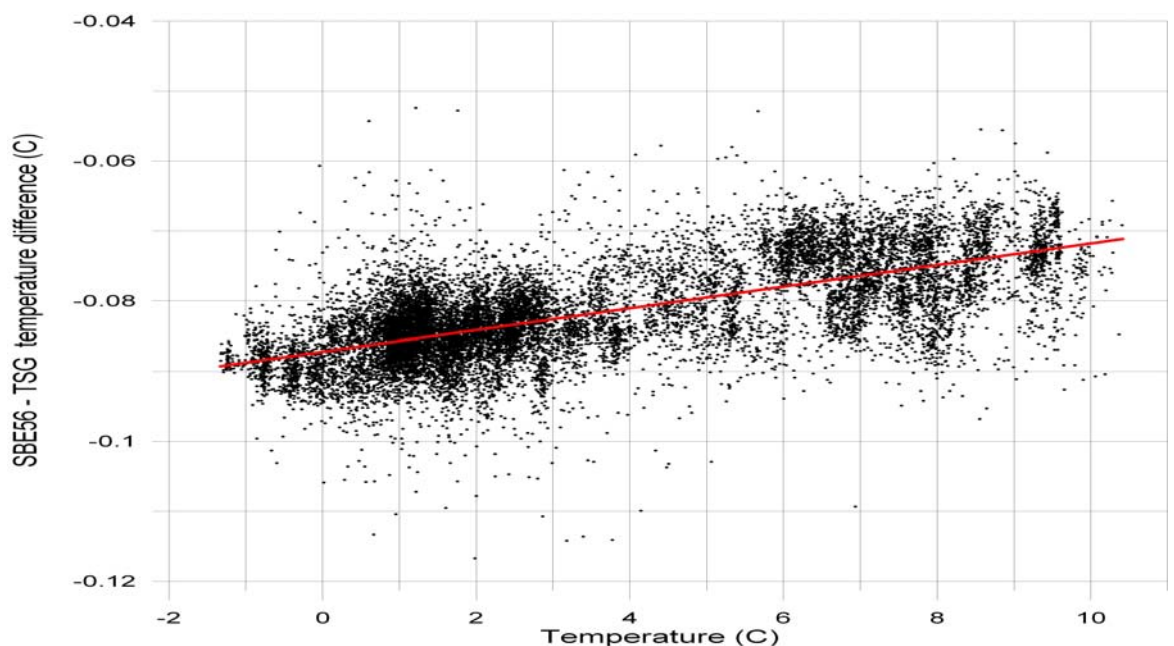


Figure 3. SBE56-TSG temperature difference as function of temperature. Red thick line presents linear fit of the difference.

The CTD surface samples had their time added to the data file, and were then merged with the underway samples. The file was sorted on ascending time.

The new temperature and conductivity (salinity) were calculated and temperature, conductivity calibration was derived from the bottle samples. The data were merged on time and a linear regression used to derive A and B coefficients (TSG temperature against bottle temperature) and A1 and B1 coefficients (TSG conductivity against bottle conductivity). Prior to this, the difference between the bottle temperatures (salinities) and the TSG temperatures (salinities) was plotted to establish that there was no substantial drift with time or temperature. After calibration new residuals were calculated and the mean and standard deviation of the differences found. Based on the standard deviation of 83 data points accuracy of the TSG measurements is equaled 0.02 °C in temperature and 0.02 mSm/cm in conductivity.

We also used SBE 56 as a remote sensor to correct TSG temperature records. SBE 56 was installed near Kingston at the seawater intake to minimize contamination of the surface temperature measurement by the ship own thermal heating. Figure 3 demonstrates temperature difference measured with SBE56 and TSG as a function of temperature. It is clearly seen that water warms up inside of the pipes between 0.06 and 0.1° C.

Each time (during each trip) SBE 21 S/N 3254 data were collected along the ship track starting when the ship left Beagle three miles away from islands Isla Nueva and Islas Hermite. Data acquisition was stopped in Drake Passage on 3rd March. Totally twenty eight tracks were made and ten of them were crossing Drake Passage. Six tracks were made in Scotia Sea along the track the Beagle – Falkland – South Georgia – South Orkneys – Antarctic Peninsula. Twelve short tracks carried out across Bransfield Strait. The data acquisition was stopped each time when the ship arrives at the South Shetlands or at the Antarctic Peninsula.



Figure 4. Thermosalinograph SBE 21 aboard of R/V Akademik Ioffe.

The data processing takes the following steps:

DATCNV Converts the raw data to physical parameters.

WINDOW FILTER cosine filter temperature and conductivity with various window sizes are applied.

DERIVE Computes salinity, sigma-t.

BINAVG Averages into time bins taking into account window filter size applied.

2.4 Echosounding

The bathymetric equipment aboard during RV Akademik Ioffe Cruise 40 consists of an ELAC 12 kHz hydrographic echosounder. Data were collected for most of the cruise simultaneously with TSG and VMADCP data. The hull mounted transducer is located 5.8 metres below the sea surface and this value was entered to estimate the depth.

Depth was indicated on the echosounder display and stored on the PC together with the navigation.

Two files with extension NAV and MET with maximum size 256032 b were created. File name corresponded to GMT time when the file was opened for records.

The data processing takes the following steps:

Removing repeated records with equaled coordinates and depth.

Excluding neighbor records with depth difference more than 300 - 500 m.

Comparison with existing bathymetry (GEBCO, ETOPO, Sandwell/Smith) to eliminate false peaks.

Correction due to sound speed changes across Drake Passage based on the comparison of historical CTD altimeter data and Echosounder records.

2.5 Vessel mounted Acoustic Doppler Current Profiler (VMADCP) OS 38 kHz

The Ocean Surveyor 38 kHz is designed for vessel-mount current profile measurement in the upper ocean water from depths greater than 40-50 meters. The system consists of a transducer and electronics chassis connected to PC.

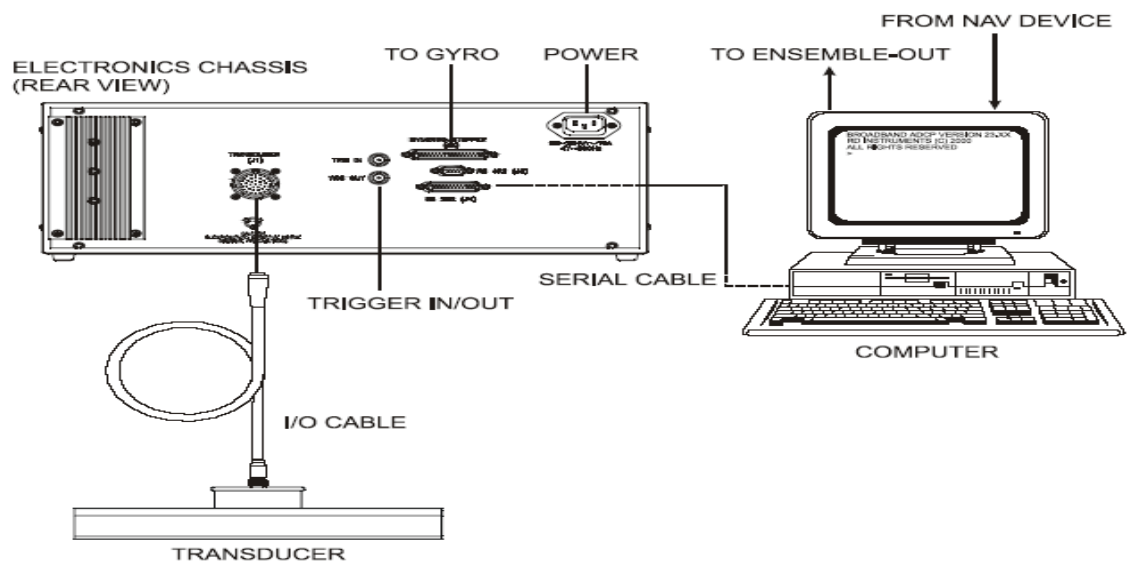


Figure 5. Ocean Surveyor 38kHz Interface Cable Layout.

Data are transmitted in binary format through the I/O cable. GPS data in NMEA format are transmitted separately to another PC COM – port. The VMADCP can operate in two regimes (Narrow Bandwidth and Broad Bandwidth Profiling). Its main specifications are shown below.

To collect OS 38 kHz data we used *VmDas* software (version 1.46). The NMEA messages *VmDas* reads are standard GGA, HDG, HDT, VTG messages.

Table 2

	Bin size	Maximum range	Accuracy (cm/s) ²
NarrowBand (long-range mode)	16 m	800 - 1000 m	30
	24 m	900 - 1200 m	23
BroadBand (high-precision mode)	16 m	520 - 730 m	12

The following configuration file was mainly used to collect the data.

Deep water (>500 m):

NP00001 – Narrow Bandwidth profiling

NN060 – number of bins 60

NS2400 – cell size 24 m

NF1600 - blanking size 16 m

BP000 - disable single-ping bottom track (BP),

Shallow water (<500 m):

WP00001 – Broad Bandwidth profiling

WN045 – number of bins 60

WS1600 – cell size 24 m

WF1600 - blanking size 16 m

BP001 - enable single-ping bottom track (BP),

VmDas saves data in a few files with extension ENX, ENS, ENR (raw data with and without navigation), NR – NMEA messages, STA and LTA averaged data. Misalignment angle equaled 44.59° was introduced in configuration file and was used by VmDas for data correction.

Data processing performed STA files with 40-profile averaging. Taking into account that single ping takes about 3 seconds, one 40-profile ensemble lasts near 120 seconds in Narrow Bandwidth and slightly different time in Broad Bandwidth regime.

Data processing consists of data conversion in NetCDF format with extension NC and further cleaning, filtering, detiding (using barotropic tidal model TPXO 7.2) and averaging. The standard averaging is 1 km. IFREMER software was used to process OS 38 kHz data.

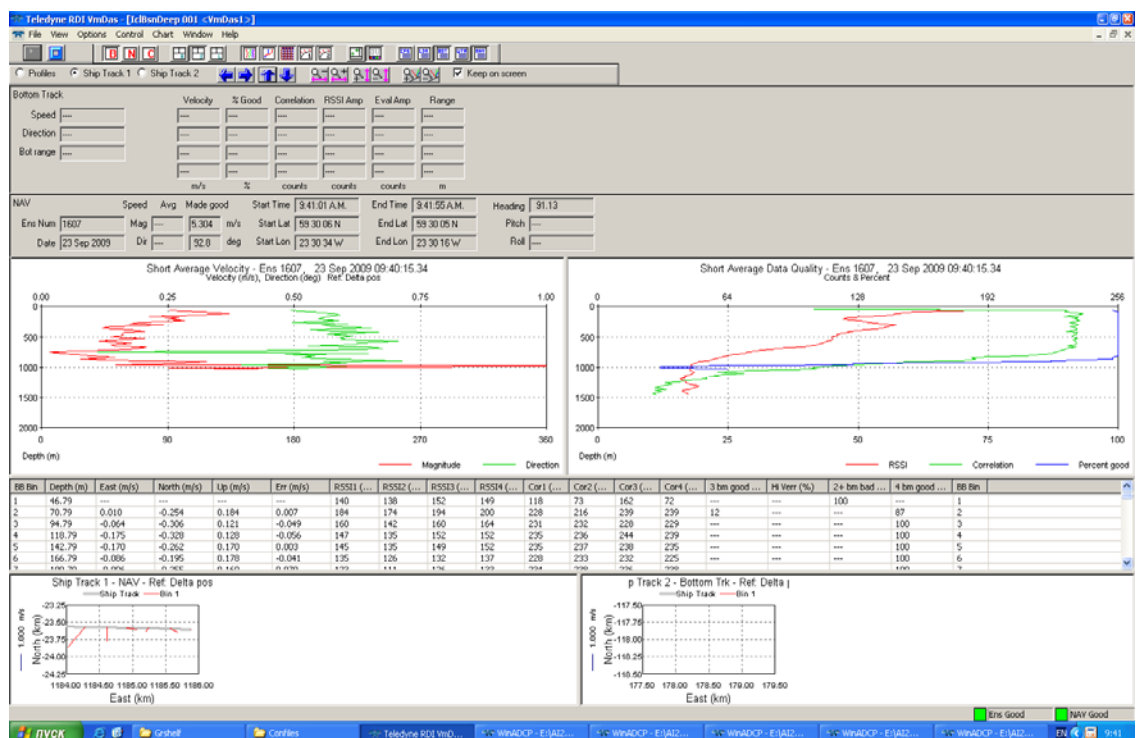


Figure 6. The VM DAS main window.



Figure 7. The WinADCP main window.

3. CRUISE LOGISTICS

Mobilization

Mobilization for the cruise took place when the vessel was in Ushuaia. We had one day to complete all our preparations. When we finished the cruise one day was necessary to pack the equipment when the vessel steamed to Montevideo (Uruguay).

4. Cruise Diary (GMT)

Sa 8.12.12

1800 Depart Ushuaia, start the 1st track to Melchior I., H=54 m

Su 9.12.12

0300 Begin TSG logging 55°12.8 S, 66°20.7 W, PC time synchronization

0306 Begin Echosounder logging 55°11.9 S, 66°21.1 W, PC time synchronization

0310 Begin logging ADCP data (BB regime, BT) 55°11.9 S, 66°21.1 W, PC time synchronization

0617 Restart logging ADCP data (NB regime) 55°50.4 S, 66°09.75 W, PC time synchronization

Mo 10.12.12

1837 Restart logging ADCP data (BB regime) 63°03.4 S, 63°35.2 W

Tu 11.12.12

0346 ADCP, TSG and Echosounder are turned off, **end of the 1st track**

64° 14.7 S, 63°06.5 W, H=311 m, Track length = 551 nm

Sa 15.12.12

0145 **Start the 2nd track in Bransfield St. (Trinity I. – Robert I., H=120 m**

0145 Begin TSG logging 63°44.5 S, 61°06.3 W

0155 Begin Echosounder logging

0200 Begin ADCP logging (NB regime, cell size 16 m)

1100 Stop ADCP logging

1100 Stop Echosounder logging

1105 Stop TSG logging, **end of the 2nd track** 62°27.3 S, 59°22.0 W, H=113 m, Track length = 91 nm

Su 16.12.12

0019 **Start the 3rd track S. Schetlands (Nelson I) – Cape Horn** 62°07.4 S, 59°30.4 W, H=76 m

0019 PC time synchronization, begin TSG logging

0025 Begin Echosounder logging

0030 Begin ADCP logging (NB regime, cell size 24 m), PC time synchronization

0040 Remove air bubbles from TSG tank

1644 Reboot Data PC, no connection to ELAC server

1655 Stop TSG logging to clean conductivity sensor

1747 PC time synchronization, begin TSG logging

1939 Restore connection between Data PC and ELAC server

Mo 17.12.12

1020 Restart logging ADCP data (NB regime, cell size 16 m) 56°31.7 S, 66°58.5 W, H=533 m

1105 ELAC server turned off because of the power supply unit problem

1155 Restart Echosounder logging

1430 Stop ADCP logging

1430 Stop Echosounder and ADCP logging

1434 Stop TSG logging, **end of the 3rd track** 56°04.2 S, 67°21.1 W, H=93 m,

Track length = 436 nm

We 19.12.12

0518 **Start the 4th track from Nueva I. to Nelson I. (South Schetlands Is.), 55°16.6 S, 66°16.0 W, H=74 m**

0518 PC time synchronization, begin TSG logging

0525 Begin Echosounder logging

0530 Begin ADCP logging (NB regime)

Th 20.12.12

1210 Data PC monitor is out of range, replaced by new one

2330 Restart logging ADCP data (NB regime, cell size 16 m) 61°50.8 S, 59°46.7 W, H=528 m

Fr 21.12.12

0310 Stop ADCP and Echosounder logging

0315 Stop TSG logging, **end of the 4th track, 62°07.8 S, 59°27.9 W**

H=76 m, Track length = 464 nm

2308 **Start the 5th track in Bransfield St. from Deception I. to Gourdin I., 62°59.6 S, 60°30.9 W, H=80 m**

2308 PC time synchronization, begin TSG logging

2308 Start Echosounder logging

2330 Begin ADCP logging (NB regime, cell size 16 m)

Sa 22.12.12

1005 Stop ADCP and Echosounder logging

1015 Stop TSG logging, **end of the 5th track, 63°06.5 S, 57°21.0 W, H=103 m,**

Track length = 86 nm

Mo 24.12.12

0157-0220 **Start the 6th track in Bransfield St. from Bransfield I. to King George I, begin data logging (NB regime), 63°09.6 S, 56°59.5 W, H=123 m**

1912-1917 Stop the data logging, **end of the 6th track, 61°32.0 S, 57°20.5 W H=449 m,**
Meet ice field, Track length = 141 nm

Tu 25.12.12

1656-1707 **Start the 7th track from Elephant (Mordvinova) I. to Falkland Is, start data logging (NB regime) 60°46.1 S, 54°52.7 W, H=3000 m, start to move in ice**

Th 27.12.12

0040 Restart logging ADCP data (NB regime, cell size 16 m) 54°48.7 S, 61°02.4 W, H=627 m

0256-0920 No connection between Data PC and ELAC server

0911-0915 Stop TSG records restart TSG logging

Fr 28.12.12

0300-0305 Stop the data logging, **end of the 7th track, 51°50.5 S, 61°30.0 W, H=131 m**

Track length = 593 nm

Su 30.12.12

2320-2330 **Start the 8th track from Falkland Is. to King Haakon Bay (South Georgia).**,
begin data logging (NB regime, cell size 16 m)
52°22.8 S, 58°32.3 W, H=108 m

Mo 31.12.12

0441 Restart ADCP logging (NB regime) 52°29.2 S, 56°55.7 W, H=817 m

Tu 01.01.13

2130 Restart ADCP logging (NB regime, cell size 16 m) 52°29.2 S, 56°55.7 W, H=817 m

We 02.01.13

1310-0407 **End of the 8th track**, stop data logging, 54°11.8 S, 37°32.6 W, H=195 m
No SBE56 data
The track length = 767 nm

Su 06.01.13

2320-2330 **Start the 9th track from Cooper I. (South Georgia) to Elephant (Mordvinova) I.**, 54°51.4 S, 35°40.0 W, H=83 m

Mo 07.01.13

0225 Restart the ADCP logging (NB regime, cell size 24 m) 55°18.5 S, 36°24.4 W, H=1221 m
2127-2135 Reboot Data PC, restart TSG logging, back up UPS out of range, UPS replacing

We 09.01.13

1545-1547 **End of the 9th track**, stop data logging, 61°04.5 S, 54°51.9 W, H=138,
The track length = 767 nm

Th 10.01.13

2306-2335 **Start the 10th track from Gibbs I. to King George I.**; begin data logging, PC time synchronization, 61°28.9 S, 55°19.8 W, H=340 m,
1200-1205 Stop data logging, **end of the 10th track**, 62°04.6 S, 57°37.3 W, H=116 m, The track length = 116 nm

Fr 11.01.13

2322-2340 **Start the 11th track from King George I. to Bransfield I.** 62°10.6 S, 58°23.6 W, H=522 m,
Begin data logging (NB regime, cell size 16 m)

Sa 12.01.13

1100-1103 Stop data logging, **End of the 11th track** 63°10.3 S, 57°05.1 W, H=92 m,
The track length = 91 nm

2351-0000 **Start the 12th track in Bransfield St. from Bransfield I. to Deception I.**

63°12.6 S 57°02.9 W, H=279 m
Start data logging (NB regime, cell size 16 m)

Su 13.01.13

0933-1200 Stop TSG logging, cleaning because of low salinity records due to algae

0933-0936 **End of the 12th track**, stop data logging 62°59.6 S 60°30.3 W H=40 m
The track length = 97 nm

2100-2130 **Start the 13th track in Bransfield St. from Deception I. to Trinity I.** 62°59.8 S
60°30.8 W,
H=35 m, Start data logging (NB regime, cell size 16 m)

Mo 14.01.13

0001 Data PC rebooting, Network problem

0310-0320 **End of the 13th track**, stop data logging 63°59.6 S 61°18.5 W, H=334 m
The track length = 63 nm

We 16.01.13

0715-0730 **Start the 14th track in Bransfield St. from Trinity I. to Livingston I.** 63°45.4 S
61°06.5 W, H=146 m

Start data logging (NB regime, cell size 16 m)

0945 no power in wall outlets, stop data logging

1025 Start Echosounder logging

1030 Start ADCP logging (no heading from GPS)

1035 Start TSG logging

1035-1530 Restore GPS default set up, no heading data

1300-1305 stop data logging **End of the 14th track** 63°59.6 S 61°18.5 W, H=197 m
The track length = 66 nm

Th 17.01.13

0115-0130 **Start the 15th track in Drake Passage from Smith I. (South Shetlands Is.) to Cape Horn** 62°56.7 S 61°55.9 W H=853 m, begin data logging (NB regime)

1700 no GPS data on ELAC server

1750 Restart Data PC and TSG logging

1800 no GPS data on ELAC server

1812 Restart Data PC and TSG logging

1825 Restart Echosounder logging

Fr 18.01.13

1330-1345 Stop data logging, **End of the 15th track** 56°04.5 S 67°22.7 W, H=94 m
The track length = 444 nm

Su 20.01.13

0415-0430 **Start the 16th track in Drake Passage from Nueva I. to Nelson I. (South Shetlands Is.)** 55°12.2 S, 66°21.0 W

H=42 m, begin data logging (NB regime, cell size 16 m)

0645 Restart ADCP logging (NB regime, cell size 24 m)

Mo 21.01.13

1601-1613 Restart TSG logging

1613 no GPS data on ELAC server, Data PC rebooting, restart Echosounder logging

Tu 22.01.13

0000-0005 **End of the 16th track**, stop data logging 62°07.0 S 59°29.2 W, H=89 m

The track length = 466 nm

We 23.01.13

2203-2215 **Start the 17th track in Bransfield St. from Deception I. to Trinity I.** 62°59.5 S, 60°27.2 W

H=442 m Begin data logging (NB regime, cell size 16m)

Th 24.01.13

0205-0210 **End of the 17th track**, stop data logging 63°45.7 S 61°07.6 W H=146 m

The track length = 50 nm

Mo 28.01.13

2000-2015 **Start the 18th track in Bransfield St. from Trinity I. to Nelson I.** begin data logging (NB regime cell size 16 m) 63°46.1 S 61°07.5 W H=319 m

Tu 29.01.13

0330-0335 **End of the 18th track**, stop data logging (NB regime) 62°22.4 S 59°13.6 W, H=212 m, the track length = 98 nm

0438-0445 **Start the 19th track in Drake Passage (Nelson I. – Nueva I.)** begin data logging (NB regime, cell size 24 m) 62°56.7 S 61°55.9 W H=853 m

1600 Increasing to rough seas and heavy cross swell

We 30.01.13

0100-0518 no GPS data on ADCP PC, stop ADCP data logging, very rough seas and very heavy cross swell

0600 Restart TSG logging

1000 GPS cable breakdown identification

1047 Restart ADCP logging (NB regime), rough seas slightly decreasing

Th 31.01.13

0000-0005 **End of the 19th track**, stop data logging 55°20.2 S 66°17.2 W, H=84 m

The track length = 474 nm

Fr 01.02.13

0815-0825 **Start the 20th track from Estados Is. to Falkland Is.** begin data logging (NB regime cell size 16 m) 54°40.2 S 64°50.2 W H=87 m

Sa 02.02.13

0530-0540 **End of the 20th track**, stop data logging 51°42.9 S 61°29.2 W, H=118 m

The track length = 214 nm

Mo 04.02.13

0100-0110 **Start the 21st track between Falkland Is. and West coast South Georgia** 51°40.4 S 57°34.2 W,

H=82 begin data logging (NB regime cell size 24 m)

1200 Increasing to rough seas

Tu 05.02.13

1200 decreasing to slight seas

1355-1407 Restart ELAC server

1401 Reboot Data PC
1407 Restart TSG logging

We 06.02.13

1430-1435 **End of the 21st track**, stop data logging 53°52.1 S 37°53.9 W, H=214 m
The track length = 737 nm

Fr 08.02.13

2010-0220 **Start the 22nd track between Cooper I. (South Georgia) and Laurie I. (South Orkneys)**, begin data logging (NB regime) 54°51.1 S 35°52.8 W, H=119 m

Su 10.02.13

1030-1035 **End of the 22nd track**, stop data logging 60°46.9 S 44°21.0 W, H=188 m
The track length = 446 nm

1646-1700 **Start the 23rd track between S Orkney Is. and Elephant (Mordvinova) I.**, begin data logging (NB regime) 60°50.5 S 44°45.8 W, H=188 m
2000 Moderate ice field

Mo 11.02.13

1336 Reboot Data PC
1345 Restart TSG logging
2000 Moderate ice field

Tu 12.02.13

1840-1845 **End of the 23rd track**, stop data logging 61°04.4 S 54°51.9 W, H=139 m
The track length = 477 nm

Th 14.02.13

0141-0200 **Start the 24st track in Bransfield St. between Deception I. and Trinity I.**, begin data logging (BB regime) 63°00.0 S 60°30.6 W, H=152 m

0740 -0745 **End of the 24th track**, stop data logging 63°42.5 S 61°06.4 W, H=127 m
The track length = 48 nm

Fr 15.02.13

2305 -2310 **Start the 25th track in Drake Passage between Melchior I. and Cape Horn - Evout I.**, begin data logging (NB regime) 64°15.0 S 63°06.1 W, H=308 m
0715 Restart ADCP logging (NB regime)

Su 17.02.13

1640 Restart ADCP logging (BB regime BT)
2222-2230 **End of the 25th track**, stop data logging 55°34.1 S 66°32.2 W, H=73 m
The track length = 549 nm

Tu 19.02.13

1140-1145 **Start the 26th track in Drake Passage between Nueva I. and Marguerite Bay**, begin data logging (NB regime) 55°10.9 S 66°20.6 W, H=45 m
1200-0000 Increasing heavy seas

We 20.02.13

0500-1600 Decreasing rough seas
 1810 Rebooting of Data PC
 1956 Restart TSG logging

Fr 22.02.13

0145 Restart ADCP logging (NB regime)
 1355 No TSG data, power cable break off
 1515-1520 **End of the 26th track**, stop data logging 68°11.3 S 69°23.4 W, H=689 m
 The track length = 789 nm

Th 28.02.13

0520-0540 **Start the 27th track in Bransfield St. between Trinity I. and Deception I.**, begin data logging (NB regime, cell size 16 m) 63°45.1 S 61°06.2 W, H=127 m

1125-1135 **End of the 27th track**, stop data logging 63°00.4 S 60°29.0 W, H=330 m
 The track length = 48 nm

Fr 01.03.13

0000-0010 **Start the 28th track in Drake Passage between Nelson I. (South Schetlands Is.) and Cape Horn**, begin data logging (NB regime) 62°08.5 S 59°28.9 W, H=70 m
 2157 the Echosounder PC power off
 2357 Restart TSG logging
 2357 Rebooting of Data PC

Sa 02.03.13

0005 Restart ELAC server
 1300-1305 **End of the 28th track**, stop data logging 56°04.7 S 67°25.0 W, H=90 m
 The track length = 438 nm

5. ACKNOWLEDGEMENTS

The principal scientists would like to thank the Master, officers and crew of the RV Akademik Ioffe for making this such an enjoyable, as well as successful cruise.

FIGURES

Fig. 8. Correlation, echo intensity and percent good of the processed VMADCP data during the third track between Nelson I. and Cape Horn in Drake Passage (16-17 December 2012).

Fig. 9. Processed U and V components of the ADCP during the third track between Nelson I. and Cape Horn in Drake Passage (16-17 December 2012).

Fig. 10. Correlation, echo intensity and percent good of the processed VMADCP data during the fourth track between Nueva I. and S. Shetland Is. in Drake Passage (19-21 December 2012).

Fig. 11. Processed U and V components of the ADCP during the fourth track between Nueva I. and S. Shetland Is. in Drake Passage (19-21 December 2012).

Fig. 12. Correlation, echo intensity and percent good of the processed VMADCP data during the twelfth track between Nueva I. and Melchior I. in Drake Passage (19-21 December 2011).

Fig. 13. Processed U and V components of the ADCP during the twelfth track between Nueva I. and Melchior I. in Drake Passage (19-21 December 2011).

Fig. 14. Correlation, echo intensity and percent good of the processed VMADCP data during the eighth track between Estados Is. and Falkland Is. (01 -02 January 2013).

Fig. 15. Processed U and V components of the ADCP during the eighth track between Estados Is. and Falkland Is. (01 -02 January 2013). Noisy data at the bottom of the northern slope will be removed.

Fig. 16. Correlation, echo intensity and percent good of the processed VMADCP data during the fifteenth track between Smith I. and Cape Horn in Drake Passage (17-18 January 2013).

Fig. 17. Processed U and V components of the ADCP during the the fifteenth track between Smith I. and Cape Horn in Drake Passage (17-18 January 2013).

Fig. 18. Correlation, echo intensity and percent good of the processed VMADCP data during the twenty fifth track between Melchior I. – Cape Horn and Evout I. in Drake Passage (15-17 February 2013, the fresh weather).

Fig. 19. Processed U and V components of the ADCP during the twenty fifth track between Melchior I. – Cape Horn and Evout I. in Drake Passage (15-17 February 2013, the fresh weather).

Fig. 20. Correlation, echo intensity and percent good of the processed VMADCP data during the twenty sixth track north of the Marguerite Bay (22 February 2013).

Fig. 21. Processed U and V components of the ADCP during the twenty sixth track north of the Marguerite Bay (22 February 2013). Noisy data at the surface and at the bottom will be removed.

Fig. 22. Correlation, echo intensity and percent good of the processed VMADCP data during the twenty eighth track north between Robert I. and Cape Horn (01-02 March 2013).

Fig. 23. Processed U and V components of the ADCP during the twenty eighth track north between Robert I. and Cape Horn (01-02 March 2013).

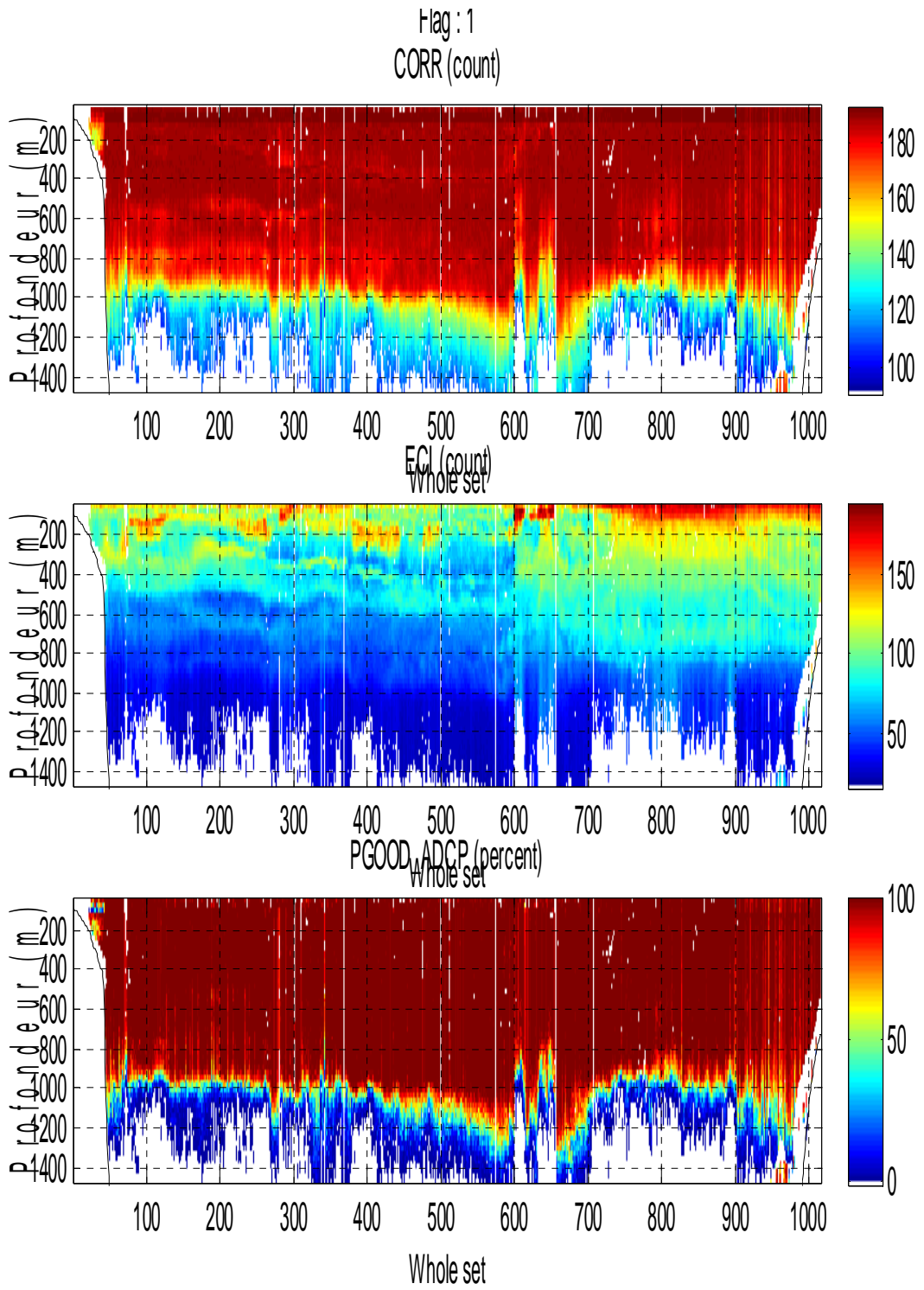


Figure 8. Correlation, echo intensity and percent good of the processed VMADCP data during the third track between Nelson I. and Cape Horn in Drake Passage (16-17 December 2012).

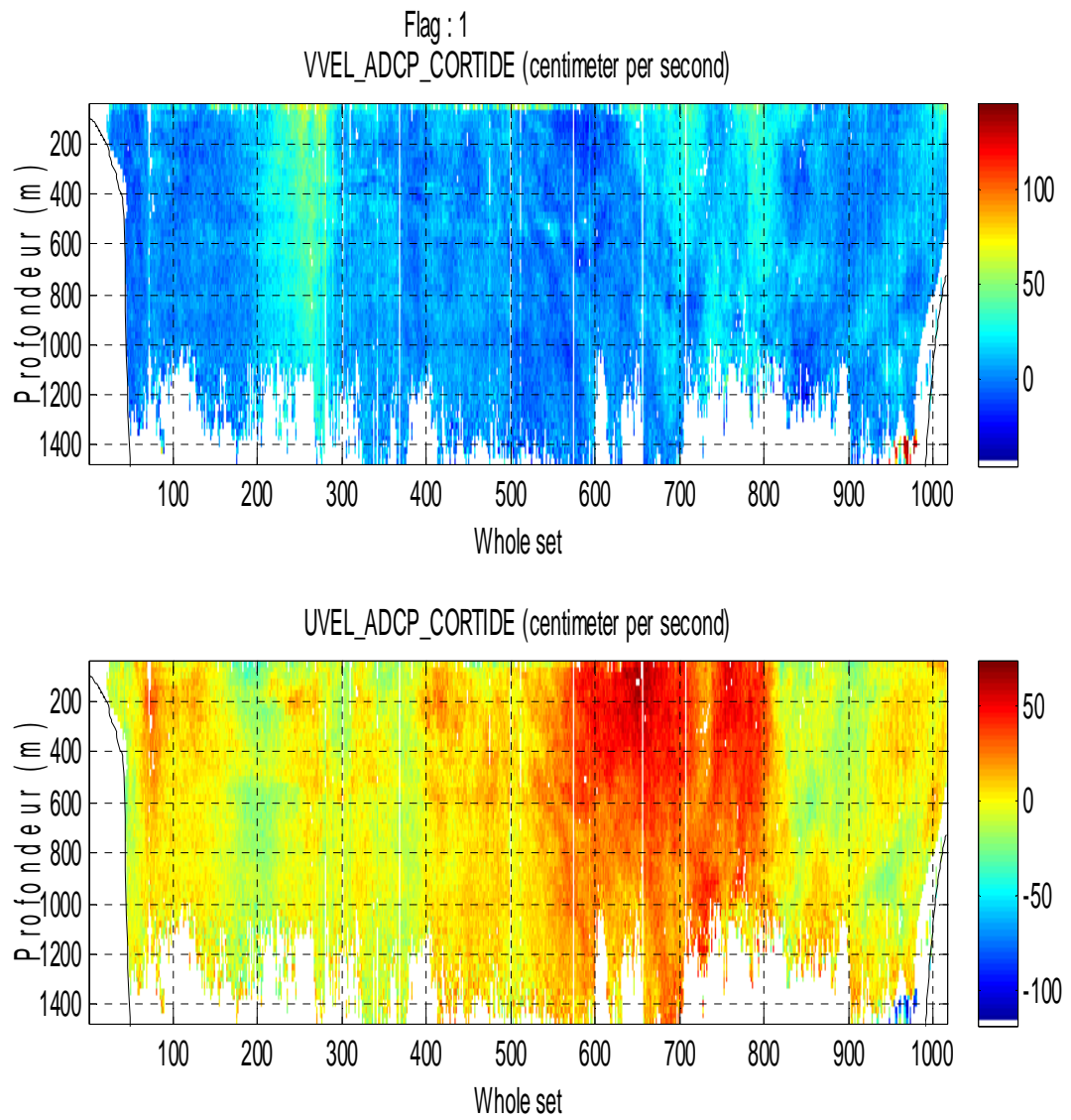


Figure 9. Processed U and V components of the ADCP during the third track between Nelson I. and Cape Horn in Drake Passage (16-17 December 2012).

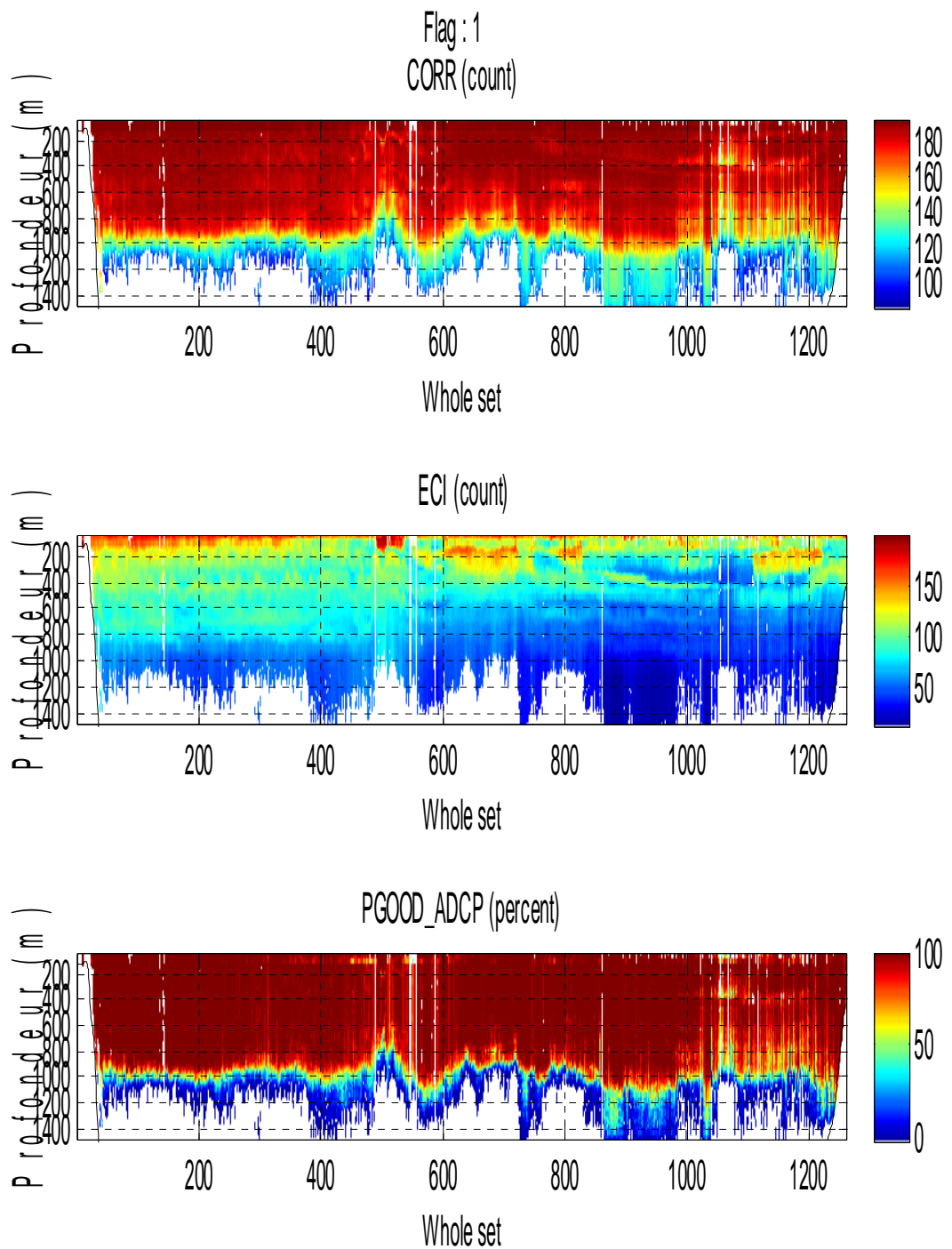


Figure 10. Correlation, echo intensity and percent good of the processed VMADCP data during the fourth track between Nueva I. and S. Shetland Is. in Drake Passage (19-21 December 2012).

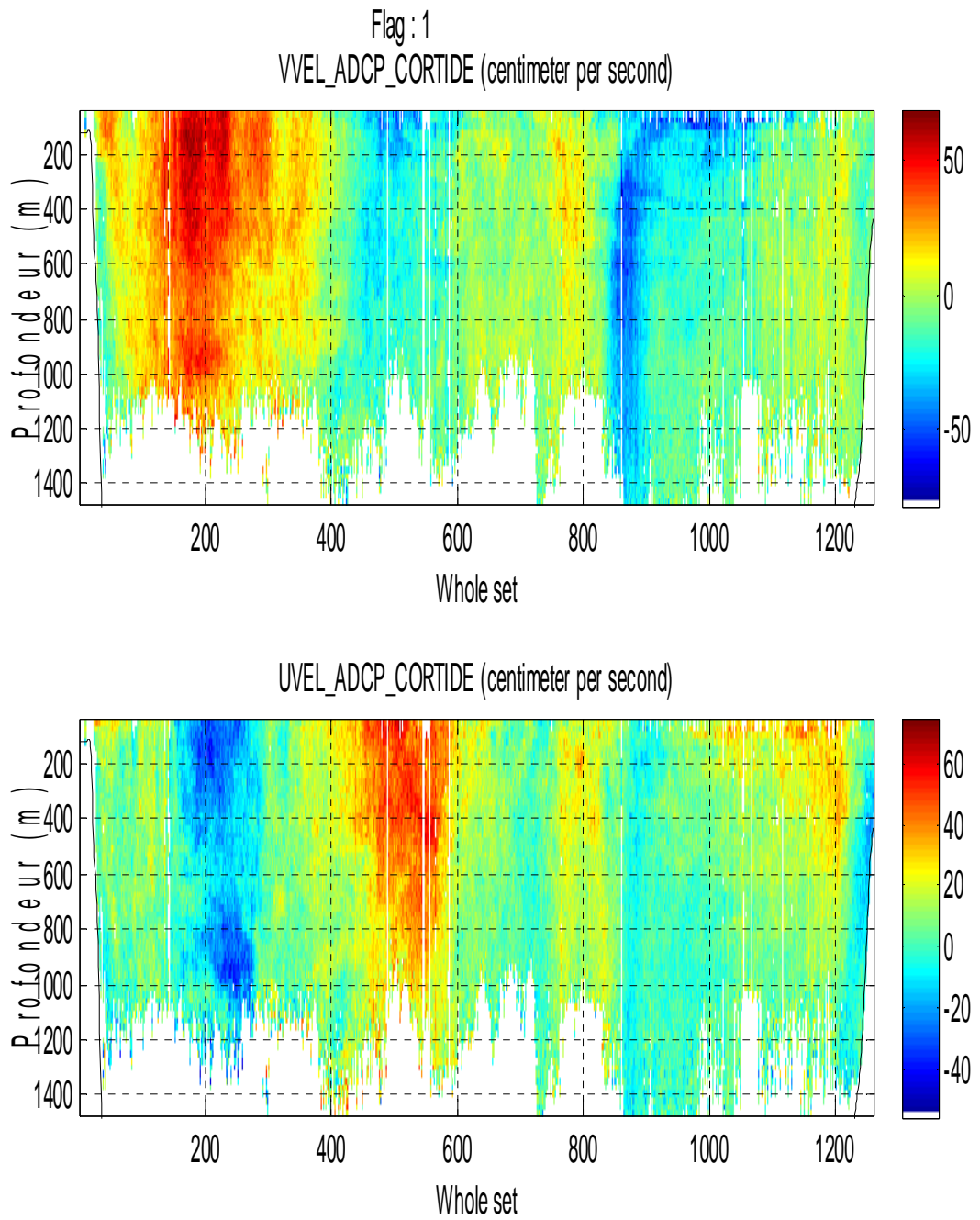


Figure 11. Processed U and V components of the ADCP during the fourth track between Nueva I. and S. Shetland Is. in Drake Passage (19-21 December 2012).

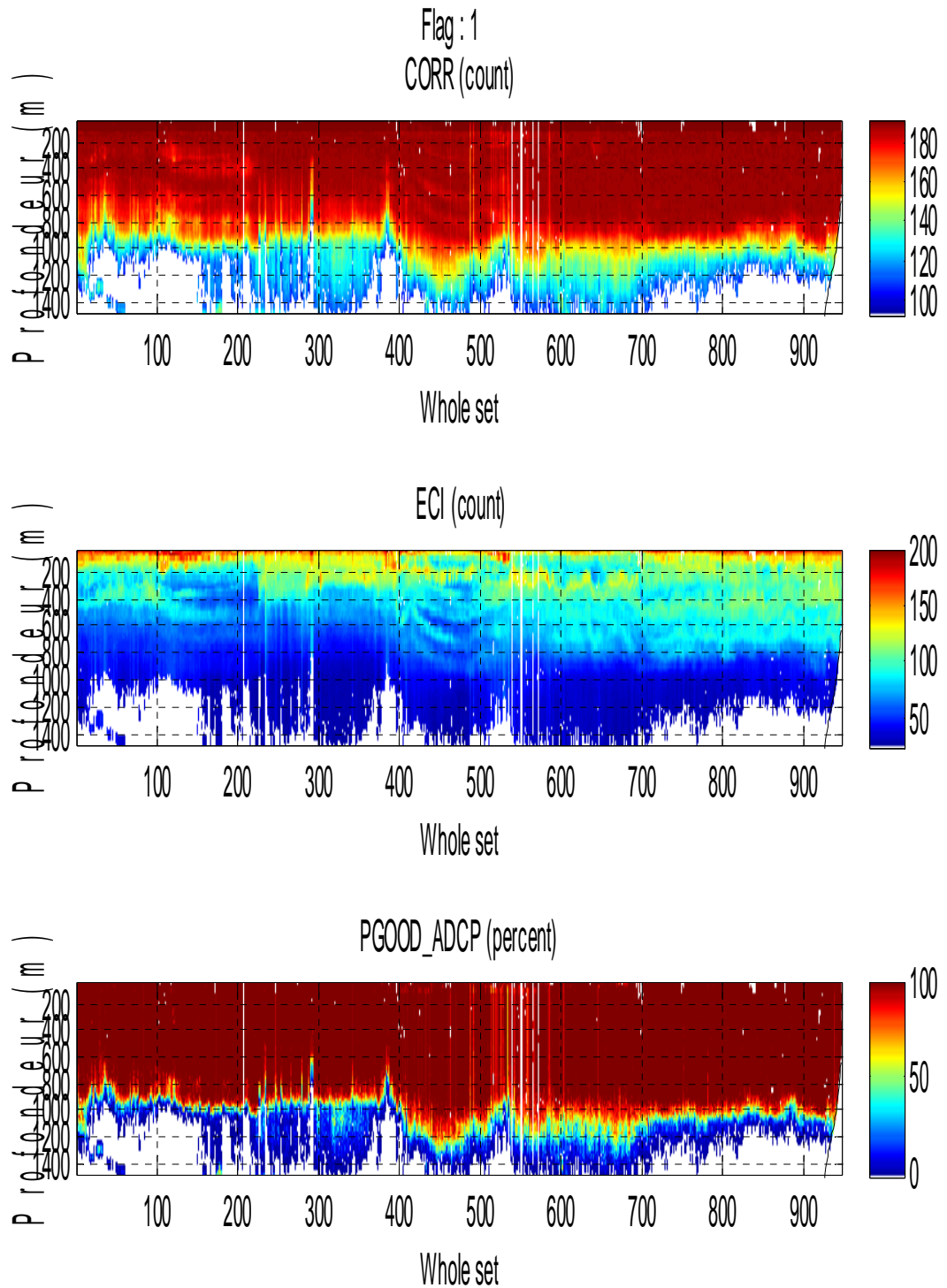


Figure 12. Correlation, echo intensity and percent good of the processed VMADCP data during the seventh track between Elephant I. and Estados Is. in Drake Passage (25-28 December 2012).

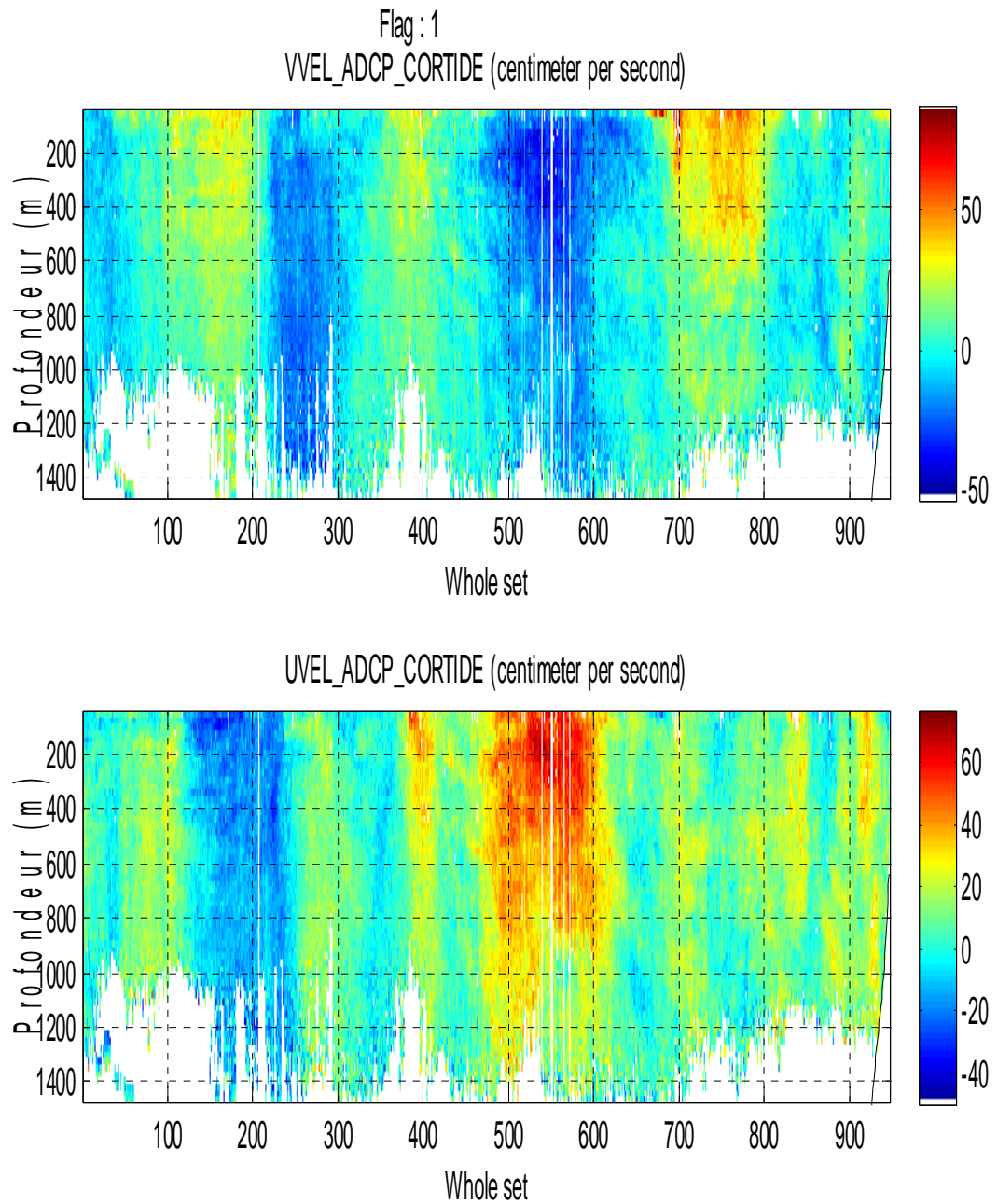


Figure 13. Processed U and V components of the ADCP during the seventh track between Elephant I. and Estados Is. in Drake Passage (25-28 December 2012).

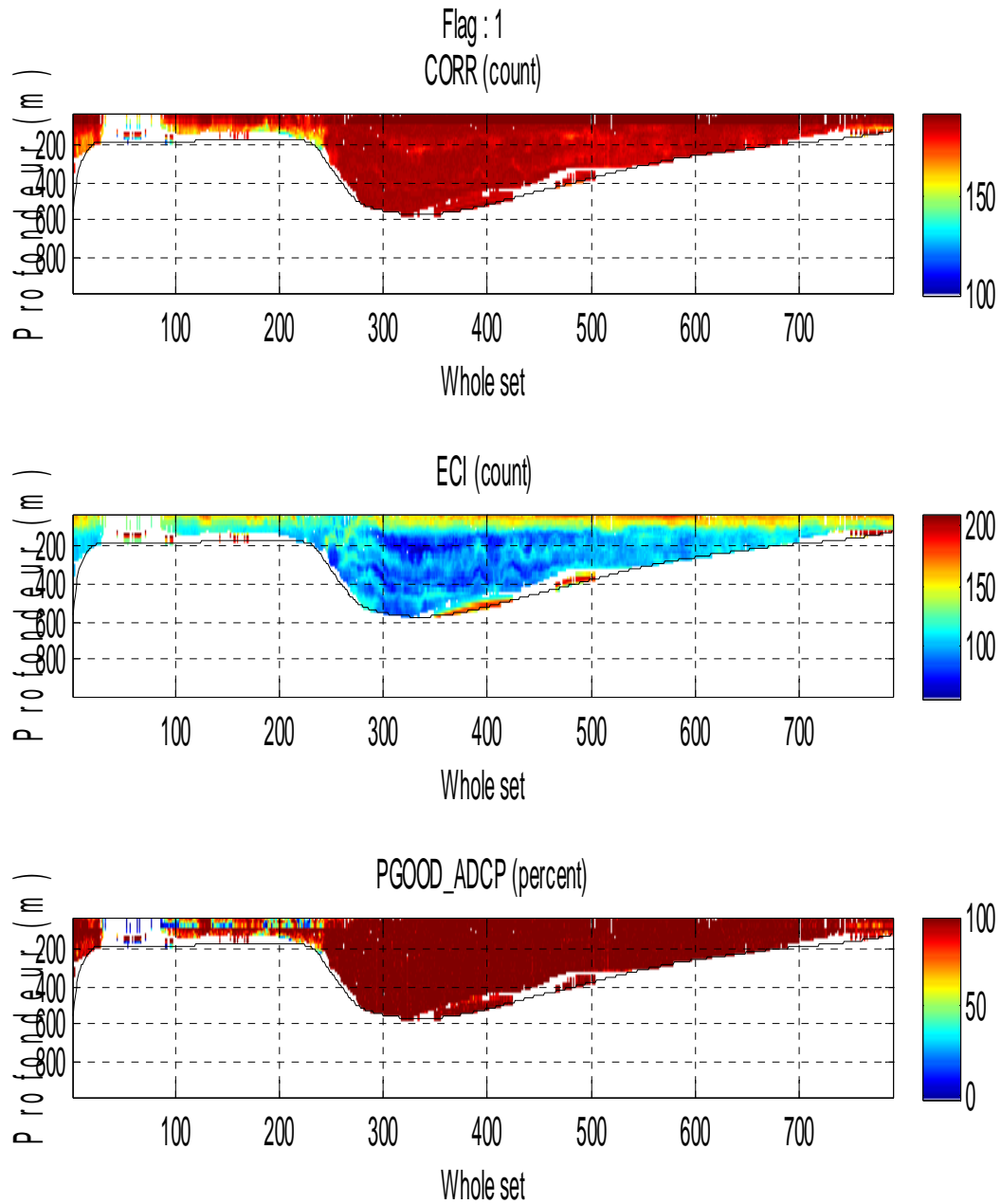


Figure 14. Correlation, echo intensity and percent good of the processed VMADCP data during the eighth track between Estados Is. and Falkland Is. (01 -02 January 2013).

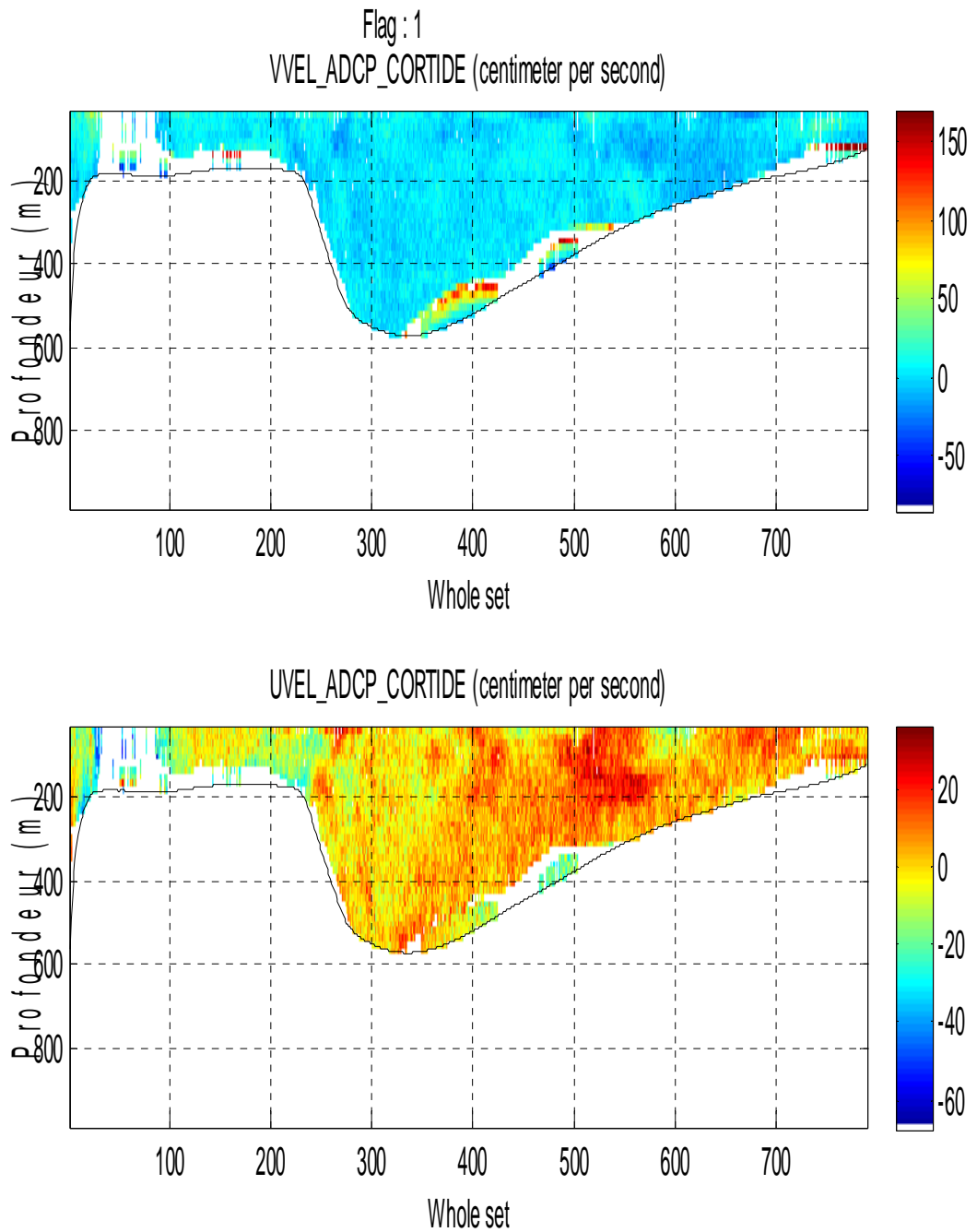


Figure 15. Processed U and V components of the ADCP during the eighth track between Estados Is. and Falkland Is. (01 -02 January 2013). Noisy data at the bottom of the northern slope will be removed.

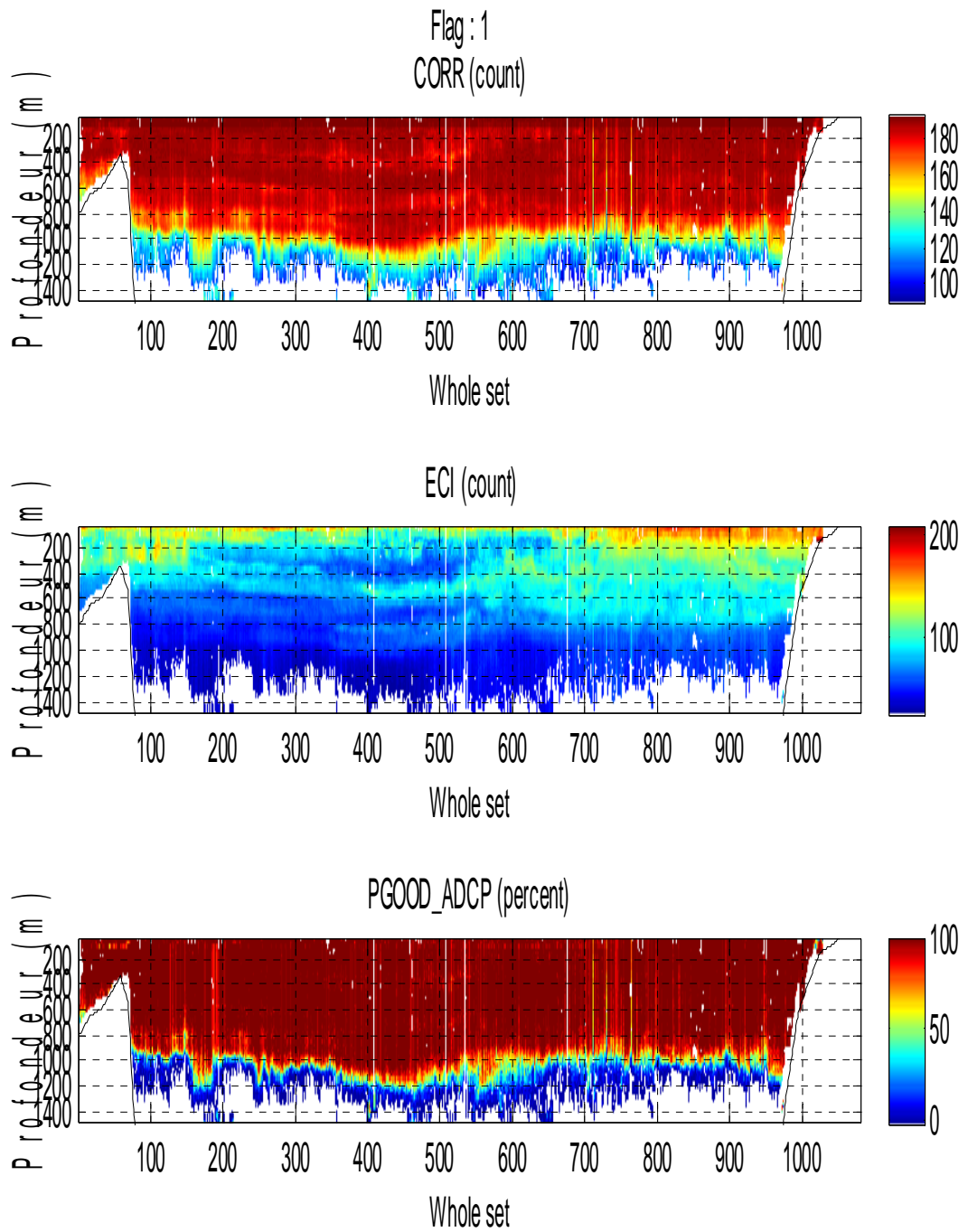


Figure 16. Correlation, echo intensity and percent good of the processed VMADCP data during the fifteenth track between Smith I. and Cape Horn in Drake Passage (17-18 January 2013).

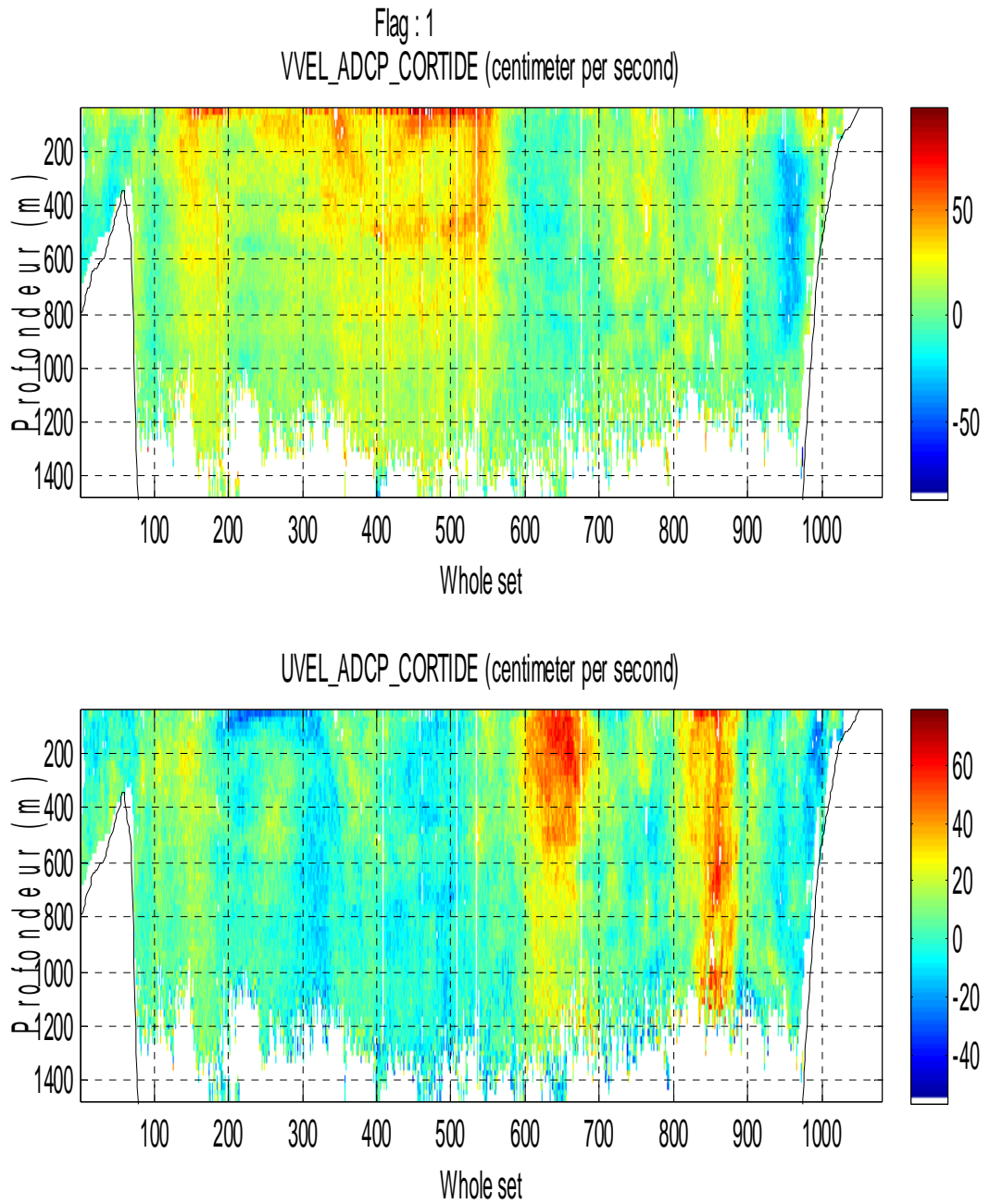


Figure 17. Processed U and V components of the ADCP during the the fifteenth track between Smith I. and Cape Horn in Drake Passage (17-18 January 2013).

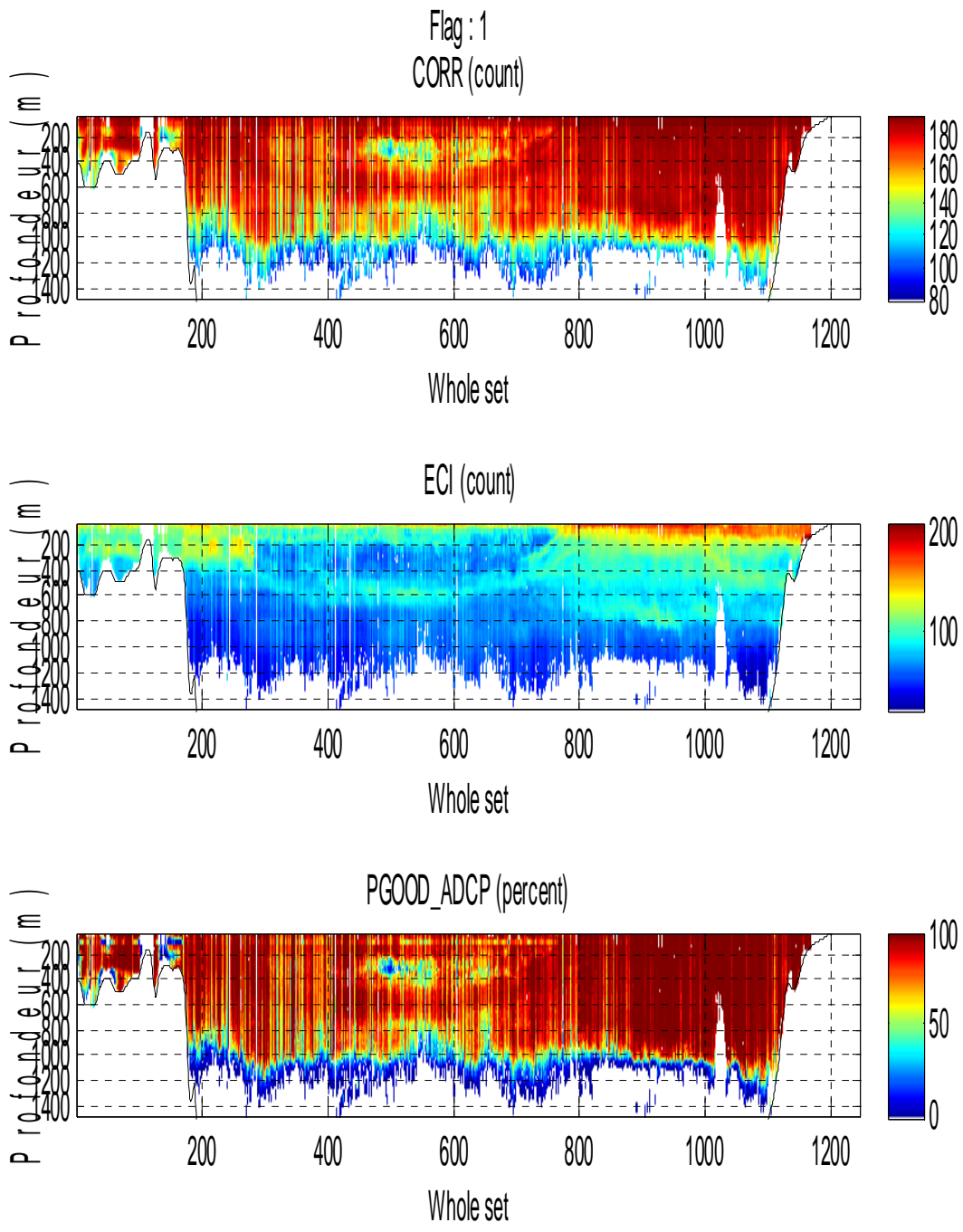


Figure 18. Correlation, echo intensity and percent good of the processed VMADCP data during the twenty fifth track between Melchior I. – Cape Horn and Evout I. in Drake Passage (15-17 February 2013, the fresh weather).

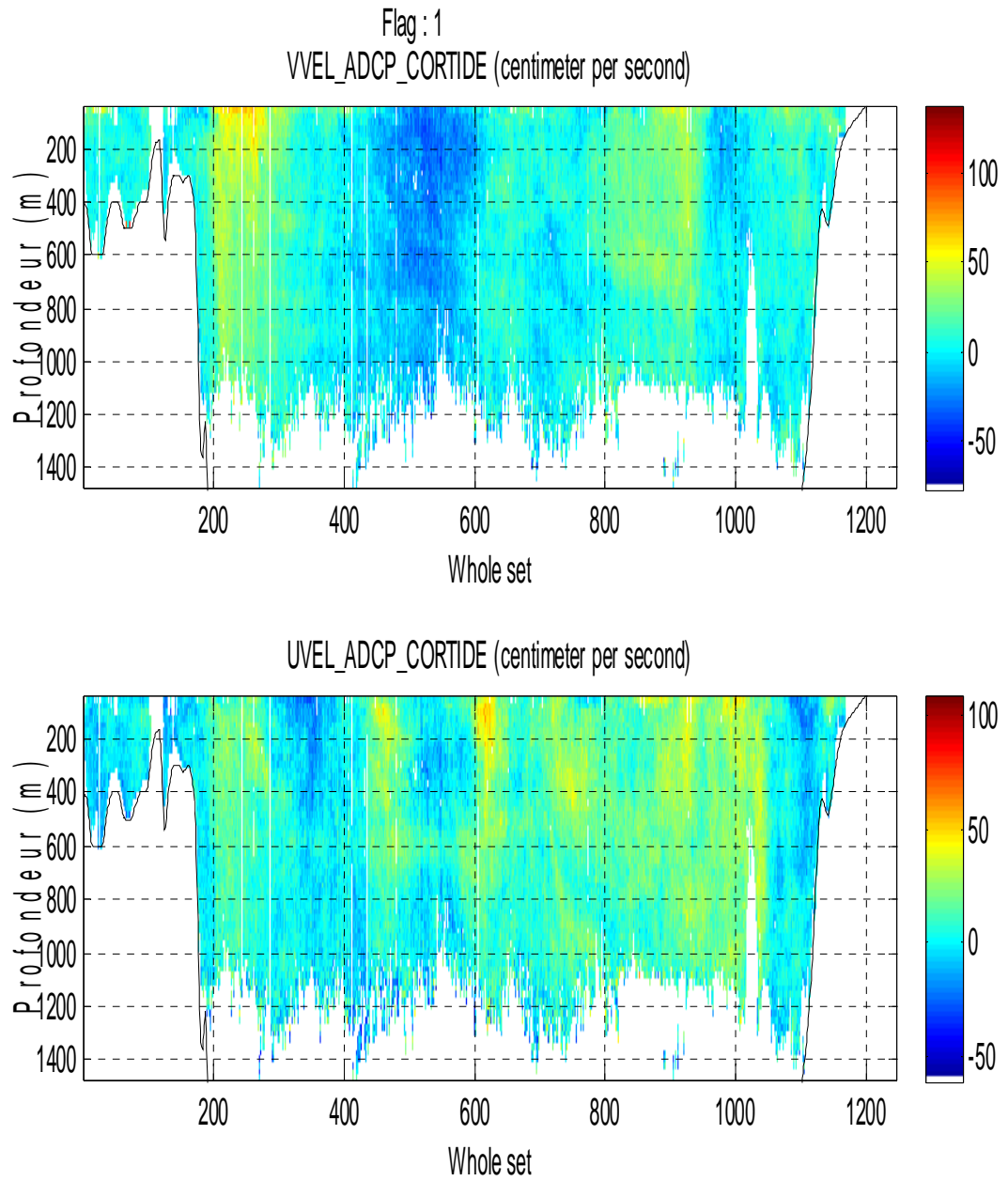


Figure 19. Processed U and V components of the ADCP during the twenty fifth track between Melchior I. – Cape Horn and Evout I. in Drake Passage (15-17 February 2013, the fresh weather).

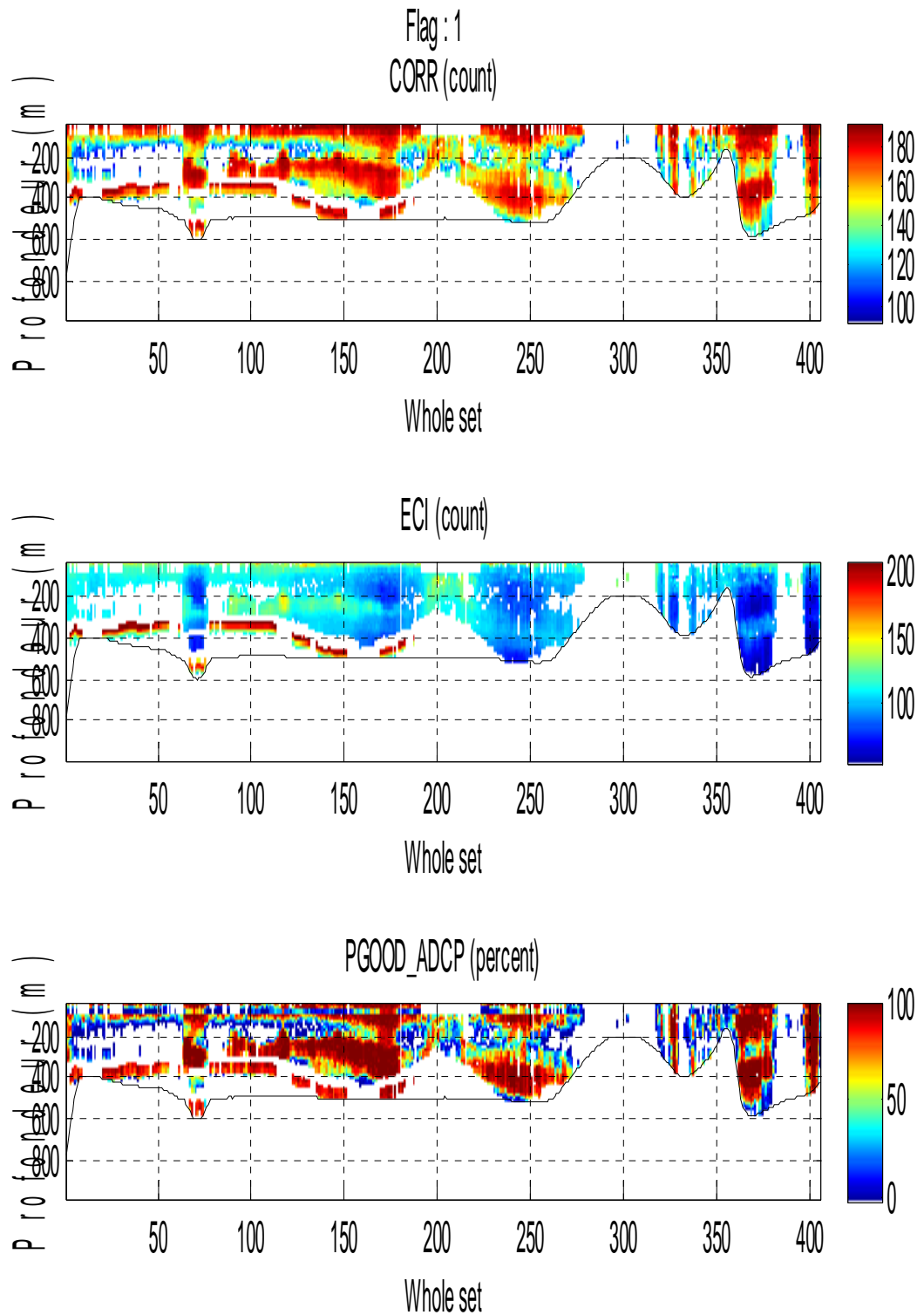


Figure 20. Correlation, echo intensity and percent good of the processed VMADCP data during the twenty sixth track north of the Marguerite Bay (22 February 2013).

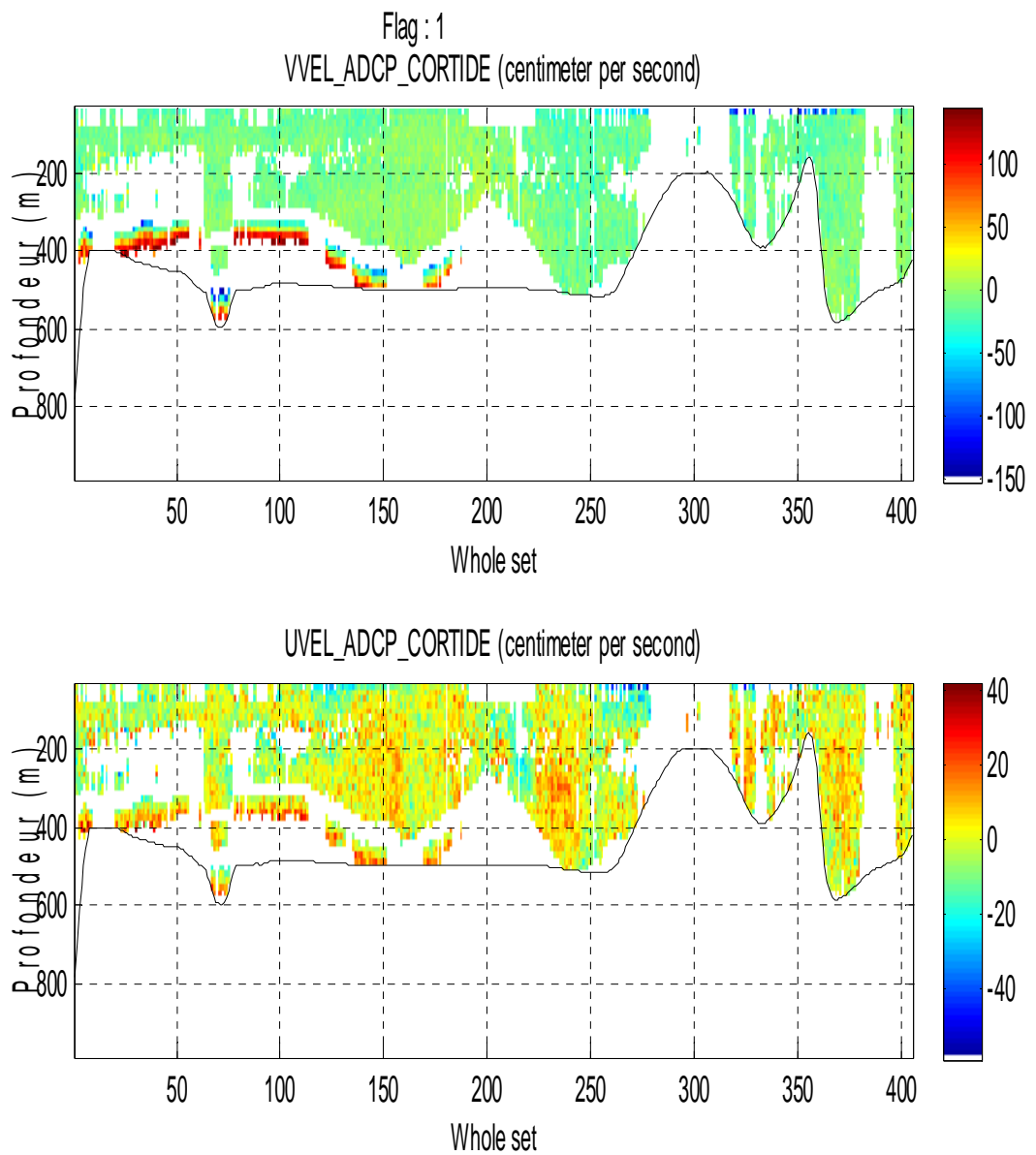


Figure 21. Processed U and V components of the ADCP during the twenty sixth track north of the Marguerite Bay (22 February 2013). Noisy data at the surface and at the bottom will be removed.

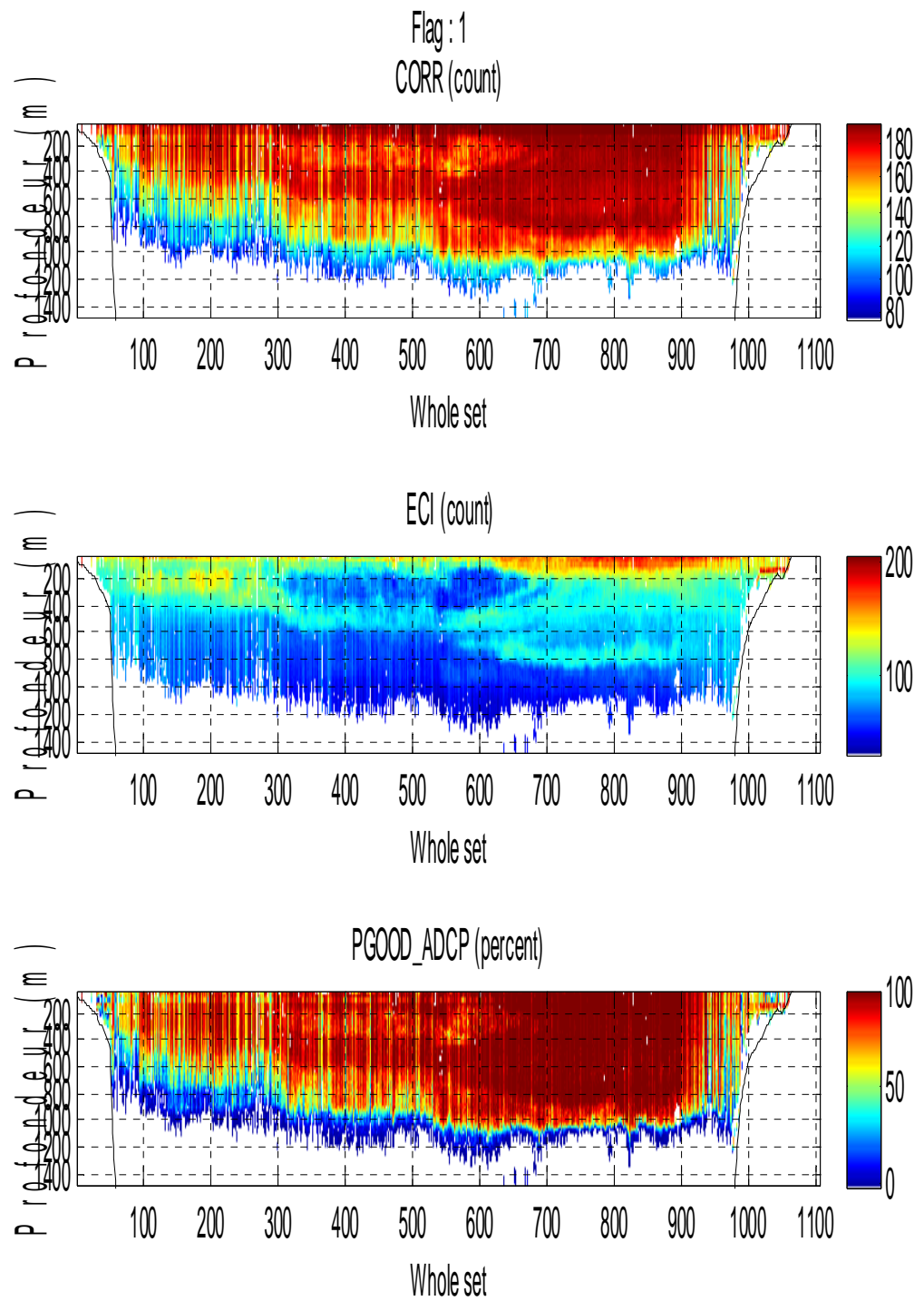


Figure 22. Correlation, echo intensity and percent good of the processed VMADCP data during the twenty eighth track north between Robert I. and Cape Horn (01-02 March 2013).

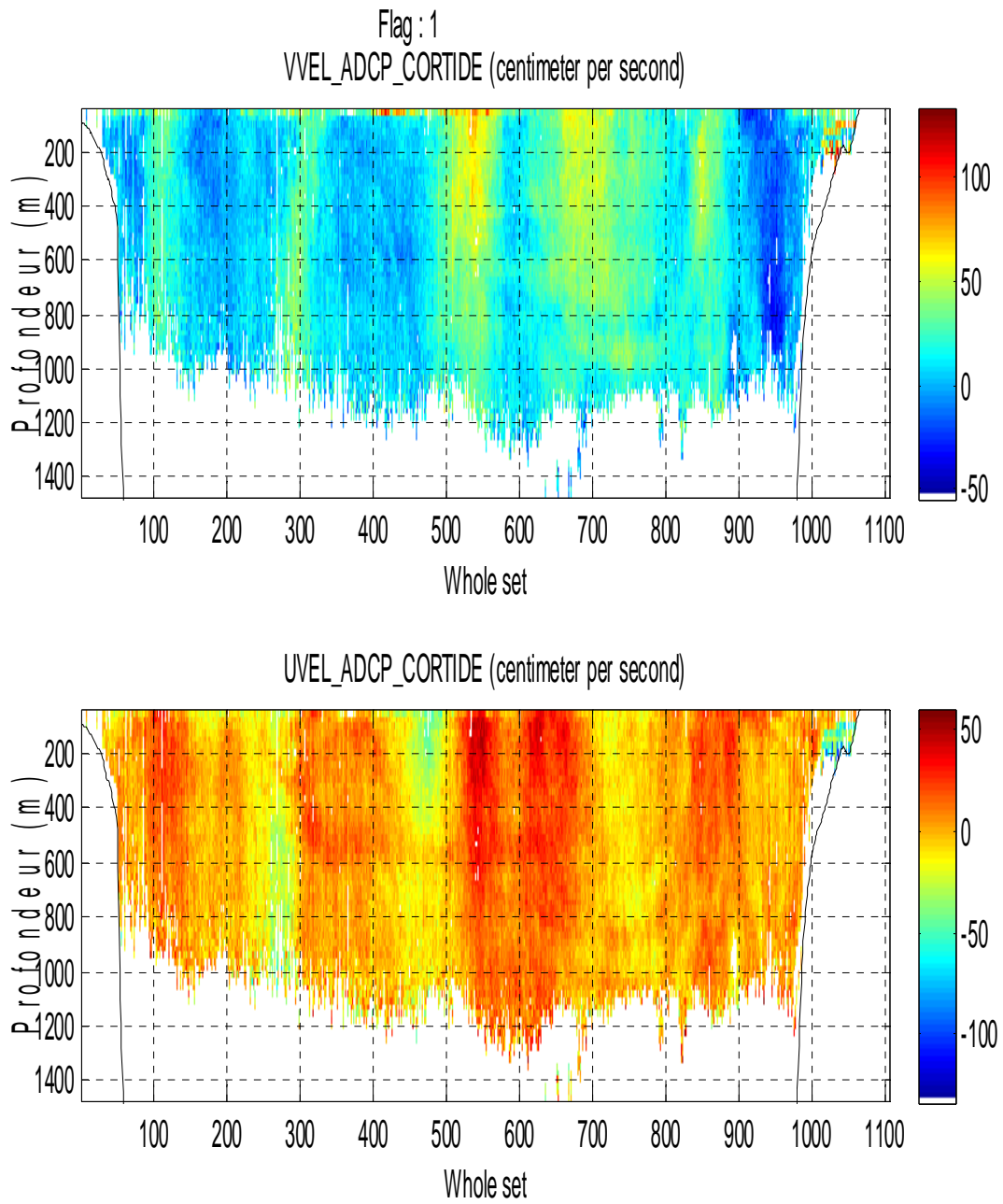


Figure 23. Processed U and V components of the ADCP during the twenty eighth track north between Robert I. and Cape Horn (01-02 March 2013).

