

## **CLIVAR/CliC/SCAR Southern Ocean Region Panel SORP-11: Sept. 17-18, 2016**

### **National activities report**

Country Italy

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#### **A. Recent and ongoing activities**

Does your country have a national committee tasked with oversight of Southern Ocean climate science?

YES (Italy has a Scientific Committee for Antarctic Research, or CSNA. The CSNA has identified a series of scientific themes, among which climate, paleoclimate, climate change, atmosphere and ocean are clearly identified)

What major activities have been carried out in the last several years or are in progress now? Contact information for the projects would be useful.

##### 1. Observational

In the last few years, marine research in the Southern Ocean and in the Ross Sea has been accomplished from the R/V Italice or from other ships in the framework of scientific collaboration programmes. In the last three years:

- Summer 2015/16 R/V Italice (Italy)
- Summer 2014/15 R/V Araon (South Korea)
- Summer 2013/14 R/V Italice

Measurements carried out mainly comprehend:

Expendable probe observations:

Italian scientists have been continuing a long-term (over 20 year) XBT and XCTD deployment plan along the route New Zealand – Ross Sea. These measurements represent the recurrent observations of the Antarctic Circumpolar Current recommended by the Southern Ocean Observing System (SOOS). In Figure 1 we show a map of all XBT launches carried out by the Italian Program for Antarctic Research on the transect, starting in 1994 through 2016.

Moreover, in cooperation with the South African National Antarctic Programme, in the austral summer of 2016 XBT launches have been conducted from the R/V Agulhas 2, as shown in Figure 2. These measurements were collected along the NOAA AX 25 high resolution XBT monitoring line ([http://www.aoml.noaa.gov/phod/hdenx/bt/ax\\_home.php?ax=25](http://www.aoml.noaa.gov/phod/hdenx/bt/ax_home.php?ax=25)), repeated since 2004.

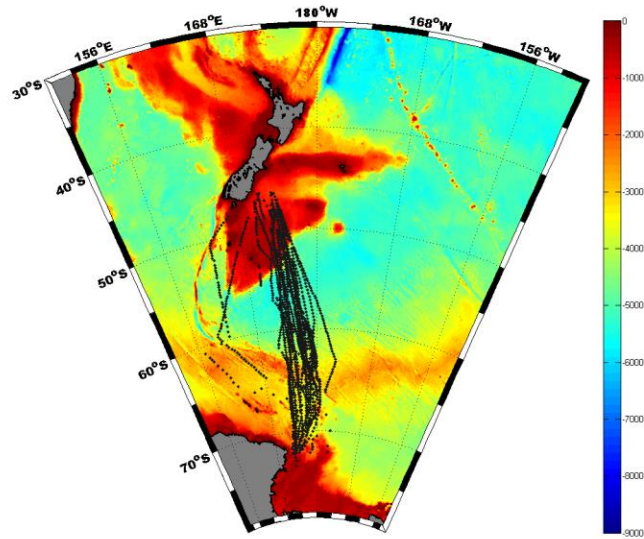


Figure 1: map of XBT launches carried out by the Italian Program for Antarctic Research on the transect New Zealand – Ross Sea, starting in 1994 through 2016

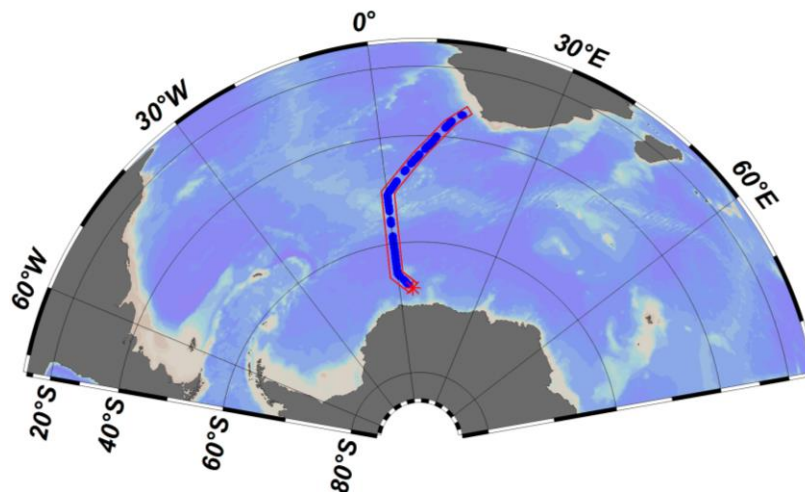


Figure 2: map of XBT launches jointly carried out in the austral summer of 2016 by the Italian Program for Antarctic Research and the South African National Antarctic Programme along the route South Africa – Antarctica.

#### Moorings:

The Italian National Programme for Antarctic Research maintains a network of moorings in the Ross Sea within the MORSea – Marine Observatory in the Ross Sea Programme. Currently, 4 moorings are present (B, D, G, L), equipped with a suite of current meters, sediment traps, CTD units, turbidimeters (see Figure 3)

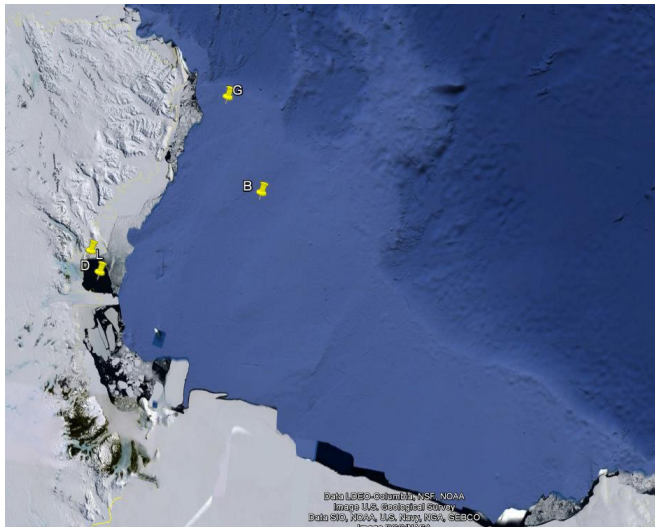


Figure 3: Map of B, D, G and L mooring locations as deployed in early 2016.

Lagrangian measurements:

Thanks to synergy with, and funding from, the ARGO-Italy programme, SVP near-surface drifters and ARGO floats have been regularly deployed on the route from New Zealand to the Ross Sea and back (A) and from South Africa to Antarctica and back (B).

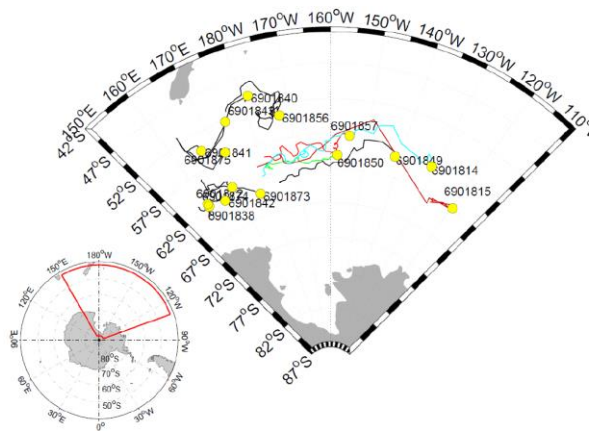


Figure 4: trajectories of floats deployed in 2015 in the Pacific Sector of the Southern Ocean

In the last few years, Lagrangian instrument deployments amounted to:  
 A) 10 floats and 10 drifters in Summer 2014/15 from the R/V Araon  
 A) 10 floats and 10 drifters in Summer 2015/16 from the R/V Italica  
 B) 5 floats in Summer 2015/16 from the R/V Agulhas II

Figure 4 shows the trajectories of all floats deployed in 2015 in the Pacific Sector of the Southern Ocean.

Underway measurements:

Surface temperature and salinity as well as meteorological parameters have been routinely measured along ship tracks during the R/V Italice cruises. In addition to the New Zealand-Ross Sea transect, these measurements have also been carried out in the Ross Sea, as shown as an example in Figure 5.

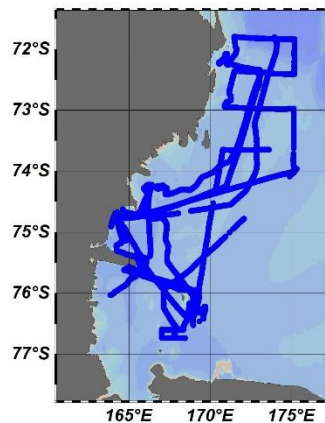


Figure 5 – R/V Italice route in the Ross Sea, along which continuous measurements of sea surface temperature and salinity were carried out in the summer 2015/2016

Hydrology:

The Italian Program for Antarctic Research has been performing hydrological measurements over the whole water column for the last 20 years and more (Figure 6 shows a composite of all CTD casts performed since 1995). This was also done during the cruise carried out in the austral summer 2015/16, and the relative hydrological network is shown in Figure 7.

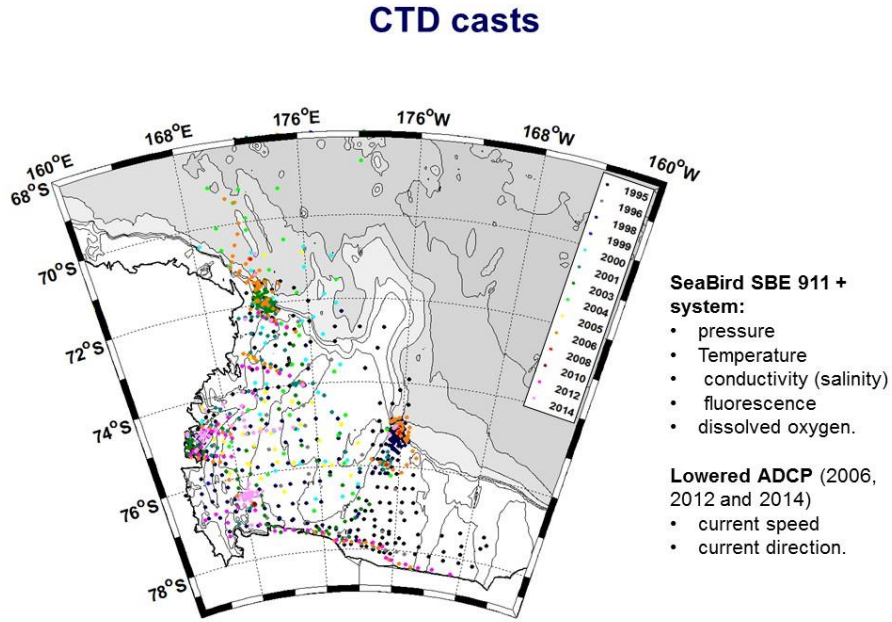


Figure 6 – locations and measurement type of all CTD casts performed since 1995 in the Ross Sea by the Italian Program for Antarctic Research.

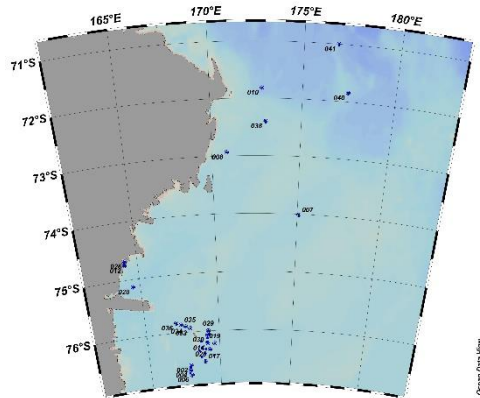


Figure 7 - Map of CTD casts performed in the Ross Sea by the Italian Program for Antarctic Research in the summer 2015/2016

## 2. Modeling

In the last two years a customized version of the Princeton Ocean Model has been implemented in a sector of the Southern Ocean ranging from 90°E to 250°E in longitude (with periodic boundary conditions at the western and eastern boundaries) and from 80°S to 30°S (solid boundaries North and South, with free slip boundary conditions). Its horizontal resolution 0.18°, with 14 sigma vertical layers.

The latest version of the model has a realistic initial stratification, surface forcing based on  $\frac{1}{2}^\circ$  ECMWF ERA-Interim data. Initial 3D temperature and salinity conditions have been drawn from the Southern Ocean database (SODB, <http://wocesootlas.tamu.edu/>). Figure 8 shows surface elevation and current over the whole domain relative to the 20<sup>th</sup> day of simulation with ECMWF surface heat fluxes.

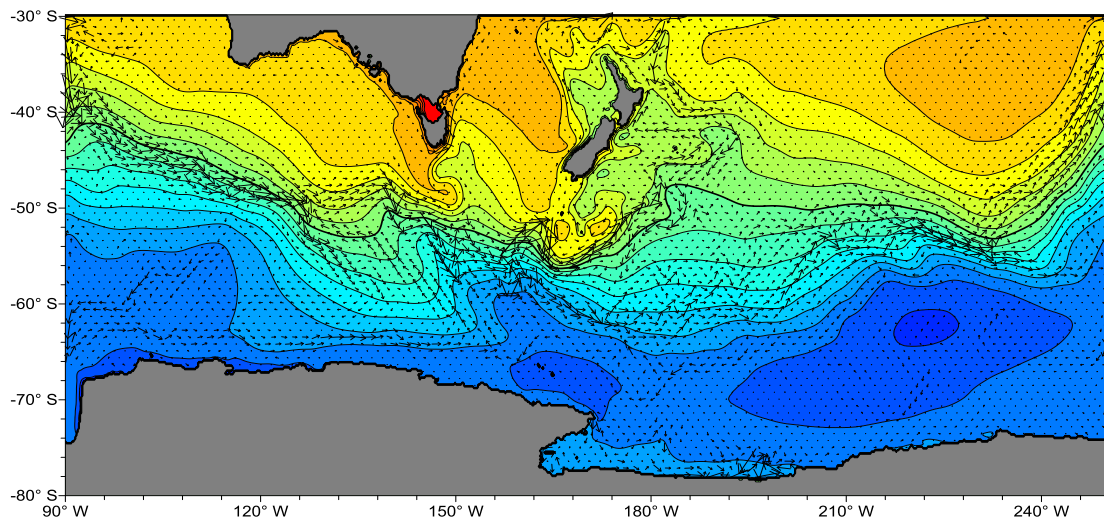


Figure 8: surface elevation and current field over the whole domain relative to the 20<sup>th</sup> day of simulation with ECMWF surface heat fluxes.

## B. Planned activities

What major activities are planned or likely to occur during the next several years? Contact information for the projects would be useful.

### 1. Observational

Plans for observational activities are set for the austral summer 2016/17. They will be carried out from the R/V *Italica* (A) and from the South African R/V *Agulhas 2* (B). In particular, XBT launches will be performed from both ships on the routes from New Zealand (A) and from South Africa (B) to Antarctica, plus an additional route from Tasmania to Antarctica (C):

(A) 10 floats (7 ARGO and 3 ice floats) and 10 drifters in 2016/17

(B) 5 floats and 6 drifters in 2016/17

(C) 5 floats and 10 drifters in 2016/17

(B) 5 floats and 10 drifters in 2017/18 (cruise still in planning phase)

Mooring maintenance and redeployment and underway measurements of surface temperature and salinity are also planned for the next cruises.

As to hydrology, CTD, LADCP, turbulence profiles as well as biological measurements will be carried out in the Ross Sea in the framework of the Celeber project, funded by the Italian Program for Antarctic Research.

## 2. Modeling

The existing, limited domain Princeton Ocean Model will be extended to the whole circumpolar Southern Ocean, limited only in latitude from 80°S to 30°S, same horizontal and vertical resolution as above.