

A16S Chief Scientists' update #4. Jan. 19, 2014

The weekly report and additional pictures from the cruise can be found at:

http://www.aoml.noaa.gov/ocd/gcc/A16S_2014 bottom left hand under "During-Cruise"

Into the roaring 40-ties.

What a difference a week makes; the azure blue seas have made way for a steel blue ocean covered with whitecaps and 20-foot swells. Sea surface temperatures have dropped by over 15 degrees. Sampling in shorts and T-shirts are a thing of the past and we are bundled in foul weather gear while sampling and deploying the CTD package (see figure 1). Instead of the nutrient depleted subtropical gyres with little apparent sea life, we are now in an area with high biological productivity as manifested by high surface chlorophyll and low surface CO₂ levels. A clear indicator of the big change in regimes was a pod of whales that entertained us while on station when we entered the sub-polar regime.

It was a big relief earlier this week when we received clearance from Argentina to sample in their exclusive economic zone (EEZ) meaning we can complete the reoccupation of the A16S line as proposed. The *EEZ* is an ocean region of 200 miles from the nearest coastline over which a state has special rights according to the UN Convention on the Law of the Sea. Much of the ocean is carved into sovereign domains of the adjoining nations (for a map with EEZ boundaries see e.g. http://www.marineregions.org/eezmapper.php?line_id=617). Obtaining the clearances requires a significant amount of paperwork and is handled through to US Dept. of State and its embassies. Approvals are often at the last minute, particularly when the requests are submitted late, as in this case, creating some anxiety regarding our route to avoid the territories.

Work is progressing according to schedule. We've taken advantage of time gained during the nice weather to steam slower and delay deployments waiting for improving conditions when needed. Weather maps are scrutinized with great interest anticipating conditions in the days to come. While the weather forecasts rely on computer models and satellite data, data from ships remain important in the assimilation routines (figure 2). Those of us who have been here before know that the next two weeks will be trying ones. It's a bit like doing everyday chores on a carnival ride, fun at first, and tiring with time.

Steaming and working under these conditions makes it apparent why relatively little data is obtained in the Southern Ocean especially during the Austral winter. This is rapidly changing however with the advent of profiling floats (see figure 2). During the cruise we are deploying 14 of them. These floats drift at about a mile depth for two weeks and then pop to the surface taking temperature and salinity measurements on the way up that are then relayed via satellite to data centers (www.nodc.noaa.gov/ARGO; www.usgodae.org/argo/argo.html; <http://www.coriolis.eu.org/Observing-the-ocean/Observing-system-networks/Argo>). About 3000 are deployed to date and they have a lifetime of 5 years providing a wealth of physical data on the world's ocean. Sensors are being developed for biogeochemical observations from the floats. Several hundred of the floats already have oxygen sensors, while sensors for nitrate and pH are in late stages of development. Indeed, a large research program is currently being proposed to

study and model the Southern Ocean utilizing over a hundred of these advanced floats to get year round measurements over 5-years of the physical and biogeochemical dynamics of the region- a true breakthrough. Research cruises will remain important in oceanography as only select measurements can be performed from floats and often at lower accuracy. Moreover, the cruise data are a premier source of validation of the sensors on the floats.

Currently we are doing a CTD cast at Station 81 at 46 °S, 29 °W. All is well onboard; there is still coffee; spirits remain high; and we have only about 32 more stations to go!

Rik & Leticia, Chief scientists GO-SHIP/CLIVAR A16S



Figure 1: We are not in the tropics anymore. Deployments and sampling have become more challenging with rough seas and falling temperatures. Shown is a nighttime recovery of the CTD/O2 package. The key is to prevent the 2000 lbs. package from swinging like a pendulum

once out of the water, and landing it safely on the cart that it towed into the staging bay for sampling.

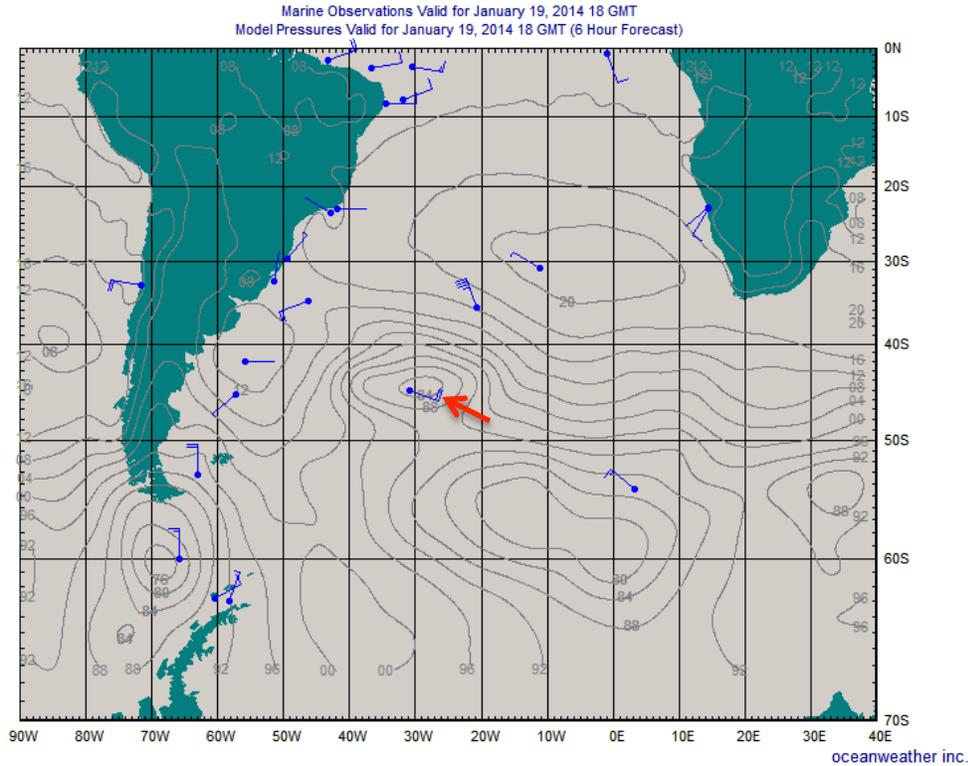


Figure 2: Weather map for the South Atlantic. Thousands of merchant ships world-wide provide barometric pressure, temperature and wind data every six-hours as input for ocean weather maps. The data from 45 °S, 31 °W (red arrow) is that of the *Ronald H. Brown* showing that it is currently one of the few observing platform in the area. The arrows with barbs indicate direction and magnitude of the wind. The bull's-eyes are regions of low pressure and are associated high winds and wave state. Weather has subsided considerably in the last day and today (Sunday Jan 19) winds were at 10 knots but have increased to 20 knots (two barbs) from the SE in the last two hours. (map from <http://www.oceanweather.com/data/>, for illustration only).



Figure 3: A profiling float deployment from the stern of the ship by Alex Quintero (SIO) and Darcy Balcarce (RHB survey). Jay Hooper (AOML), looking over the rail, is checking that the float won't be dropped on a curious whale. Several manufacturers now build the floats. This one is a new model and is considerably smaller than most of the floats. Since we are deploying the larger variants as well we call these "mini-me's". Many of the floats are deployed by cargo ships but research ships that often go to regions removed from trade routes remain an important means to populate the world's oceans.

SIO: Scripps Institute of Oceanography

CTD: conductivity/temperature/depth profiler

AOML: Atlantic Oceanographic and Meteorological Laboratory of NOAA

RHB: NOAA ship Ronald H. Brown