Operational Applications of Euro Argo Data - Ireland

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1. Introduction

In January 2008, Ireland (through the Marine Institute) officially became one of fifteen partners in the Euro Argo PP. Twelve floats were procured using a European Regional Development Fund (ERDF) grant. It is the intention of the Marine Institute to deploy four floats per annum for the lifetime of the Euro Argo project and to secure long term funding for a continuation of the programme.

One of the Marine Institute's key deliverables in the project is to use float data to validate the Regional Ocean Modeling System (ROMS model). The model simulates the ocean currents, tides, temperature and salinity structure incorporating detailed sea bed bathymetry, atmospheric forcing, freshwater discharge, tides, and ocean boundary conditions from a large scale model.

The results show that although temperature profiles are highly correlated, salinity profiles are less so. As one would expect, the vertical resolution of Argo float profiles are higher than those derived from the model. Maps showing the distribution of rms errors and correlation coefficients show that in general, the model represents the distribution of water masses very well.

Work is underway by the Marine Climate Change team in the Marine Institute to use time series data from the Argo array as a tool to assess changes in oceanographic conditions in the NE Atlantic.

2. Deployment in Rockall Trough

The first four floats from the Euro Argo Ireland programme were deployed in March 2008 from the R/V Thalassa. The cruise was primarily devoted to collecting oceanographic data for the annual ICES transects in the NE Atlantic. Four locations on opposing margins of the Rockall Trough were chosen for deployment.
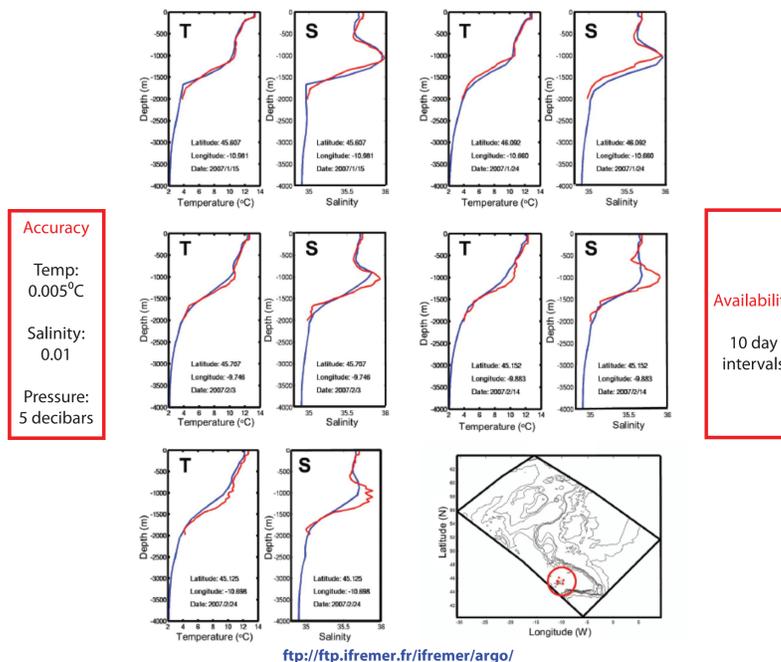
3. Float Trajectories
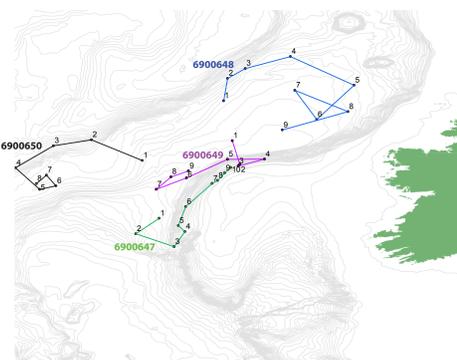
To date, all four floats have successfully completed up to nine cycles and have remained within the confines of the Rockall Trough. Float no. 6900648 (blue) appears to be drifting along an anti-cyclonic eddy. Both cyclonic and anti-cyclonic eddies are common in the Rockall Trough. Float no. 6900647 (green) is following the shelf-edge current which flows northeastwards along the continental slope. During the 3rd and 4th cycles, the float profiled vertical sections on the flanks of the deepwater Porcupine Bank Canyon system.

4. Comparison with ROMS model

http://www.marine.ie/home/services/operational/oceanography/OceanModelSimulation.htm
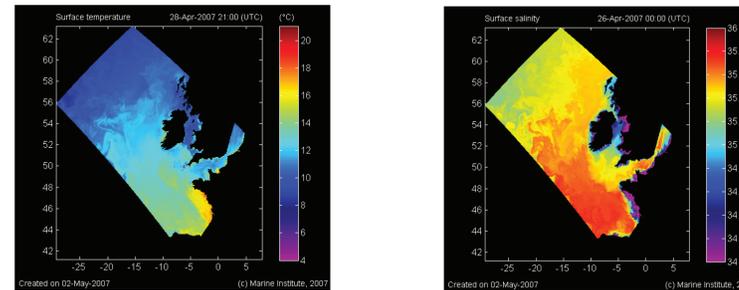
The ocean circulation model incorporates detailed bathymetry from the seabed survey. The circulation is driven by winds, heat fluxes and rainfall derived from NCEP's GFS atmospheric model. Measurements of freshwater discharge from some 40 rivers are included in the simulations. The model is embedded into a much larger scale North Atlantic model, MERCATOR, to include regional oceanic variability such as variations in the North Atlantic Current. Tidal variations are included, both at the model boundaries and by direct attraction by the sun and the moon on the water.

Accuracy

Temp: 0.005^{0}C

Salinity: 0.01

Pressure: 5 decibars

Availability

10 day intervals

ftp://ftp.ifremer.fr/ifremer/argo/

The diagram above shows a comparison of temperature and salinity profiles measured by Argo floats (red) and simulated by MI-ROMS (blue) in the Bay of Biscay. Profiles are arranged sequentially at 10 day intervals and relate to the period 15th Jan 2007 to 24th Feb 2007. The float trajectory over the period is illustrated in the bottom right panel.

Near real time data from Argo floats are very important for Hydrodynamic modelling, especially operational modelling. 234 individual Argo float profiles were analysed for the purpose of model validation. Correlation coefficients and depth mean rms errors between Argo float temperature profiles and corresponding ROMS temperature profiles at each float location are illustrated on the following diagram.
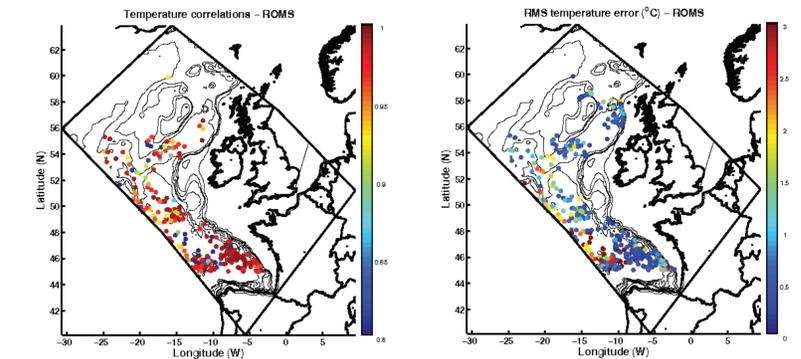
Correlation coefficients (left) and depth mean RMS errors (right) between ARGO float temperature profiles and corresponding ROMS temperature profiles.

Temperature profiles were highly correlated, having a mean correlation coefficient of 0.96. Salinity profiles were less well correlated, with a mean correlation coefficient of 0.74. Maps of depth mean error, indicated that the largest errors in temperature and salinity profiles occurred in the vicinity of the south western boundary of the model domain, providing evidence of boundary problems in this region.

5. Mixed Layer depths and Temperature - Salinity Plots (48-58^{0}N, 10-24^{0}W)
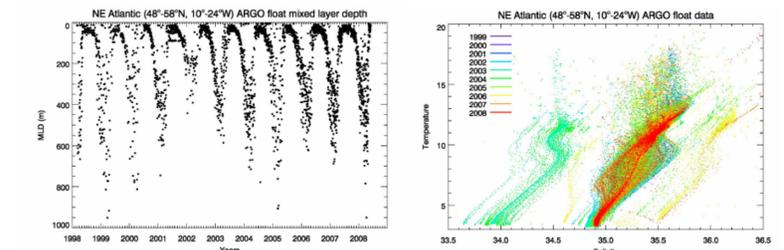
The Marine Climate Change (MCC) programme in the Marine Institute intends to make use of Argo float data for analysis purposes. As a preliminary approach, the floats are providing valuable time series data to assess spatial and temporal variations in the mixed layer depth and Temperature-Salinity profiles in the North East Atlantic.

6. Future plans for Euro Argo Ireland

Work is currently underway in the Marine Institute to update the ROMS model and Argo float comparisons. The comparison will be performed on a weekly basis and the outputs displayed on the Marine Institute website. On a quarterly basis, a comprehensive report will be prepared which will include plots of rms errors and correlation coefficients.

In addition to the Euro Argo float programme, the Marine Institute recently took delivery of a Slocum glider (AUVG). Together with the data buoy programme and tide gauge network, these instruments will form part of the Integrated Marine Observations portal on the Marine Institute webpage.
(http://www.marine.ie/home/publicationsdata/data/IMOS/)

The Marine Institute are seeking funding for the Euro Argo array as part of the Marine Climate Change programme (2009-2013). The budget requested is for six floats per annum. This is subject to approval from the relevant funding agencies.