Project AFI 6/25
ADELIE Antarctic Drifter Experiment: Links to Isobaths and Ecosystems

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Co-Investigator: Dr Sally Thorpe (British Antarctic Survey)
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Location: On board the RRS James Clark Ross, tip of the Antarctic Peninsula

Field Personnel:
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Rationale:
Recent data suggest that, contrary to prevailing views, there are pathways for near surface currents around the Antarctic Peninsula that connect current systems on the eastern and western sides of the peninsula. If proved, these pathways would be important for the retention and/or dispersal of krill larvae and other drifting particles. These currents have never before been mapped with Lagrangian instruments that mimic the passive drifting with ocean currents experienced by many such marine plankton. The Antarctic Slope Front appears to lose its properties as it enters the Weddell Scotia Confluence. The locations and transports of the Antarctic Coastal Current and Antarctic Slope Front were unknown. Output from eddy resolving ocean models are often used for managing the ocean’s living resources, and form the basis of coupled climate models. It is unknown whether these models perform in a reasonable manner in the complex region of retroflection and convergence near the Antarctic Peninsula. Using theory, observations and numerical models, we are testing the importance of bathymetry in controlling the splitting and steering of these frontal jets that determines the transport properties around the Antarctic Peninsula.

Highlights:
During February 2007 we undertook a research cruise (JR158) on the RRS James Clark Ross, just to the south-east of the Antarctic Peninsula. Forty surface drifters, drogued at 15 m, were deployed on the Antarctic shelf and slope and are subsequently being tracked by satellite. Their paths are available on our website, http://www.uea.ac.uk/~wvj06ssu/ADELIE.html We are very grateful to the Global Drifter Programme (http://www.aoml.noaa.gov/phod/dac/gdp.html) who matched the number of drifters that we bought with AFI funding.

As we had hoped, some of the drifters have been carried around the Peninsula to the west. At the time of writing, we are waiting to see how far they travel before the winter sea ice destroys them. We have deployed virtual drifters into a variety of eddy-resolving ocean-ice models. This has shown that some of the models are much better at simulating the drifters’ paths than others. As yet, reasons for this are still being investigated, but may include better sea bed topography, better atmospheric forcing fields, better sea ice model components, or better ocean physics.

(continued overleaf)
Andy Thompson deploys a drifter from the RRS James Clark Ross during the ADELIE cruise.

Four Argo floats were deployed that will drift at 1000 m, profiling to the surface every 10 days. These should travel through the ocean for several years, possibly all around the Southern Ocean. As well as contributing to the global Argo array (http://www.argo.ucsd.edu/), the paths taken by the Argo floats will test the flow patterns around the South Orkney Islands predicted by our previous studies.

Twenty hydrographic stations documented the properties of the water, its temperature, salinity, oxygen and current speed, across the Antarctic Slope Front. We also obtained the first direct measurements of current velocity in the deep outflow of Antarctic Bottom water that hugs the steep topography, and we will be able to quantify the volume transport of this flow. This is the most detailed section across the current system ever measured. It is co-located with the western end of a series of sections across the Weddell Sea undertaken every few years for the last 2 decades by German oceanographers from the Alfred Wegener Institute. We are therefore comparing our section with data taken during previous occupations. When the ship returns to the UK in June, we will be analysing water samples collected during the CTD section for the stable isotopes of oxygen in seawater. These will tell us the relative importance of various sources of freshwater.

This was a highly productive and efficient cruise. Although it was a very short time away at sea, it has yielded a large and exciting new data set destined to keep us busy for many years. We were fortunate to only have one storm to delay us, so achieved all our objectives and more. We are grateful to the ship’s officers and crew for their hard work, dedication, professionalism and enthusiastic willingness to help. We also appreciate all the logistical and planning support from those at BAS who ensured that it all happened!