

# The BLUElink analysis and re-analysis systems at work in Australia

David A. Griffin  
Madeleine L. Cahill  
Peter R. Oke  
Andreas Schiller

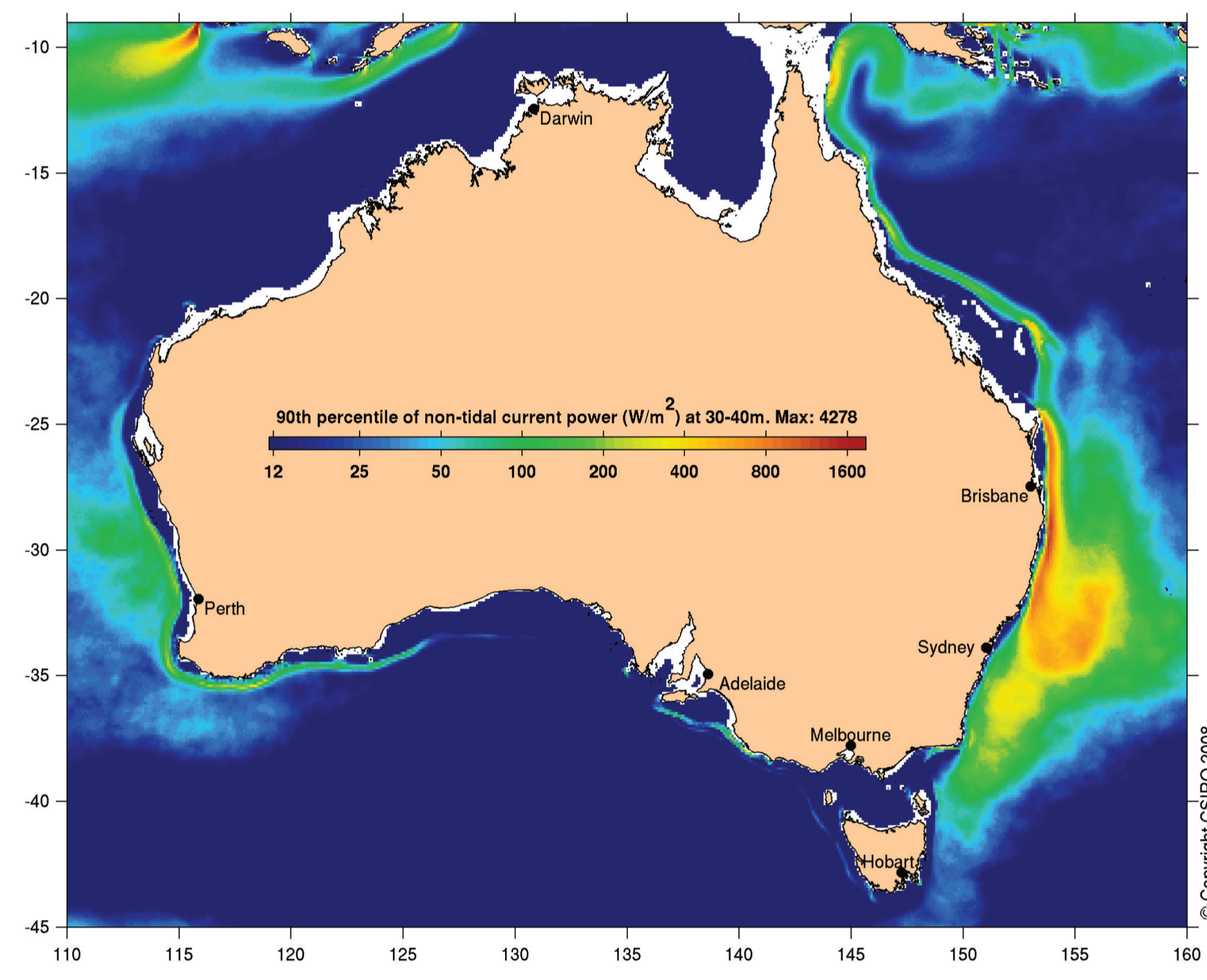


**The Bluelink ReANalysis (BRAN)** – is a long integration of the same data-assimilating model now producing operational ocean forecasts at the Australian Bureau of Meteorology. It is a global implementation of MOM4 with  $0.1^\circ \times 0.1^\circ \times 10\text{m}$  resolution in the upper 200m in the Australasian region. The data assimilation scheme is Multi-Variate Ensemble Optimal Interpolation. The output is freely available to registered users: <http://www.marine.csiro.au/ofam/>.

## Some recent end-user applications of BRAN include the following:

### Energy from ocean currents?

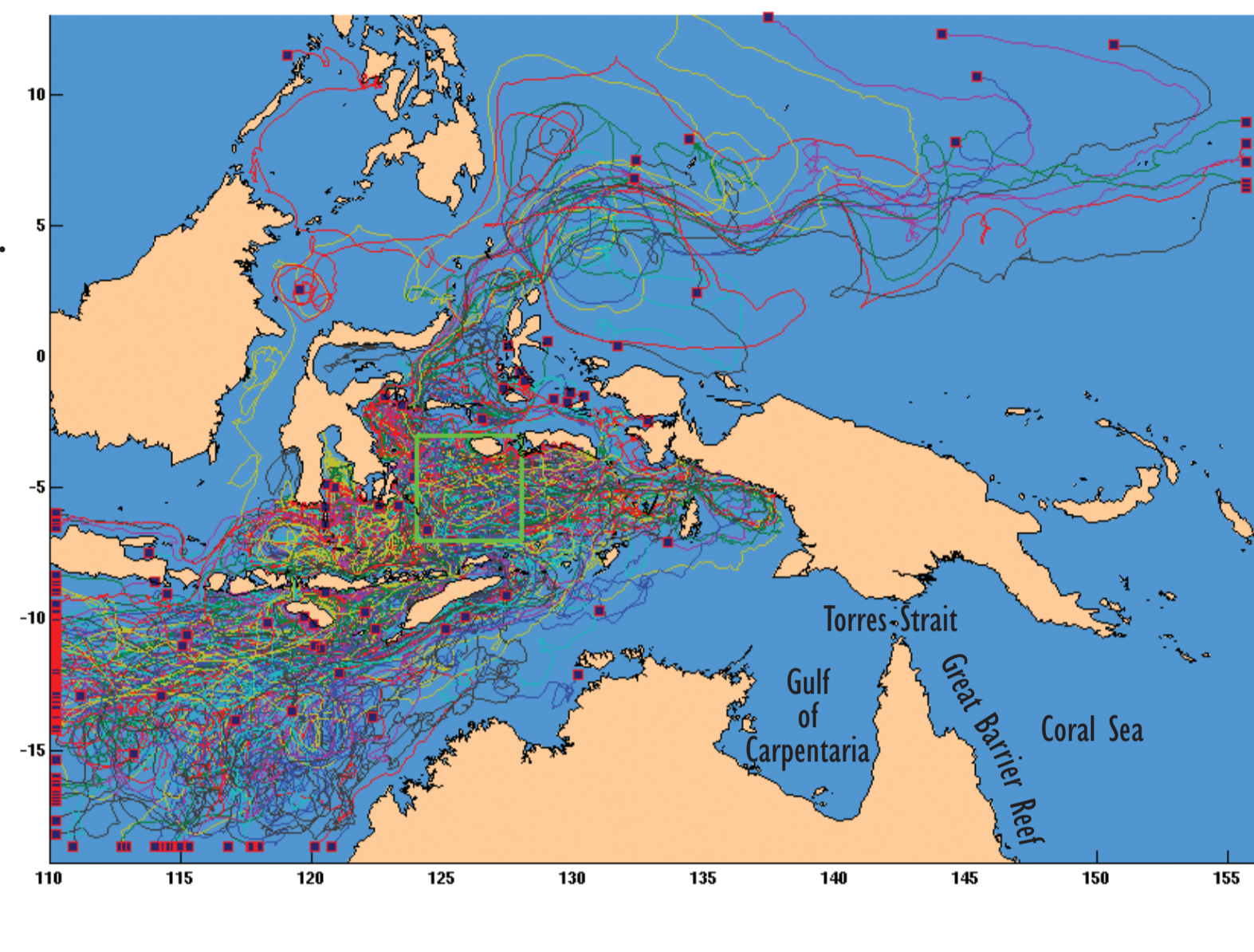
People are turning to the ocean as a potential source of clean energy. We have used BRAN to estimate statistics of the kinetic energy flux (proportional to speed<sup>3</sup>). A 50m-radius turbine in the path of the East Australian Current near Brisbane intercepts up to 8MW, powering 4000 homes if half the energy is converted to electricity. Forecasting the day-to-day variations of the flow will be very important if this energy source is to be exploited.



<http://www.environment.gov.au/settlements/renewable/index.html>

### Origins of marine debris

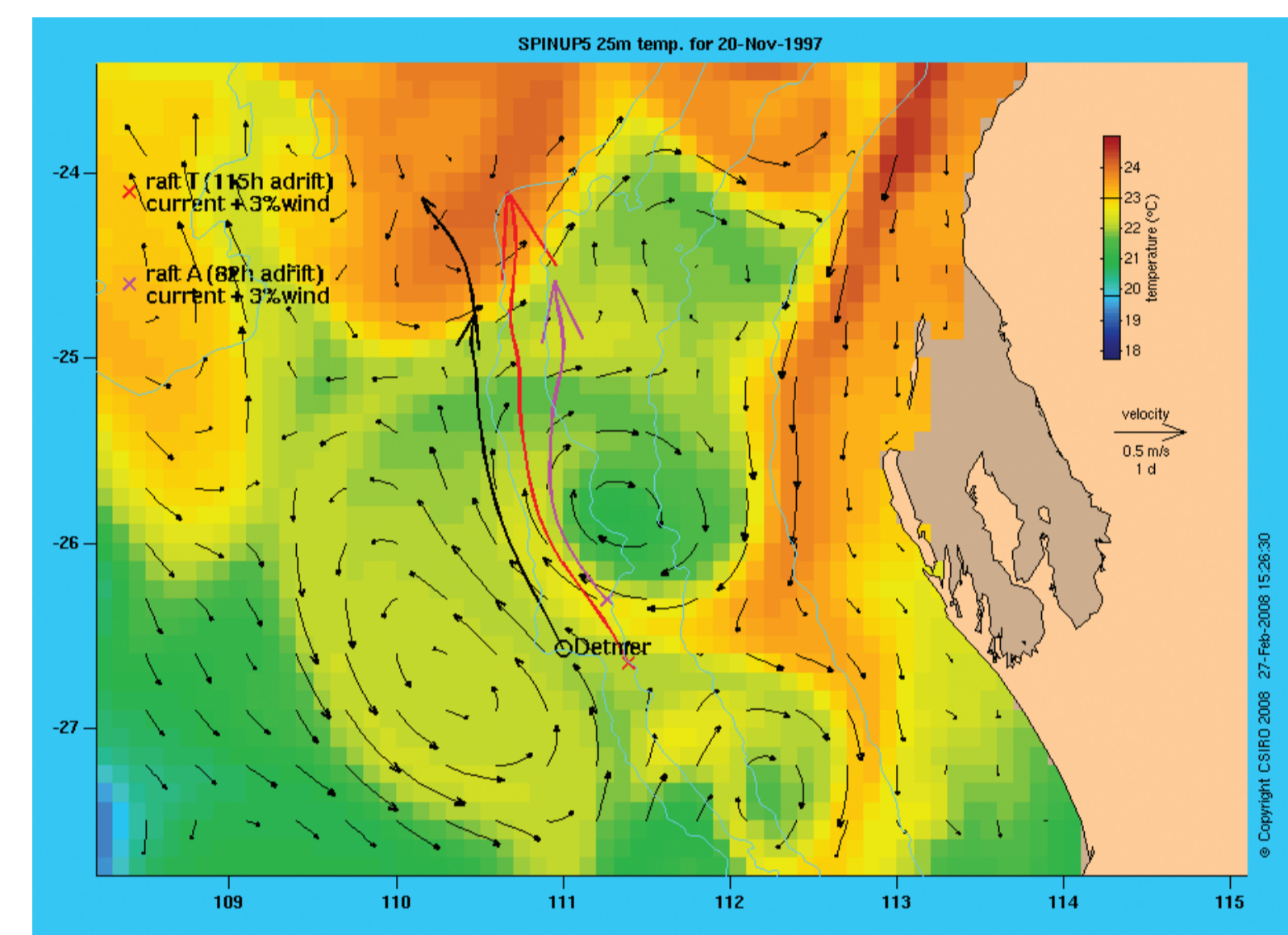
Large numbers of derelict fishing nets are found on the shores of the Arafura Sea north of Australia in the Gulf of Carpentaria. These nets are a major problem because they continue to kill fish as they drift about. We used BRAN to simulate the paths taken by deeply submerged items spanning much of the 10m-deep surface layer of the model, and found that very few such items find their way from, for example, the center of the green square on the map, to the areas where nets are found. This result is controversial, and more so because the model also shows that debris drifting in the Coral Sea east of northern Australia has a high probability of stranding on the Great Barrier Reef, or passing through Torres Strait and stranding in the Gulf of Carpentaria.



<http://www.environment.gov.au/coasts/publications/origins-marine-debris.html>

### Search for HMAS Sydney

The pride of the Australian WWII Navy fleet was sunk off Western Australia in 1941, with no survivors. She was located on 16 March 2008, ending 67 years' argument over the site of the battle. One reason a search was left so long was that the German account of the battle was not believed. Back-tracking the drift of life-rafts using Bluelink models, however, showed that the Capt. Detmers' position, or a little to the NE of it, could indeed be where the wrecks might be found, as proved to be the case. The eddy field for 1941 could not be estimated but studying many modern-day scenarios like the one shown above produced a cluster of estimates that guided the search.

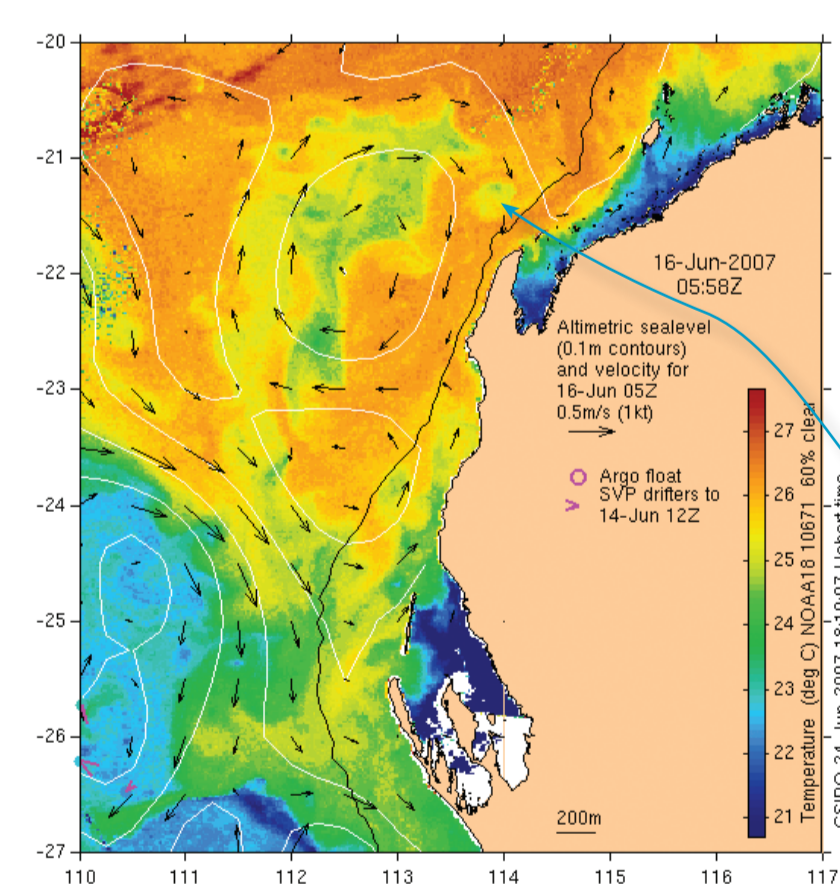


<http://www.findingsydney.com/>

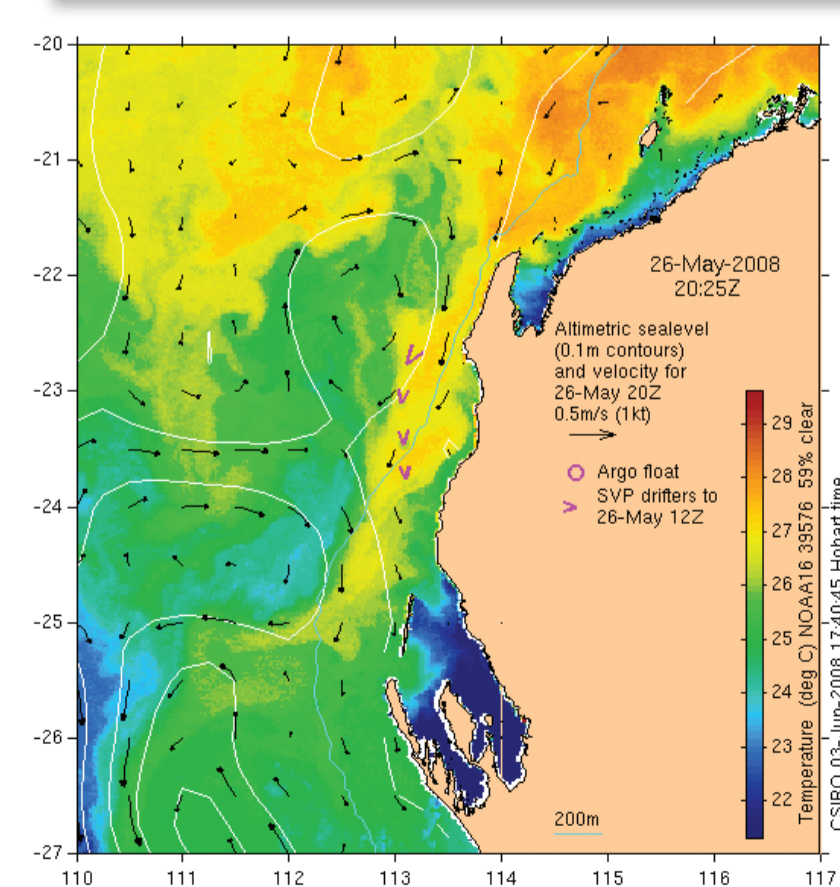
**The Bluelink High-Resolution Regional Analysis** – is based on a simple two-dimensional mapping of sea level measured by altimeters (Topex/Poseidon, Jason-1, Jason-2, ERS1, ERS2, Envisat and GFO) and coastal tide gauges. Daily-updated maps of sea level, geostrophic currents computed from the gradients of sea level, and sea surface temperature have been freely available at <http://www.marine.csiro.au/remotesensing/oceancurrents/> since 2004. These are used by a wide range of sporting (yachtsmen, fishermen, open-ocean rowers), engineering (oil exploration and extraction, shipping), public sector (defense, search-and-rescue, law enforcement, fisheries management) and scientific users.

## Some recent examples of end-user applications include:

### North-west Cape 2007 extreme currents event



In June 2007, two groups of observers (one scientific, one industry) noticed that particularly strong currents were occurring on the continental slope at  $22^\circ\text{S}$  near Ningaloo Reef, Western Australia. The general clockwise circulation of the eddy was resolved by multi-mission altimetry but the details of the sub-mesoscale features (e.g. the spiral eddy – visible clearly in animated SST) were not.



The following year, industry attention was again focussed on the same region. An SVP drifter transited the area of interest, providing valuable ground-truth data that was clearly consistent with the SST imagery, but not with some of the routinely-generated altimetry maps, which were clearly suffering with only two altimeters (Jason-1 and Envisat) in use. The Maximum Cross Correlation (MCC) method estimates velocities by comparing pairs of thermal images (Bowen et al., 2002). Suitably filtered, these scattered velocity estimates were used as a gradient constraint when mapping coastal and altimetric sea-level observations, bringing the geostrophic velocity into agreement with the drifter. Use of this ocean information saved industry several days of expensive ship time.

### Trans-Tasman Sea rowers

One group of people very grateful for a detailed map of the very high velocities of the East Australian Current was a group rowing west across the Tasman Sea from New Zealand in late 2007. The map shows how a fortuitous positioning of the eddies, and knowledge of this, gave them a rapid passage to Sydney.

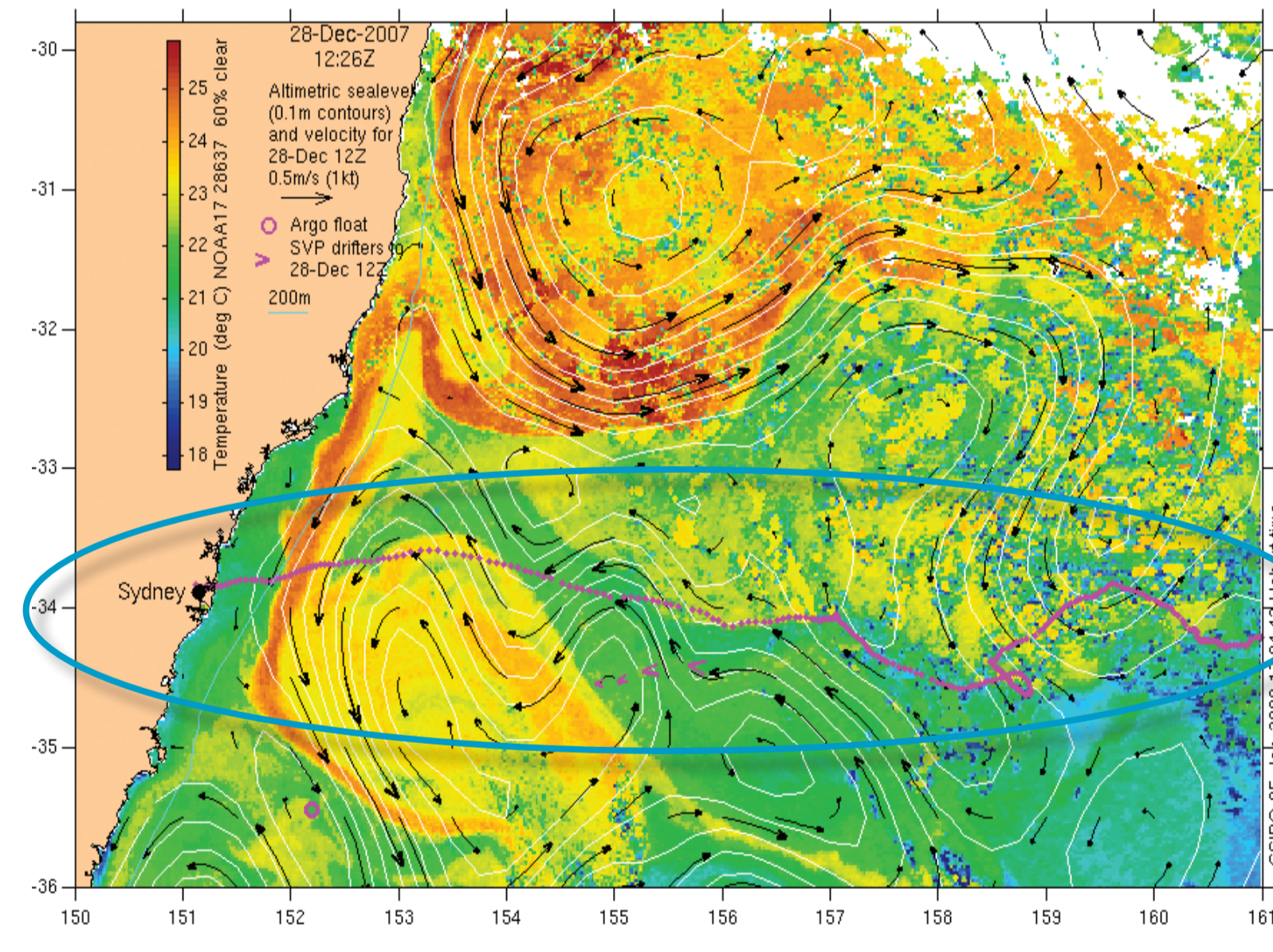


Photo: BASEfx Expedition Photo Archives

**Adventurers and yachtsmen**, like Formula-1 race teams, are early-adopters of new technology. With time, we expect the 'mainstream' maritime sector to make more use of whatever ocean information is available. It is clear, however, that the user demand for information on ocean currents is for more detail and accuracy than we can presently provide.