

"New Applications" session summary

Oral Session

Notes compiled by Trevor Guymer

Takano: Distribution of bigeye tuna

Introduction – examples of use of SST imagery in studying fish distribution and use of altimetry for validation.

A 2-layer model (baroclinic + barotropic) was used, the interface defined by 15C isotherm. Because the baroclinic and barotropic details are not known an empirical regression approach was adopted. Absolute dynamic topography (ADT) was obtained from AVISO, T and S structure from Argo and WOA1 for monthly mean objective analyses. From this it was possible to estimate the isotherm depth. It was found that the baroclinic component correlated better with ADT than the depth of the 15C isotherm. The isotherm depth was validated using XBTs with $r=0.74$. The 15C isotherm is significant because it shows upwelling of North Pacific SubTropical Mode water. High bigeye tuna fishing activity is associated with shoaling of the 15C isotherm to 300m, making the boundary between water masses. Maps of these zones could be produced for fisherman.

Gaspar: Altimetry helps understand the behaviour of marine animals

Introduction - issue of marine living resources

Electronic tagging is used to monitor both the environment and movement of animals. The problem is the animal swims as well as being carried by the currents. Biologists tend to neglect details of currents and impacts. This study looks at leatherback turtles, 18 of which were tracked.

80% of the time these are shallower than 100 m so we use surface velocity derived from a mean sea surface together with altimeter-derived height anomalies and the ageostrophic velocity obtained from scatterometer winds. It was found that the turtles swim N w.r.t the current by ~ 0.5 m/s. The swimming velocity was derived and used to compute a current-corrected track. This is the track that the animal would have swum in a motionless ocean. The results show that the turtle swims only half the distance; moreover, they have a strong compass sense. Another question of interest is whether the animal is travelling or foraging. A straightness index was defined and this led to a rather different interpretation. In fact, in the Gulf Stream extension the turtle was actually foraging.

Griffin: Oceanography and yacht racing – a handful of competitors, millions of spectators

The presentation started with a history of developments in producing web sites for the Sydney-Hobart yacht race. A range of information was displayed including meteorological data and sea surface temperature images showing the presence of strong eddy activity in the East Australian Current; such eddies can be the deciding factor in the race. The information is provided to each crew and also to the media. In 1995 no altimeter data were used. By 2000 Topex/Poseidon data were employed and showed a cyclonic eddy off Sydney which had an impact on the progress of yachts, depending on the track they chose to take. For the 2003 race, a combination of SST and altimetry were used and by 2005 some Argo data were added and the system had become fully automatic.

The scope of the enterprise had also been broadened to cover all Australian coastal waters and ran for all of the year. It was emphasised that the project was not concerned with who won the race but was concerned about safety. Use of the products was a very useful test-bed of an ocean forecasting system. There had been many PR opportunities for oceanography with the increased public awareness of how dynamic the ocean really was. It was also clear that many potential stakeholders are slow to believe in the benefits of ocean

information; it may help if they see yachtsmen using it to good effect. More user pull was needed if funding for more altimeters was to be obtained. An interesting aside was that for commercial ship operators it was not necessarily finding the fastest route that was of primary concern but wanting to keep to a schedule which made most efficient use of berthing arrangements.

Frew:

Introduction – relevant to regional and global gas cycling and for climate change studies

There is a strong correlation between gas transfer and the mean square slope of the sea surface. In fact, it is greater than with either wind speed or wind stress. Recent lab studies have revealed a new understanding of the mechanisms involved. Two scales can be identified. One is associated with small scale waves breaking as a result of wave-current interaction; the other, larger scale process involves plumes, etc. Mean square slope at two different scales can be obtained using dual frequency altimeter data such as provided by Topex/Poseidon. The transfer velocity uses a quadratic dependence of k on.....(my notes ran out here as my mind was concentrating on getting my own presentation ready.)

Guymet: Altimetric rain detection: Past, present and future

Anomalies in altimeter radar backscatter, waveheight and sea level data had been observed with the Ku-band instrument carried on the Seasat mission in 1978. It had been concluded at the time that these were due to rain cells but strong supporting evidence was lacking. The presentation showed that sudden reductions in backscatter intensity could be explained in terms of changes in wind speed and in attenuation by rainfall within the radar beam, but unambiguous separation of the two effects was generally not possible with a single frequency altimeter. The Topex altimeter operated at Ku and C-band; the latter is much less affected by rainfall and can be used as a reference level for the unattenuated backscatter. The difference between the two measurements is proportional to the rain rate and, by assuming a standard drop-size distribution and knowing the depth of the rain column, rain rate can be estimated.

Thus, not only is it possible to improve the quality control of altimeter data by more sophisticated rain flagging but altimetry can be used to provide study the distribution of rain over the ocean. Global climatologies produced by the National Oceanography Centre, Southampton look realistic and compare well qualitatively with those obtained from other sources, such as infra-red and passive microwave sensors. However, the altimeter technique has some advantages, including providing simultaneous information on wind, wave height and rain. The talk concluded with reference to research at Ifremer on ways of estimating the depth of the rain column from passive microwave data, and to case studies in which altimetry, passive microwave and infra-red techniques have been used to examine the characteristics of tropical rain systems.

Poster Session

Notes compiled by Ouan-Zan ZANIFE

Kubota : Movements and accumulation of floating marine debris simulated by surface currents derived from satellite data.

Used of TOPEX/POSEIDON data (as geostrophic current) and NCEP re-analysis (as Ekman drift) to deduce daily mean of surface currents. These surface currents are then applied to floating marine debris to model their movement and accumulation in the North Pacific trough several years. It is indicated that the floating marine debris have a tendency to accumulate in specific areas and can become harmful to bird and fish species.

Zanife : ENVISAT radar altimeter individual echoes.

A study related to RA2 Individual Echoes (IE) and the combination of the Ku and S band data has been conducted by CLS, Pildo, IFREMER, UCL and Legos under ESA responsibility. The goal was first to provide the scientific users with a new handy product, and the second goal was to perform scientific investigations using these data as well as investigate applications when combining Ku and S band data.

CLS and Pildo have developed a software processor that generates the new IE SGDR product. This product contains the elementary waveform (1800 Hz) expressed in amplitude and phase in the frequency domain (they also exist in the temporal domain and are called Burst).

Thanks to this new product, investigator can use these data in several fields such as:

- ♣ To check and verify the speckle over ocean
- ♣ To derive new retrackings over non ocean surfaces
- ♣ To deduce the IE distribution over non ocean surfaces
- ♣ To increase the data resolution thanks to speckle analysis

Through several small studies, it has been shown that the IE ENVISAT RA-2 IE have a great potential in terms of new findings. Thus the effort should be pursued.

Commenginger : New scientific applications for ocean, coastal, land and ice remote sensing with ENVISAT radar altimeter individual echoes.

In parallel to the above study, ESA has launched a similar study with the NOC, DMU and SciSys. The objectives of this study is similar to the ones given above. A software has been developed to understand and validate the generation of IE level 1B data and to use them for scientific investigations such as :

- ♣ Waveform shape analysis over several area (ocean, ice, land, ...)
- ♣ Analysis of output from the DMU expert system (including retracking)
- ♣ Analysis of the amplitude and phase of the IE

It was found that the part of the waveform that contains information depends upon the surface overflow. Also the phase fluctuations of the IE was found to be related to the angular encounter spectrum of scattered waves.

But as for the other study and as also mentioned for the poster below, more data and study are needed.

Milagro : How to get ENVISAT RA2 individual echoes.

Through a clear and easily accessible poster, ESA is providing information on how to get the RA2 IE. First the context is recalled. Then a description of the on board operations related to the acquisition of these IE is provided. It is followed by two very important web pages, first the one on the documentation available, and the second one on how to get the data.

One thing we can regret is the address of the web site which is not indicated (still under construction).

Given the potential of these data as already mentioned in the two previous review, ESA is encouraging the scientific users interested by these data to gather in an IE user group to develop new research field and new applications: send email to raies(@)plod.esrin.esa.it.