Marine Meteorology Session Summary

B. Greco

The session focussed on the sea state studies with EO data. Nine presentations were given, dealing with wave climatology, wave modelling /altimeter data assimilation, surface backscattering models and wind speed determination, tsunami observation and modelling.

The operational work for wind&wave exploitation by metoffices goes on and is spreading to more and more centres. The great addition is the new regional dimension that enables high-resolution wave forecast for science but also for public use.

Wave climatology, a well established altimeter application, is continuously enriched with new data as long as they become available, and it appears that the long record enables the consistency and reliability of the results. Correlation of wave height variations with climatological (eg NAO) phenomena was observed, opening a new science.

Wave model development, anther traditional application, has greatly improved in the past thanks to altimeter data, and is at the origin of the success of sea state predictions.

The Sumatra tsunami of 2004 was the first one observed with altimeters. Altimeter data enabled to diagnose the existing tsunami propagation models, and are going to be invaluable for the improvement of tsunami models that are of the greatest interest for science but also for disaster prevention.

Overall, altimeters are an indispensable tool for observing sea-state for a variety of applications, and it is imperative that the data stream is not interrupted in the future to avoid discontinuation of the very successful research and application lines developed so far.

During the discussion some issues were discussed regarding the required maximun latency for near real time. The traditional 3 hours data latency are declared to long for some applications. For Sentinel-3 it is essential to get specific and incremental requirements for latency options, e.g., what benefits is gained at 3h,2h and1 h) and what regions have regional models that require priority for the quickest data availability.

Detailed summary

1. Challenor

This is a review paper on the history of wave research. The major benefit of altimetry is coverage. Consistency of measurement requires inter-calibration between altimeters and buoys. Seasonal variations are evident. Internannual signal very well correlated with NAO. Extreme phenomena can be assessed (centennial waves). Dual frequency enables measurements through rain cells. Simple model enables to infer the wave period, which also correlates with the NAO. RA-2 Individual Echoes provide the phase, possibly related to wave spectrum; interesting research ahead using the RA-2 Individual Echoes.

2 Vandemark

Geophysical retrieval goes through understanding of scattering physics. Parameters in the play: SSB, wind, long wave spectrum, mass and momentum flux, wind direction.
Altimeters cannot enable retrieval of all surface parameters involved in the scattering.
Dual frequency improves. First info is onset of wave break. Emipirical wave spectral model. The wind is not the only on to have effect to Ku sigma0, sea state plays a role. Ifremer shows that RA Measurements are sensitive to wind direction. Longer wavelengths have an influence on backscatter more than thought. S and C band are not considered very different in terms of information content.

3. Lefevre

Wave analysis and forecasting versus socio-economic importance. 500 maritime accidents reported by Lloyds in 5 years for ships over 500 tonnes. In some cases in-situ wave observation is poor quality (visual judgement). Data assimilation

of RA every 6 hours data improves a lot. Wave modelling in Mediterranean sea lead to accuracy improvements. Freak waves: ship accidents seems to happen predominantly when/where ECMWF waves are low. Recent results show synergy of RA and ASAR extends the validity of predictions.

Data latency: the 3 h lag causes reject of about 50% of the data. Reduction of latency would increase data inclusion. Regional forecasting have even more stringent requirements.

4. Cavaleri, presented by Mauro Sclavo

Medatlas project, commissioned by WEAO. 10 yrs analysis, Jul 1992/Jun 2002. ERS RA data provided by Meteofrance. Tradjtional gridding techniques, except where the morphology required resolution enhancement. Validation with Italian buoys.

5. Janssen

Wave modelling at ECMWF: ongoing for several years, assimilates RA SWH data. Wind info is used to check GCM, but it is not assimilated. A new wind model has been developed, still as function of a single parameter, the Sigma0 Ku. Minimum latency for data: 5h before run, but there is increase pressure to start earlier.

5. Queffeulou

Altimeter data cover of Mediterranean sea. Along-track SWH variability over 3 days. 9/10 day samples is not adapted to estimate mean SWH except over a very long time serie (10 yrs). 13 seasonal means show typical med sea features (mistral, sirocco) effects on SWH. Monthly means from 6 altimeters show good consistency among different altimeters. Annual and interannual variability appears. Globally, one altimeter is sufficient for the whole med sea, but the monitoring of the variability requires more, as appearing in the different Mediterranean areas. Overall many areas however exhibit similar anomalies with respect to seasonal means.

6. Soelvsteen

Comparison of altimetry wave and wind data with model and buoy data ot
Royal Danish Administration for Navigation and Hydrography. RA SWH correlates with buoys in the same way, independently on the buoy location around Denmark.

7. M. Holt / Jian-Guo-Li

A recall of the history of ASAR/RA data assimilation. Comparisons RA/ASAR with buoys and models. Expected results. Use of specific buoys, sometimes measurements corrupted by land, visible in ASAR spectra (no land filtering in ASAR processing).

8. M. Ablain

Tsunami observations from RA was unconclusive in the past; the signal is too weak to lead to conclusions. The Sumatra 2004 tsunami was the first one to be seen by Radar Altimetry**.** Tsunami was observable thanks to the high space/time sampling offered by 4 altimeters. CEA model and Jason SLA correlate very well. ENVISAT flew over the Indian ocean a little later, but the signal is still detectable and correlates well with the CEA model. Jason and ENVISAT noise over the Tsunami is higher than normal.

9. Manman Zhang

Tsunami model is the basis (from UCSB). Multiple altimeter observations. Similar approach as Ablain (SLA modelling). Forcing mechanism include slip & uplift, with horizontal motion possibly having the dominating effect (70% against 30%.uplift) Two models for ocean circulation used, global and hi-resolution. Tide gauges used for comparison and Tsunami model validation. Sumatra earthquake of 20.03.2005 also examined, for its ocean circulation effects. Overall Tsunami models are bad in coastal regions. Global OCM for the moment seems better than dedicated tsunami model. Radar Altimetry is absolutely indispensable for tsunami model development, as is the only way to get SSH in open ocean.