The Use of Radar Altimeter Data to Diagnose Wave Model Initialization and Improve Short Term Wave Height Forecasting

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NCEP/OPC – Responsible for issuance of marine warnings, forecasts, and guidance in both text and graphical formats over Atlantic and Pacific marine areas extending from 20°N to 67°N

- Significant wave height (SWH) analyses and forecasts to day 5
- In situ buoy and ship observations
- Jason-1, Jason-2, and Envisat radar altimeter
- NOAA Wavewatch III and ECMWF wave models

To evaluate wave model initialization/first guess:

Pre altimeter:
- Buoy observations
- Very limited spatial resolution
- Subjective and inconsistent methods/means of observing

Altimeter data are accurate, consistent, uniformly distributed over all oceans and have a positive impact when assimilated into global wave models.

Examples of OPC Atlantic regional (upper left) and high seas (lower left), and Pacific regional (upper right) and high seas (lower right) SWH analyses. Regional analyses (ft) are issued every three hours and high seas analyses (m) once per day.

NCEP/OPC – Near real-time significant wave height (SWH) data by Jason-1 radar altimetry since June 2007 and Jason-2 and Envisat radar altimetry since August 2008

Example of a visualization technique (lower panel) used at OPC to determine initial SWH errors in wave models. Jason-1 altimeter SWHs (ft) are overlaid on the NOAA Wavewatch III SWHs (color filled contours) 9 hour forecast valid 1500 UTC 15 Oct 2009. Using the same color intervals in each data set allows forecasters to rapidly identify model errors. In this case the model is (1) depicting a smaller areal extent of SWH 30 ft or greater, (2) 30% - 40% underdone with the maximum SWHs, and (3) incorrectly placing the maximum SWHs 2-3 degrees South of the maximum indicated by the altimeter data.

Summary

- Near-real time altimeter data have improved OPC sea state analyses and short term SWH forecasting. Multisatellite altimeter data has been shown to have a positive impact when assimilated into wave models at a global scale (Skandrani et al 2004)
- From an operational wave forecasting perspective, visualization techniques developed at OPC allow forecasters to rapidly identify initial wave model errors under tight time constraints over extensive forecast areas
- Altimeter data from multiple satellites are allowing for the development of wave climatology
- Altimeter SWH under investigation to be added to the NWS National Marine Verification Program for high seas SWH verification