

Operational Oceanographic Applications for the Wide Swath Ocean Altimeter

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Abstract: The Wide Swath Ocean Altimeter (WSOA) is an interferometric radar instrument presently being developed by the Jet Propulsion Laboratory for integration to the Ocean Surface Topography Mission. The Naval Research Laboratory has a long history of working with satellite remote sensing instruments and applying the information to ocean environment prediction. Traditional nadir altimeter satellites measure sea level at the satellite nadir point with a footprint of about 7 km at intervals of about 6.5 km along the ground track. While the information is very useful for ocean monitoring and prediction, the limited spatial extent creates a large possibility that ocean mesoscale features such as eddies or current meanders may not be sampled. The wide swath instrument provides a much greater spatial density of measurements. The intrinsic instrument resolution is about 1 km in the across-track direction and 11 km in the along-track direction. The instrument provides measurements within these cells across a 200 km wide swath. Errors levels are high, and averaging to 15 km bins greatly reduces error levels.

This presentation examines some of the systems to which this data will be applied. Originally, the demonstration of altimeter sea surface height (SSH) measurement application to ocean circulation was conducted through twin model experiments. These experiments were critical toward providing a sound technical basis for the present day altimeter missions. Present altimeter missions have returned data in real time to operational systems at the Naval Oceanographic Office, where the data streams are processed and made available to ocean prediction systems. The predictions systems output information for Navy applications, but

the results have been used in a variety of dual use areas. Fisheries have utilized the system output for surface currents and thermocline depth, and environmental management groups have used the information for efficient tagging of tuna. Systems providing operation information have a wide use through many sectors of society.

Providing substantiation for operational altimeter system requirements has been difficult. The National Polar-orbiting Operational Satellite System (NPOESS) is designed to meet a minimal threshold requirement. This threshold requires only a single nadir-looking altimeter instrument. Several studies have shown that the ocean synoptic mesoscale is poorly resolved by a single nadir altimeter, and the improved resolution of the WSOA is demonstrated to provide an accurate representation of the mesoscale sea surface height (SSH). Within the deep ocean, SSH is closely related to the subsurface temperature and salinity structure as the deep ocean acts primarily as a first mode baroclinic system. Accuracy of SSH and SST measurement are critical in determining subsurface temperature and salinity. For mesoscale application, a single nadir altimeter is demonstrated to have some skill (depending on orbit sampling characteristics). Combinations of several nadir altimeters improves prediction skill. The WSOA is a significant step forward towards providing ocean mesoscale circulation accuracy even relative to several nadir altimeters. In addition to the deep ocean, tide measurement could be substantially improved by the WSOA. Based on these considerations, the Naval Research Lab is a strong supporter of the WSOA instrument test and demonstration.