Calibration and stability assessment for POSEIDON-2 altimeter

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A radar altimeter system must be calibrated and stable. Every altimeter is different, and it is useful to take advantage of what has been learned in previous altimeter systems. We have more than 20 years of involvement with radar altimeter systems, and we provided the algorithms for correction of TOPEX altimeter instrument effects. For the Jason-1 project, we will perform independent assessment of the POSEIDON-2 altimeter data, both from preflight testing and from on-orbit, to characterize possible instrument effects and to determine possible drifts in altimeter performance.

In order for the Jason-1 mission to provide useful scientific data for the study of the world's oceans it is necessary that the POSEIDON-2 altimeter be calibrated and stable. The shape of the echo of the ground return signal from the ocean surface provides a measurement of the surface height and distribution. To provide calibrated data to the science community it is important to properly describe all the effects on the return signal that do not come from the real surface, and to remove all the instrument-induced estimation errors. Two important calibration issues are the shape of the transmitted radar pulse which affects the shape of this return signal, and the receiver hardware interaction with this return signal.

Spaceborne radar altimeters are not off-the-shelf items. Each radar altimeter is one of a kind, having its own subtle differences from other altimeters. Every altimeter has extensive preflight testing to characterize its performance for different values of range rate, signal-to-noise ratio, ocean waveheight, and spacecraft attitude angle. This preflight testing requires an altimeter signal simulator, itself a very complicated system having its own subtleties; these subtleties must be removed from the ground test data for proper altimeter characterization. In assessing performance of a new radar altimeter system, particularly in its early on-orbit results, it is important to use the knowledge and opinions of people having experience with previous radar altimeter systems.

In our research at the Wallops Flight Facility (WFF) of the NASA Goddard Space Flight Center, we have been active in development of satellite radar altimetry for more than two decades, from its beginnings with the Skylab S-193 altimeter/ scatterometer, through the Geos-3, Seasat, and TOPEX/POSEIDON (T/P) radar altimeters. We have collaborated in performance assessment of the U.S. Navy's Geosat and Geosat Follow-On (GFO) radar altimeters. WFF was responsible for supplying the NASA radar altimeter for T/P. Our work involved TOPEX altimeter specifications, monitoring its development and construction (by the Johns Hopkins Applied Physics Laboratory), assessing data from the altimeter's preflight testing, and the continuing assessment of the altimeter's performance from launch through its eventual end of mission. We have also provided corrections to the TOPEX data products based on the altimeter hardware characteristics [Hayne et al., 1994], and have developed additional corrections to compensate for changes in hardware characteristics over the life of the mission. Details of the TOPEX radar altimeter work are posted on the web at http://topex.wff.nasa.gov.

For POSEIDON-2, CNES will provide the primary instrument calibration. In collaboration with CNES, our work will include independent assessment of the performance of the instrument corrections. Some POSEIDON-2 preflight data have already been analyzed at WFF, and substantially more will be examined by the time of the Jason-1 launch. The goal of the WFF analysis of POSEIDON data, both pre- and post-launch, is to ensure that instrument-induced errors are minimized and that the scientific end user has the cleanest possible set of altimeter data.

References

Hayne G.S., D.W. Hancock III, C.L. Purdy, P.S. Callahan, 1994: The corrections for significant wave height and attitude effects in the TOPEX altimeter, *J. Geophys. Res.*, 99, 24941-24955.

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