

WindSat Space Borne Polarimetric Microwave Radiometer: Sensor Calibration and System Performance

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ABSTRACT

WindSat, a satellite-based multi-frequency polarimetric microwave radiometer developed by the Naval Research Laboratory for the U.S. Navy and the NPOESS Integrated Program Office (IPO), has collected nearly five years of fully-polarimetric microwave measurements from space since its launch in 2003 [1]. The primary WindSat mission was to demonstrate the capability retrieve the ocean surface wind vector from a space-based microwave radiometer. The WindSat data is now being used to produce near-real-time products for the ocean surface wind vector, sea surface temperature (SST) and atmospheric columnar water vapor and cloud liquid water over the ocean at the U.S. Navy's Fleet Numerical Meteorological and Oceanographic Center (FNMOC). Several groups have worked on assimilating WindSat data products into numerical weather models with positive results.

To further exploit the unique WindSat data set, significant effort has gone into improving the spatial resolution of the WindSat ocean products. Higher spatial resolution not only better resolves the wind field, but also improves high wind speed retrievals because of the smaller spatial scales of higher winds. Furthermore, reduced spatial resolution allows for retrievals closer to coastlines. The current WindSat ground data processing software produces retrievals of sea surface wind vectors, total precipitable water, and cloud liquid water at three spatial resolutions (pixel sizes of 50x71 km; 35x53 km; and 25x35 km). We will present comparisons of retrieval products at these three resolutions.

In addition to providing environmental products over the ocean, the WindSat data set has been exploited for retrievals over land and ice. In particular, the WindSat channel set is well suited to retrieving soil moisture and land surface temperature. We have also built on heritage algorithms to derive sea ice concentration.

The success of the WindSat mission is directly traceable to the on-orbit sensor calibration. WindSat was designed with a one-year mission requirement and three year goal, continues to operate five years after launch. We continue to monitor the instrument performance and the calibration stability to ensure consistency of WindSat data products throughout the mission life. Key system performance and calibration parameters include the receiver gains and NEDTs. These parameters are susceptible to component aging and changes in the payload thermal behavior. We will present trends in NEDT and receiver gains over the life of the mission. We will also describe other system behaviors such as thermal and scan control over the mission life.