Next-Generation Global Environmental Sensors

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The National Polar-orbiting Operational Environmental Satellite System (NPOESS) is currently developing the next-generation measurement capability for the United States. Formed in 1994 by presidential directive, the NPOESS Integrated Program Office oversees development of several next generation sensors including two passive microwave sensors: the Microwave Imager Sounder (MIS) and the Advanced Technology Microwave Sounder (ATMS).

The ATMS is a cross-track passive microwave radiometer measuring brightness temperatures in 22 channels ranging from 23- to 183-GHz in order to permit the calculation of atmospheric temperature and moisture profiles. The ATMS works in conjunction with the Cross-track Infrared Sounder (CrIS), also on NPOESS, in order to provide precision atmospheric temperature and moisture profiles in support of operational weather forecasts, climate studies and earth science. The heritage sensors for ATMS include the Advanced Microwave Sounder Unit (AMSU) A and B and the Microwave Humidity Sounder (MHS) that have formed the backbone capability of operational satellite measurements used in numerical weather forecasting to date.

The MIS is a conically-scanning passive microwave radiometer utilizing 39 channels covering 6- through 183-GHz. The MIS heritage is from the Defense Meteorological Satellite System (DMSP) Special Sensor Microwave Imager (SSM/I) and the Special Sensor Microwave Imager Sounder (SSMIS). The SSMIS and SSM/I are well known for their measurements of a variety of operational environmental parameters including sea surface winds, sea ice characteristics, integrated atmospheric water vapor, cloud water, precipitation and land temperature. These parameters measured on a global basis have supported operational weather forecasting and climate studies since 1987. The NPOESS MIS improves on this heritage by providing additional low frequency channels sensitive to sea surface temperature (near 6- and 10-GHz), polarimetric channels to measure sea surface wind direction, greatly improved spatial resolution (1.8m main reflector), and with the capability to measure atmospheric temperature and moisture profiles using the conical-scan geometry. The extended set of co-registered simultaneous measurements from the MIS using the same observation geometry provides many exciting new potential improvements to the previous capability. For example, retrieval of atmospheric temperature and moisture profiles may be improved by better characterization of surface effects (errors) in the retrieved temperature profiles. Conversely, MIS provides the ability to more precisely remove the atmospheric effects in retrieval of surface parameters. The current MIS design also takes some of its heritage from the U.S. Naval Research Laboratory's WindSat radiometer and the Japan Aerospace Exploration Agency's Advanced Microwave Scanning Radiometer (AMSR-E) on NASA's EOS Aqua mission. Measurement of sea surface winds and sea surface temperature from the MIS is also expected to improve the overall value of its suite of measurements.