Atmospheric Infrared Sounder: A Case Study of Transitioning Research to Operations

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The planned transition of Earth observation research data to operational capacity is a deliberate, structured process. This includes calibration, retrieval algorithm validation, long-term product stability evaluation and numerical model-based analyses that assess the marginal benefit of these data products on meeting operational requirements. The Atmospheric Infrared Sounder (AIRS) is one of six instruments onboard Aqua, launched on May 4, 2002 as part of the NASA Earth Observing System. The AIRS instrument is the first high-spectral-resolution infrared sounder developed by NASA in support of operational weather forecasting by NOAA, while addressing research needs in global energy and water cycles, weather and climate. AIRS, with 4 channels in the visible and near-infrared (0.4 to 0.95 mm) and 2378 channels in the infrared (3.7 to 15.4 mm), in conjunction with the Advanced Microwave Sounding Unit (AMSU-A), also onboard Aqua, represents an advanced atmospheric sounding system that is making highly accurate measurements of air temperature, humidity, clouds and surface temperature. These measurements are contributing significantly to scientific research and can have equally significant operational impact on global weather monitoring and long-term climate and environmental observations. Numerical weather prediction and forecasting models in fact are moving towards improved spatial resolution coverage. Various AIRS data products are routinely distributed to Numerical Weather Prediction (NWP) Centers in near real-time, the Distributed Active Archive Center at the NASA Goddard Space Flight Center, and by direct broadcast. AIRS is a pathfinder for future systems such as the National Polar-orbiting Operational Environmental Satellite System (NPOESS). The excellent radiometric sensitivity, and spectral and radiometric stabilities of AIRS products to-date suggest the design of next-generation integrated imagers/sounders, with the incorporation of complementary all-weather standalone microwave sounding capabilities. AMSU-A, for example, is a 15-channel microwave sounder (15-90 GHz) designed primarily to obtain temperature profiles in the upper atmosphere and to provide cloud-filtering capability for tropospheric temperature observations and tropospheric winds. As part of JPL's ongoing observational venue architecture studies, integrated instrument suite concepts that support high-spatial-resolution hyperspectral imagers for improved feature definition and cloud retrieval – such as AIRS – with high-spatial-resolution microwave sounders– such as AMSU (15-90 GHz) and GeoSTAR (50- 186 GHz), a synthetic thinned aperture radiometer – are being investigated and evaluated as to their ability to substantially improve weather predictions. Advanced broader band AIRS-type instruments integrated with instruments such as AMSU and GeoSTAR provide case studies for discussing key elements of transitioning to operational capacity – ranging from advanced high spatial and spectral resolution instruments for integrated measurements to data assimilation into numerical models, yielding wide-ranging user benefits and in turn refining requirements for future systems.