Enhanced Validation of Satellite Derived Sounding Products using Reference and Dedicated Radiosondes

Flavio Iturbide-Sanchez[1], Anthony Reale[2], Nicholas R. Nalli[1], Murty Divakarla[1], Antonia Gambacorta[1], Bomin Sun[1], Changyi Tan[1], Xiaozheng Xiong[1], Eric S. Maddy[3] and Mike Wilson[1]

[1]I. M. Systems Group, Inc., at the NOAA/NESDIS/STAR, College Park, MD 20740-3818 USA
[2]NOAA/NESDIS/STAR, College Park, MD 20740-3818 USA
[3]Science and Technology Corp. at the NOAA/NESDIS/STAR, College Park, MD 20740-3818 USA

The National Oceanic and Atmospheric Administration (NOAA) Products validation System (NPROVS) has been operating at NOAA/Center for Satellite Applications and Research (STAR) since 2008 to routinely monitor over different latitudes the performance of temperature and water vapor profiles retrieved from operational environmental satellite sensor observations against conventional upper air radiosonde observations (RAOB). The following paper presents an enhancement of this approach, NPROVS+, using routinely available reference and satellite synchronized dedicated RAOB data. Dedicated RAOB funded by the S-NPP JPSS Cal/Val program include those launched at several sites including the Atmospheric Radiation Measurement (ARM) Climate Research Facility, and the Pacific Missile Range Facility (PMRF) as well as series of intensive AERosols and Ocean Science Expeditions (AEROSE) field experiments. Reference RAOBs are from the Global Climate Observing System (GCOS) Reference Upper Air Network (GRUAN) and include traceable uncertainty estimates of observed geophysical parameters. The use of reference and dedicated RAOBs elevates the validation and allows direct use of uncertainty estimates to help interpret satellite product performance. These data are generally independent of numerical weather prediction (NWP) models (which assimilate conventional RAOBs), typically used to validate satellite-derived products and in some cases also used to provide apriori information for the satellite products. This independence along with the reference standard provided by such data make them desirable for characterizing satellite product performance.

A unique aspect of NPROVS+ is its direct connection to S-NPP product development activities. The retrieval validation capabilities are planned to simultaneously evaluate the performance of several retrieval algorithms based on Microwave (MW), Infrared (IR) and combined IR/MW passive remote sensing observations applied for over different satellite sensors in the past. Among the retrieval approaches selected are the NOAA Unique Cross-track Infrared Sounder (CrIS)/Advanced Technology Microwave Sounder (ATMS) Processing System (NUCAPS), the Cross Track Infrared and Microwave Sounder Suite (CrIMSS) algorithm, as well as retrieval systems based on observations from the Atmospheric Infrared Sounder (AIRS) and Advanced Microwave Sounding Unit-Aqua (AMSU-A) from NASA-Aqua-EOS, and the Infrared Atmospheric Sounding Interferometer (IASI) and AMSU/Microwave Humidity Sounder (MHS) from the Meteorological Operation (MetOp)-A and –B satellites. The structure of the retrieval validation system is being designed to accommodate various retrieval approaches. However a focusing goal is to support the development of a single NOAA compatible scientific algorithm across historical CrIS, IASI and AIRS hypersepctral sensors. A major feature of the validation system includes the integration of routine monitoring and scientific algorithm development activities to a unified landscape. First results for various retrieval approaches and validation datasets are presented.