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The Development of AMSU-A Fundamental CDR's

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Current passive microwave sounder data, used in hydrological applications, are derived from NOAA's POES satellites and EUMETSAT's MetOp-A satellite for which the primary mission is operational weather prediction. These data are not calibrated with sufficient stability for climate applications. In addition, the data also suffer from various biases that are not adequately studied and removed. A properly calibrated Fundamental Climate Data Record (FCDR) needs to be developed to enable the utilization of these data for Thematic CDR (precipitation, cloud liquid water, etc.) and Climate Information Records, and to extend their application into the JPSS era. The methods for developing the FCDR will also benefit the data assimilation community and help to improve the quality of reanalysis data. This presentation introduces the on-going effort at NOAA and its Cooperative Institute for Climate and Satellites to create FCDR of the window channel measurements from the Advanced Sounding Unit-A (AMSU-A). The FCDR will consist of AMSU-A data from six satellites (NOAA-15 to -19 and MetOp-A) and include 11 years of consistent and inter-calibrated AMSU-A brightness temperatures (Tb) at 23.8, 31.4, 50.3, and 89 GHz. A similar effort is being initiated for the AMSU-B and MHS sensors, but is not part of this presentation.

The AMSU-A observations suffer from some known and potentially some unknown biases such as across scan bias (ASB), geolocation and pointing angle error, orbital decay, warm target contamination, and sidelobe effect etc. Among these, ASB has been observed in the measurement from all existing AMSU-A sensors. It could be the combined result of multiple bias sources. To characterize ASB in AMSU-A measurement, the across scan difference between the observed and the simulated Tb was analyzed for the tropical and subtropical oceans and under clear sky condition. The simulations were derived using the Community Radiative Transfer Model (CRTM). ERA-interim data provided the atmospheric and surface information required by CRTM. The cloud data from PATMOS-x, an AVHRR product, were applied to determine sky condition. Much effort was devoted to analyzing these input datasets to ensure the appropriate usage of the data and to minimize any bias that propagates from the data to the simulation. Similarly, study was conducted on CRTM to understand the model uncertainty. The window channel measurements are strongly influenced by both atmosphere and surface. Consequently, ASB also appears to be subject to the changes in environmental conditions. The dominant factors that impact Tb over ocean are total precipitable water, SST, and ocean wind. Therefore, ASB was characterized with data stratified based on the three variables and the findings will be presented. Geolocation error was also studied for the six satellites. Data from some sensors, such as AMSU-A on NOAA-15 and NOAA-18 exhibit clear geolocation errors while some others appear to have minimal error. Geolocation issue can also contribute to ASB as will be shown in the presentation.