# Cross-Calibrated MSU/AMSU Radiance Observations to Improve Long-Term Temperature Trends in Future Reanalyses

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Long-term temperature trends inferred from climate reanalyses are not yet believed to represent the real trends of the Earth's surface and atmosphere. Part of the reasons is that there is lack of a long-term observation with consensus reliable temperature trends to anchor the reanalyses. The 30 plus years of MSU/AMSU level-1c radiance dataset represents a significant input in reanalysis systems. However, time varying bias corrections to these data have been made before they are assimilated in the reanalysis systems, as a result, temperature trends of the climate reanalyses are in general different from the satellite temperature trends. On the other hand, the MSU/AMSU observations have been merged together to develop deep-layer temperature time series which have been extensively used to monitor and investigate the atmospheric temperature trends by the climate community. It has not been fruitful to compare the reanalysis trends with those from the merged MSU/AMSU temperatures since different bias correction algorithms were applied in the two different types of datasets.

Important progresses have been made at NOAA/NESDIS to cross-calibrate the MSU/AMSU level-1c radiance data for reanalysis data assimilation applications. 20-years of inter-calibrated MSU radiance data have been assimilated into the NCEP CFSR and NASA MERRA reanalyses. Significantly improved bias correction patterns were observed from the cross-calibrated MSU radiance data compared to those from using pre-launch calibrated MSU radiances. Assimilation of the cross-calibrated MSU data in reanalysis allows direct comparisons of temperature trends from the reanalysis with those from the merged MSU/AMSU time series.

This presentation reports the latest progress in the MSU/AMSU inter-calibration effort at NOAA/NESDIS with an emphasis on the AMSU results. Recently, inter-calibrations of AMSU-A radiance data for most atmospheric temperature channels for polar orbiting satellites NOAA-15, -16, -17, -18, European MetOp-A, and NASA Aqua are completed. The inter-calibration removes time-varying inter-satellite biases and results in more consistent and homogenized radiance data for use by future reanalyses. The inter-calibrated AMSU-A observations have also been merged with MSU to generate the NOAA version of upper-air temperature climate data record for climate trend and variability monitoring from 1979 to present. The temperature trends from this temperature time series can be directly compared to those from climate reanalyses if future reanalyses also use cross-calibrated AMSU radiances.

This presentation provides recommendations on how to use the newly developed MSU/AMSU radiance dataset and what need to be adjusted in the reanalysis data assimilation systems. Expected results from using these datasets in reanalyses and their comparisons to the merged MSU/AMSU time series will be discussed.

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