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A New Approach to Measurement Uncertainties in the SBUV Profile Ozone Record

S. Frith
Science Systems and Applications, Inc., United States (stacey.m.frith@nasa.gov)

The combined record of total and profile ozone measurements from the Solar Backscatter Ultraviolet (SBUV) and SBUV/2 series of instruments, known as SBUV Merged Ozone Data (MOD), constitutes the longest satellite-based ozone time series from a single instrument type, and as such plays a key role in ozone trend analyses. The NOAA 19 SBUV/2 and the next generation Ozone Mapping Profiler Suite (OMPS) Nadir Profiler instruments are currently operational, with OMPS instruments planned for decades to come on the JPSS platforms. Recent analyses indicate positive trends since 2001 at layers above 6 hPa in the 60°N-60°S SBUV MOD, but the significance of these results is highly dependent on the measurement record uncertainty. Though the design of each instrument is similar, differences in satellite orbit, calibration, and operational quality lead to offsets and drifts between the data sets that must be accounted for when estimating the overall uncertainty in the merged data record. We use a Monte Carlo modeling approach to estimate the potential for uncertainties in the calibration and drift of individual instruments to mimic long-term variations in the merged data set. We use intra-instrument comparisons as well as comparisons with independent data sources to quantify the uncertainty of each instrument in the Monte Carlo simulations. In this investigation we update SBUV validation to include the latest versions of external data sets (SAGE V7, AURA MLS V4.2), and test the viability of using the high spatial and temporal resolution of output from the MERRA-2 (Modern Era Retrospective analysis for Research and Applications, Version 2) as a means of reducing co-location errors between correlative measurements. MERRA-2 assimilates SBUV profile ozone from 1980-late 2004; after this time AURA MLS profile ozone and OMI total ozone are assimilated. Using the longitudinal variability about the zonal mean in MERRA-2, adjustments can be made to SBUV and correlative measurements to effectively remove co-location errors to first order. Uncertainty estimates from external comparisons will be evaluated relative to intra-SBUV comparisons, and updated trend results with realistic error bars will be presented.