Estimation of smoothing error in SBUV profile and total ozone retrieval.

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ABSTRACT

Data from the Nimbus-4, Nimbus-7 Solar Backscatter Ultra Violet (SBUV) and seven of the NOAA series of SBUV/2 instruments spanning 41 years are being reprocessed using V8.6 algorithm. The data are scheduled to be released by the end of August 2011. An important focus of the new algorithm is to estimate various sources of errors in the SBUV profiles and total ozone retrievals. We discuss here the smoothing errors that describe the components of the profile variability that the SBUV observing system can not measure. The SBUV(/2) instruments have a vertical resolution of 5 km in the middle stratosphere, decreasing to 8 to 10 km below the ozone peak and above 0.5 hPa. To estimate the smoothing effect of the SBUV algorithm, the actual statistics of the fine vertical structure of ozone profiles must be known. The covariance matrix of the ensemble of measured ozone profiles with the high vertical resolution would be a formal representation of the actual ozone variability. We merged the MLS (version 3) and sonde ozone profiles to calculate the covariance matrix, which in general case, for single profile retrieval, might be a function of the latitude and month. Using the averaging kernels of the SBUV(/2) measurements and calculated total covariance matrix one can estimate the smoothing errors for the SBUV ozone profiles. A method to estimate the smoothing effect of the SBUV algorithm is described and the covariance matrixes and averaging kernels are provided along with the SBUV(/2) ozone profiles. The magnitude of the smoothing error varies with altitude, latitude, season and solar zenith angle. The analysis of the smoothing errors, based on the SBUV(/2) monthly zonal mean time series, shows that the largest smoothing errors were detected in the troposphere and might be as large as 15-20% and rapidly decrease with the altitude. In the stratosphere above 40 hPa the smoothing errors are less than 5% and between 10 and 1 hPa the smoothing errors are on the order of 1%. We validate our estimated smoothing errors by comparing the SBUV ozone profiles with other ozone profiling sensors.

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