Bias correction of satellite multi-sensor total column ozone datasets and their merged ozone dataset

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This study evaluates 20 level 2 total column ozone (TCO) datasets acquired covering the 40 years from 1978 to 2017, by comparing satellite overpass data coincident with ground-based Dobson and Brewer spectrophotometer measurements. These 20 individual TCO datasets and a merged TCO datasets are corrected for systematic mean biases and drift. Two bias correction methods are used: simple linear regression (SLR) fitting of the data as a function of time and multiple linear regression (MLR) fitting of the data as a function of time, solar zenith angle, and effective ozone temperature. All of the satellite datasets agree well, within ±1-2%, with the ground-based measurements, except for some degraded data from the Total Ozone Mapping Spectrometer (TOMS)/Earth Probe during a terminated period and from the Ozone Mapping and profiling Suite (OMPS) provided from NOAA at an early stage of measurements. The OMPS data provided from NASA do not show any significant bias or trend relative to the ground-based data. The Global Ozone Monitoring Experiment/MetOp-A and -B datasets show abrupt changes of up to 7-8 DU coincident with the introduction of a new retrieval algorithm. The root mean square error of uncorrected merged datasets, 8.6 DU, is reduced to 8.4 DU after correction by multiple linear regression. Further, the negative trend is seen in 1979-1996 in the uncorrected merged dataset is reduced by 2 DU per decade in the corrected dataset. The TCO trend during 2000-2017 does not differ between the uncorrected and corrected merged datasets.

Reference

Naoe, H., T. Matsumoto, K. Ueno, T. Maki, M. Deushi, and A. Takeuchi, 2020: Bias correction of multi-sensor total column ozone satellite data for 1978-2017. J. Meteor. Soc. Japan, 98, https://doi.org/10.2151/jmsj.2020-019.

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