QOS2016-305, 2016
Quadrennial Ozone Symposium of the International Ozone Commission

Impact of approximations in the recommended Dobson algorithm on total column ozone measurements at four Australian sites

M.B. Tully
Bureau of Meteorology, Melbourne VIC, Australia (m.tully@bom.gov.au)

Observations of total column ozone made by the GAW network of Dobson spectrophotometers are processed by each operator using a standard algorithm, with the resulting processed data, rather than raw observations, being submitted to the World Ozone and Ultraviolet Data Centre and from there, available to data users. For simplicity, the official WMO algorithm uses a crude parameterised value of mean ozone height by latitude, and assumes a constant "effective ozone temperature" for all locations and times of year. These approximations potentially interfere with the comparison of Dobson measurements with those from other instruments, as well as introducing the possibility of a spurious ozone seasonal cycle, trend, or response to signals such as the QBO.
Here, daily ozone and temperature profiles from the MERRA-2 reanalysis (Rienecker et al. 2011) are used to calculate the mean ozone height and effective ozone temperature at four long-standing Australian Dobson sites (Darwin, Brisbane, Melbourne/Airport and Macquarie Island) for each individual day from 1980 to 2015, also making use of the current state-of-the-art ozone cross-sections (Serdyuchenko et al. 2014), and the effect on the calculation of total column ozone investigated.
The effect on the calculated ozone of the annual cycle in temperature ranges from 2.5% at Macquarie Island to 0.5% at Darwin, but day to day variations can be twice this amount. The effect of the seasonal cycle in mean ozone height is negligible at Darwin but increases poleward, reaching 0.6% for measurements made two hours from local noon at Macquarie Island.
These results suggest the standard Dobson algorithm should be updated to incorporate reanalysis data in the ozone retrieval.

References

Rienecker, M.M., M.J. Suarez, R. Gelaro, R. Todling, J. Bacmeister, E. Liu, M.G. Bosilovich, S.D. Schubert, L. Takacs, G.-K. Kim, S. Bloom, J. Chen, D. Collins, A. Conaty, A. da Silva, et al., MERRA: NASA's Modern-Era Retrospective Analysis for Research and Applications. J. Climate, 24, 3624-3648, doi:10.1175/JCLI-D-11-00015, 2011.
Serdyuchenko, A., Gorshelev, V., Weber, M., Chehade, W., and Burrows, J. P.: High spectral resolution ozone absorption cross-sections – Part 2: Temperature dependence, Atmos. Meas. Tech., 7, 625-636, doi:10.5194/amt-7-625-2014, 2014.