Removal of Seasonal Bias from Dobson Spectrophotometer Records using Reanalysis

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The Dobson spectrophotometer is an ozone-observing instrument that has been in operation in the NOAA ozone-observing network since the early 1960's. Dobson spectrophotometers measure differential absorption in solar ultraviolet (UV) spectrum and use lab-measured ozone absorption cross sections to derive total column ozone. However, differential absorption in UV spectrum depends on stratospheric temperature. A correction for the historical Dobson dataset is proposed to account for the daily variability of stratospheric temperatures via an ozone-weighted temperature. Presently, Dobson observations use Bass and Paur (1985) ozone absorption dataset. Recently, new ozone cross section lab measurements were acquired and published by Serdyuchenko et al. (2014). Operational ozone monitoring at all World Meteorological Organization ground-based stations relies on a single static temperature of -46.3°C. Daily stratospheric temperatures deviate from this reference temperature and directly affect the measurement. The difficulty of applying a correction is having a temperature and ozone profile available at the same time as a Dobson measurement. Ozonesondes are not a daily occurrence and satellites generally pass over a station once every one to two days. Therefore, we propose using a reanalysis product to account for daily variability in ozone and stratospheric temperatures to correct Dobson historical record. NASA's GMI-MERRA product is used for this project. We will present results of daily corrections for NOAA Dobson total ozone record and compare against other co-located ozone measurements, including satellites.
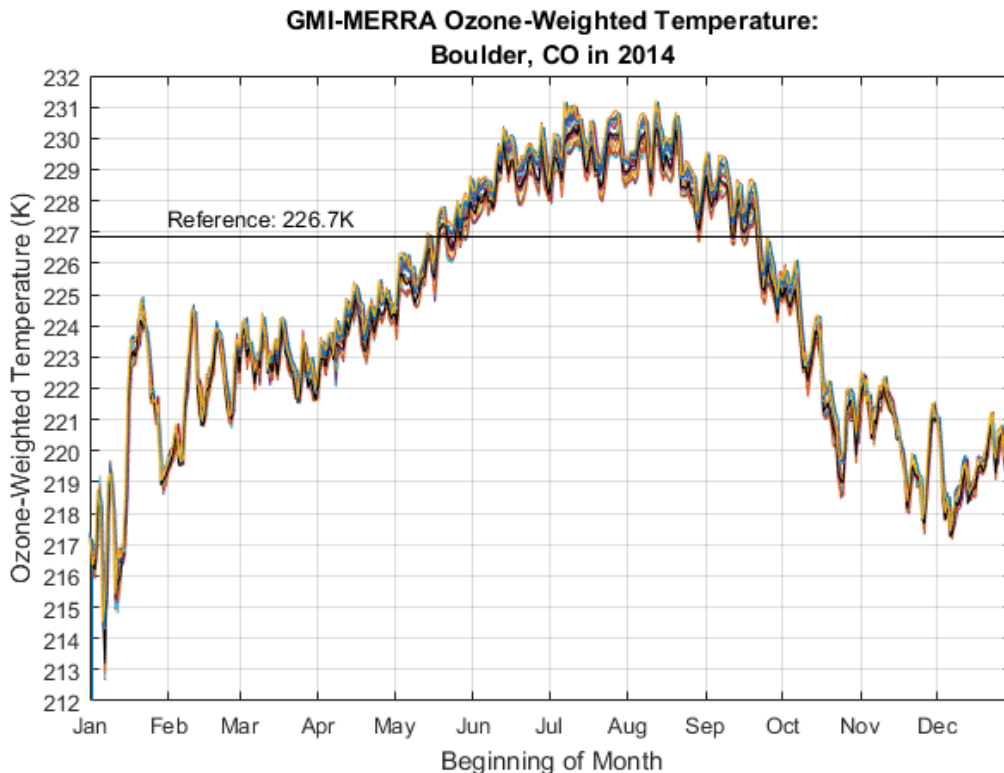
Figure 1. Time series of effective temperatures derived using GMI-MERRA dataset for Boulder, CO. Currently used operational static temperature is shown as reference.