Improvements in the Brewer Mark IV Spectrophotometer Ultraviolet AOD Retrievals

P. Disterhoft[1,2] and S. Stierle[1,2]

[1]Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, CO 80309; 303-497-6355, E-mail: patrick.disterhoft@noaa.gov
[2]NOAA Earth System Research Laboratory, Global Monitoring Division (GMD), Boulder, CO 80305

The ultraviolet (UV) portion of the solar spectrum accounts for 8-10% of the total radiation budget reaching the surface of the earth. It is important to measure the aerosol optical depth (AOD) in this region of the spectrum as it contributes to the total radiative forcing. The NEUBrew network operates two Mark IV Brewer spectrophotometers, #131 and #137 in a special day-long schedule, taking only direct-sun spectral irradiance measurements from 290 to 363 nanometers at 0.5 nm increments. The two Brewers are separated by 15 kilometers between the Table Mt. Test Facility (TMTF) (#131) and the roof of the David Skaggs Research Center (#137), Boulder, Colorado. At the TMTF there is a collocated AERONET CIMEL, #705. The Brewer Mark IV and CIMEL have overlapping measurements at 340 nm which allows for direct comparison between the retrievals. Comparison between the two Brewers and the CIMEL retrievals are made and an approximation of their relative calibration offset is determined. A handheld Microtops AOD sunphotometer is used as a reference device to determine any relative difference between the Brewers. From the retrieved aerosol optical depths we compare the Angstrom exponent determined from an Angstrom plot to that calculated directly from the data. The calculated Angstrom exponent value is used to extrapolate to both lower and higher wavelength AOD values measured by the Brewer to determine the quality of the Angstrom method in the UV across the Brewer's spectral range. The Langley method is used to determine the extraterrestrial constant (ETC) calibration factor, using only days where the AOD and total column ozone are stable.

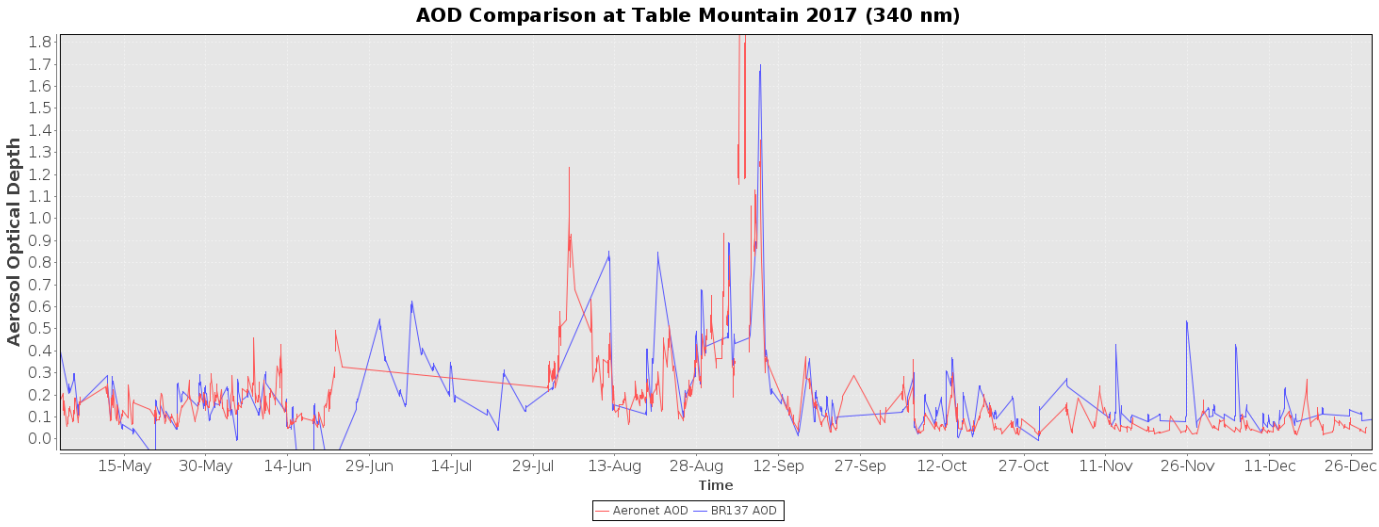

Figure 1. A preliminary comparison of Brewer 131 (Table Mt., Colorado) to the collocated AERONET CIMEL #705 AOD's at 340 nm is plotted. It shows good agreement between the two instruments. The chart also reveals a dramatic increase in the optical depth retrieved from both instruments in the summer of 2017 and is most likely due to the fires in the western U.S.