Analysis, Determination and Reprocessing Methods Used For Homogenization of the NOAA Long-term ECC Ozonesonde Time Series

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The NOAA electrochemical concentration cell (ECC) ozonesonde network has been taking measurements for nearly 40 years and extends to nine sites worldwide. These vertical ozone profiles are used in a wide range of applications by many institutions and individuals. During this time period, many instrument configurations, solutions, and processing changes have occurred. These changes have introduced systematic biases into the data record. In order to reduce uncertainty, recover original raw data, and analyze and calculate the remaining random uncertainties, the Ozonesonde Data Quality Assessment (O3S-DQA) was initiated by the ozonesonde community. NOAA's network is unique due to the large number of sites, length of record, and unique solutions and instrument types used. NOAA has generally followed the homogenization guidelines published in the World Meterological Organization Global Atmosphere Watch Report #201 [2014]. However, the uniqueness of NOAA's data record required us to develop our own transfer functions. The Boulder, CO station is used here as an example to illustrate NOAA's reprocessing system and the method used to determine the appropriate corrections. Initially, ozone soundings were processed from the raw data in order to recover and record the cell current and original measured backgrounds in the data files. Next, the ozonesonde cell current backgrounds were systematically reduced and pressure offsets were applied to radiosondes. Flowrate corrections and pump temperature corrections were applied when necessary. NOAA has developed transfer functions to remove biases created by solution changes. In order to determine appropriate transfer functions, 1% Full Buffer and 2% No Buffer solutions were compared to the 1% 1/10th buffer solution and an ozone photometer via dual ozonesonde flights and testing in atmospheric chambers. The final piece of the data homogenization process was implementing a robust, bottoms up uncertainty calculation. The instrumental uncertainty of the ozonesonde measurement is a composite of the contributions of the individual uncertainties of the different instrumental parameters, namely, the measured sensor current, background current, conversion efficiency, pump temperature, and pump flowrate. The uncertainty calculation takes into account the added uncertainty of implementing transfer functions. This data homogenization effort improves the agreement in total column ozone between ozonesondes, co-located Dobson spectrophotometers, and satellites (AURA's Ozone Monitoring Instrument and Microwave Limb Sounder and NOAA-9 through NOAA-19).

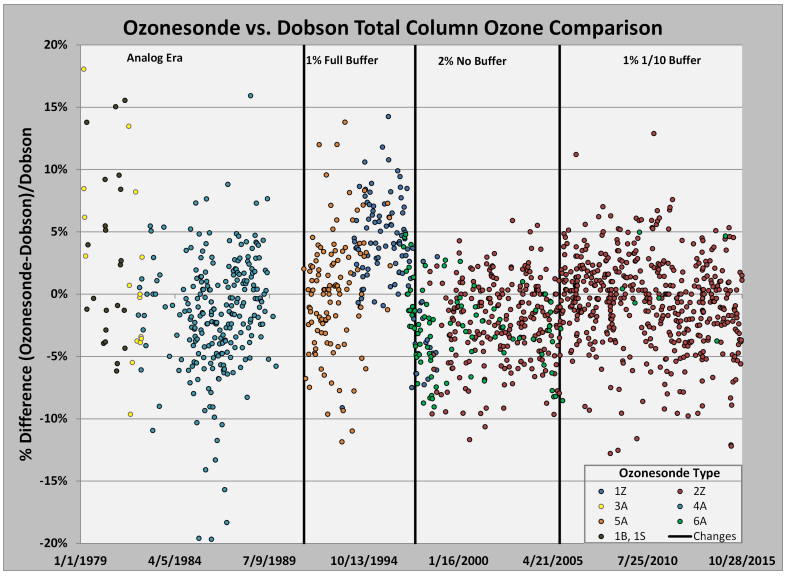

Figure 1. Time series of ozonesonde vs dobson total column ozone for Boulder, CO pre-homogenization.