CHEESEHEAD Ozone Flux Measurements

Dataset Authors:

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General Dataset Description:

This dataset contains quality-controlled O3 fluxes 30-minute averaging periods. Fluxes were calculated at two different heights (30 and 122 m) at the WLEF very tall tower. Ozone mixing ratio measurements were made using a chemical ionization time of flight mass spectrometer (CI-ToFMS). All flux values are in ppbv cm/s. Time is in fractional day of year CDT. For all measurements assume a 20% uncertainty, as that is the upper limit in flux uncertainty calculations.

Instrument Description:

A full description of the instrument can be found in
Bertram, T.H., et al., A field-deployable, chemical ionization time-of-flight mass spectrometer, Atmos. Meas. Tech., 4, 1471–1479, 2011, www.atmos-meas-tech.net/4/1471/2011/doi:10.5194/amt-4-1471-2011

A full description of the detection method (Ox-CIMS) can be found in
Novak, G. A., Vermeuel, M. P., and Bertram, T. H.: Simultaneous Detection of Ozone and Nitrogen Dioxide by Oxygen Anion Chemical Ionization Mass Spectrometry: A Fast Time Response Sensor Suitable for Eddy Covariance Measurements, Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2019-445, in review, 2019.

Data Collection:

Fluxes were calculated via Reynold's averaging of 30-m blocks of ToF signal (X) and vertical winds (w) of a collocated sonic anemometer. Prior to Reynold's averaging of a flux period, X was despiked and detrended by subtraction of the linear fit of the signal time series. Winds were rotated based on the planar fit method (PFM), which is an assessment of the anemometer tilt with respect to long-term local streamlines. A plane was fit using 15-minute averaged sonic anemometer u, v, and w data from 2019 April – July.

Quality Control:

Flux periods were removed if any of the following conditions were true:
1. The calculated friction velocity was less than 0.1 m/s
2. The mean flux value of five flux sub-periods differed from the value of the entire 30-minute flux period by more than 30% (i.e. stationarity test)
3. The calculated Obukhov length was greater than 20 m (this on average was between 2200-0500 CDT so those points were removed).
4. The calculated cospectra had >3 instances where the differences between two consecutive frequencies had their cumulative flux differ by >18%

5. An individual flux period had a cross-covariance time lag of beyond 5 seconds of the calculated campaign average time lag in cross-covariance. Lag times were calculated using the method in

Langford, B., et al., Eddy-Covariance Data with Low Signal-to-Noise Ratio: Time-Lag Determination, Uncertainties and Limit of Detection, Atmos. Meas. Tech. 2015, 8 (10), 4197-4213. https://doi.org/10.5194/amt-8-4197-2015

Uncertainties:
Flux uncertainty was calculated following the methods in Langford, B., et al., 2015.

Time Period: 2019/07/02 20:07:52.3 - 2019/07/15 23:36:31.68

Location: The tower is located at 45.946 N and 90.272 W.

Data Frequency: 30 minute

Data Spatial Type: Time series data from a single tower at two vertical heights.

Dataset Restrictions: No restrictions. Please see the CHEESEHEAD Data Policy.

File format: All files are in .xlsx format in a single Excel file.

Data format:
The .xlsx file should have 5 columns:
DOY - Fractional day of year (CDT)
flux_30m_ppbv_cm_s = O3 flux at the 30-m inlet height (ppbv cm/s)
flux_122m_ppbv_cm_s = O3 flux at the 122-m inlet height (ppbv cm/s)
vd_30m_cm_s = O3 deposition velocity at the 30-m inlet height (cm/s)
vd_122m_cm_s = O3 deposition velocity at the 122-m inlet height (cm/s)

GCMD Keywords:
EARTH SCIENCE, ATMOSPHERE, ATMOSPHERIC CHEMISTRY, OXYGEN COMPOUNDS, OZONE