

1. Motivation and Overview

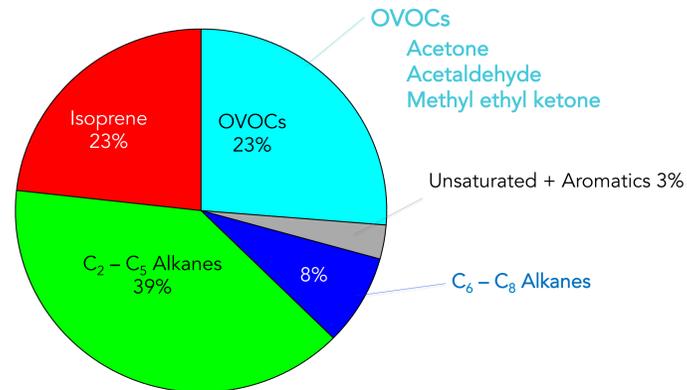


Figure 1: Summary of the contribution of different VOCs to OH reactivity observed in the Colorado Front Range in summer 2015. See Abeleira et al., [2017] for details. This pie chart includes non-smoke-impacted periods only⁵.

- Oxygenated volatile organic compounds (OVOcs) account for almost a quarter of OH reactivity in the Front Range. This region exceeds the air quality standard for ozone¹.
- Abeleira et al. [2017] showed that compared to other co-measured VOCs, the OVOcs were poorly reconstructed (i.e. explained) by a positive matrix factorization (PMF) analysis.
- We focus here on methyl ethyl ketone (MEK), investigating its relationship with known precursors and the other observed OVOcs.

2. Methods

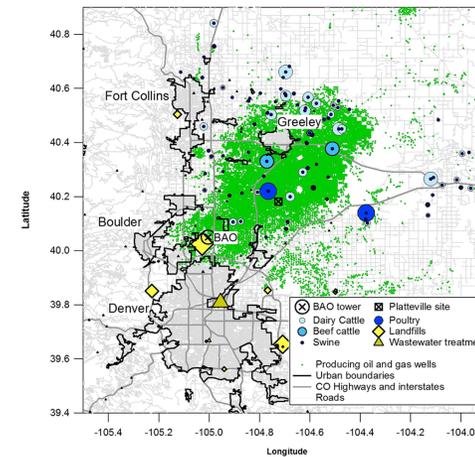


Figure 2: Map of study region from Abeleira et al. [2017]

- The Boulder Atmospheric Observatory (BAO) is located at the southwestern corner of the Denver-Julesburg Basin and north of the Denver metropolitan areas.
- VOCs were measured ~hourly with a custom on-line gas chromatograph during two field intensives in spring (3/20-5/17) and summer (7/24-8/16*) 2015. The inlet was located at 6 m a.g.l.
- A suite of reactive nitrogen species (NO, NO₂, NO_y, PAN, HNO₃), and other carbon gases (CO, CO₂, CH₄) were also measured during the field intensives.
- Meteorological data (temp., RH, WS, WD) was collected every minute and merged with a ten minute average centered on the VOC timestamp. Meteorological data was collected at 10 m a.g.l.

*Summer data was shortened by 13 days because of smoke influences from wildfires.

3. Results

1. Mean MEK mixing ratios were higher in summer than spring; elevated days occurred in each season.

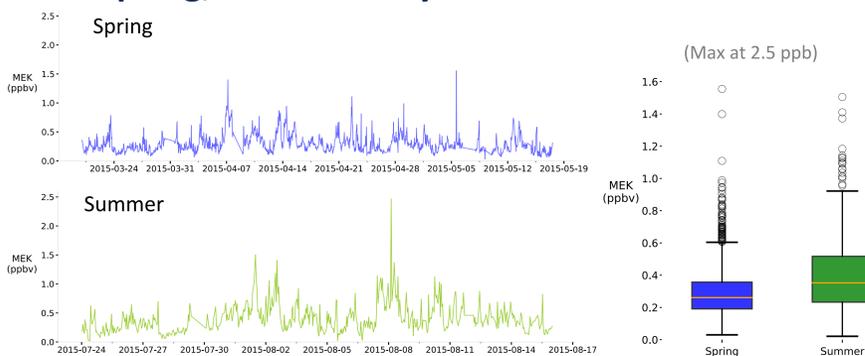


Figure 3 (above): Time series of spring and summer. Mean MEK mixing ratio for spring and summer are .3 ppbv and .4 ppbv, respectively. Median MEK mixing ratio (orange line) for spring and summer are .26 ppbv and .35 ppbv, respectively. For spring, outliers are between .6 ppbv and .03 ppbv. Summer outliers are between .922 ppbv and .021 ppbv.

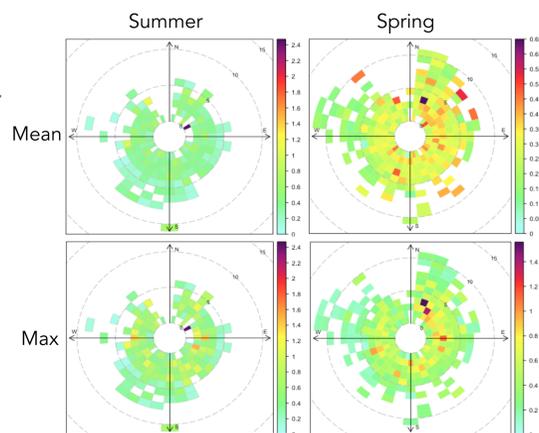


Figure 4 (right): Wind speed and direction are plotted on a polar plot and colored by mean or max MEK for each bin. In summer there is no clear directionality while spring has increased MEK with Easterly flow.

2. There is evidence of local photochemical production on select days.

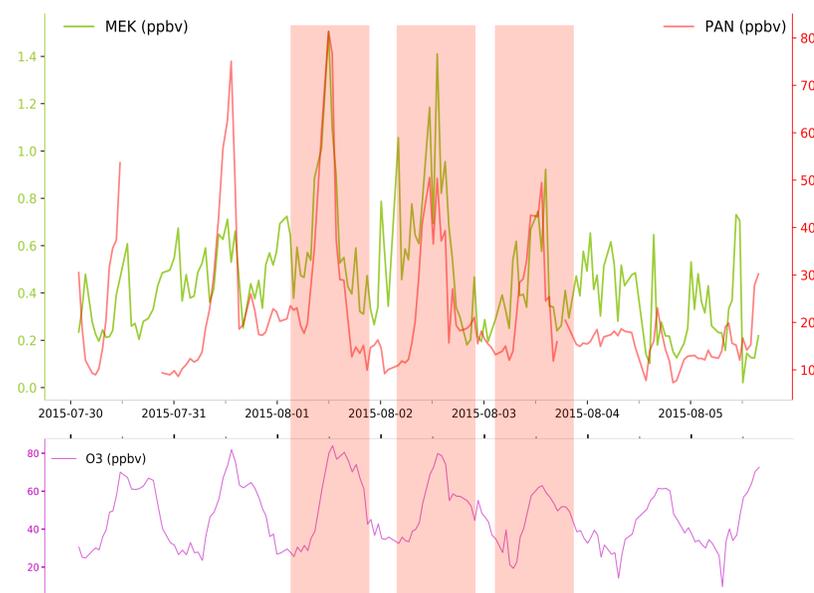


Figure 5: Time series of MEK, PAN, and O₃ for the first week of August, 2015. Ozone reached 84 ppbv on August 1st (ten minute average). PAN is considered to be a strong indicator of photochemical activity or transport of polluted air parcels. PAN is not emitted directly and it has a low background mixing ratio⁴.

3. MEK is not strongly correlated with precursors known to be important in other regions³.

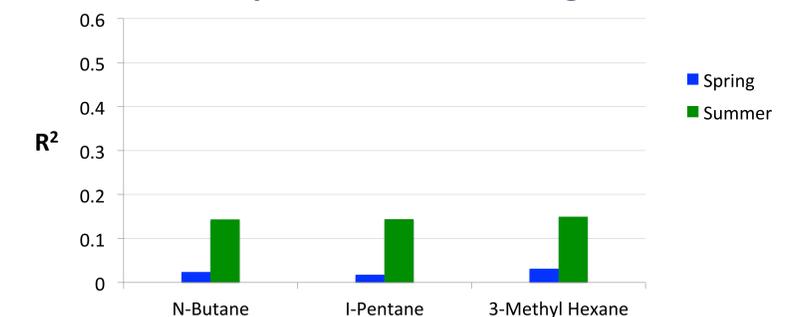


Figure 6: R² values for MEK versus its co-measured precursors measured at the BAO.

4. The strongest relationships in both spring and summer are with the alkyl nitrates and OVOcs.

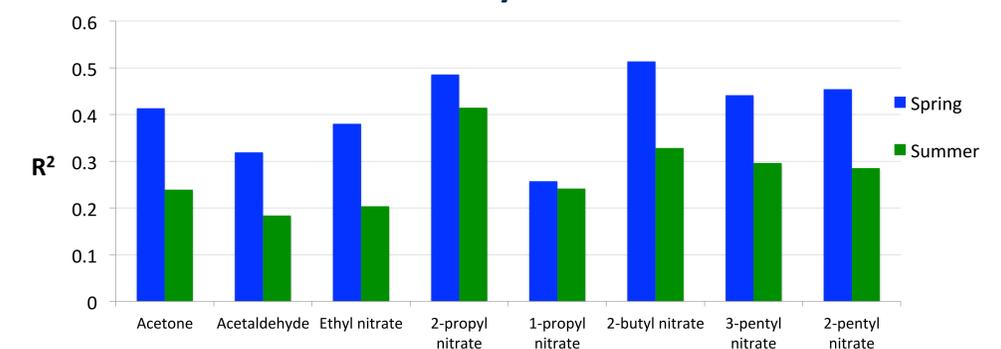


Figure 7: R² values for MEK versus co-measured OVOcs and alkyl nitrates. Highest correlation found between MEK and 2-butyl nitrate, which share a parent hydrocarbon (n-butane)¹.

Acknowledgements

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