

The sensitivity of the oxygen isotopes of sulfate to changes in oxidant concentrations during the preindustrial-industrial transition

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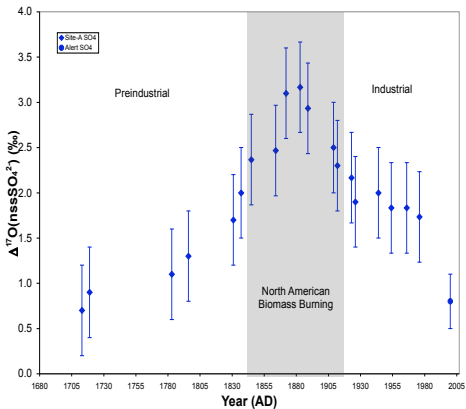


Motivation: Preindustrial $\Delta^{17}\text{O}$ of SO_4^{2-} Measurements

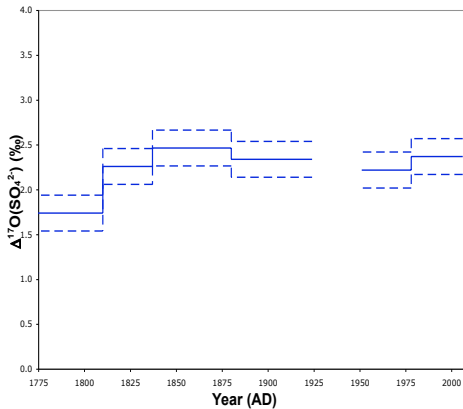
Site-A, Greenland



WAIS-Divide, Antarctica



[Alexander et. al., 2004]



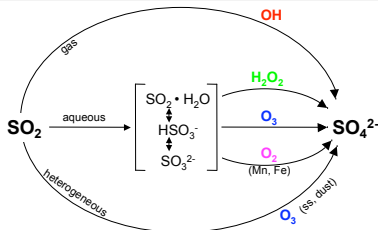
[Kunasek et. al., manuscript in prep.]

GEOS-Chem Model Configuration (v8-01-01)

- 1989-1991 GEOS-4 Meteorology, Reduced (30) vertical levels
- 2-year spinup, 3-year run
- NO_x-O_x-HC → extract oxidant fields → Offline Aerosol
- RPMARES Aerosol thermodynamic routine

Preindustrial Configuration

- Fossil Fuel & Fertilizer Emissions: **OFF**
- Biomass Burning Emissions: **Scaled to 10% of present-day (1997)**
- CO₂ = 285 ppm, CH₄ = 792 ppm



$\Delta^{17}\text{O}$ of SO_4^{2-}

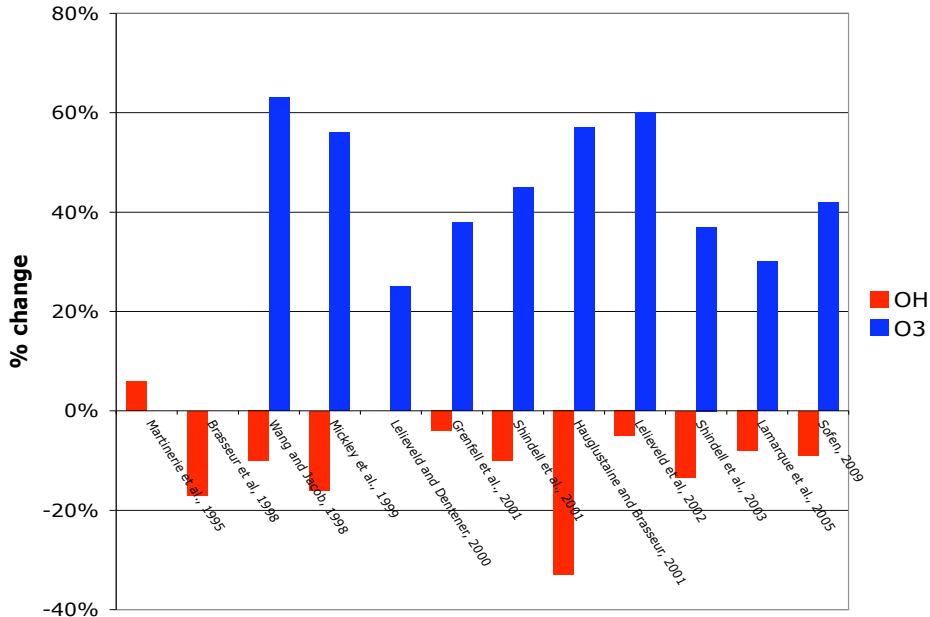
0.0‰

0.9‰

8.8‰

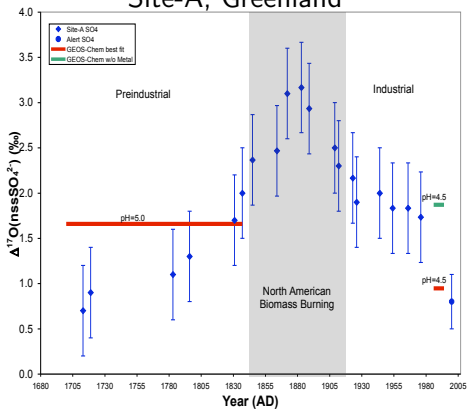
0.0‰

Change in Global Average Oxidants from Preindustrial



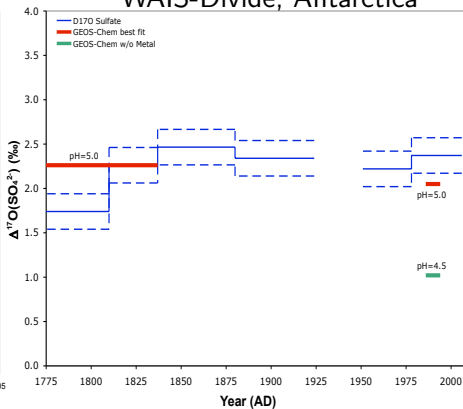
Isotope Results

Site-A, Greenland



[Alexander et. al., 2004]

WAIS-Divide, Antarctica



[Kunasek et. al., manuscript in prep.]

Conclusions

- NH: Metal-catalyzed oxidation is important in the industrial period.
- SH: $\Delta^{17}\text{O}$ is insensitive to small changes in oxidants; pH is important.

Future Work

- Sensitivity to pH
 - ▶ Dynamic calculation with Isorropia II?
- Biomass burning peak
 - ▶ 1900 emissions inventory from Brian Magi, NOAA GFDL (in progress)
- Preindustrial & glacial chemistry/climate simulations
 - ▶ with GISS-E and BIOME4 (with Loretta Mickly and others)
- More ice core measurements