

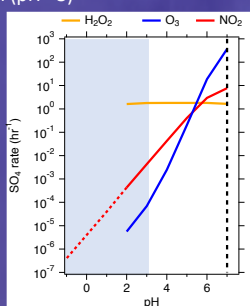
## INTRODUCTION

- Sulfate aerosols cool the Earth's surface
- They produce harmful effects for human health
- Sulfate is formed through the oxidation of SO<sub>2</sub>
- Biomass burning emits large concentrations of SO<sub>2</sub>
- Large uncertainty in SO<sub>2</sub> emission factors have been reported
- Conversion mechanism of SO<sub>2</sub> to sulfate remains uncertain creating underprediction of sulfate in atmospheric models by up to a factor of two (Wang et al., 2016; Shao et al., 2019; Wang et al., 2014).

## METHODS

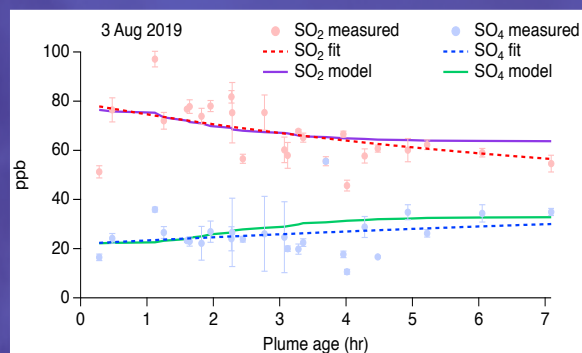
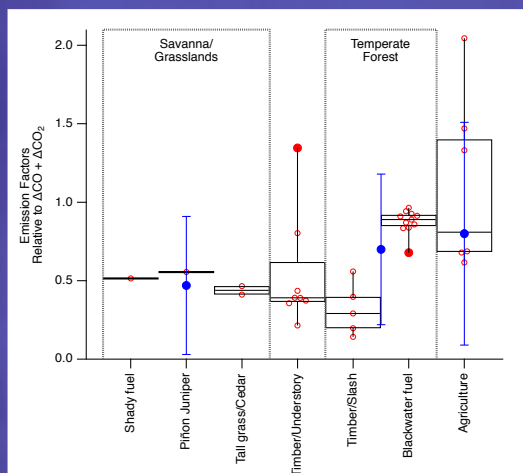


- Laser-induced fluorescence used to measure SO<sub>2</sub>
- Sulfate measurements from the aerosol mass spectrometry group
- DC-8 platform used for measurements of biomass burning smoke plumes
- FOAM 0-D box model used for modelling conversion of SO<sub>2</sub> to sulfate in a more neutral environment (pH 7) compared to urban (pH <3)



## EMISSION FACTORS

- Emission factor data during flaming conditions agree well with compiled field values when combined based on environmental characteristics.
- Large variation in temperate forest data suggests a more limited definition may be necessary.
- Overall, difference between flaming and smoldering emissions is unclear with flaming stage =  $0.62 \pm 0.27 \text{ g kg}^{-1}$  and smoldering stage =  $0.56 \pm 0.26 \text{ g kg}^{-1}$ .



## MODELLING

- FOAM mechanism developed with the inclusion of O<sub>3</sub>, H<sub>2</sub>O<sub>2</sub>, NO<sub>2</sub>, and HCHO aqueous phase S(IV) oxidation.
- Produces S(IV) pH dependence
- Produces pH dependence of sulfate production as previously observed for each oxidant
- Reproduces downwind SO<sub>2</sub> trends within 10% and sulfate trends within 15% for the Williams Flats fire.
- O<sub>3</sub> + SO<sub>3</sub><sup>2-</sup> is the largest contributor to sulfate production.

## References

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