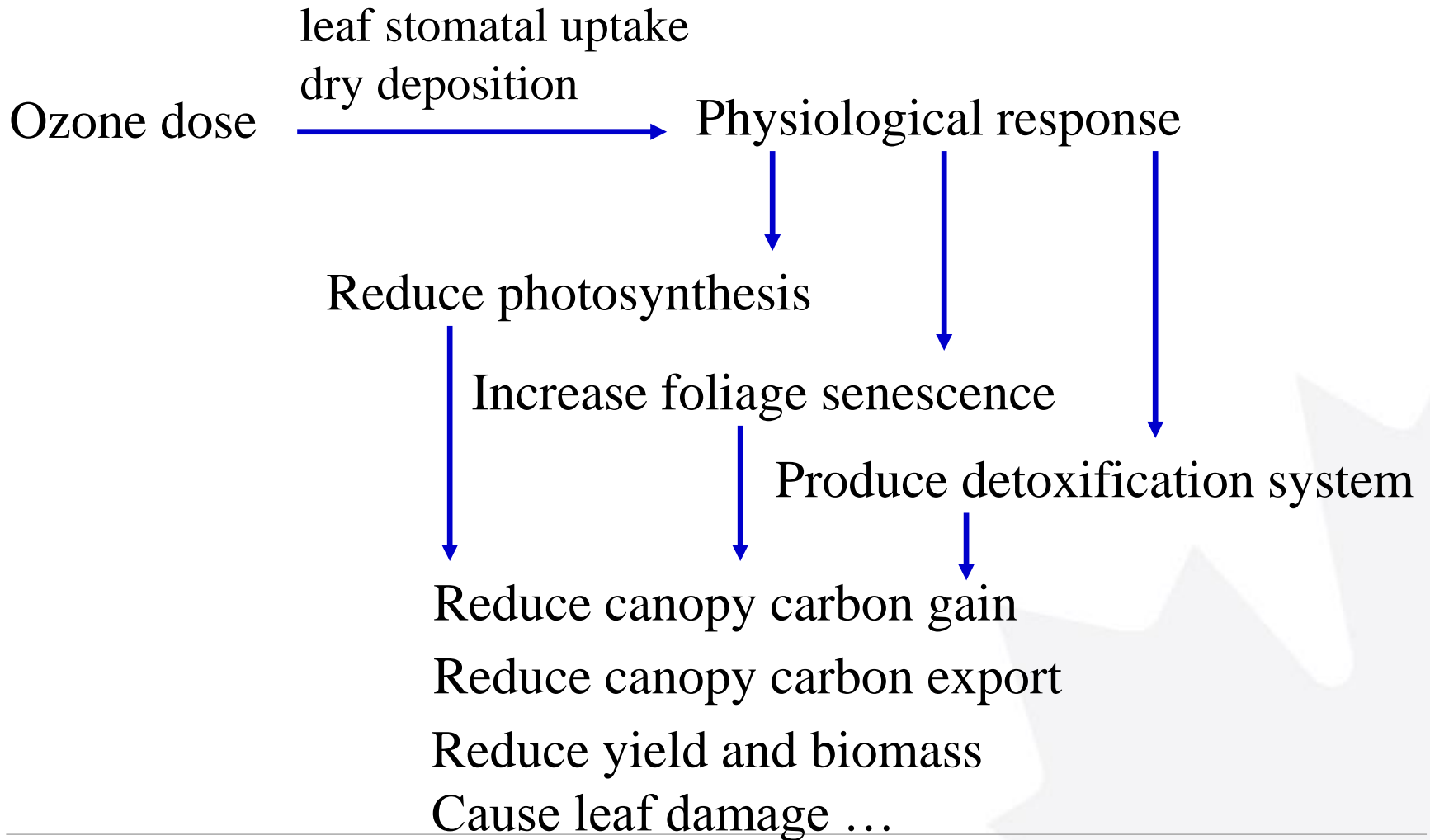




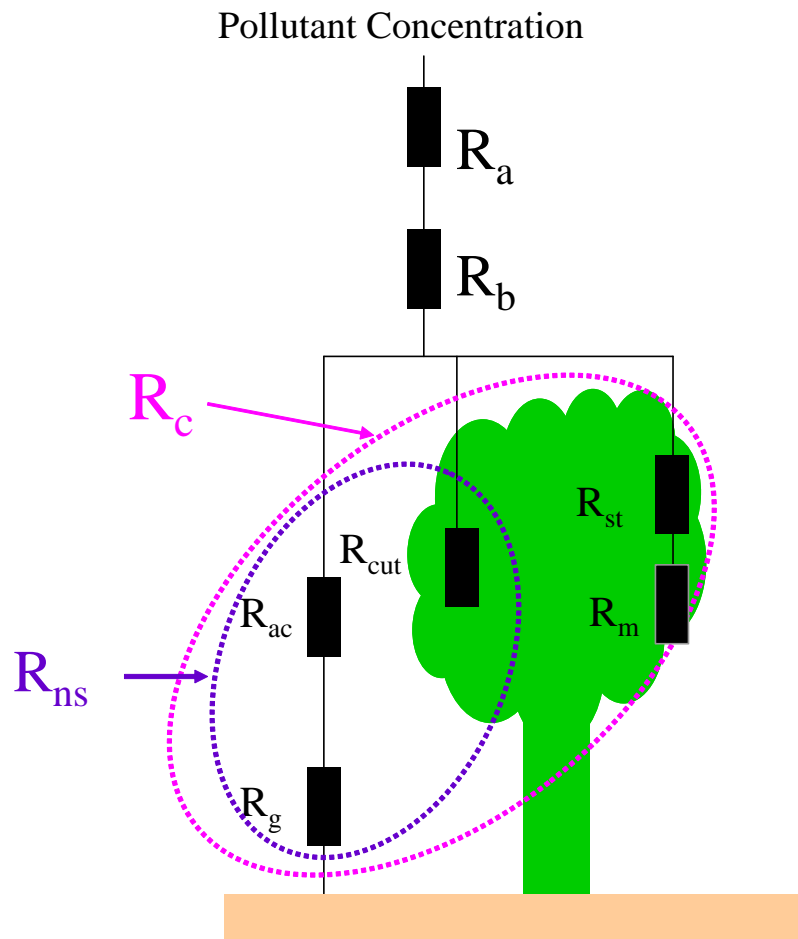
Introduction of TOARI-Ozone Deposition Focus Working Group

Leiming Zhang, Lisa Emberson,
and ~20 group members

Introduction



Introduction



$$V_d = \frac{1}{R_a + R_b + R_c}$$

$$\frac{1}{R_c} = \frac{1 - W_{st}}{R_{st} + R_m} + \frac{1}{R_{ns}}$$

R_{st} : Stomatal uptake

R_{ns} : Non-stomatal uptake

W_{st} : fraction of stomatal blocking due to wetness

Introduction

- Simple function of T and solar radiation (Wesely, 1989)
 - Single leaf Jarvis type (Jarvis 1976)
 - Sunlit/shade (two-big-leaf) (Hicks et al, 1987; Zhang et al., 2002)
 - Photosynthesis approach (CO₂ diffusion equals to the net CO₂ assimilation rate for photosynthesis minus respiration (Charusombat et al., 2010))
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Goals

- Assess and improve existing ozone stomatal deposition schemes
- Identify sensitive model input parameters causing the large uncertainties in stomatal flux estimation
- Estimate stomatal flux as a fraction of total deposition
Produce stomatal flux maps by landcover type and geographical region
- Assess long-term trends of ozone stomatal deposition and connections with climate change and extreme air pollution conditions
- Address the impact of ozone stomatal deposition on various vegetation types and ecosystem health through exploration of effect in various indices (e.g. M7/M12, AOT40, vs POD1/6)

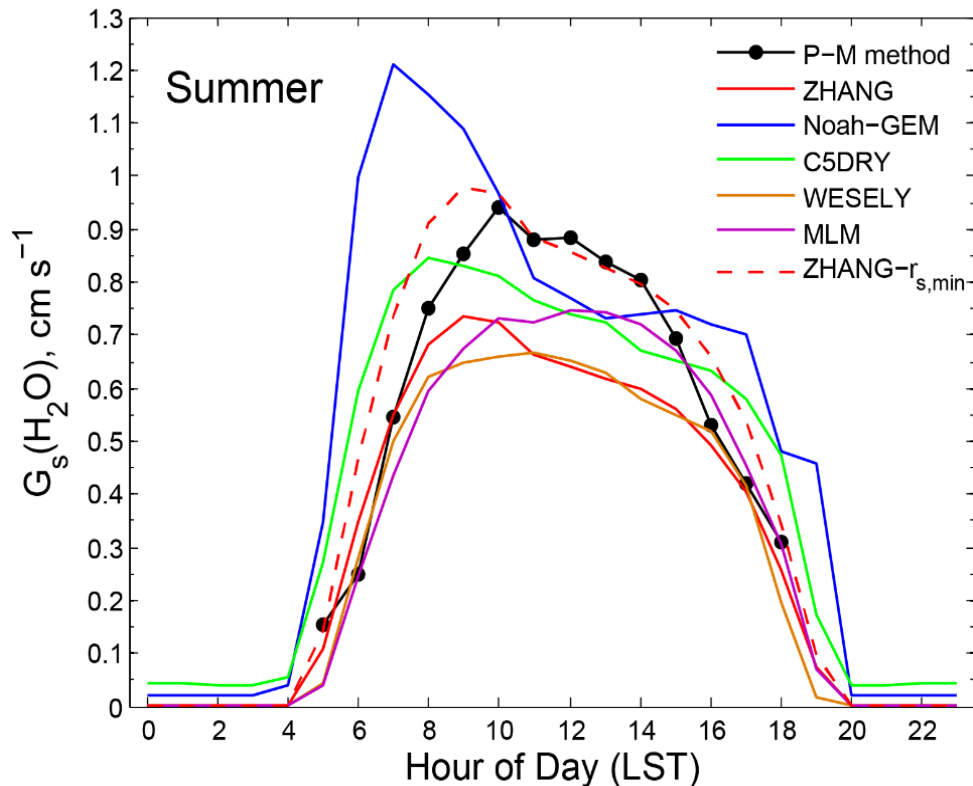
List of potential studies

1. Model intercomparison of ozone stomatal uptake (including five to 10 popular schemes and at least five sites with flux data)
2. Ozone stomatal conductance and/or flux maps on global and regional scales, and to particular land types, making use of TOAR II ozone concentration data and multiple stomatal modelling
3. Long-term trends of ozone stomatal deposition and connections with climate change, extreme weather events and air pollution conditions.
4. A comparison of flux based metrics and concentration based metrics. TOAR II ozone concentration data will likely be used in this study

List of potential studies

5. Sensitivity of stomatal uptake to key environmental variables (e.g., vapour pressure deficits, soil moisture deficits)
6. Intercomparison of CTM deposition schemes with other land surface models (e.g. crop models; land surface exchange schemes) to improve estimates of biogeochemical cycling and environmental damage
7. A review of existing studies on ozone damage to vegetation
8. Assessment of ozone impact on agricultural production. TOAR II ozone concentration and meteorological data will likely be used in this study. Potentially link to the AgMIP-Ozone project

Example results of the potential studies



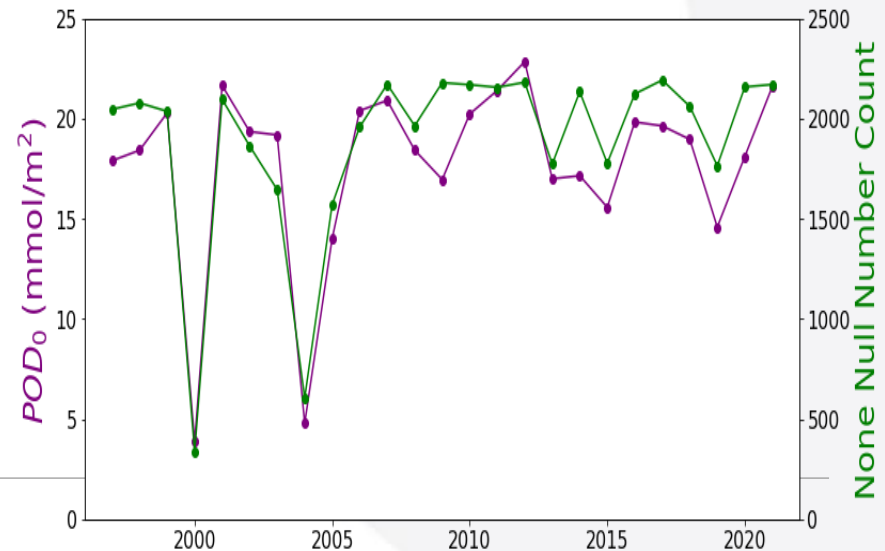
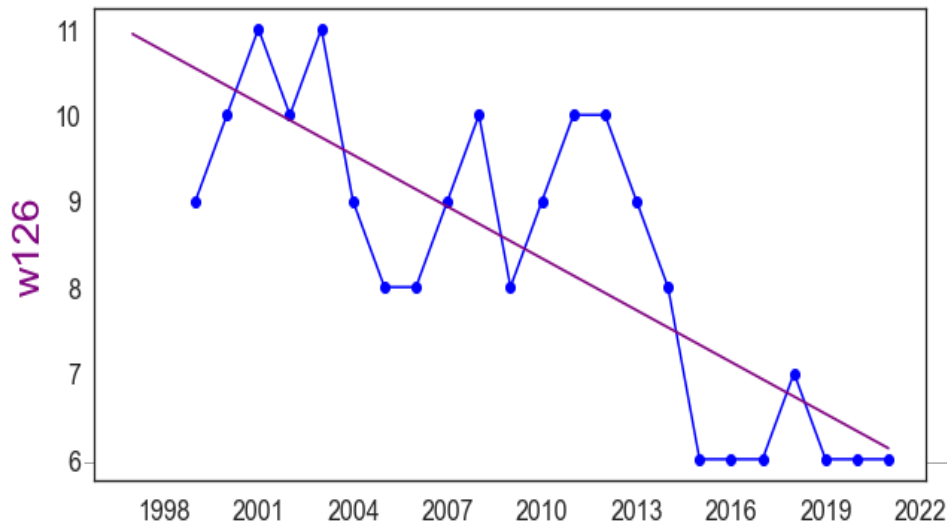
Comparison of modeled and observed averaged diurnal cycles of stomatal conductance (G_s) for water vapor in summer. G_s for water vapor is about 1.6 of that for O_3 .

Wu, Z., Schwede, D. B., Vet, R., Walker, J. T., Shaw, M., Staebler, R., & Zhang, L. (2018). Evaluation and intercomparison of five North American dry deposition algorithms at a mixed forest site. *JAMES*, 10, 1571–1586.

Example results of the potential studies

Quantifying Ozone Impacts on Vegetation in the Great Yellowstone Area Using Long-term CASNET Data

- Indexes used in the literature to quantify ozone damage to vegetation (Lefhon et al., 2018, Elementa):
 - ✓ Atmospheric concentration – based: W126, AOT40, Daily 12-h average exposure
 - ✓ Flux-based: POD_y



Contribution to the TOAR-II Community Special Issue

1. A comparison of various metrics assessing ozone impact on vegetation
 2. Mapping ozone stomatal fluxes on global and regional scales with an ensemble of stomatal uptake models
 3. Exploring likely trends in ozone deposition and stomatal ozone uptake over time
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