Analysis of TF HTAP NO_y deposition results

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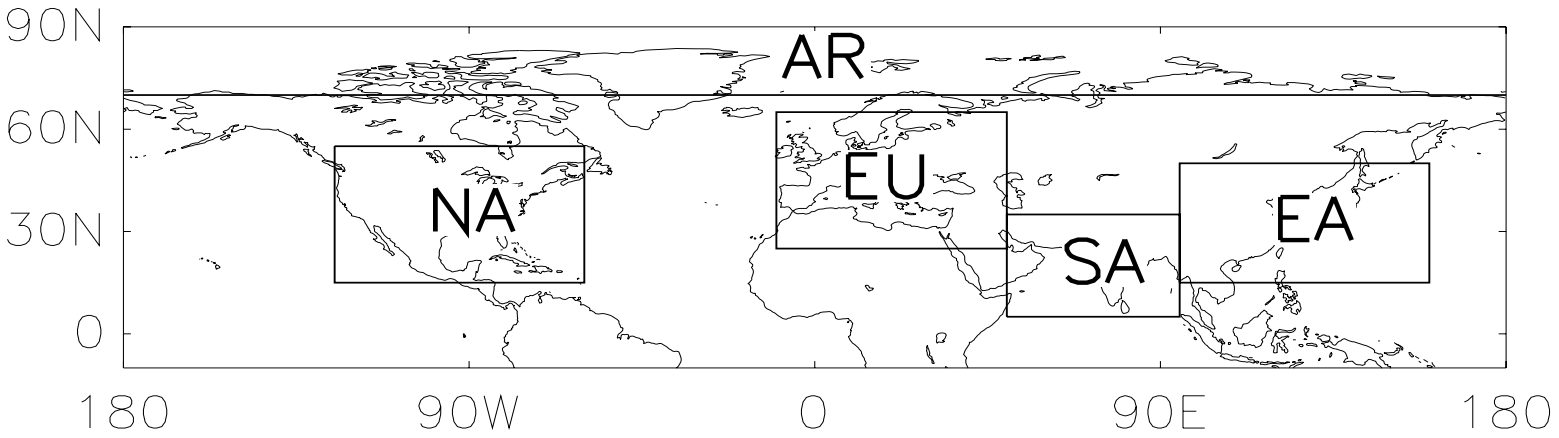
Importance of NO_y

- Includes NO, NO_2, HNO_3, N_2O_5, PAN + organic nitrates
- Major contributor to eutrophication and acidification
- Controls ozone formation
- Can be transported large distances from source regions
- Undergo heterogeneous and gas-phase reactions – important source of uncertainty

TF HTAP Regions and Experiments



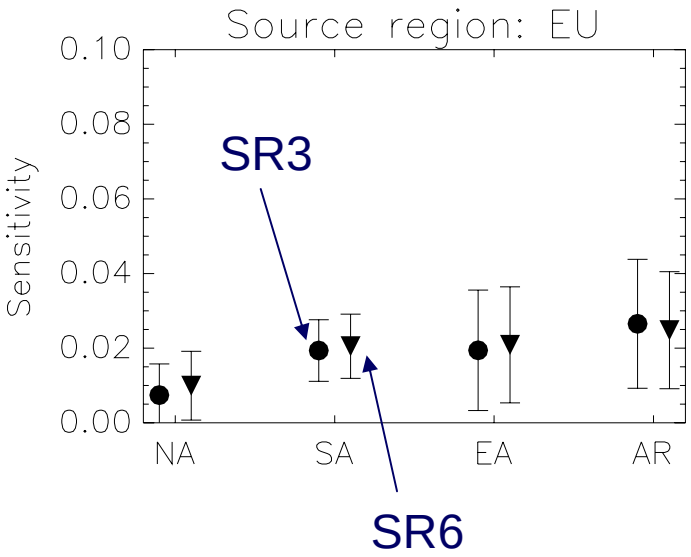
- SR1 – Control run
- SR3 – 20% reduction of anthropogenic NO_x emissions in each HTAP region
- SR6 – 20% reduction of all anthropogenic emissions in each HTAP region

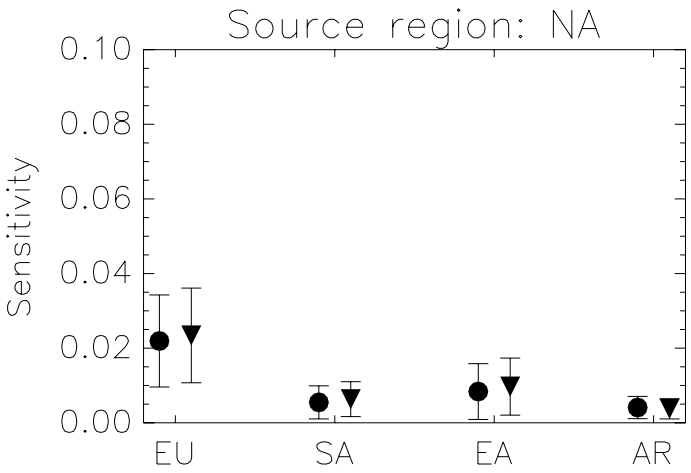
Models

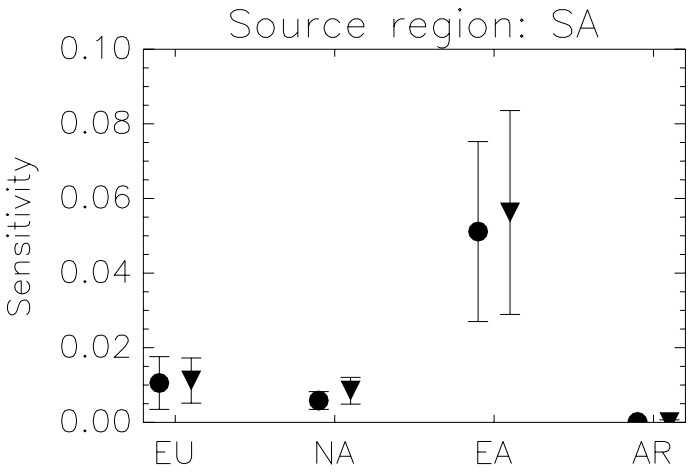
- 9 models submitted usable results
- Analysed total NO_y deposition, plus wet and dry deposition fractions
- Focus on multi-model mean + standard deviations
- Calculated source-receptor relationships

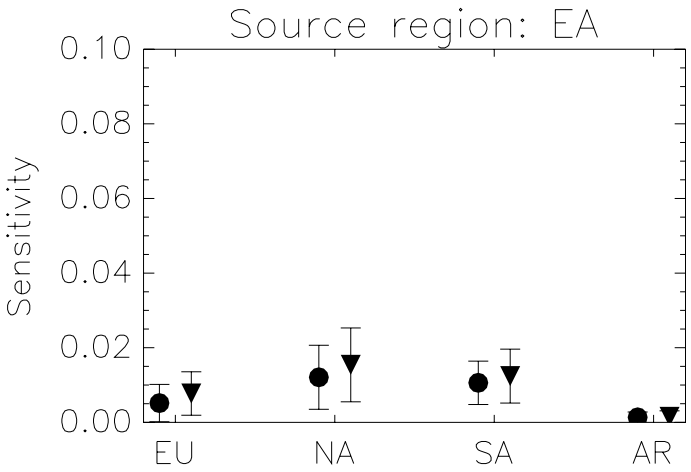
$$Sensitvity = \frac{dep(ctl, receptor) - dep(expt, receptor)}{emiss(ctl, source) - emiss(expt, source)}$$

Source-Receptor Relationships







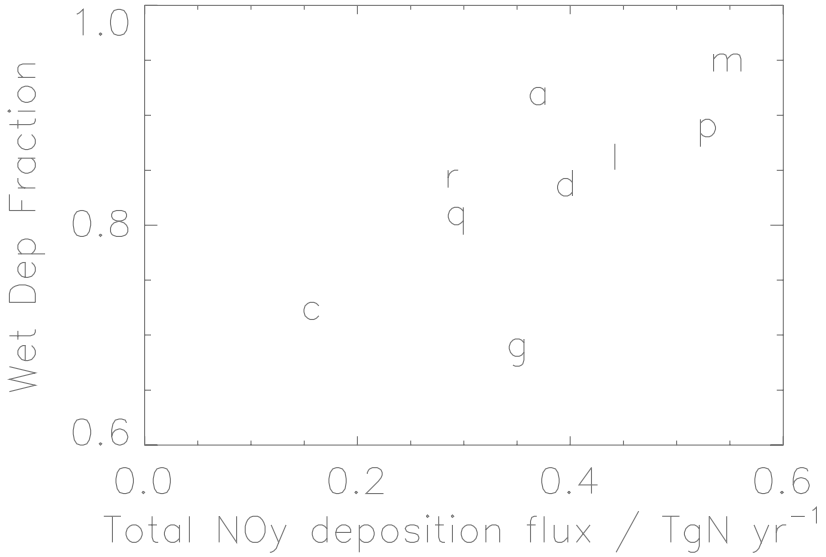


Summary of S-R Relationships

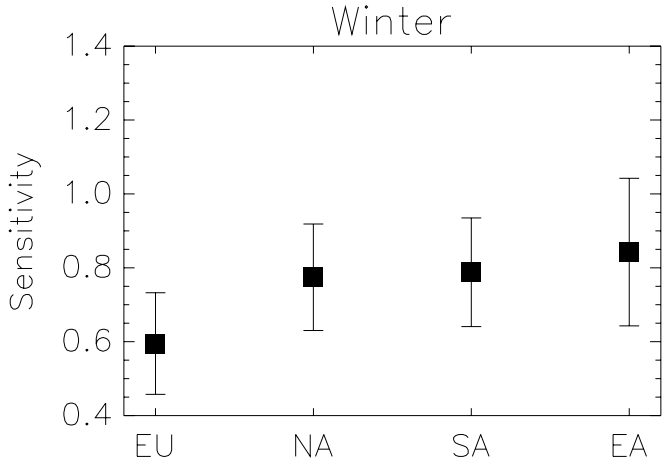
- SA has significant influence on EA
- EU has largest impact on Arctic. Impacts on SA, EA similar.
- Some non-linear chemical effects evident, particularly when NA is receptor

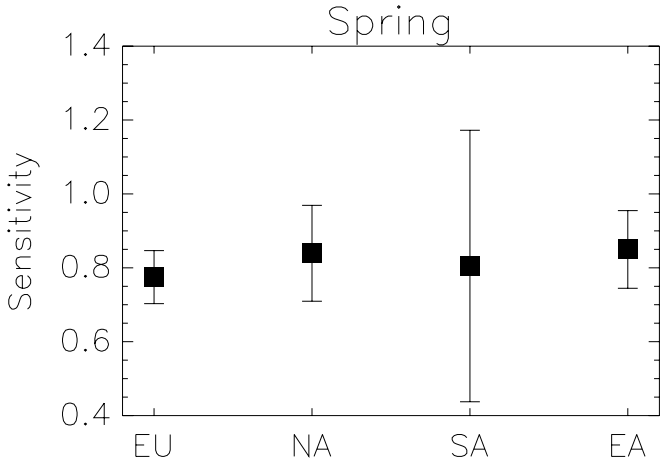
Deposition to Arctic

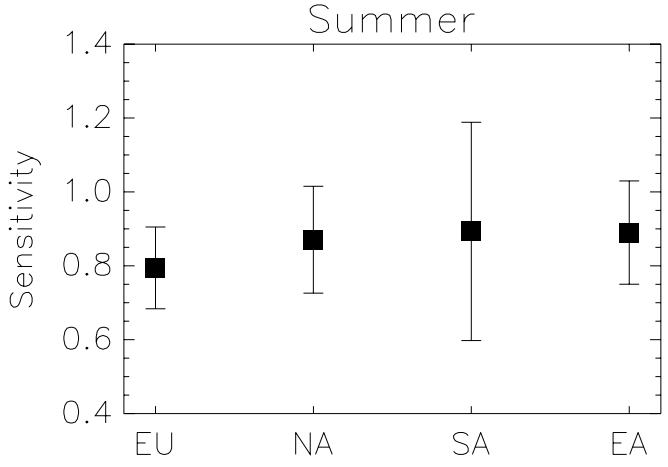
- Results suggest a dependence of the NO_y deposition flux to the Arctic on the wet deposition ratio
- Size of perturbation of EU emissions may also be important
- Multiple linear regression inconclusive – only wet dep fraction had significant correlation.
- NO_y burdens over AR differ by over 1 order of magnitude.

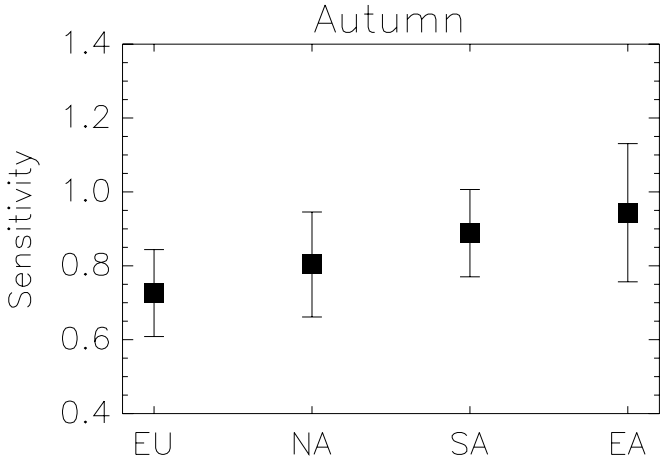


Export Fractions: Expt SR3

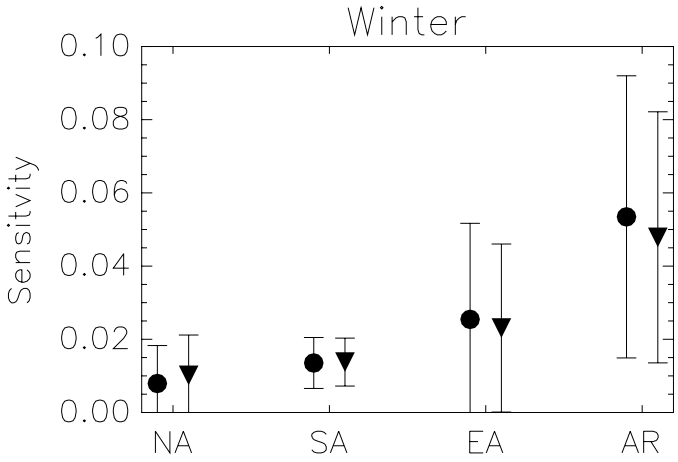


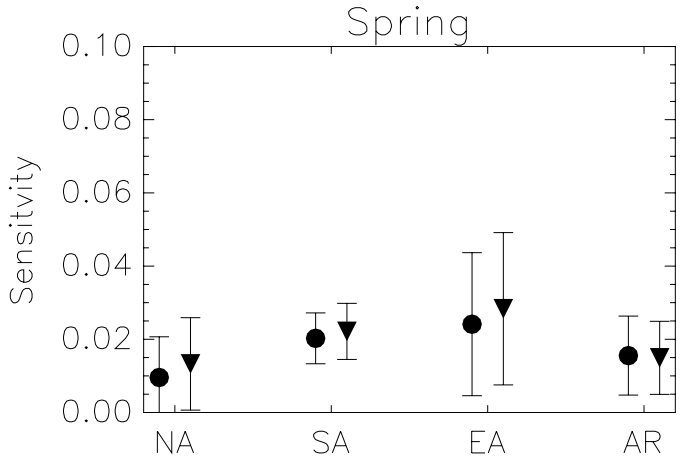


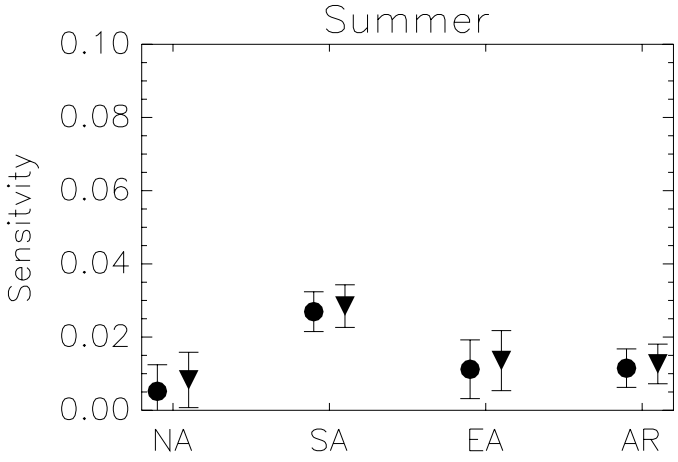


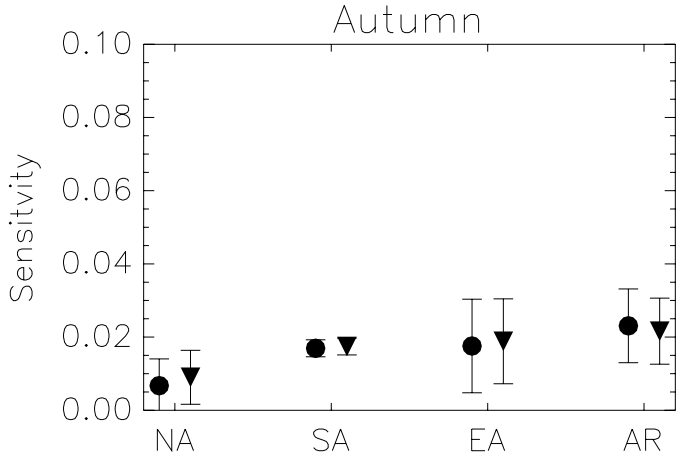


Seasonal S-R relationships (EU as source)





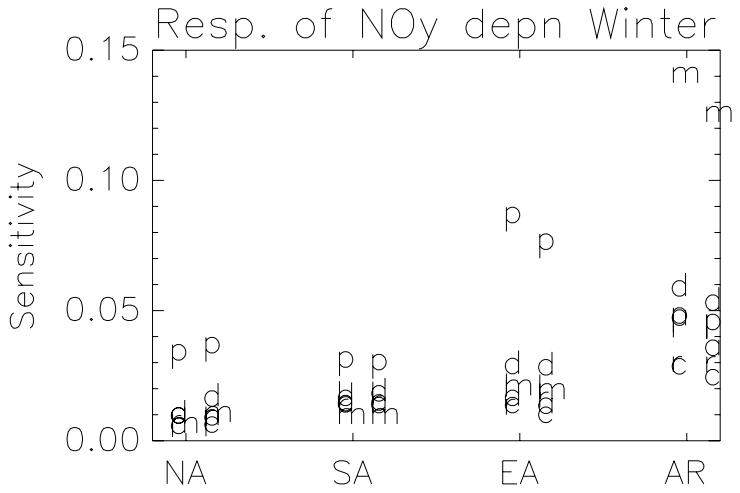


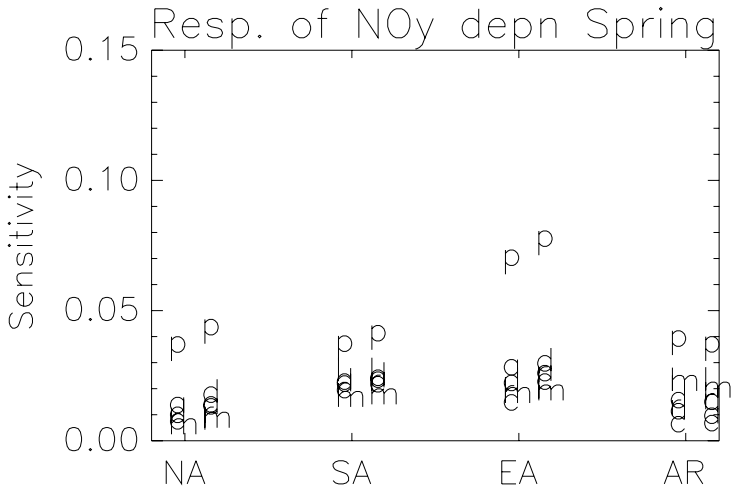


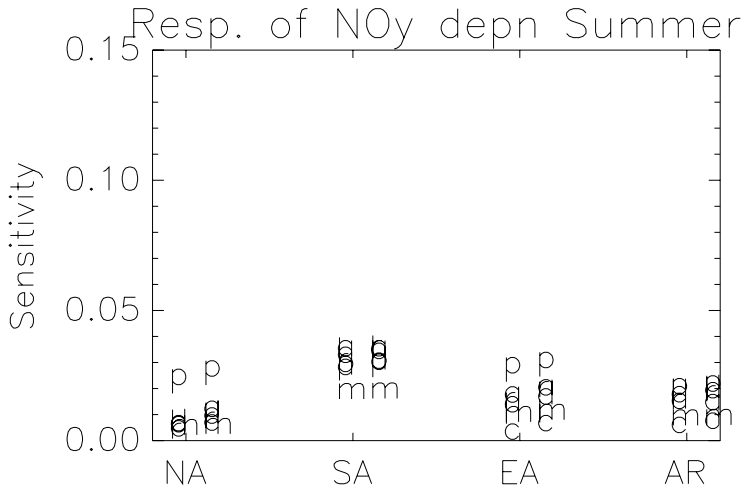
Summary

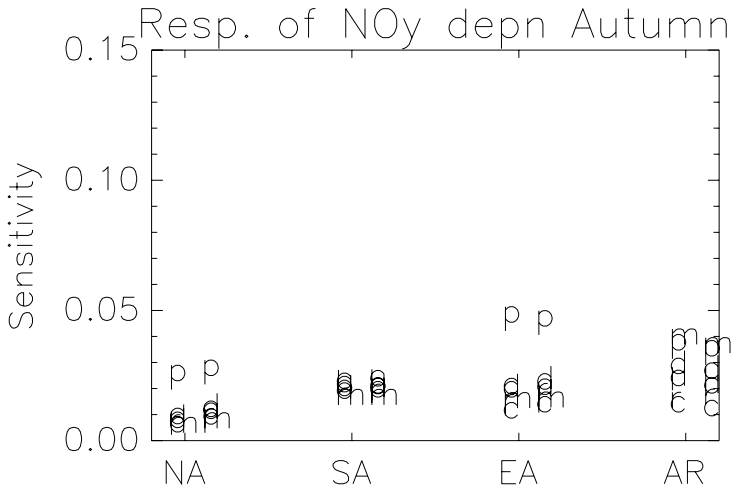
- Models predict more export of NO_y from EU to AR in winter than other seasons. EA exports the least NO_y.
- Largest uncertainty is influence of SA on EA.
- EU emissions have greatest impact on AR.
- Annual mean results hide significant seasonal differences.

Model sensitivities: Source EU

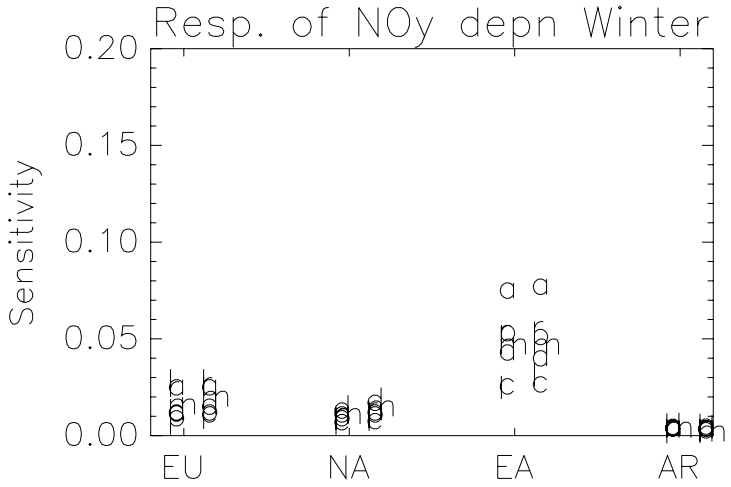


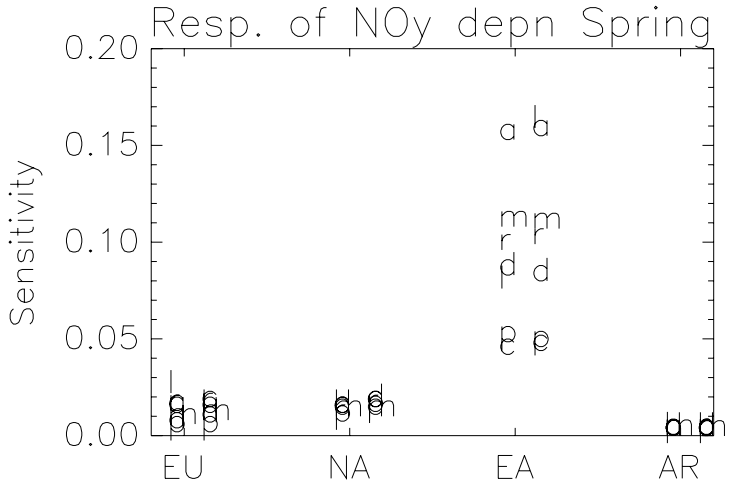


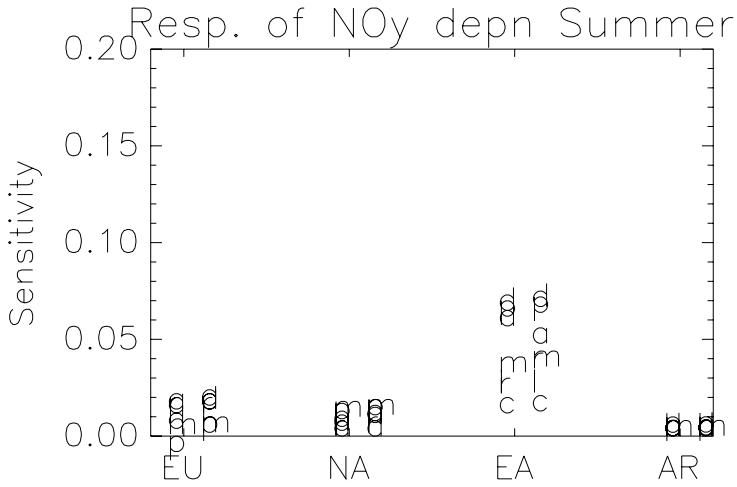


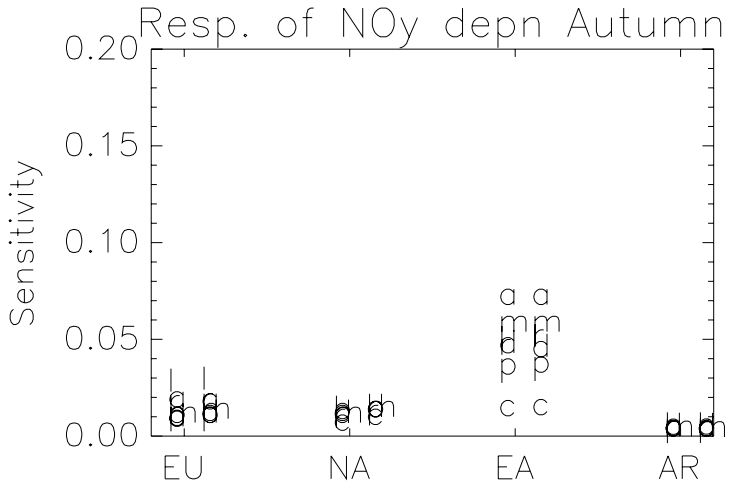


Model sensitivities: source SA









Uncertainties

- Model sensitivity roughly stays in same order, but ...
- Some models have a large response for particular S-R pairs
- Occasionally, some models have a very large change between SR3 and SR6 – non-linear chemical effects.
- For EA as source region, models sensitivities similar for each receptor, and in all seasons.

Acknowledgement

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Questions & Answers