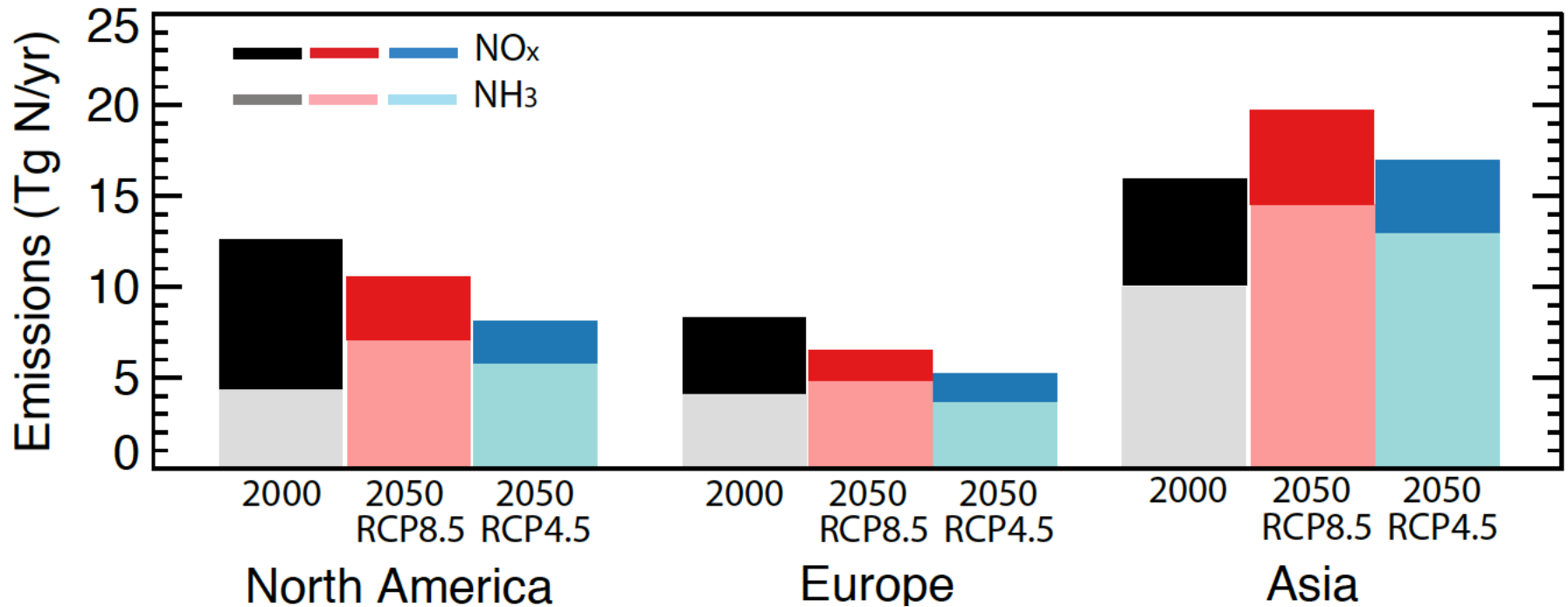


# **Using CESM to study the impacts of future nitrogen deposition on global ecosystems**

Maria Val Martin (Sheffield)

Colette Heald (MIT), J-F Lamarque (NCAR),  
Kevin Hicks (York) and Mike Ashmore (York)

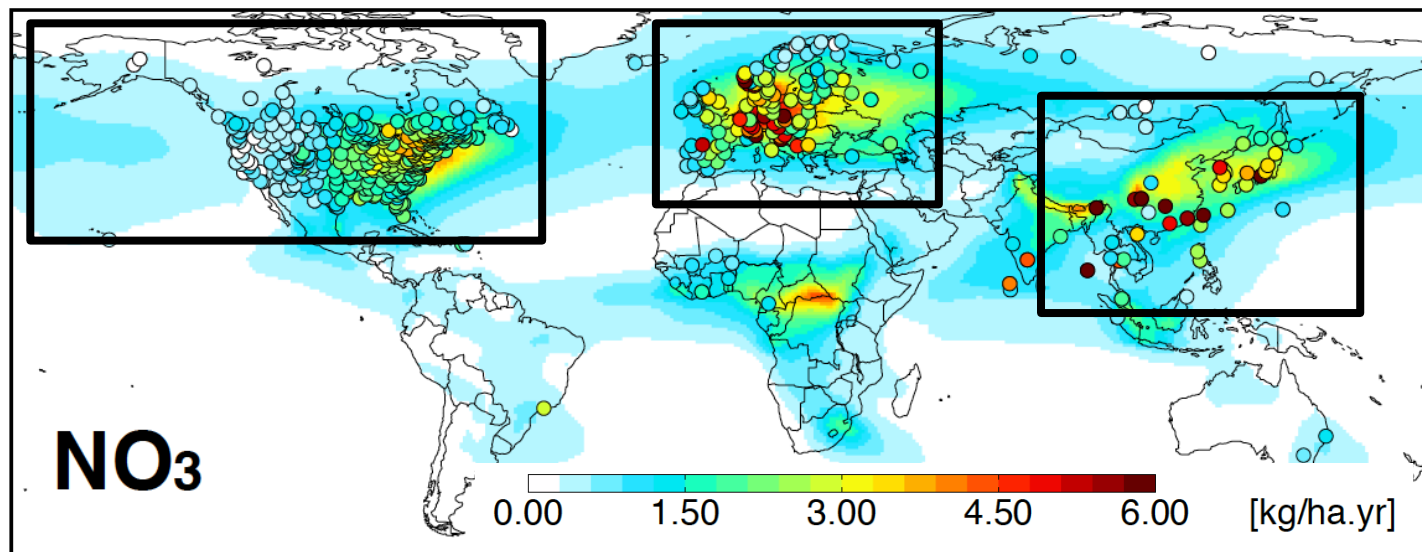
# RCPs Project Important Changes in NO<sub>x</sub> and NH<sub>3</sub> Emissions across the world



- The objective is to study the impact of future N emission changes on ecosystem in North America, Europe and Asia
- We run CESM1.1 at 1.9x2.5 resolution with the RCP4.5 and RCP85 scenarios for present-day and 2050 accounting for changes in climate, emissions and land cover

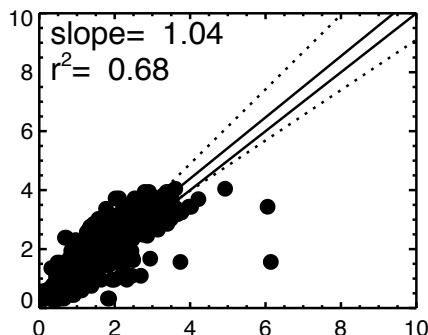
# CESM captures spatial wet $\text{NO}_3^-$ deposition gradient, but underestimates magnitude over Europe and Asia

Observations from WMO compiled by Vet et al (2014)

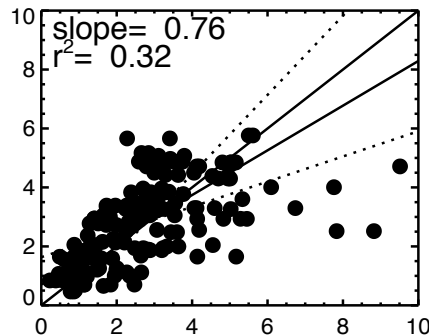


CESM (Kg N/ha yr)

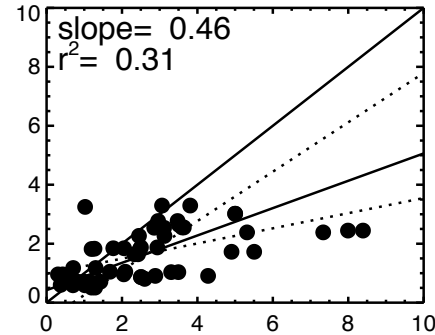
North America (NADP+CAPMoN)



Europe (EMEP)



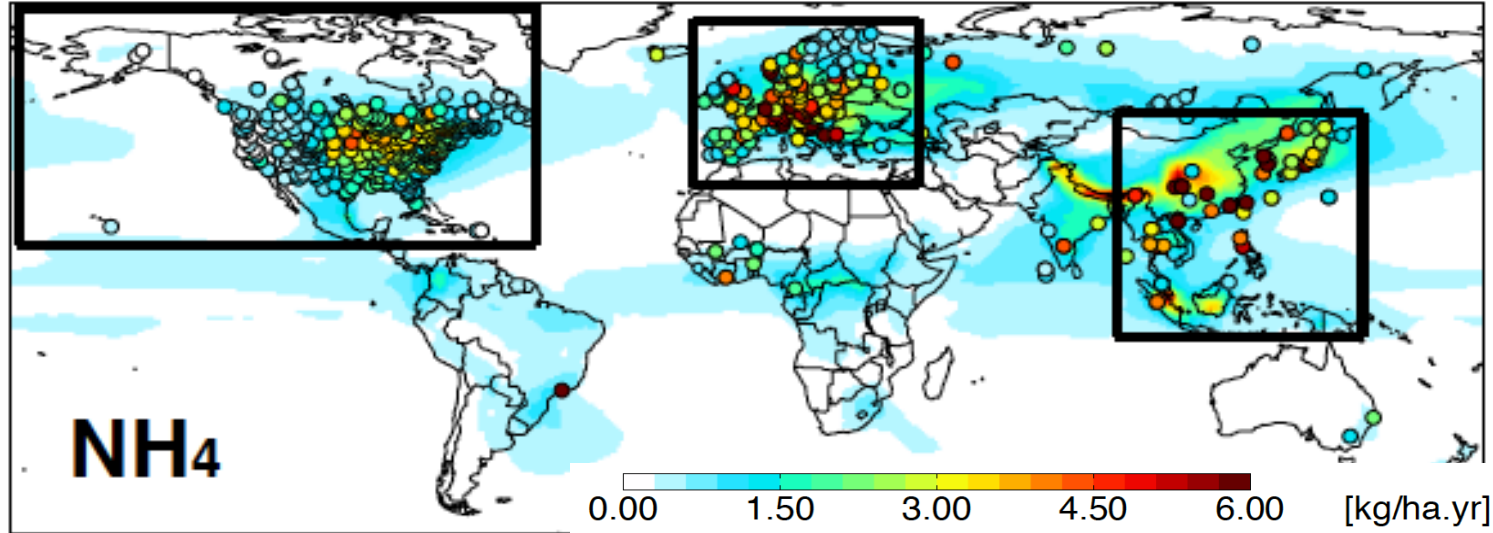
Asia (EANET)



Observations (Kg N/ha yr)

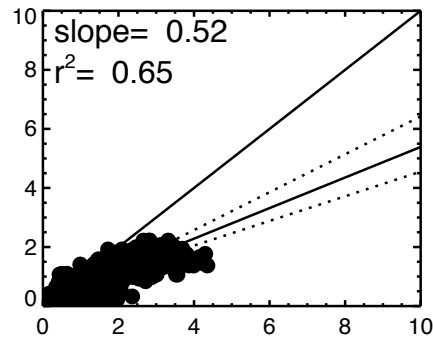
\* Similar results as Lamarque et al (2013) for the ACCMIP multi-model N deposition evaluation

# CESM captures spatial wet $\text{NH}_4^+$ deposition gradient, but underestimates magnitude across the world

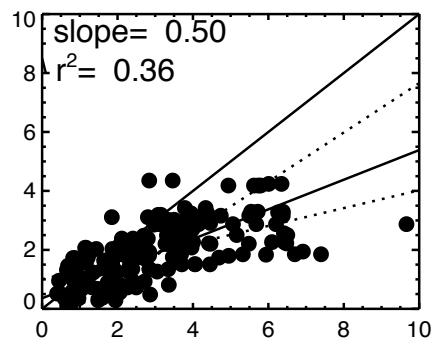


CESM (Kg N/ha yr)

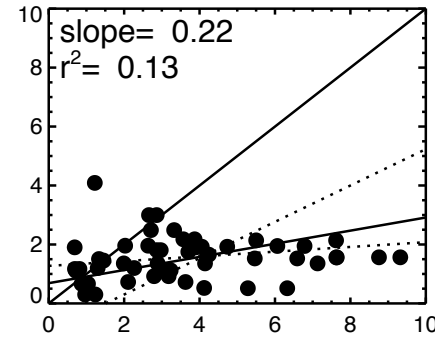
North America (NADP+CAPMoN)



Europe (EMEP)



Asia (EANET)

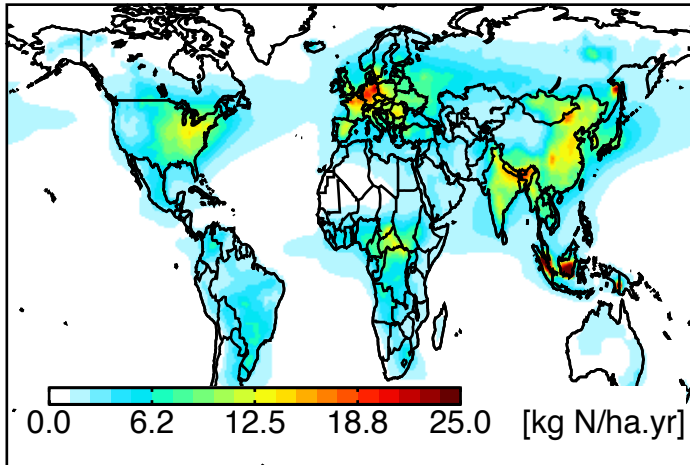


Observations (Kg N/ha yr)

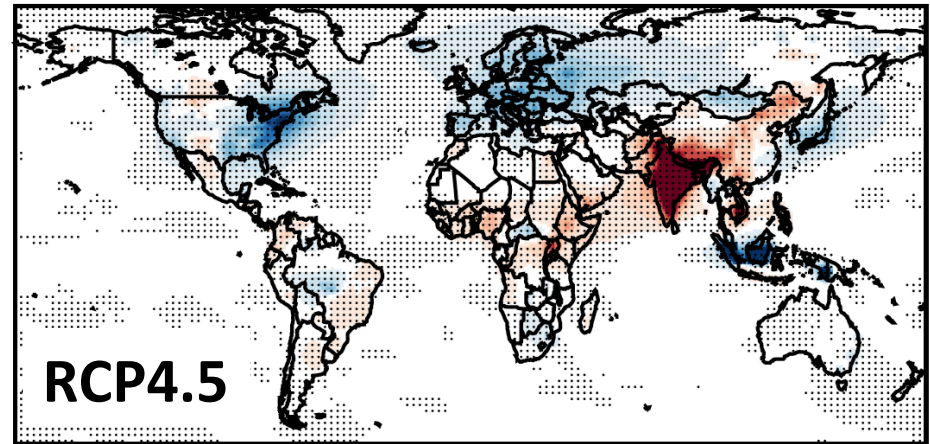
\* Similar results as Lamarque et al (2013) for the ACCMIP multi-model N deposition evaluation

# Both RCPs project important changes in N deposition across the world

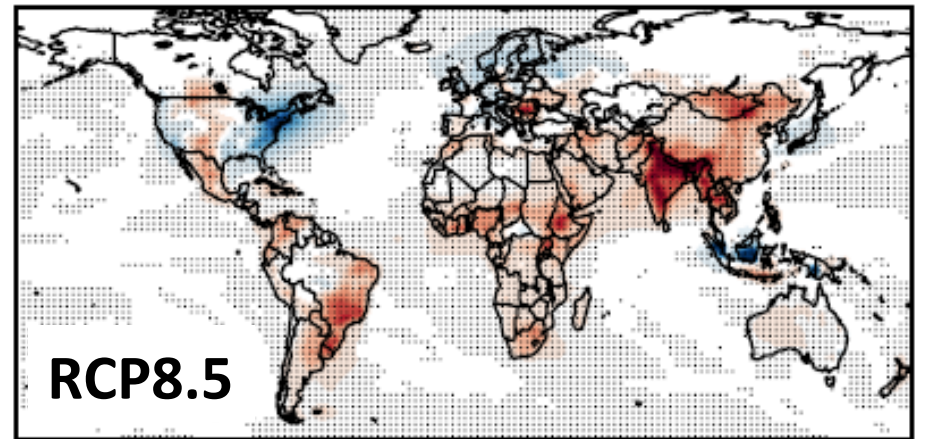
Present day N deposition



2050-2000 changes in N deposition



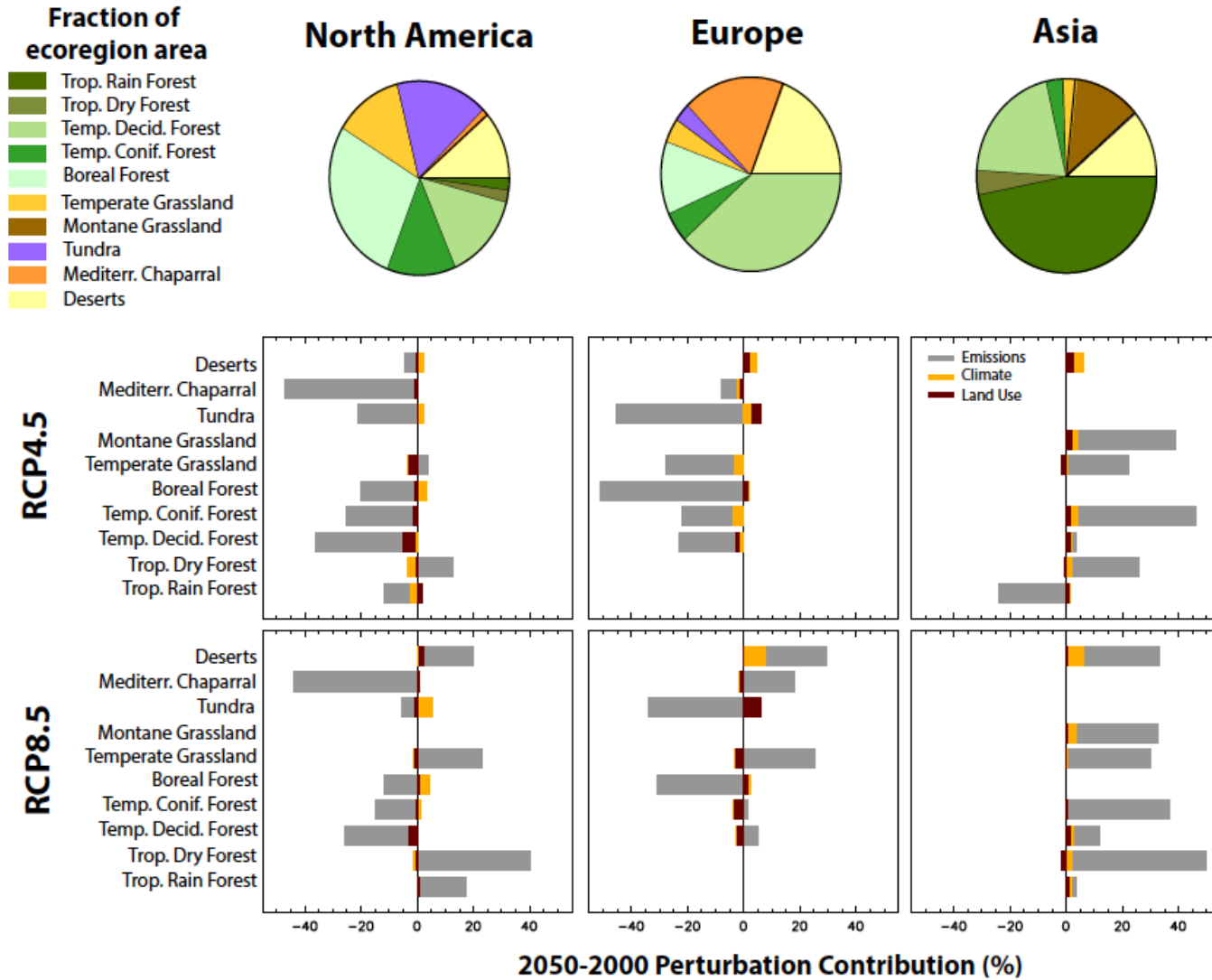
CESM N deposition =  $\text{NO}_x + \text{PAN} + \text{HNO}_3 + \text{NH}_3 + \text{NH}_4 + \text{etc}$



\*stippling means 95% confidence



# Impact of Future N Deposition on Global Ecosystems



Changes in anthropogenic emissions will drive future N deposition; contribution from climate and land use changes may be significant in some ecosystems.....

# Summary

- CESM captures well the spatial gradient of wet  $\text{NO}_3$  and  $\text{NH}_4$  deposition, but underestimates the magnitude in particular over Europe and Asia
- Future N deposition will be a threat for most ecosystems in Asia and some in Europe and North America
- Changes in N deposition will be mainly driven by changes in anthropogenic  $\text{NO}_x$  and  $\text{NH}_3$  emissions

