

# › MULTIMODEL ANALYSIS OF TRENDS IN EUROPEAN SIA CONCENTRATIONS

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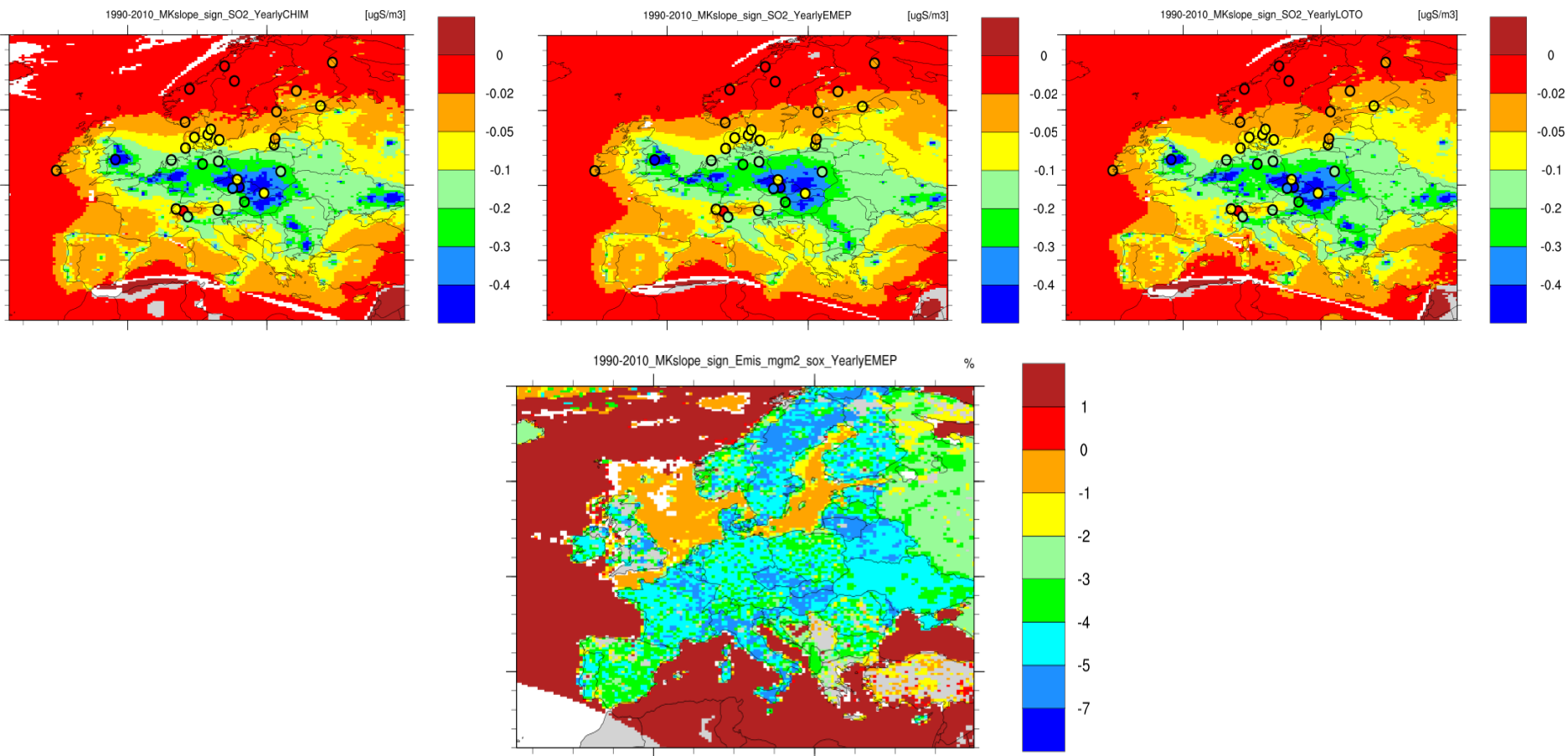
Maria Teresa Pay

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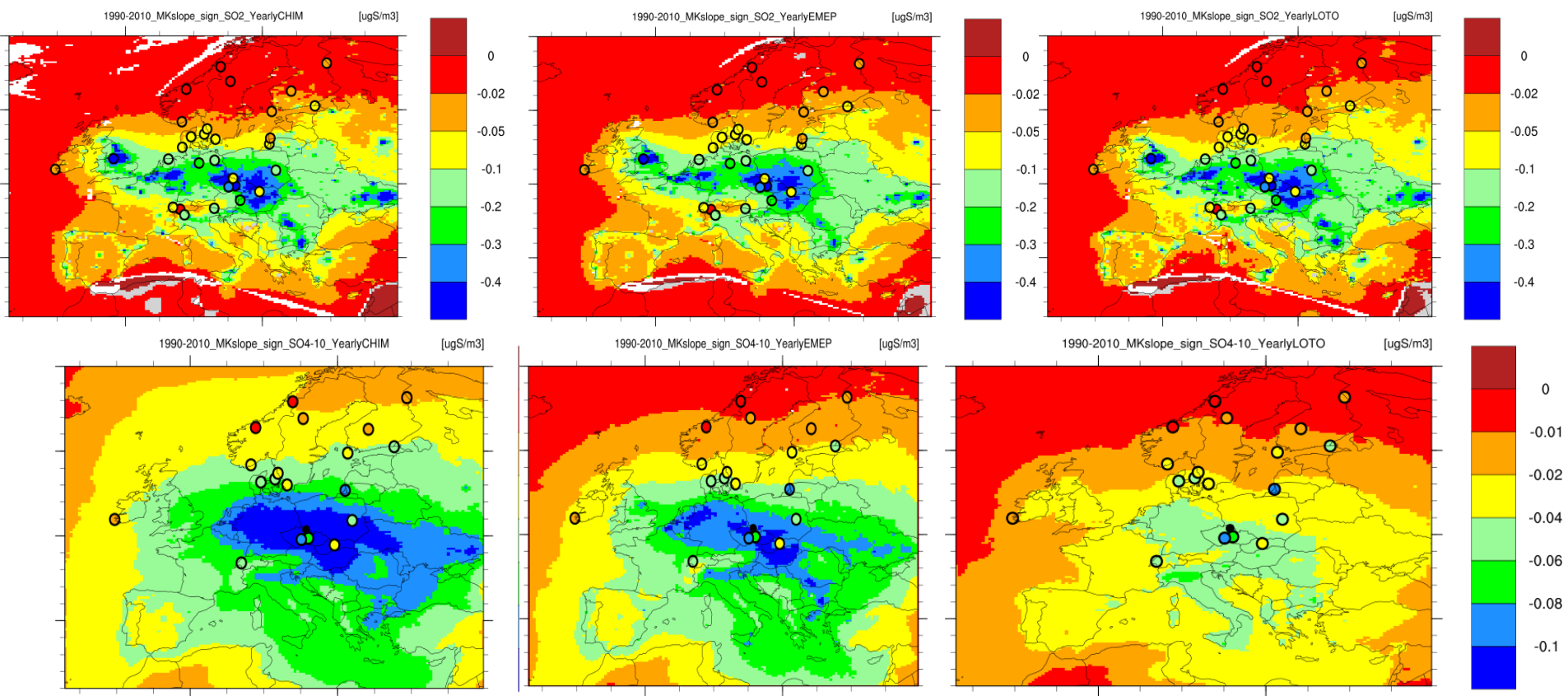
# SET-UP

- › 21 years with Chimere, EMEP, LOTOS-EUROS
- › 2010 with emissions 2010 and 1990 with Chimere EMEP, LOTOS-EUROS, MINNI, CMAQ, WRF-Chem
- › Changes in emissions-> changes in concentrations
- › Do we represent the observed trends?
- › Can we understand the observed trends?

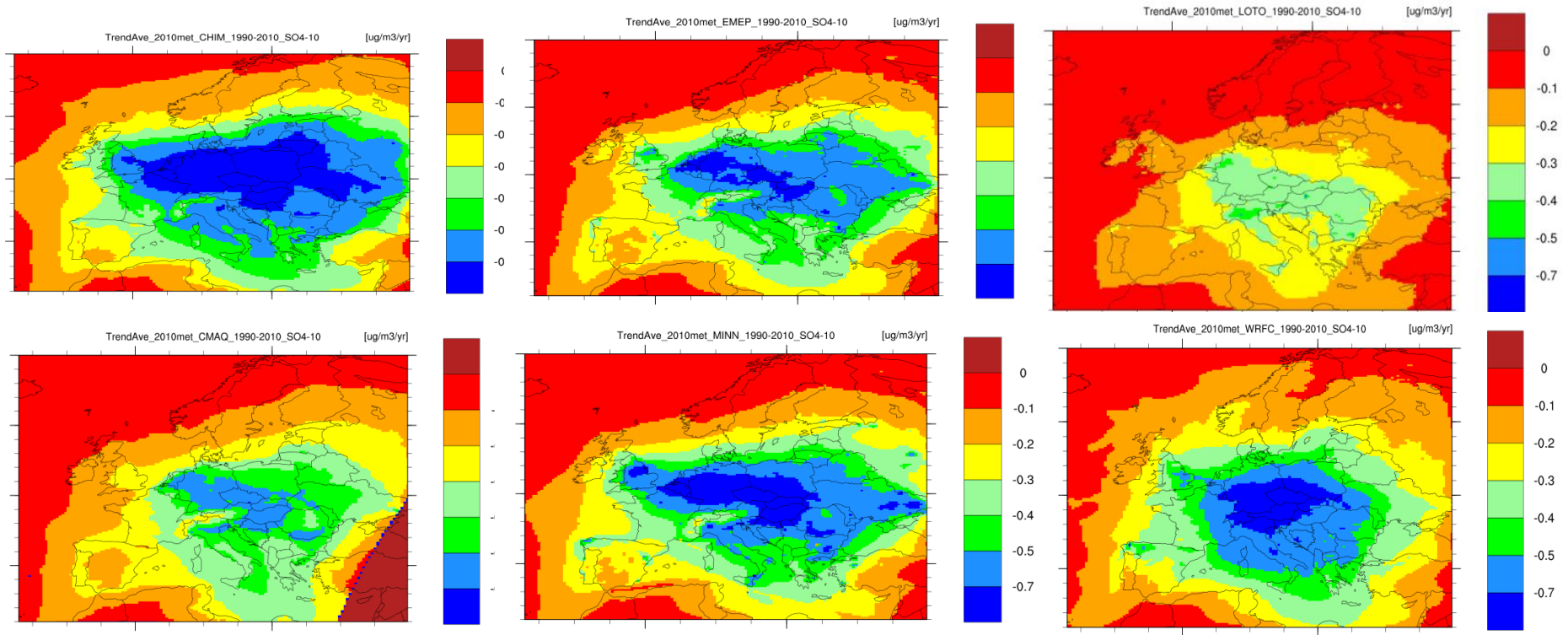
# SOX



# SOX



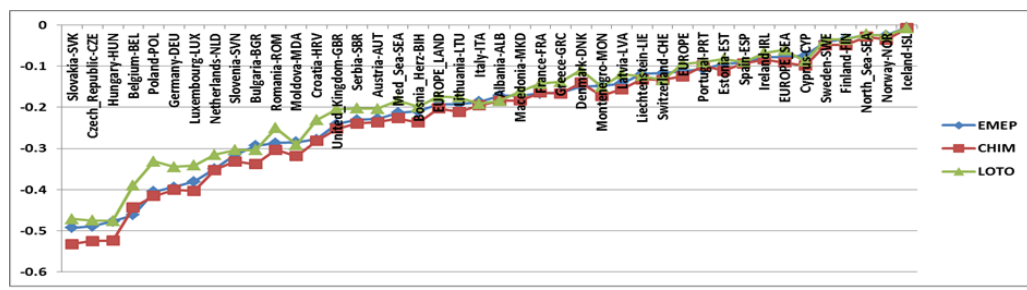
# SO4: SENSITIVITY CONSTANT METEO



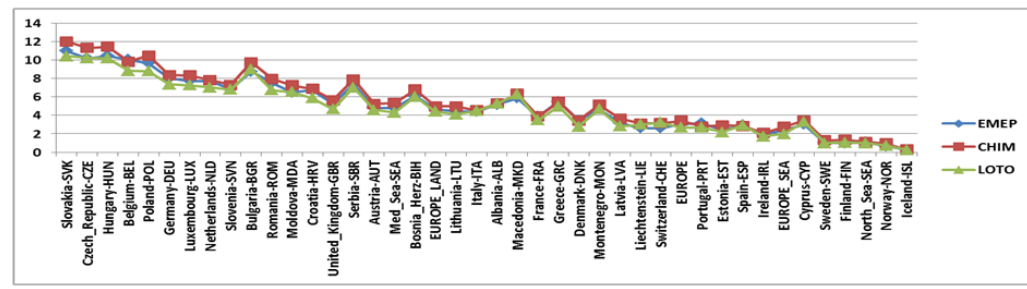


# TSO4 TRENDS PER COUNTRY

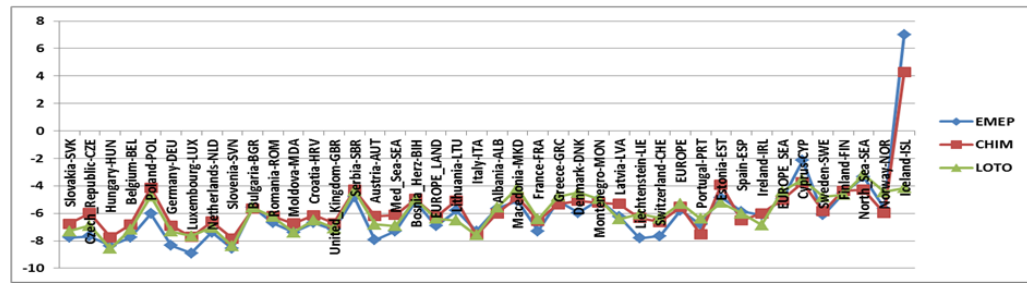
Slope  
 $\mu\text{g S/m}^3/\text{yr}$



Intercept  
 $\mu\text{g S/m}^3$



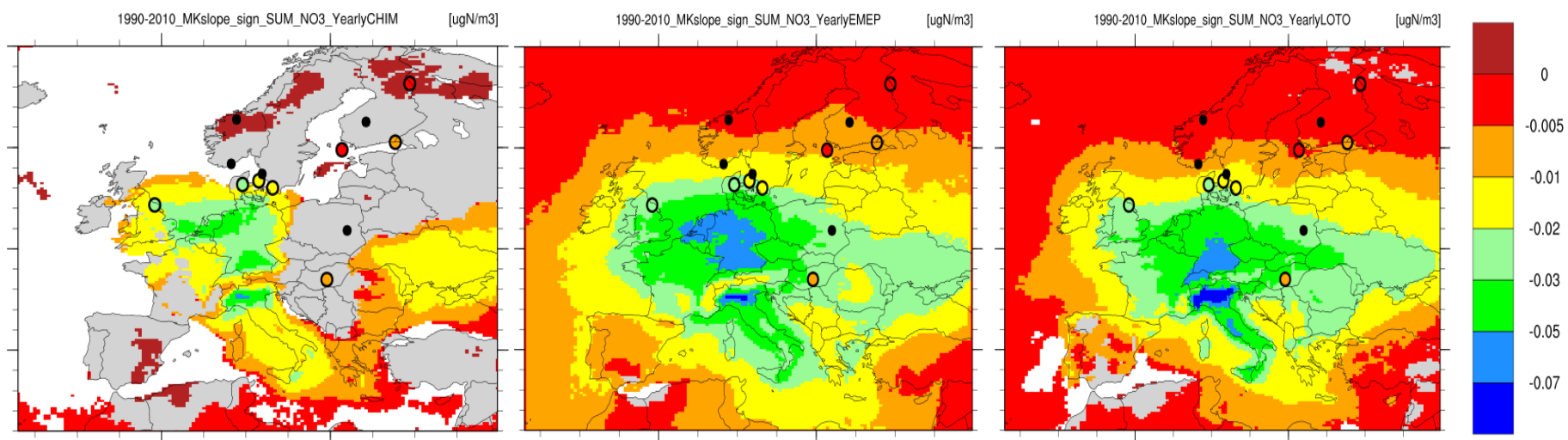
%reduction  
per year



## SUMMARY SOX

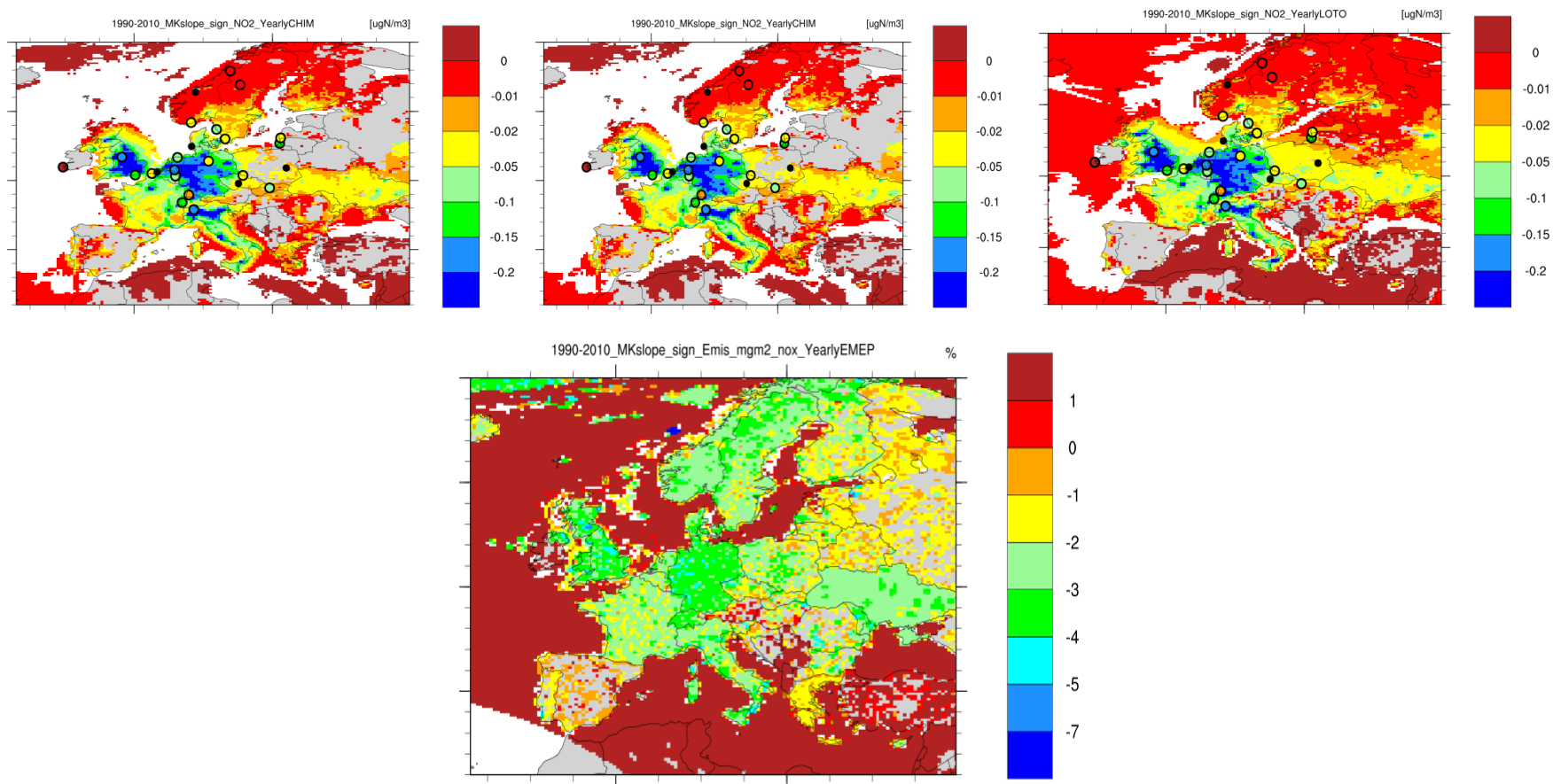
- › Trends in SO<sub>2</sub> and SO<sub>4</sub> fairly well represented by 3 models. Trends SO<sub>4</sub> underestimated for LOTOS-EUROS, overestimated for Chimere
- › Few notable exceptions central Europe, Lithuania
- › Sensitivity to emissions: 6 models roughly agree on patterns and magnitude, but also clear differences (pattern WRF-CHEM, lower values CMAQ and LOTOS-EUROS)

# NO<sub>3</sub>+HNO<sub>3</sub>

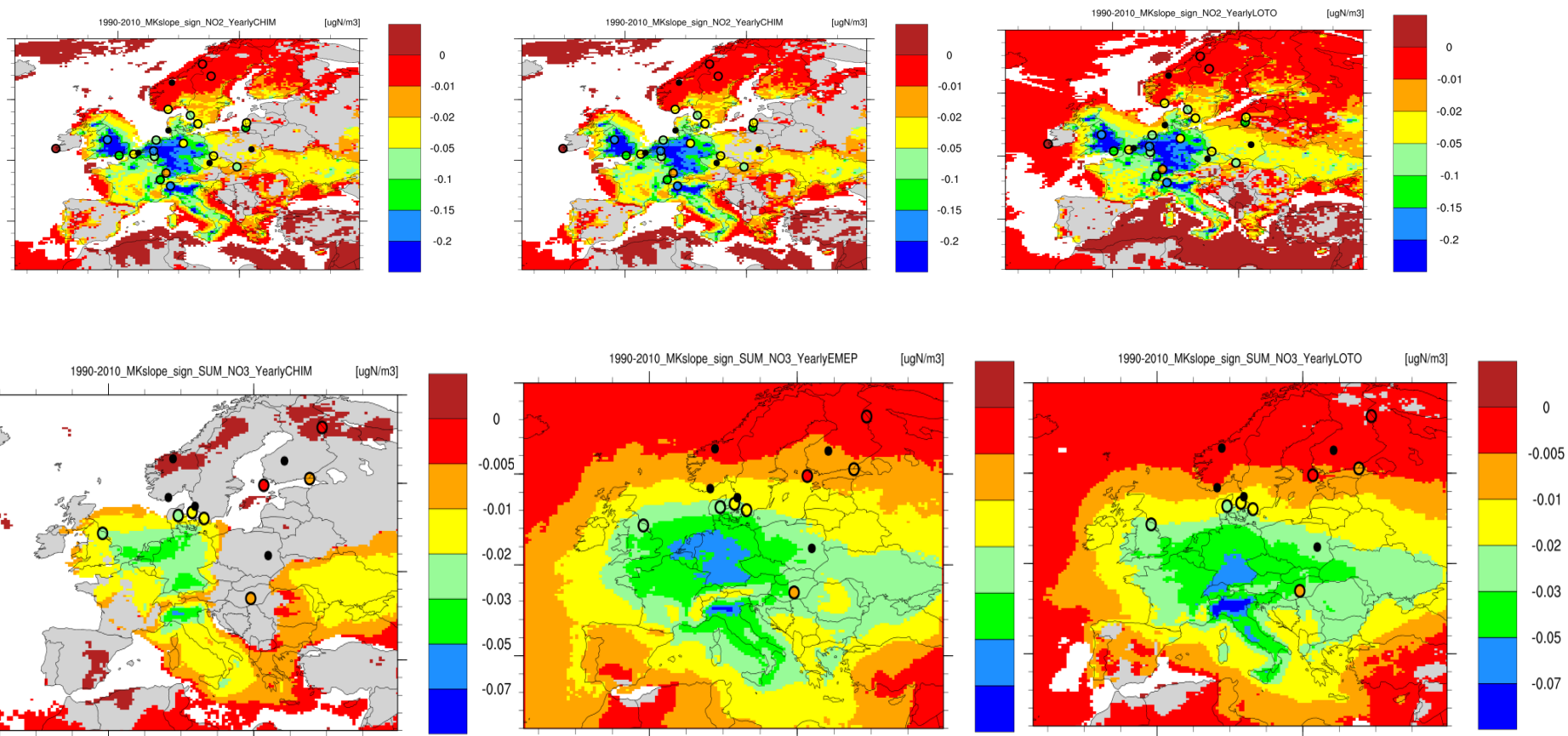




# NOx

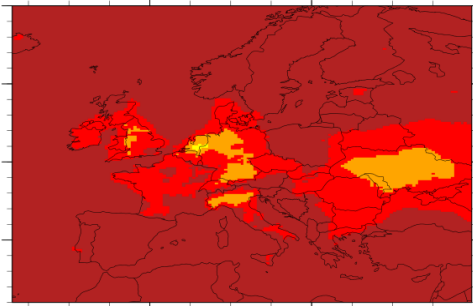


# NOx

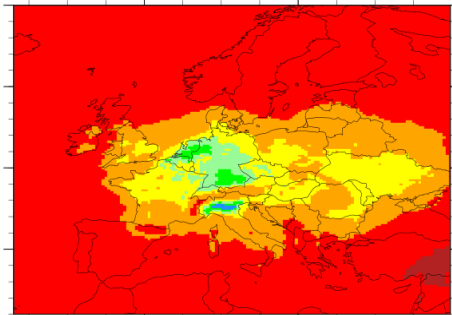


# NO<sub>3</sub>: SENSITIVITY CONSTANT METEO

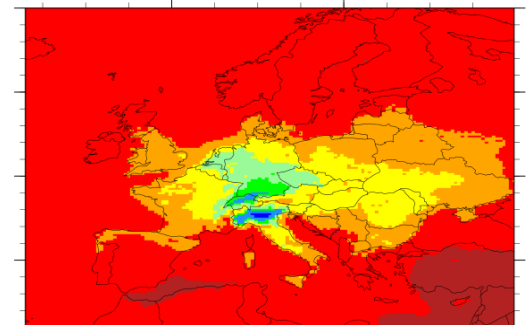
TrendAve\_2010met\_CHIM\_1990-2010\_NO3-10 [ug/m3/yr]



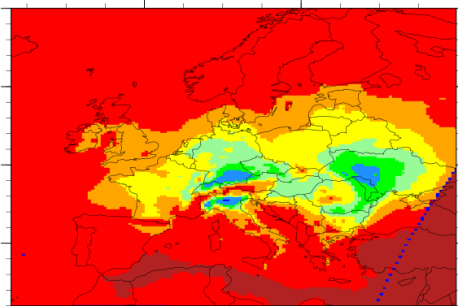
TrendAve\_2010met\_EMEP\_1990-2010\_NO3-10 [ug/m3/yr]



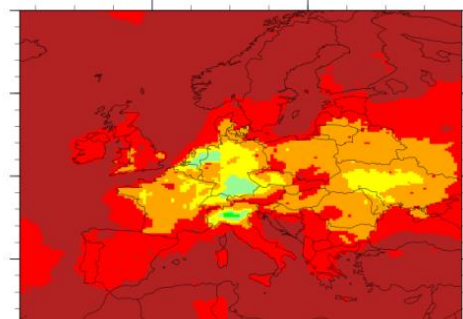
TrendAve\_2010met\_LOTO\_1990-2010\_NO3-10 [ug/m3/yr]



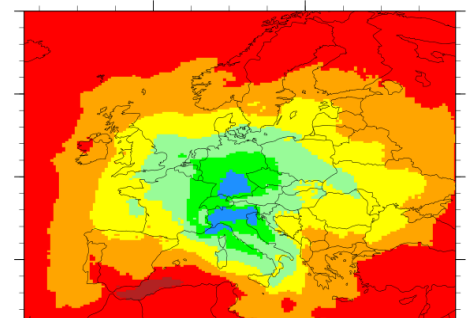
TrendAve\_2010met\_CMAQ\_1990-2010\_NO3-10 [ug/m3/yr]



TrendAve\_2010met\_MINN\_1990-2010\_NO3-10 [ug/m3/yr]



TrendAve\_2010met\_WRFC\_1990-2010\_NO3-10 [ug/m3/yr]

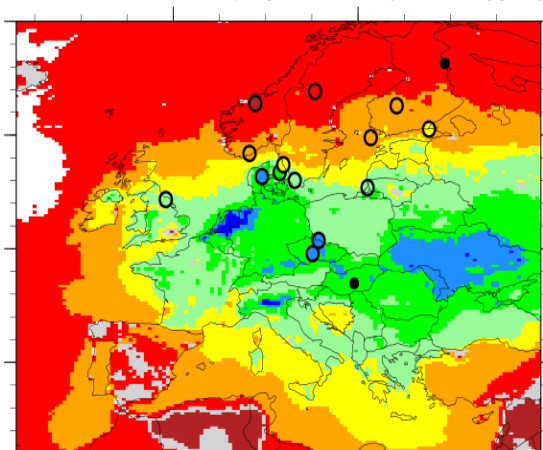


## SUMMARY NOX

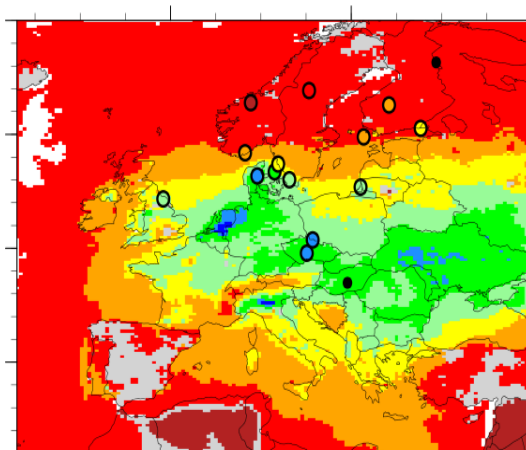
- › NO<sub>2</sub>: models agree on patterns, some over/underestimations
- › TNO<sub>3</sub>: few measurements, lower trends for Chimere.
- › NO<sub>3</sub>: large differences between models (Chimere, Minni lower trends, WRF-CHEM different pattern, CMAQ larger differences in east)

# NH<sub>3</sub>+NH<sub>4</sub>

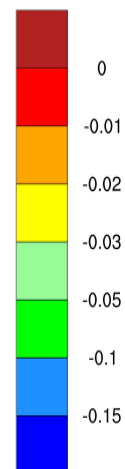
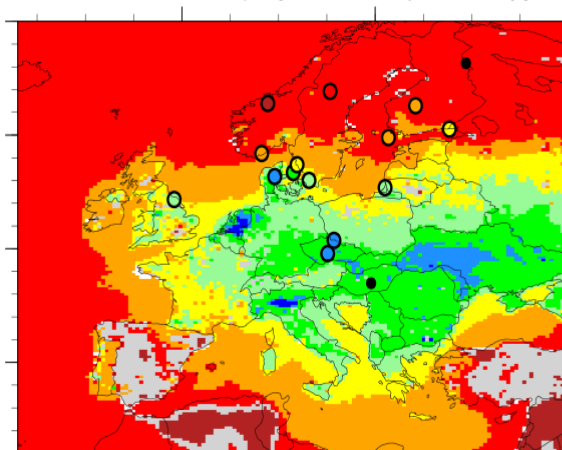
1990-2010\_MKslope\_sign\_SUM\_NH4\_YearlyCHIM [ugN/m3]



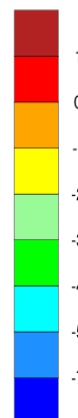
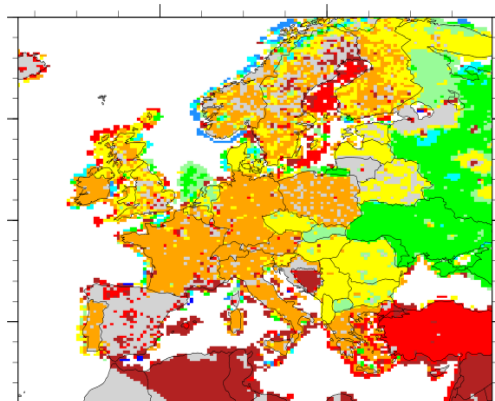
1990-2010\_MKslope\_sign\_SUM\_NH4\_YearlyEMEP [ugN/m3]



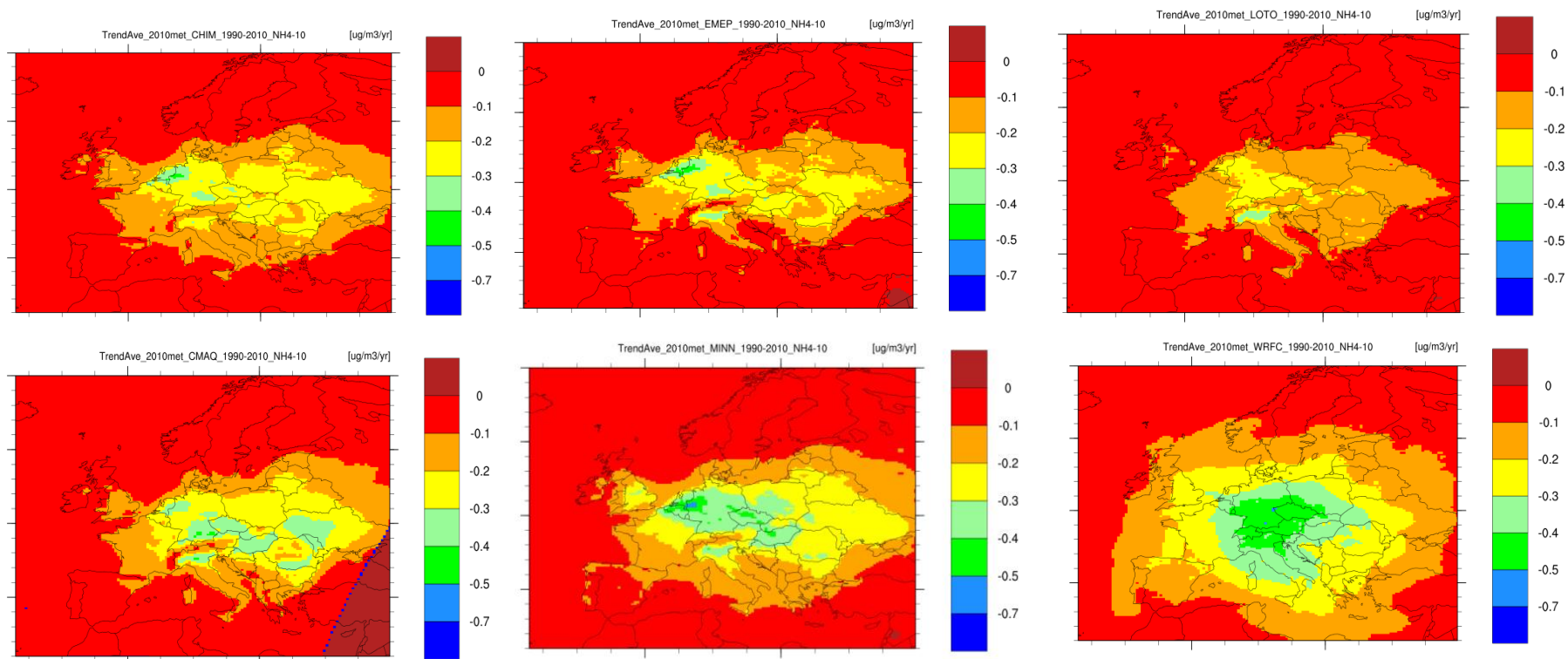
1990-2010\_MKslope\_sign\_SUM\_NH4\_YearlyLOTO [ugN/m3]



1990-2010\_MKslope\_sign\_Emis\_mgm2\_nh3\_YearlyEMEP %



# NH4 SENSITIVITY: CONSTANT METEO





# SUMMARY NHX

- › Good agreement with observations for 3 models
- › NH<sub>4</sub>: differences between 6 models (lower values LOTOS-EUROS, larger values for MINNI, different pattern WRF-CHEM)

# DISCUSSION

- › 21 year trend: many but not all features reproduced by models
- › Not shown: interannual variability
- › Monitoring sites do not cover all countries
- › Consistency between models in terms of large-scale patterns and scales, but significant differences can be found
- › Differences in balance NO<sub>3</sub>-HNO<sub>3</sub>, SO<sub>4</sub>-TSO<sub>4</sub>, NH<sub>3</sub>-NH<sub>4</sub>
- › Single model will not give robust answer

## TO BE DONE

- › Look into chemical conversion rates per model, per country
- › Compare relative and absolute changes per model, biases
- › Look into differences in 1990-2000 and 2000-2010

› **THANK YOU FOR YOUR ATTENTION**



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