

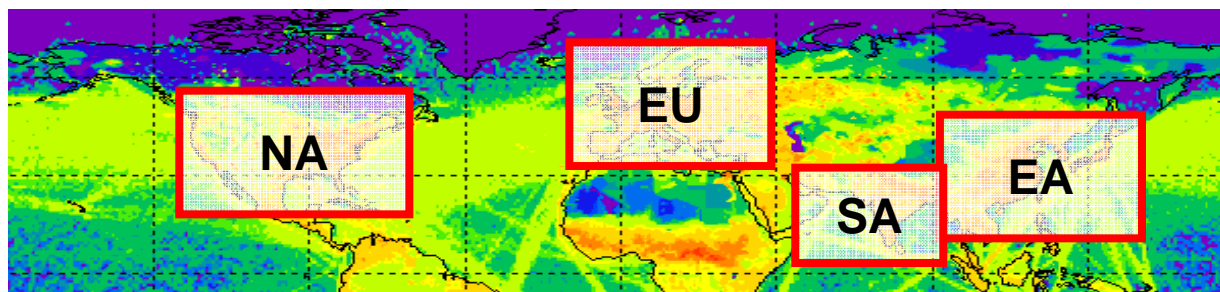
HTAP

Results from experiment set 1

Arlene Fiore, Frank Dentener
Oliver Wild, Martin Schultz, Michael Schulz
HTAP modellers

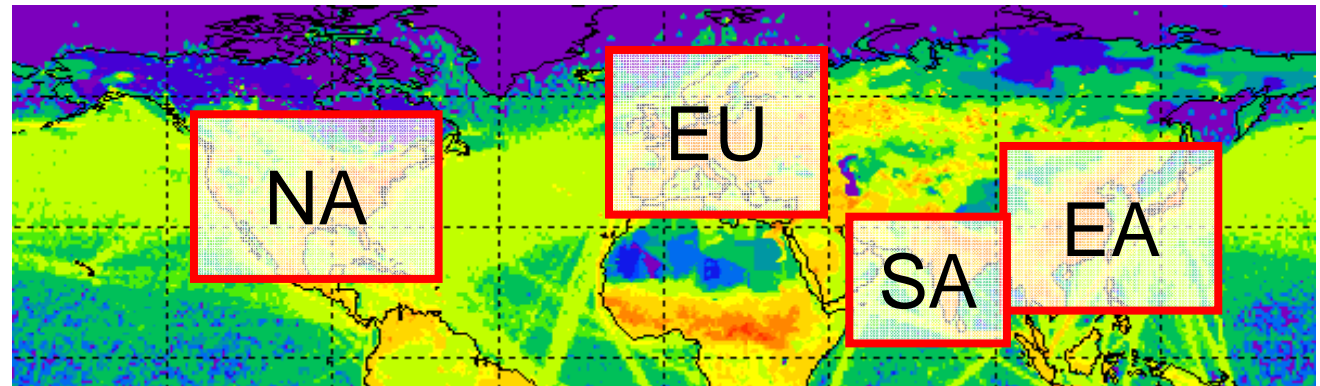
- Overview of experiments
- Results in interim report for surface ozone
- Some further analysis
- Next steps

Source Receptor Relationships



- First insight about the importance and uncertainties of hemispheric transport processes for **ozone and its precursors, particulate matter**
- Using **'best' emission inventory and meteorological dataset** for 2001.
- Simulations consist of a reference simulation (2001), and simulations **with anthropogenic emissions decreased in each region by 20 %**.
- The four regions of interest for Source Receptor Relationships are **Europe (EU), North America (NA), East Asia (EA), South Asia (SA)**.
- **>25 models** participated in Experiment 1

www.htap.org



1. SR1 = base case (methane prescribed 1760 ppb)
2. SR2 = global methane reduction by 20% (1408 ppb)
3. 4x SR3 = regional **NO_x** anthropogenic emissions reduced by 20%
4. 4x SR4 = regional **NMVOC** anthropogenic emissions reduced by 20%
5. 4x SR5 = regional **CO** anthropogenic emissions reduced by 20%
6. 4x SR6 = regional reduction of **all anthropogenic emissions** by 20%

18 experiments in total (each at least 18 months simulation time)

Experiment Set 2: Processes and tracer studies (M. Schultz, O. Wild & D. Shindell)

- To develop a simple set of diagnostics that can be used to understand the model differences that occurred under Experiment 1.

Experiment Set 3: Detailed experiments.

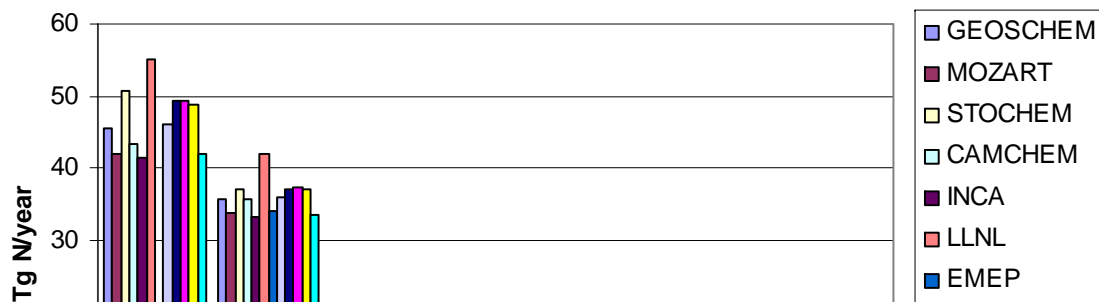
Linkage to campaigns (I. Bey), climate change (D. Stevenson, P. Hess), regional scale issues, Mercury, POPs, Aerosol (AEROCOM)

- To assess in more detail the model skill at representing HTAP processes and to better identify the major uncertainties.

Experiment Set 4: Improved sets of Source Receptor experiments to be defined=>input to 2009 report.

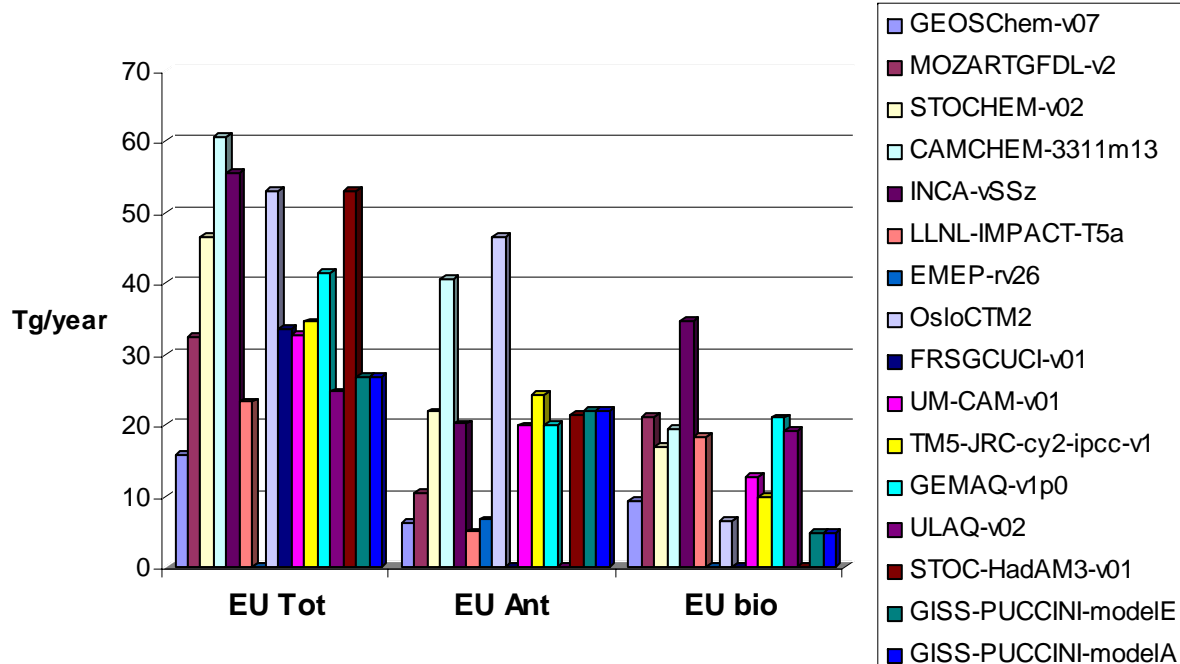
- Overview of experiment requirements: <http://aqm.jrc.it/HTAP>
- CF conventions (Christiane Textor)=>interoperability
- Data server: htap.icg.kfa-juelich.de
Kees Cuvelier (JRC) some format/data quality checks + processing
- Quick check with HemiTap tool
- Users have their own directories; consolidated data copied to 'DVS'
Frozen version of DVS in ca. august 2007 (as used for report)
- Server is getting 'full' now
- Model description: "<http://www.mi.uni-hamburg.de/List-classification-and-detail-view-of-model-entr.567.0.html>": will need improvement
- Wiki: <http://icg-ii-wikis.icg.fz-juelich.de/HTAPWiki>

Total NOx emissions

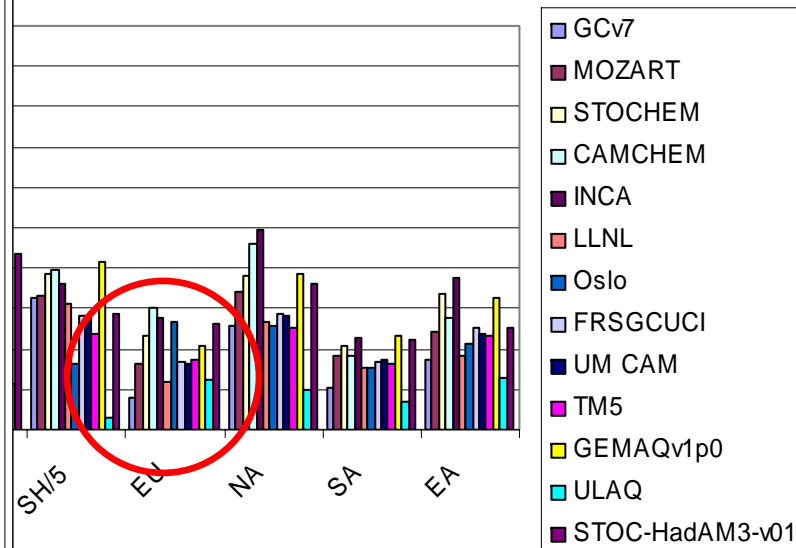


A subset of models have submitted emission data: it is essential for meaningful further analysis that all groups report emissions

European NMVOC emissions

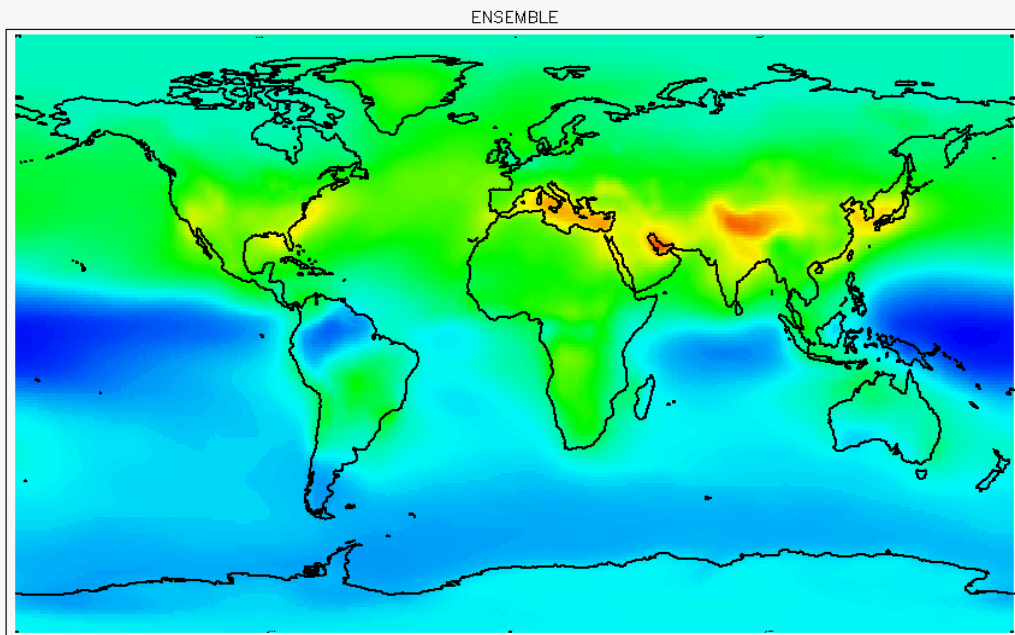


Total NMVOC Emissions



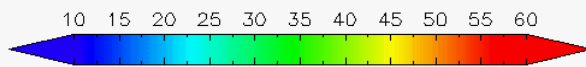
- HTAP: 22 models

Ensemble of 22 models

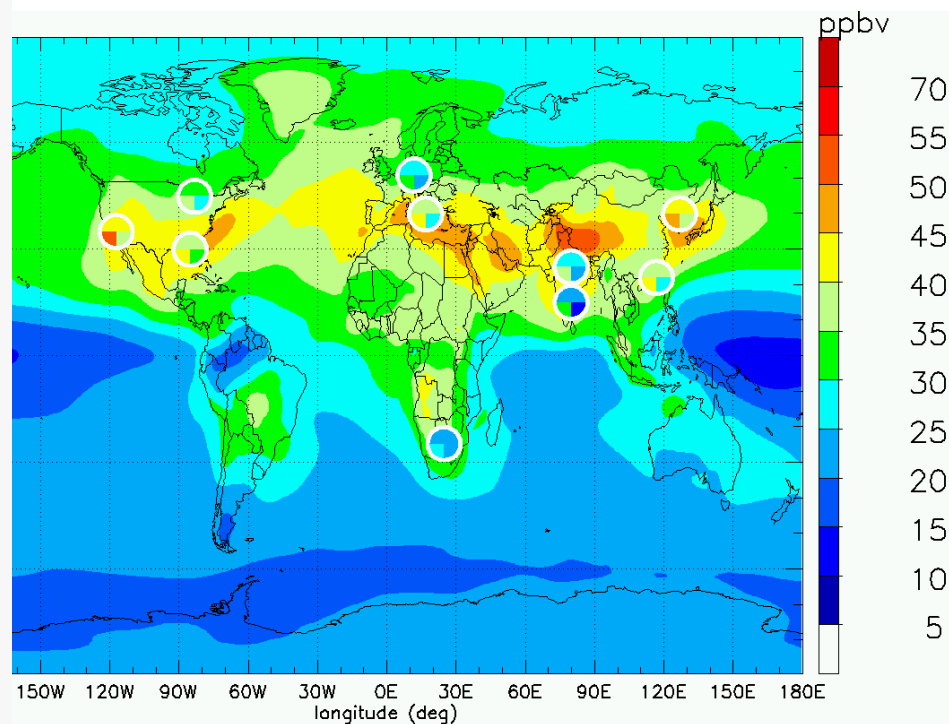


MAX 53.3715

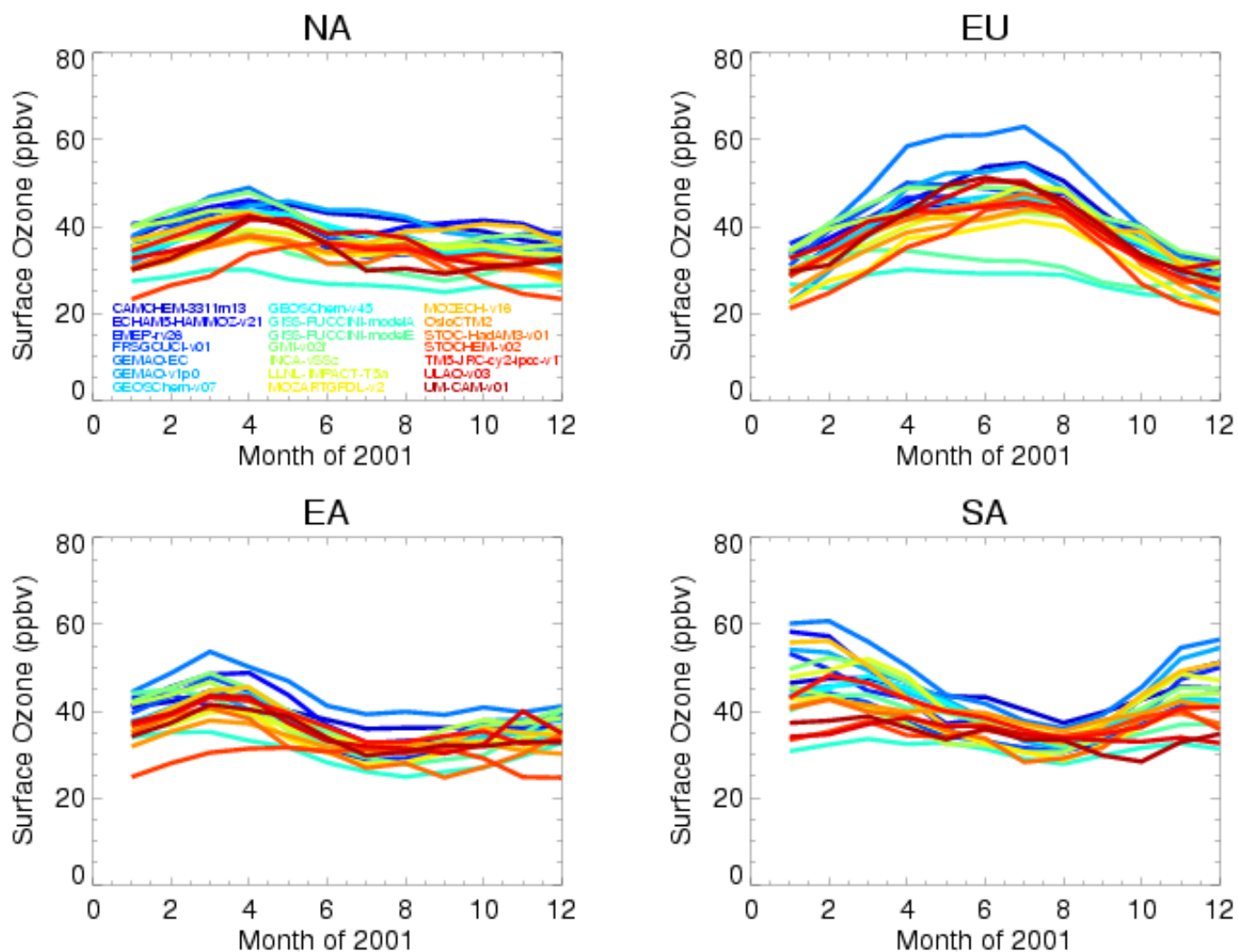
MIN 11.9616



ACCENT-Photocomp ensemble
Ca. 20 models

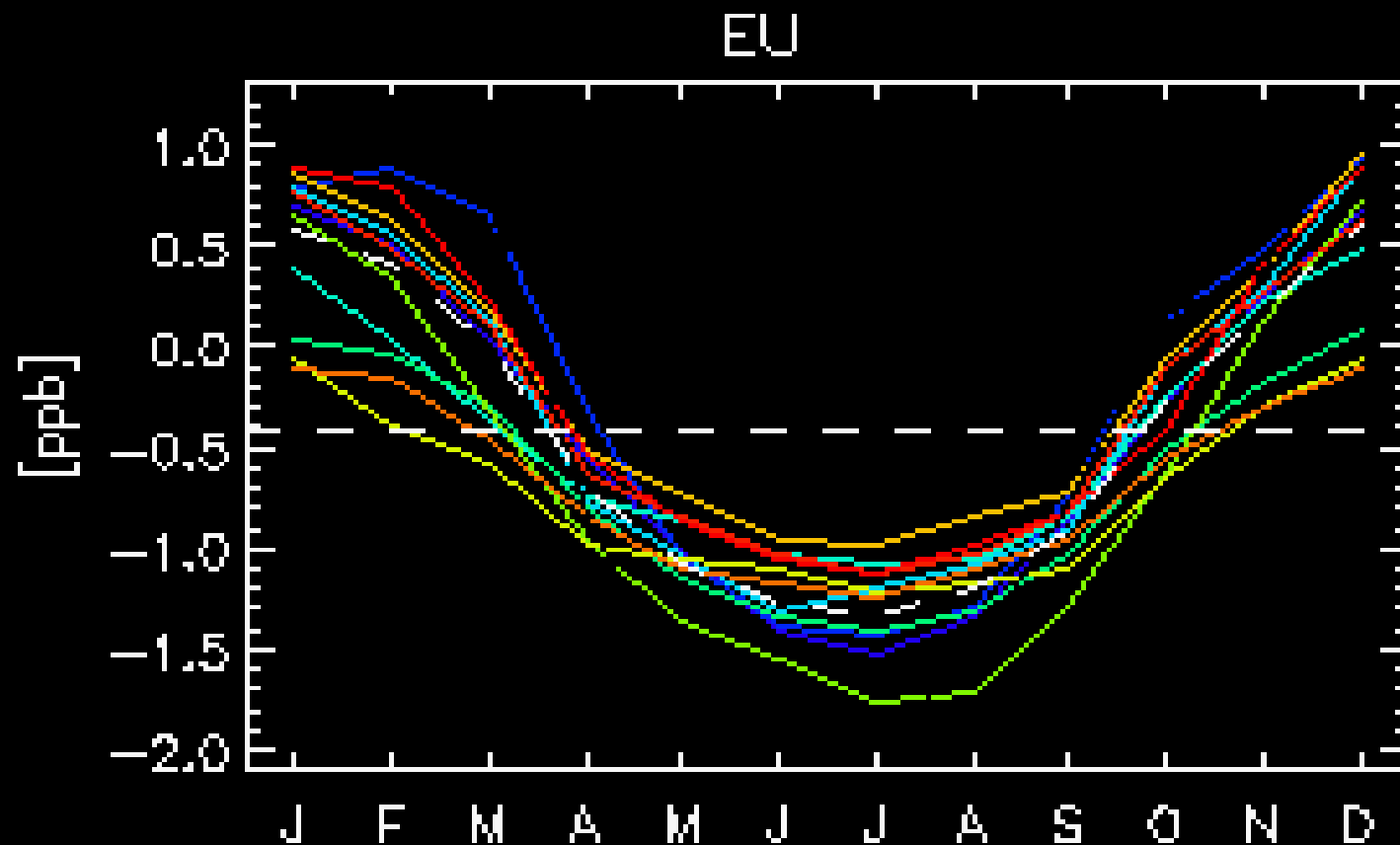


SR1 results from 21 individual models including 5 „twins“



Model range often spans ~15-30 ppbv

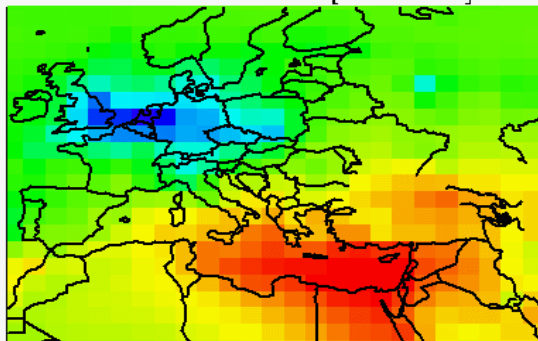
GEOSChem-v07
MOZARTGFDL-v2
CAMCHEM-3311m13
INCA-vSSz
LLNL-IMPACT-T5a
EMEP-rv26
OsloCTM2
FRSGUCI-v01
UM-CAM-v01
TM5-JRC-ey2-ipcc-v1
MOZECH-v16
GEMAQ-v1p0
ULAQ-v02
MeanValue - - -



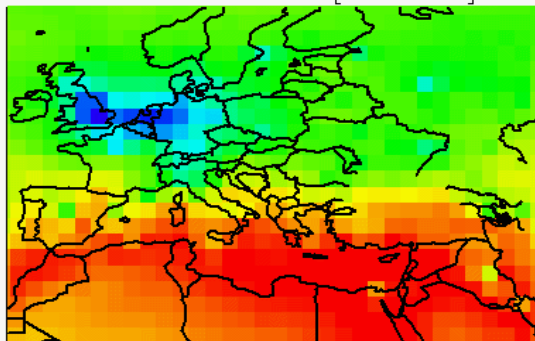
→ Large seasonality masked by annual mean statistic

Annual mean surface O₃ change in EU from 20% reductions of domestic NO_x emissions

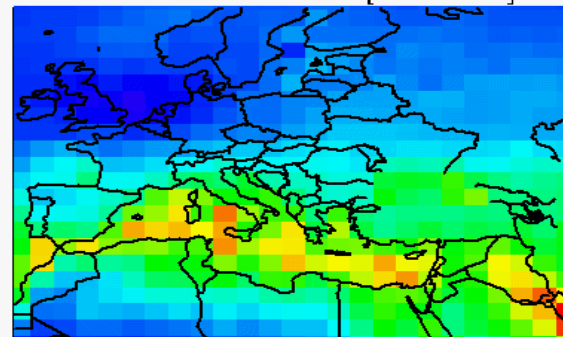
01 => GEOSChem-v07 [Z=468m asl]



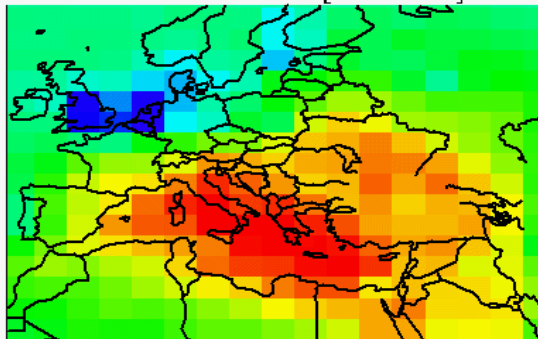
02 => MOZARTGFDL-v2 [Z=454m asl]



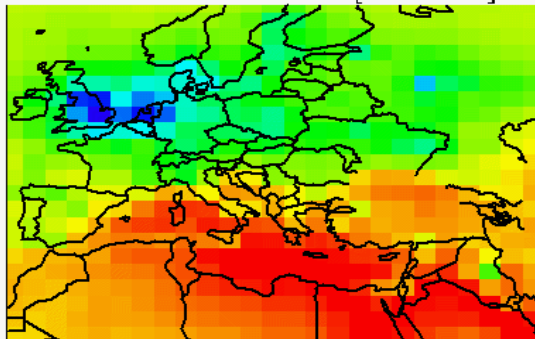
06 => LLNL-IMPACT-T5a [Z=422m asl]



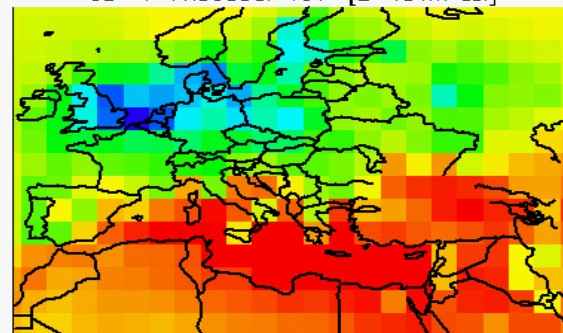
03 => STOCHEM-v02 [Z=555m asl]



04 => CAMCHEM-3311m13 [Z=471m asl]



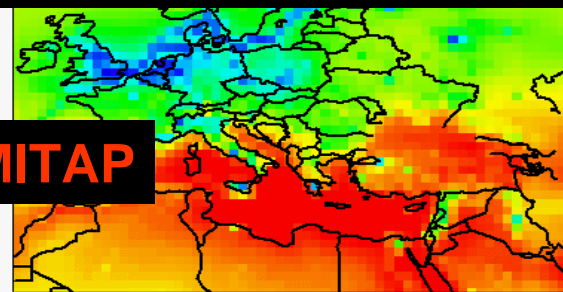
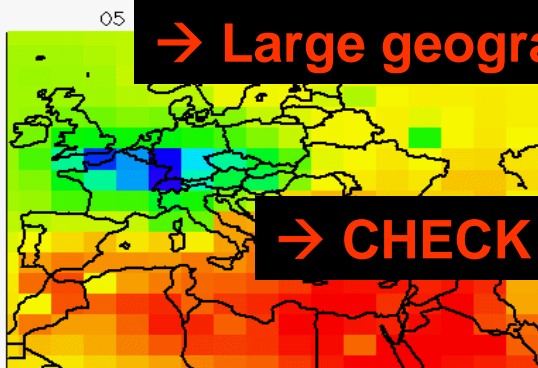
08 => FRSGCUCI-v01 [Z=434m asl]



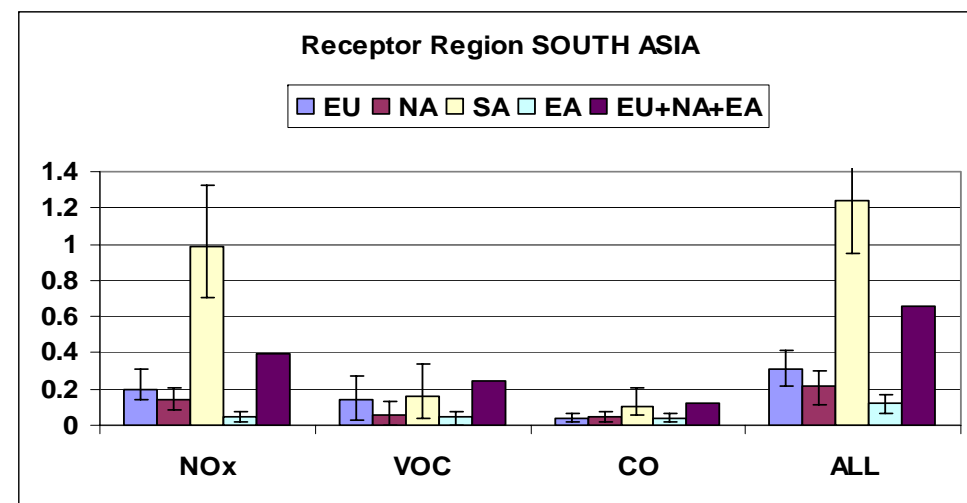
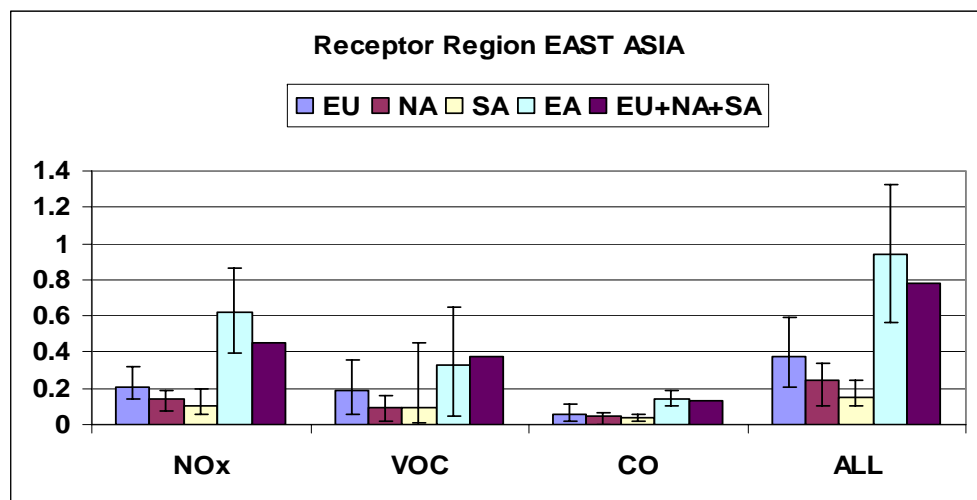
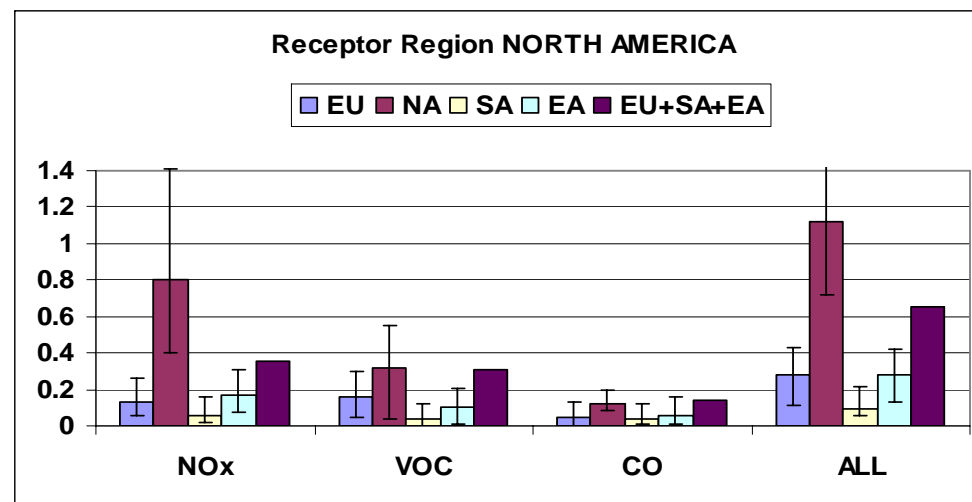
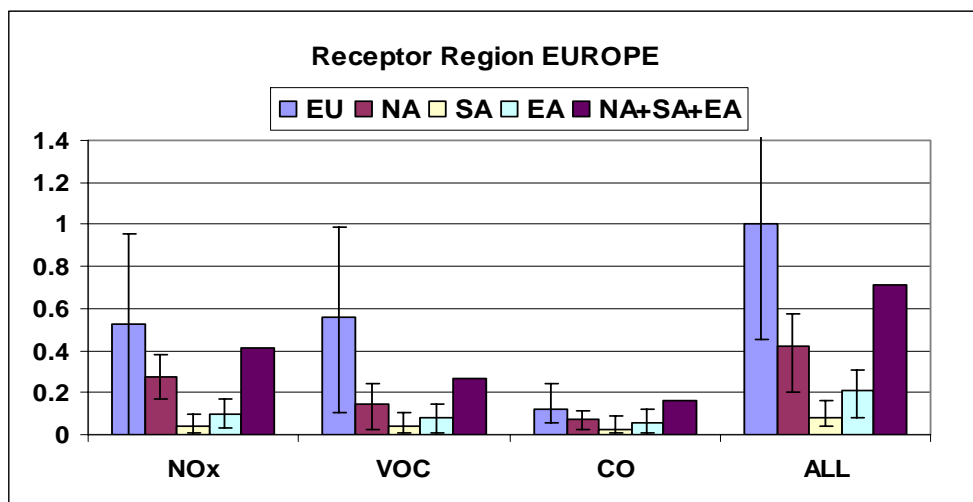
05 → Large geographical variability masked by regional mean statistics

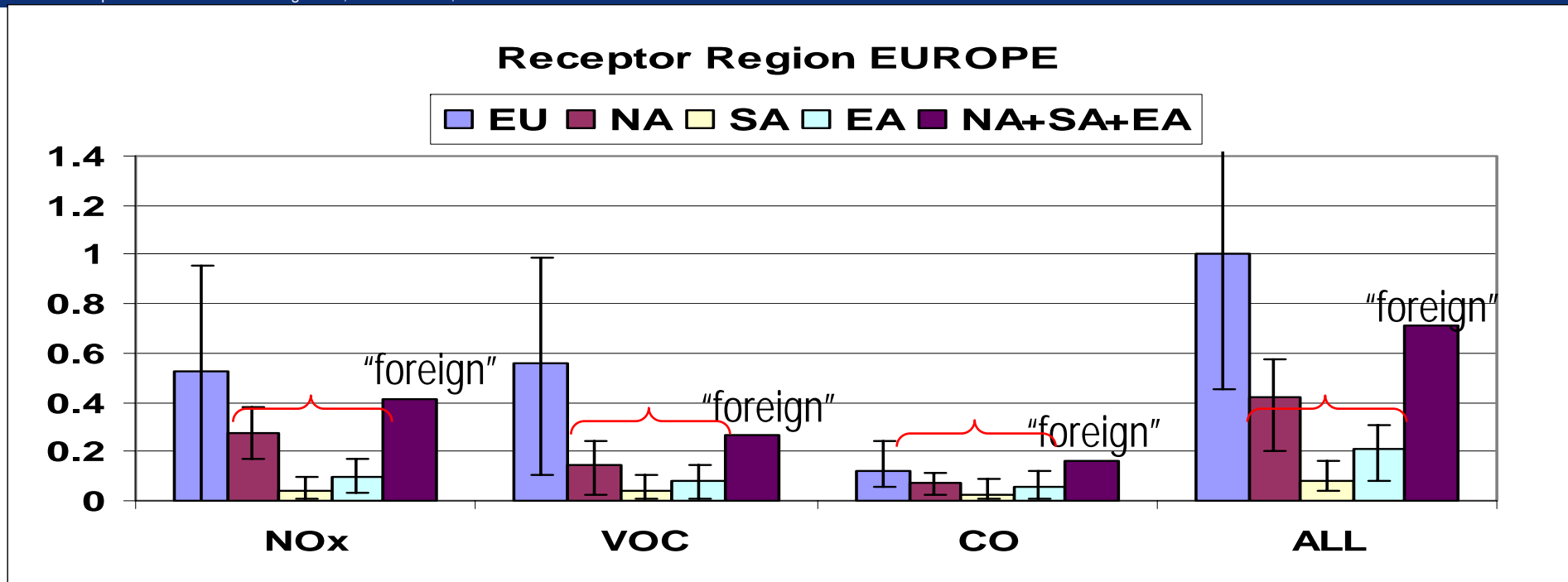
02	MOZARTGFDL-v2:	-2.47967	1.41240
03	STOCHEM-v02:	-0.708902	1.86159
04	CAMCHEM-3311m13:	-3.08968	1.84386

→ CHECK YOUR OWN MODEL WITH HEMITAP



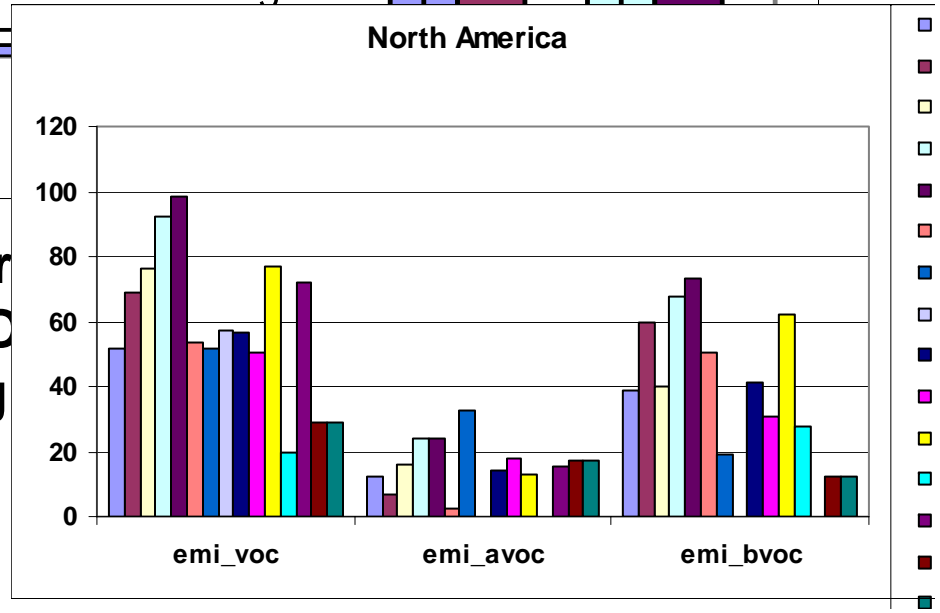
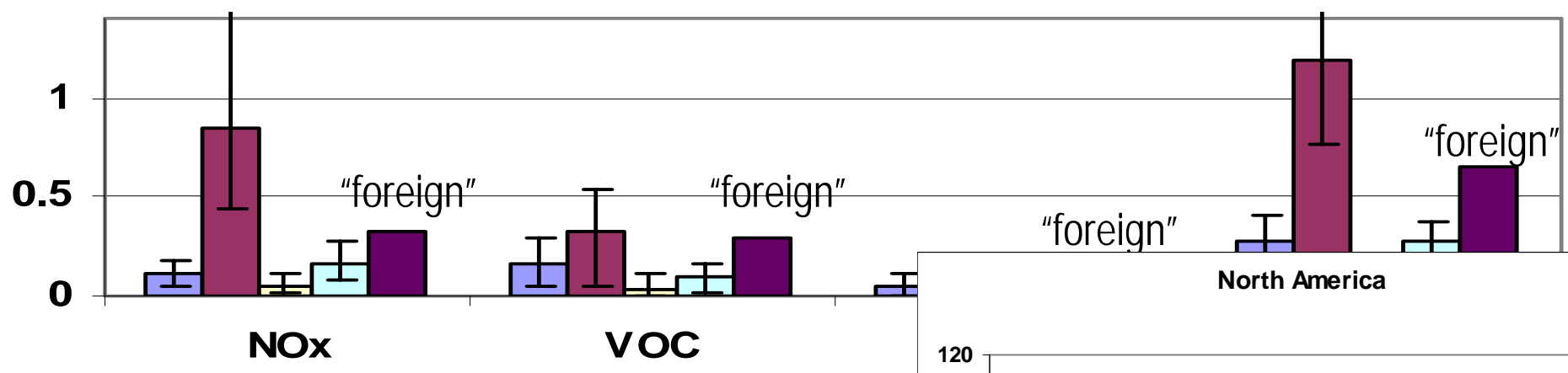
Ozone Response [ppbv] in Receptor regions due to 20 % ant. Emission reduction





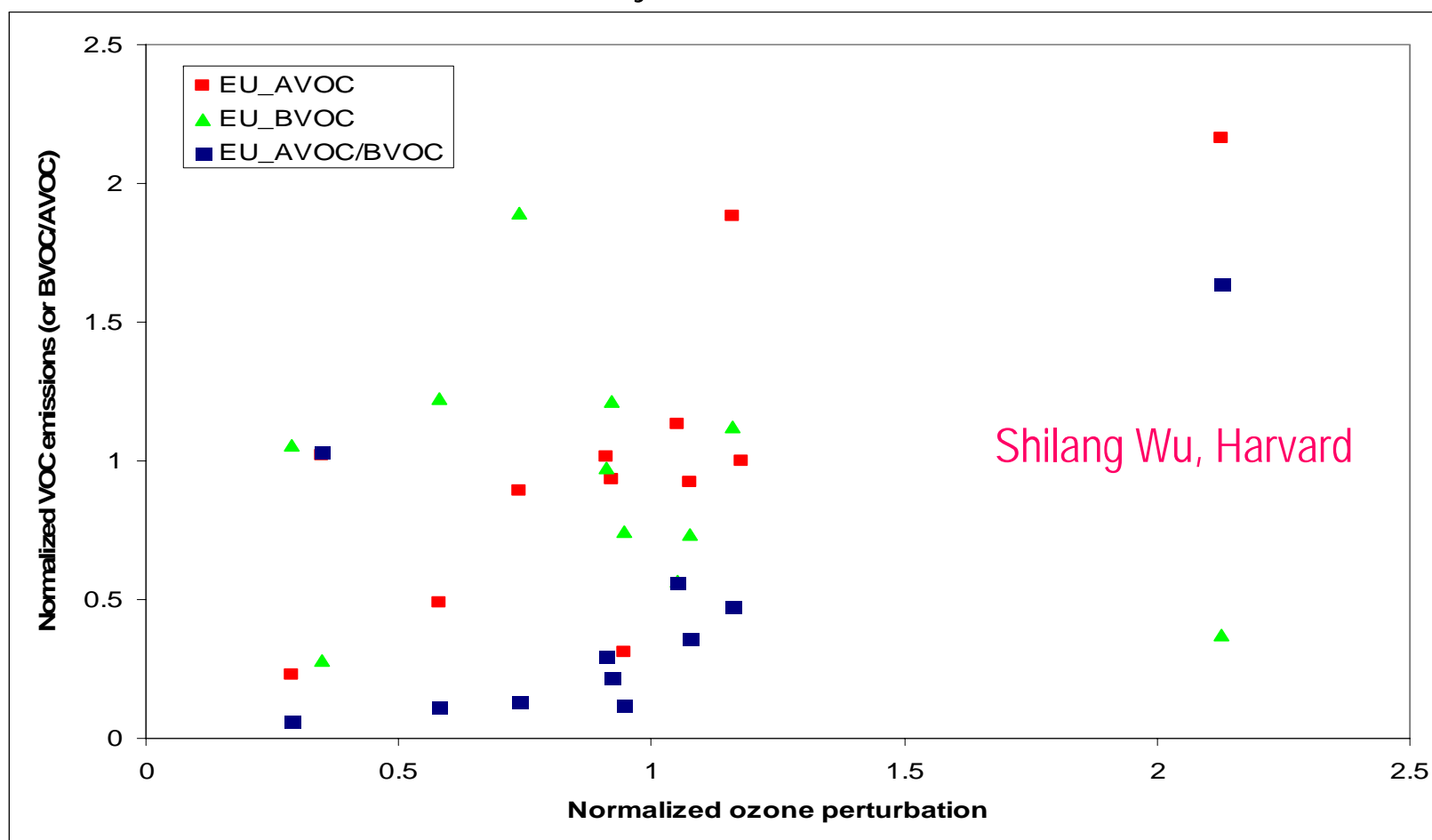
- Combined influence of 3 foreign regions emission reductions similar to that in the domestic regions
- NOx (SR3) and VOC (SR4) have the greatest influence:
(Ratio Emission NOx/Emission VOC= 0.24 ± 0.11)
- weak non-linearity

Receptor Region NORTH AMERICA

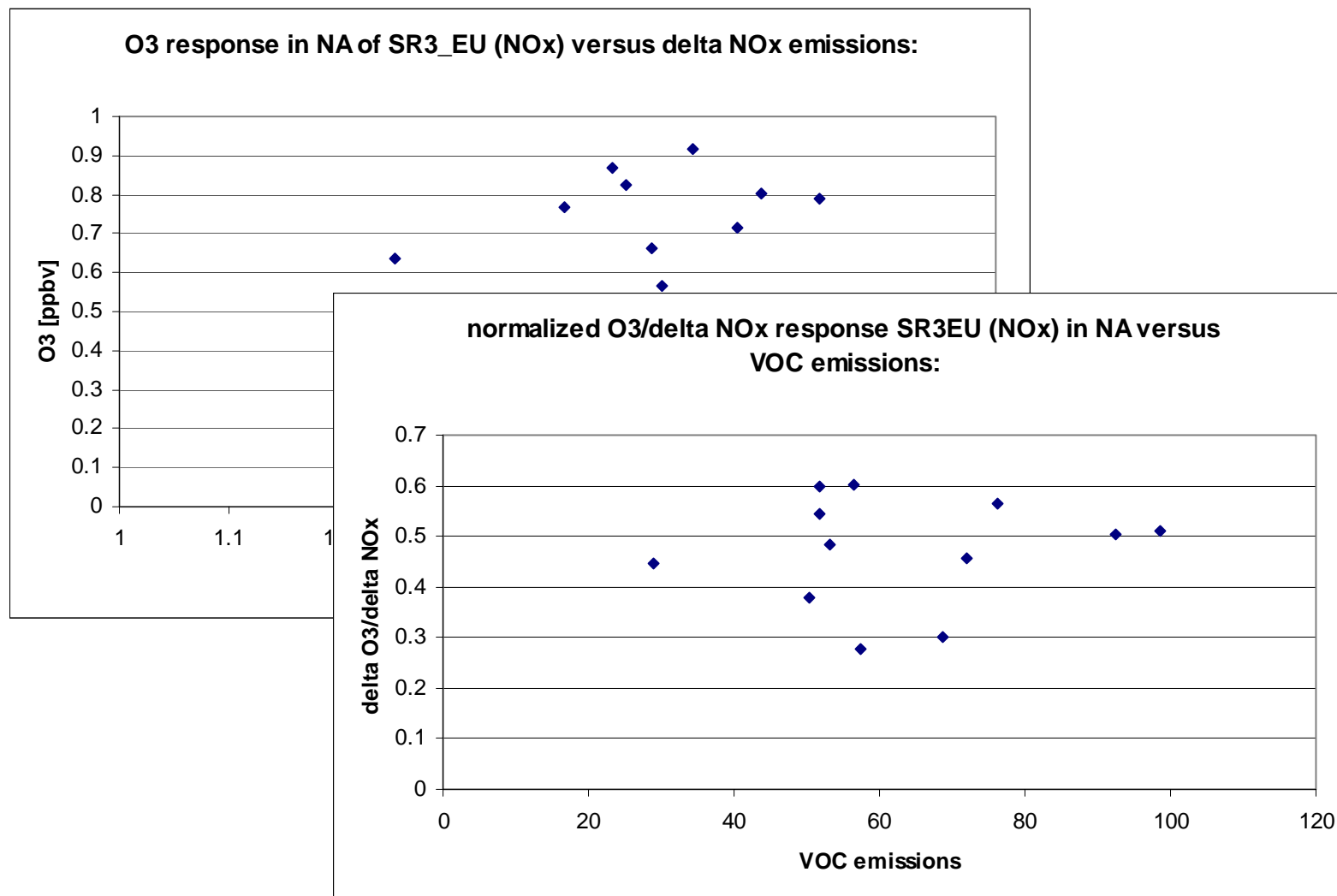


- NOx emission have the domestic gr
- Ratio Emission NOx to Emission VC
- Combined influence of 3 foreign reg that in the domestic regions

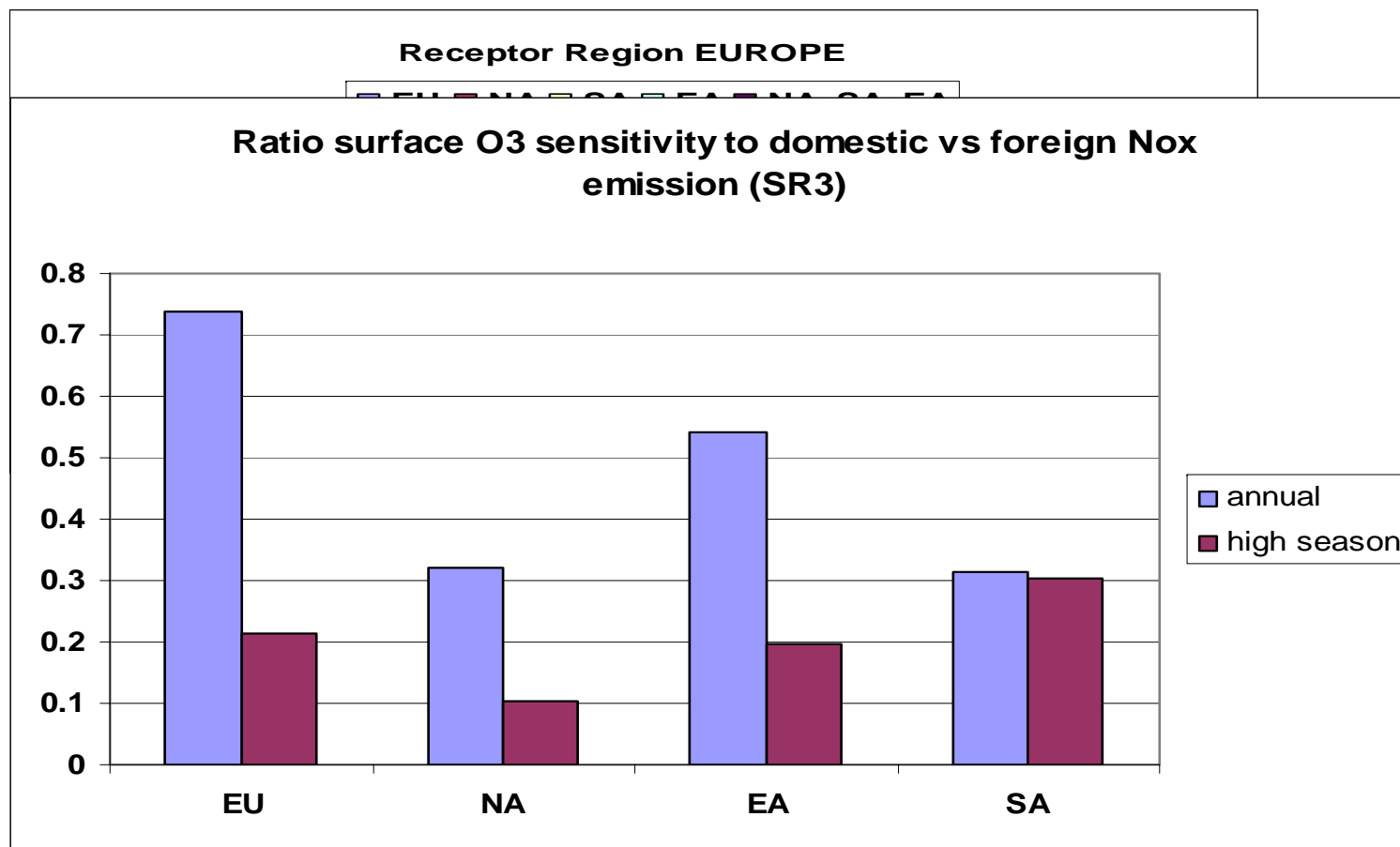
SR4EU effect of hydrocarbons on NA ozone



Ozone response to VOC emissions changes in individual models: AVOC seems to be important factor



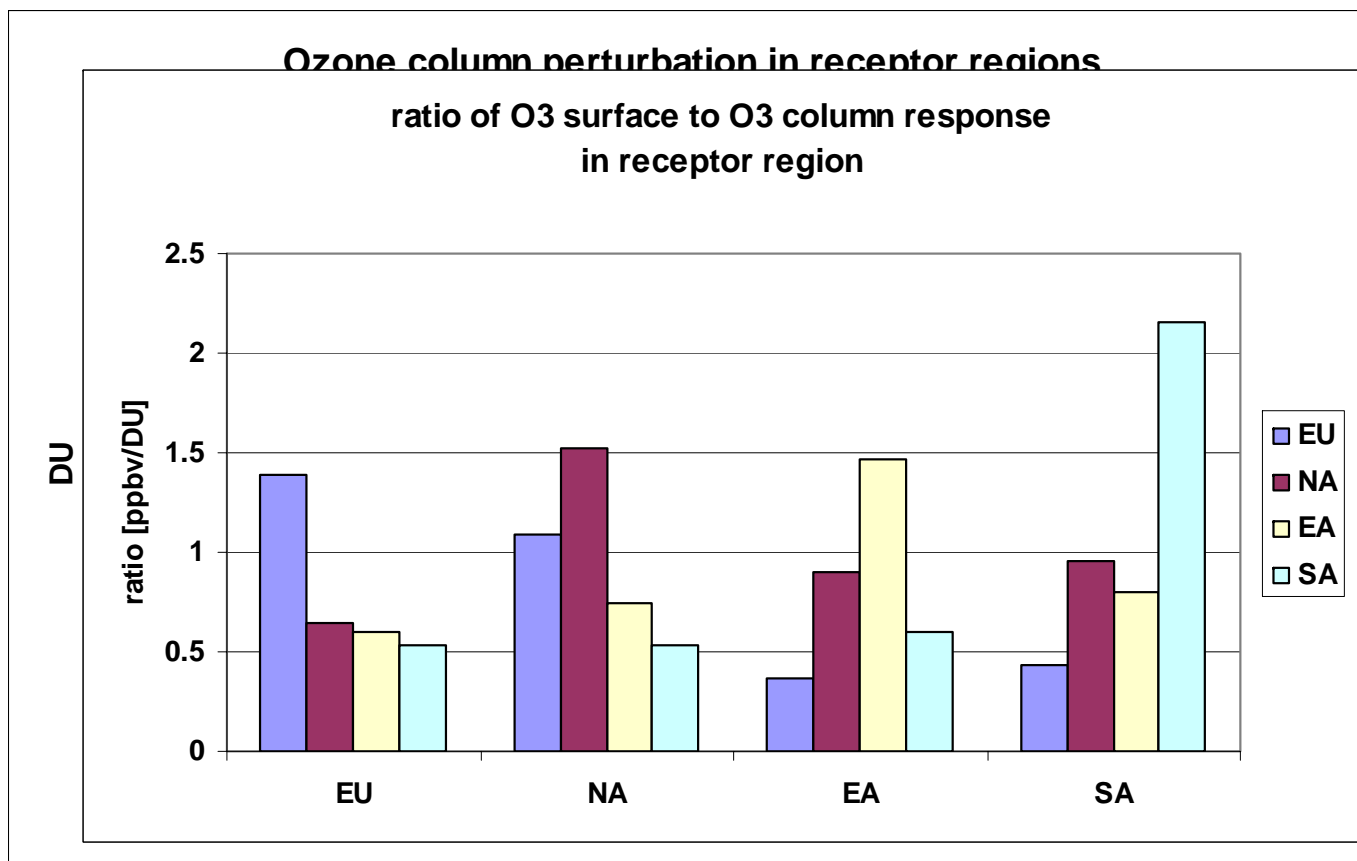
Ozone response to VOC emissions in individual models; confounded by other factors



Strongest SR between NA-EU: annual average

In high O₃ season more similar influence.

High Ozone (JJA); except SA (SON)



Ratio highest in source region (of course!)

Ratio lowest in Europe (effective ventilation)

Some interesting difference between surface and column response appear=> to be analyzed in terms of transport paths.

- Perturbation experiments for 4 world regions: NO_x, CO, VOC, (SO₂, EC, POM, CO, Hg Pops).
- Model spread in perturbation signal typically factor of 2
- Ozone sensitivities ca. 1.5-2 ppbv to reduction by 20% of all anthropogenic emissions
- EU and EA are most influenced by other regions.
- Large difference in VOC emissions probably important
- Role of methane: SR of NO_x, VOC, CO may change for different CH₄ concentrations

To be done with **current set** of model results:

- Modelling groups: update model documentation (will need extended info 16.11.2007);
- Modelling groups: verify and complete results (emissions! 30.11.2007); use HemiTap!
- Improved use of Wiki page for exchange of information and document problems per model (avoid double work)
- Write-up (Arlene Fiore): outline on:
<http://icg-ii-wikis.icg.fzjuelich.de/HTAPWiki/ExperimentSet1>

Further analysis of:

- seasonal signal (resolution dependency)
- NO_x/VOC sensitivity+variability across models and regions
- CH₄ sensitivity (change in CH₄ concentrations will influence the NO_x, CO lifetimes;
Change in NO_x, CO, VOC=> CH₄)
- Link to TP1
- Variations in transport pathways regionally (+later interannually)
- Analysis of transport events + analysis of contribution to high conc. episodes