Task Force on Hemispheric Transport of Air Pollution

Boundary Conditions: linking regional and global perturbation experiments

Co-Chairs

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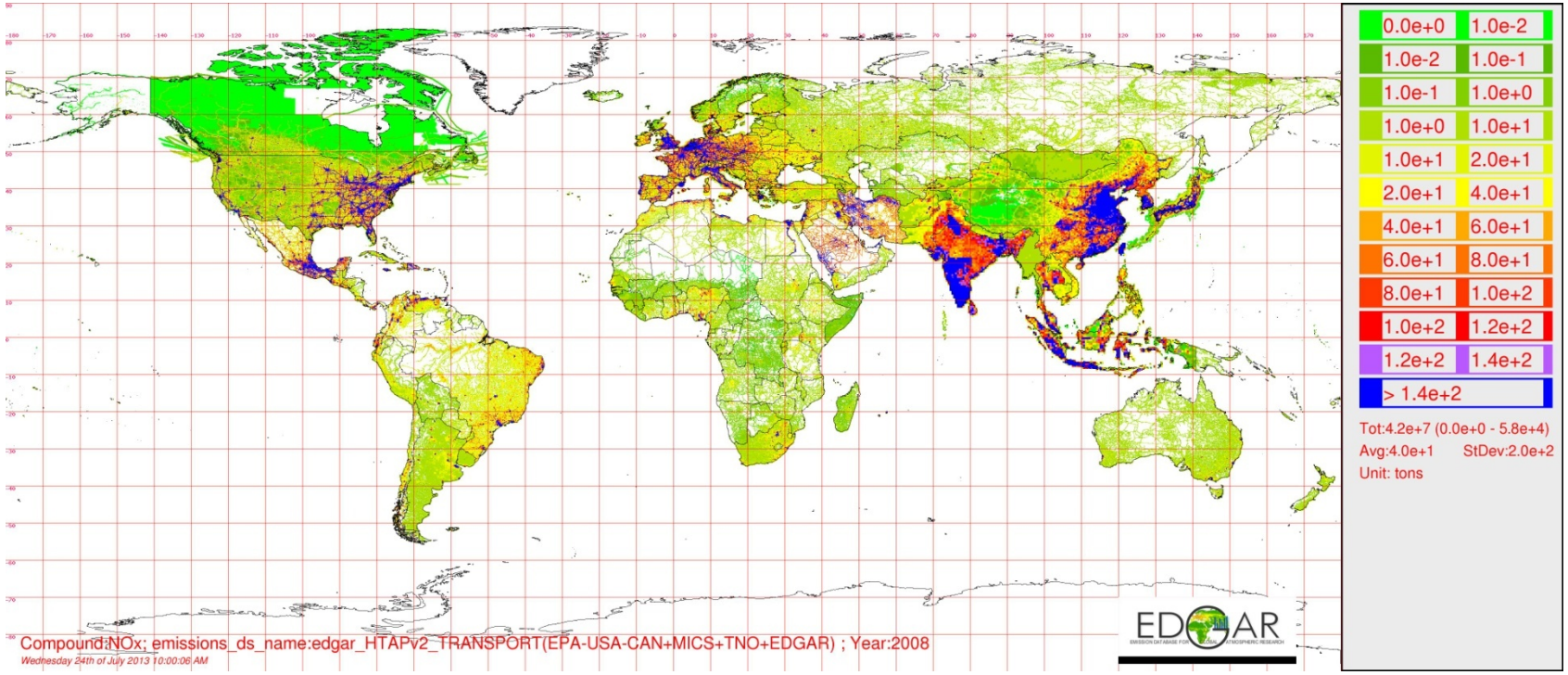
Why?

- HTAP needs improved estimate of impacts:
  resolution helps
- Global consistency versus regional accuracy:
  the best of two worlds
- Exploring the usability of regional models for hemispheric/global issues
- What is covered well by each scale
- Outreach and connecting communities

2008 & 2010 Global Emissions Mosaics

- SO_2, NO_x, NMVOC, CH_4, CO, NH_3, PM_{10}, $PM_{2.5}$, BC, OC
- 0.1°x0.1° grid, annual (monthly for some sectors)
- Aviation, Shipping, Electricity Generation, Industry, Transport, Residential, Agriculture

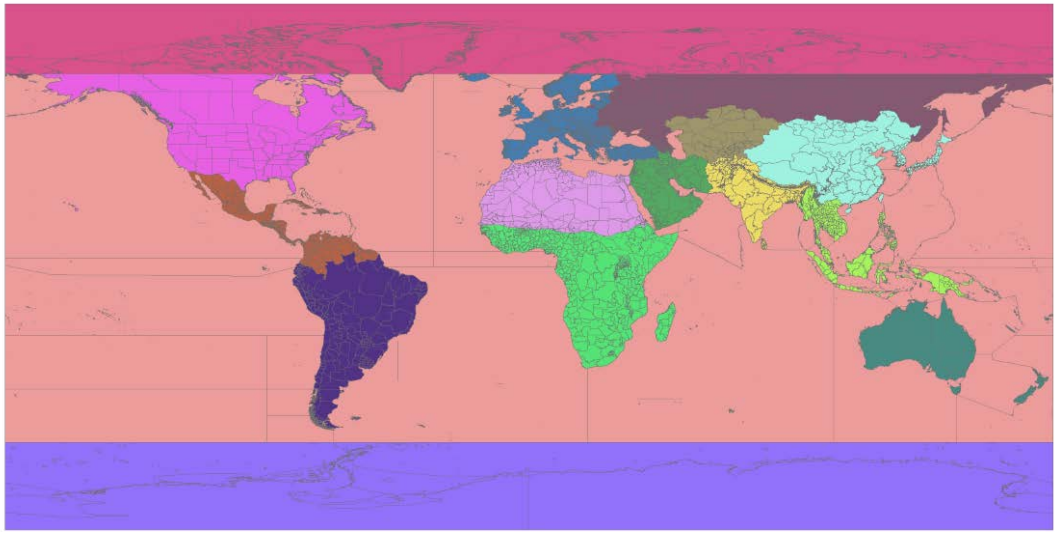


- 2008-2010

http://edgar.jrc.ec.europa.eu/htap_v2/index.php?SECURE=123

Source-Receptor Analyses

- Planned Experiments Focus on 2008-2010
- World divided into 16 regions (60 sub-regions).



7 Regions identified as priorities:
North America, Europe, East Asia, South Asia, Russia/Belarus/Ukraine, Middle East.

- Perturbation Experiments: 20% Emission Reductions By Region and Sector (or By Region and Pollutant)
- Matched Global and Regional Perturbation Simulations
- Comparison of Perturbation and Other S/R Method

Priorities for HTAP2 Simulations

		2008	2009	2010
Base	BASE	1		1
Increase CH4 Conc	CH4INC			1
Decrease CH4 Conc	CH4DEC			

Highest Priority 1
Next Priority
Lower Priority

Region of Emissions Perturbation		All			NOX			CO			VOC			SO2			NH3			PM			TRN			PIN			RES			OTH			FIR			DST		
		2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010
Global	GLO			1			1			1															1			1			1					1			1
N America	NAM			1																																			
Europe	EUR			1																																			
East Asia	EAS			1																																			1
South Asia	SAS			1																																			
Rus, Bel, Ukr	RBU			1																																			
Middle East	MDE			1																																			1
SE Asia	SEA																																						
Central Asia	CAS																																						1
N Afr/Sahara/Sahel	NAF *																																						1
Mex/C America	MCA																																						
Southern Africa	SAF																																						
South America	SAM																																						
Aust/NZ/Pacific	PAN																																						
Oceans	OCN																																						

PM = Other Particulate Matter (BC, OC, PM10, PM2.5)

TRN = Ground Transport Sector; PIN = Power and Industry Sectors; RES = Residential Sector; OTH = Other Sectors (Ships, Aviation, Agriculture); FIR = Fire

DST = Dust * For dust, some models should divide the NAF source into separate source regions for the Sahara (091+092, in the Tier2 regions) and Sahel (093).

HTAP policy relevant metric

RELATIVE ANNUAL INTERCONTINENTAL RESPONSE

$$RAIR = \frac{\Sigma R(\,foreign\_regions)}{\Sigma R(all\_regions)}$$

R= annual average response to emission perturbation

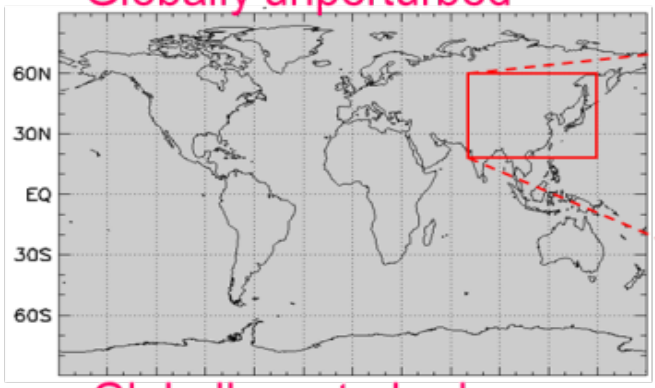
We want to use **the global models** for:
A more complete set of perturbations region/sector/component
What fraction of pollution is coming from abroad,
and which sector/component are responsible?

We want to use the **regional models** for:
A limited set of perturbations focusing on impacts of foreign emissions on region
What is coming from abroad and what is the impact compared to regional emissions

Global Model

Regional Model

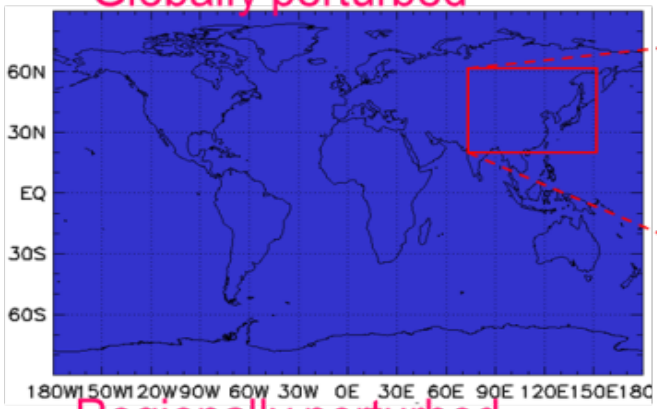
Globally unperturbed



Boundary Conditions

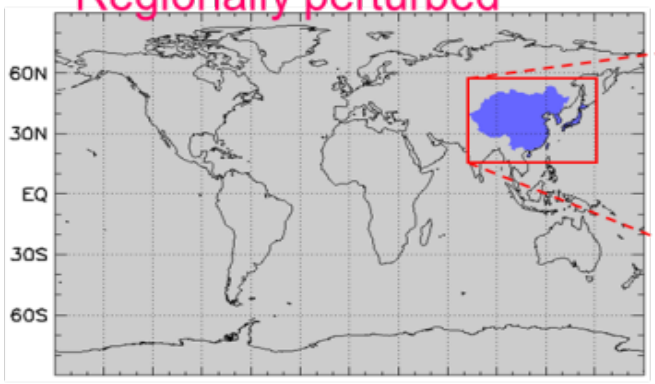
Regionally unperturbed

Globally perturbed



Regionally perturbed

Regionally perturbed



Regionally perturbed

Global models provide BC

4 models-typically linked already to regional modeling activities
ECMWF-IFS (MACC/AQMEII)
CHASER (+>MICS)
NOAA-GFDL (Meijun also used for specific analysis CalNex)
GEOS-CHEM (Rokjin Park=>CMAQ)
Each global model provides:

1. Base
2. Global perturbed

And two or more regions with -20 % perturbations
North America- Europe - East Asia 6 South Asia

7. Methane perturbed
8. 3 (6) hourly – selected components- selected domains

Need to discuss:

- Which components (long-lived?)
- How to ‘match’ lumped components?
- What to do about missing components?
- Tools for horizontal and vertical interpolation to regional model grid.
- Output domains sufficient?
- Sharing tools?
- Some regional models with multiple global models?
- Lessons learned from previous exercise
- Time schedule.
- Potential innovative analysis methods.