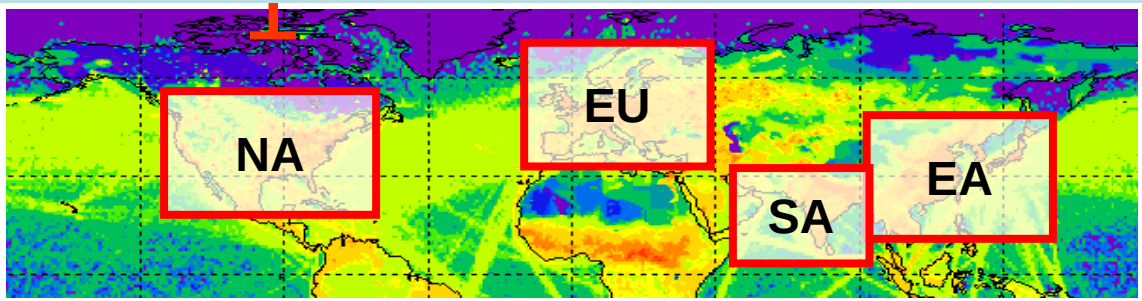
HTAP Overview of experiment set

Initiated by Terry Keating / EPA & Andre Zuber / EU & Frank Dentener / JRC

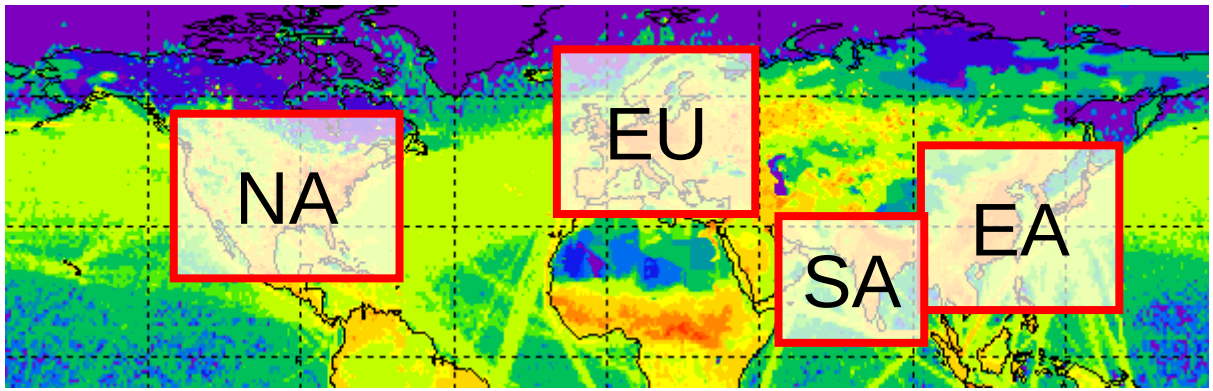
Source Receptor Relationships



- 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

Overview of experiment set 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)

Other experiments

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.

Atmospheric Chemistry and Climate Initiative: Background

Initiated by A. R. Ravishankara / WCRP-SPARC, Phil Rasch, Sarah Doherty, IGBP-IGAC

AC&C endorsed **March 2006** as a joint effort of **WCRP** and **IGBP**, with the

and

projects tasked to take the lead in its implementation.

- Initial scoping meeting August, 2006, Boulder, CO
  - laid the groundwork for the basic structure & goals of AC&C
- First AC&C Workshop January, 2007, Geneva
  - engaged larger community; open workshop
  - established implementation plan for Phase I

- Joint HTAP & AC&C workshop in Washington DC, June 08

Atmospheric Chemistry & Climate Initiative: Motivation

- Much of human induced climate forcing occurs through chemically active species
- Climate Forcing agents are highly variable
- Many radiative forcing agents are also pollutants

- **Objectives of AC&C:**
  - Understanding the role of emissions on atmospheric composition
  - Relating the concentrations to radiative forcings/climate change
  - Improve process understanding and representation
  - Helping to define common model output and data conventions, file formats, create and AC&C archive as ensemble of opportunity

The Phase 1 task:
Modeling Study

- **Emphasis will be on:**
  - **Aerosols**
  - **Ozone**
  - **Deposition processes**

- **Build on existing projects => Research Implementation Bodies of AC&C are**
  - **CCMVal** *(**C**hemistry-**C**limate **M**odel **Val**idation Project of SPARC)*
  - **AeroCom** *(Global **Aero**sol Model Inter**com**parison Project)*
  - **TropChem** *(**Trop**ospheric Gas-Phase **Chem**istry)* will augment / build on

    (ACCENT Model Intercomparison Project)

    (UNECE Task Force Hemispheric Transport of Atmospheric Pollutants)

2000 AeroCom A + B
1750 AeroCom PRE
2001 HTAP

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1980 ----- 2009 Hindcast
2000 ------2009 Small Hindcast

INTENSIFIED diagnostics
Mid 2006 - 2007 CALIPSO
2000 + 2006 + 2008 EUCAARI
2006 Intensive Microphysics?
2000 Dust source

Goal of hindcast experiments AeroCom & AC&C-IGAC

- How is atmospheric aerosol level changing in the recent decades?
- What is the possible effect of aerosols on the multi-decadal change of solar radiation reaching the surface (so-called global dimming/brightening)?
- What are the regional differences and changes in aerosol deposition?
- How do the emission change and meteorological variability affect the aerosol trends?
- Can the available long-term observations constrain the regional emission scenarios?
- **Fundamentally, what are the relationships between emission, atmospheric burden, AOD, deposition, and radiative forcing of aerosols at regional and global scales?**

Hindcast experiments

RUN	Purpose	Set-up	Options	Notes
HCA-0	Aerosol trends, variability, spatial distributions, relationships between emission, mass, AOD, forcing that change with time	- Time-varying anthropogenic and natural emissions with participants' choice - Using reanalyzed or nudged meteorology		Expected to be run by a few model groups early on (before October 2008)
HCA-IPCC	Same as HCA-0	- Same as HCA-0 but using IPCC emissions (available October 2008)	Using dust and sea-salt emissions as provided by selected model(s)	Expected to be run by most/all model groups
HCA-FX	Influence of weather/climate variability on transport and deposition of anthropogenic aerosols	Same as HCA-0 but using 2001 anthropogenic emissions (including biomass burning) for the entire simulation period	Same as above	Natural emissions are the same as in HCA-0 or HCA-IPCC
HCA-MET	Aerosol interaction with cloud and meteorology	GCMs with fully coupled aerosol-meteorology with prescribed SSTs		The GCMs only forced by SSTs, not nudged meteorology

Time period options

- Option 1 (satellite era):
  1980 – 2009 (30 continuous years)
- Option 2 (EOS and A-Train era):
  2000 – 2009 (10 continuous years)
- Option 3 (HTAP SR1/SR6 and CALIPSO comparison):
  2001 and 2007 only
- In addition, models choosing option 1 and 2 are encouraged to add a one-year simulation (with appropriate spin-up) for preindustrial conditions of aerosol emissions corresponding to the year 1860. This is to assess the change of aerosol loading and forcing since the preindustrial period.

Observations

Platform	Sensor/program	Time period	Quantity measured/retrieved
Satellite	AVHRR, NOAA AVHRR, GISS	1981 – present	AOD (over ocean only)
	TOMS	1979 – 2001	AOD, absorbing aerosol index
	POLDER-1, -2, PARASOL	1997 – present (?)	Fine-mode AOD, non-spherical fraction
	MODIS	2000 – present	AOD, fine-mode fraction
	MISR	2000 – present	AOD, non-spherical fraction
	OMI	2004 – present	AOD, absorbing aerosol AOD
	CALIOP	2006 – present	Vertical profiles of attenuated backscatter and extinction
Ground-based network	AERONET	1990s – present	AOD, fine-mode AOD, single scattering albedo, size distribution
	GEBA	1960s – present	Surface solar radiation
	BSRN	1992 – present	
	EARLINET	2000 – present	Aerosol profile (Lidar)
	MPLNET	2000 – present	
	ADNET	????	
	IMPROVE	1985 – present	Aerosol composition and concentration
	EMEP	1980s – present	
	Univ. Miami	1980s – 1990s	
Aircraft measurements	INDOEX	January – April 1998 and 1999	Aerosol concentrations, vertical profile, scattering, absorption, size
	ACE-Asia/TRACE-P	February – May 2001	
	ICARTT	Summer 2004	
	INTEX-B/ MILARGRO	Spring 2006	
	(N-)AMMA	Summer 2006	
	POLARCAT/ ARCTAS	Spring and Summer 2008	

Emissions

Preliminary set on AeroCom dods server
IPCC emissions 20th century awaited November

Time Frame

Autumn 08 – early Summer 09

Model groups having expressed interest

GISS, GOCART, INCA, GFDL, UIO-CTM, ECHAM (HAM+ETH), NCAR, Univ Michigan, NCAR, HADGEM?

Storage & Analysis

AeroCom server at LSCE
+ PCMDI - AC&C server ??