

**Draft plan for application of aerosol and chemistry models to the AMMA IOPs
(WP4.1.3: Modelling the interactions between aerosols/chemistry and the atmosphere)**

Peter van Velthoven and WP4.1.3 partners – 23 August 2007

The objective of the model intercomparison is to evaluate the model uncertainties for the AMMA region.

It is proposed to produce output from the chemistry and aerosol models for at least the golden days, but preferably July-August 2006 or from January 2006 if feasible.

High resolution models will likely only simulate selected golden days, global models can provide the whole of 2006.

Golden days are:

- For upper tropospheric studies are: 7, 11, 15 and 23 August 2006.
- 13 August 2006: elevated biomass burning emissions (e.g. CO) from Namibia over the Gulf of Guinea (presented by Idir Bouarar)
- For the middle and lower troposphere there are many other interesting days, depending on the specific scientific issue.
- For dust 15-30 January 2006 and 4-9 March 2006

...

If possible, provide the daily meridional cross section not only for 2006 but also for 2000 and 2003.

Emissions

- Use the best emissions you have globally/regionally for the simulated year.
 - Fossil fuel and biofuel (combustion) emissions: global emissions for 2003 provided by Cathy Liouse on the password protected webpage <http://www.aero.obs-mip.fr:8001/> Username and password have been mailed to you on 23 August 2007.
Emissions at higher resolution for Africa are also expected to be available in 1 or 2 years.
 - Global and African biomass burning emissions based on L3JRC 2003,2006 are prepared by LA.– expected end of October.
For 2000 and 2003 emissions from the same source should be used (but different years) – use what you like for the moment. If you start simulations after GBA 2003-2006 has been finished by LA use this.
Use GBA 2000 to prepare your emission preprocessing. Cathy Liouise has prepared these at 0.5x0.5 degree, monthly resolution. They are available at the above mentioned website <http://www.aero.obs-mip.fr:8001/>
Use injection heights as described in GBA2000.
 - Dust emissions might be provided by Beatrice Marticorena (LISA).
For dust emissions there is also a file with soil properties in high resolution (B. Marticorena) e.g. used by Karlsruhe. **Peter to contact Beatrice**
 - Soil NOx emissions: use Yienger and Levy, included in GEIA.
Use LA emissions in a sensitivity study by only a few models.
 - Also for isoprene the emissions from GEIA can be used.
- Additional tracers (AT and ST) to facilitate interpretation of the simulations for the AMMA period and to diagnose convective transport for comparison to AMMAMIP climate/meteorological models.
 - 5 convective transport tracers with a lifetime of 20 days.
For summer the regions are

AT1: Sahara (20-30 N), 20W-40E, over land
AT2: Sahel (10-20N), 20W-40E, over land
AT3: Guinea (0-10N), 20W-40E, over land
AT4: South Africa (40S-0N), 20W-40E, over land
AT5: South Atlantic (40S-0N), 20W-40E, over ocean

For winter another set of regions will be defined.(Remy Roca)

Set mixing ratio for all AT tracers to 100 between the surface and 850hPa.

Initialize everywhere else to zero mixing ratio.

The regions have been defined according to meteorological regime.

- One stratospheric (dry intrusion or ozone flux) tracer (ST) will be added in the global models

Output

- A **6-hourly** meridional vertical cross section (first for 2000, 2003, later 2006).
 - between 20 S and 40 N (or shorter if your model has a more limited latitudinal domain)
 - representative of (averaged over) 2W-6E (covering the aircraft flights)
 - mixing ratios for AT, ST, CO, isoprene, HCOH, O₃, NO_x (NO+NO₂), HNO₃, PAN, H₂O₂, and OH, all aerosol concentrations & optical depths

This corresponds to the “cross”-output of the AMMA MIP for dynamical models, see <http://amma-mip.lmd.jussieu.fr/>

This can be provided on pressure or model levels. In case of model levels please also provide the pressure variable.

- A monthly mean 6-hourly horizontal map at the surface/lowest model level
For 2006 6 hourly output surface maps (not monthly averaged).

Store in netcdf file and provide to AMMAMIP (LMD). **KNMI to provide test files.**

Additional output for 2006:

- Chemical constituents at the locations of the aircraft (time resolution: every whole minute) for point-to-point comparisons.
Files with aircraft location (longitude (degr E), latitude (degr N), pressure (hPa) and time (hours & minutes UT) are already available for the DLR Falcon and the French ATR and Falcon aircraft and the British BAE aircraft at http://www.knmi.nl/samenw/campaign_support/AMMA/TRACKDATA/index.html
Geophysiciae location data are still missing-will be provided by Idir. It is planned that these files are complemented with T (K), U-wind (m/s), V-wind (m/s), water vapour mixing ratio (ppmv) or RH (%), so that the representativity of the model simulated meteorological fields can be assessed.
Requested model output at these points: date+UT (minutes), T(K), U, V, RH, H₂O, O₃, NO₂, NO, HNO₃, OH, CO, AT, ST, isoprene, ...
Add the output as extra columns to the aircraft location files.
- Daily tropospheric columns 2D-field of NO₂, and HCHO at the local overpass time of Sciamachy (10h00 LT) and OMI (13h30 LT) – output netcdf
- Monthly mean tropospheric columns 2D-field of O₃ to compare to OMI-MLS product
Peter to inquire about product.
- AT and CO output fields at 700, 850, 500, 350 hPa (**at 10h30 LT?**) for comparison with MOPITT- output netcdf
- Daily aerosol optical depth to compare to MODIS and the AQUA train – output netcdf

- Ozone, CO, AT and ST profiles at Windhoek (about 17.5 E, 22.5 S – **to be precised**) for comparison to MOZAIC Air Namibia flights (twice daily). Please also include pressure (hPa) in the output. **Hours to be defined (Brice)**. Put all profiles for a month in 1 file (ascii or netcdf).
- Ozone, AT and ST profiles at Cotonou (6.21 N, 2.23 E), Nairobi (**location**) and Malindi (**location**). Please also include pressure (hPa) in the output. **A date list to be provided by Peter.**
- Mixing ratio and wet deposition output at 8 IDAF sites:
 Banizoumbou (13.54N,2.66E in Niger), Hombori (15.2 N, 1.3 W in Mali), Lamto (6N, 5 W in Ivory Coast), Djougou (9.66 N, 1.91E in Benin), Zoétélé (3.16N,11.96E in Cameroon), Louis Trachardt (South Africa), Amersfoort (South Africa), Cape Point (South Africa) – **coordinates to be completed (Fabien)**.
 Output: monthly mean :
 Volume mixing ratios
 - 2000-2006 : SO₂, NO₂, HNO₃, NH₃, O₃
 - 2006: OC, BC
 Wet deposition (kg/m²/year or microgram/liter):
 - **List to be completed (Fabien)**
- Aerosol optical depth at 12h UT at AERONET sites Agoufou (15.34N, 1.48W) in Mali, Capo Verde (16.73N, 22.93W), Banizoumbou (13.54N,2.66E) in Niger, Dahkla (23.71N,15.95W) in Morocco, Dakar (14.39N,16.96W) in Senegal, Djougou (9.66 N, 1.91E) in Benin, IER-Cinzana (13.28N,5.93W) in Mali, Illorin (8.32N, 4.34E) in Nigeria, and Ouagadougou (12.20N, 1.40W) in Burkina Faso.
 For 2006 Lamto has to be added (location)
 Central Africa station?
 For 2000/2003 a reduction of the number of sites is possible.
- 2006: aerosol extinction and SSA profiles at 12h? at the lidar location at Banizoumbou (13.54N,2.66E) and Djougou (...). (**Cathy informs about Djougou & Peter will ask Beatrice about lidar transect**)
Investigate what optical properties are used to make this calculation in the models.
- 3-hourly chemical boundary conditions for regional models from 1 global model (ORISAM-TM4 – Bruno Guillaume) for selected periods in 2006.

Output for 2000 to be provided end of October 2007, for 2003/2006 in January 2008. Peter will try to set up an ftp-server for additional output.

The preferred output format is netcdf. Time series and profile data may also be provided in ascii. Please stick to CF convention as much as possible. See examples at http://wiki.esipfed.org/index.php/CF_Standard_Names_-_Accepted_names_for_TF_HTAP

KNMI (Peter van Velthoven) and Un. Reading (John Methven) will provide backward trajectories from the aircraft locations based on ECMWF, possibly including convective cloud encounters derived from MSG. See http://www.knmi.nl/samenw/campaign_support/AMMA/TRAJ/index.html

Involved European models and contacts

Model	Domain	Type	Contacts	Mail
TM4/5	global	Chemistry	Peter van Velthoven, Jason Williams, KNMI	velthove@knmi.nl williams@knmi.nl
Meso-NH	Regional	Chemistry Aerosols	Céline Mari, Claire Delon, Marielle Saunois, Veronique Pont, LA Pierre Tulet, CNRM	marc@aero.obs-mip.fr delc@aero.obs-mip.fr saum@aero.ob-mip.fr ponv@aero.ob-msip.fr Pierre.Tulet@meteo.fr
RegCM	Regional	Chemistry , aerosols	Cathy Liousse, Fabien Solmon, LA	Catherine.Liousse@aero.obs-mip.fr soif@aero.obs-mip.fr
TM4-ORISAM	Global	Aerosol	Cathy Liousse, Bruno Guillaume, LA	Catherine.Liousse@aero.obs-mip.fr guib@aero.obs-mip.fr
Mocage	Global	Chemistry	Jean-Luc Attié, Brice Barret, LA Béatrice Josse, CNRM	attjl@aero.obs-mip.fr Beatrice.Josse@meteo.fr barp@aero.obsip.fr
LM-ART	Regional	Chemistry Aerosols	Bernhard Vogel, Karlsruhe	Bernhard.vogel@imk.fzk.de
BOLAM	Regional	Chemistry ?	Federico Fierli ?, CNR ISAC	f.fierli@isac.cnr.it
LMDZ-INCA		Chemistry , aerosols	Kathy Law, Idir Bouarar, Mai Pham IPSL	kathy.law@aero.jussieu.fr mai.pham@aero.jussieu.fr idir.bouarar@aero.jussieu.fr
Chimere	Regional	Aerosols, chemistry	Schmechtig?, Marticorena?, LISA	schmechtig@lisa.univ-paris12.fr marticorena@lisa.univ-paris12.fr
pTOMCAT	Global	Chemistry	Xin Yang, Un.Cambridge	Xin.Yang@atm.ch.cam.ac.uk
			Clermont-Ferrand?	
Contact AMMA-MIP			Frederic Hourdin	Frederic.Hourdin@lmd.jussieu.fr

Subjects for joint analysis

Gas phase chemistry

- Lightning NO_x (Brice/Celine, Peter, Idir, Xin)
- Impact of soil NO_x emissions (Marielle, Idir, Xin, Peter)
- Biomass burning (NO_x, CO) (LA, KNMI, UCAM)

Gives us a very picture of the NO_x budget

- Isoprene and associated ozone formation (UCAM, KNMI, SA, LA)

Aerosols + gases

- Wet deposition. together with IDAF (aerosols + gases) – most groups
Note: already work done by Dentener for 2000.
- Heterogeneous chemistry (chemistry with/without) – IPSL (Mai Pham, Michael Schulz?), LA – EDI, Un. Karlsruhe
- Photolysis rate + optical depth changes due to aerosols (LA, Karlsruhe, IPSL, LISA, CNRM)

Aerosols

- Dust: LISA (Chimere), Karlsruhe, IPSL, CNRM, LA
Perhaps also study scavenging by dust?
Focus: march 2006 dust storm
- Mixed aerosol incl. Biomass burning aerosols, SOP0 episode analysis 19-21 January (Karlsruhe, LA + any other models)

Aerosol-climate coupling?

Is done by Un. Karlsruhe – otherwise left to other WPs

Tracer experiments - analysis

KNMI+all groups