Activity 3 Large scale chemistry modeling
Status of work packages and deliverables after 18 months

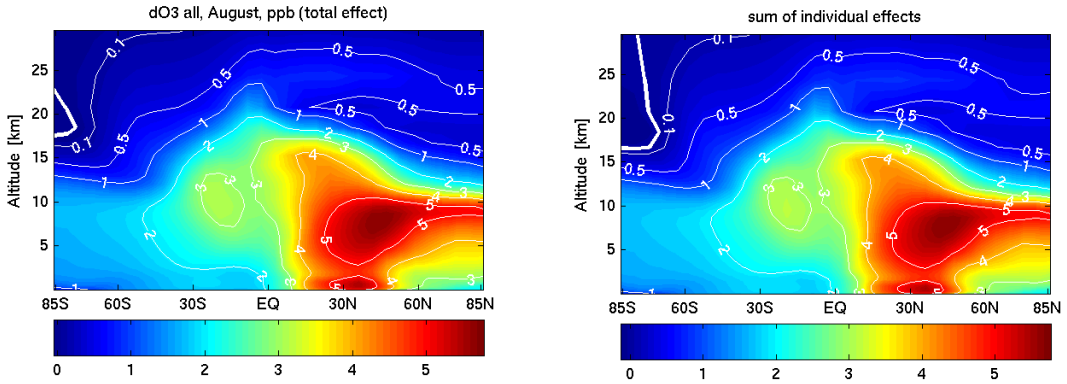
Most groups have now finished the simulations for the evaluation of current impact (WP3.1.2) and for the evaluation of the models (WP3.1.1). These had been delayed due to late provision of first order emission data by Activity 1.

WP3.1.2 Current impact

The models have performed 5 simulations over 2003:

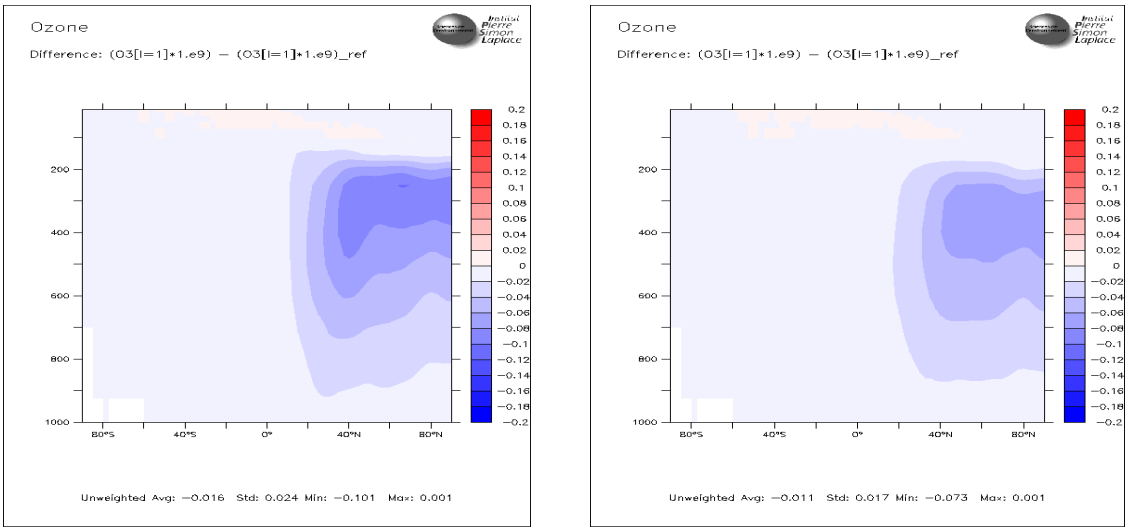
I. All sources
II. 5 % less aircraft emissions (AERO2K)
III. 5 % less shipping emissions (Endresen)
IV. 5 % less road traffic emissions (EDGAR/FT2000)
V. 5 % less aircraft, shipping and road traffic emissions

A 5 % perturbation was chosen because the chemical impact is non-linear for large perturbations, in particular if road traffic would be totally switched off. Multiplying the calculated impacts by 20 will give an estimate of the current impact of the transport sectors given the current background atmospheric composition. The figure below shows that with this method the sum of the impacts of the 3 transport sectors on ozone (runs II+III+IV, right panel) closely approximates the total impact of the transport sector on ozone (run V, left panel). i.e. the responses are additive and linear.



A file database and server for gridded model output have been set up at the Un. of Oslo (http://norgrid.uio.no/mySRB). The gridded output files from the E39C (DLR-IPA), LMDZ-INCA (CNRS/CEA), TM4 (KNMI), CTM2 (Un. Oslo), and p-TOMCAT (Un. Cambridge) models for 2003 are already in the database. These correspond to deliverables D3.1.2.2, D3.1.2.3, D3.1.2.4, D3.1.2.6, and D3.1.2.8, respectively. Output from MPI-CHEM's ECHAM5-Messy model (D3.1.2.5) will soon be added. The simulations have not yet been performed by the US partner UCI (D3.1.2.7).
The report with the first-order estimate of the current impact of the different transport sectors (D3.1.2.9, due month 18) is currently being drafted.

The impact of aviation is quite sensitive to the parameterization of convective transport in the models. The figure below shows the ozone perturbations due to aviation emissions calculated with LMDZ-INCA model with the Tiedtke (left panel) and Emanuel (right panel) convection schemes.



The ozone perturbation (and therefore the radiative forcing) is significantly larger at tropopause altitudes for the Tiedtke scheme.

WP3.1.1 Model evaluation against observations

Monthly files giving the geographic location and time of observations from various campaigns have been prepared by ETHZ. Observations in the database coinciding with the model simulated period these include ozonesondes (1966-2005), surface data from WDCGG (1972-2004), MOZAIC cruise data and profiles (1994-2003) , and the SPURT (2001-2003), CONTRACE (2003) and QUANTIFY (23 July 2004; 3,22,28 April 2006) campaigns. The diagnostic model output for the model evaluation has been provided by DLR-IPA, KNMI, MPI-CHEM and Un. Oslo. Corresponding deliverables are D3.1.1.3, D3.1.1.5, D3.1.1.6 and D3.1.1.8. Output diagnostics from CNRS (D3.1.1.4) and Un. Cambridge (D3.1.1.7) are still in preparation. The comparison of the model output to the observations has now started.

WP3.2.1 Removal by precipitation

During month 12-18 simulations of the contribution of the different transport sectors to acidification/nitrification have been performed by KNMI. The table below gives an overview of the contributions to global nitrogen deposition ($\mu g m^{-2} yr^{-1}$):

	Dry deposition	Wet deposition	Total deposition
Aviation	0.02	0.09	0.11
Shipping	0.45	1.6	2.05
Road transport	0.85	3.5	4.35
All transport	1.3	5.2	6.5
All sources	4.2	15	19.2

It shows that transport activities are responsible for about one third of the total deposition of nitrogen. The contribution of aviation is relatively small. Geographically the east coasts of the US and China, and the west coast of Europe suffer most from nitrogen deposition.
These simulations still have to be performed by Un. Cambridge and CNRS.