Geophysical Research Abstracts,
Vol. 11, EGU2009-9501, 2009
EGU General Assembly 2009

Long-range transport and its impact on trace gas variability at selected GAW stations

S. Henne, D. Brunner, J. Klausen, and B. Buchmann

Empa, Materials Science and Technology, Air Pollution/Environmental Technology, Dübendorf, Switzerland
(stephan.henne@empa.ch)

To improve our understanding of the impact and the time-scales of atmospheric pollution transport and to understand the mixing ratios of non- or weakly reactive gases observed within monitoring programmes such as the Global Atmosphere Watch (GAW) programme global scale atmospheric transport models provide valuable and requisite information. Atmospheric transport described in a Lagrangian framework, contrary to the Eulerian approach, does not suffer from numerical diffusion. In addition, information on transport times of newly released emissions is easily accessible in the Lagragian concept. Therefore, Lagrangian models are the ideal tool to answer the questions raised above.

To this end the Lagrangian particle dispersion model FLEXPART (Version 8.0) was extended and set up on the global domain with 3 million particles that are permanently transported based on ECMWF wind fields. All particles carry 9 different counters that indicate times since certain atmospheric regions were left: 1 counter for each of the 6 WMO regions keeping track of atmospheric boundary layer contact, 2 counters for inter-hemispheric transport, and 1 counter for stratosphere-troposphere exchange. Thirteen different species are represented with each particle: 1 atmospheric air tracer, 6 carbon monoxide (CO) and 6 methane (CH_4) tracers according to emissions from the 6 WMO regions. Gridded emissions are taken up by particles passing through the atmospheric boundary layer of each grid cell and are based on constant EDGAR3.2FT2000 (anthropogenic) and 8-daily GFED (v2) (biomass-burning) emission inventories. Degradation of CO and CH_4 (and also CO production from CH_4 degradation) is considered by temperature and pressure dependent reaction with hydroxyl radicals (OH). Monthly OH fields are taken from HTAP.

Global monthly mean fields for each species, each clock and 11 age-classes are produced by the model and offer detailed insight into the time-scales of transport and the contributions from different source regions. Furthermore, receptor concentrations (daily temporal resolution) are produced for selected GAW sites and allow for model intercomparison and interpretation of observations. In this contribution we present details on the model concept and first results obtained for an iterative spin-up run for the year 2001.