Model set-up specification for comparisons of aerosol lifetimes

We encourage modellers to perform simulations of the release of aerosol-bound radionuclides emitted from the Fukushima Dai-Ichi nuclear accident in 2011. These radionuclides were transported and measured on a global scale for more than 3 months after their release. This provides a unique opportunity to estimate the lifetime of the aerosols which the radionuclides attach to (mainly sulphate).

The aerosol lifetime can be estimated directly from the station measurements of the radionuclides xenon and cesium as given in the ACPD paper by Kristiansen et al. (2012). Xenon is a noble gas which serves as a passive tracer of the atmospheric transport, while cesium attaches mainly to accumulation-mode aerosols and traces their fate during transport.

There is now a need to compare the observation-based aerosol lifetime to the lifetimes obtained by models. We therefore kindly ask you to contribute to a comparison study of modelled and observed aerosol lifetimes with the model specifications listed below and with other required material found at the information site: *http://zardoz.nilu.no/~nina/aerosol/*

Input:

Emissions:

Use the emission-estimates for xenon and cesium from the Fukushima Dai-Ichi nuclear power plant (141.03°E, 37.42°N) available as a supplement to the ACP paper by Stohl et al. (2012) and also found at the information site.

The format of the emission-files is briefly explained at the top of the text files. An example Fortran program (*totals.f*) reading the cesium data and calculating the total emission for comparison with Stohl et al. (2012) can be found at the information site.

Species:

For the model simulations we suggest to use

- ***a passive tracer*** using the xenon emission estimate.
- **a *sulphate accumulation-mode aerosol* tracer** using the cesium emissions (using the default setting of your model for parameters such as size distribution, solubility, or aerosol density)

Simulation period:

The model needs to be run from the start of the emissions (11 March 2011) until at least **5 June 2011** for when the last measurements of the radionuclides were taken.

Output:

Time resolution:

Ideally one hourly-output resolution is preferred but three-hourly output may also be suitable to compare with the 12- and 24-hourly (with variable starting/ending times) measurement data.

Products:

1) Station-concentrations

Sample the modelled aerosol and passive tracer concentrations at the lowest model level at the geographical coordinates of the measurement stations and for the sample times listed in the file *stations_sampletimes.txt*, found at the information site. The format of this file follows: "Sample time [yyyymmddHHMM], longitude, latitude, station name".

The output files should ideally be given in a plain text file named *modelname_sampled_at_stations.txt* with the following format:
"Sample time [yyyymmddHHMM], longitude, latitude, station name, passive tracer concentration [µg/m^3], sulphate concentration [µg/m^3]"

2) Global budgets

Calculate the total mass of each tracer as budgeted in your model every six hours and produce the output in the format: "Time [yyyymmddHHMM], total mass of passive tracer [µg], total mass of sulphate [µg]". These data should be put into a file named *modelname_global_mass.txt*

Please send the output to
Andreas Stohl (ast@nilu.no) and Nina Iren Kristiansen (nik@nilu.no)

REFERENCES

Stohl, A., P. Seibert, G. Wotawa, D. Arnold, J. F. Burkhart, S. Eckhardt, C. Tapia, A. Vargas, and T. J. Yasunari, *Xenon-133 and caesium-137 releases into the atmosphere from the Fukushima Dai-ichi nuclear power plant: determination of the source term, atmospheric dispersion, and deposition*, Atmos. Chem. Phys., 12, 2313-2343, doi:10.5194/acp-12-2313-2012, 2012, *http://www.atmos-chem-phys.net/12/2313/2012/acp-12-2313-2012.html*

Kristiansen, N. I., A. Stohl, and G. Wotawa, *Atmospheric removal times of the aerosol-bound radionuclides ^{137}Cs and ^{131}I during the months after the Fukushima Dai-ichi nuclear power plant accident – a constraint for air quality and climate models*, Atmos. Chem. Phys. Discuss., 12, 12331-12356, doi:10.5194/acpd-12-12331-2012, 2012.
http://www.atmos-chem-phys-discuss.net/12/12331/2012/acpd-12-12331-2012.html