Comparison of observed and modelled aerosol lifetimes:
Model set-up specification

We would like to encourage modellers to perform simulations for the release of aerosol-bound radionuclides emitted from the Fukushima Dai-Ichi nuclear accident in 2011. Some of the radionuclides released during the accident attached to ambient accumulation mode (AM) aerosols and traced their fate in the atmosphere. The radionuclides were transported and measured on a global scale for more than 3 months after their release.

The global radionuclide measurements provided a unique opportunity to estimate the lifetime of AM aerosols in the atmosphere, as presented by Kristiansen et al. (2012). Measurements of the radionuclides Xenon and Cesium were used. Xenon is a noble gas which served as a passive tracer of the atmospheric transport, while Cesium attached to the ambient AM aerosols (mainly sulphate). Kristiansen et al. (2012) estimated an AM aerosol lifetime of *10-14 days* which is longer than the mean lifetimes of AM aerosols obtained from most aerosol models (typically in the range of 3–7 days). This could be due to the fact that the measurements were all ground-based and the data not fully representative of the global-mean aerosol lifetime. The proposed study will try to resolve this issue and investigate to what extent the aerosol models can reproduce the observations, especially with respect to the observed loss of aerosol mass with time.

There is a need to compare the observation-based aerosol lifetimes to the lifetimes obtained by models. We therefore kindly ask you to contribute to a comparison study of modelled and observed aerosol lifetimes. The study should serve as a new and unique evaluation of the aerosol models. The model specifications are listed below and other required material can be found at the information site: *http://zardoz.nilu.no/~nina/aerosol/*

We would offer co-authorship for up to two people per model contributing to this study, on any publication that may come out of this exercise.

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:

The measurement data are 12- or 24-hourly average values but the sampling periods vary from station to station. We would therefore suggest using *one-hourly* or *three-hourly* time resolution for the model output. This way we would be able to sample the model output within the varying sampling periods for each measurement station.

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: "Start of sample time [yyyymmddHHMM], End of sample time [yyyymmddHHMM], longitude, latitude, station name".

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

2) Global budgets

To allow determining the global-mean aerosol lifetime, 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_version_global_mass.txt*

Please send the output to
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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 measured after the Fukushima Dai-ichi nuclear accident – a constraint for air quality and climate models*, Atmos. Chem. Phys., 12, 10759-10769, doi:10.5194/acp-12-10759-2012, 2012.
http://www.atmos-chem-phys.net/12/10759/2012/acp-12-10759-2012.html