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Mercury Modelling: Progress and Problems.

Gerhard Petersen
GKSS Research Center
Institute for Coastal Research/System Analysis and Modelling
Max-Planck-Strasse
D-21502 Geesthacht
Germany

ABSTRACT

A variety of modelling techniques have been developed for exploration of atmospheric mercury processes. These include relative simple mass balance models that examine the pooling and exchange of mercury species between various environmental compartments as well as complex deterministic atmospheric dispersion models attempting to simulate the transport and transformation of mercury over domains of hundreds to thousands of kilometers.

The recently signed UN-ECE protocol on reducing the atmospheric transboundary transport of mercury in Europe have intensified the scientific interest in relating the spatial and temporal information on the release of mercury into the atmosphere to the pattern of atmospheric deposition fluxes to various ecosystems by means of long-range transport modelling on regional European scales. In this context, efforts have been made to simulate the atmospheric transport and fate of mercury and to derive estimates of ambient concentrations and dry and wet deposition fluxes of mercury over Europe through either relative simple Lagrangian formulations or Eulerian approaches employing extensive gas- and aqueous phase chemical mechanisms and explicitly tracking numerous species concentrations.

Overall, the development level of mercury models is such, that they can be considered as an essential step towards decisive assessments of the sources or source types most responsible for mercury contamination in Europe through the atmospheric pathway. Although the model incorporates significant progress in the understanding of mercury atmospheric processes our knowledge is far from complete. Models have to be developed further as additional information on emission speciation, atmospheric chemistry, air-soil exchange and vertical profiles of time dependent boundary conditions becomes available. Similarly, very little is known about other issues such as the role of methyl mercury compounds on observed deposition pattern. As research on these issues matures and more data exist, an explicit treatment of methyl mercury processes in European scale models is one of the most important next logical steps.