Geophysical Research Abstracts
Vol. 13, EGU2011-11404, 2011
EGU General Assembly 2011

Model evaluation of two decades of atmospheric concentrations of persistent organic pollutants

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Persistent Organic Pollutants (POPs), such as Polychlorinated Biphenyls (PCBs) and Hexachlorocyclohexanes (HCHs), are persistent, bio-accumulating chemical compounds that are prone to long-range atmospheric transport and have harmful effects on the environment. POPs are subject to international regulations, e.g. under the Stockholm Convention on POPs and they have therefore been monitored in the atmosphere at several sites around the world for almost two decades. In addition to monitoring of concentrations in air and other environmental media, modelling can be a helpful tool in understanding the environmental fate of POPs.

We have applied the Danish Eulerian Hemispheric Model (DEHM) to study the atmospheric transport and environmental fate of POPs. DEHM is a 3-D atmospheric chemistry-transport model developed over the last 20 years for studying the long-range transport of SO2, SO4, and Pb to the Arctic. The model covers the Northern Hemisphere and all important source regions for the Arctic are included in the model domain. This model has been developed further to include four chemical groups: a group related to ozone chemistry, a group related to primary particulates, a group with mercury species/chemistry, and a group with Persistent Organic Pollutants (POPs). The model has a spatially detailed 3-D atmosphere up to 15 km over the surface. In addition, it has four surface compartments: a 75 m thick ocean layer, a 15 cm thick soil layer, and dynamically evolving vegetation and seasonal snowpack compartments.

We have performed a simulation of the atmospheric transport and environmental fate of selected PCBs and HCHs covering the period 1989 – 2008. The predicted atmospheric concentrations are compared to available monitoring data from stations within the EMEP, the IADN and the NCP networks. Examples of the evaluation will be shown with the focus on differences in the performance of the model in different regions: Europe, North America and the Arctic.