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GEM/POPs: a global 3-D dynamic model for semi-volatile persistent organic pollutants – Part 1: Model description and evaluations of air concentrations

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Abstract. GEM/POPs was developed to simulate the transport, deposition and partitioning of semi-volatile persistent organic pollutants (POPs) in the atmosphere within the framework of Canadian weather forecasting model GEM. In addition to the general processes such as anthropogenic emissions, atmosphere/water and atmosphere/soil exchanges, GEM/POPs incorporates a dynamic aerosol module to provide the aerosol surface areas for the semi-volatile POPs to partition between gaseous and particle phases and a mechanism for particle-bound POPs to be removed. Simulation results of three PCBs (28, 153 and 180) for the year 2000 indicate that the model captured the main features of global atmospheric PCBs when compared with observations from EMEP, IADN and Alert stations. The annual averaged concentrations and the fractionation of the three PCBs as a function of latitudes agreed reasonably well with observations. The impacts of atmospheric aerosols on the transports and partitioning of the three PCBs are reasonably simulated. The ratio of particulate to gaseous PCBs in the atmospheric column ranges from less than 0.1 for PCB28 to as high as 100 for PCB180, increasing from the warm lower latitudes to the cold high latitudes. Application of GEM/POPs in a study of the global transports and budgets of various PCBs accompanies this paper.

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