Atmospheric Chemistry and Physics
An Interactive Open Access Journal of the European Geosciences Union

Atmos. Chem. Phys., 7, 4015-4025, 2007
www.atmos-chem-phys.net/7/4015/2007/

GEM/POPs: a global 3-D dynamic model for semi-volatile persistent organic pollutants – Part 2: Global transports and budgets of PCBs

P. Huang[1], S. L. Gong[1,2], T. L. Zhao[2], L. Neary[3], and L. A. Barrie[4]
[1]Air Quality Research Division, Science & Technology Branch, Environment Canada, 4905 Dufferin Street, Toronto, Ontario M3H 5T4, Canada
[2]Dept. of Chemical Engineering and Applied Chemistry, University of Toronto, 200 College Street, Toronto, Ontario, Canada, M5S 3E5, Canada
[3]Dept. of Earth and Space Science and Engineering, York University, 4700 Keele Street, Toronto, Ontario, M3J 1P3, Canada
[4]Atmospheric Research and Environment Program, World Meteorological Organization, 7 bis, avenue de la Paix, BP2300, 1211 Geneva 2, Switzerland

Abstract. Global transports and budgets of three PCBs were investigated with a 3-D dynamic model for semi-volatile persistent organic pollutants – GEM/POPs. Dominant pathways were identified for PCB transports in the atmosphere with a transport flux peaking below 8 km for gaseous and 14 km for particulate PCB28, and peaking below 4 km for gaseous and 6 km for particulate PCB180. The inter-continental transports of PCBs in the Northern Hemisphere (NH) are dominated in the zonal direction with their route changes regulated seasonally by the variation of westerly jet. The transport pathways from Europe and North Atlantic contributed the most PCBs to the Arctic. Inter-hemispheric transports of PCBs originated from the regions of Europe, Asia and North America in three different flow-paths, accompanying with easterly jet, Asian monsoon winds and trade winds. PCBs from the Southern Hemisphere (SH) could also be exported into the NH. According to the PCB emissions of year 2000, Europe, North America and Asia are the three largest sources of the three PCBs, contributing to the global background concentrations in the atmosphere, soil and water. Globally, PCB28 in soil and water has become a comparable source to the anthropogenic emissions while heavier PCBs such as PCB153 and 180 are still transporting into soil and water. For all three congeners, particulate PCBs are concentrated in the higher levels than gaseous PCBs. More than half of the particulate PCB28 could reach up to the stratosphere, while most of the heavier counter-parts (PCB153 and PCB180) are stored in the troposphere including boundary layer with more than 99% gaseous PCB180 below 6 km.

Final Revised Paper (PDF, 2343 KB) Discussion Paper (ACPD)

Citation: Huang, P., Gong, S. L., Zhao, T. L., Neary, L., and Barrie, L. A.: GEM/POPs: a global 3-D dynamic model for semi-volatile persistent organic pollutants – Part 2: Global transports and budgets of PCBs, Atmos. Chem. Phys., 7, 4015-4025, 2007. Bibtex EndNote Reference Manager