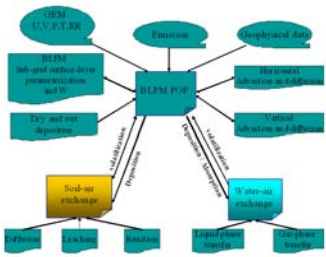


INVESTIGATION INTO ATMOSPHERIC CONCENTRATION AND DEPOSITION OF PCBs TO THE LAKE ONTARIO DUE TO SOURCES FROM GREATER TORONTO

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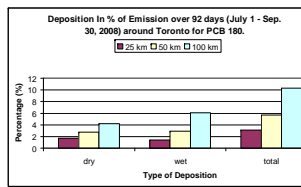
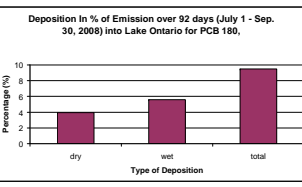
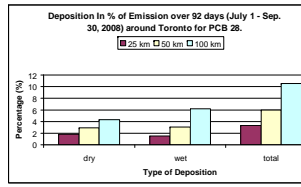
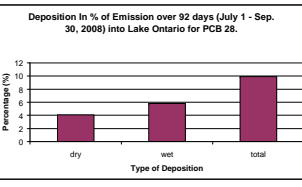
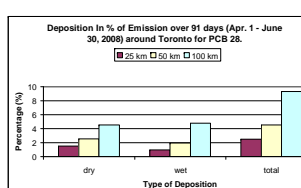
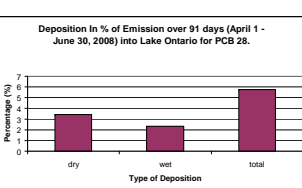
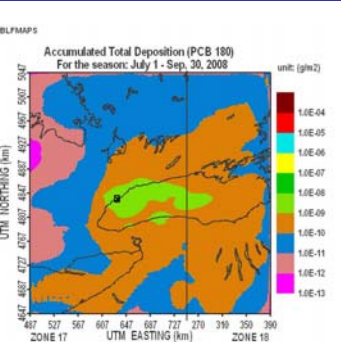
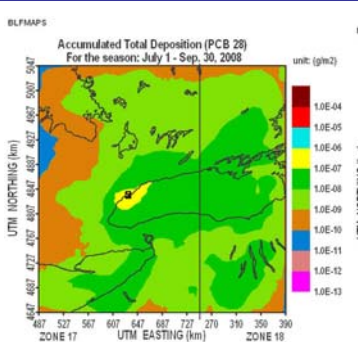
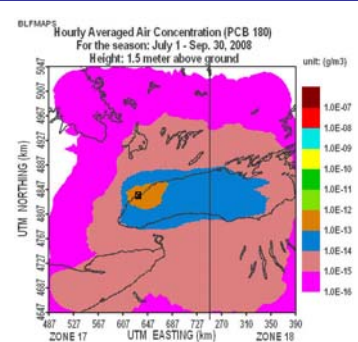
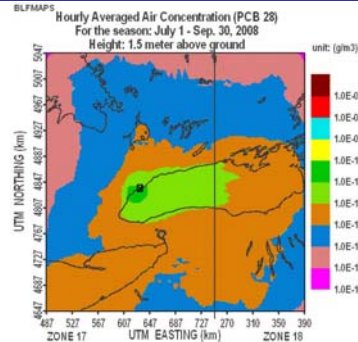
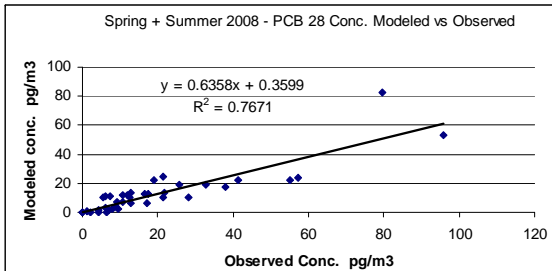
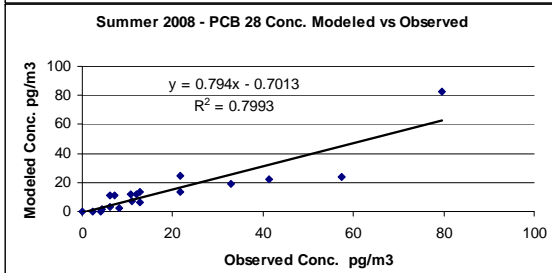
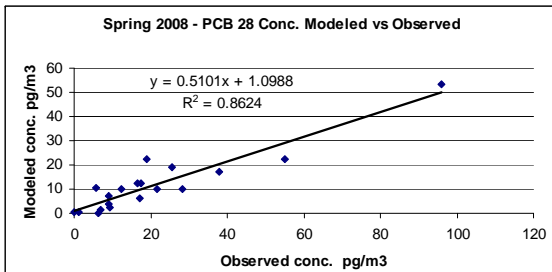
¹ University of Toronto, Toronto.



OBJECTIVE: To investigate the loading of PCBs via atmospheric pathway to Lake Ontario from emissions of sources within Metropolitan Greater Toronto area in Ontario, Canada.

METHOD: Emissions for PCBs were calculated using a model (Diamond et al 2010, Robson et al 2010) that accounted for PCBs in-use, in-storage as well as building sealants in the Greater Toronto region. An integrated measurements field experiment was conducted over the GTA (Greater Toronto Region) during October 2007 to October 2008. A coupled multimedia 3-D numerical mesoscale Boundary Layer Forecast Model for POPs (BLFMPOP) is developed. It is a mesoscale version of CanMETOP (Canadian Model for Environmental Transport of Organochlorine pesticides- Ma et al., 2006). It is used to simulate meteorology and transport, dispersion, deposition of PCBs. Air concentration, wet and dry deposition, and air-water exchange are simulated for April to September 2008. The above flow diagram outlines the Mesoscale Boundary Layer Forecast and Persistent Organic Pollutants - Air Pollution prediction System (BLFMPOP).

RESULTS:



CONCLUSIONS:

PCB 28 is found to be the dominant contributor to the Lake Ontario compared to PCB180 mainly due to higher emission strength.

Summer seasonal concentration and deposition are more than that of spring. It attests to the enhanced re-volatilization during summer.

The model simulated PCB 28 air concentrations agree very well with the monitored concentration values over GTA with R² of about 0.8. However the model is found to underestimate the monitored site values.

During 2008 spring (6%) and summer (10%) of PCB emissions are deposited to the Lake Ontario through the atmospheric pathway, specifically for PCB 28 ~500g in spring and 860g in summer. For PCB180 ~10g in spring and 16g in summer deposited to the lake.

Broadly speaking 90% of PCB emissions are transported away from GTA i.e., beyond a circular area with 100km radius.

References: Diamond et al 2010. Environ. Sci. Technol. 44 ,2777-2783. Ma, et al 2003 Environ. Sci. Technol.37,3774-3781.

Robson et al., 2010. Environ Internat 36, 506-513.

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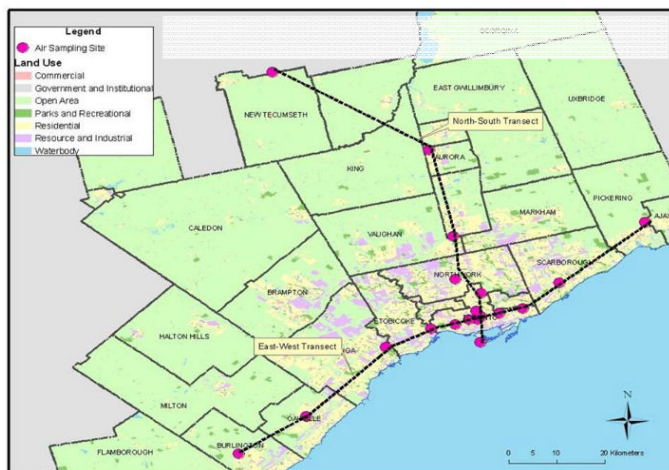
Abstract:

Polychlorinated biphenyls (PCBs) are classified as persistent organic pollutants (POPs) and are part of the toxic substances under the treaty of Stockholm Convention. PCBs persist in the environment for long periods of time, which allow them to be transported long distance from source regions, are toxic and have tendency to bio-accumulate in food chain. It is our intent to investigate the impact of elevated concentration often found in air and precipitation of PCBs in Greater Toronto area (GTA), the largest urban area on Lake Ontario.

An integrated measurements and modeling experiment was conducted during 2007-08 over the GTA and adjoining lake and water areas. Inventory of PCBs in-use and in-storage and locations were compiled. Similarly survey, mapping and sampling of PCBs in building sealants were done. Some emission estimates for select PCB congeners (28, 52,101,153 and 180) were developed for the study area of Greater Toronto.

A coupled multimedia numerical mesoscale Boundary layer forecast model for POPs (BLFM-POP) is developed for the study of transport, dispersion and deposition of POPs through soil, water and atmospheric mediums. Loadings of PCBs to Lake Ontario were numerically simulated with the use of estimated emissions data set.

Comparison of modeled air concentrations with the field measured values showed good agreement, but the model is slightly under-predicting. In conclusion those about 90% of PCB emissions are transported away from the GTA, beyond a circular area with 100 km radius.



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