

CanMETOP modeling of Hexachlorobenzene- a progress in 2007

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Environment Canada
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Last Chicago BTS meeting

What do we do next?

- More reliable emission data, accounting for historical agricultural application of HCB accumulated in North America soils
- Run CanMETOP with high spatial resolution (24km x 24km) using new emission inventory
- Run and integrate CanMETOP with low resolution (35km x 35km) using historical emission inventory from the 1970s through 2000s
- Tracking North America sources of HCB over the GL



Global amount of HCB in soils in 2000

ton Half-life (yr)

1170 2.7

5410 5.7

17000 11.7

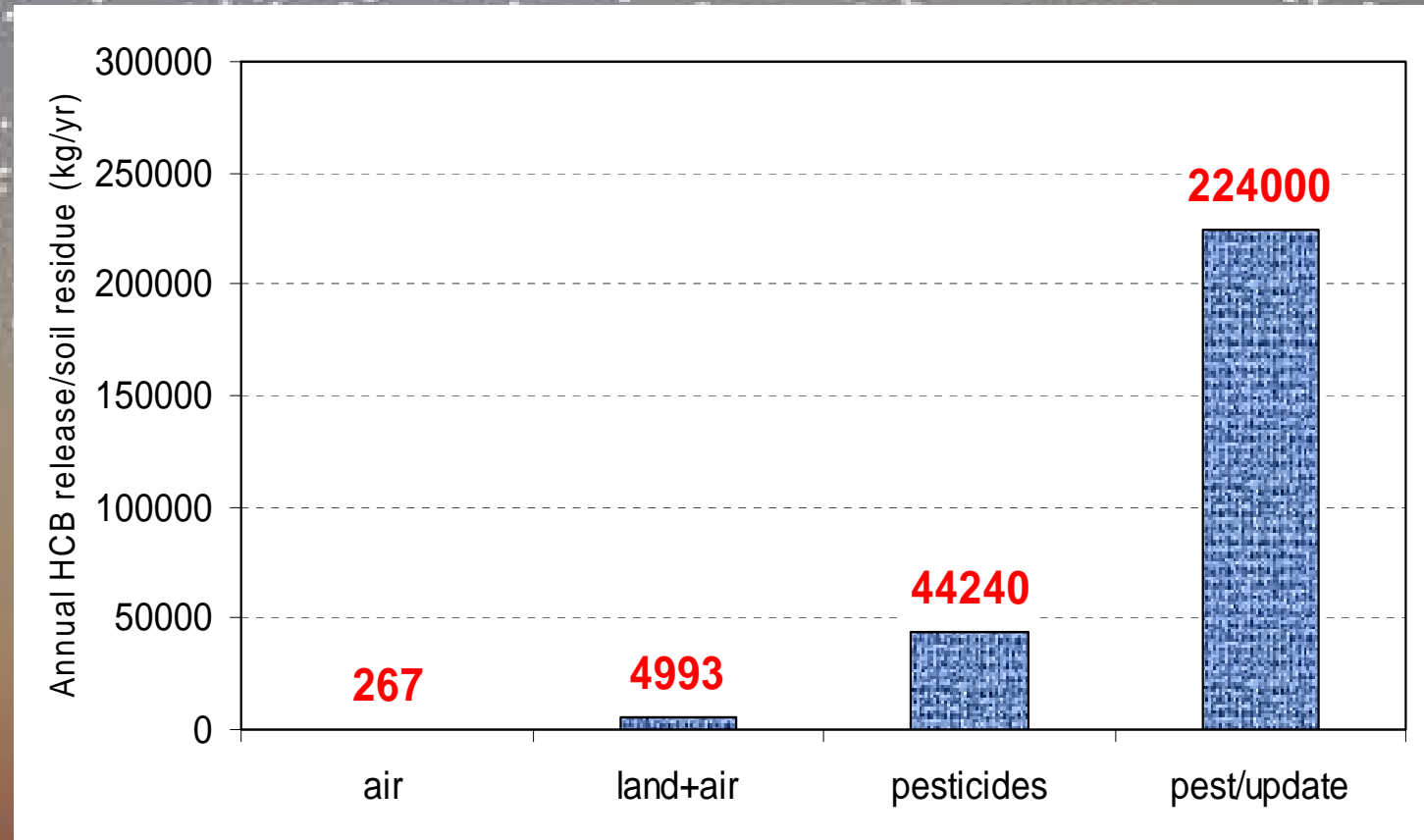
-Jonathan et al, 2005

Canada and US in 2000

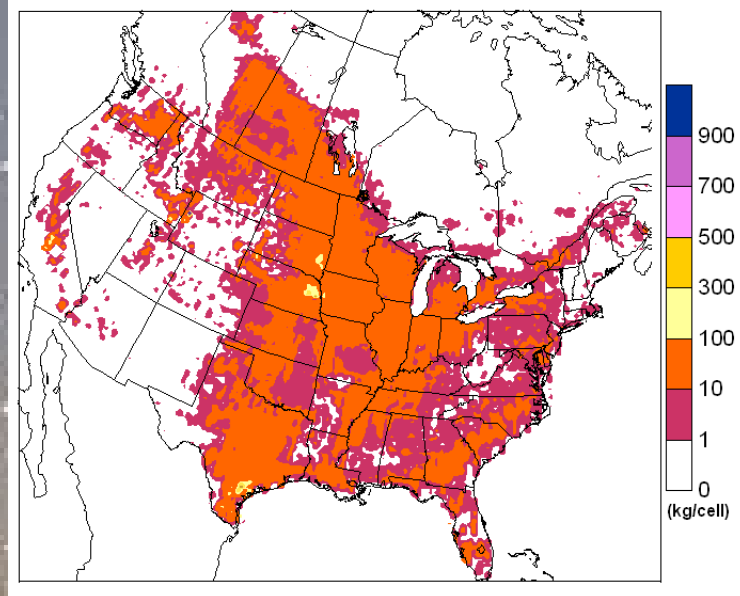
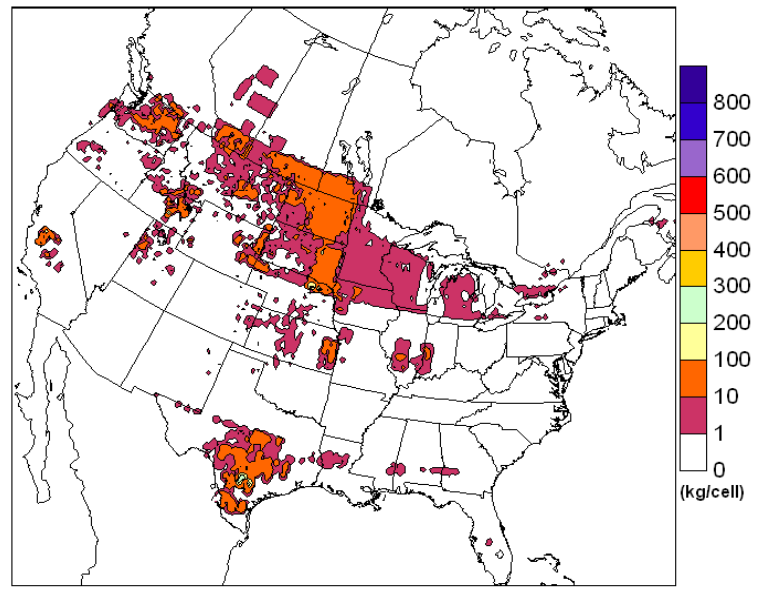
241 ton

Task 1

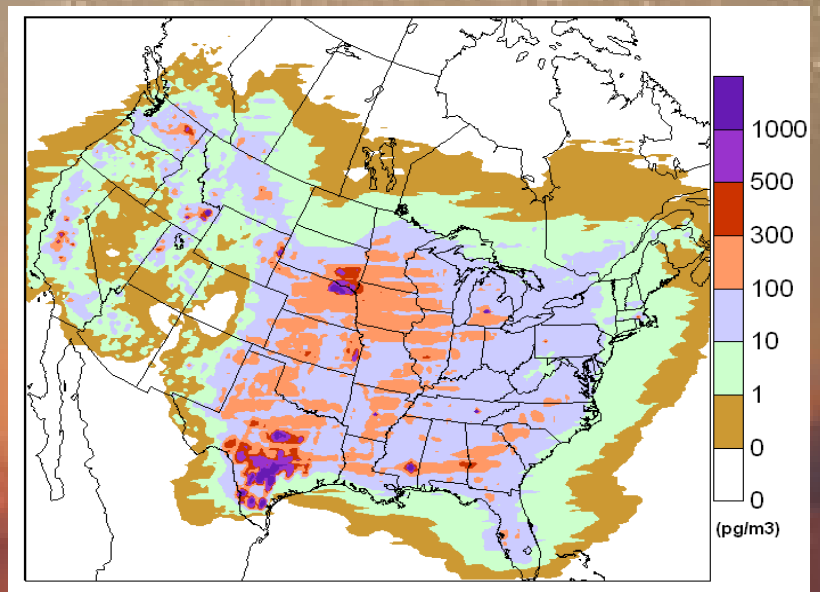
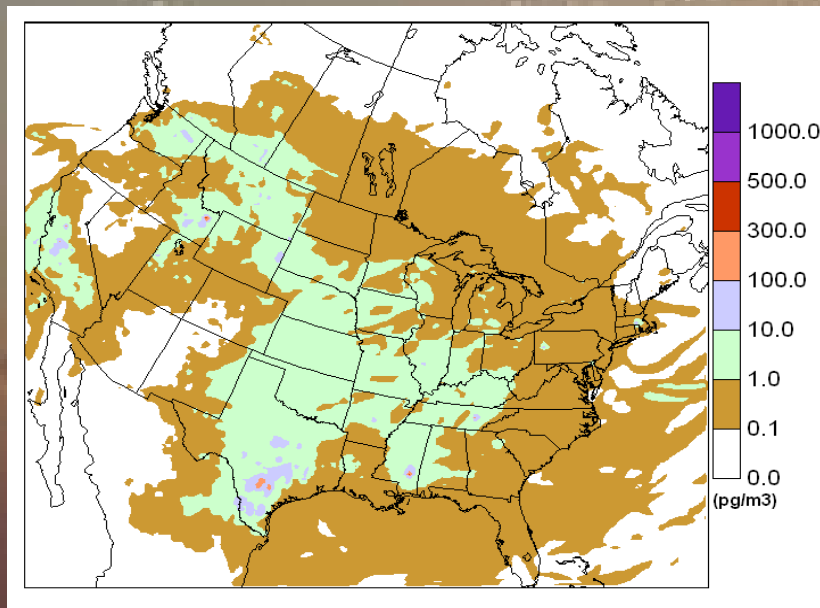
Update emission and soil residues from historical pesticides application



Annual air/land release of HCB in the US from USEPA TRI emission inventory and annual soil residue of HCB in the US and Canada from historical pesticides application in 2001 (Unit: kg yr^{-1})



Old (left) and updated (right) HCB soil residues in agricultural lands in 2000



Modeled daily HCB air concentration at 1.5 m averaged over summer 2000 using old (left) and updated (right) HCB soil residues in agricultural lands

Task 2: High resolution model run

Numerical Experiments setup: 4 scenarios

Scenario 1. TRI air release data

Scenario 2. TRI air and land release data

Scenario 3. Soil residues from historical pesticides application

Scenario 4. Updated soil residues over agricultural land

Model run: from January 1st 2000 to January 1st 2002

Initial condition:

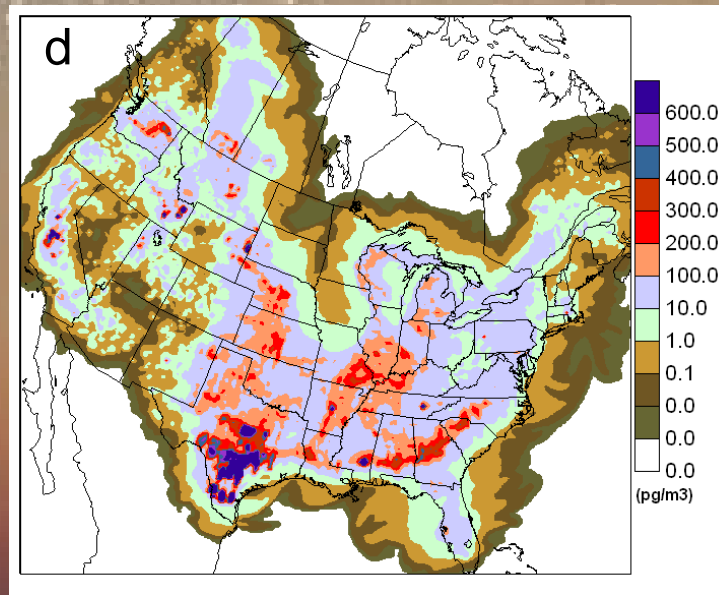
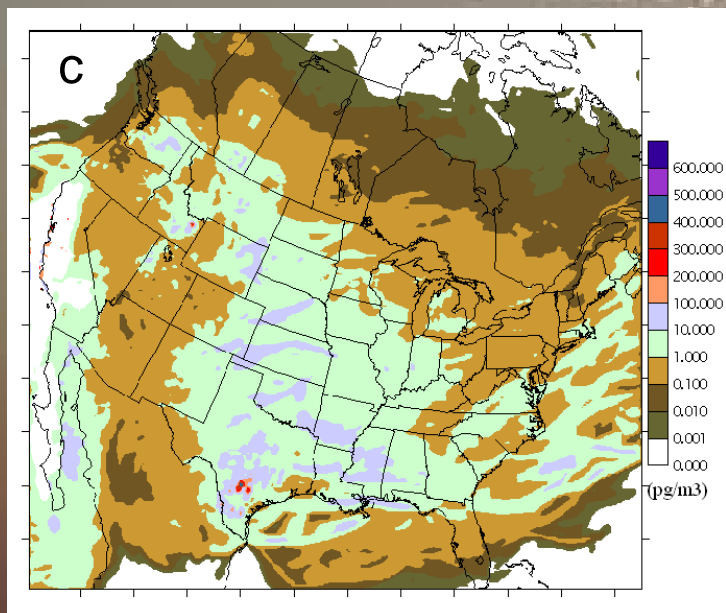
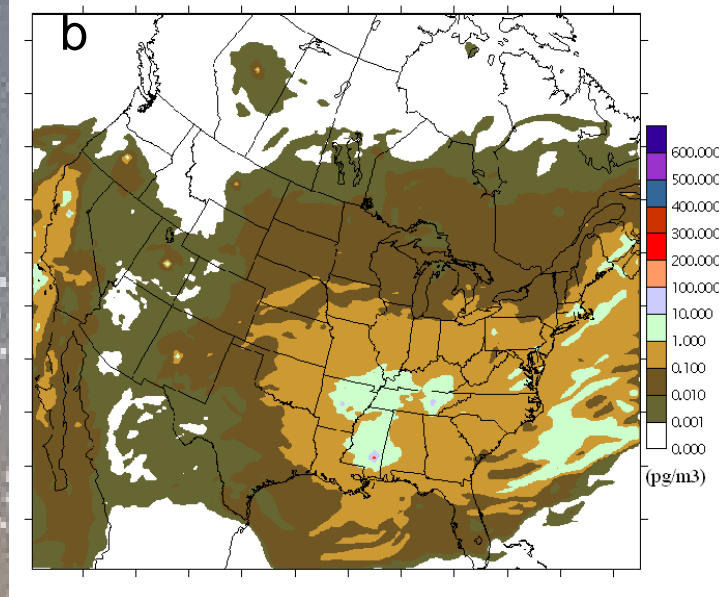
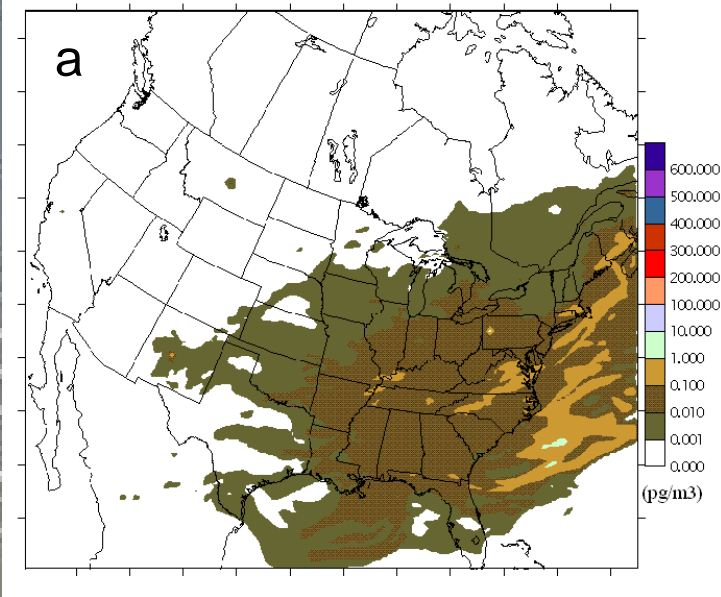
1 HCB air release data on a state level in the US was treated as area sources which were emitted continuously throughout the year

2 Land releases were assumed to be absorbed to soils and air releases were assumed to be deposited 100% to soils. Both releases data were added to form soil concentration

3 Soil residues from historical application of pesticides (HCB as a fungicide, atrazine, dacthal, lindane, Pentachloronitrobenzene...) in the US and Canada

4 Same as Scenario 3 but updating soil residues

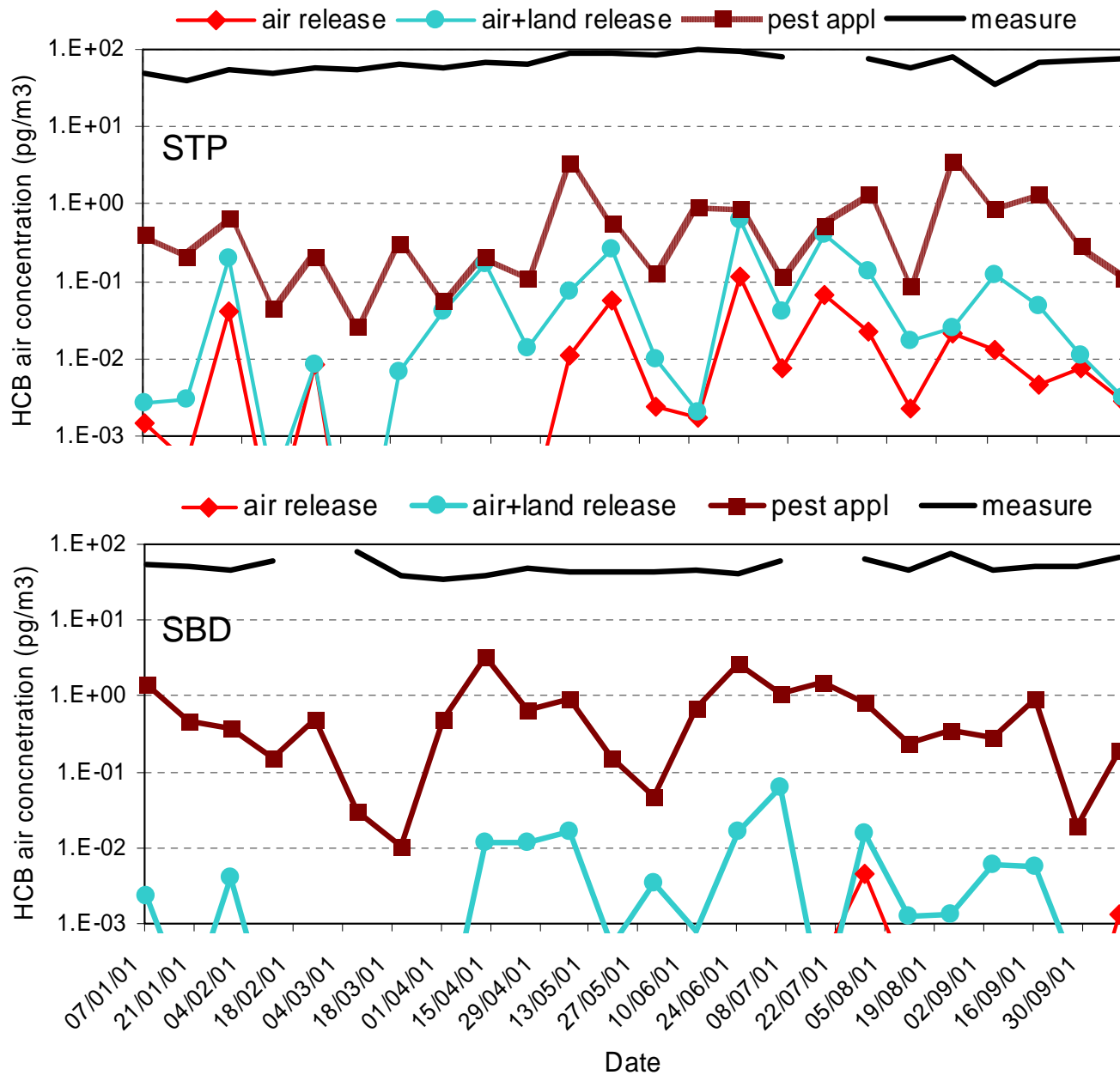




Modeled HCB air concentration at 1.5 m averaged over summer 2001.

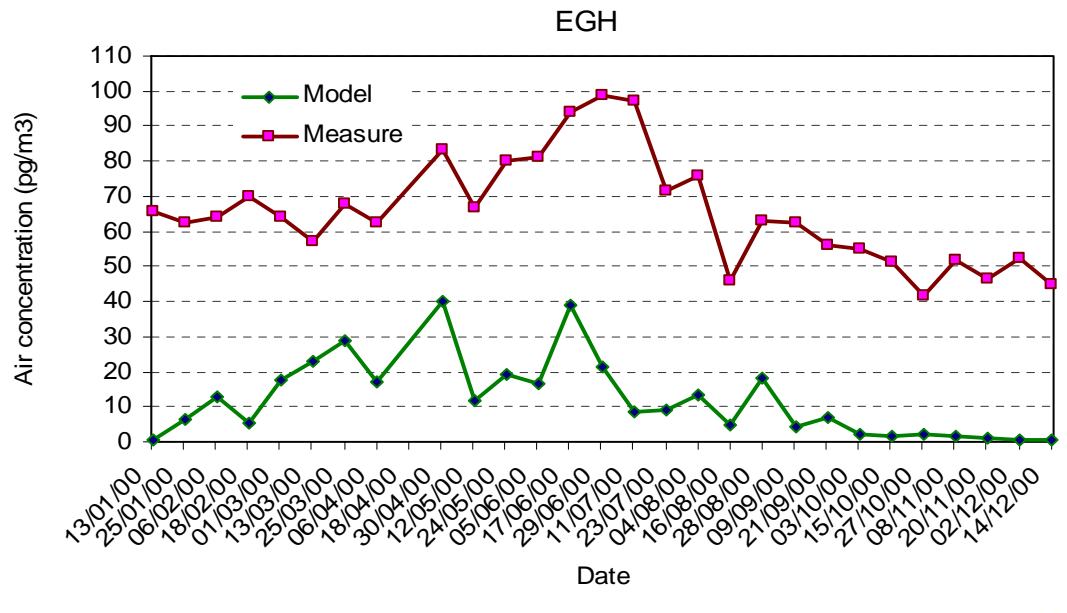
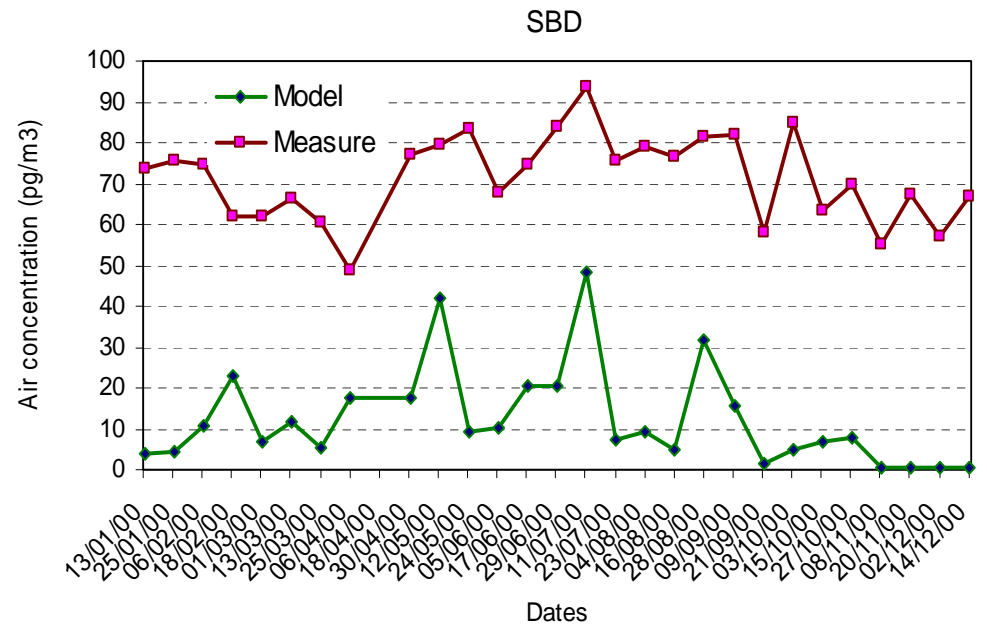
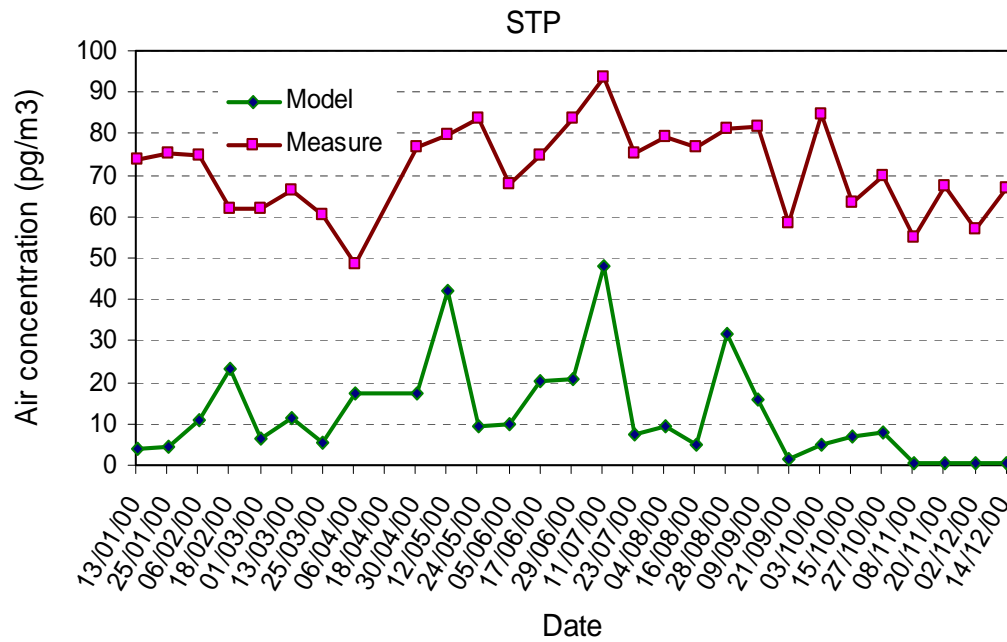
- a.Scenario 1
- b.Scenario 2
- c.Scenario 3
- d.Scenario 4

24 km x 24 km resolution, meteorological data from GEM



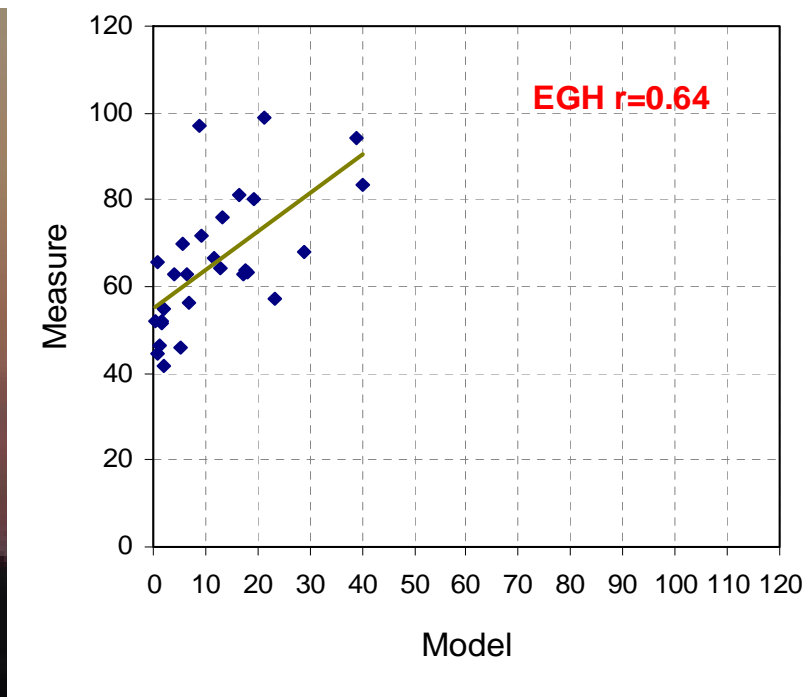
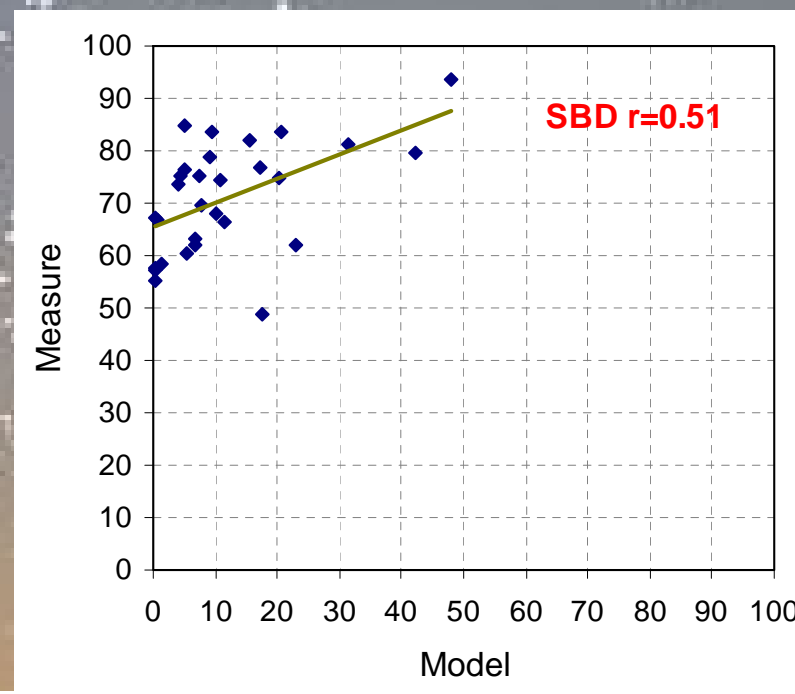
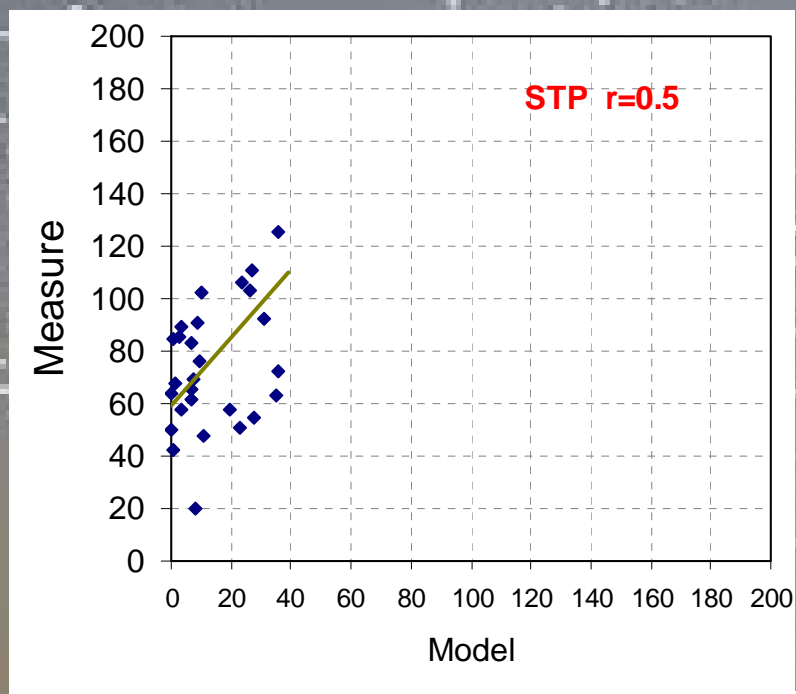
CanMETOP modeled and IADN measured air concentration (pg m⁻³) at a: Sturgeon Point (STP, Lake Erie); b: Sleeping Bear Dune (SBD, Lake Michigan)





CanMETOP modeled and IADN measured air concentration (pg m⁻³) in 2000 at STP (Lake Erie); SBD (Lake Michigan) and EGH (Lake Superior)

Comparing modeled and monitored air concentration



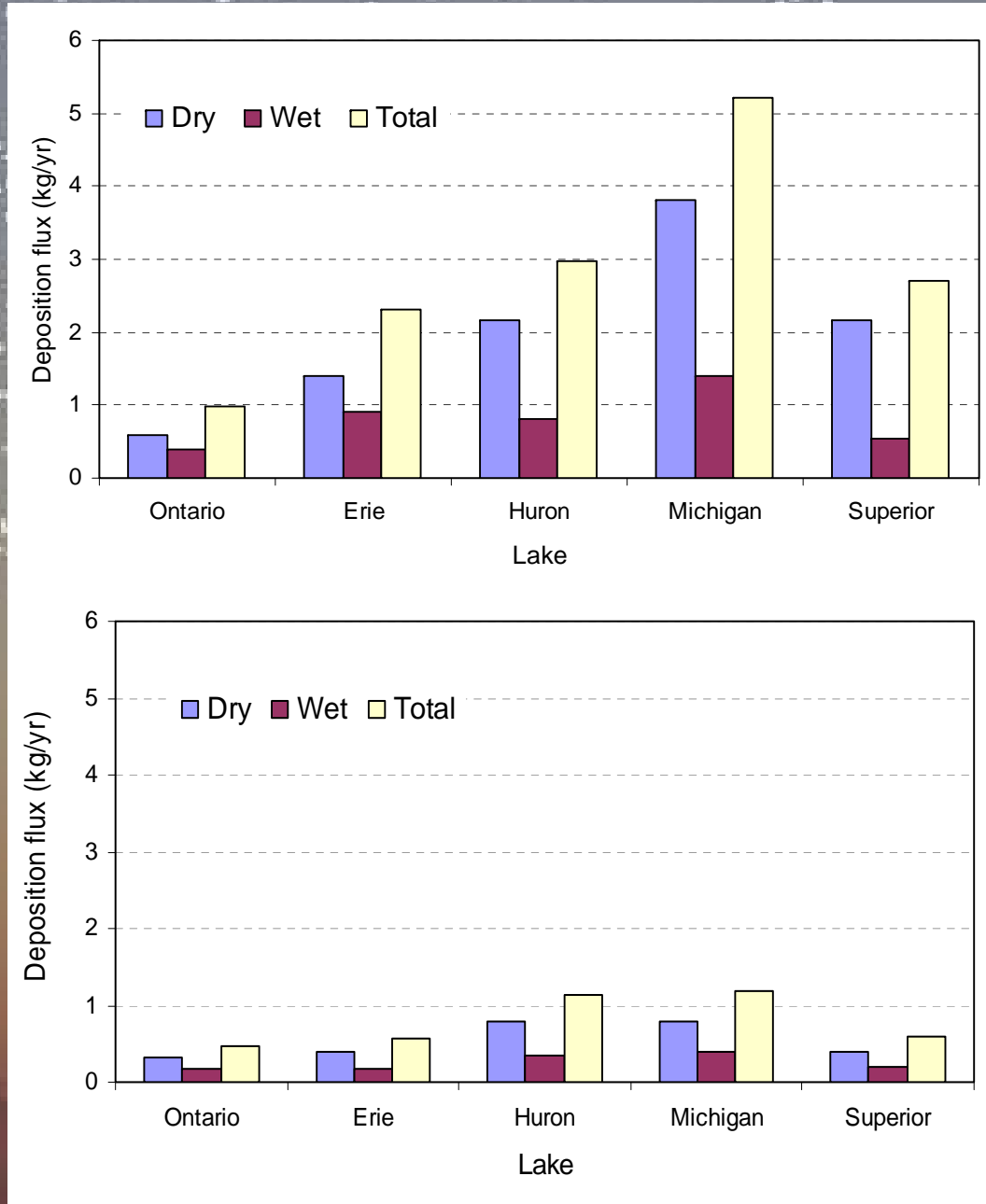
Wet deposition
in 2000 (kg yr⁻¹)

Superior

Model	IADN
1.40	0.84

Michigan

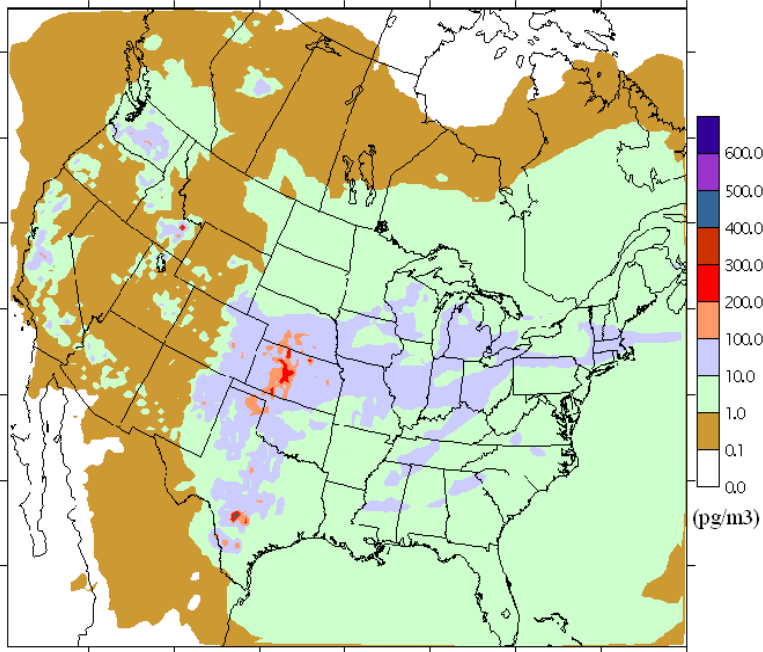
Model	IADN
0.55	0.99



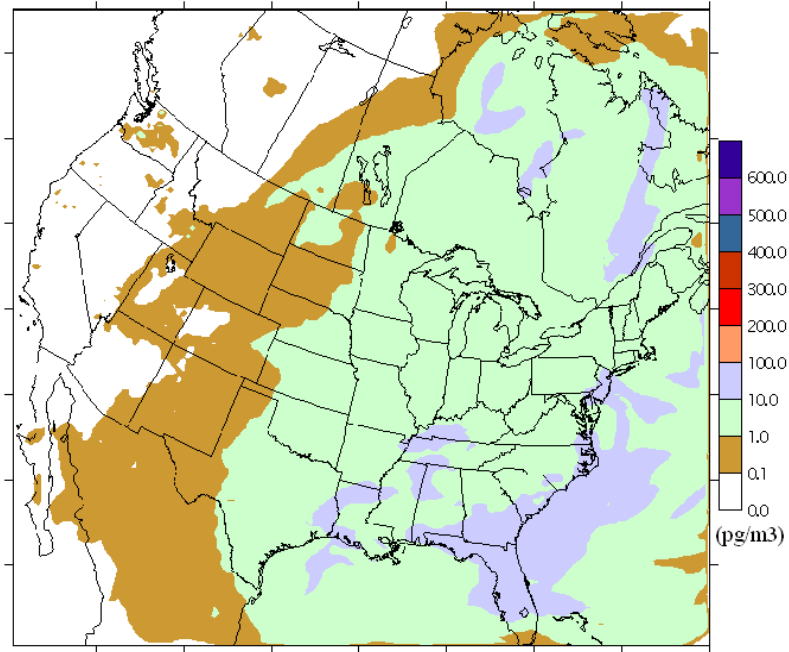
Modeled annual dry and wet deposition fluxes (kg yr⁻¹) to the Great Lakes

Task 3 26 years run from 1978-2003

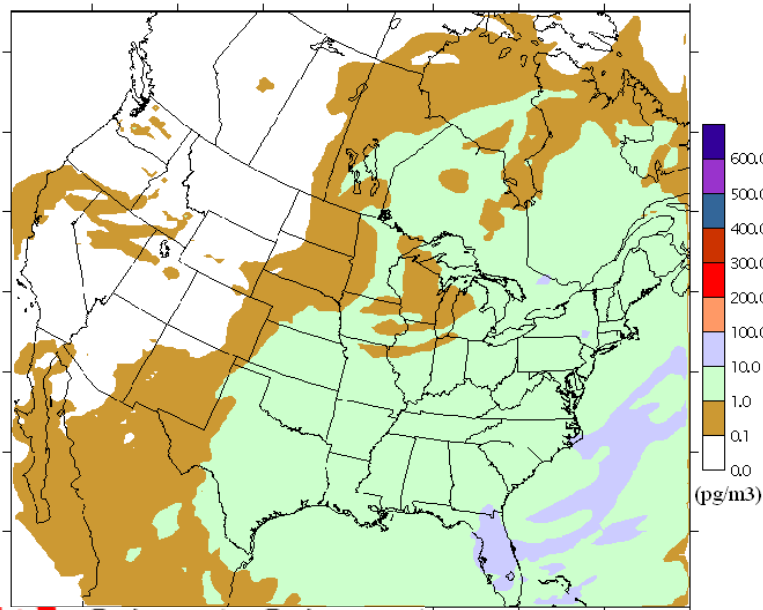
1978



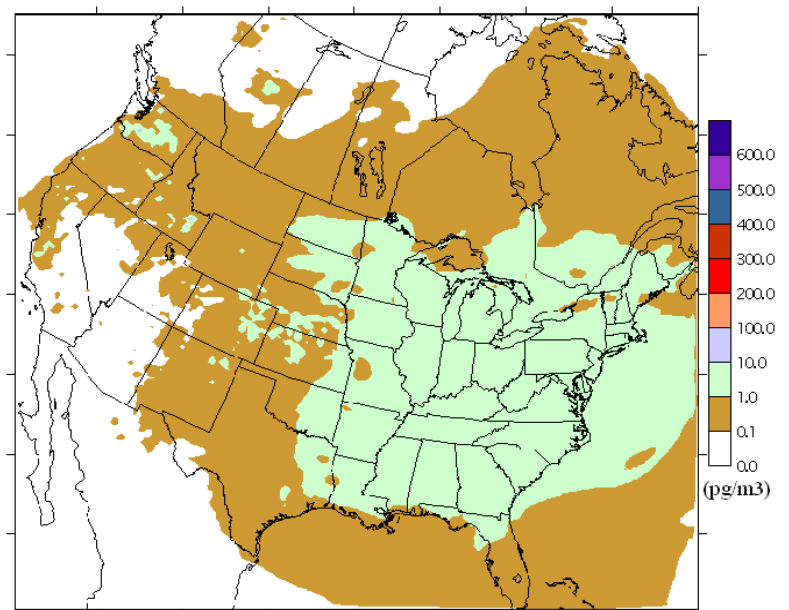
1986



1994

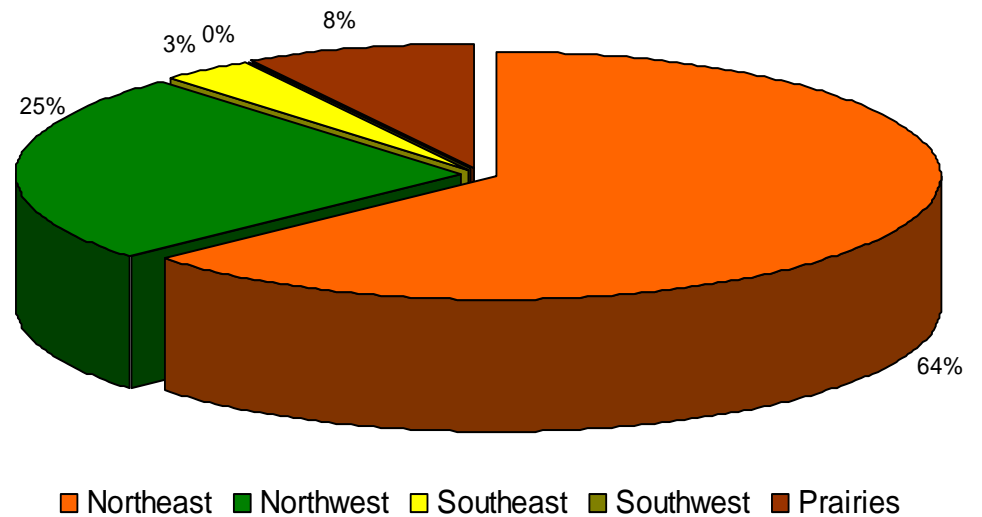
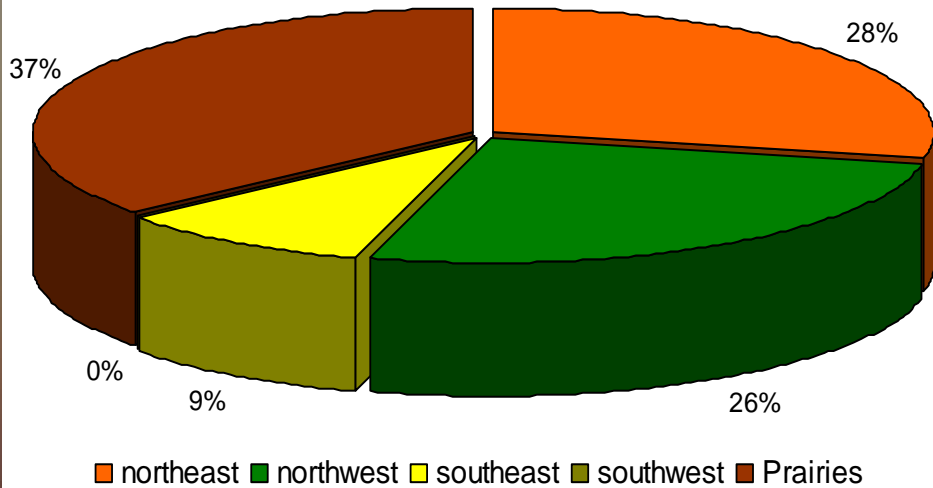
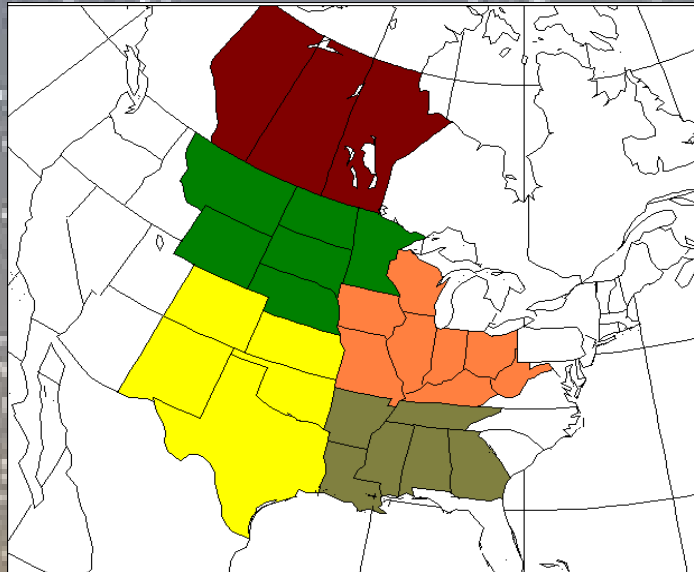


2002



35 km x 35 km resolution, meteorological data from NCEP reanalysis; soil residue data from pesticide application

Task 4



Contribution of sources to air concentration over the Great Lakes

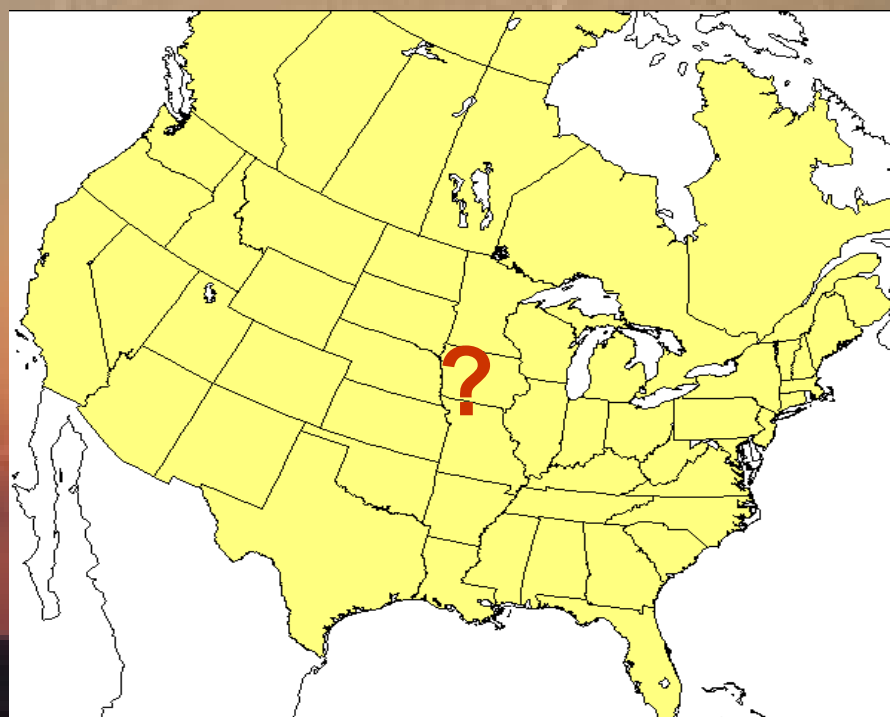
Remaining work

- **Complete computation of water/air exchange for 2000-2001**
- **Run CanMETOP for 1978-2003 using updated soil residue data**
- **Complete multiple scenario runs for assessing impact of sources on the GL in 2001**
- **Submit report of HCB project in April 2008**

Further study: a proposal

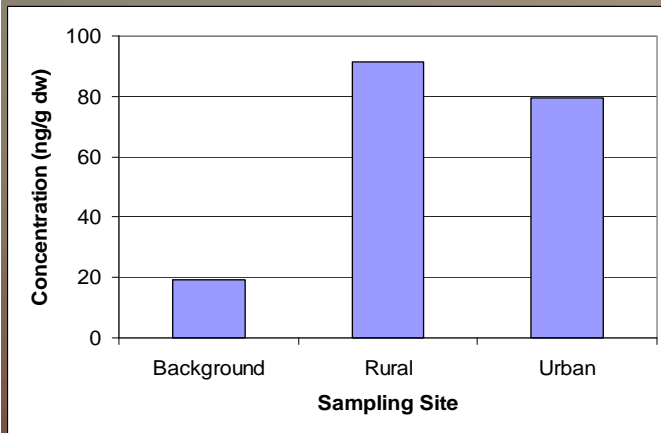
US – Canada – China soil sampling, comparison, and atmospheric transport of HCB to the Great Lakes

- Collect 50 soil samples in China and 20 in North America
- Analyze HCB level in China and North America rural, urban and background soils
- Establish reliable HCB (and other toxics) soil emission inventory in NA and Asia
- Using regional- and global-scale CanMETOP to investigate regional and trans-Pacific transport of HCB and their impact on its budget over the Great Lakes

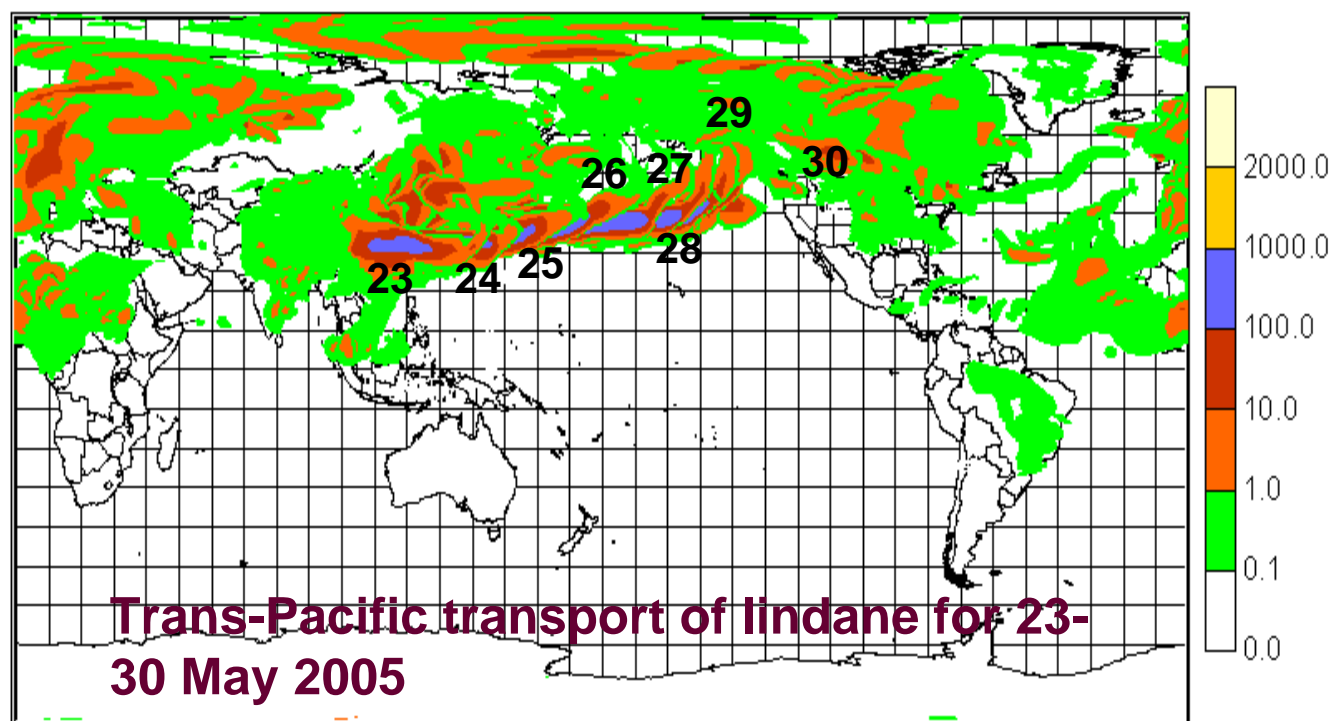


International Joint Research Center for Persistent Toxic Substances (IJRC-PTS) - Harbin Institute of Technology, China

- Canada - China Joint Project on Reduction of Lindane Usage in China and its Impact Globally and on North America
- IPY program: INCATPA



Mean concentration of HCB in Chinese urban, rural, and background soils in 2005





Thank you



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