Environment Canada Environnement Canada

Canada

Atmospheric Pathways and Sources of Dioxin/Furans in Canadian and the Great Lakes Environments – A Progress

GLBTS Meeting

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Presenter: Jianmin Ma

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Anita Wong – MPD/ESB Coordinating project

Dr. Yi-Fan Li – (ARQI) Global Dioxin emission inventory

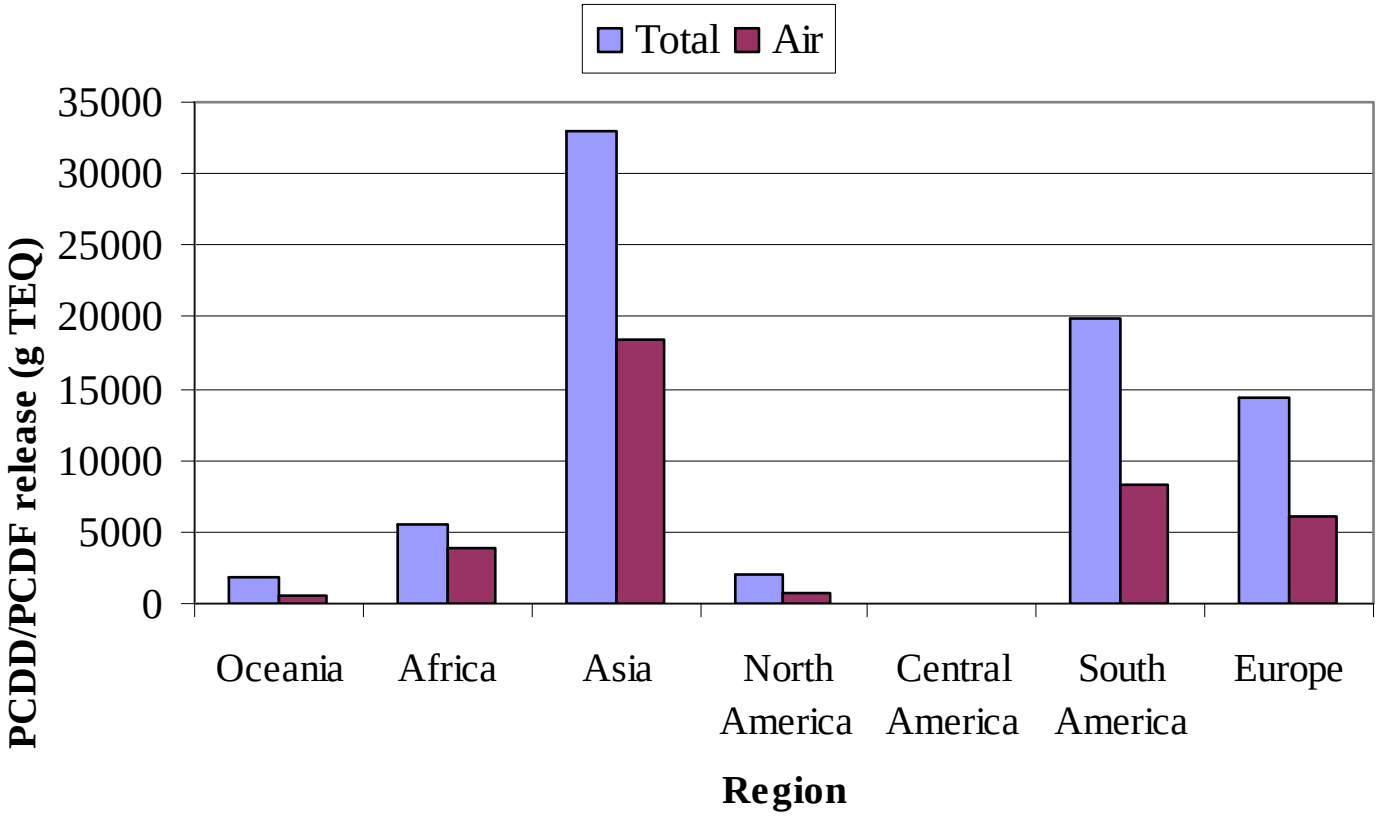
Dr. Lisheng Zhang – (Contract scientist) Multi-scenarios modeling

Philip Cheung – (ARQI) Multi-scenarios modeling

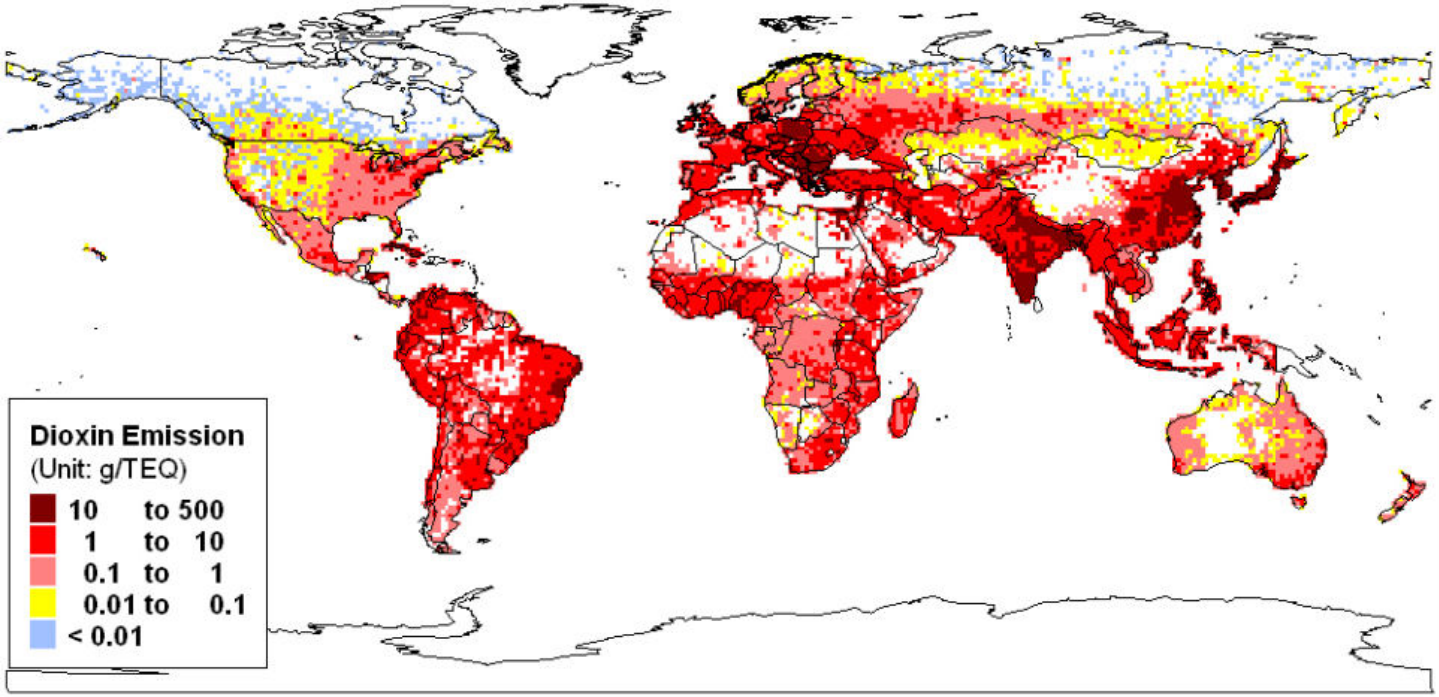
Prof. James Li – Ryerson University

Objective

Does Dioxin still matter to the US and Canada?



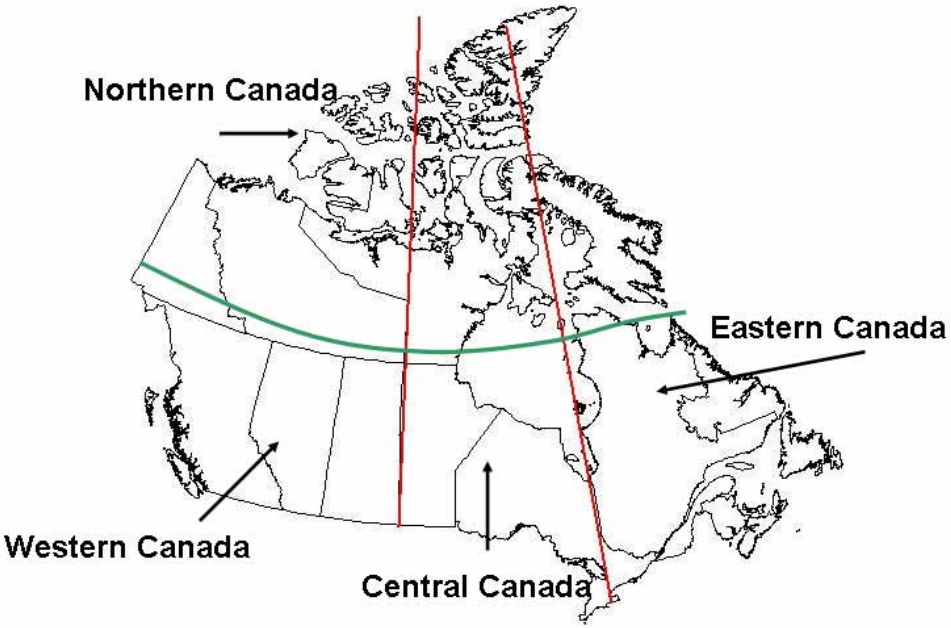
Total PCDD/Fs emissions in different regions (data estimated, reference year: **2004**)



Gridded dioxin emission inventories with 1º latitude by 1º longitude resolution

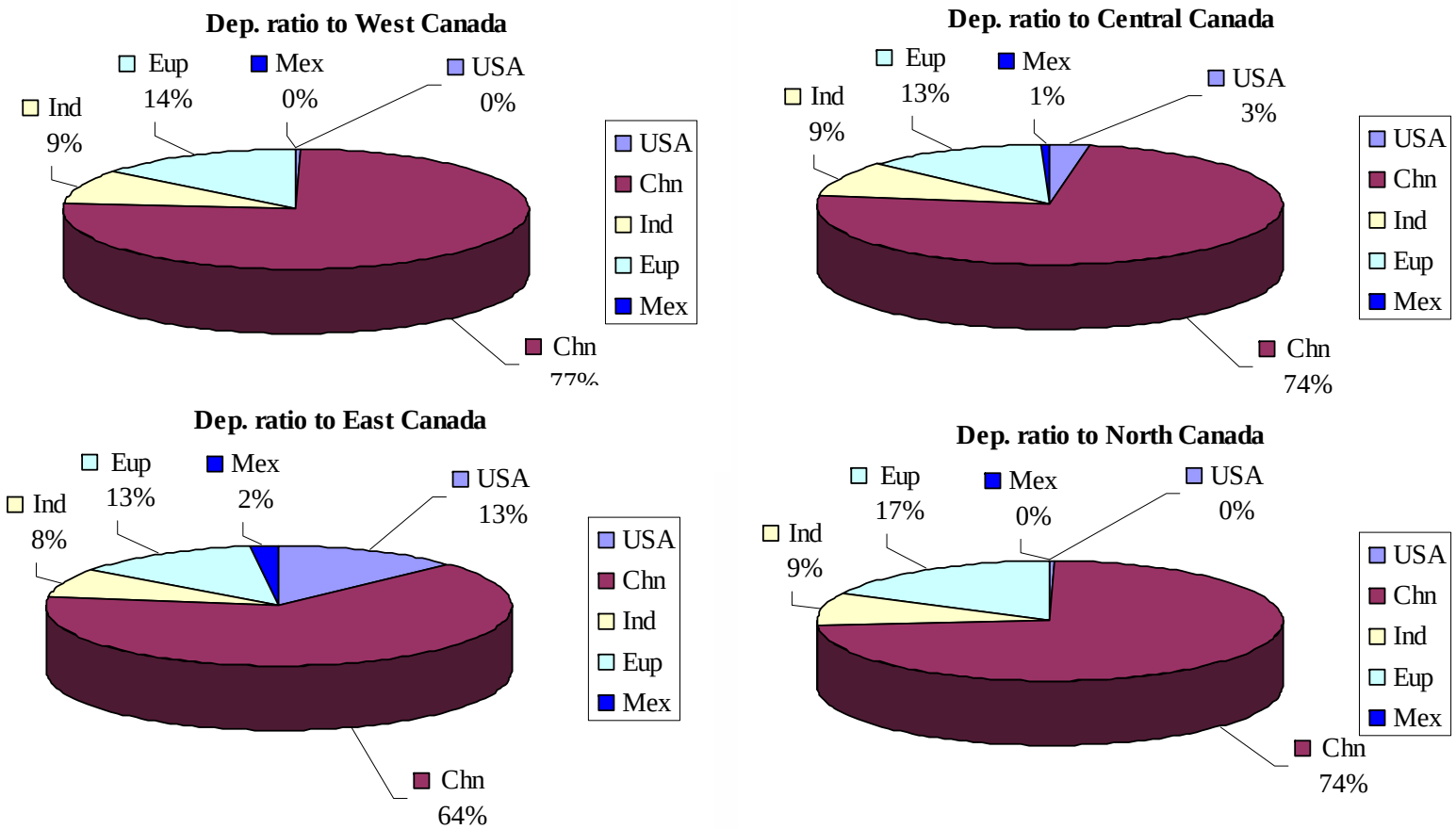
Results – atmospheric transport & deposition modeling for 2005

- Atmospheric transport model: global-scale Canadian Environmental Transport of Organochlorine Pesticides (CanMETOP)
- Model scenarios (8 scenarios)
  - Scenario 1: all sources in the globe (**Glb**)
  - Scenario 2: the U.S. sources only (**USA**)
  - Scenario 3: China sources only (**Chn**)
  - Scenario 4: India sources only (**Ind**)
  - Scenario 5: European sources only (**Eup**)
  - Scenario 6: Mexican sources only (**Mex**)
  - Scenario 7: Doubling China source (**2×Chn**)
  - Scenario 8: Doubling India source (**2×Ind**)



PCDD/Fs receptor regions in Western, Central, Eastern Canada, Canadian Arctic, and High Arctic

Results – loadings to receptors in Canada



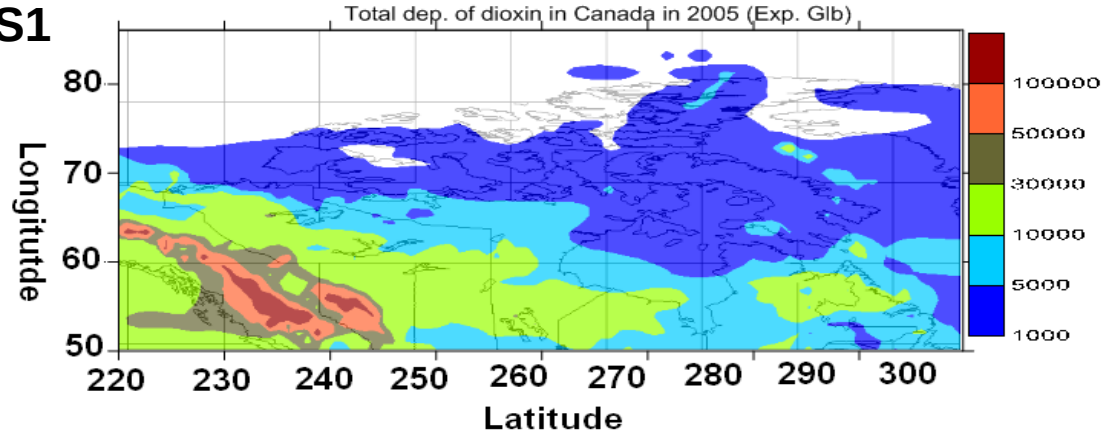
Relative contribution of PCDD/Fs from different sources to 4 Canadian regions

Contribution of different sources to 5 Canadian regions

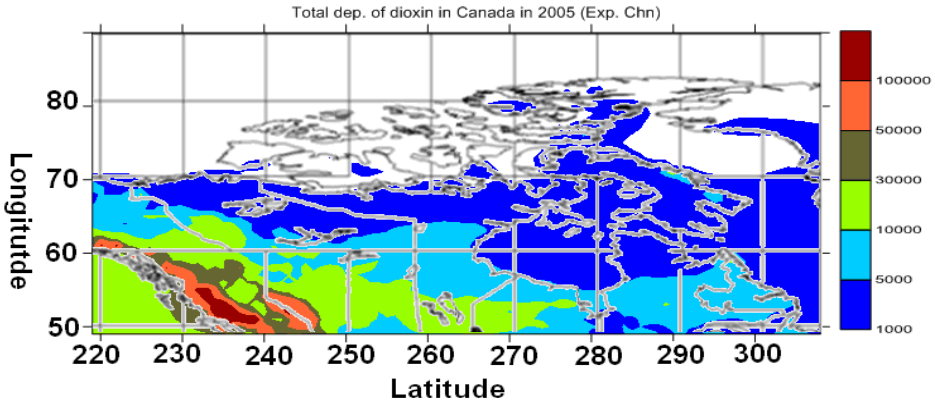
	West	*Central*	*East*	*North*	*High Arctic*
USA	0	3%	13%	0	
Mex	0	1%	2%	0	
Chn	77%	74%	64%	74%	
2 x Chn	87%	86%	79%	85%	81%
Ind	9%	9%	8%	9%	
2 x Ind	17%	17%	16%	14%	15%
Eup	14%	13%	13%	17%	

Total deposition to Canada-spatial pattern

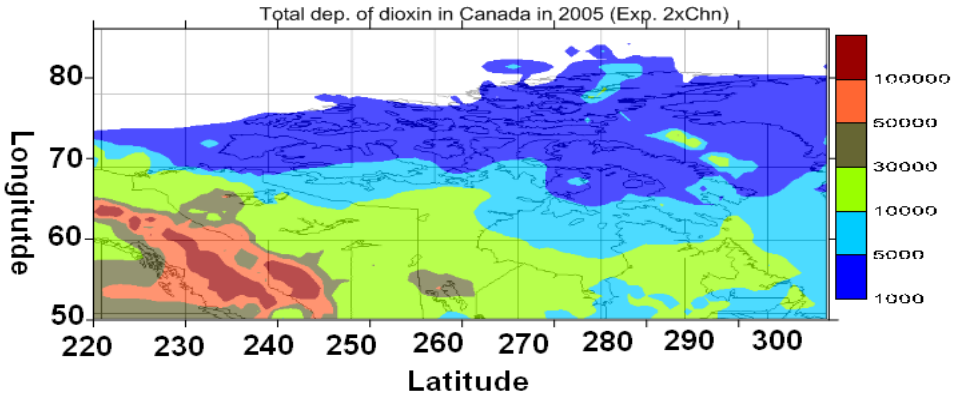
S1



S3

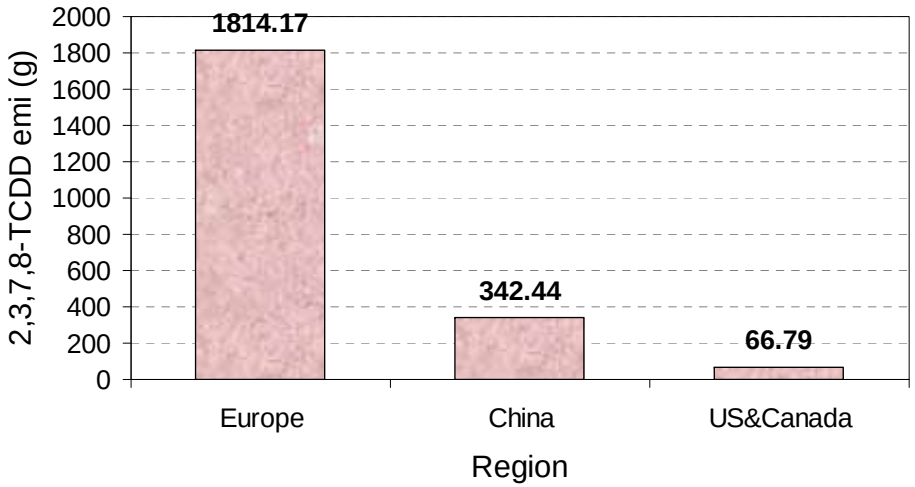


S7

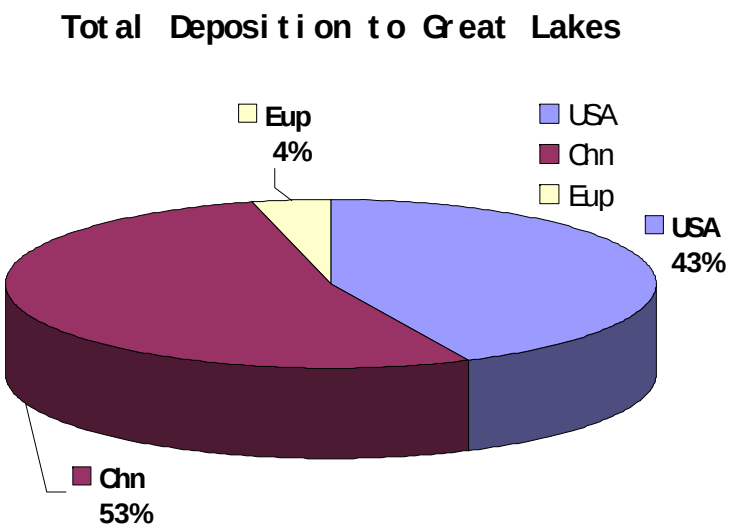


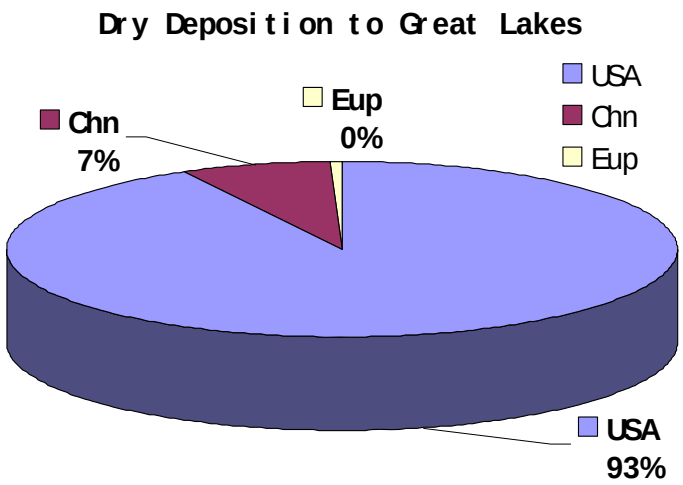
Total deposition of PCDD/Fs to Canada in 2005 (pg/m2/yr) from 3 model scenarios

2,3,7,8-TCDD – Great Lakes

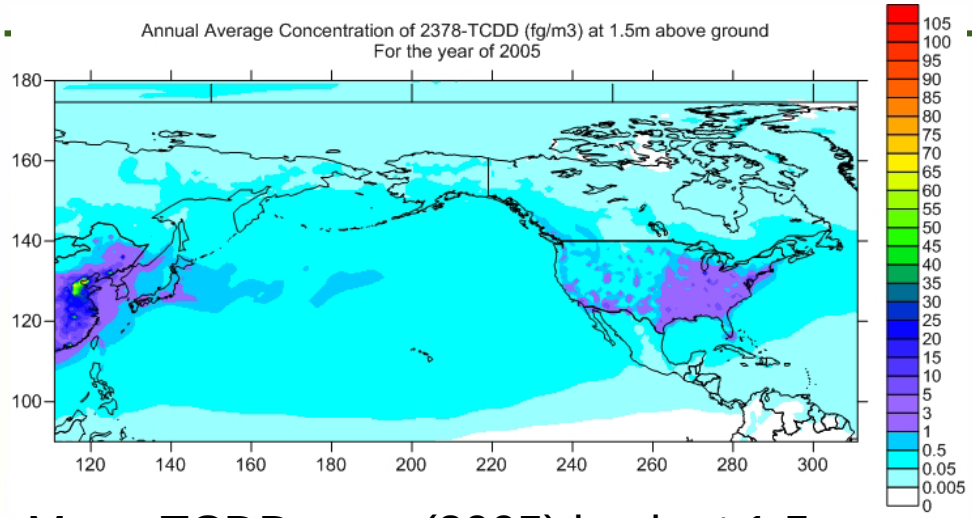


2,3,7,8-TCDD Air emission (g) in 2005

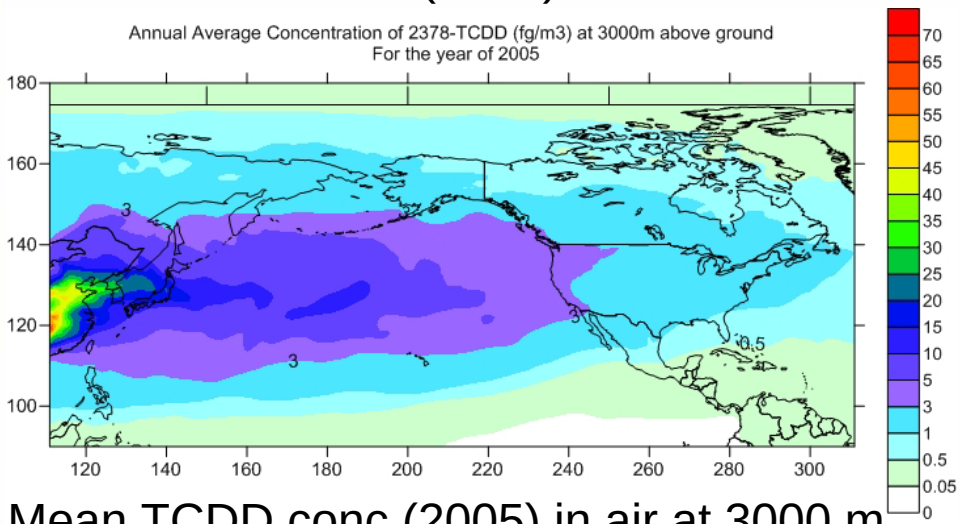




Modeled 2,3,7,8-TCDD annual air concentration

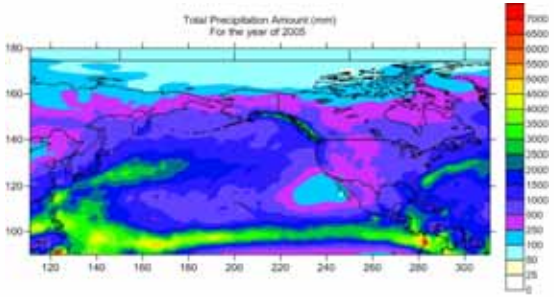


Mean TCDD conc (2005) in air at 1.5 m



Mean TCDD conc (2005) in air at 3000 m

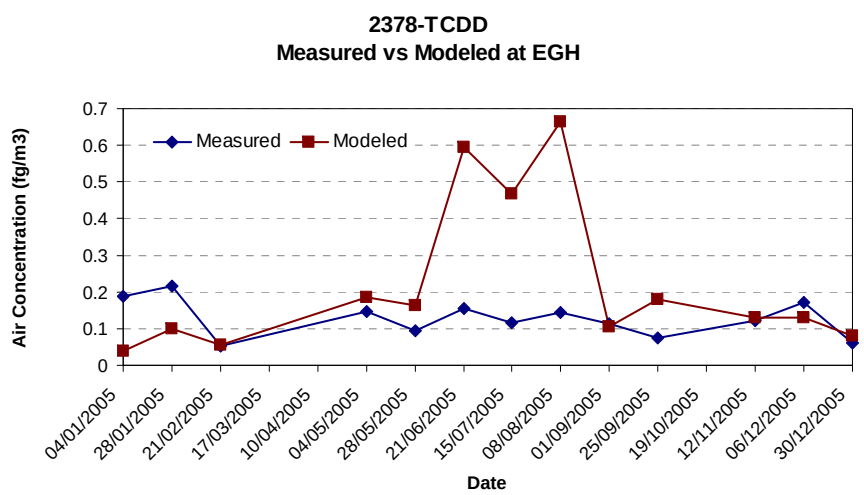
Local emission dominated dry deposition (93%) to the GL!



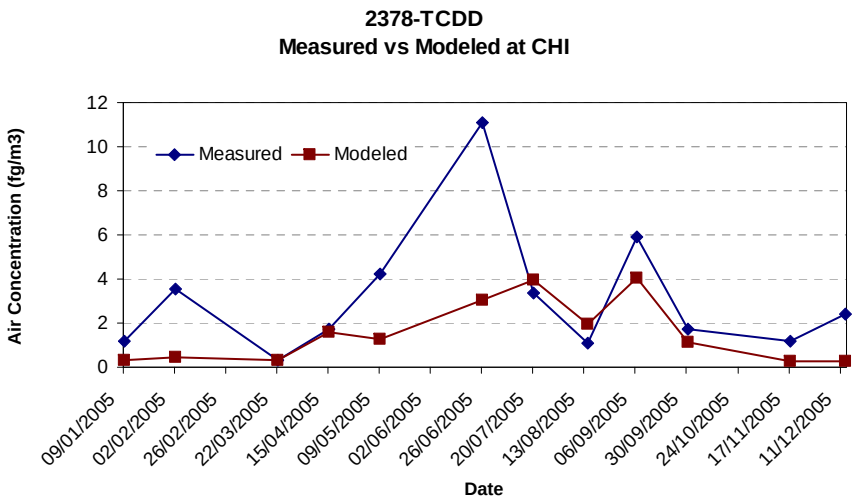
Annual precipitation (mm)

Asia (China) emission made 53% contribution of total deposition to the GL via long-range transport and precipitation scavenging!

Model evaluation: 2,3,7,8-TCDD



Background site (Eagle Harbor)



Urban site (Chicago)

Concluding Remarks

- China is likely a major contributor to Dioxin/Furans contamination to Canada and the Great Lakes
- Precipitation/wet deposition provides a major pathway for Asian emission input into North America, including the Great Latke
- Transpacific transport is a most important atmospheric pathway of Dioxin/Furans to North America
- Concern needs to be raised in dioxin regulations to take foreign sources and emission into account