Is Trans-Pacific Atmospheric Transport and Deposition of Persistent Organic Pollutants (POPs) to the North Pacific Ocean Significant?

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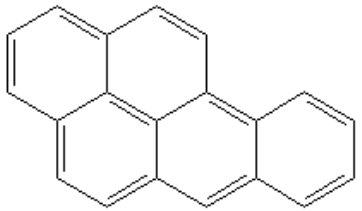
Superfund Research Program

National Science Foundation
WHERE DISCOVERIES BEGIN

Oregon State University

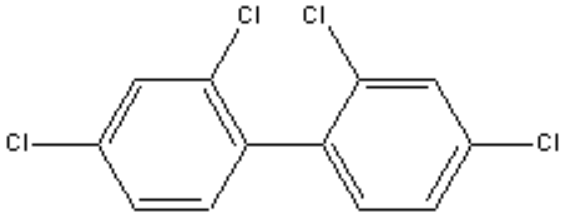
Example Persistent Organic Pollutants

Polycyclic aromatic hydrocarbons (PAHs)



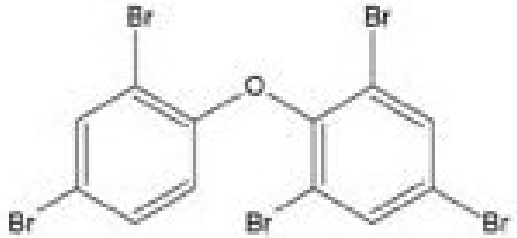
Incomplete Combustion (Wood, Coal, Diesel, Gasoline)

Polychlorinated biphenyls (PCBs)



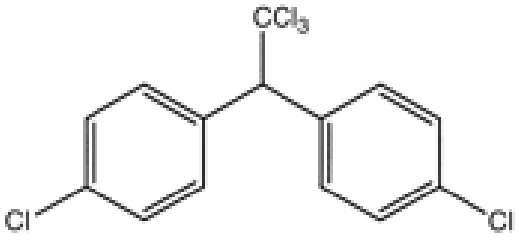
Industry (Electrical Equipment)

Polybrominated diphenyl ethers (PBDEs)



Consumer Products (Fabrics, Furniture, Electronics)

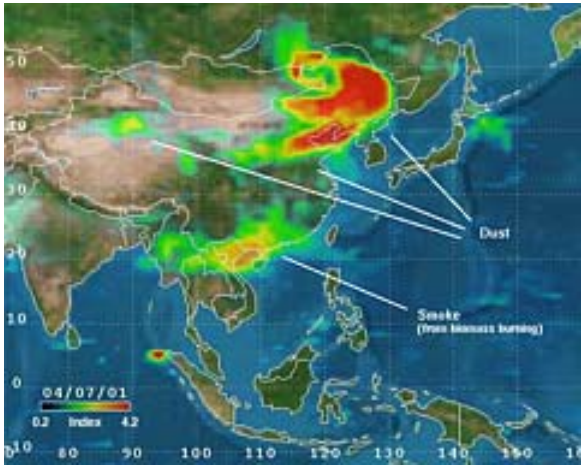
Pesticides



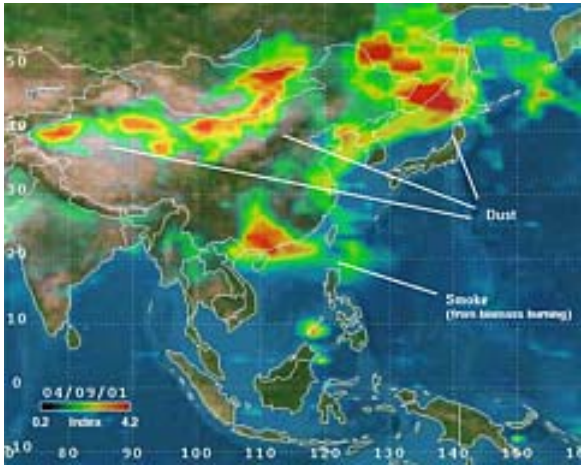
Agriculture

Asian Dust Storm Event: April 2001

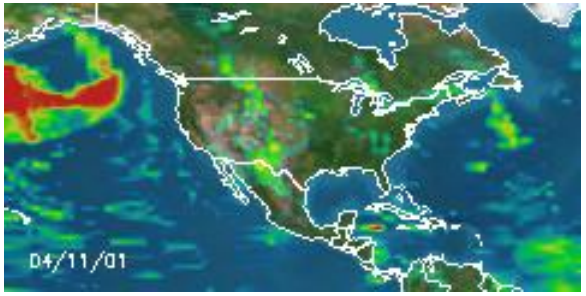
April 7



April 9



April 11



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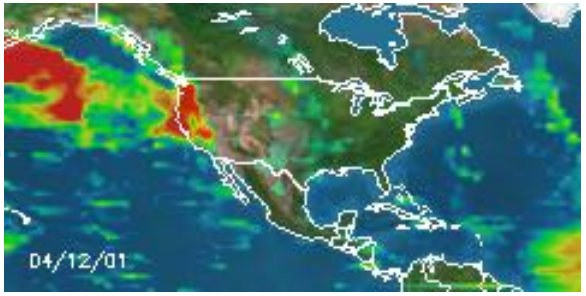

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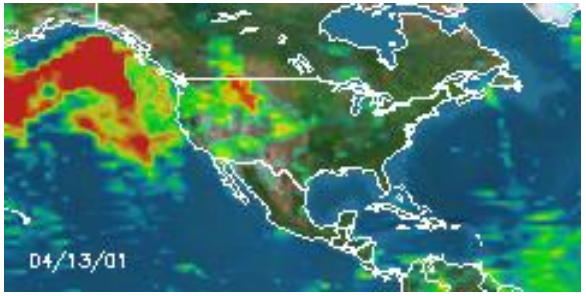
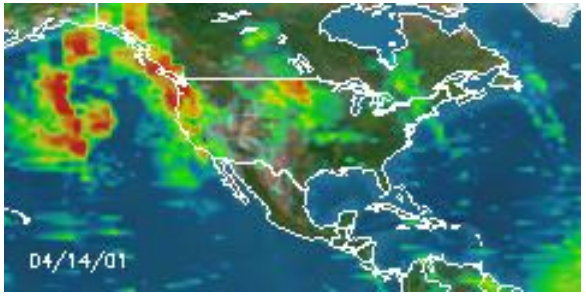
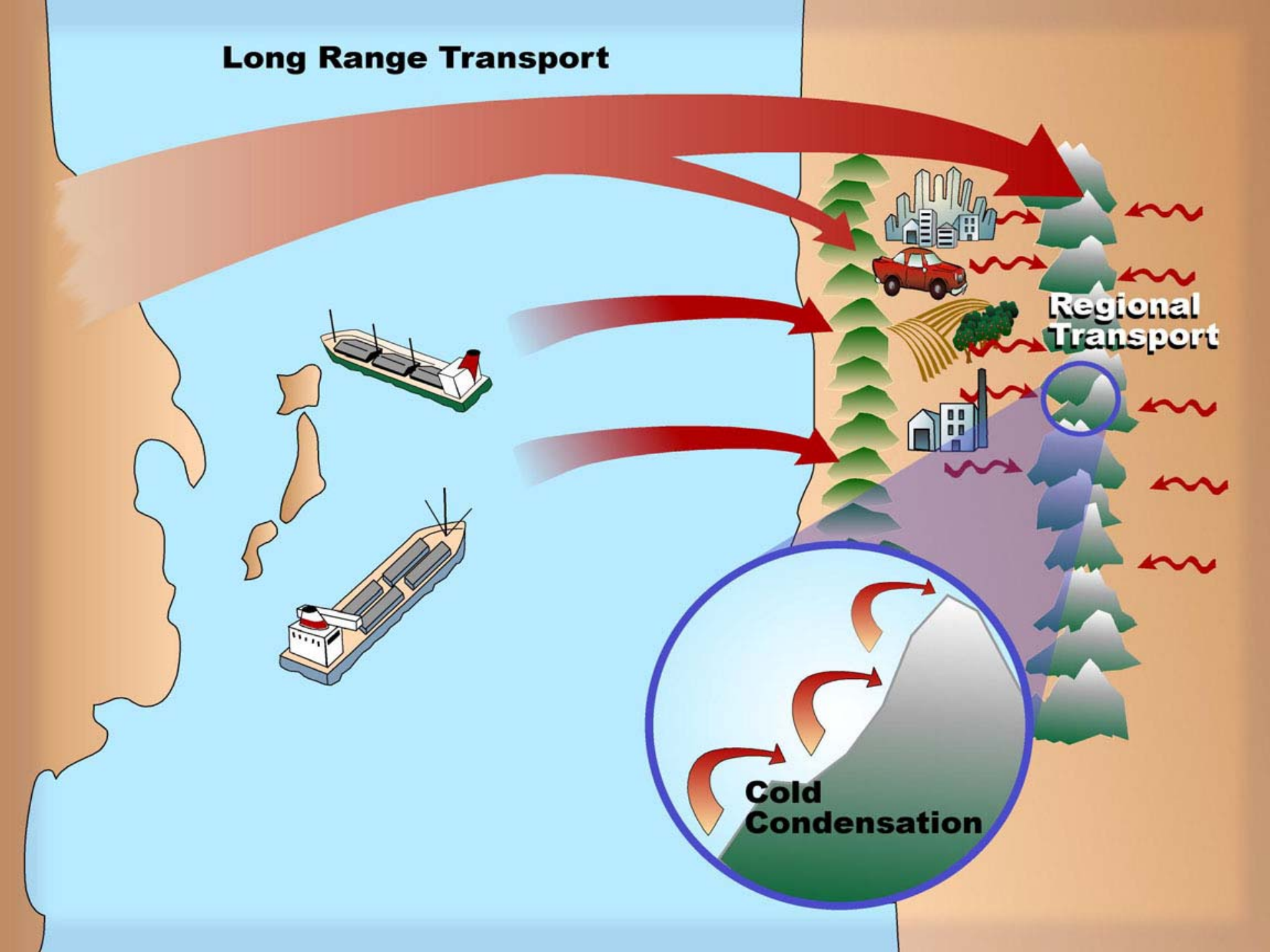


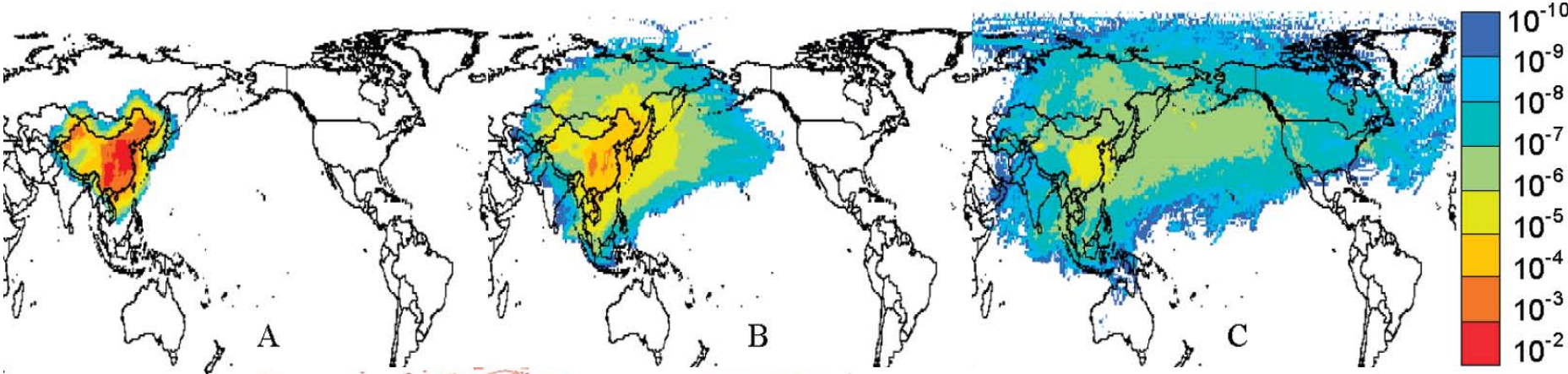
April 14



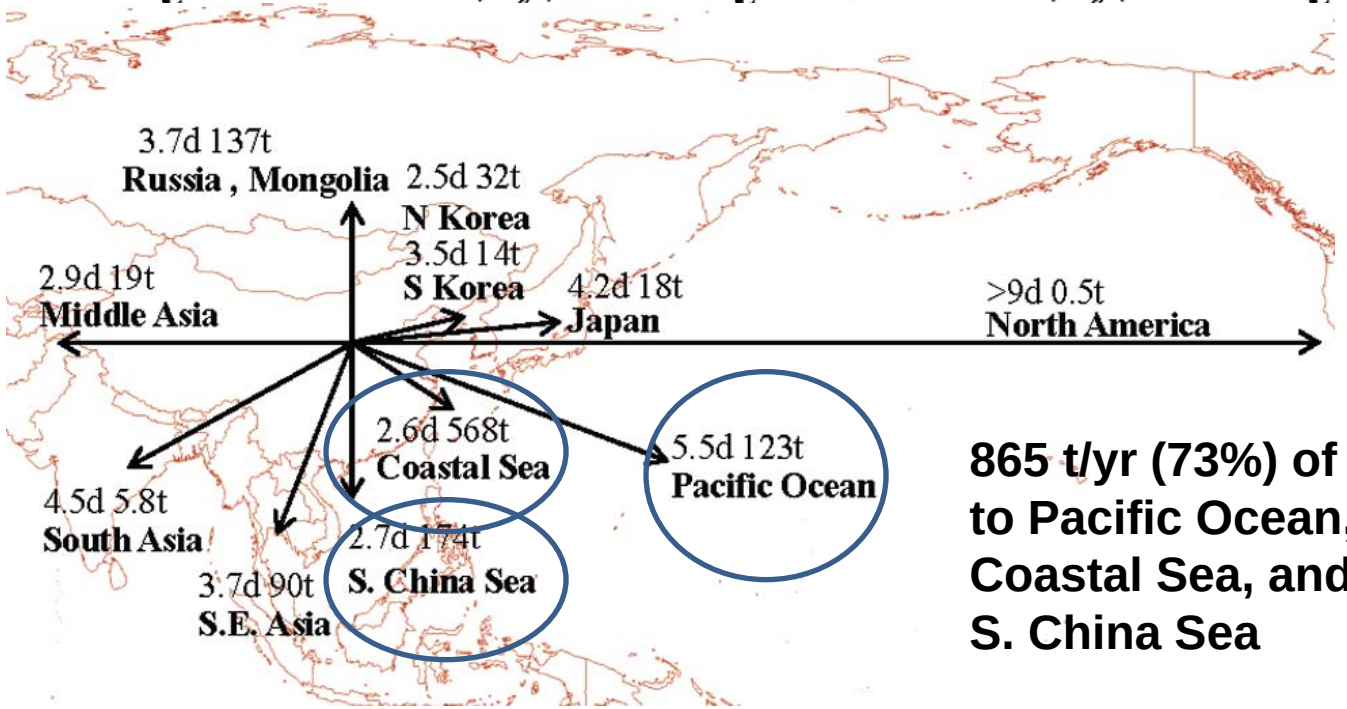
[NASA TOMS]


Long Range Transport
Regional Transport
Cold Condensation

PAH Emissions and Outflow from China



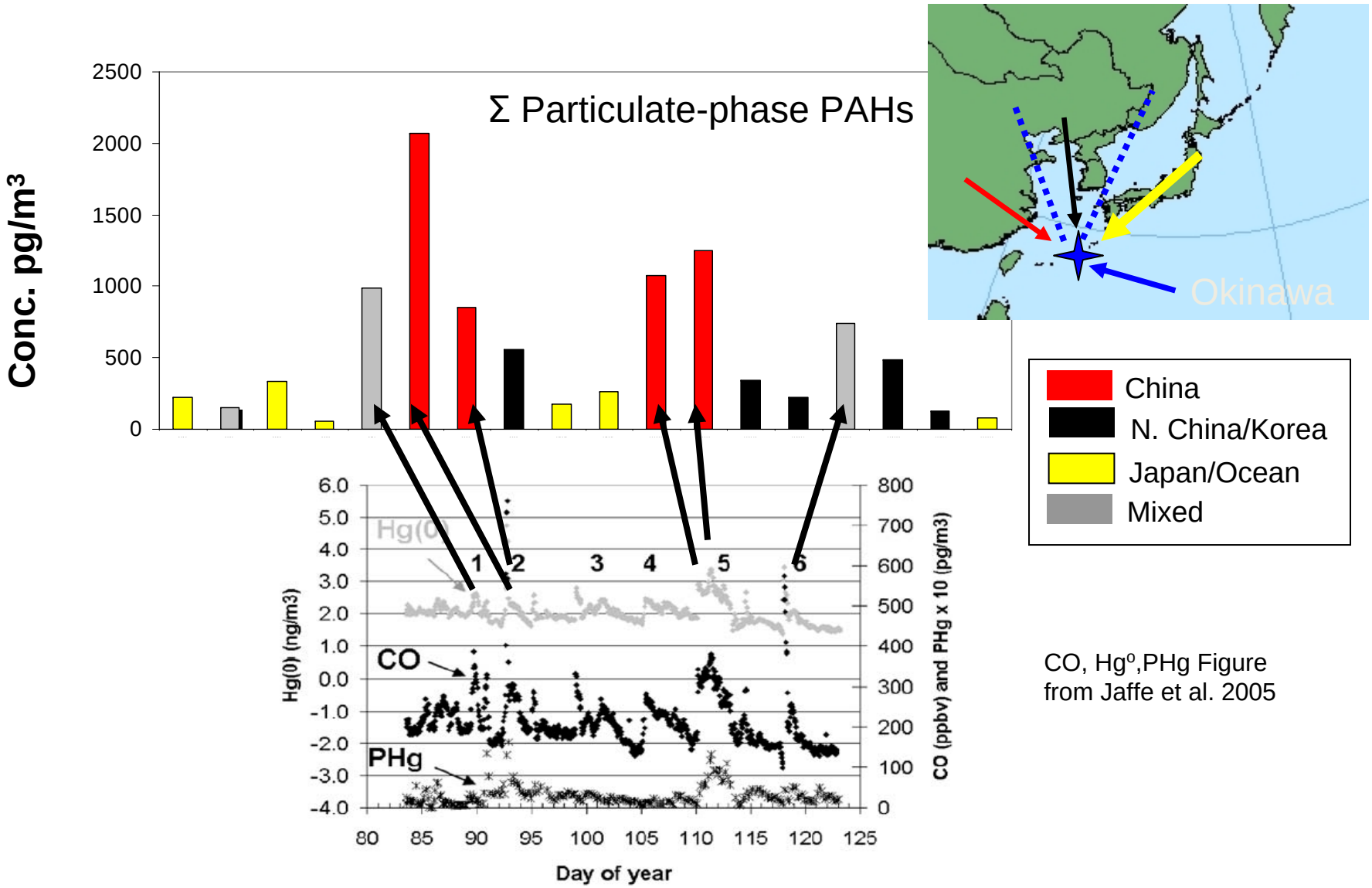
Pyrene
Annual Mean
2001



865 t/yr (73%) of outflow to Pacific Ocean, Coastal Sea, and S. China Sea

Lang, Tao, and Simonich et al, *Environ. Sci. Technol.* **2008**, 5196-5201

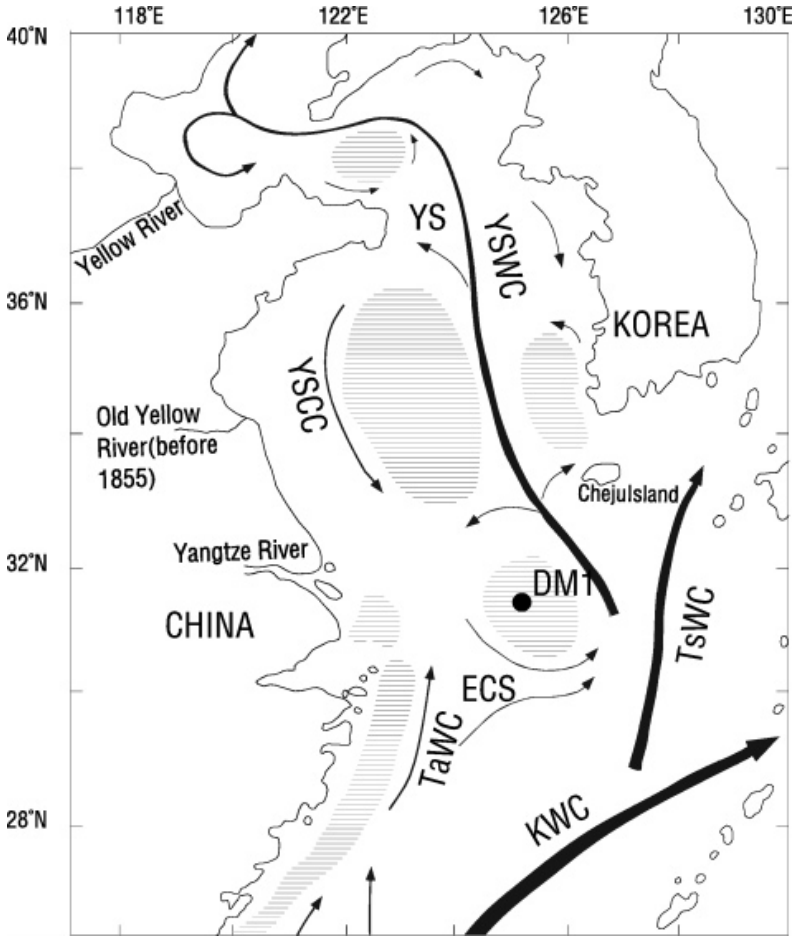
PAH and Mercury Outflow to Okinawa

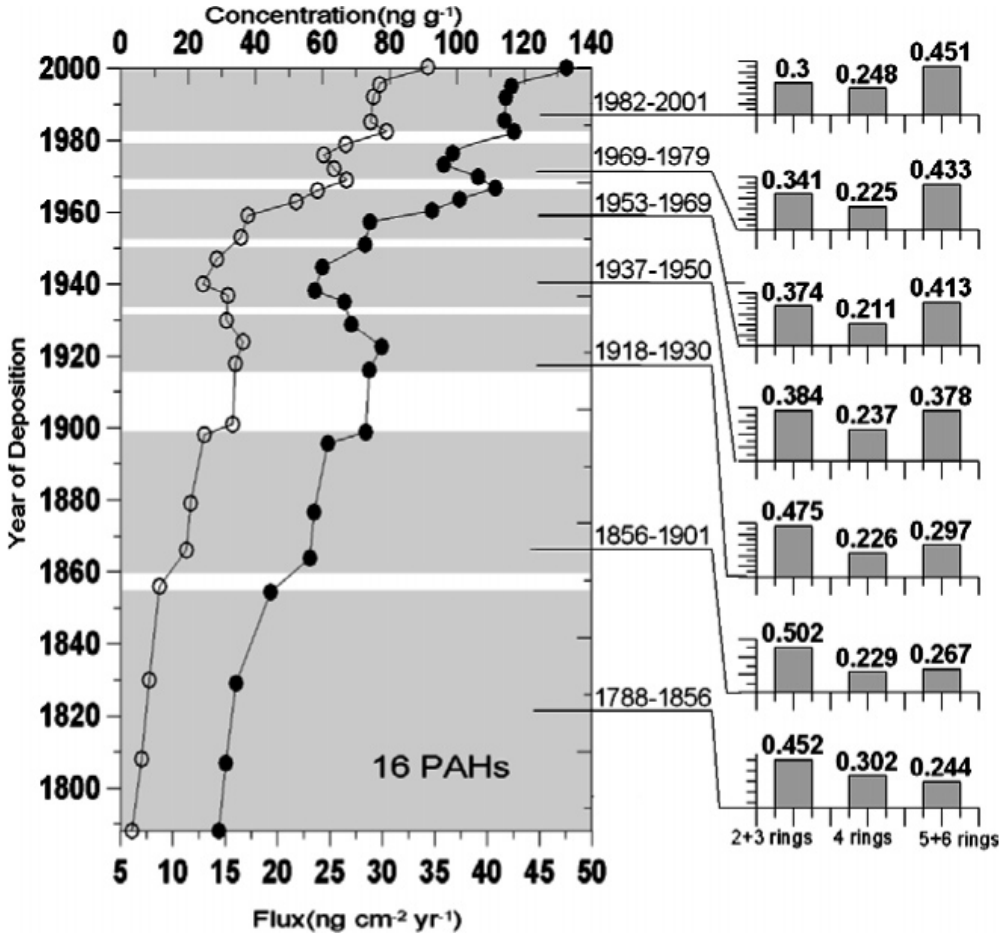


CO, Hg⁰,PHg Figure from Jaffe et al. 2005

Primbs and Simonich et al, *Environ. Sci. Technol.* **2007**, 3551-3558.

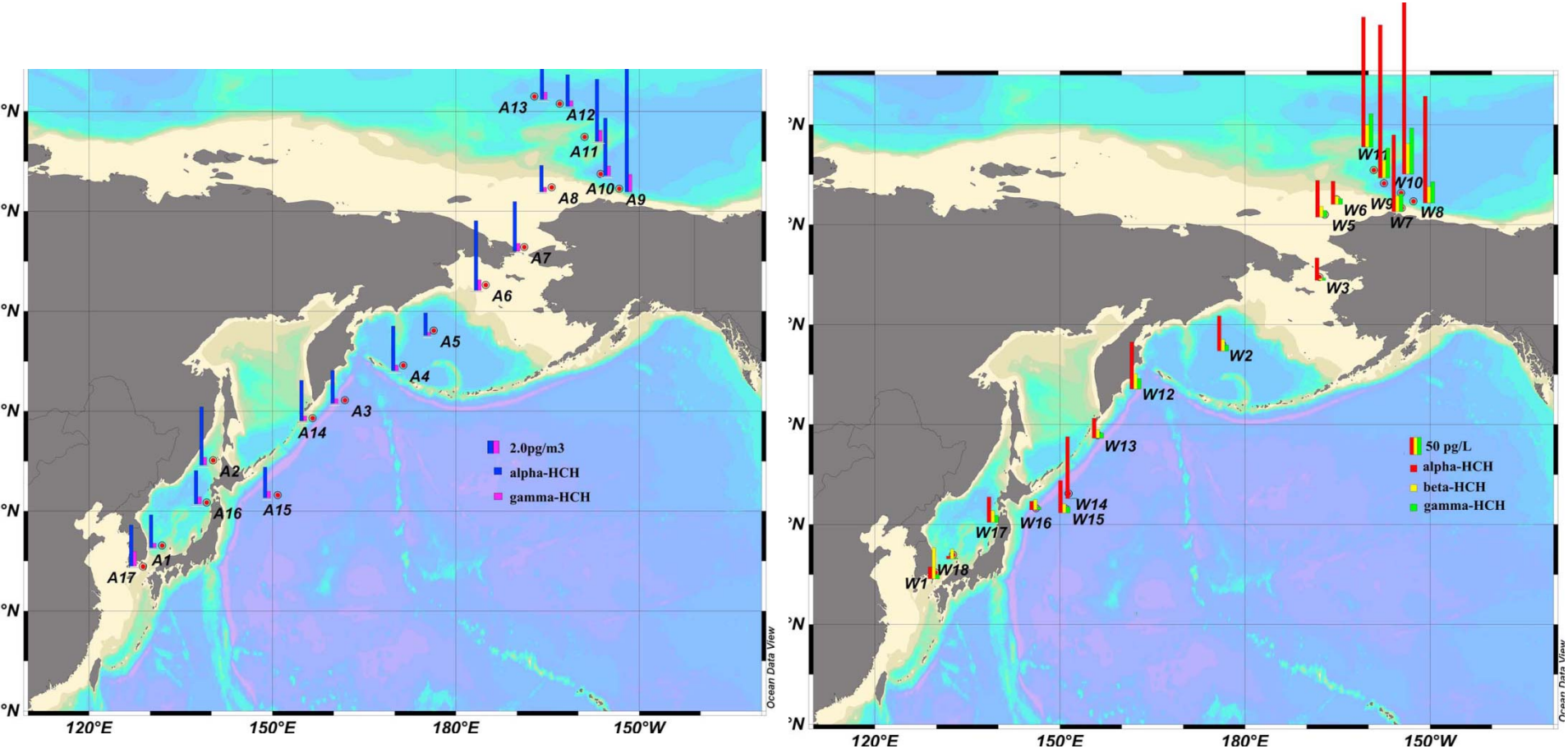
Atmospheric Deposition of PAHs to East China Sea





Guo, Lin, Fang et al, *Environ. Sci. Technol.* **2006**, 5304-5311

CHINARE2010 – Historic Use Pesticides

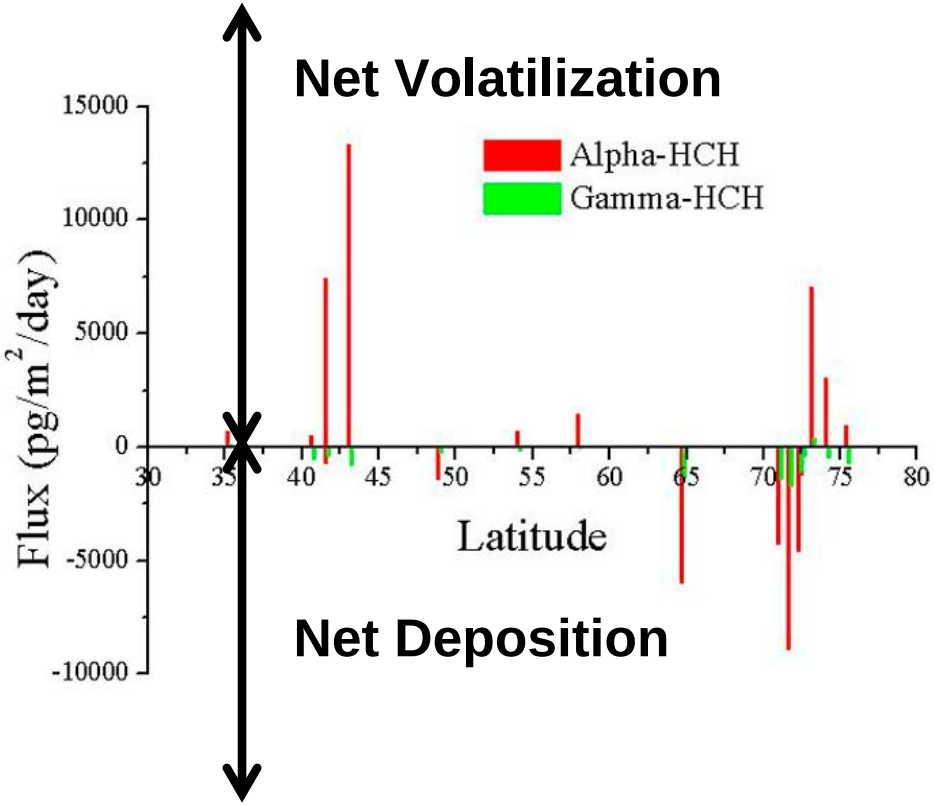


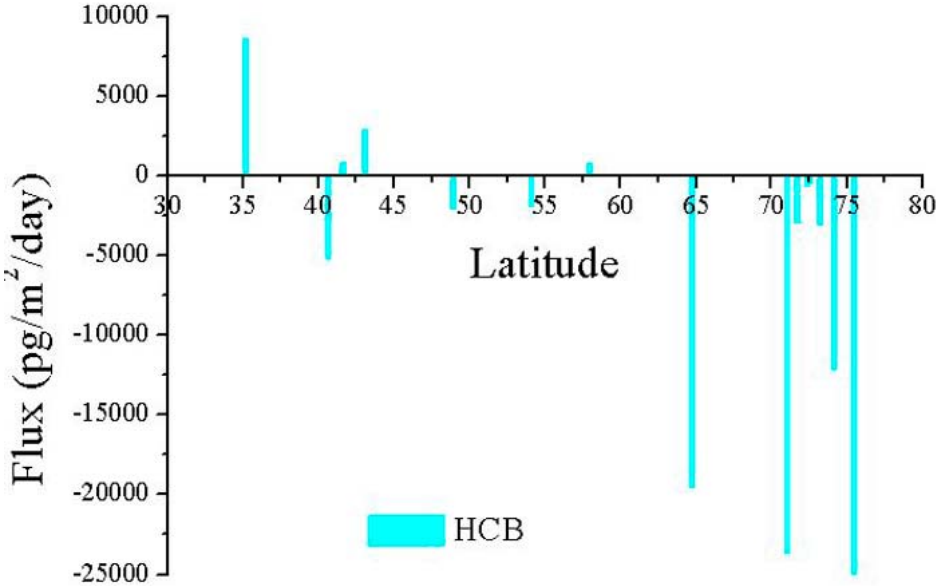
Air **Water**

Concentrations increase with latitude

Cai, Ma, Xie et al, *J. Geophysical Research* **2012**, D06311. doi:10.1029/2011JD016910

Historic Use Pesticide Net Flux

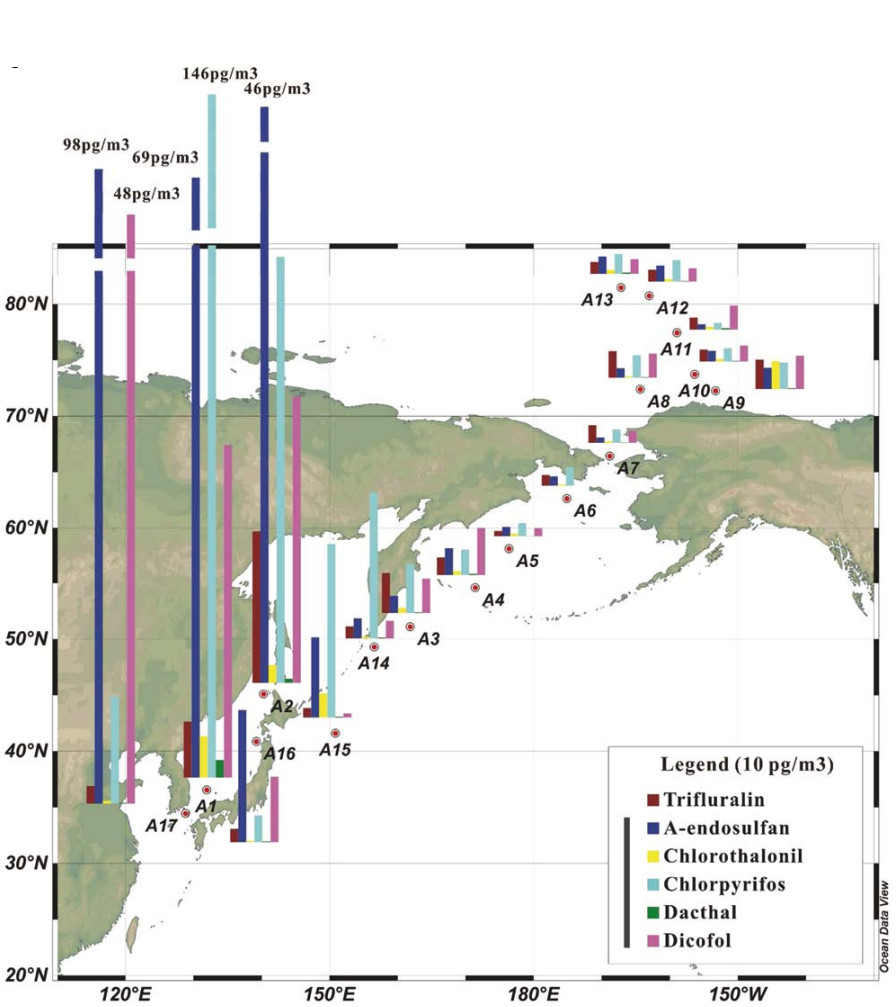


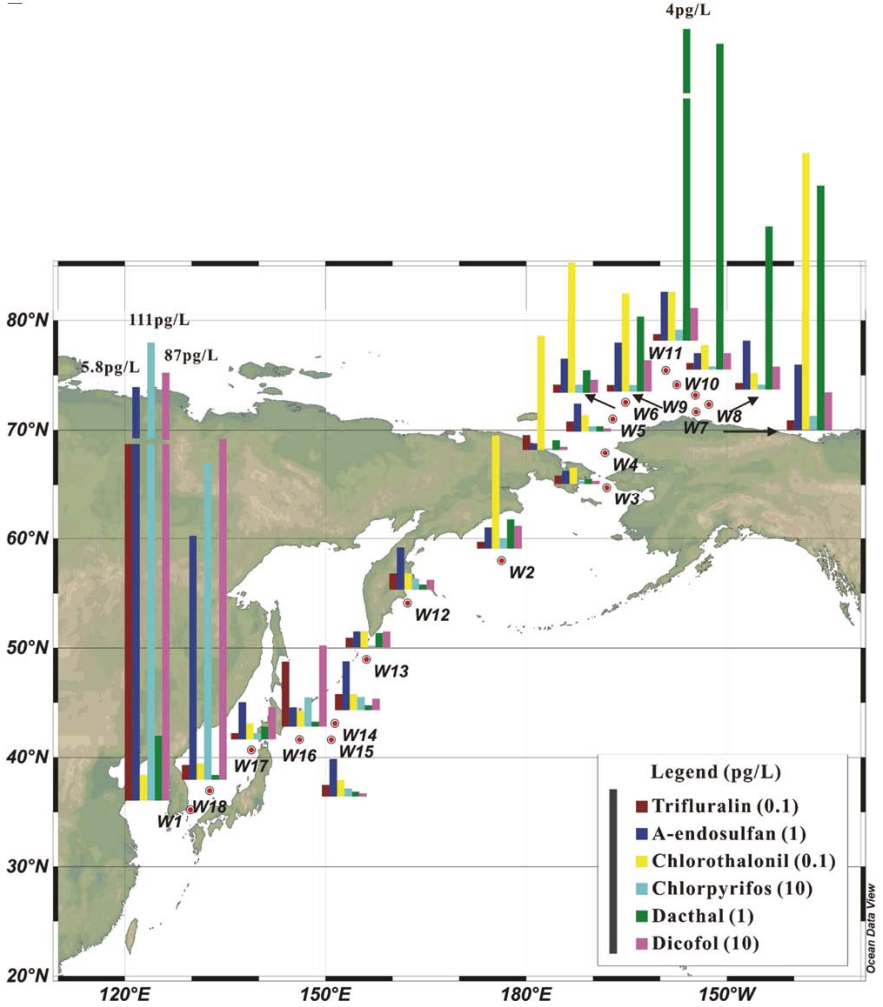


Net Deposition to North Pacific and Arctic Oceans

Cai, Ma, Xie et al, *J. Geophysical Research* **2012**, D06311. doi:10.1029/2011JD016910

CHINARE2010 – Current Use Pesticides



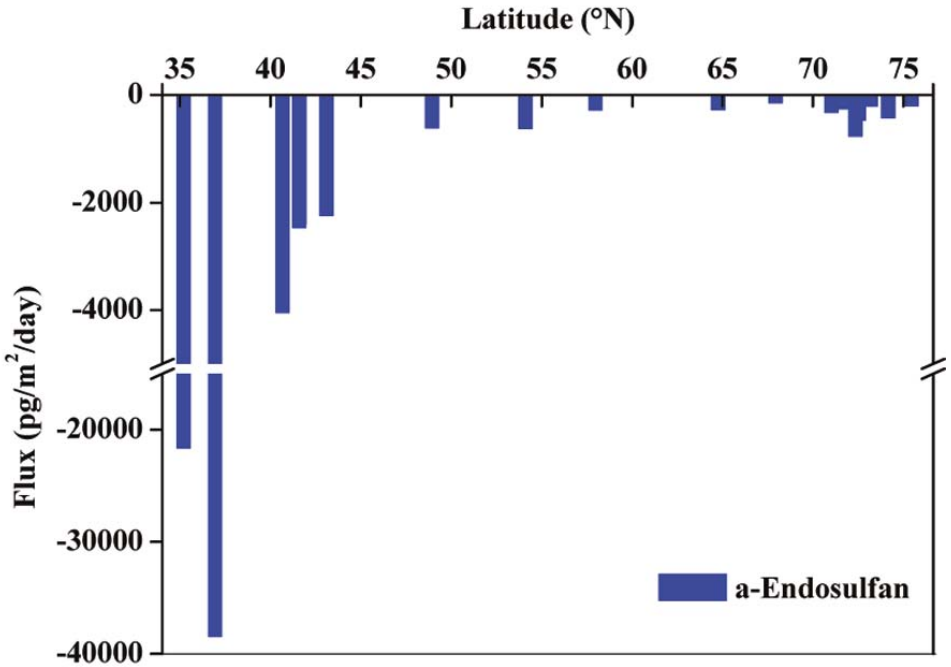


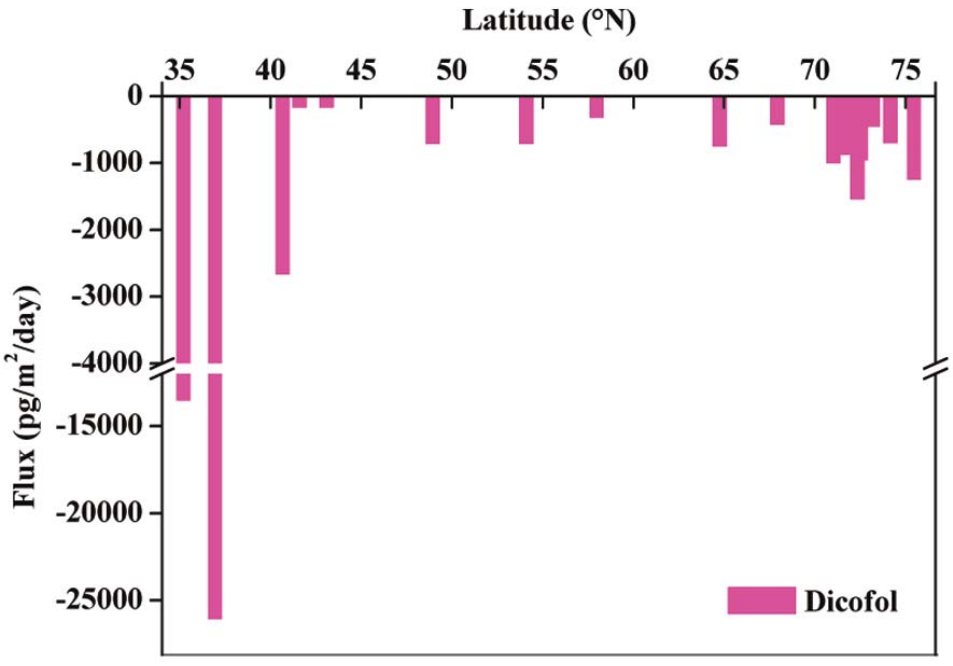
Air **Wate**

Concentrations decrease with latitude

Zhong, Xie, Cai et al, *Environ. Sci. Technol.* **2012**, 259-267

Current Use Pesticide Net Flux

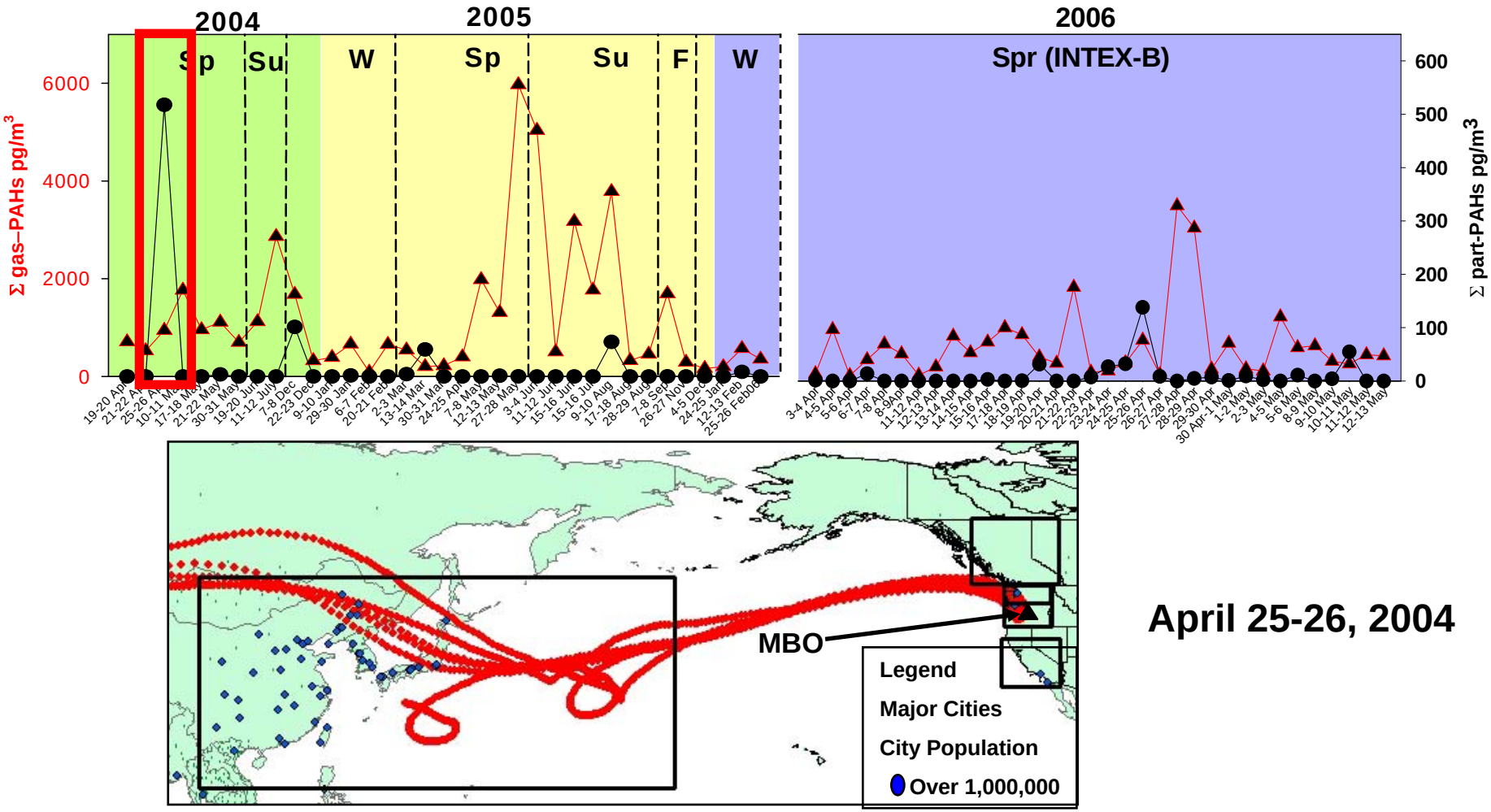




Net Deposition to North Pacific and Arctic Oceans

Zhong, Xie, Cai et al, *Environ. Sci. Technol.* **2012**, 259-267

Trans-Pacific Transport of Particulate Phase PAHs



April 25-26, 2004

Primbs, Simonich et al, *Environ. Sci. Technol.* **2008**, 6385-6391

Conclusions

- The outflow of POPs from Asia is significant.
- Atmospheric deposition of POPs to the North Pacific Ocean is significant and increasing for some POPs.
- Episodic trans-Pacific atmospheric transport of particulate phase polycyclic aromatic hydrocarbons, hexachlorobenzene and hexachlorocyclohexanes to North America has been identified.
- Additional research is needed to study the flux of POPs to/from the North Pacific Ocean with respect to climate change and the effects on organisms/food web.

Acknowledgements

National Institute of Environmental Health Sciences, National Institutes of Health – SRP (P30ES00210 and ES016465)

U.S. National Science Foundation (ATM-0239823)

National Scientific Foundation of China