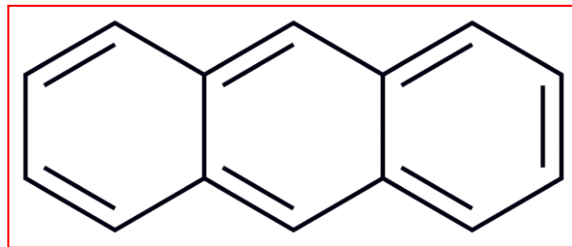


Modeling global atmospheric transport of PAHs (polycyclic aromatic hydrocarbons) with GEOS-Chem



Carey Friedman

Noelle Selin

MIT Center for Global Change Science

PAHs and Persistent Organic Pollutants (POPs)

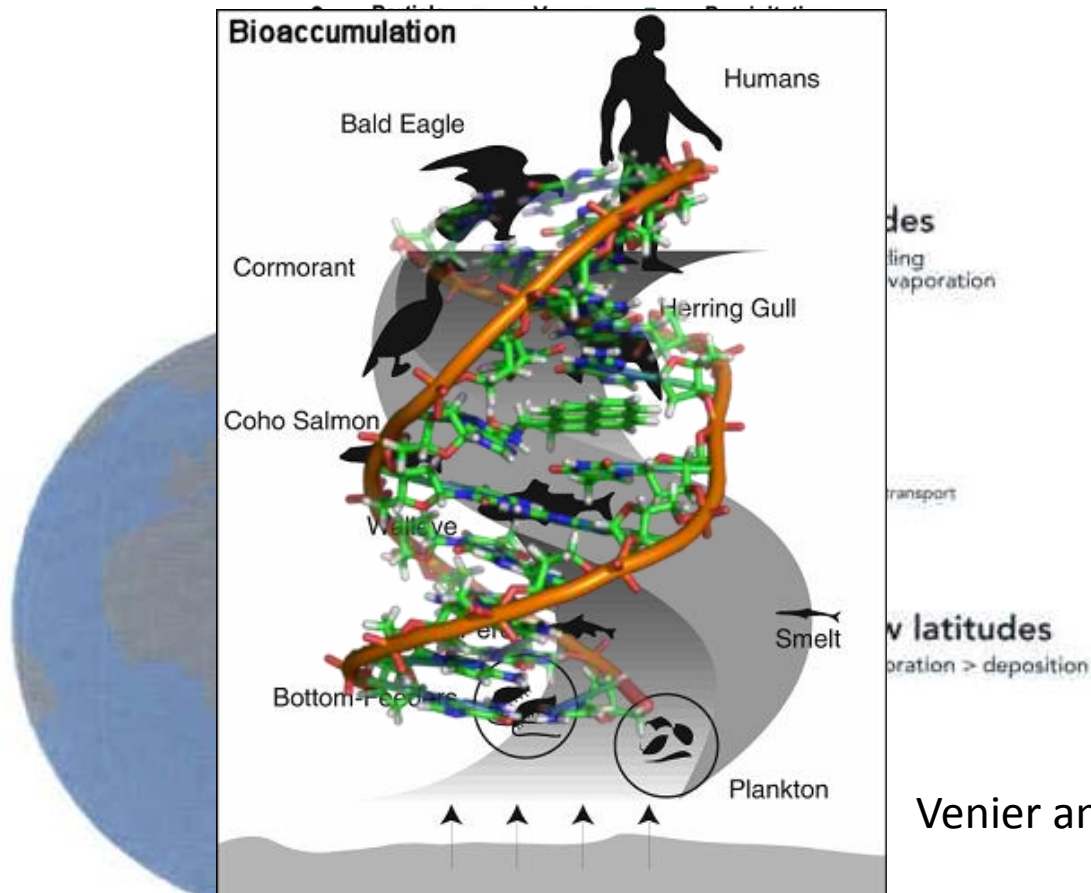


Toxicity

Bioaccumulation

Persistence

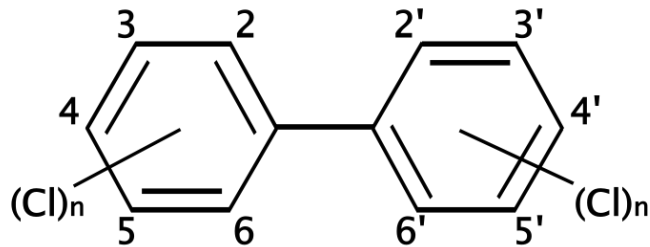
Long-range transport



Venier and Hites, EST, 2010

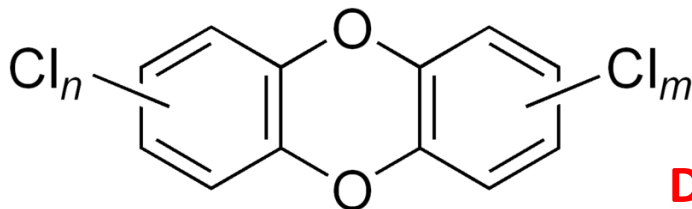
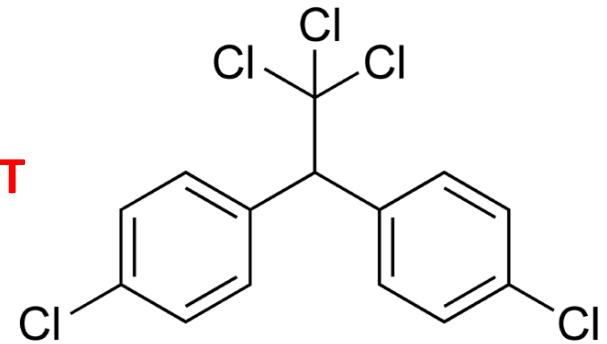
Most POPs have similar chemistry

- Despite different sources:
 - Industrial (PCBs, flame retardants)
 - Pesticides (DDT, lindane)
 - Unintentional byproducts (PAHs, dioxins, furans)



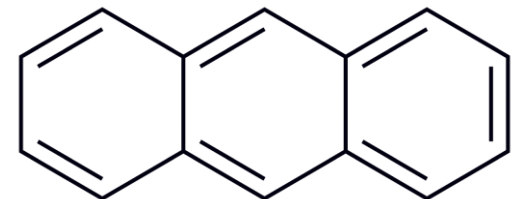
PCBs

DDT



Dioxins

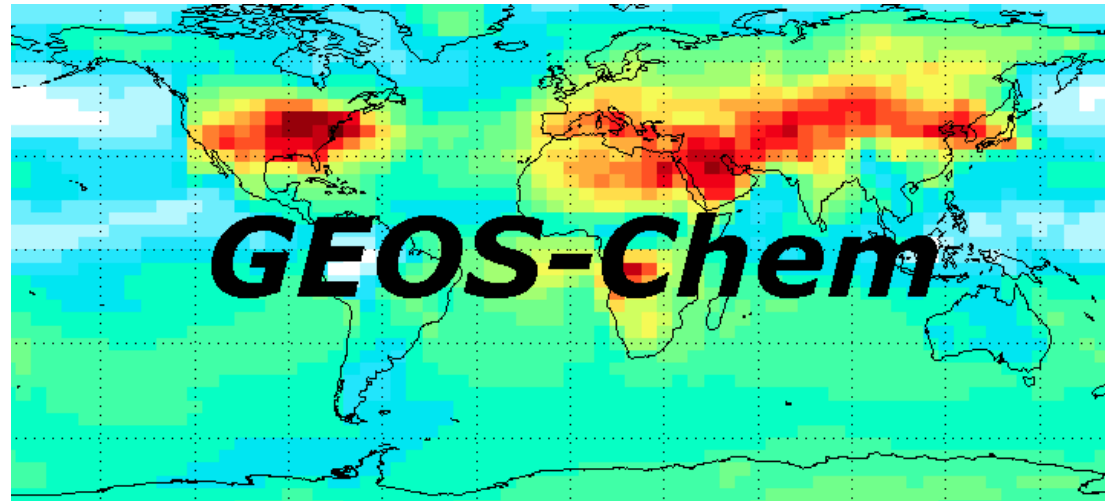
PAHs



We want a PAH model to answer:

- What is the best way to describe gas-particle partitioning?
- Is transport sensitive to on-particle oxidation?
- Can the grasshopper effect can be replicated?
- Can sources to Arctic/remote areas be identified?
- Should PAHs be regulated globally?
- Do toxic degradation products transport long distances?
- Will a predicted future climate affect global distribution?

Why use

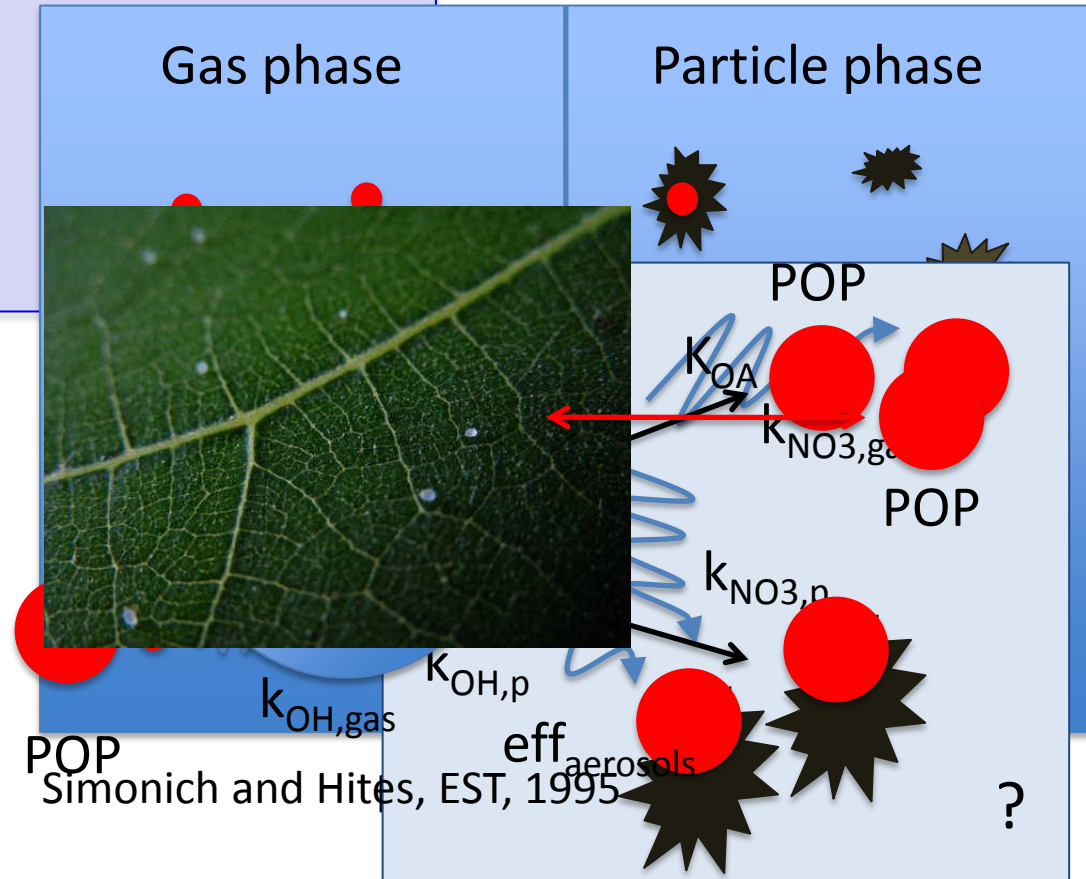


- Interested in long-range (global) transport
 - Previous models:
 - Multimedia box models (many examples)
 - Back-trajectory (e.g., Genualdi *et al.*, EST, 2009)
 - Regional (e.g., Lang *et al.*, EST, 2008; Zhang *et al.*, Atm Env. 2011)
 - None resolve episodic transport/meteorology globally
 - Better ability to compare with observations

Environmental behavior/model parameterizations

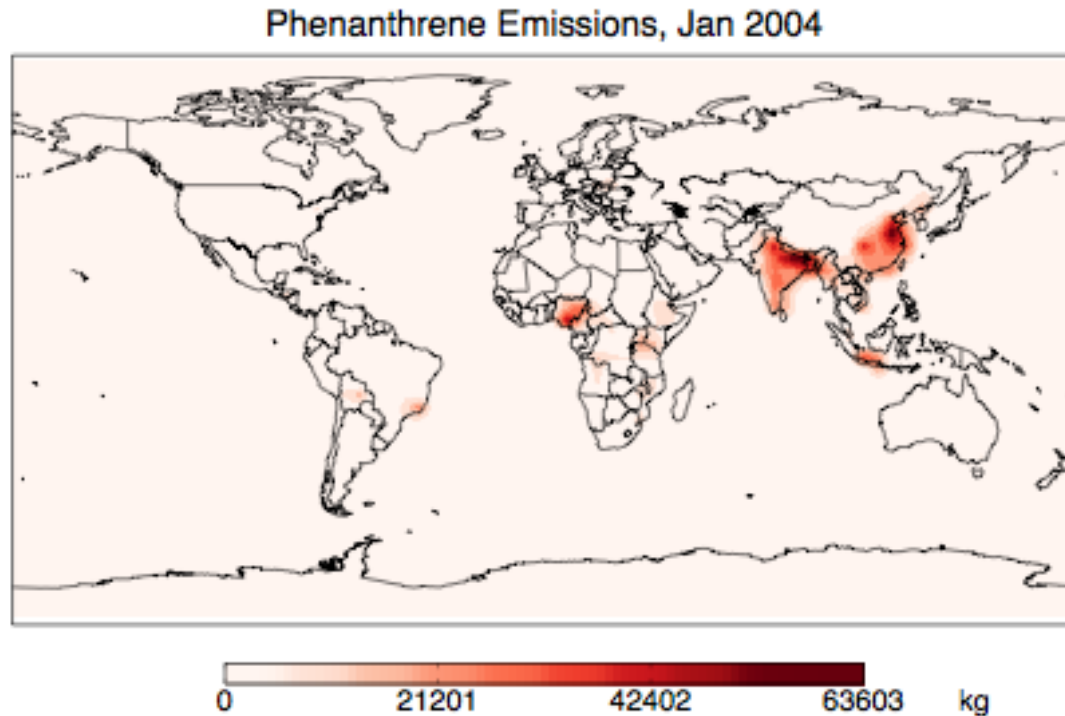
- Partitioning to particles
- Oxidation
- Wet deposition
- Dry deposition
- Re-volatilization
- Ocean transport

PAHs



Other parameterizations and validation

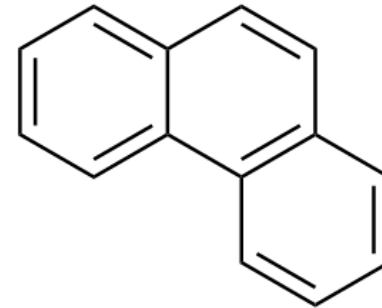
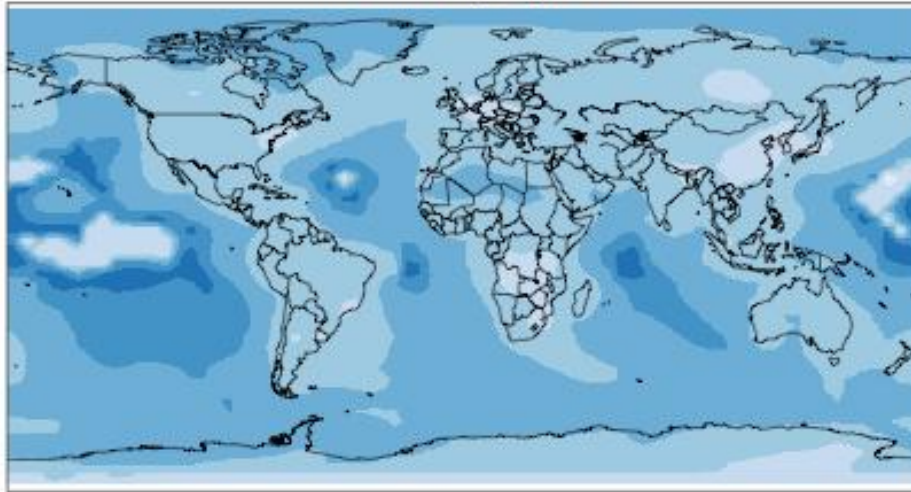
- Emissions (Zhang and Tao, 2009, *Atm. Env.*, 43:812)



- Measurement networks
 - IADN (Great Lakes, US), AMAP (Arctic, International), EMEP (across Europe, NCP (Canada), UNEP (International), others

Importance of gas-particle partitioning

Phenanthrene, July 2008

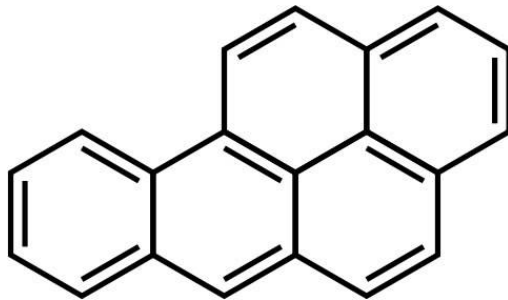
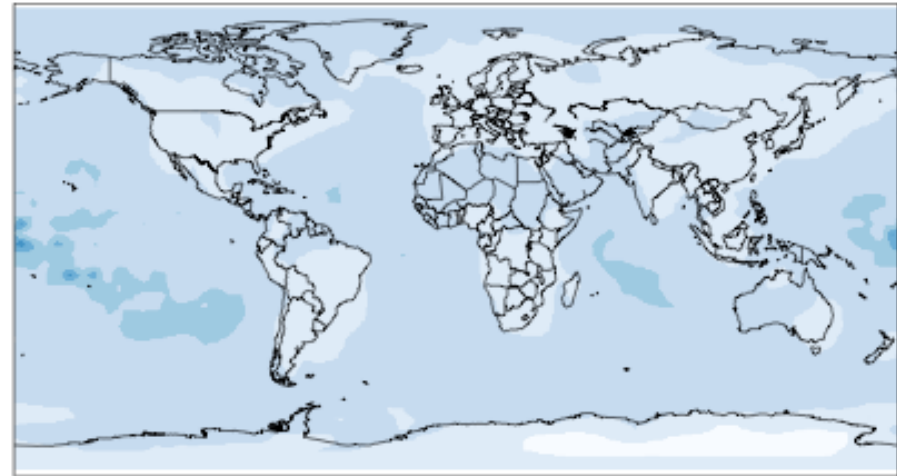


log scale



[Gas-phase]/[BC-phase]

Benzo[a]pyrene, July 2008



log scale



[Gas-phase]/[BC-phase]

Questions?

Thanks to:

Abby Koss (for compiling PAH measurements)

Qiaoqiao Wang (for OC and BC aerosol runs)

MIT Ferry Fund

