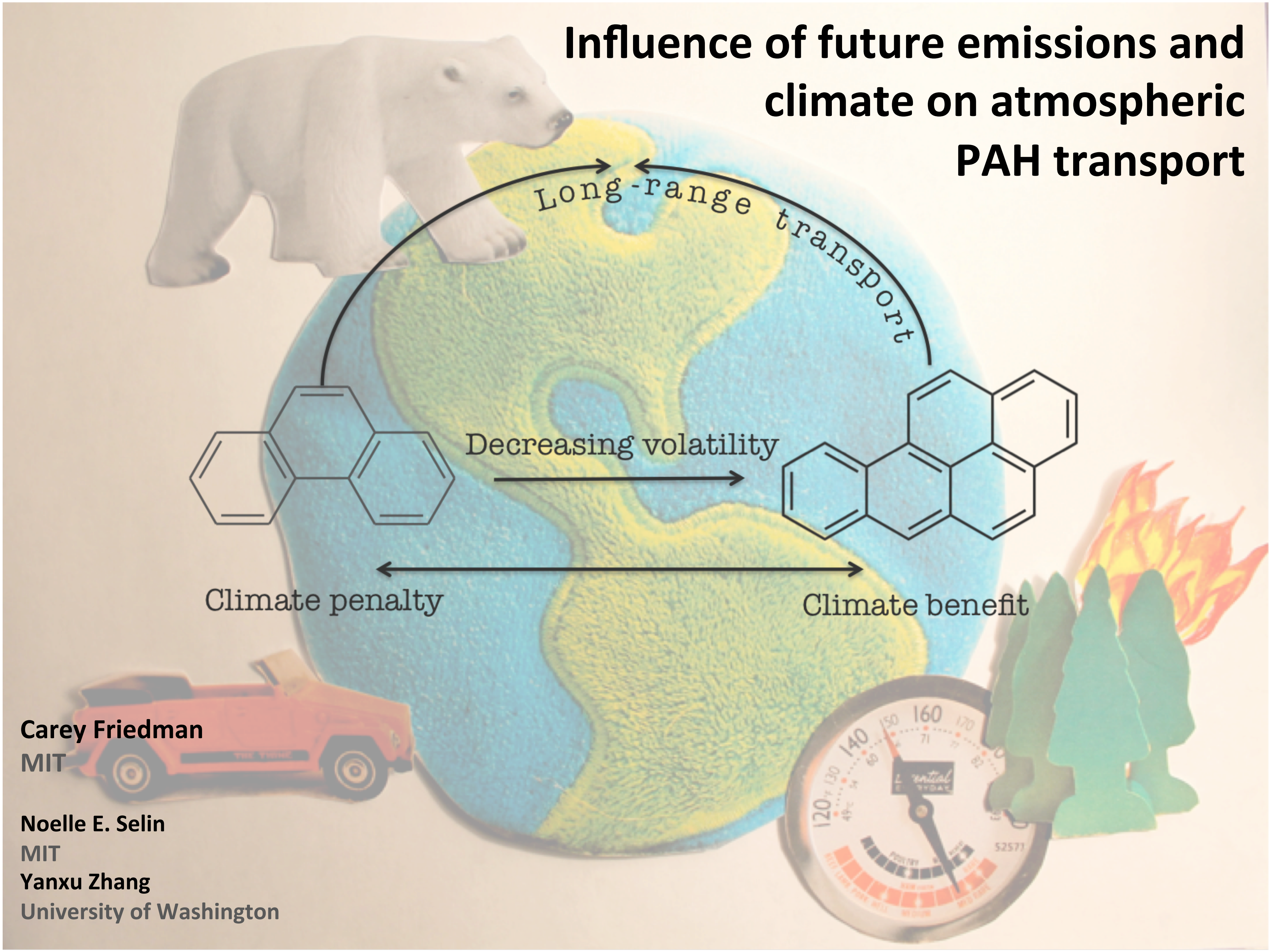
Influence of future emissions and climate on atmospheric PAH transport



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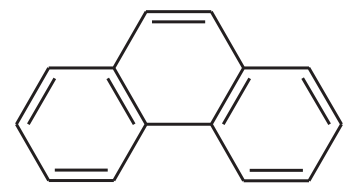
Polycyclic aromatic hydrocarbons (PAHs): Why do we care?

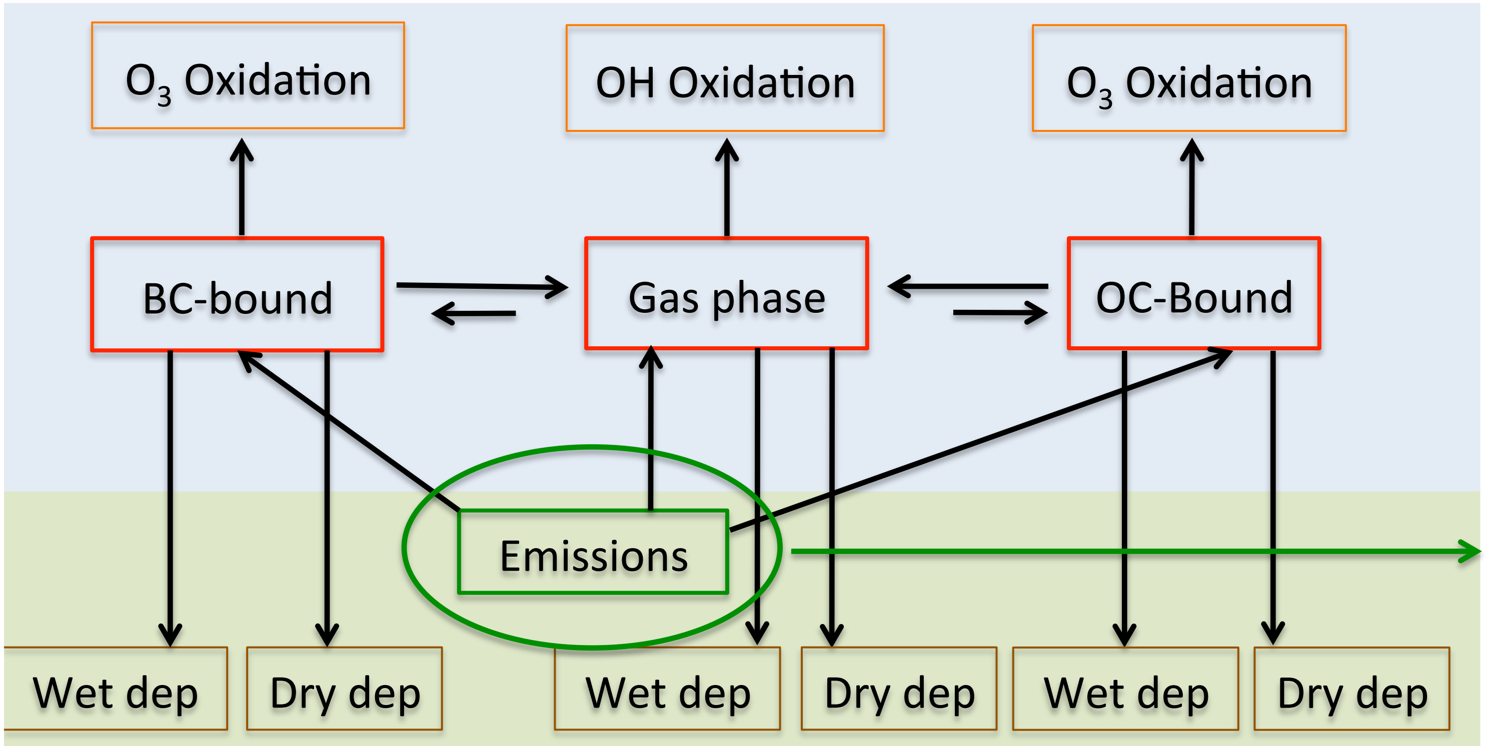
- Probable/possible human carcinogens (U.S. EPA)
- Travel long distances in the air (measured in Arctic)
- Exposures include inhalation



Questions in this study:

- What is the relative influence of future (2050) climate and future emissions on PAH transport?
- How might we diagnose climate versus emissions influences?

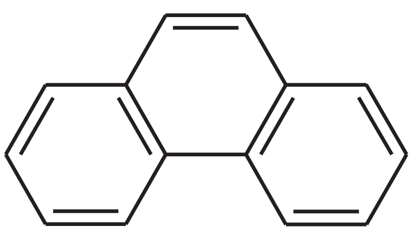
The GEOS-Chem PAH model



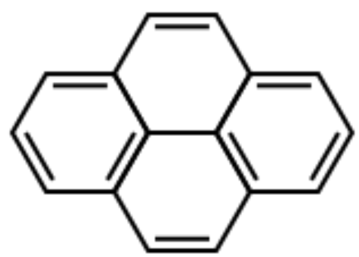
Friedman and Selin
ES&T 2012

Emissions:
1) Primary
2) Secondary

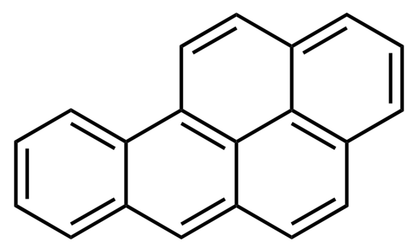
Phenanthrene (PHE)



Pyrene (PYR)



Benzo[a]pyrene (BaP)

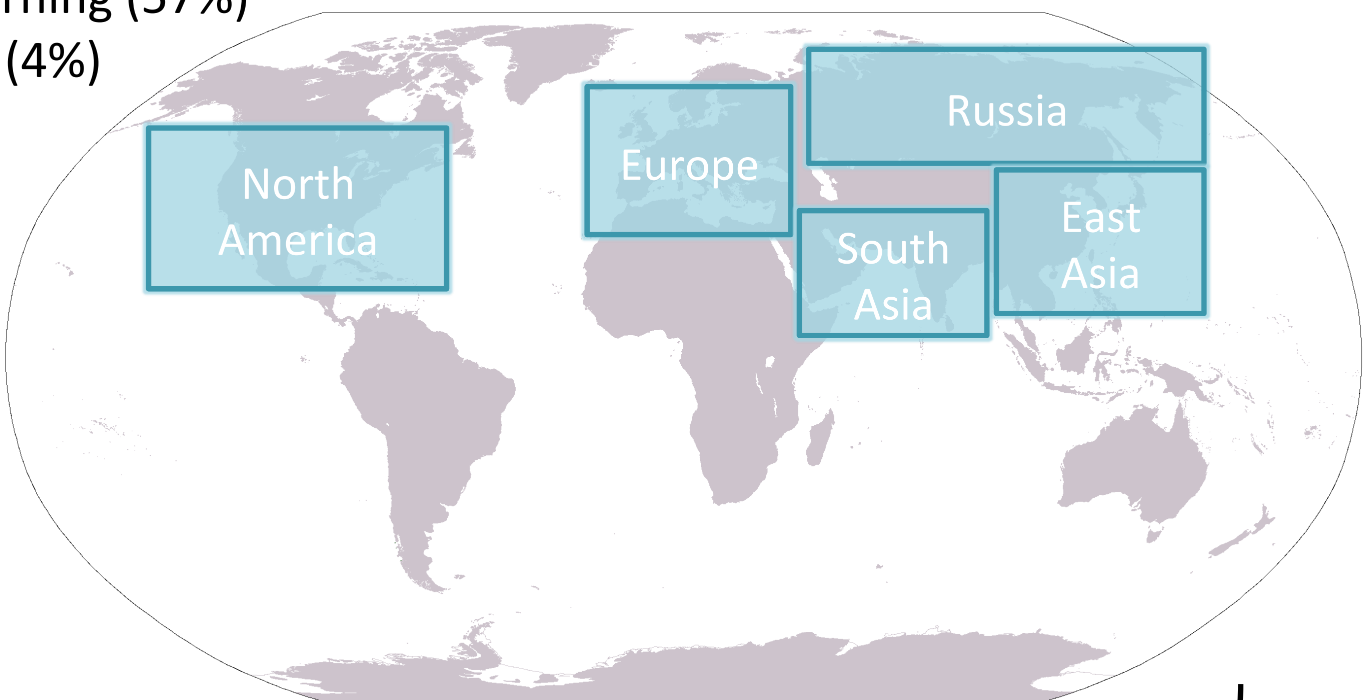


Gas ⟷ Particulate

This study: future emissions and future climate

We scale the top (70%) global anthropogenic sources from the
Zhang and Tao (*Atmos. Environ.*, 2009) inventory from ~2000 to 2050:

Traditional biomass burning (57%)
Domestic coal burning (4%)
Vehicle emissions (5%)
Coke production (4%)



EMISSIONS GO DOWN

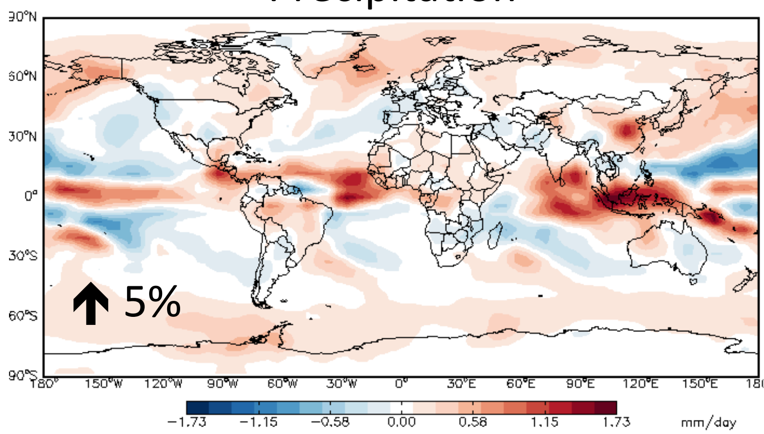
Particles: OC ↓ BC ↓ Oxidants: OH ↑ O_3 ↑

This study: future emissions and future climate

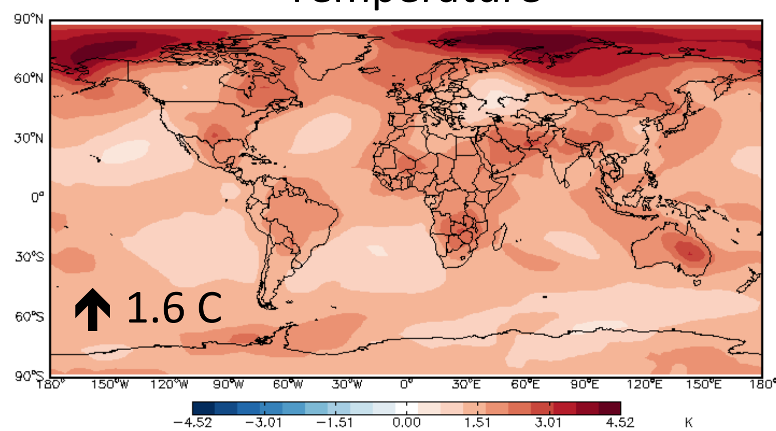
We simulate present and future climate with GISS GCM meteorology from the GCAP project:

	Present climate	Future climate (IPCC A1B)
Mean of simulated years:	1997-2003	2047-2053

Precipitation



Temperature



Wildfire emissions (17%) } ↑ or no change

Particles: OC ↓ BC ↓ Oxidants: OH ↓ O_3 ↓

Results: Volatility Matters

Change in mean northern hemisphere concentrations

2050-2000:

Phenanthrene (volatile)

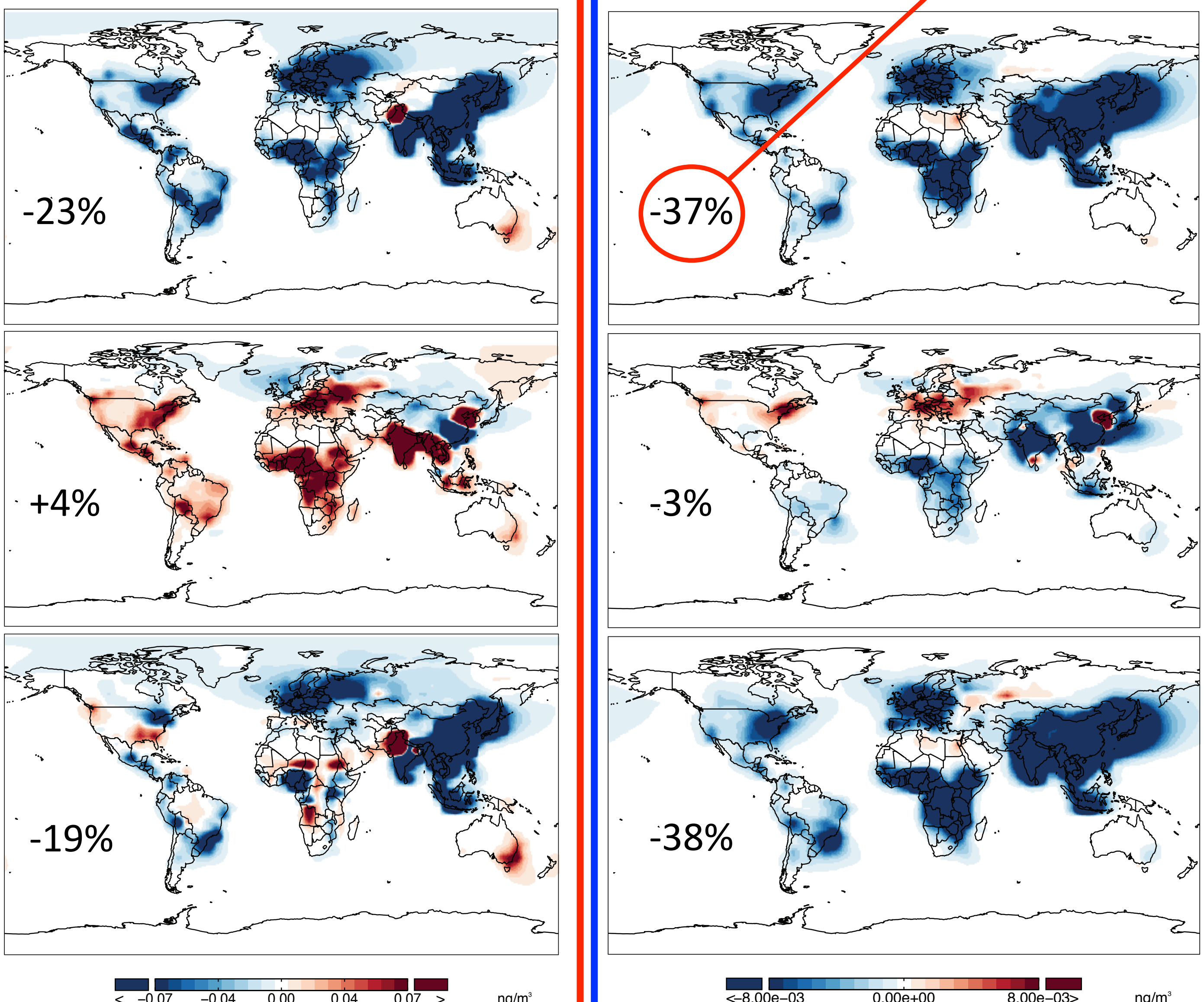
Benzo[a]pyrene (non-volatile)

Emissions

Climate

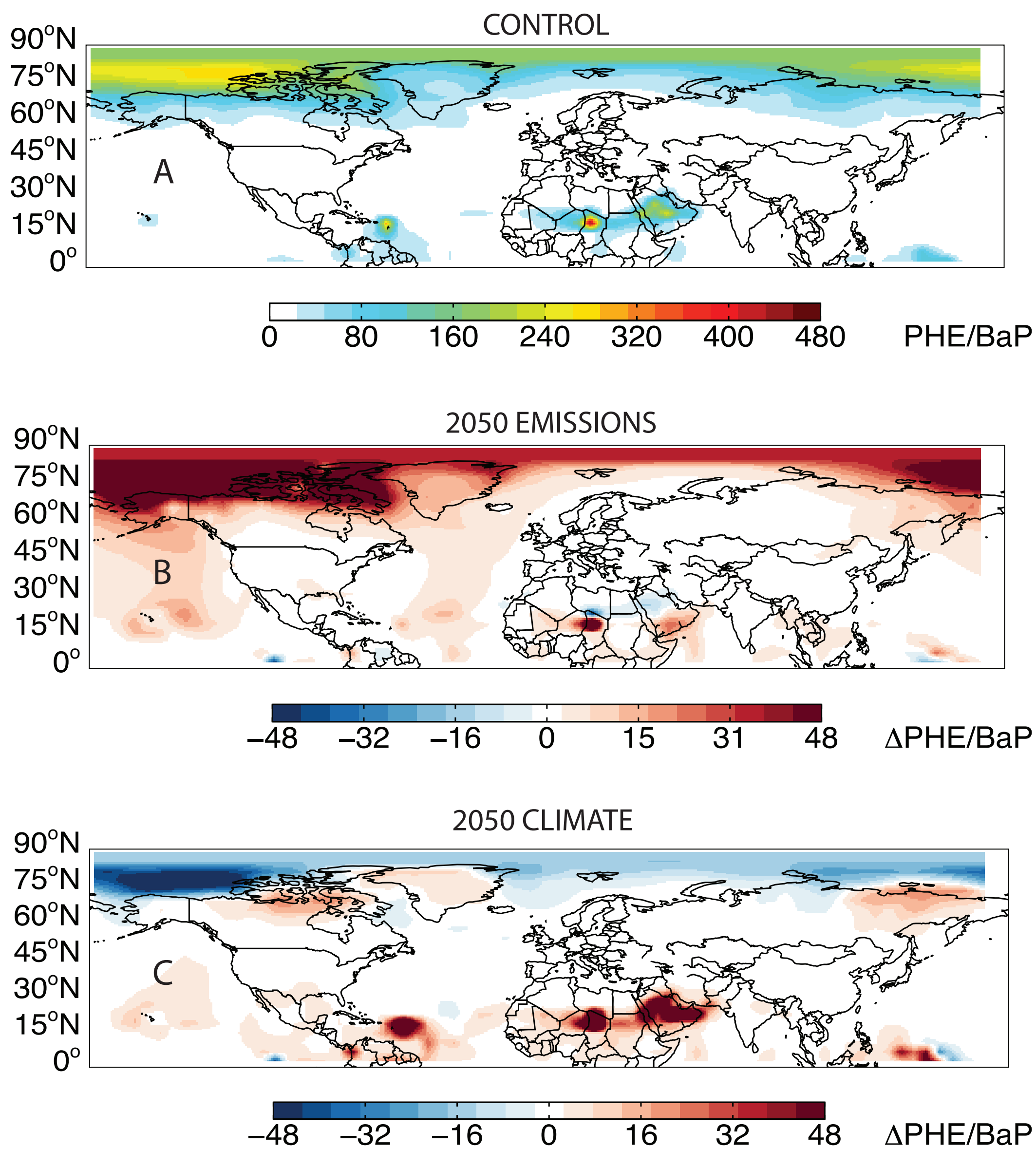
Emissions & Climate

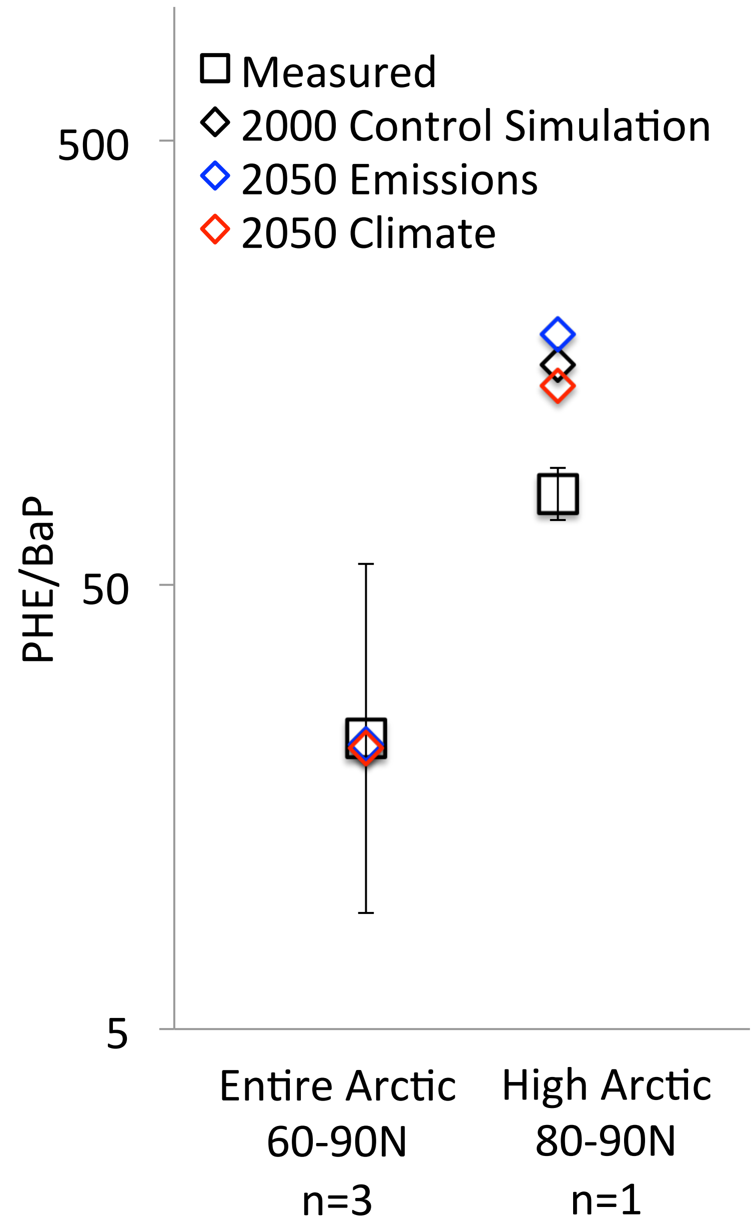
CLIMATE PENALTY: 19%



CLIMATE BENEFIT: 5%

The Arctic is a priority for resolving climate vs. emissions influences





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Related literature:

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