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Multi-scale data assimilation and model comparison for ABoVE to identify processes controlling CO_2 and CH_4 exchange and influencing seasonal transitions in Arctic tundra ecosystems

Munger-04

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Institutional Collaborations

- U. S. NOAA & DoE (LBNL)
- Harvard University, Univ. AK, Fairbanks, San Diego State Univ., AER Inc.

And… but… therefore

Observations of CO_2 and CH_4 fluxes from tundra demonstrate previously unrecognized carbon exchange during transition seasons, and transition seasons are especially sensitive to climate because the ice-water phase transition happens over a narrow temperature range, thus annual carbon balances may be acutely sensitive to processes during the critical seasonal transitions.

Therefore, we will assimilate data and models to examine how the large pool of carbon stored in frozen tundra soils is responding to changing climate conditions.

Science Questions & Objectives

- #6 How are the magnitudes, fates, and land-atmosphere exchanges of carbon pools responding to environmental change, and what are the biogeochemical mechanisms driving these changes
- Tier 2 Science Objectives

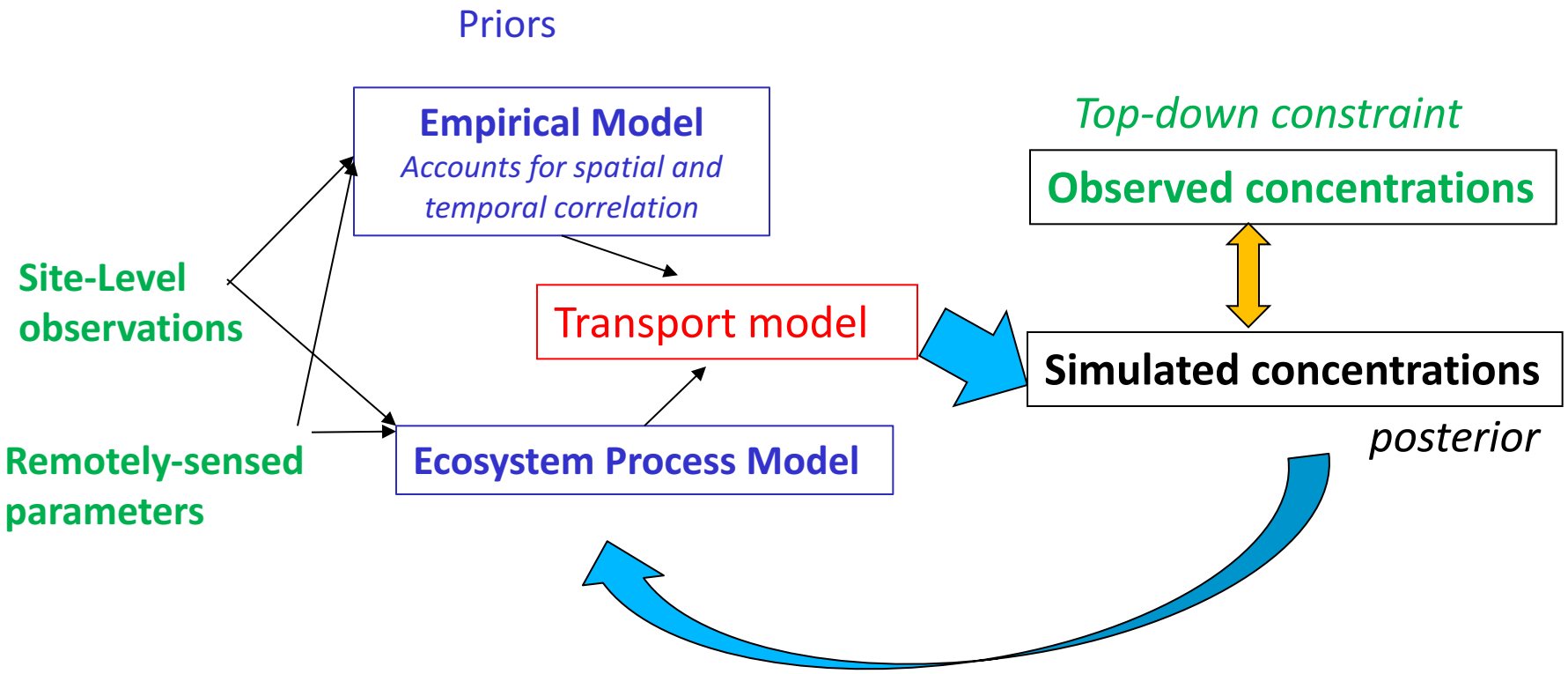
#6 Elucidate how climate change and disturbances interact with above - and belowground communities and processes to alter carbon biogeochemistry, including release to surface waters and the atmosphere

#5 Determine the sources of variations in climate feedbacks from Arctic and boreal ecosystems and assess the potential for futurechanges to climate regulating services at regional to global scales.

Overarching Project Questions

- Are observed patterns of transition-season carbon exchange occurring throughout the region, or are they confined to local “hotspots”?
- What environmental state variables best predict the timing of seasonal transitions in carbon exchange at the local level?
- How can they be extended to larger regions?
- Are simulated carbon exchange rates consistent with the top-down constraint imposed by observed CO_2 and CH_4?
- If there are mismatches to the observations, what missing processes are suggested?

Project framework



+ other empirical & process-model estimates from ABoVE team

Data sources

Data Type	Source
Plot-scale fluxes	Flux towers, Toolik & Barrow
Active Layer Thickness & subsurface variables	Site level data archives, CALM, ABoVE data products
Background Concentrations	NOAA flask network, ABoVE airborne in situ,
In situ concentrations	CARVE, ACME-V, NOAA
Satellite column observations	OCO-2, TROPOMI
Vegetation state	MODIS reflectance, GOME & OCO-2 SIF, ABoVE airborne observations

Geospatial Data Products

- *What?* 3.3 km meteorology fields;
  Optimized empirical flux estimates;
  Process-model fluxes
- *Where?* Alaska North Slope
- Formats and grid projections adaptable to user needs
- *When?* selected focus periods 2015-2018
- Data users: modeling community, ABoVE Science Team

Questions?

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Job opportunities! We have a post-doc opening for someone interested in ecosystem modeling