Benchmarking large-scale carbon fluxes in the CMIP6 ensemble using novel CO_2 observations

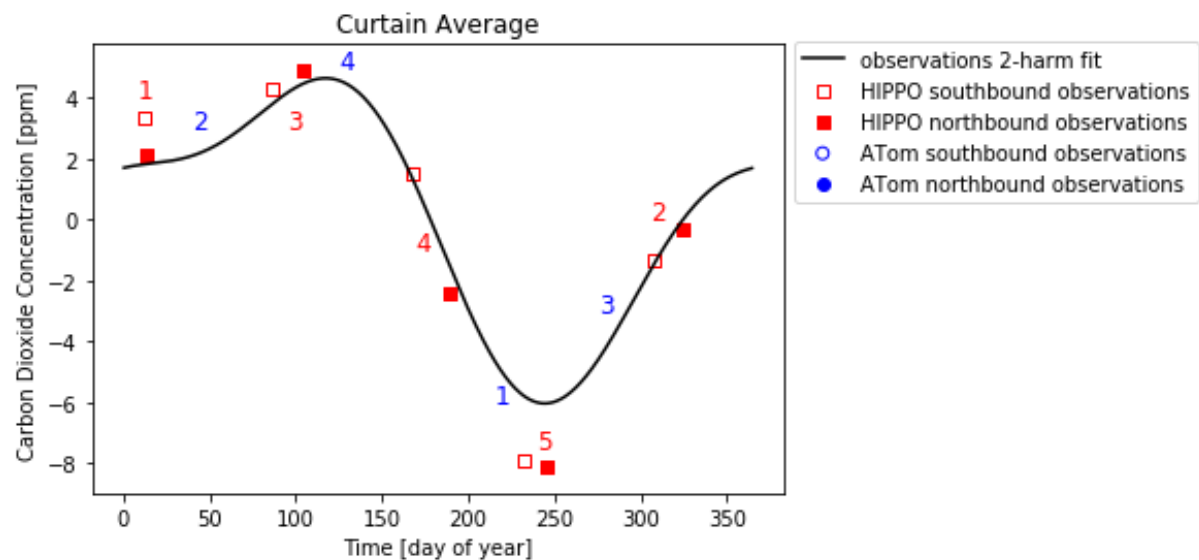Gretchen Keppel-Aleks[1], Morgan Cheatham[1], Britton Stephens[2], Ke Xu[1], and Nate Collier[3]
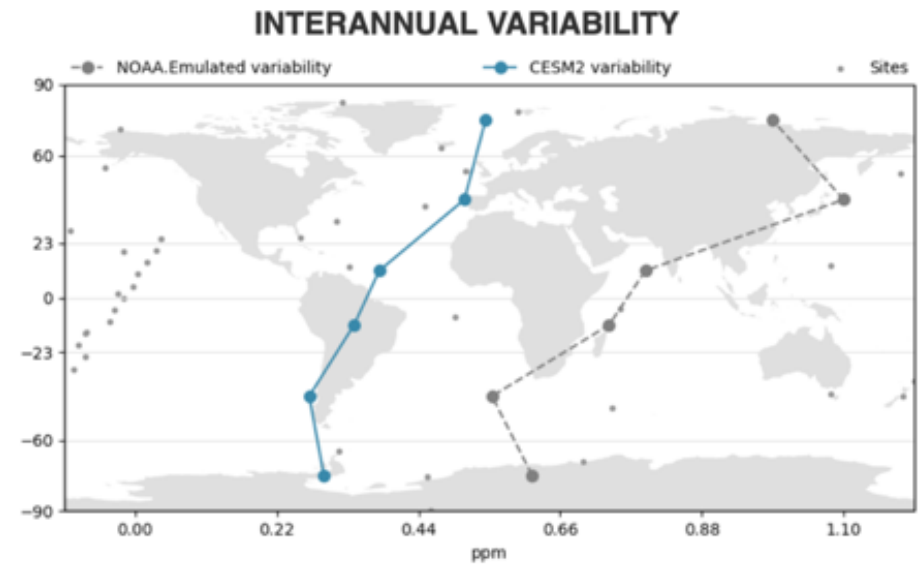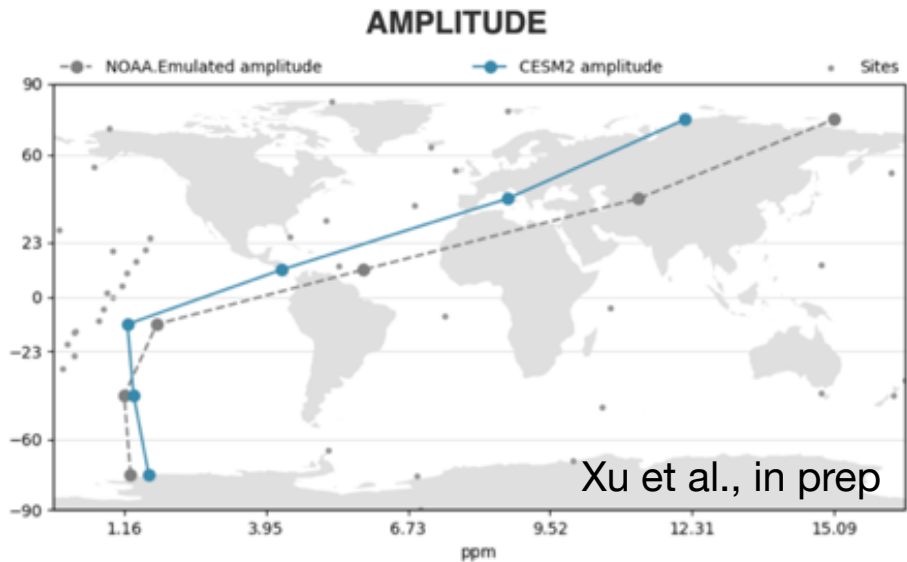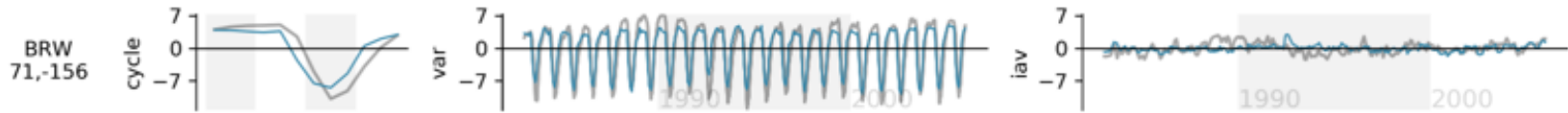
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We have developed new metrics to quantify large scale land-atmosphere carbon exchange using atmospheric CO₂ observations

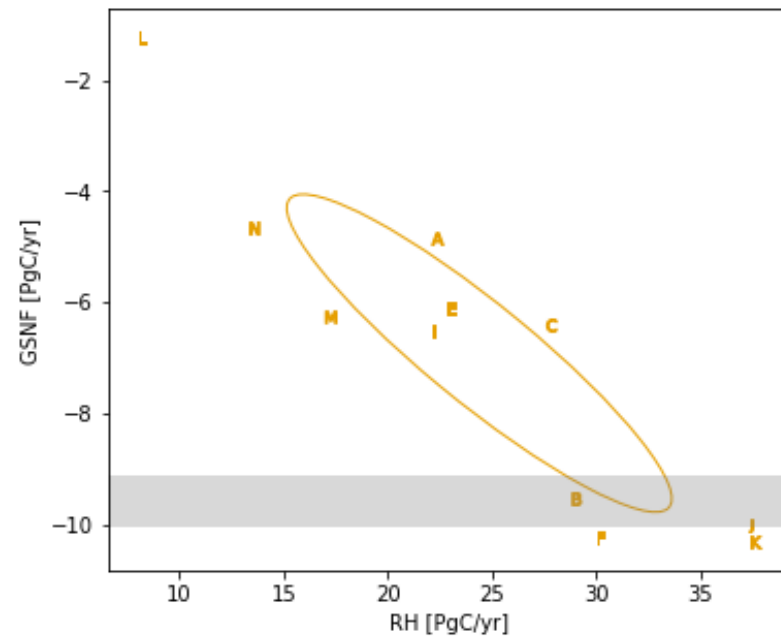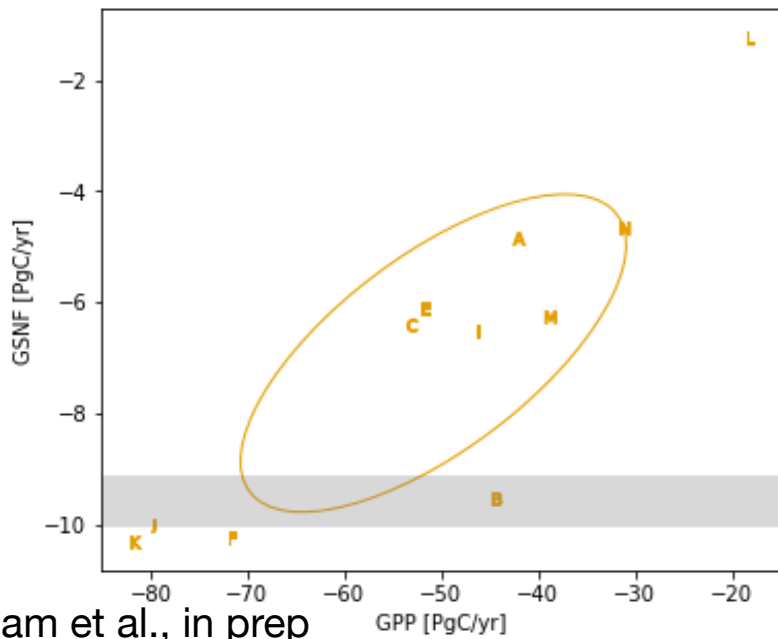

Xu et al., in prep

Cheatham et al., in prep

Given strong relationships between net carbon exchange and heterotrophic respiration (HR) in CMIP6 models, we will leverage multiple datasets within ILAMB to drill into processes
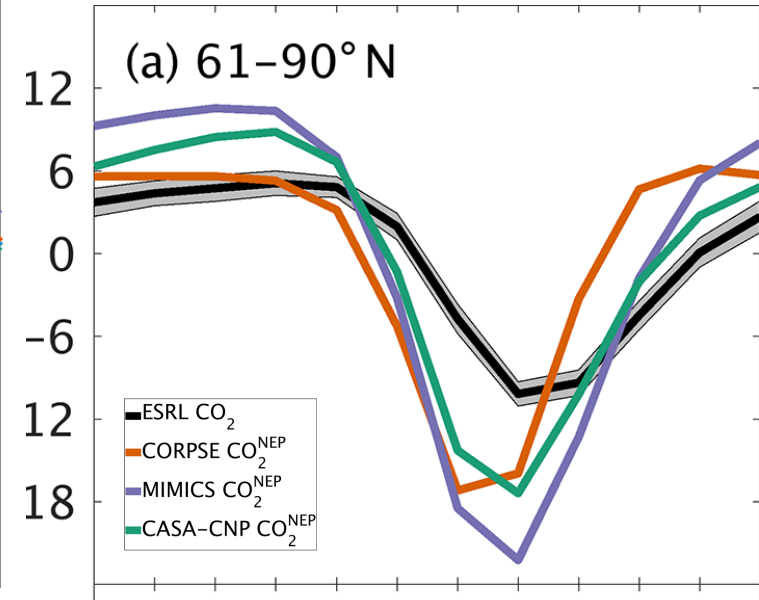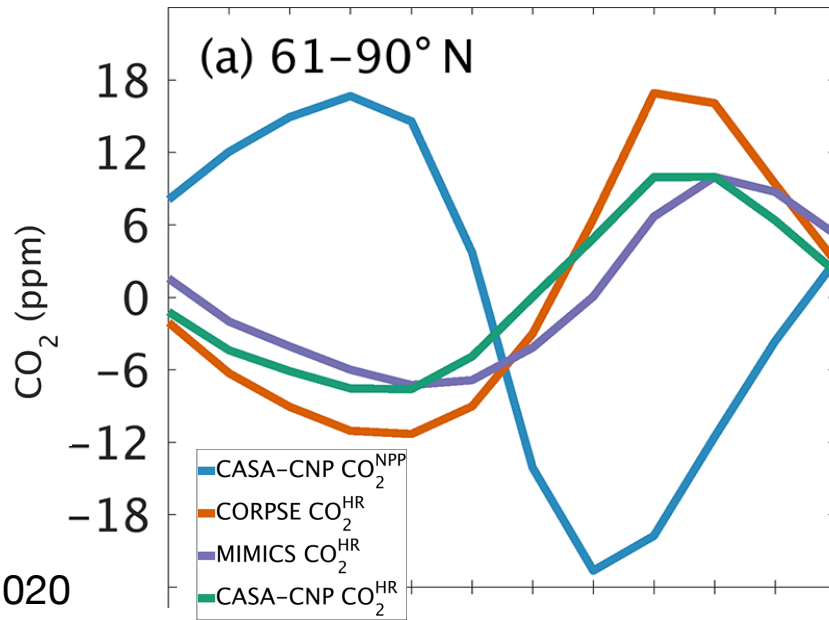
Basile et al., 2020

Cheatham et al., in prep

Relationship to White paper

- Evaluate plant physiological and land surface responses to changing atmospheric CO_2 levels, surface energy budgets, nutrient availability, and regional environmental conditions.

Atmospheric CO_2 is the ultimate carbon-climate feedback. Our understanding of land surface responses must result in getting the atmospheric CO_2 mole fraction correct for the right reasons.

- Characterize and evaluate soil dynamics (e.g., decomposition, nutrient cycling, cryoturbation) to better understand distributions of soil organic matter and influences of turnover time using isotope data and advanced tracer methods.

Our research suggests that atmospheric observations contain a lot more direct or proxy information about heterotrophic respiration that can be used as a top-down constraint on process level information solicited here.

- Develop and distribute model benchmarking tools employing novel metrics for evaluating model fidelity of ESMs in terms of representation of biogeochemical processes and feedbacks to the Earth system.

We are continuing to develop methods to use atmospheric CO_2 to evaluate modeled fluxes, both by comparing mole fractions directly and by translating atmospheric observations into robust flux signals that can be directly compared with local to regional scale flux constraints.