

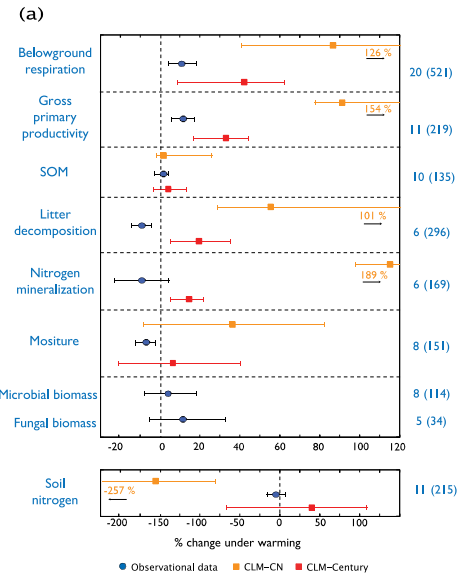
# Observations in Tundra Imply Needed Improvements in Land Models

## Objective

We describe an observational and modeling meta-analysis to benchmark land models and identify needed improvement. We applied the method to CLM with two versions of belowground biogeochemistry (CN and Century).

## Research

- We extracted benchmark metrics (e.g., belowground respiration, soil organic matter content) from 53 manipulation experiments studies across 17 high-latitude ecosystems.
- We calculated a response ratio of a metric relative to the control.
- We performed complimentary CLM4.5 simulation and analyzed discrepancies.



Carbon cycle responses to warming in observations (blue) and two versions of CLM. CLM performed poorly against many of these observations.

## Impacts

- We identified poor representation of microbial activity, above- and belowground coupling, and nutrient cycling as the primary reasons for the discrepancies.
- Identifying deficiencies in the model structure can motivate future experiments and focus model development efforts.

Reference: Bouskill NJ, Riley WJ, Tang J (2014) Meta-analysis of high-latitude nitrogen-addition and warming studies implies ecological mechanisms overlooked by land models. *Biogeosciences*. 11:1-15.