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The impact of the temperature sensitivity of ecosystem respiration on the climate-carbon cycle feedback strength

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Rapidly increasing atmospheric carbon dioxide concentrations are altering the Earth's climate. The anthropogenic perturbation of the global carbon cycle is expected to induce feedbacks on global climate and future CO2 concentrations. However, these feedbacks are poorly constrained and potentially large. Prediction of these feedbacks using Earth System Models (ESMs) requires knowledge of mechanisms connecting carbon and nutrients in the biosphere with the climate system. In order to reduce the range of uncertainty in climate predictions, model representation of feedbacks must be improved through comparisons with contemporary observations. The climate sensitivity of land carbon storage (γ-land) varied by a factor of almost nine in the 11 C4MIP models (Friedlingstein et al., 2006), suggesting a large uncertainty in ecosystem responses to climate change. The temperature sensitivity of terrestrial ecosystem respiration (Q10), a significant component of γ-land, was recently reported to be independent of mean annual temperature, constant across biomes, and confined to values around 1.4±0.1 based on observations from 60 FLUXNET sites, suggesting a weaker climate-carbon cycle than projected by most models (Mahecha et al., 2010). Presented will be the results from a sensitivity analysis across different time scales using a range of Q10 values for heterotrophic respiration (Rh) in the Community Land Model version 4 (CLM4). The sensitivity of the annual cycle of CO2 will be evaluated and compared with measurements from Globalview-CO2 sites. In addition, the effect of different Q10 values on the modeled ecosystem response to the El Niño-Southern Oscillation and on the long term trend in CO2 will be discussed.