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The sensitivity of latent heat flux to changes in the radiative forcing: A framework for comparing models and observations

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A climate model must include an accurate surface physics scheme to examine the effects of a changing atmosphere. Given an increase in the radiative forcing, the sensitivity of surface latent heat flux to available energy plays an important role in determining the energy budget and has a significant influence on the sensitivity of surface temperature.

The Penman-Monteith model of evapotranspiration is used to construct a physically-based framework for evaluating the climatology of evapotranspiration and the sensitivity of latent heat flux to available energy. Regional Climate Model version 3 (RegCM3) coupled to Integrated Biosphere Simulator; RegCM3 with its native land surface model, Biosphere-Atmosphere Transfer Scheme 1e; and FLUXNET micrometeorological tower observations are compared and contrasted using the developed methodology.

The Penman-Monteith framework generally captures the rank and trends of the empirical sensitivity of models and observations calculated by regression. On average, FLUXNET observations have the highest sensitivity of latent heat flux to available energy due to their small surface resistance and large aerodynamic resistance. Both models underestimate aerodynamic resistance, which is the primary cause of their reduced sensitivity of latent heat flux to available energy. Additional information provided by the physically-based Penman-Monteith framework is employed for detecting errors and guiding the calibration of models, allowing tuning of both the model climatology and sensitivity.