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Biogeophysical climate-vegetation feedback under a broad range of forcings

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The terrestrial biosphere controls the land surface-atmosphere exchange of energy, momentum and water. A changing climate will affect the geographical distribution of vegetation cover as vegetation shifts following optimal climatic conditions, with typical timescales of decades to centuries. This in turn will affect climate resulting in a feedback loop.
Using the Earth System Model of Intermediate complexity CLIMBER-2, we investigate the quasi equilibrium (allowing the ocean circulation to equilibrate but not the continental ice sheets and the carbon cycle) feedback of vegetation on climate from continental to global scales. The feedback is computed for 1/2x, 2x and 4x CO_2 with respect to preindustrial (280ppm). Structural model uncertainties are accounted for through an ensemble of simulations with different parameters/parameterizations for evapotranspiration, snow masking by vegetation and snow albedo.
Results show a globally positive, relatively small, vegetation feedback. In particular regions the vegetation feedback is found to be important and comparable in magnitude with the fast Charney feedbacks. Vegetation feedback for a CO_2 doubling is generally positive in high northern latitudes, negative in northern mid-latitudes and positive over the Sahara and (with more uncertainty) over the Amazon. The magnitude (and in some regions also the sign) of the feedback is very sensitive to the choice of parameterizations. Furthermore the vegetation feedback is shown to be nonlinear over the broad range of CO_2 forcings.