Geophysical Research Abstracts
Vol. 17, EGU2015-15160, 2015
EGU General Assembly 2015

Emulator based identification of model differences in describing the residence time of vegetation carbon.

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The past three decades have witnessed the development of so-called global vegetation models (GVMs), encompassing accurate representations of a wide range of cross-scale biophysical processes, at the core of the carbon dynamics of terrestrial ecosystems. When forced with climate projections derived from Global Circulation Models (GCMs), GVMs enable one to quantify global-scale, multi-decadal impacts in terms of changes in plant type composition and ecosystem-atmosphere fluxes, at different levels of global warming and CO_2 atmospheric concentrations.
However, impacts estimated along individual emission pathways appear to be specific of the combination GCM–GVM that is used in the quantification of impacts.
In order to gain insights into the sources of multi-model uncertainties of impacts in biomes, it is convenient to resort to simplified representations –so called emulators, of dominant processes explaining the response of biomes, in terms of aggregate variables.
This work presents novel results, that illustrate the use of emulators in the analysis of inter-model differences. In particular, we build on ISI-MIP model output data to identify sources of uncertainty in the residence time of carbon in natural vegetation, resulting from 4 representative GVMs under the forcing of 4 RCP scenarios.
Our results provide a reliable basis for future model improvement, as well as the possibility to efficiently reproduce the response of vegetation along arbitrary trajectories of CO_2 and global warming. This is of special interest in the context of integrated impact assessment, where the application of GVMs becomes computationally unaffordable.