



Integrating LCLM feedbacks into climate models: an emulator approach

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The role of Land Cover and Land Management (LCLM) changes in shaping the climate has garnered increasing interest, particularly in light of its potential for climate adaptation and mitigation. Earth System Models (ESMs), however, have hitherto handled LCLM-climate interactions as a unidirectional process, lacking explicit treatment of LCLM-Climate feedbacks. Consequences of these feedbacks nevertheless hold social relevance, affecting agricultural systems, food provision and prices. Furthermore, LCLM can be linked to extreme climate events such as heat waves and drought, which in turn carry economic costs through loss in worker productivity. It is thus essential to integrate LCLM processes and their feedbacks into ESMs, in order to build consistent storylines for future development pathways that take into account their potential for adaptation and mitigation. Moreover, to ensure robustness in the detected LCLM signals, such integration should be done over a range of ESMs.

Emulators represent a computationally cheap but effective way of approximating ESMs. Here we outline an emulator approach to represent LCLM-Climate feedbacks based on a framework developed by Beusch et al. (2019). This framework provides spatially explicit data by translating annual global mean temperatures into local temperatures and can be extended to use for other relevant variables. The emulator is developed as part of the LAnd MAnagement for CLimate Mitigation and Adaptation (LAMA CLIMA) project, and is trained on dedicated ESM simulations that isolate the effects of key land management practices focussed on by LAMA CLIMA: irrigation, de/reforestation and wood. Variables considered include temperature, evapotranspiration, runoff, crop yields, carbon storage and heat stress. Besides providing spatially explicit representation of these variables, the emulator also allows flexibility in prescribing land-use scenarios under which their responses are explored.

Beusch, L. Gudmundsson, and S. I. Seneviratne: Emulating Earth System Model Temperatures: from Global Mean Temperature Trajectories to Grid-point Level Realizations on Land, doi: 10.5194/esd-2019-34, 2019 (accepted for ESD).