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PARALLEL SESSION B : FRONTIER DOWNSCALING TOOL
B2: HUMAN-CLIMATE REGIONAL INTERACTIONS, TOWARDS RESMS

An Integrated Land System Model System to study soil-vegetation-atmosphere feedbacks in agricultural landscapes under climate change

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Given that emission reduction commitments to mitigate global climate change will likely not be successful, there is a general shift in the research focus, not the least driven by climate politics, from exploring the future climate under different emission scenarios to possible adaptation measures. Current climate projections and recommendations for adaptation measures deduced from them fall short of accounting for important feedbacks:

1) Regional climate simulations neglect important feedback processes in the soil-crop system. An example is the assumption that vegetation dynamics are independent from weather conditions, even under a changing climate. However, the development of crop canopies and roots controls energy partitioning at the land surface. This will directly affect evapotranspiration, cloud formation, and precipitation, as well as, via additional feedbacks, soil carbon pools, crop yields and agricultural land use.
2) Changes in agricultural land use as a consequence of adaptations to climate change may feed back into local climate conditions. Predicting changes in land use is, however, complex. Human-human interactions (e.g., land markets, machinery and farm-related investments) and human-environment interactions (changes in crop mix and crop management) are not captured in conventional simulation models, but are required for projections of land system change on the regional scale. Extreme events have significant influence in shaping the trajectory of climate change adaptation by raising awareness and consequently triggering farmer responses.

We introduce an Integrated Land-system Model System (ILMS) capable of capturing complex land-atmosphere as well as human-environment interactions at high spatial (~1 km) and temporal resolution. ILMS considers the relevant biophysical and socioeconomic processes and accounts for the feedbacks listed above allowing the simultaneous study of their inter-linkages under climate change conditions. ILMS consists of an advanced Atmosphere-Land surface-Crop Model based on WRF and coupled to a Bio-Economic Model System.

In the future ILMS will be applied to downscale EURO-CORDEX hindcasts and climate projections until 2040 for southern Germany to study at which scale vegetation and soil moisture dynamics and land use change will affect regional climate through feedback mechanisms, and if the adaptive capacity of agricultural land users will be sufficient under these conditions to ensure economic survival.

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