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Land-atmosphere coupling and European climate change

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We provide an overview on recent results investigating the role of land-atmosphere coupling, and in particular of soil moisture-temperature coupling, for summer climate variability and climate change in Europe. Increasing greenhouse gas concentrations are expected to enhance the interannual variability of summer climate in Europe and other mid-latitude regions, potentially causing more frequent heatwaves. In a recent study (Seneviratne et al. 2006, Nature), we explore the underlying mechanisms using regional climate simulations of recent and future climatic conditions with and without land-atmosphere interactions. Our results indicate that the increase in summer temperature variability predicted in central and eastern Europe is mainly due to feedbacks between the land surface and the atmosphere. Furthermore, they suggest that land-atmosphere interactions increase climate variability in this region because climatic regimes in Europe shift northwards in response to increasing greenhouse gas concentrations, creating a new transitional climate zone with strong land-atmosphere coupling in central and eastern Europe. These findings emphasize the importance of soil moisture-temperature feedbacks in influencing summer climate variability and the potential migration of climate zones with strong land-atmosphere coupling as a consequence of global warming. This highlights the crucial role of land-atmosphere interactions in future climate change, and opens new perspectives for the investigation of their role on the European continent. Finally, additional results from a few more recent experiments will be discussed.

Reference:

Seneviratne, S.I., D. Lüthi, M. Litschi, and C. Schär, 2006: Land-atmosphere coupling and climate change in Europe. Nature, 443, 205-209.