Session: B2 Oral presentation

Intensification of climate extremes through physical feedbacks: Overview and role within climate change

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Climate change is not only expected to affect the mean of climatic variables, but also their variability and the occurrence of related extreme events such as heat waves, droughts and heavy precipitation events. Physical feedbacks are important contributors to such changes in extremes, and can lead to substantial intensification of the projected changes in some regions. We present here an overview on the role of physical feedbacks for projected changes in extremes, with a focus on the impact of soil moisture-atmosphere feedbacks for changes in heatwaves and droughts in mid-latitude regions (e.g. Seneviratne et al. 2006, Jaeger and Seneviratne 2011). Modeling results suggest that up to 40-60% of summer temperature variability in regions with transitional climate regimes (seasonally dry) is due to the amplification of extremes through soil moisture feedbacks. Observations are consistent with this result (Hirschi et al. 2011), but also highlight the importance of processes not currently included in climate models in controlling the involved feedbacks, such as differences in evapotranspiration dynamics between forests and grassland (Teuling et al. 2010). An analysis of Global Climate Model projections of the AR4 reveals high variations between models with regard to the strength of soil moisture-temperature feedbacks. We discuss how observational constraints can be applied to reduce the model spread in these simulations and the implications for projections of changes in temperature extremes. Results with recent AR5 simulations will also be presented. References Hirschi, M., S.I. Seneviratne, V. Alexandrov, F. Boberg, C. Boroneant, O.B. Christensen, H. Formayer, B. Orlowsky, and P. Stepanek, 2011: Observational evidence for soil-moisture impact on hot extremes in southeastern Europe. Nature Geoscience, 4, 17-21, doi:10.1038/ngeo1032 Jaeger, E.B., and S.I. Seneviratne, 2011: Impact of soil moisture-atmosphere coupling on European climate extremes and trends in a regional climate model. Climate Dynamics, 36 (9-10), 1919-1939, doi: 10.1007/s00382-010-0780-8. Seneviratne, S.I., D. L¸thi, M. Litschi, and C. Sch‰r, 2006: Land-atmosphere coupling and climate change in Europe. Nature, 443, 205-209. Teuling, A.J., S.I. Seneviratne, R. Stˆckli, M. Reichstein, E. Moors, P. Ciais, S. Luyssaert, B. van den Hurk, C. Ammann, C. Bernhofer, E. Dellwik, D. Gianelle, B. Gielen, T. Gr¸nwald, K. Klumpp, L. Montagnani, C. Moureaux, M. Sottocornola, and G. Wohlfahrt, 2010: Contrasting response of European forest and grassland energy exchange to heatwaves. Nature Geoscience, 3, 722-727 doi:10.1038/ngeo950.