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Simulating Evapotranspiration in the Drâa Valley, Southern Morocco: Model Sensitivity to Surface Properties

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ABSTRACT: Within the interdisciplinary project IMPETUS (an integrated approach to the efficient management of scarce water resources in West Africa) the effect of interaction between the earth's surface and atmosphere on fresh water availability is investigated. In this study the focus is laid upon model studies for regions north and south of the Sahara. At the high-resolution end of the meteorological model chain employed in IMPETUS, simulations with the non-hydrostatic mesoscale model FOOT3DK (Flow Over Orographically structured Terrain, 3-Dimensional, Cologne-version) are carried out for two subcatchments in Morocco and Benin. The main objectives are: 1) to establish high-resolution, area covering data-sets of evaporation, precipitation and related quantities, and 2) to assess the sensitivity of the atmospheric branch of the hydrological cycle to variations in the land surface. For this purpose, FOOT3DK is nested into the Local-Model (LM) of the German Weather Service (DWD), which is used for episode simulations within IMPETUS. For a first case study sensitivity tests have been carried out with FOOT3DK on 3 km horizontal resolution for the mid and lower Drâa valley in Morocco, south of the Atlas mountains. Special emphasis is given to response of the model to heterogeneities in soil water content and in soil type. Considering the response to heterogeneities in soil water content, two different methods were used to artificially enhance the water resources available for transpiration. Results show not only enhanced transpiration rates, but also changes in near surface atmospheric flow patterns. This is due to stabilisation of the atmosphere on account of reduced near surface temperatures associated with enhanced evapotranspiration. To examine the model sensitivity to soil types, the uniform soil type taken from LM-simulations is replaced by a more realistic height dependent soil type distribution. Simulations show only small sensitivity to these changes, compared to changes in soil water content, especially for very dry situations. The interdisciplinary co-operation within the IMPETUS project is expected to improve the data-base of the soil properties. Additionally, meteorological measurements at climatic stations are carried out and can be used for validation of the results of the simulations.