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Modification and testing of the ECMWF land surface scheme

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The model performance of the operational version of the Royal Netherlands Meteorological Institute (KNMI) regional climate model RACMO predicts too high temperatures for dry summers in some regions in Europe (e.g. Hungary and the Netherlands). The main reason is the desiccation of the soil during summer when transport of moist air from the Atlantic is blocked. As soil moisture is one of the key parameters for evapotranspiration, the partitioning of precipitation between soil moisture, evapotranspiration, surface runoff and subsurface runoff is directly linked to the surface energy balance. Hence when water availability is sub-optimal, an improved parameterization for the processes that describe transpiration is needed. Based on a sensitivity analysis using the relatively detailed agrohydrological model SWAP, the current land surface atmosphere scheme has been revised. Discretization of the number of soil layers was increased from 4 to 8, soil depth was made variable according to soil maps of the FAO, the effect of shallow groundwater was included and root water uptake was redefined. The sensitivity to the modifications has been tested for the relative dry year of 2005. Tests with the new scheme were performed using meteorological data from standard meteorological stations and two high towers in Hungary. Additionally, the remote sensing based Surface Energy Balance Algorithm for Land (SEBAL) was used to derive a time series of evapotranspiration with a spatial resolution of 1 x 1 km.