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A high resolution calculation of the climatology water table depth and the climatology soil moisture profile for Europe: does the water table matter?

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Using a 2-d groundwater flow model at 30-arcsecond resolution we construct an estimate of climatology water table depth for Europe, defined as the long-term hydrological balance between the vertical atmospheric-induced flux (recharge) and the lateral, geologic and topographically induced flow below and parallel to the water table (drainage). We then solve numerically Richard's equations for vertical water flux in the unsaturated zone and calculate an equilibrium soil moisture profile with the climatology water table as lower boundary condition and the estimated atmospheric mean recharge as the upper boundary flux. We find that the soil moisture pattern reflects the spatial structure in water table depth, more so in the top-2m; in general the soil is wet where the water table is shallow, like in flat river valleys, even in semiarid climates, and it is dry where the water table is deep. We recognize the fact that the equilibrium soil moisture profile lacks the effect of individual wetting events on the top and only reflects the capillarity rise of groundwater from the bottom and the effect of different soil textures. We demonstrate however the link between two terrestrial reservoirs: the root zone soil moisture and the groundwater and that the imprint of the water table on soil moisture may have important climatic implications, due to an increase in root zone water storage and persistence in relatively shallow water table regions, effects that are mostly absent in present climate simulations.