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Assessing the soil texture specific sensitivity of simulated soil moisture to projected climate change by SVAT modelling

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Climate change is assumed to have a regionally specific impact on the soil moisture regime. The impact of climate change on the soil moisture can be expected to depend on the soil texture. Since soil moisture observations are not available operationally, models can be used to elaborate such sensitivity. In this study, a soil vegetation atmosphere transfer scheme (SVAT) was applied to virtual soil columns to assess the soil texture specific sensitivity of simulated soil moisture to projected climate change. For each of the 31 soil texture classes of the German soil texture classification, long term simulations were carried out based on observed and scenario based climate data representing five different climate regions in Germany. The simulation results indicate that soil moisture regimes considerably differ from region to region and among different soil texture classes. Different soil texture classes showed different sensitivities of soil moisture with respect to projected climate change. While differences in soil moisture between current conditions and SRES climate scenarios were largest for silt soils, they were smallest for clay soils for continental as well as humid climates. Sand and loam soils behaved intermediately, showing a moderate sensitivity. The results also showed that soil texture specific sensitivity of soil moisture to climate change was largest for soils which were not affected by groundwater (no capillary rise). With an increasing influence of groundwater, differences between soil texture classes decreased. In contrast, increasing vegetation density, rooting depths and transpiration demand induced an increasing sensitivity of soil moisture to climate change except for continental climates. This study indicates that validated, physical based soil hydrological models serve as suitable tools to assess the response of soil moisture to changing climate conditions. Based on virtual soil columns, modelling experiments systematically reveal soil texture dependent sensitivities which can hardly be identified in real world studies due to limited availability and accessibility of the wide spectrum of different soil textures.