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Impact of soil moisture-climate feedbacks on CMIP5 projections: First results from the GLACE-CMIP5 experiment

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GLACE-CMIP5 is a global-scale multi-model experiment investigating the impact of soil moisture-climate interactions in CMIP5 projections. This article presents first GLACE-CMIP5 results based on simulations with five global climate models (ECHAM6, GFDL, CESM, IPSL, EC-Earth), and focuses on how projected 21st-century changes in mean soil moisture due to changes in precipitation and land hydrology feed back onto the late 21st-century mean climate and extreme events. Mean projected decreases in soil moisture substantially impact climate in several regions in both boreal and austral summer, in particular for extreme events. The strongest impacts are found for extremes of the daily maximum temperature with effects reaching up to 2-3K in many regions. Impacts on mean temperature are more modest (of the order of 1-2K). A direct scaling between soil moisture-induced changes in evaporative cooling and resulting changes in temperature is found in the simulations. In the northern hemisphere, the imposed soil moisture anomalies also markedly affect simulated changes in heavy precipitation, despite a small impact on mean precipitation.