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Present and future impact of soil moisture on precipitation in the Euro-Mediterranean area

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Soil moisture is regarded as an important variable influencing climate variability and climate change. So far the role of slowly varying boundary conditions in the framework of statistical downscaling has not systematically been assessed. However, there exists the well-founded assumption that the consideration of land surface-atmosphere-precipitation interactions might lead to an improvement of regional assessments of future climate change in Europe and the Mediterranean area.

The present contribution focuses on a statistical downscaling procedure to model regional precipitation considering soil moisture as predictor in addition to commonly used atmospheric variables. Soil moisture data from the Global Land Data Assimilation System (GLDAS) dataset as well as from two Earth System Models (MPI-ESM-MR, CNRM-CM5) are considered to quantify the role of soil moisture as predictor for precipitation under present and future climate conditions. Different settings of the downscaling models, differing in terms of the predictor variables used, are compared to analyse the influence of soil moisture on downscaled precipitation.

Results indicate an improvement of the statistical model skill when using soil moisture information. This improvement is only moderate when averaging over the whole Euro-Mediterranean domain. However, for individual regions the gain in performance can be substantial. It is also shown that future projections are impacted by the use of SM as an additional predictor.