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Climatic change impacts on water balance of the Upper Jordan River

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The Eastern Mediterranean and Near East (EM/NE) is an extremely water scarce environment. It is expected that problems will increase due to climate change and population growth. The impact of climate change on water availability in EM/NE and in particular the Jordan River catchment is investigated in this study.
Focus is set on the Upper Jordan River catchment (UJC) as it provides 1/3rd of freshwater resources in Israel and Palestine. It is a hydro-geologically extremely complex region with karstic groundwater flow and an orography with steep gradients.
The methods used are high resolution coupled regional climate – hydrology simulations. Two IPCC scenarios (A2 and B2) of the global climate model ECHAM4 have been dynamically downscaled using the non-hydrostatic meteorological model MM5 in two nesting steps with resolutions of 54x54 km2 and 18x18 km2 for the period 1961-2099, whereby the time slice 1961-1989 represents the current climate. The meteorological fields are used to drive the physically based hydrological model WaSiM applied to the UJC. The hydrological model computes in detail the surface and subsurface water flow and water balance in a horizontal resolution of 450 x 450 m2 and dynamically couples to a 2-dim numerical groundwater model. Parameters like surface runoff, groundwater recharge, soil moisture and evapotranspiration can be extracted.
Results show in both scenarios increasing yearly mean temperatures up to 4-5 K until 2099 and decreasing yearly precipitation amounts up to 25% (scenario A2). The effect on the water balance of the UJC are reduced discharge and groundwater recharge, increased evaporation and reduction of snow cover in the mountains which usually serves as an important freshwater reservoir for the summer discharge.