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Multi-model projections of water resources in Europe under two degree global warming

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One of the main objectives of the EU-FP7-project IMPACT2C is to develop projections of water fluxes and stores in Europe under two degree global warming. For this purpose, a multi-model assessment was carried out using eleven CORDEX climate change simulations, which were carried out with five different GCM/RCM combinations driven by three different RCPs (2.6, 4.5 and 8.5). After making bias corrections, the output from the eleven climate simulations was used to force five pan-European hydrological models (E-HYPE, Lisflood, LPJmL, VIC and WBM), resulting in an ensemble of 55 simulations. The ensemble of climate changes (the plus-two-degrees climate relative to 1971-2000) was evaluated in terms of the median, the standard deviation (measure for uncertainty) and significant changes. The latter are defined as those changes for which the absolute value of the median exceeds the standard deviation. We also performed a flood analysis for two return periods (10 and 100 years) fitting a GEV distribution on the data. Changes in water resources and largely driven by changes in precipitation. Precipitation is projected to increase in most parts of Europe with decreases confined to Southern Europe. Generally, the patterns of changes in evapotranspiration and runoff mimic the precipitation change pattern. As a result river discharge is projected to increase in the majority of Europe in the plus-two-degrees climate. The largest increases occur in the east and the far north while discharge decreases in parts of the Mediterranean. Due to a large spread in model outcome only in half of Europe the projected changes in discharge are significant. Changes (mostly decreases) in soil moisture are significant only in parts of the Mediterranean. It was found that uncertainty in runoff change was to a larger extent due to the climate models than to the hydrological models whereas uncertainty in soil moisture changes was mainly due to the hydrological models.