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Impact of climate change on runoff timing over the Alpine region

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We investigate the greenhouse gas-induced change in snowmelt-driven runoff (SDR) over the Alpine region using the output from two Med-CORDEX and two EURO-CORDEX regional climate model (RCM) projections (RCP8.5 scenario) at two resolutions (12km, 50km) driven by a sub-set of the CMIP5 GCMs. Comparison with the European Water Archive (EWA) observed runoff dataset (242 stations) over Alps shows a good performance by the higher resolution models in representing present day SDR, with the lower resolution simulations being less accurate in capturing the SDR timing. In the future projections all the models show a temperature increase of up to 4 degrees by the end of the 21st century throughout the Alps and this leads to an anticipation of SDR timing throughout the year that can span from 1 to 3 months depending on the model horizontal resolution. These timing changes are associated to changes in snow cover modulated by the complex Alpine topography. In fact, model resolution plays a critical role in regulating the magnitude, timing and spatial distribution of the response of snow cover and SDR to warming. Accurate simulation of changes in runoff timing requires high resolution representation of the Alpine topography, and can be important for water storage regulations concerning energy production, agriculture and domestic use.