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Understanding recharge elasticity through large-scale simulations of Europe's karst regions under varying climatic boundary conditions

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Karst develops through the dissolution of carbonate rock. Karst groundwater in Europe is a major source of fresh water contributing up to half of the total drinking water supply in some countries. Climate model projections suggest that in the next 100 years, European karst regions will experience a strong increase in temperature and a serious decrease of precipitation - especially in the Mediterranean region. To be prepared, policy-makers need quantitative and reliable estimates of potential changes to karst water resources. This study presents an attempt to quantify karst water resources over the whole Mediterranean. This is done by quantifying large-scale karst recharge with a newly developed hydrologic model that considers the strong heterogeneities of recharge processes that evolve from carbonate rock dissolution. The model is driven by long-term gridded data from the European Climate Assessment & Dataset project (ECA&D). Soil moisture and evapotranspiration measurements that are available across Europe's carbonate rock regions are used for model evaluation. To assess the climatic sensitivity of recharge, we define the recharge elasticity as ratio of normalized changes of annual recharge to precipitation between years. Using large-scale simulations of the recharge model we can explore the spatial and temporal variability of the recharge elasticity among the Mediterranean's karst regions and understand the impact climatic change.