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Groundwater recharge and groundwater water resources under present and future climate over the Pyrenees (France, Spain, Andorre)

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Climate change is expected to have a significant impact on water resources in mountain areas, as it is the case of the Pyrenees range between France, Spain and Andorre. Independently of future changes on rainfall patterns, global temperature rise is likely to provoke larger and earlier snowmelt, and enhanced precipitation deficits during the dry summer season. Exploring the impacts of this future situation on groundwater is essential, as this resource is often important for drinking water, irrigation and breeding uses in mountain regions. However, studies on groundwater recharge in the context of climate change are relatively scarce, as compared to studies focusing on surface water resources.

We assessed potential groundwater recharge (part of effective precipitation that infiltrates and potentially reach the aquifers) over the Pyrenean range in the framework of the PIRAGUA project, a collaborative multi-national effort funded by the EU's Interreg POCTEFA program. Based on a gridded (5x5 km²) meteorological dataset derived from observational data by the CLIMPY project, we estimated effective precipitation for each grid cell using a conceptual water balance scheme. The effect of the seasonal change of land cover / land use (based on the Corine Land Cover dataset) on the water budget model has been assessed, and showed the need to include this component for a more accurate simulation. Based on a spatial characterization of the land infiltration capacity, the potential groundwater recharge has been computed for homogeneous groundwater bodies. Results have been compared to the outputs of groundwater models applied on selected karstic catchments using the BALAN code, and to a general knowledge of groundwater recharge rates for different regions within the study zone. Finally, climate change impacts on future IDPR have been explored using scenarios provided by the CLIMPY project.

The Pyrenees range is a hot-spot for water resources with a tremendous impact over a much

broader region in SW Europe, as Pyrenean rivers are fundamental contributors to large systems such as those of the Adour and Garonne (France) or Ebro (Spain), as well as smaller systems in the western and eastern sectors such as the Bidasoa (Spanish Basque Country), Llobregat-Ter-Muga (Catalonia), or Têt-Tech-Aude (France). Our results are relevant for the planning and management of water resources for this important transboundary region in the future, as changes in groundwater recharge will also affect water resources availability.

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