



Uncertainty sources in a large ensemble of hydrological projections across diverse hydroclimates: characterization and take-home messages for stakeholders

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Robust adaptation to hydrological climate change requires an assessment of possible climate and hydrological futures at different scales. Explore2 is a recent multimodel ensemble of hydrological projections developed to accompany local adaptation plans for metropolitan France and Corsica, a 550,000 km² wide territory with a large diversity of climate and hydrological regimes (Sauquet et al. 2024). The Explore2 ensemble provides transient projections of daily river flow for more than 4'000 locations on French rivers. Projections have been obtained for three RCP emission scenarios with 4 to 9 hydrological models (HMs) driven by 36 bias adjusted regional climate projections (36 EUROCORDEX projections obtained for a number of different GCM/RCM combinations, Marson et al. 2024).

Explore2 projections, making no exception, come with sometimes large uncertainty (Evin et al., 2024). This uncertainty has been characterized and analyzed with Qualypso (Evin et al. 2021) for different climate and hydrological metrics. Qualypso is an advanced ANOVA approach, based on the quasi-ergodic assumption for transient climate projections (Hingray et al. 2014) and applicable for unbalanced datasets. It allows to disentangle and prioritize the different components of uncertainty, namely emission scenario uncertainty, the different components of model uncertainty (GCM uncertainty, RCM uncertainty, HM uncertainty) and uncertainty due to climate internal variability.

In this work, we examine the following questions:

- What are the projected changes for different climate and hydrological metrics for metropolitan France and Corsica (e.g. precipitation, annual discharge, high and low flows) and how strong do the modelling chains agree on projections?
- How do scenario uncertainty and the different components of model uncertainty contribute to the total uncertainty in projections and what additional variability is introduced by internal variability of climate?
- What are the main effects of each model compared to the others and are there highly contrasting chains?
- How do the results depend on location and/or hydroclimatic context?
- What messages can be conveyed to stakeholders about the future of climate and hydrology in France?

References:

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