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Capacity of climate models to capture multi-decadal hydrological variations over France

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In France, large multi-decadal variations in river flows have occurred over the instrumental period. These multi-decadal variations, likely of internal origin, could be a major source of uncertainties in the evolution of river flows during the 21st century, and especially during the coming decades, when the climate change signal is weaker. Depending on their phase, these variations might indeed strongly temporarily amplify or weaken (and even possibly reverse) the signal of climate change. From an adaptation perspective, it is crucial that hydrological projections correctly capture the amplitude of these multi-decadal variations, so that the associated uncertainties can be correctly estimated. The realism of hydrological projections in this context lies to a large extent in the realism of climate models, used at the first stage of the vast majority of the studies of the impacts of climate change.

The brevity of the instrumental record makes it difficult to characterize robustly multi-decadal hydro-climate variations, and the lack of observations for important hydrological variables makes it difficult to understand the mechanisms at play. The evaluation of climate models in this context is therefore also particularly challenging.

In this presentation, I will describe our work to better characterize hydrological variations over France in terms of amplitude and mechanisms, thanks to joint use of newly developed hydrological reconstructions beginning in the mid-nineteenth century, long observations from data-rescue efforts and paleo-climate reconstructions. Based on this work, I will then describe the results of the evaluation of multi-decadal hydrological variations in current global climate models, in terms of amplitude and associated mechanisms, taking into account the very large sampling uncertainties associated with the characterization of multi-decadal variations on relatively short periods.