



## **Ensemble reconstruction of severe low flow events in France since 1871**

Laurie Caillouet (1), Jean-Philippe Vidal (1), Eric Sauquet (1), Alexandre Devers (1), and Benjamin Graff (2)

(1) Irstea, UR HHLy, Hydrology-Hydraulics Research Unit, Villeurbanne, France (laurie.caillouet@irstea.fr), (2) Compagnie Nationale du Rhône (CNR), Lyon, France

This work presents a study of severe low flow events that occurred from 1871 onwards for a large number of near-natural catchments in France. It aims at assessing and comparing their characteristics to improve our knowledge on historical events and to provide a selection of benchmark events for climate change adaptation purposes.

The historical depth of streamflow observations is generally limited to the last 50 years and therefore offers too small a sample of severe low flow events to properly explore the long-term evolution of their characteristics and associated impacts. In order to overcome this limit, this work takes advantage of a 140-year ensemble hydrometeorological dataset over France based on: (1) a probabilistic precipitation and temperature downscaling of the Twentieth Century Reanalysis over France (Caillouet et al., 2015), and (2) a continuous hydrological modelling that uses the high-resolution meteorological reconstructions as forcings over the whole period. This dataset provides an ensemble of 25 equally plausible daily streamflow time series for a reference network of stations in France over the whole 1871-2012 period.

Severe low flow events are identified based on a combination of a fixed threshold and a daily variable threshold. Each event is characterized by its deficit, duration and timing by applying the Sequent Peak Algorithm. The procedure is applied to the 25 simulated time series as well as to the observed time series in order to compare observed and simulated events over the recent period, and to characterize in a probabilistic way unrecorded historical events. The ensemble aspect of the reconstruction leads to address specific issues, for properly defining events across ensemble simulations, as well as for adequately comparing the simulated characteristics to the observed ones.

This study brings forward the outstanding 1921 and 1940s events but also older and less known ones that occurred during the last decade of the 19th century. For the first time, severe low flow events are qualified in a homogeneous way over 140 years on a large set of near-natural French catchments, allowing for detailed analyses of the effect of climate variability and anthropogenic climate change on low flow hydrology.

Caillouet, L., Vidal, J.-P., Sauquet, E., and Graff, B. (2015) Probabilistic precipitation and temperature downscaling of the Twentieth Century Reanalysis over France, *Clim. Past Discuss.*, 11, 4425-4482, doi:10.5194/cpd-11-4425-2015