Geophysical Research Abstracts
Vol. 19, EGU2017-7439, 2017
EGU General Assembly 2017

Downscaling and hydrological uncertainties in 20th century hydrometeorological reconstructions over France

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The record length of streamflow observations is generally limited to the last 50 years, which is not enough to properly explore the natural hydrometeorological variability, a key to better understand the effects of anthropogenic climate change. This work proposes a comparison of different hydrometeorological reconstruction datasets over France built on the downscaling of the NOAA 20th century global extended reanalysis (20CR, Compo et al., 2011). It aims at assessing the uncertainties related to these reconstructions and improving our knowledge of the multi-decadal hydrometeorological variability over the 20th century.

High-resolution daily meteorological reconstructions over the period 1871-2012 are obtained with two statistical downscaling methods based on the analogue approach: the deterministic ANALOG method (Dayon et al., 2015) and the probabilistic SCOPE method (Caillouet et al., 2016). These reconstructions are then used as forcings for the GR6J lumped conceptual rainfall-runoff model and the SIM physically-based distributed hydrological model, in order to derive daily streamflow reconstructions over a set of around 70 reference near-natural catchments.

Results show a large multi-decadal streamflow variability over the last 140 years, which is however relatively consistent over France. Empirical estimates of three types of uncertainty – structure of the downscaling method, small-scale internal variability, and hydrological model structure – show roughly equal contributions to the streamflow uncertainty at the annual time scale, with values as high as 20% of the interannual mean.

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