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High-resolution reanalysis of precipitation over France through offline data assimilation in a downscaled ensemble meteorological reconstruction

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The knowledge of historical French weather has recently been improved through the development of the SCOPE (Spatially COherent Probabilistic Extended) Climate reconstruction, a high-resolution daily ensemble reconstruction of precipitation and temperature covering the period 1871–2012 which is based on a statistical downscaling of the Twentieth Century Reanalysis (Caillouet et al., 2016, 2017). However, historical surface observations of precipitation and temperature do exist from at least the beginning of the period considered. This information – even though rather scarce and sparse – does not currently feed SCOPE Climate reconstructions. The goal of this study is therefore to assimilate these historical observations into SCOPE Climate reconstructions in order to build a 150-year meteorological reanalysis over France.

This study considers an "offline" data assimilation method – based on the Ensemble Kalman Filter theory – that have successfully been used in recent paleoclimate studies, i.e. at much larger temporal and spatial scales (see e.g. Bhend et al., 2012). The data assimilation framework allows taking into account the change in the observation network, and better characterizing the uncertainty of the reanalysis. Two features are implemented for assimilating precipitation data: (1) an anisotropic localization procedure based on the SCOPE Climate background climatology, and (2) a Gaussian transformation that allows using the Ensemble Kalman filter in an optimal way for non-gaussian variables such as daily precipitation.

The overall data assimilation is here applied for reconstructing the daily 8km gridded precipitation fields over France for the 2009-2012 period. The methodology is evaluated on increasing observation density using actual historical density of 1871, 1920 and 1970. A consistent set of independent stations is used for validation in term of both accuracy and reliability.

Results show that: (1) the reanalysis has a much lower uncertainty than the initial SCOPE Climate reconstructions, (2) the accuracy of the reanalysis increases with the assimilated observation density, and (3) the data assimilation scheme enables to reach the performance of the well-validated Safran reanalysis (Vidal et al., 2010), even for a density of stations as low as the one of 1920.

Bhend, J., Franke, J., Folini, D., Wild, M., and Brönnimann, S.: An ensemble-based approach to climate reconstructions, Clim. Past, 8, 963-976, doi: 10.5194/cp-8-963-2012, 2012

Caillouet, L., Vidal, J-P., Sauquet, E., and Graff, B.: Probabilistic precipitation and temperature downscaling of the Twentieth Century Reanalysis over France, Clim. Past, 12, 635-662, doi: 10.5194/cp-12-635-2016, 2016.

Caillouet, L., Vidal, J.-P., Sauquet, E., Devers, A., and Graff, B.: Ensemble reconstruction of spatio-temporal extreme low-flow events in France since 1871, Hydrol. Earth Syst. Sci., 21, 2923-2951, doi: 10.5194/hess-21-2923-2017, 2017

Vidal, J-P., Martin, E., Franchistéguy, L., Baillon, M., and Soubeyroux, J-M.: A 50-year high-resolution atmospheric reanalysis over France with the Safran system, Int. J. Climatol., 30, 1627-1644, doi: 10.1002/joc.2003, 2010.