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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Ensemble reconstruction of spatio-temporal extreme low-flow events in France since 1871" *by* Laurie Caillouet et al.

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Review of the paper "Ensemble reconstruction of spatio-temporal extreme low-flow events in France since 1871", by Caillouet, Vidal, Sauquet, Devers & Graff. Review by Thibault Mathevet (15/10/2016)

Synthesis of my review :

Even if this paper appear to be rather long and sometimes "dense", I really appreciated reviewing this paper. I am very happy to congatulate authors for such an amount of work and very useful information and analyses on the drought history over France, since 140 years. Having an experience on data-rescue and long-term historical reconstructions, I consider that this work could have many applications, both in terms of reseach activities or operational hydrology. This work could also help hydrologists to

communicate with water managers, decision-makers or stakeholders, in order to show them exemples of long-term hydrological variability. I really hope that SCOPE hydro time-series would be available soon ?

I would rate the scientific significance and quality as Excellent. However, I rate the presentation quality as Fair to Good, because some paragraphs appear to be difficult to understand, even with carefull attention. I would like to invite authors to improve the explanation in a more pedagogical way of §2.2.2 (Bias correction and Schaake Shuffle) and 3.2.2 (spatial matching procedure, also used for the ensemble case). This could undermine our appreciation of the quality of the paper, even if §4 and §5 are very interesting.

It might not be the objective of the authors, but a paper in two parts could be easier to read, with a first part considering the methodology (basicaly from 20CR-SANDHY-SUB datasets to SCOPE climate) and a second part considering hydrological analyses and the discussion (basicaly, SCOPE Hydro and hydrological analyses).

Major comments :

§2.2.2 SCOPE Climate : this paragraph presenting the bias correction via a resampling-based correction approach and improvement of spatial coherence via Schaake Shuffle should be improved in order to be easily understood ;

§3.2.2 spatial matching procedure : the overlapping process is not clear. This paragraph should be improved in order to be easily understood

* the step from Fig 4a to Fig 4b is not clear on this example : I don't understand why two independent events are considered for red and grey colors, while there is only one event considered with the purple color ? Station 11 event definition should be continous during period covered by red and grey colors ?

* the step from Fig 4d to Fig 4e is not clear on this example : again, I don't understand why an event could be discontinuous, for the two blue and two green events ? p15, l7,

Fig 7 : again, I don't understand why there is only two spatio-temporal events and not four ?

§3.1 hydrological modeling : since the aim of this study is to represent particularly well drought events and that it is well-know that hydrological models are performing poorly on drought, why authors didn't consider an objective function based on hydrological signitures specific for drought, such as distribution of drought duration, severity, etc (VCN 10, VCN30, ...) ?

Minor comments :

p4, l26 : problem with the length of the line ;

p6, l11 : it might be out of the scope of this paper, but have you tryed to analyse the 20CR-SANDHY-SUB bias using a weather type classification (the seasonal classification is interesting but, beyond seasons weather type proportion might change from a season to another) ? ;

p7, l21 : KGE is expressed as KGE = 1-SQRT (...) ;

p7, §3.1 : a table with quantiles of catchments caracteristics and summary of performances (KGE, r, alpha, beta) might be interesting (as Table 2, in Pushpalatha et al., 2012);

p14, l12 : is the number of members to consider an event (10 on Fig 6 example) adapted from one station to another or roughly selected for the 662 stations ? If it's different from one station to another : give some quantile to precise the variability of this threshold ? Have you tested an unique value for the whole station sample ? ;

p17, l4, Fig 2 : I would appreciate to see distributions or boxplots of r, alpha, beta and KGE criteria ;

p17, §4 : again, it might be out of the scope of this paper, but it could be interesting to caracterise SCOPE hydro performances for drought simulation using hydrological

signatures and/or probabilistic criteria, such as CRPSS, etc. ? ;

p18, figure 10 & p19, figure 11 : for the ones not used to duration values and severity values, it could be interesting to put a panel on these figures with the distributions of event durations and severity obtained with the Observation or Safran Hydro. Another option would be to add a second y-axis with the quantiles corresponding to the duration/severity values ? ;

p22, fig 14 : what is the total spatial extent of the 622 hydrological stations ? what is the proportion of gauged surface over the France surface ? ;

p22 : It would be interesting to distinguish snow-dominated catchments and rain-dominated catchments and show a figures with the spatial extent of drought, given these two main processes (snow/rain)? ;

p25 & p26 l14-22 : given the length and density of your paper, Figure 17 and its related §do not appear necessary for me ;

p29, §6.4 : have you compared the Safran Hydro and SCOPE Hydro analyses on the 1958-2012 period, where hydrological simulations are both available ? A scatterplot of duration, severity or spatial extent by year could be interesting ? ;

p30, §6.6 : considering drought simulation, my experience is that conceptual RR models could be strongly biased. In a future work, you could consider a very simple method, using a bias correction of streamflow simulations by quantile classes, as proposed by F. Bourgin in its PhD at IRSTEA.

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