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Discussions

Interactive comment on "Towards a monitoring system of temperature extremes in Europe" *by* Christophe Lavaysse et al.

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This is an interesting study that quantify the intensity of heat and cold waves regarding the climatology for the development of a monitoring system of temperature extremes in Europe. This study represent a substantial contribution to the understanding of natural hazards and their consequences. Explanations, results and references are appropriate, and are presented in a clear, concise and well-structured way. Figures and tables are helpful and the number and quality of both is appropriated. Overall, I found it is an interesting paper and would recommend publication after some additional work. Although I enjoyed reading the manuscript, the paper is written well and I appreciate the work of the authors, I have some concerns about the methodological choices.

We would like to thank the reviewer for his fruitful and positive comments. Please find below the responses of the comments. The article has been revised according to the suggestions of all the reviewers.

My main concern is related to the small size of the sample and the return times computation. Although climate is usually defined as an average of weather, the classical period as defined by the World Meteorological Organization (WMO) is 30 years. So the most important caveat that I see in this study is the small sample of 21 years. The return times are computed with the intensities of the waves you have detected with a climatology of 21 years, it is also difficult to believe in return times greater than 100 years (figure 11) computed over a basis of 21 years. I also understand that Lisflood has more benefits than the other two for the monitoring system but it is quite short dataset (starting at 1990).
Therefore, and in order to validate and justified the short period of study, I suggest to repeat the experiment (including some additional figures or tables in the manuscript) but using just EOBs for the whole period (1950-2015) since is the largest dataset you have used and has a good agreement with Lisflood. Hence, you will have a largest climatology to detect the waves and compute the return times with less influence of noise due to the small sample size. If these results are in consistence with the ones you got using the 21 common years of the three datasets your results and the monitoring system, which, by the way, I find very interesting and promising, will demonstrate that are robust enough even for a short period, and so the use of Lisflood will be justified for this purpose. This is a very interestcomment. The size of the samples and the extrapolation of the data are always an important and sensitive point.

First of all, the recommendation of WMO could be slightly different depending the purpose of the study: climate evolution, detection of extreme, climatological reference, climatological evolution of extremes etc... However, there is no clear consensus according to WMO (2009) about a specific duration. As the purpose of this monitoring system is not to assess the climatological trend of the extreme events, as done by Russo et al. (2015), but it is on the detection of relative intense events according to a reference period we believe that a shorter time series (20 years instead of 30) is sufficient. This baseline duration is not considered as too short and plenty of study/datasets are using this duration period (Kharin et al. 2013, Vautard et al. 2013, Monhart et al. 2016). It is also possible to mention that ECMWF runs an extended ensemble model twice a week that going up to 45-day lead time (Vitart, 2004). In parallel, the European Centre runs hindcast (or reforecast) to create a climatological baseline (to correct bias of the model, built climatology and detect the strongest anomalies). These hindcasts are also performed using 20 years highlighting the usefulness of this length of climatological reference. According to the WMO guideline and the mentioned previous studies, but also due to two technical reasons i) the availability of the datasets and ii) to be consistent with the forecasts that will be implemented in the same system in the future, we decide to keep the 20-year climatology to detect and characterize the intensities of heat and cold waves.

Moreover, the suggestion of the reviewer about using the full 50-year period to perform the climatology and the return period is interesting but questionable. Indeed, it is well known that Europe endures a significant evolution of the climate and of the extreme temperatures generating a non-stationary occurrence/intensity of heat and cold waves (Gonzales-Hidalgo et al. 2016). This is especially true if we consider a long period (such as 50-year). In that non-stationary context, using a 'too' long sampling to compute the return period of extreme events will generate an underestimation of these values comparing to the more recent climatology. For this reason we consider non relevant to perform this long-term reference that has been already study for other purposes (Russo et al., 2016). To better identify and extrapolate the return periods of rare events, the fitting of the observed extreme event onto a parametric distribution is

a robust and common method employed in the literature (Coles et al. 2001, Schar et al. 2004, Blender et al. 2008). According to significant tests employed in that study to guarantee the robustness of the distribution, it exists uncertainties for return periods larger than the duration of the observed sampling. For these reasons, and according to the reviewer's comment, in Figure 11 of the revised manuscript, return periods longer than 25-years are indicated with grey shadows and, in addition, the x-axis is reduced in order to have less than 50

Finally about the use of the Lisflood datasets, according to the WMO report previously mentioned, we believe that a 20 year period is long enough to provide robust climatology of the events for this purpose; furthermore, this database is also the most accurate and dense observed datasets of temperature we can access operationally with a very short delay (about 24h). For these consideration, we are still considering this dataset as the most suitable for our purposes. Considering our study, we have also verified that the results and the climatology obtained using the dataset used in this study is very close to other well-known and commonly used datasets (E-OBS and ERAI reanalysis) although they are released too late for use in an operational system as the one proposed in our work. In the future, depending the possibly to get new datasets from Copernicus CCS, we could change the datasets.

Bibliography:

Blender, Richard, K. Fraedrich, and Frank Sienz. "Extreme event return times in long-term memory processes near 1/f." Nonlinear Processes in Geophysics 15.4 (2008): 557.

Coles, Stuart, et al. An introduction to statistical modeling of extreme values. Vol. 208. London: Springer, 2001. GonzalezâĂŘHidalgo, José Carlos, et al. "Recent trend in temperature evolution in Spanish mainland (1951–2010): from warming to hiatus."

International Journal of Climatology 36.6 (2016): 2405-2416

Kharin, Viatcheslav V., et al. "Changes in temperature and precipitation extremes in the CMIP5 ensemble." Climatic change 119.2 (2013): 345-357.

Monhart, Samuel, et al. "Verification of ECMWF monthly forecasts for the use in hydrological predictions." EGU General Assembly Conference Abstracts. Vol. 18. 2016.

Russo, Simone et al. “Top ten European heatwaves since 1950 and their occurrence in the coming decades.” Environmental Research Letters, 2015, 10.12: 124003.

Russo, Simone, et al. “When will unusual heat waves become normal in a warming Africa?” Environmental Research Letters, 2016, 11.5: 054016.

Schar, Christoph, et al. "The role of increasing temperature variability in European summer heatwaves." Nature 427.6972 (2004): 332.

Vautard, Robert, et al. "The simulation of European heat waves from an ensemble of regional climate models within the EURO-CORDEX project." Climate dynamics 41.9-10 (2013): 2555-2575.

Vitart, Frédéric. "Monthly forecasting at ECMWF." Monthly Weather Review 132.12 (2004): 2761-2779. DATA, Climate. Guidelines on analysis of extremes in a changing climate in support of informed decisions for adaptation. World Meteorological Organization, 2009.

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