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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Early warning of drought in Europe using the monthly ensemble system from ECMWF" *by* C. Lavaysse et al.

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General comments This paper discusses the forecast of the ECMWF seasonal (SEAS) and their monthly ensemble forecasts to forecast drought which is measured by the standardized precipitation index (SPI1). The paper is long on statistics. There is not a lot of physical explanation. The paper is well written and should be published. Specific comments:

We thank the reviewer for the encouraging and insightful comments, which helped us to make the paper more straightforward.

1. Drought usually indicates persistent lack of precipitation. In general, it means negative SPI (SPI< -1 as the indicator used by authors) for three months or longer. There-

fore, the 3-months or 6- month SPIs are used to indicate drought instead of SPI1. Is there any reason that you use SPI1?

This comment is a very important point. The use of the SPI-1 is motivated by several reasons:

a- The skill score of precipitation forecasts decreases drastically during the first month. So, the benefit to use a lead time of two months or more is not obvious (Dutra et al. 2013).

b- While in this study we intend to test the reliability of the forecast, an improvement could be achieved with the combination of different information types: monitoring by satellite or in-situ measurements that give an accurate characterization of ongoing drought conditions (e.g. during the last two months), combined with the forecasted SPI-1 that provides the best estimate of near future conditions. However, this will still not allow looking more than one month ahead and would bias the testing of the forecast skill, which was the intention of this paper.

c- The seasonal model (SEAS) is here compared to ENS, the up-to-date version of the ensemble system. Currently, the ENS, however, provides a forecast only up to 32 days once a week. So it is technically impossible to compare these models for SPI-3 or SPI-6.

d- a one month forecast with a good reliability is considered to be a very valuable product for decision makers as it provides information on the probability of occurrence of a dry spell (in case of ongoing normal conditions) and of the probable persistence or end of a drought (in case of an ongoing precipitation deficit).

We have modified the introduction to include the above comments.

Also we consider it important to provide to stakeholders a trend of precipitation forecast one month in advance. As we have indicated in the introduction, we do not intend to detect the entire period of a drought but the objective is to assess the most robust

product for drought forecasting. To help the stakeholders to make a decision, this work is an additional product to the drought monitoring and it will forecast a precipitation deficit that will occur in the next month over a region.

2. If you use SPI3 or SPI6, do your conclusions change?

As we have not used any precipitation forecasted for more than 1 month using ENS, it is too speculative to answer as we explicitly intended to focus on SPI-1 (see text above). Nevertheless, based on the decrease of the skill scores with longer lead times, we expect lower skill scores for these lead times.

3. You use SPI1 so how well is your system to predict drought onset? (the first time in a time series that SPI1 is below -1)

In this study we have tested two different thresholds of drought detection: SPI-1 lower than -1 and lower than -1.5 (the time series was too short to analyze the case of extreme droughts with SPI lower than -2). So, the first month of forecast with SPI-1 lower -1 or -1.5 is defined as the beginning of a drought or a dry spell (defined as a short rainfall deficit).

4. Do forecasts have higher skill after a drought onset?

This comment is very interesting. We have modified the paper to include a discussion as follows :

'The importance of the drought duration has also been tested. The scores were calculated independently for drought onset (first SPI-1 lower than thresholds), persistence (consecutive SPI-1 lower than the threshold), or end of the drought (first SPI-1 above the threshold after a drought). First, the duration of a large majority of SPI-1 lower than -1 (more than 80%) is one month (isolated value, dry spell). The scores display a slight increase of the score for persistent droughts (condition unchanged), for the median the POD score increases from 0.33 to 0.36. But the difference is not significant according to the t-test.'

5. It will be nice to show examples that SPI1 has high/low skill.

The case studies selected are very different from each other and adding more examples is indeed desirable. However, the paper is already fairly long and we believe that the case studies presented illustrate the main aspects of the discussion.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 1973, 2015.