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Interactive comment on "Developing a global operational seasonal hydro-meteorological forecasting system: GloFAS v2.2 Seasonal v1.0" *by* Rebecca Emerton et al.

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- AC: We thank the reviewer for their positive overview of the paper and suggestions for further improvement. Please find our responses to any questions raised, and suggested changes to the manuscript, below.

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This paper introduced a global operational seasonal hydrological forecasting system based on the ECMWF seasonal climate prediction and an extension of the Global Flood Awareness System (GloFAS). This is an important work to extend regional op-

erational system to the global scale. The evaluation results, although preliminary, are very interesting. The paper is also well written, and it is suitable for publication in GMD. I have a few comments below, basically for the clarification. I hope they are useful to improve the paper.

1. My only major concern is about the validation of the system, and the corresponding interpretation. I understood this paper does not aim to comprehensively evaluate the system. However, additional clarification is needed to help the readers to obtain more information on the system. Section 4.2 discussed the evaluation, and mentioned the deficiency in hydrological model, meteorological forecast, and even the ERA5-R reanalysis used for the initial conditions. In order to separate the sources of uncertainties, some analysis could be carried out. For example, to diagnose the impact of the hydrological model, the forecast results could be compared with hydrological model simulated streamflow, driven by observed meteorological forcings. To diagnose the impact of meteorological forecasts, the results could be compared with the Ensemble Streamflow Prediction (ESP)-based simulations, etc. While I am not suggesting this paper should carry out these simulations and comparisons, I would like to see more interpretations of current results (e.g., Figures 6 & 7). For example, for the lower skill than climatology, how about the precipitation forecast skill in the events of low flows or high flows? How about the comparison with the offline-simulated streamflow?

- AC: We agree of course that it is both important and interesting to further evaluate the GloFAS-Seasonal forecasts. We will endeavour to provide some further discussion of the figures already included in the manuscript as suggested, and we will also be undertaking an assessment of the reliability of the probabilities, and including the associated reliability diagrams for the 80th and 20th percentiles in the updated manuscript. While decomposing the sources of predictability is outside the scope of this current paper, and the resources required to conduct the suggested analysis are very extensive and would result in a significantly longer paper, this is work that is ongoing within the research group and will be published in due course. To provide an example, a recent

paper by Arnal et al (2018) looks at decomposing the skill of the EFAS (European Flood Awareness System) seasonal hydrological forecasts, with plans for the research group to conduct similar studies using GloFAS, alongside further studies.

Reference: Arnal, L., Cloke, H. L., Stephens, E., Wetterhall, F., Prudhomme, C., Neumann, J., Krzeminski, B., and Pappenberger, F.: Skilful seasonal forecasts of streamflow over Europe?, Hydrol. Earth Syst. Sci., 22, 2057-2072, https://doi.org/10.5194/hess-22-2057-2018, 2018

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2. P1L26, what is "seasonal weather forecasts"? Do you mean forecasting weather or synoptic phenomena (e.g., storms, heat waves) at seasonal time scale? Or, do you mean "seasonal climate forecasts"?

- AC: We will change "seasonal weather forecasts" to "seasonal meteorological forecasts" which we believe is a better description, since neither 'weather' nor 'climate' correctly describe these forecasts and there is some controversy surrounding the correct terminology, and which term is used in various fields of research.

3. Besides introducing several regional operational systems, it would also be beneficial to mention a few research efforts for regional to global hydrological forecasting, e.g., Princeton's Global Seasonal Hydrologic Forecast System (Yuan et al., 2015), U.S.–Mexico Drought Prediction Tool (Lyon et al., 2012).

- AC: We will include a short summary of ongoing research efforts as suggested.

4. The authors' mentioned that there are 233TB data per day (P3L31). It is a huge amount of data, so it would be more useful if they can be widely shared to the community. Are there any thoughts for the data dissemination (e.g., cloud distribution)?

- AC: Overall, all forecasting and research activities at ECMWF produce ∼233TB of data per day in addition to the ∼210PB stored in the archives. Much of this data is shared with the wider community through the MARS archive, which can be accessed

online through the ECMWF website, and through other repositories such as the TIGGE archive and Copernicus Climate Data Store. As stated in the data availability section, ECMWF's ERA5 reanalysis and SEAS5 forecasts are available through the Climate Data Store, and the ERA5-R river flow reanalysis and the GloFAS-Seasonal reforecasts will be made available through an ECMWF data repository in due course; this is a time-consuming process due to the data volumes involved, and as such, GloFAS-Seasonal data are currently available from the authors upon request.

5. P4L9, what does "SEAS5" stand for?

- AC: SEAS5 in this case is not an acronym; ECMWF recently changed the naming convention for the seasonal forecasting system, and as such, SEAS5 is the name of the latest seasonal forecasting system (following System 1, System 2, System 3 and System 4).

6. P17L1, remove one of the "indicate that".

- AC: Thank you for highlighting this mistake, which we will correct in the updated manuscript.

References:

1. Lyon, B., et al., 2012: Baseline probabilities for the seasonal prediction of meteorological drought. J. Appl. Meteor. Climatol., 51, 1222–1237, doi:10.1175/JAMC-D-11-0132.1.

2. Yuan, X., et al., 2015: Seasonal forecasting of global hydrologic extremes: system development and evaluation over GEWEX basins. Bulletin of the American Meteorological Society, 96, 1895-1912, doi:10.1175/BAMS-D14-00003.1

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