

## ***Interactive comment on “The benefit of seamless forecasts for hydrological predictions over Europe” by Fredrik Wetterhall and Francesca Di Giuseppe***

**K. Foster (Referee)**

kean.foster@smhi.se

Received and published: 10 October 2017

### **Summary:**

In this paper the authors evaluate the added benefit of using a seamless integration (SEAM) of the outputs from ECMWF extended-range ensemble prediction system (ENS-ER) and the ECMWF system 4 seasonal forecast system (SYS4) for hydrological applications. The added benefit from this approach is evaluated by comparing the continuous rank probability scores for the outputs from the hydrological model LISFLOOD forced by SYS4, SEAM, and a climatological ensemble (CLIM) over the hindcast period.

C1

The authors find that hydrological hindcasts made using SEAM show better skill, over those made using SYS4, for much of Europe with lead times up to seven weeks. In some areas like the parts of Alps and northern Finland the reverse was true; however these results are uncertain due to the general poor performance of LISFLOOD in these regions. They argue that the increased skill can be attributed to the better initial conditions of the hydrological and meteorological conditions (models are initialised biweekly as opposed to once per month for SYS4) as well as the use of a better atmospheric model in SEAM (the atmospheric model used in SYS4 is locked at the initial version released with system 4 while the one used in ENS-ER is updated regularly). They conclude that the use of SEAM for hydrological forecasting at the seasonal scale has an added value for decision makers given the higher frequency of updates and improved skill, especially at the sub seasonal scale, making the forecasts more actionable.

The topic of this paper is of great interest at the moment considering the increased focus on forecasting at the sub seasonal to seasonal scales in recent years. Although the concept is not new this paper is the first, that I am aware of, that makes an attempt to evaluate a system that utilises current ‘off-the-shelf’ operational products. The paper is well written with a good structure and generally clearly formulated, the methods are scientifically sound, and the results are interesting. Additionally, the research presented in this paper is very relevant to the topic of this special issue. In my opinion, the manuscript has a lot of potential for publication in this HESS special issue. However the authors need to clarify some points and revise some statements so that the paper is more easily understood.

### **General comments:**

1) I feel that it is not clear for what periods the study was performed, something which has a bearing on the quality of the results. The authors state that (P5, L132-L135)

“This study focuses on the performance of SYS4 and SEAM over the hindcast period of the operational forecast with a sequence of starting dates over the period 2015-05-14

C2

(the first available date with 11-member hindcast for ENS-ER) to 2016-06-02 producing daily output time series of discharge over the 20-year hindcast period."

The first part of the sentence suggests that the evaluation period is between the dates 2015-05-14 and 2016-06-02 yet the second part says that the hindcast period has a length of 20 years. The next line has a similar mixed message. From the paper I get the general impression that the evaluation is done for the 20 year period so I assume that the issue is to do with how section 2.3 is worded. This should be addressed as there is some confusion in the way that the paragraph (p5, L231-L238) explains it. Further it has implications on the robustness of the results, should the evaluation period be just the 13 months between the aforementioned dates this would give a limited data sample from which to draw the wider reaching conclusions made by the authors. How can the authors know whether the performance of the different approaches during that period was typical of their general performance?

2) The results show that SEAM has skill over SYS4 in the first 3-8 weeks (Figure2b), mostly concentrated in the first 6 weeks. This would imply that there may be a benefit of merging the two meteorological forecasts before day 46. Did the authors consider this and if not why?

Specific comments:

P2, L26: "TSYS4 is also..." I assume that this is a typo and should read, "SYS4 is also..."

P7, L224-L225: Although this line is factually correct it appears to contradict the preceding ones. The reader is being told how the low flows during this period caused substantial economic losses due to it affecting inland navigation in the Danube and Rhine basins only then to be told that navigations are regulated during high flows and not low flows. I suggest rewording this or removing this sentence to remove the perceived contradiction or removing this line altogether as it does not add anything significant to the discussion.

C3

P8, L249-L250: The second part of this line is awkward to read and should be rephrased.

P11, L350-L35: I think the reference is - Pappenberger, F., Wetterhall, F., Dutra, E., Di Giuseppe, F., Bogner, K., Alfieri, L., and Cloke, H. L.: Seamless forecasting of extreme events on a global scale, pp. 3–10, Proceedings of H01, IAHS-IAPSO-IASPEI Assembly, Gothenburg, Sweden, July 2013 (IAHS Publ. 359, 2013)

P16, Caption to figure 3: The last line states, "The dimension of the circles is proportional to the number of days while the color scale refers to progressive weeks." What do the authors mean by number of days?

---

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2017-527>, 2017.

C4