

## ***Interactive comment on “Observational gridded runoff estimates for Europe (E-RUN version 1.0)” by Lukas Gudmundsson and Sonia I. Seneviratne***

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The paper describes the development of a monthly gridded runoff time series for Europe generated from river discharge observational network using machine learning statistical techniques. The paper is well written, in particular the method, quality checks and cross validation sections. The product is made available free of charge and will be a great asset to the scientific community. Impacts can range from improving hydrological process understanding to hydrological model calibration.

While I very much like the paper and welcome its publication, I have one major concern and therefore suggest a major revision. Below are also some additional specific points that would benefit being addressed.

My main concern relates to the treatment of ‘values with more than 10 consecutive

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equal days' [which could be re-worded as 'periods with more than 10 consecutive days with equal values']. As pointed out by the other reviewers, such periods could be legitimate, especially during the summer in arid regions and in the winter in high altitude/ high latitude regions when flows are null, describing non perennial rivers. Flagging those periods as suspect and then to missing data effectively removes any non perennial rivers from the dataset. This might have two consequences: first, the resulting sub-sample used for the rest of the analysis to be biased towards higher runoff; second to reduce the density of stations in those regions and hence increase uncertainty. In fact the authors themselves acknowledge that uncertainty in the generated runoff is largest in arid regions – which coincides with regions with the largest proportion of 'suspect'/ missing data. One alternative is to change the criterion to ONLY remove those data points when consecutive equal values DIFFERENT from zero are recorded. This is likely to increase the used sample in particular in southern Europe and the Iberian Peninsula and to overall improve the accuracy of the generated runoff. More discussion about the setting up of missing data and the consequence for the estimated runoff should be provided as this also is the same as where performance is worse, e.g. for southern Europe.

Specific points:

- Page 2, line 15: the authors should give a value of what is a 'relatively small catchment';
- The authors should justify the rationale from producing a monthly runoff product from daily river discharge: why not daily runoff? If monthly runoff is the only scientifically robust product, why have the authors limited their sample to daily river discharge time series, excluding monthly time series? Those could help increase gauged density and ultimately increase the accuracy/ reduce uncertainty in the monthly runoff estimates. This might be particularly beneficial for regions/ periods where fewer daily time series are available.

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- P5, line 26: 'very likely missing' is a new terminology not defined in the text
- Section 5.2.2. It would be good if the authors could provide range of error measures associated with good/poor performance. This would help with the interpretation of fig 8
- Section 5.3.2. The authors should provide the range of standardized runoff anomalies corresponding to drought periods
- Fig11, 4, 5: dots are very small and difficult to see. Please increase the size e.g. to that of fig2
- Fig 3, 4, 5, 10: the continuous colour bars make it very difficult to distinguish the different colours. A larger palette, for example with more pale colours, might work better
- Fig9 legend is not colour-blind friendly
- Fig 8: it would be good to have the same colour tone for 'good' performance. At the moment it is difficult to quickly compare the different maps
- Maps of fig 5, 8., 9 and 10 are too small and difficult to read.
- Fig 6 : there is a lot of season-to-season variability in the number of spatial information time series. For me this is a spurious consequence of setting up missing data to rivers with no flow. This does not look right and requires an explanation; I think this justifies exploring a new criteria for instrument failure / equal values records.

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