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Hydrology and Earth System Sciences Discussions

Interactive comment on "On selection of the optimal data time interval for real-time hydrological forecasting" *by* J. Liu and D. Han

J. Liu and D. Han

hettyliu@126.com

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The anonymous referee has made some interesting comments on the paper. Our reply to these comments are as follows:

Reviewer comment 1: The paper describes an analysis to identify the optimal time interval of the input data for rainfall-runoff modeling/forecasting. The paper is interesting, well written but the question remains if the author really solved a burning issue.

Reply: We thank the reviewer for providing helpful comments on the paper and agreeing that the topic is interesting and it is a burning issue in hydrological forecasting. Although this single study is not able to really solve this complex problem, the paper it-

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self would highlight the time interval problem in hydrological forecasting and encourage more studies on this topic.

——————————— Reviewer comment 2: I think amongst hydrologist it is basic knowledge that the temporal resolution of the input data and model should be several times smaller than the characteristic response time of the catchment (in other words the reaction time determines the maximal time interval). I would like to see an analysis of the rainfall-runoff models and their time interval + concentration time used by EA in England and Wales to see if this is really an issue in operational flood forecasting (I have my doubts this is the case for England and Wales). The EA in England and Wales used different models with different time intervals for different areas (depending on the concentration/reaction time). (See for instance some publications on forecasting/modelling in England and Wales The PDM rainfall-runoff model, R. J. Moore Hydrol. Earth Syst. Sci., 11, 483-499, 2007. Risk-based Probabilistic Fluvial Flood Forecasting for Integrated Catchment Models. Phase 2 Report. Science Report – SR SC080030, Environment Agency, 2010. K. Sene, A.H. Weerts, K. Beven, R.J. Moore, C. Whitlow, J. Beckers, A. Minett, H.C. Winsemius, J. Verkade, P. Young, D. Leedall, P. Smith, S. Cole, A. Robson, P. Howard, M. Huband, N. Breton, 2010 The use of MOGREPS ensemble rainfall forecasts in operational flood forecasting systems across England and Wales, J. Schellekens, A.H. Weerts, R.J. Moore, C. E. Pierce and S. Hildon, Advances in Geoscience, special issue, vol. 29, 77-84, doi:10.5194/adgeo-29-77-2011, 2011 Estimation of predictive hydrological uncertainty using quantile regression: Examples from the National Flood Forecasting System (England and Wales), A.H. Weerts, H.C. Winsemius, J.S. Verkade, Hydrol. Earth Syst. Sci., 15, 255–265, doi:10.5194/hess-15-255-2011, 2011.)

Reply: The reviewer has rightly pointed out that model time interval is an important issue in hydrological forecasting because 'The EA in England and Wales used different models with different time intervals for different areas (depending on the concentration/reaction time)'. However, it is also clear that there is a lack of studies in analysing

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model time intervals in the hydrological literature. Instead, modellers tend to intuitively use different time intervals by their 'gut feeling', as illustrated by those papers/reports provided by the reviewer. We agree that it would be ideal if more hydrological models and catchments could be analysed. However, for a single study, it is not possible to explore a large number of hydrological models over the whole England and Wales. It is possible that the model time interval may only affect certain types of hydrological models in certain catchments. This should be checked out by encouraging more hydrological modellers to apply the methodology from this paper to a broad range of hydrological models and catchments, so that a comprehensive pattern could be discovered.

——————————— Reviewer comment 3: One other burning issue is probably the estimation of the areal precipitation, which is not treated or hardly mentioned at all. I think this issue is more difficult and a bigger problem than the time interval of the input data (and which is probably well taken care of in England and Wales).

Reply: We agree that areal precipitation estimation is a burning issue in hydrology, especially for large catchments with sparse rain gauge networks. The catchments in the study are quite small (from 20 sq km to 200 sq km) with adequate rain gauge network coverage. For example, the Brue catchment has 49 rain gauges over 135 sq km and it has shown similar patterns to other three catchments with different areas and rain gauge densities. Therefore, the areal precipitation in this study is not a major problem.

——————————— Reviewer comment 4: Please adopt the general guidelines for a publication completely separating material and methods (including the experimental design) from the results and discussion. It is now completely mixed and makes the manuscript difficult to follow. Also use introduction-material&methods-results&discussion-conclusions instead of report style headings.

Reply: Scientific research can be divided into curiosity-driven, hypothesis-driven and

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data-driven. The former two are traditional approaches, and the latter is a new trend. This research is data driven and the hypothesis is proposed in the later part of the paper instead of the earlier part. We have published many papers in the traditional style, but we believe that the current style is more suitable to the content of the research. However, if the reviewers and readers feel strongly that the traditional style should be used, we are happy to amend the manuscript accordingly.

——————— Reviewer comment 5: How much do the results depend on the use of the ARMA model? In other words, can you split the results or redo the experiment with only the PDM model? It might be that the results are completely due to the use of the ARMA model, as the behavior might be very different for different time intervals. This is mentioned as a problem/issue (section4) but not followed up. Please answer this important question because your conclusions (1-4) may depend on this.

Reply: As mentioned above, it is possible that the results may be different if other models and catchments are analysed. The reviewer's comment highlights the importance that such a study should be carried out more widely among the hydrological modellers so that better understanding on model time interval for different models could be achieved.

——————— Reviewer comment 6: Conclusions are very weak. I get the feeling nothing has been solved or clarified. Maybe because the hypothesis is not well posed (purpose is to explore the general impact of the data time interval on hydrological forecasting)

Reply: Yes, we agree that the current conclusions can be misleading. They are presented as if they are true for all hydrological models applicable to any catchment conditions. We will amend the conclusions to make them clear that the results are conditioned on the model and catchments used in this study only, and a wide range of models and catchments should be analysed by the community in the future to draw more comprehensive conclusions. Hopefully, this paper will stimulate such studies.

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