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Hydrology and Earth System Sciences Discussions

Interactive comment on "A data based mechanistic real-time flood forecasting module for NFFS FEWS" *by* D. Leedal et al.

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The authors present a development of a data based mechanistic real-time flood forecasting module for NFFS FEWS. The paper is well written and the subject of their research is of interest to the hydrological community. The novelty of the research is in the development of a DBM FEWS module written in R language. It is extremely difficult to write a general code that can be implemented within a specific program architecture. Moreover, the on-line implementation structure requires the establishment of very efficient communication paths. The authors seem to have achieved both aims and should be congratulated for it. There is a big gap between theoretical investigations and practice and the authors have managed to cross it.

The outline of the paper is well thought through. The introduction gives the general background to the problem. In section 2 the authors describe the fundamental DBM component and provide a mechanistic interpretation. One has to say that a lot is left here for the reader to guess how this interpretation is applied in the present case. However, a reference to the literature is given, hence an interested reader can follow it up. It is worth noting that the transformation from an input–output transfer function formulation into state space is never unique, as the state space model depends on the choice of state space variables.

The rest of the section gives a brief description of the input nonlinearity, data assimilation algorithm and adaptive gain module. Again, appropriate references are given for the interested reader who wants to know more about the methods used. In order to keep a proper sequence of the procedures the authors should give the subsection describing input nonlinearity earlier, before the subsection describing state space formulation. It should be mentioned that the transformation of input should be done simultaneously with an estimation of the TF model parameters. Another point, that should be discussed by the authors, is the adjustment of the variance heteroscedasticity done in the state space formulation stage of the problem. The heteroscedastic variance affects the estimates of the STF model parameters and this might be a major obstacle in getting the final optimal solution.

DBM FEWS module, being the main focus of the paper, is described in Section 3 and the Eden case study, where the module was tested, is presented in Section 4. Implementation of the DBM node in FEWS puts specific requirements regarding the data, source code and the model implementation routine. The data are stored in a model agnostic format and handled using a generic XML scheme. The requirements regarding the DBM FEWS module are flexibility, extensibility and transparency. The authors have applied an open source R language to avoid licensing problems. It obviously required a considerable amount of programming skills to develop the DBM module for implementation within FEWS. However, the authors had a difficult task in describing the

programming procedures in a few sentences and the outcome is not very clear. The authors forgot to mention that the main difficulty lies in the coding of the DBM module in an on-line form, which is different from the typical programming practice.

An application of the DBM FEWS module to the Eden case study involved calibration of the module and verification. The catchment is well instrumented, with 31 level and 16 rainfall telemetered gauges but the authors do not give any information on whether all these measurements were involved in the forecasting scheme. The authors presented the resulting forecast up to 7 hours ahead. The results show that the forecasting ability of the developed DBM FEWS module is very good. The forecast uncertainty described by a +- 2 standard deviation estimate is high even for a 2 hours ahead forecast (+- 1.5m), indicating that there are improvements still needed.

I will be very glad to see this paper published – it is nearly 8 years since the idea of doing such a DBM FEWS module first emerged in Lancaster and it is good to see it accomplished.

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