Nat. Hazards Earth Syst. Sci. Discuss., 3, C3195–C3198, 2016
www.nat-hazards-earth-syst-sci-discuss.net/3/C3195/2016/

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Ensemble flood forecasting to support dam water release operation using 10 and 2 km-resolution JMA Nonhydrostatic Model ensemble rainfalls" *by* K. Kobayashi et al.

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Received and published: 10 February 2016

Dear Anonymous Referee #1,

Thank you very much for your comment, especially for the positive evaluation in the former half of your comment.

"This manuscript presents a state-of-the-art scheme to support dam water release operation and to improve ensemble rainfall and flood forecasts using position error correction method. The proposed method is verified by ensemble flood hindcast at a

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Japanese catchment. And the proposed method is expected to contribute the current rainfall and flood forecasts using numerical weather prediction model, which would be of interest to a broad ranges of the hydro-meteorologic researchers. Overall the paper proposes technically sound method and those detail steps are well documented in a concise manner."

To respond to the latter half of your comment, we would like to first tell the premise/condition of our research activities.

First, we consider that one of the strengths of our research is the use of cloud-resolving ensemble NWP. Note that the cloud-resolving ensemble forecast is still too expensive for operational NWP. Thus, the experimental period in the paper is limited.

Second, in Japan, hydrological data that are necessary to validate our research are not necessarily open to public, and it may take long time to obtain the data. Fortunately, we obtained the precious hydrological data for the current case from the local office of the government.

For these reasons, we decided to focus on the particular high-impact case that we presented in this paper to demonstrate the potential usefulness of the cloud-resolving ensemble NWP in flood forecasting. We would appreciate it very much if you could understand the standpoint of our study.

More comments from us are written in lines below.

"However, I would like to emphasize the need for further research on the interpretation of ensemble outputs, sufficient events for statistical analysis, especially pre/post-processing (i.e., some kind of correction) of the raw ensemble outputs. To reduce the uncertainty of rainfall and flood forecasts, the bias correction and/or hybrid products blending with radar-based prediction are required to achieve more reliable hydrologic predictions. From the further research by the bias correction of NWP model, please verify the applicability through a number of case studies, and please apply to catchment-

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based flood warning system and optimized release discharge for dam operation."

As mentioned, it is not easy to carry out ensemble simulations for multiple cases immediately. However, as other example using the same NWP model, you can find the paper by Yu et al. (2015).

Yu et al. (2015) show the improvement of rainfall and flood forecasting by a blending method of NWP rainfall with radar prediction. Their target is typhoon “Talas” of 2011 over the two catchments, Futatsuno (356.1 km2) and Nanairo (182.1 km2) dam catchments of Shingu river basin (2360 km2).

In contrast, our target site (72.7 km2) is much smaller and the target weather system is more confined in space, implying that the current case can be more challenging than the cases in Yu et al. (2015). Nevertheless, our study revealed that the NWP-based ensemble QPF with the position error correction had a good potential for reliable flood forecasting.

Of course, bias correction and blending radar-based QPF and NWP-based QPF will also improve QPF up to lead times of several hours (e.g., Sun et al. 2014), and would bring further improvements in flood forecasting. A good example of short-term blending ensemble rainfall prediction can be found at e.g. Bowler et al. (2006).

In this paper, we discussed the position error correction of NWP-based ensemble QPF for the use in a small catchment of less than 100 km2. This problem has not been considered in the previous studies. Thus, we believe that the result shown in our paper is worthwhile for a consideration in the hydro-meteorologic society.

Nevertheless, we recognize further need of the research for the generalization of the proposed method, and increase of number of the experiments. This aspect will be addressed in concluding remarks in the revision of our paper, and the current paper will become the basis for the further development.

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Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 3, 7411, 2015.