

## ***Interactive comment on “Development of a hydrological ensemble prediction system and a visualization approach for improved interpretation during typhoon events” by Sheng-Chi Yang et al.***

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1. The manuscript has a double objective: 1- Proposing a hydrological ensemble prediction system (HEPS) that includes numerical weather models that perform rainfall forecasts and hydrologic models that produce assessments of surface runoff and the associated flooding. 2- Introducing an extension of the ‘Peak-Box’ visualization methodology that assists in interpreting the forecast results for operational purpose. I think the authors do not achieve the first of their purposes while the 2nd in my opinion is an outstanding innovation work (successfully approached) but might be not enough for a research paper. The Introduction section presents an interesting state-of-the-art re-

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view. However, this is not clear in this section what the current proposal is (what actually the authors propose and how this represent a novelty out of the literature in the topic). Section 2 attempts to describe the HEPS proposed in this work. The authors again introduce another review of certain models and methodologies to ensemble. However, they fail again to propose and to properly explain any novelty regarding the ensemble they use.

Reply:

The main objectives of this study are the development of a HEPS and a modified visualization “SD-Box” methodology for the HEPS’ forecasting results. It is the first attempt in Taiwan to integrate ensemble NWP, hydrological models (rainfall-runoff model and river routing model), and ocean models to establish an operational hydrological ensemble prediction system for typhoons. The proposed HEPS includes the rainfall forecasts with a 72-h lead time and uses it as model input to generate river flow forecasts. However, the ensemble based HEPS would generate results, which confuse end users for identifying key information. The HEPS along with the proposed visualization methodology helps emergency responders take necessary measures to prevent and mitigate the impacts of flooding include loss of human life and damage to property. The authors appreciate the reviewer’s comments and will modify the manuscript to emphasize the novelty regarding the work.

2. Section 3 is a case-study.

Reply:

As described in this section, Taiwan Typhoon and Flood Research Institute (TTFRI) establishes two experimental watersheds in Taiwan which provide long-term hydrologic monitoring data. The Yilan river basin is one of these two experimental watersheds and has many high-quality observation data including rainfall, water-stage, surface velocity, and flowrate. This manuscript is the first article using these data to establish and calibrate the ensemble meteorological-hydrological model. The authors will add more

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content to describe the study area in the revised manuscript.

3. Section 4 is the visualization approach that in my opinion is the asset of this work. The authors should clearly state firstly the novelties of the work (where are the novelties, why are novelties, how are them compared to previous research). In addition, the authors should clearly explain their proposal for HEPS. Are they proposing some original idea for the ensemble? This is not well explained or not explained at all in the document. Half manuscript should be clearly improved and rewritten while the second half is interesting add-on for a visualization method (that already existed). In the current form of the manuscript I'm afraid I can't find novelty enough to be published. However, there is room to do a much better work after a major revision or re-submission.

Reply:

The idea of visualization approach "SD-Box" is originally inspired from Zappa et al. (2013) and the study modified it especially for a typhoon event. This study identified the "SD-Box" by including all available forecasts with different times at present time. It is explained that the accuracy of typhoon track forecasts varies with forecast lead time. Typhoon track forecast has a significant impact on the rainfall forecast. If only one forecast at present time instead of inclusion of all available forecasts from a certain time, the uncertainty of track forecast would be neglected. This study considered all available forecasts from a certain time to decrease the forecast uncertainty and provide a better interpolation of results. To draw the box, this study used mean and standard deviation of collected forecasts to determine the enveloping rectangle. The standard deviation takes into account every variable in the dataset and it is most robust and widely used measure of dispersion from a statistical point of view. Therefore, the end-users can construct a confidence level of the forecast based on the size of the enveloping rectangle and also identify the key information for immediate response. The goal of this study is to develop a visualization approach which is statistically meaningful and can demonstrate the risk of the hydrological ensemble forecasts. The authors appreciate the reviewer's suggestion. Detailed explanation will be added in the revised manuscript

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accordingly.

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