Hydrol. Earth Syst. Sci. Discuss.,
doi:10.5194/hess-2016-104-AC1, 2016

Hydrology and Earth System Sciences
Discussions

Interactive comment on "A Retrospective Streamflow Ensemble Forecast for an Extreme Hydrologic Event: a Case Study of Hurricane Irene and on the Hudson River basin" *by* F. Saleh et al.

F. Saleh et al.

fsaleh@stevens.edu

Received and published: 22 April 2016

Dear Referee,

We are deeply grateful for your valuable comments and suggestions that will greatly improve the quality of this manuscript. We outline below your comments and our responses.

SPECIFIC COMMENTS Comment 1: In the abstract the authors state that this modeling framework could be applied anywhere in the world. However, they use NARR dataset and a database from US based gage sites for calibration. How would these methods be applied for watersheds without gaging stations (or with only a few) out-

side of the US where the NARR dataset does not apply? Also, this statement was not discussed in the paper.

Thank you for pointing this out. We will make sure that this statement is addressed properly in the paper. It is possible to use other sources of atmospheric data in the framework instead of NARR in order to apply the framework to watersheds in other countries. For instance, one may use atmospheric reanalysis products from the European Center for Medium range Weather Forecasting (ECMWF), National Centers for Environmental Prediction (NCEP) and National Center for Atmospheric Research (NCAR). The framework directly handles GRIB1, GRIB2 and NetCDF. As for watersheds without gaging stations (or with only a few), it is possible to use remote sensing river discharge data to calibrate and validate the modeling outputs. Despite that fact that such data have uncertainties, there have been many advancements in this field and there is potential for future applications (e.g., the Surface Water and Ocean Topography (SWOT) satellite mission).

Comment 2: The HEC-HMS model uses the SCS Curve Number method that includes "antecedent moisture content" (P5 Line 22) as a parameter for estimating runoff. From my experience, model runoff estimation can be very sensitive to soil moisture. This indicates that calibrating the model will only produce accurate answers for the conditions of the storm it was calibrated to. How do you account for changing soil moisture in the forecast framework?

This is a very important point that the referee is addressing. We are aware of the limitations in using static parameters for the SCS curve number method. To this end, the framework has a look up table for the initial abstraction parameters based on the hindcast and the continuous run of the model with the NARR data. We are actively working on integrating a machine learning technique which automatically selects the optimal initial abstraction parameters on the fly, this is a subject of active research by our team. We will make sure this is discussed in the paper.

Comment 3: How long does it take for the streamflow forecasts to be produced? How much lead-time is left over? Is it enough to issue a warning?

For the entire Hudson River Basin, the required time for GEFS (21 members) is around 30 minutes. This includes processing the GRIB files and post-processing of the ensemble outputs. We are currently running 125 ensemble members in the framework and this includes (in addition to GEFS) the ECMWF, ECMWF-HRES, the Short-Range Ensemble Forecast (SREF), the Canadian Meteorological Centre (CMC) and the North American Mesoscale Forecast System (NAM). The total time for all these ensemble members is around five and a half hours from pre-processing to updating the database and the website. We are currently updating the forecasts every 6 hours. The current lead time (87 hours) is sufficient for issuing a flood warning.

TECHNICAL CORRECTIONS

We are very grateful for the technical corrections, we will make sure they are all addressed in the manuscript.

ADDITIONAL INFO The authors may be interested in an upcoming publication on ensemble forecasting using ECMWF datasets listed here (http://rapid-hub.org/publications.html): Snow, Alan D., Scott D. Christensen, Nathan R. Swain, James Nelson, Daniel P. Ames, Norman L. Jones, Deng Ding, Nawajish Noman, Cédric H. David, Florian Pappenberger (In Press), "A High-Resolution National-Scale Hydrologic Forecast System from a Global Ensemble Land Surface Model", Journal of the American Water Resources Association.

Indeed, we are very interested in the Snow et al. (2016) publication once it becomes available online. Actually, I am very familiar with the work of certain co-authors and have also used the routing model RAPID in the past.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-104, 2016.