FEATURED COLLECTION INTRODUCTION: NATIONAL FLOOD INTEROPERABILITY EXPERIMENT II

Jim Nelson


The ribbon cutting ceremony in May 2015 of the National Weather Service’s (NWS) new National Water Center (NWC) provided the necessary facilities for the National Oceanic and Atmospheric Administration to carry out its vision for a weather-ready nation (OWP, 2016). The idea of a national center was to complement the 13 existing River Forecast Centers by transforming the national capability for hydrologic prediction with a seamless national water model that could enhance both temporal and spatial forecasting resolution. The NWC provides a hub whereby the NWS can engage the academic community and other federal institutions involved in the variety of data, modeling, visualization, and dissemination of forecast product activities. Of the NWC Dr. Kathryn Sullivan said, “The National Water Center will bring researchers, forecasters and stakeholders together to accelerate progress towards the improved water forecasts the nation needs to manage our precious water resources wisely.” This research-to-operations mentality is what led to the idea of a National Flood Interoperability Experiment or NFIE as an inaugural event at the NWC. Proposed by Dr. David Maidment (Maidment et al., 2014) as a way to kick-start activities in support of the NWS vision, it also intends to train a new generation of scientists who can contribute to it. This is the second half of a two-part featured collection summarizing the research emanating from the first summer institute held during the summer of 2015. The overarching goal of the first NFIE was to demonstrate a continental-scale flood forecast modeling system was feasible, a task that for all of the data and computational resources required had been achieved. Maidment’s (2016) overview was accompanied by five other papers in the first part of the featured collection (JAWRA, 2017). The following provides a synopsis of the remaining seven papers of the NFIE Featured Collection. The first three describe issues and methods for comparing output from the national scale model with observed and other modeled data. The next two discuss data-driven approaches to produce similar kinds of results as are modeled or provided missing data for assimilation and the final two papers extend the streamflow forecasting to flood mapping and damage assessment.

SYNOPSIS

Salas et al. (2017) documented the success of the first NFIE summer institute’s principal objective of creating an operational national streamflow forecasting model. Based on the Weather Research and Forecasting Hydrological modeling system (WRF-Hydro) framework and built on 2.7 million river segments of the NHDP plus (Horizons Systems Corporation, 2011), the goal of NFIE was achieved and this paper also

2Professor, Civil & Environmental Engineering, Brigham Young University, 242-K CB, Provo, Utah 84602 (E-Mail/Nelson: jimn@byu.edu).
presents work done to compare with U.S. Geological Survey (USGS) streamflow and the evaluation of reservoirs from a case study in Texas.

As the national water model evolves, it is important to be able to compare with other models and systems. For example, the Iowa Flood Center has developed a comprehensive flood information system for the state of Iowa that is similar in concept to the national water model and it is useful to be able to compare frameworks and results. Quintero and Krajewski (2017) discussed the issues around mapping results from the Iowa system to the national system, so relevant comparisons can be made. Comparisons of evapotranspiration (ET) and streamflow from the national water model are compared with observed data in the paper by Lin et al. (2017). This analysis was done in Texas where they were able to compare against 271 USGS stream gages for flow, while calculated ET was compared to satellite data from MODIS and FLUXNET. Their results showed better fits were obtained during wet years.

Essential to a robust national water forecasting system is the ability to assimilate existing streamflow measurements. As part of their contribution to the NFIE research, Petty and Dhingra (2017) developed a machine learning program that would provide immediate estimates of streamflow for gages out of operation based on the operable stations within the same region. Their work was tested in watersheds in Washington and Idaho and showed a very high degree of accuracy.

Zhao et al. (2017) presented an application that predicts reservoir inflows from statistical and physics-based models using a machine learning model on Azure. This is a key element in water resources management and their approach could be compared with predictions made by the national water model.

An important aspect of a national-level streamflow forecasting ability is to be able to extend the flows to inundation maps that can be used to assess impact and help develop plans that can make flood-prone areas more resilient. In their contribution to the featured collection, Selvanathan et al. (2017) presented a framework for developing flood maps from hydraulic models that form a part of the Federal Emergency Management Agency’s database that include incorporation of climate change scenarios in order to evaluate resiliency. Gutenson et al. (2017) took the idea of using flood maps a step further by showing flood damage can be estimated by combining flood maps with infrastructure and damage curves associated with geographic point and polygon features. Such features can be mapped on the inundation boundaries and then the overall damage can be assessed using the appropriate damage curve.

LITERATURE CITED


