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Integrating Fluvial and Oceanic Drivers in Operational Flooding Forecasts for San Francisco Bay

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The nine counties that make up the San Francisco Bay area are home to 7.5 million people and these communties are susceptible to flooding along the bay shoreline and inland creeks that drain to the bay. A forecast model that integrates fluvial and oceanic drivers is necessary for predicting flooding in this complex urban environment. The U.S. Geological Survey (USGS) and National Weather Service (NWS) are developing a state-of-the-art flooding forecast model for the San Francisco Bay area that will predict watershed and ocean-based flooding up to 72 hours in advance of an approaching storm. The model framework for flood forecasts is based on the USGS-developed Coastal Storm Modeling System (CoSMoS) that was applied to San Francisco Bay under the Our Coast Our Future project. For this application, we utilize Delft3D-FM, a hydrodynamic model based on a flexible mesh grid, to calculate water levels that account for tidal forcing, seasonal water level anomalies, surge and in-Bay generated wind waves from the wind and pressure fields of a NWS forecast model, and tributary discharges from the Research Distributed Hydrologic Model (RDHM), developed by the NWS Office of Hydrologic Development. The flooding extent is determined by overlaying the resulting water levels onto a recently completed 2-m digital elevation model of the study area which best resolves the extensive levee and tidal marsh systems in the region. Here we present initial pilot results of hindcast winter storms in January 2010 and December 2012, where the flooding is driven by oceanic and fluvial factors respectively. We also demonstrate the feasibility of predicting flooding on an operational time scale that incorporates both atmospheric and hydrologic forcings.