An integrated operational forecast system for coastal, fluvial, and pluvial flooding in the San Francisco Bay area

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Motivation

Account and timely flood and precipitation information is critical for making emergency response decisions regarding public safety, infrastructure operations, and resource allocation. Lundsten, the California Department of Water Resources has funded the development of a state-of-the-art Advanced Quantitative Precipitation Information (AQPI) system to provide near-term precipitation and flooding forecasts using an integrated observation and modeling framework for the San Francisco Bay area. The main goals of this collaboration project are to detect and track storms, forecast high-resolution precipitation with cutting-edge radar technology, and forecast watershed and coastal flooding up to 72 hours in advance. This presentation focuses on the most downstream model in the AQPI framework, which is based on the USGS Coastal Storm Modeling System (CoSMoS) www.usgs.gov/cosmos).

CoSMoS set up: DELFT3D-FM MODEL

CoSMoS is a physics-based numerical modeling system for assessing coastal hazards from the combined effects of tides, rivers, storm surges, and waves. In particular, the USGS is using the DELFT3D Hydrod Mod suite, developed by Delft, that enables 1D-3D coupling and efficient and reliable modeling. DELFT 3D-FM, a shallow water flow solver, is implemented in two dimensions on the unstructured grid shown here in blue and in 1 dimension along the channels shown in red. The model domain extends ~50 km offshore of the coast and extends from Point Reyes in the north to Montara in the south. There are ~4,470 2D grid cells and 2,425 1D profiles defined. The forcing applied to the operational models are shown in the list on the right, although the ones in grey are still under development for operations.

Future Work

Our ultimate goal is to create a number vulnerability forecast map based on the three processes that can drive flooding: rain, river flow, and coastal water levels. Some of our partners can currently use rain forecasts coming from AQPI to create floodplain inundation forecasts (Figure 9). The National Water Model is currently developing a similar capability. In order to have a comprehensive understanding of vulnerability during an event we must combine the coastal inundation mapping with the hydrologic model predictions. These can then be combined with important features like the one shown in Figure 10 to understand the potential impact of an event.

Future Questions

Further questions can be directed to Liv Herdman lherdman@usgs.gov or Babak Tehranirad btehranirad@contractor.usgs.gov.