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Coastal hazards in a changing world: projecting and communicating future coastal flood risk at the local-scale using the Coastal Storm Modeling System (CoSMoS)

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The risk of coastal flooding will increase for many low-lying coastal regions as predominant contributions to flooding, including sea level, storm surge, wave setup, and storm-related fluvial discharge, are altered with climate change. Community leaders and local governments therefore look to science to provide insight into how climate change may affect their areas. Many studies of future coastal flooding vulnerability consider sea level and tides, but ignore other important factors that elevate flood levels during storm events, such as waves, surge, and discharge. Here we present a modelling approach that considers a broad range of relevant processes contributing to elevated storm water levels for open coast and embayment settings along the U.S. West Coast. Additionally, we present online tools for communicating community-relevant projected vulnerabilities.

The Coastal Storm Modeling System (CoSMoS) is a numerical modeling system developed to predict coastal flooding due to both sea-level rise (SLR) and plausible 21st century storms for active-margin settings like the U.S. West Coast. CoSMoS applies a predominantly deterministic framework of multi-scale models encompassing large geographic scales (100s to 1000s of kilometers) to small-scale features (10s to 1000s of meters), resulting in flood extents that can be projected at a local resolution (2 meters). In the latest iteration of CoSMoS applied to Southern California, U.S., efforts were made to incorporate water level fluctuations in response to regional storm impacts, locally wind-generated waves, coastal river discharge, and decadal-scale shoreline and cliff changes. Coastal hazard projections are available in a user-friendly web-based tool (www.prbo.org/ocof), where users can view variations in flood extent, maximum flood depth, current speeds, and wave heights in response to a range of potential SLR and storm combinations, providing direct support to adaptation and management decisions. In order to capture the societal aspect of the hazard, projections are combined with socioeconomic exposure to produce clear, actionable information (https://www.usgs.gov/apps/hera/); this integrated approach to hazard displays provides an example of how to effectively translate complex climate impacts projections into simple, societally-relevant information.