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High-Resolution global coastal flood forecasting across the power spectral density function from $10^{-2}$ to $10^2$ cpd

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Extreme sea levels associated with storm surges and high tides can have devastating impacts on coastal societies due to flooding. Easily accessible and accurate information on coastal flooding should be available to all citizens of the world. To provide such global-scale information we have made advances in the use of a globally forced unstructured mesh storm tide model (2 km to 25 km resolution) that incorporates seamless local high-resolution insets (minimum resolution of 50 m). In forecasting mode the system selects which local insets to seamlessly merge into the global model based on an a priori indicator of potential storm surge threat. In this way the modeling system takes full advantage of unstructured mesh capabilities by modeling atmospheric and astronomically-driven surge and tides on a global scale while concurrently simulating local coastal flooding at a practically useful resolution. An additional advance includes extracting ocean density fields from a three dimensional Ocean Generation Circulation Model (OGCM) in order to compute the baroclinic pressure gradient term used to force steric sea level variability and ocean current systems as well as internal tide dissipation in an otherwise two dimensional barotropic circulation model. This allows us to account for density-driven sea surface height anomalies present during a forecast and will help improve dynamical and non-stationary aspects in studies of long-term future coastal flood risk.