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Integrating storm surge observations and forecast products for event response and climate change monitoring

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Understanding, forecasting, monitoring and post-evaluation of storm surge requires integrated data collection and models for time-critical storm response and long-term flood hazard planning. The National Oceanic and Atmospheric Administration (NOAA) utilizes nationwide in situ observation networks and a national forecast model for storm surge prediction, monitoring and historical storm comparison.

The National Water Level Observation Network (NWLON) configurations include primary and backup systems, real-time transmissions, 24-7 quality assurance and new, hardened station installations. During landfalling cyclones, the “Storm QuickLook” provides a synopsis of oceanographic and meteorological data. Observations and tidal predictions are transmitted to the forecasting community, including the Sea, Lake, and Overland Surges from Hurricanes (SLOSH) modelers. Modelers use the difference between observed water levels and predicted tides to initiate and evaluate the models during the storm and for post-event validation.

SLOSH is a 2.5 D (vertically integrated), gridded, finite difference numerical model developed for storm surge simulation. SLOSH uses the following parameters: central

pressure deficit, hurricane track information (location, speed and direction), radius of maximum winds and regional topography and bathymetry. Model runs are combined into composite maps to define the hurricane surge flood plain. NOAA is also utilizing SLOSH to produce an experimental Probabilistic Storm Surge calculation. SLOSH basins have been developed for portions of coastlines in India, China, and Korea.

As a result of NOAA's long term station operation and accrual of water level data, it is possible to calculate sea level trends, evaluate the effects of sea level rise on storm tides and surge, and define the frequency of occurrence of the most extreme events. After adjusting historical storm records to include subsequent sea level rise up to a baseline year, the highest water levels reached by different storms may be compared in an unbiased manner. The long-term series of the monthly highest and lowest water levels at a station annual exceedance probability levels, e.g. the 1% annual exceedance probability level will correspond to a water level that would be exceeded once every 100 years on average.

These observations, analyses and models are being integrated in hurricane evacuation tools, studies, inundation maps and community planning. This supports NOAA's goal of value-added products as required by U.S. Ocean Action Plan and Integrated Ocean Observing System (IOOS), the U.S. contribution to the Global Ocean Observing System (GOOS). Five IOOS variables (temperature, salinity, sea level, surface currents and ocean color) are being integrated by 2010, for operational access and ingestion into four products, including hurricane modeling.