SurgePrint

SURGEPRINT ADVANTAGES

- Promptly determine extents and depth of inundation
- Model projected impact of inundation accurately
- Confidently determine the accuracy of inundation

DESIGN PRINCIPLES

- Created specifically to model street-level inundation
- Computationally efficient
- Numerically stable and reliable
- Downscales from ocean-basin scale disturbances to street level inundation
- Requires LiDAR-scale (1-10m) topological information
- Requires high-resolution atmospheric forcing

KEY FEATURES

- Storm peak and time series data
- Hourly water elevation and thickness of inundation values
- Tailored visualizations
- Interoperable GIS-compatible data
- Large scale east coast surge model
- Urban inundation models available in New York, DC, Hampton Roads
- Interactive web browser using Google Earth compatible KML files
- Interoperable data inputs: Compatible with WeatherFlow GRIB and NetCDF files
- Interoperable data outputs: Compatible with GIS using GeoTIFF files.

Prof. Wang 804-684-7215 wang@vims.edu
Dr. Forrest 804-684-7900 drf@vims.edu

SurgePrint is a state of the art geospatial analysis developed by the Virginia Institute of Marine Science that provides an extremely accurate representation of storm surge and inundation experienced during land-falling hurricanes and other strong coastal storms.

Driven by high quality observational and modeled atmospheric data, such as the WeatherFlow RAMS model, SurgePrint effectively supports the insurance, weather enterprise, and emergency response industries, as well as the National Weather Service with reliable, representative, and timely water data so that critical decisions can be made rapidly and based on the best possible information.

Inundation on Manhattan Island during 2012 Hurricane Sandy (Loftis, 2014)

SURGEPRINT ADVANTAGES

Model large scale effects on localities

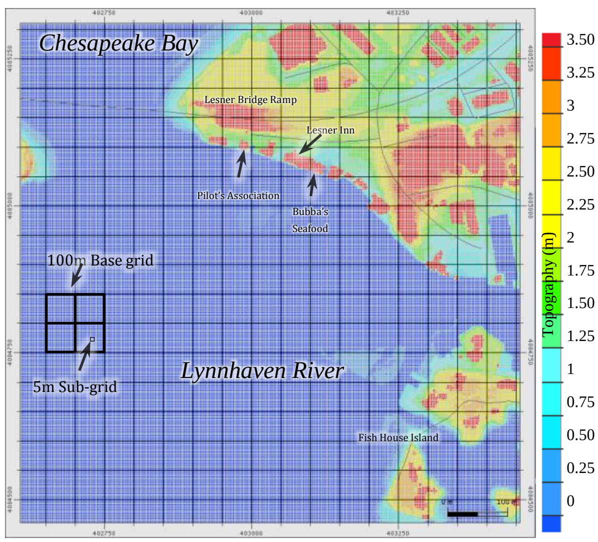
The East Coast/Atlantic unstructured computational grid domain efficiently models large-scale ocean disturbances and their effects on small-scale coastal systems—integrating high quality, high-resolution atmospheric models and the far-field processes that drive storm surge. The figure below shows the finite element computational grid that integrates basin-scale weather forcing into coastal storm surge and inundation impacts in the Greater Hampton Roads region of Virginia (see inset).

Advanced efficient and stable models

The SurgePrint system uses the state-of-the-art hydrodynamic models to model large scale surge and street-level inundation. SurgePrint uses the SELFE hydrodynamic model to simulate large grids with modest computing requirements. This enables rapid integration of water level observations and atmospheric modeling to produce high quality surge estimates. SurgePrint also uses the UnTRIM2 sub-grid modeling system to model street-level inundation at the urban level. Moderate computing requirements enable the rapid production of analysis results within hours of a storm's passage.

Model small scale effects at street level

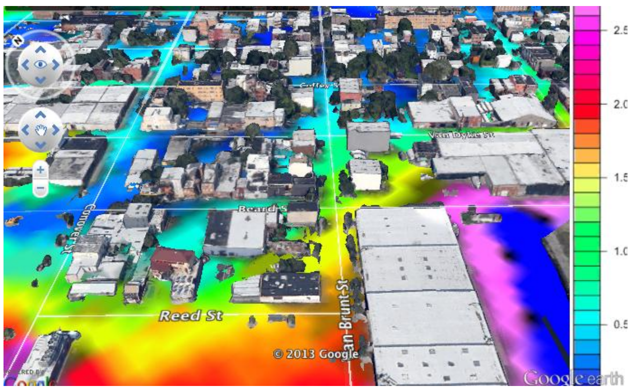
SurgePrint uses sub-grid modeling to enable street-level inundation by efficiently combining hydrodynamic calculations on a larger-scale base grid with inundation and flux and inundation calculations on smaller scale. This enables use of LiDAR-scale building, topography, and bathymetry spatial information with efficient water level and velocity information at larger scales to produce high-resolution, accurate wetting and drying for inundation simulation. In the figure of the Lynnhaven river mouth below, the dark grid represents the 100m resolution of the hydrodynamic computational grid, the light grid represents the 5m sub-grid, while the colored features represent the LiDAR-scale topography incorporating buildings, infrastructure, and bathymetry resolved by the sub-grid.



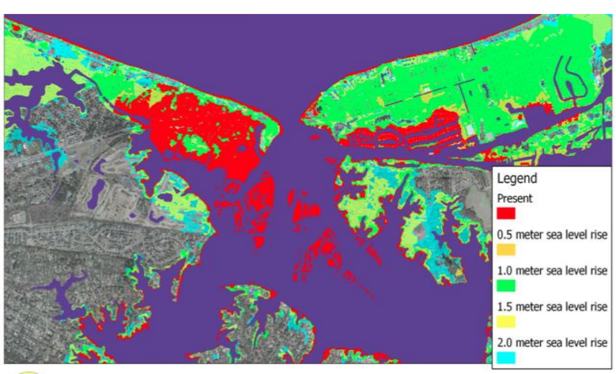
VIMS advanced modeling capabilities combine remote weather effects with local wind effects using 80km resolution cells in the deep ocean to 100m cells with 5m sub-grid resolution in urban areas of interest, providing an integrated solution for estimating surge and inundation. The modest computing resources required by the these efficient models enable rapid response to storm events, while also making it possible to estimate the effects of what-if scenarios on surge and inundation on communities.

Interoperable inundation data

Delivery of the storm tide elevation and inundation extents data in interoperable formats, such as time-aware GeoTIFFs and GoogleEarth KML files can be easily adapted to customer's toolsets.



The image above demonstrates usage of Google Earth KML to show street level inundation in the Red Hook area of New York during the peak of Hurricane Sandy. The KML delivery mechanism enables investigation of the time-series of inundation data by users with minimal client software.



The preceding image uses standard GIS mapping software to integrate VIMS model results for Hurricane Isabel in the Lynnhaven area of Virginia Beach, VA under a set of hypothetical sea level rise scenarios.

Translating VIMS model output into GIS compatible data enables rapid assimilation of the information into the workflows of professionals interested in high-resolution inundation information for decision making.

Summary of SurgePrint

Advances in hydrodynamic modeling and computer hardware have enabled efficient, rapid simulation of storm surge and inundation across a wide range of spatial and temporal scales. VIMS' use of SELFE and UnTRIM2 integrates information from large-scale weather patterns in the deep ocean with the local effects of wind and LiDAR-scale topography at the street and building scale to produce high resolution inundation data. The efficiencies of the models provide for investigation of multiple hypothetical scenarios for long term planning purposes, as well as for rapid estimation of surge and inundation within the storm forecast cycles.

The ability of the VIMS models to incorporate high-resolution atmospheric models and LiDAR scale topography at the local level can resolve the set-up or set-down of water in and around small creeks or peninsulas, providing detailed information on the timing, duration, and spatial extent of damaging inundation.