## UMBC AN HONORS UNIVERSITY IN MARYLAND

We demonstrate how the model forecasts and social media data, if combined in a single framework, can be used for near real-time forecast validation, damage assessment and disaster management. Geolocated and timestamped Instagram photos allow us to access the surge levels at different locations thus not only validating the model forecasts, but also giving timely glimpse into the actual levels of surge. Photos of flooded streets, cars and basements allow us to have a rough estimate of the surge level at that given location and time, while photos of rainy, yet not flooded scenes allow us to determine an upper bound beyond which the surge did not spread.

Geolocated tweets can be used to not only monitor the emotional response of different geographic areas affected by the disaster, but also provide insight into the problems that different communities experience such as power outages, elevated crime (looting, etc.), and refusal to evacuate.

mergency responders have long-established protocols for response management and mitigation. For disaster modeling and risk assessment, they rely on data collected by other government agencies, and on conventional media outlets for communication of risk and evacuation orders to the public. Only recently emergency responders have begun utilizing Social Media outlets such as Facebook and Twitter for the purpose of communicating urgent information to populations affected by disasters. The flow of information from social media users to the emergency responders is currently in its infancy and in the early stages of research. In our work we present methods and frameworks that would allow emergency responders to "listen" to the affected public by monitoring social media outlets for posts related to the disaster at hand. This approach would be invaluable in providing emergency responders with timely understanding of how the disaster has affected different areas and segments of the population and allowing for more accurate assessments of the needs of different neighborhoods. It would also be useful in validating the forecasts of risk assessment and geophysical models.

- Human Sensor Network: Social Media users are viewed as "sensors" deployed in the field, their posts are "observations"
- Use-case scenario: Hurricane Sandy.
- **Data gathered**: ~8 million tweets, ~370k Instagram images referencing hurricane.
- Framework Developed: AsonMaps - Google Maps based web application. Allows visualization and analysis of geolocated HSN data in the same framework with the storm forecasts from a variety of geophysical and probabilistic models.
- Operational Model: NOAA's Sea, Lake and Overland Surges from Hurricanes (SLOSH). Due to inherent uncertainties in weather forecasts only provides worst-case scenario for any given storm.

## Human Sensor Network: **A Social Media Observational Tool for Improved Modeling and Mitigation of Extreme Weather Events**

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Below: USGS employee collects High Water Marks data

Bored at work #Sandy http://t.co/TTPW4jxF - Mon Oct 29 2012 16:00:00 GMT-0400 (EDT) 0/29/2012

#hurricanesandy #sandywhereyouat #lovethisshit #bringiton (Made with #jusgramm App) @jusgramm - Mon Oct 29 2012 12:00:01 GMT-0400 (EDT) 10/29/2012

#sandy http://t.co/0oKuZWWz - Mon Oct 29 2012 16:00:03 GMT-0400 (EDT) 10/29/2012

Five alarm chili during the storm #hurricanesandy #chili - Mon Oct 29 2012 12:00:03 GMT-0400 (EDT) 10/29/2012

@ComcastNetworks just warned me not to come in contact downed wires. #Sandy #stupidPeople - Mon Oct 29 2012 16:00:04 GMT-0400 (EDT) 10/29/2012

#infinity #scarf #etsy #yarn #poodle #fluffy #cozy #winter #autumn #hurricanesandy - Mon Oct 29 2012 12:00:08 GMT-0400 (EDT) 0/29/2012

Sandy Lite Right Now! Oct 29 2012 16:00:06 GMT-0400 (EDT) 10/29/2012

#hurricanesandy batten down the hatches - Mon Oct 29 2012 12:00:10 GMT-0400 (EDT) 10/29/2012

Im scurred! Oh sandy! @ Parkway North http://t.co/ABlyCXkR - Mon Oct 29 2012 16:00:06 GMT-0400 (EDT) 10/29/2012



29 2012 22:26:33 GMT-0400 (EDT)-(40.716133117,-74.050109863)





**Top**: AsonMaps Framework for hybrid modeling that we developed Right: Operational SLOSH model

**Bottom**: Instagram photo showing flood and Google StreetView of the same location for comparison

that have power and areas that lost power



Probe Flag

✓ Locations

✓ Tracks ✓ SLOSH Surge

IOOS Observation Sites

lakes.shp

✓ N roads\_limitedacce // roads\_highway.shp

√ rivers.shp 🛛 🔜 urbanareas.shp

States/Counties

✓Lat/Lon Grid

/ roads\_other.shp

(140, 86) Lat: 40.4802N Lon: 72.4000W



Map Satellite Map Satellite Satellite Satellite Map Satellite Sat	Start Date 10/29/2012 Time 12:00 AM End Date 10/31/2012 Time 12:00 PM Twitter Pictures Both Filter Slosh Model P-Surge Model WNW = Category 1 Speed 20 High • Mean Low Animate: < 5000 Forward Tallies
m Animate Tides Download Help	Storm: Dir nw: Cat 1: 20 mph High Tide
	Image: state of the state

Height: 3.0 ft