



## Ocean Survey: Hurricane Deadly Waves Tracker System (H.D.W.T.S).

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### ABSTRACT

Ocean Survey: Hurricane Deadly Waves Tracker System (H.D.W.T.S) is a new tool that will help scientists and meteorologists to have a horizontal profile of dangerous waves on the surface of sea water in the path of an upcoming super storm (hurricane, typhoon...). Until now, they use only satellites images for this task... We must track, in parallel at the same time dangerous waves causing deaths and damages along coastal cities. Using a specific craft linked to an ultrasonic wave's measurement system is the solution.

**Keys words:** *Ocean, Hurricane, Waves, Measurements, Track*

After super storm Sandy hit some countries in October 29, 2012, we need to rethink our marine weather forecast and our potential storm surge map with a new approach. According to the last Climate Change's report, experts predict that "sea levels will increase at least a foot and perhaps as much as four feet. This could be catastrophic for millions of people living along the ocean" around the world (Europe, Asia and North America). In a near future we should be able to save people and to limit damages due to an upcoming storm, hurricane or typhoon, by developing a new tool called Ultrasonic Waves Measurement in a new program: hurricane deadly waves tracker system. For this new approach, scientists and meteorologists must take into account wave's action by tracking in parallel deadly waves generated by winds on the path of a super storm. The potential storm surge flooding map in United States for example does not take into account the wave's action phenomena. This approach needs to be corrected with this new tool. Factors the map takes into account: (according to N.H.C)

-Flooding due to storm surge from the ocean, including adjoining tidal rivers, sounds, and bays-tides-land elevation-uncertainties in the track, landfall location, intensity, and size of the cyclone.

Factors the map does not take into account: (according to N.H.C)

-Wave action, flooding from rainfall, inside levees and overtopping.

This new system will correct this factor by giving to scientists the geometrical form and profile of dangerous waves approaching coastal cities, to better improve hurricane forecasting in North America, Europe and Asia.

Why the factor: wave's action... must be taken into account?

The phenomenon wave - submersion:

Marine submersion can cause severe and rapid coastal flooding.

They are linked to an extreme rise in sea level due to the combination of several phenomena: The passage of a storm, producing an elevation of sea level in three main processes:

- 1) Swell or waves that increase the water level.
- 2) The wind exerts friction on the surface of the water, which causes a change in currents and sea level (accumulation of water approaching coasts).
- 3) The reduced atmospheric pressure: the weight of the air decreases while the sea surface level rises. A decrease in the atmospheric pressure of one hectopascal (hPa) is approximately equivalent to a rise of one centimeter of water depth. Example: A pressure of 980 hPa (a difference of 35 hPa over the average atmospheric pressure of 1015 hPa) generates an elevation of about 35 cm. Jetties, breakwaters and other coastal infrastructure can then be weakened or damaged. (Katrina).

Aggravating factors: The simultaneity of the phenomena described above increases overflow and allows the sea to reach usually sheltered areas. The severity of these overflows varies depending on the water level reached, the incoming volume and drainage speed. The intensity of these phenomena strongly depends on the configuration of the seabed, foreshore and coastal geographical features such as:

- Decreasing the depth of the sea (on arrival on the coast, wave energy is transformed into high water level);
- The nature of funds that slows or accelerates the spread of the wave to the coast (sand, gravel, mud ...)
- The orientation of the coast relative to the direction and propagation.

The dangers due to wave's propagation: waves and marines submersions are destructive phenomena, especially when they are simultaneous. Flooding primarily affects low-lying areas near the coast. Inundation due to coastal flooding, however, can invade the coast for several kilometers inland and reach a

height of several meters of water. Channels, housing, business parks are likely to be flooded and damaged in a few hours or less.

Waves can damage coastal infrastructure (dams, piers, etc. . .) and carry objects or materials (including shingles) which then become projectiles could injure or kill people, damage property. Objects not properly secured can be taken away. Boats can be lifted and carried ashore. (Sandy in Atlantic City -New Jersey).The damage may be aggravated in case of violent winds, heavy rain, broken levees. (Super storm Katrina).

Hurricane deadly waves tracker system (H.D.W.T.S)

The new tool is a specific autonomous unmanned underwater vehicle (A.U.U.V) called “drone of the sea” linked to an ultrasonic waves measurement system (U.W.M.S).

This specific vehicle will know its own position and navigate to its goal which is to meet the storm in the projection of its “eye” toward a virtual alarm line from the coast (V.A.L.C).For this we must first make a list of tasks, operations to perform according to the direction of winds due to super storm. Programs are prepared in advance. Operators will not be involved during navigation. According to measurements of the level of sea, height of waves, periods and amplitudes... Scientists and meteorologists will know exactly where those dangerous waves will be at a zero level on the coast... This vehicle will take additional measures like sea and air temperatures, barometric pressure, salinity, speed and direction of wind; send all those data via satellite. Meteorologists will see horizontal profile of dangerous waves and then a mandatory evacuation is ordered if necessary by authorities at least three hours before deadly waves reach cities...Nowadays, meteorologists have only satellites views to perform this task...

What is the virtual alarm line from the coast (V.A.L.C)?

Each storm or hurricane will have its own virtual alarm line from coasts, calculated according to its speed. It's a virtual line that gives scientists all data needed (profile of deadly waves generated by storms and moving to coastal cities) during a constant time. Alarm for evacuation is “on” or “off” for each location on the coast according to the profile of waves. This new vehicle will meet the storm at this reference line gathering data from waves.

How to make this program work?

1)- Build this special craft linked to an ultrasonic wave's measurement system (A.U.U.V-U.W.M.S).

2) -Specify the virtual alarm line from the coast on the map along coast. A map with the V.A.L.C of all deadly storms (Katrina, Sandy, Ike, Andrew, Wilma, Ivan, Irene, Charley, Rita...) must be made according to their characteristics. This new element will help to better know the virtual alarm line from coast of an upcoming storm.

3) -Specify and collect all data related to the reference height of a normal sea level, (calm sea/level zero) and see the difference with the rising surge.

4) - Measure wave's parameters (amplitude, period, speed, direction...) and send data by satellite.

5)-Supercomputer will help to have a horizontal profile of sea water surface (dangerous waves) and determine the precise level of sea expected (according to both topologies: seabed and coastal counties). Software will make simulation (modeling) and show all areas that could be affected by wave's action: flooding areas.

6) Tests, simulation, modeling and reference level.

Many tests will be done before the new craft start to track on the ocean deadly waves due to upcoming super storm...- measurement of hallow, ridges of waves-periods and amplitudes-speed -temperature -pressure -satellite connection-direction. Others specific tests concerning this vehicle will be performed by the manufacturer (buoyancy, engines, batteries, propeller, autonomy, gyration...). Simulation and modeling by computers start to be operational with all data collected. The reference line of all wave's heights measurement in this proposal is the level of a calm sea called level zero. Some areas on the coastal counties or cities are under this level, others not. Topology will help to localize them. The new craft will take measurements at this reference level and those collected data will give us the wave's horizontal profile. The ultrasonic wave measurement system (U.W.M.S) is a key part of success for this new approach. Offshore buoys already in different points will confirm measurements taken by the Hurricane Deadly Waves Tracker (H.D.W.T). Some little correction may occur during wave's profiling. The rise of water generated by storm is usually calculated by subtraction at a fixed point where offshore buoys are localized... Experts can see horizontal wave's profile and how it moves according to the seabed and the variables parameters of storms (from category 2 to 3, diameter, winds increasing, becoming super storm...).

While tracking super storm by satellites images, we must track in parallel dangerous waves, to avoid in the future what we have seen with super storms Katrina and Sandy: death and damages. What happen with Super storm Sandy with a sudden dangerous flooding into the tunnel of the metro of New York City is an example we should keep in mind. Evacuation- on- time is the only way to save people from devastating super storm...Fighting consequences of climate change (global warming ) is the new challenge we face...and the clock is ticking!

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