

Press Release from 02nd of February 2005

Tsunami - Detection by means of an Over-The-Horizon Radar the WERA Remote Ocean Sensing System



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Summary:

WERA is a new ocean current measurement system to be installed at the coast. This system based on a development of the University of Hamburg and is available from Helzel Messtechnik GmbH since 2001.

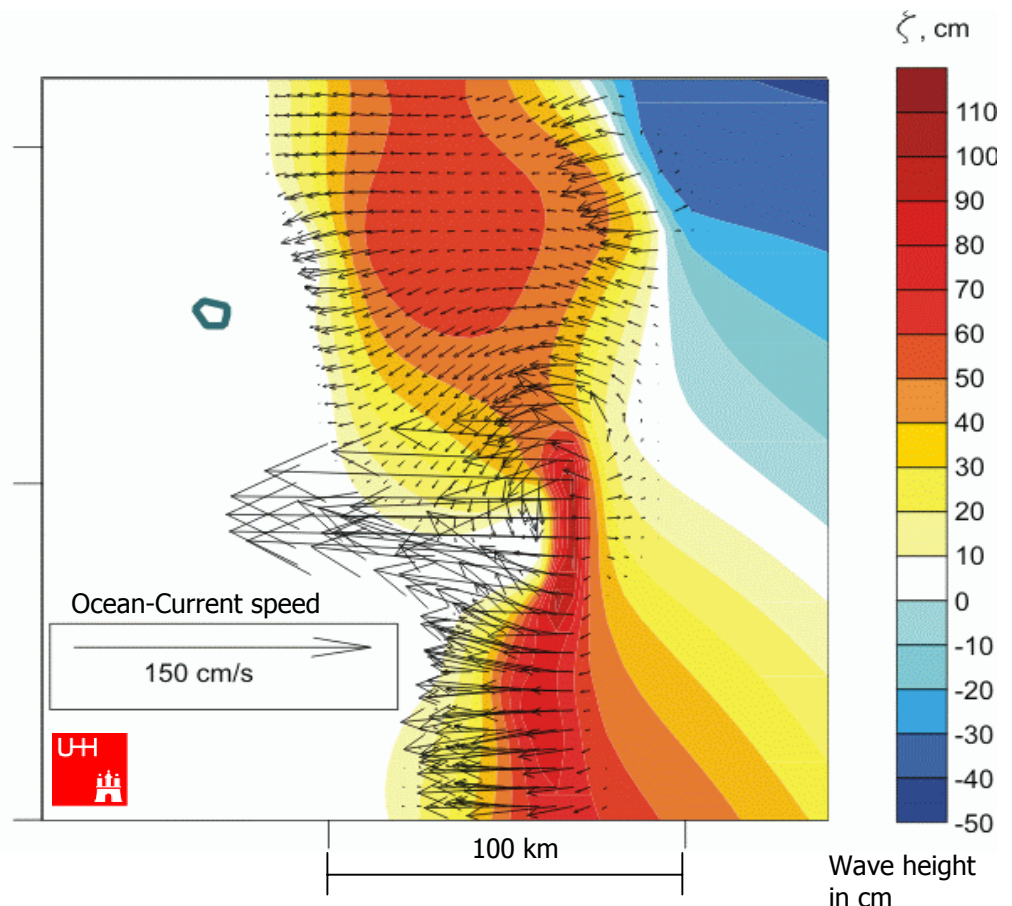
WERA produces current maps which provide data from up to 200 km offshore and are updated every 4 minutes. A tsunami that travels in deep water with speeds of more than 700 km/h reduces its speed when it reaches the continental shelf edge while it increases its wave height. This change is accompanied by a typical current pattern that can be detected by means of the WERA system.

In many cases where the coast is exposed to tsunami disasters, the shelf edge is located 100 km or more off the coast. In shallower water, a tsunami's wave speed is reduced to around 100 km/h which allows for a warning time of 1 hour or more. Therefore, WERA can be used as a powerful instrument in a local tsunami warning system.

Figure 1:

Ocean-current signature generated by an approaching Tsunami wave, at the shelf edge of the Seychelle Islands, about 200 km offshore (more than 2 hours before the wave reaches the beach of the main island and even 1 hour before reaching La Digue Island). The current signature has an amplitude that is more than 10 times higher than normal ocean currents. This allows for a reliable detection by a remote ocean sensing system like WERA.

These simulated data are kindly provided by Dr. Alexey Androsov, Dr. Angelo Rubino, Thomas Schlick and Dr. Klaus-Werner Gurgel, University of Hamburg



1. Principle of an Over-The-Horizon Radar

A modulated radio frequency signal is transmitted towards the sea. The radio frequency signal follows the curvature of the earth behind the horizon. A small part of the transmitted energy is reflected by the rough surface of the ocean. This signal can be detected and is used to derive information on the ocean surface. The resulting data is available as a continuous data stream with an update rate of a few minutes.

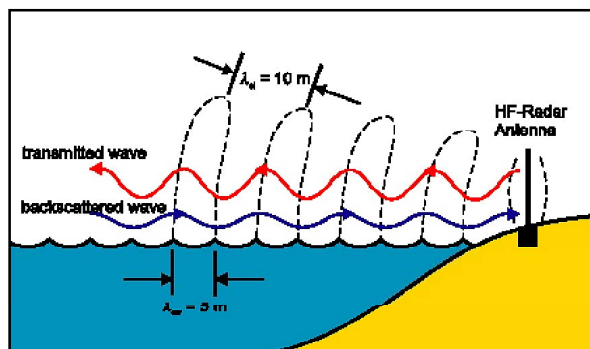


Figure 2: WERA principle

2. The Specific Features of WERA

The high sensitivity of the WERA system guarantees a detection range of up to 200 km offshore. All components of the system are installed on shore, resulting in a very robust, reliable and inexpensive system. A very important aspect for the acceptance of a tsunami warning system is, that it should not be used for tsunami detection only. The WERA system offers this advantage and is very economical since it continuously provides information for a wide variety of users:

- Search and Rescue
- Environmental protection in case of accidents
- Information for fisherman and tourists (divers, sailing and sport fishing)
- Safety for vessel traffic

3. The Mechanism to Detect the Tsunami

In the deep ocean (>1000 m) a tsunami wave propagates at a speed of about 700km/h. However, when the tsunami approaches the shelf area its characteristics changes completely. The speed will be strongly reduced while the wave height will increase dramatically.

The surface current pattern will change in the shelf area before the wave approaches the beach. This typical change of the surface current can be detected by WERA.

Depending on the distance to the shelf edge and depth of the water, a warning time of an hour or more can be achieved. About 100 km of coastline can be monitored by a pair of WERA systems.

4. Advantages of WERA

The over-the-horizon radar WERA can directly detect the approaching tsunami far away from the coast as soon as it reaches the shelf edge and track its path to the beach. A specific coastal area can be monitored to give a very good forecast and classification of a tsunami event with a warning time of about 1 hour.

The WERA system has no in-water components, is robust and easy to handle by local experts and it is less expensive than in-water sensors.

The continuously acquired data can be used for many other valuable applications.

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Acknowledgement: The described effects and the possible application of WERA for tsunami detection is based on numerical model results and information provided by the University of Hamburg HF-radar group. For additional information please contact: gurgel@ifm.zmaw.de or schlick@dkrz.de