

# FACT SHEET

## Ocean Instrumentation



### German Indonesian Tsunami Early Warning System

Installation of a tsunami  
early warning system in the  
Indian Ocean - the German  
contribution



GEFÖRDERT VOM



#### Ocean Instrumentation

In the work field "Ocean Instrumentation" various independent measuring instruments were developed to measure the sea level changes offshore as well as on the coasts of Indonesia. Tide gauges were put into operation, in the deepwater areas buoy systems (GPS buoy, PACT, OBU) were anchored. In addition, the sea-floor topography has been mapped as a basis for modeling (bathymetry).



#### Tide Gauges

With the help of tide gauges, the sea levels can be monitored along the Indonesian coast. A concept was developed for GITEWS, whereby the sea level is measured with three independent measuring instruments; in addition, the stations are equipped with GPS so that the horizontal and vertical offset of a station can be determined in the event of an earthquake. The data quality is directly checked on the station. Using a special algorithm, sudden changes in sea level can be recognized immediately and transmitted to the warning center. The data transmission takes place

with the satellite systems GTS/ Meteosat and INMARSAT/BGAN in near real time. As part of GITEWS, tide gauges were also put into operation in other littoral states of the Indian Ocean. In addition to the German installations in the tsunami-warning system, other gauges were integrated, resulting in a network with good spatial resolution.

#### GPS buoys

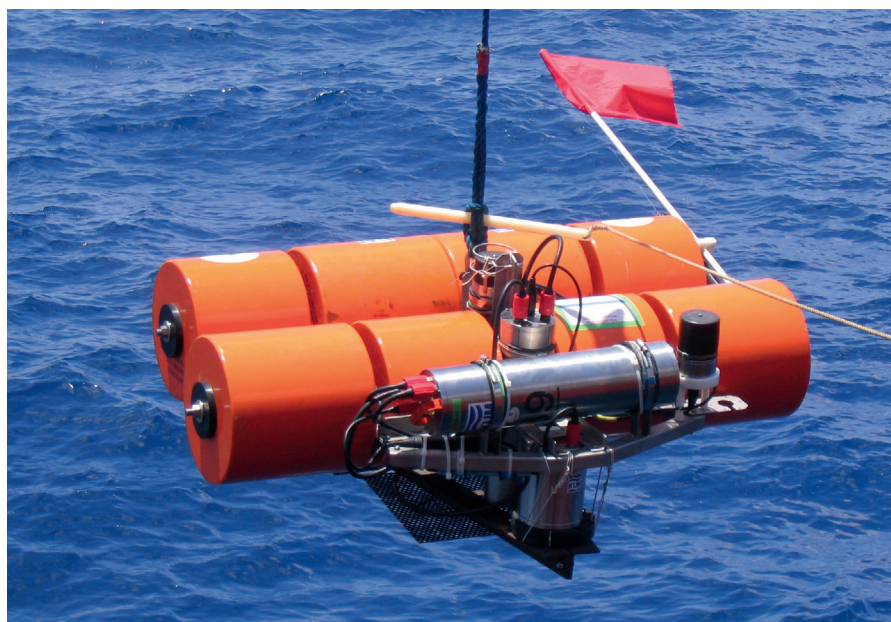
Tsunami buoys are not independent warning systems, there are singular measurement systems. For GITEWS, the buoy systems were developed for the verification of a tsunami in the open ocean. For the first time, modern GPS receivers and various, especially meteorological sensors were installed on the buoys themselves, so that a buoy itself is a measuring instrument. The buoys can be complemented by ocean bottom units; two development lines are available (OBU PACT). Buoy systems can be



employed usefully and reliably in the Indian Ocean - as in the other world's oceans - if operation and maintenance can be assured technically, organizationally and financially.

### PACT

PACT (Pressure based, Acoustically Coupled Tsunami Detector) is a continued development of the established U.S. Dart system. With this device, the water pressure is measured at the ocean floor, so that a tsunami (pressure rise) is recognized immediately. The pressure data is transmitted acoustically through the water body via a modem connection to the buoy. PACT therefore integrates all the modern marine communication and measurement techniques (pressure level, data logger, data analysis, acoustic modem, acoustic releaser, rescue aid) in one device.

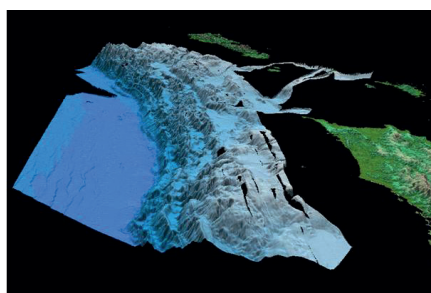


### OBU

OBU (Ocean Bottom Unit) is a second line of development to the ocean bottom units besides PACT. In this base unit, three-component broadband seismometers are added to the existing pressure sensors and hydrophones. The data recording is continuous and will initially be stored on a data recorder. In case of sudden pressure change of more than 3 cm water level change, the OBU triggers a tsunami alert and transmits the data via the buoy to the warning center. To save energy, in nominal mode the data are sent only every 48 hours automatically to the warning centre.

### Bathymetry

The basis for the simulation of a tsunami is a detailed knowledge of the bathymetry, particularly in the shallow water areas. Therefore, all available data were initially collected from research cruises with support from Germany, France, Britain and Japan. In addition, the Indonesian research vessel Baruna Jaya IV was equipped with a new high-resolution multi-frequency sonar (ELAC SEA-Beam 1050/ 1050-D) for shallow and medium water areas. With specially trained staff the Indonesian partners can measure further coastal sections independently.



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<http://www.gitews.org>

#### Partners in Germany:

Alfred Wegener Institute for Polar and Marine Research (AWI)  
 GFZ German Research Centre for Geosciences  
 Leibniz Institute of Marine Sciences (IfM-GEOMAR)  
 Consortium German Marine Research (KDM)

#### Indonesische and Internationale Partner:

- National Coordinating Agency for Surveys and Mapping (Bakosurtanal)
- Agency for the Assessment and Application of Technology (BPPT)

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