Tsunami – Monitoring & Early Warning System

Dubai Municipality –Survey Department

- *Integrated Surveying Technologies For Homogeneous Model City*

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DUBAI MUNICIPALITY

Tsunami – Monitoring & Early Warning System

Tsunami (EWS) is used to detect in advance and issue warnings to prevent loss of life and damage
Tsunami (The Great Wave) are tidal waves triggered because of the high intensity Earth Quake or Volcanic activates at the sea bed .

A100 year historical database indicates that an average of 6 tsunamis occur per year, but the dangerous of tsunami they don't happened very often

In deep ocean over 6000m tsunami waves can travel in speed commercial jet plan on 800 km/h so it move from one side of pacific ocean to another in day and can cross the Indian ocean in 12hr

Offshore and coastal feature can determine the size and impact of tsunami waves

Tsunami - Pictures

Tsunami - Pictures

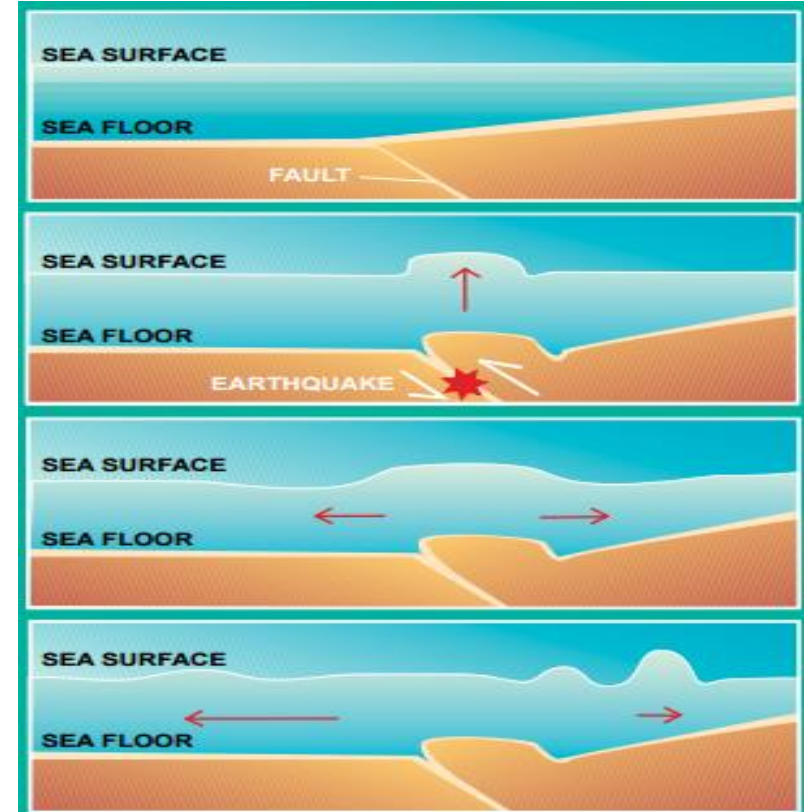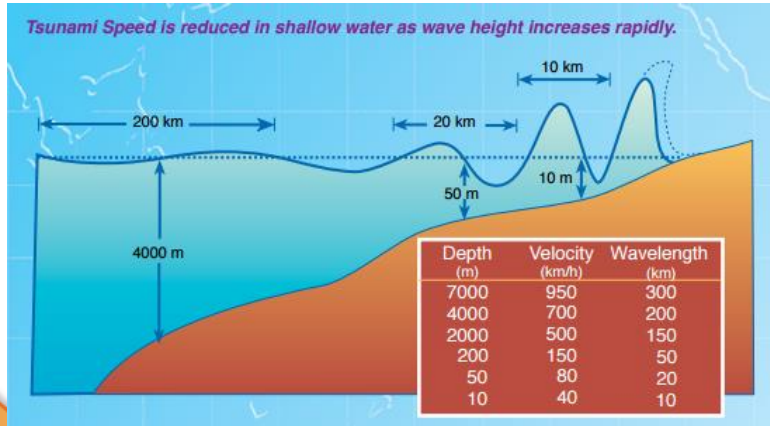Tsunami destruction in Thailand
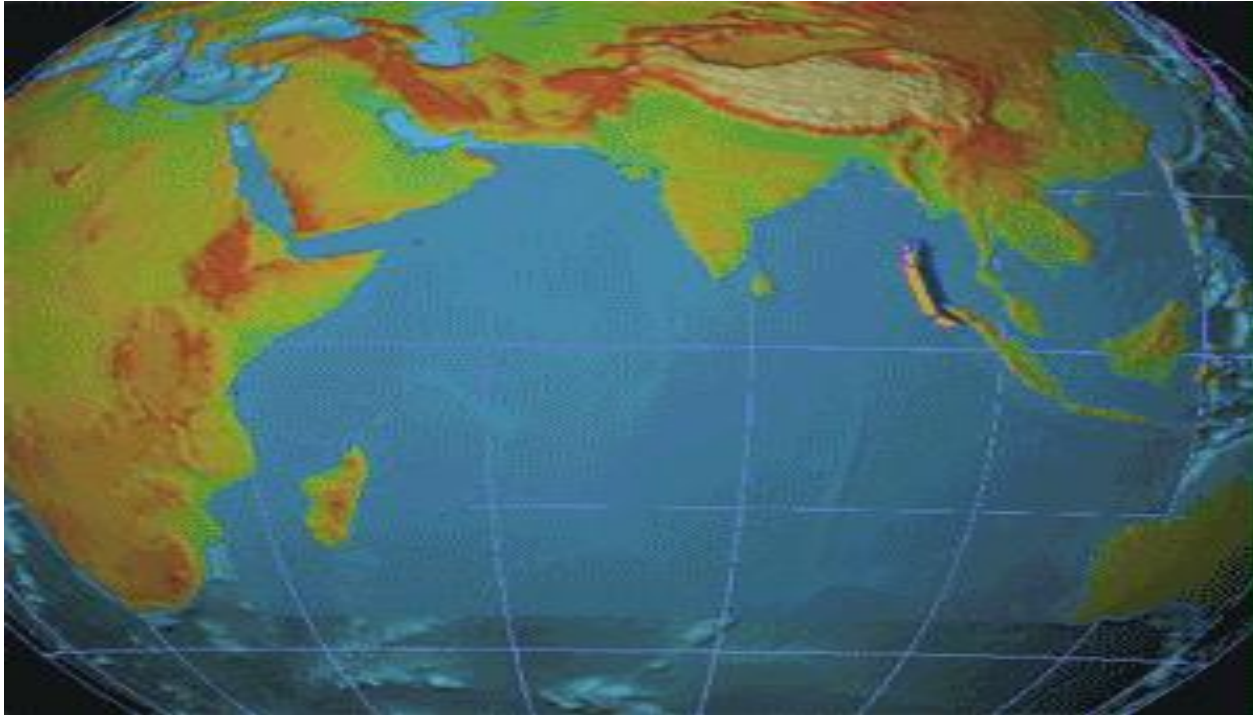
Tsunami destruction in Japan

Tsunami - How does it occur

- Tsunamis are characterized as shallow-water waves due to their long periods and wavelengths.
- As tsunami leaves deep sea and travels toward shallow coast, it transforms.
- Tsunami moves at speed relative to water depth, therefore tsunami slows as water depth decreases, and its height increases.

Tsunami Speed is reduced in shallow water as wave height increases rapidly.

Depth (m)	Velocity (km/h)	Wavelength (km)
7000	950	300
4000	700	200
2000	500	150
200	150	50
50	80	20
10	40	10

# Indian Ocean Tsunami in 2004

Tsunami Monitoring System Components

- Seismic monitoring stations

- Coastal tide & wave monitoring stations

- Offshore Tsunami monitoring stations

- Central station for integrated Tsunami Monitoring & Early Warning System

Development of Tsunami Monitoring & Warning System for DM

- A Tsunami Monitoring System could primarily incorporate two definite monitoring system; one for real-time monitoring the seismic or the trigger events and other for monitoring of the tidal waves.

- Seismic stations network currently available at DM

- Coastal tide stations network currently available at DM

- Offshore Tsunami station by upgrading DM offshore buoy with Tsunami sensor – BPR

- Central station for integrated Tsunami Monitoring & Early Warning System with central data collection & database established at DM and development of Tsunami monitoring & tidal model for tides & surface current.

Establishment of a Tsunami Early Warning System and Tidal Model for Dubai
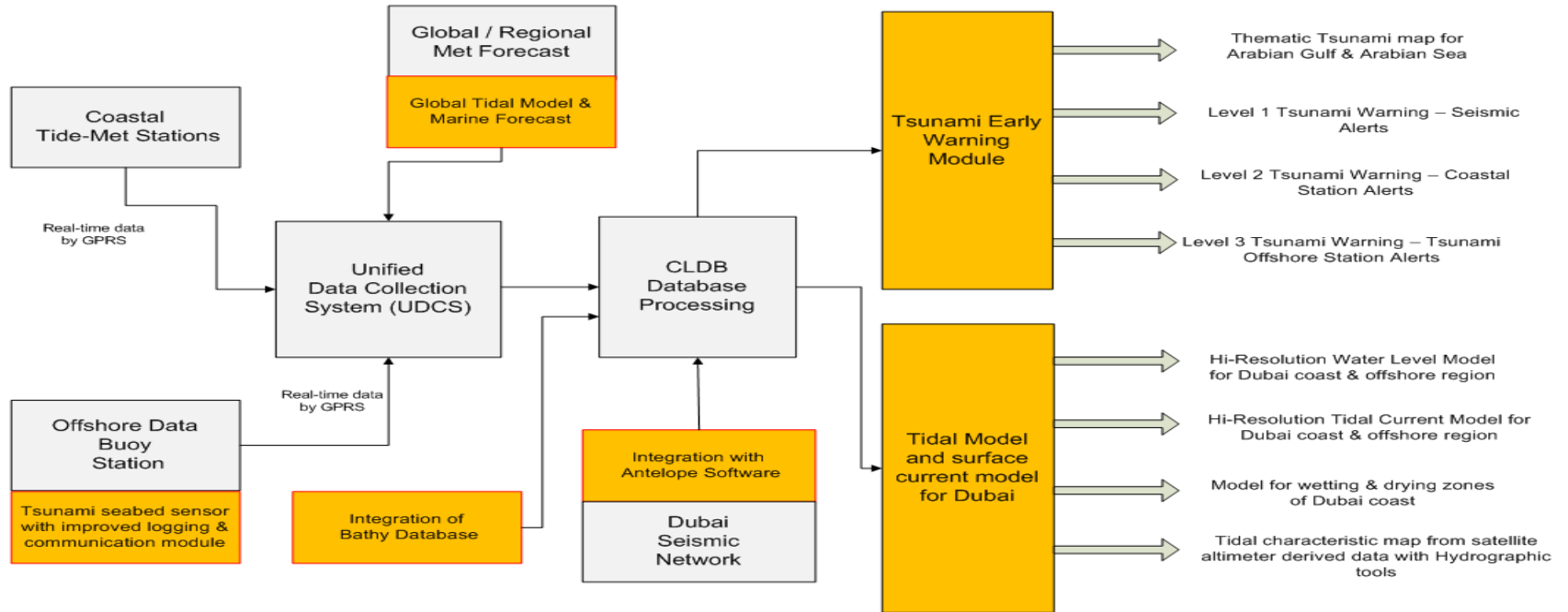
Seismic Events - 1st level Tsunami Warning

- Integration of UDCS & CLDB at DM Central station with the Antelope software for real time data exchange.

- Development of thematic digitized map for Tsunami Monitoring to cover entire Arabic Gulf and Arabian Sea as well as western region of Indian Ocean.

- Criteria rating and importance ranking of underwater seismic events with regard to Tsunami occurrence.

- Extension of the Alarms & Notification module at DM central station for 1st level of Tsunami warning Published through the emails & SMS.

- Extension of DM web server to include 1st level of Tsunami warning

Coastal Water Level Variance- 2nd level Tsunami Warning

- Tsunami is like a tide, tide goes out before it comes in. As Tsunami approaches water is drawn back from the coast to effectively help feed the wave. In some instances though, a small rise in the water level just before the recession, has been observed. Tsunami wavelength is so long that this happens slowly, over a few hours.

- Development of Tidal module to specifically monitor and analyze the water level variance before the Tsunami wave approaches the coast.

- Extension of the Alarms & Notification module at DM central station in main office for 2nd level of Tsunami warning Published through the emails & SMS.

- Extension of DM web server to include 2nd level of Tsunami warning

Upgrade of DM Offshore buoy with Tsunami sensor 3nd level

- Upgrade of DM offshore buoy with a seafloor bottom pressure recording (BPR) system capable of detecting tsunamis as small as 1 mm.

- Hardwire communication from bottom pressure recording (BPR) system to the buoy platform.

- Upgrade of DM offshore buoy data collection and communication package for event based trigger and alert to central station at DM main office central station.

Tsunami BPR system

- The BPR monitors water pressure with a resolution of approximately 1 mm sea water with 15 second averaged samples. Data is transmitted from the buoy via GPRS.

- High accuracy of 0.01% accuracy with long term stability Store over 30 million readings internally.

- On the activation of the 1st and / or 2nd level of Tsunami Alert the Offshore Buoy will be activated on a Tsunami Alert Mode and continuous sampling regime will be enabled.
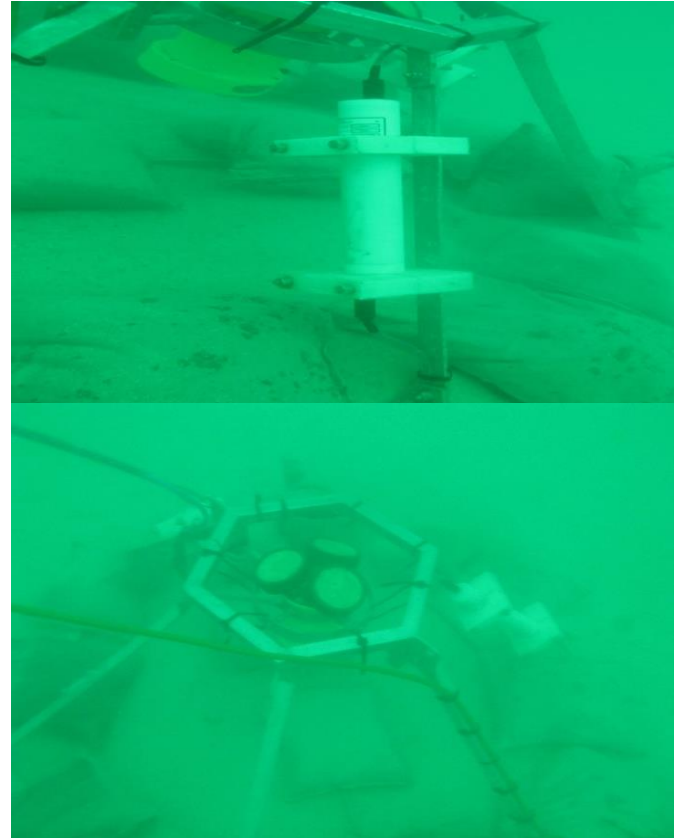
Tidal and Surface Current Model of Dubai

- Development of tide and surface current model for Dubai coast and offshore region based on (ROMS) Regional Ocean Modeling System

- ROMS is a 3 dimensional public domain community model and the most widely employed modeling platform by oceanographic modelers worldwide.

- ROMS uses stretched, terrain-following coordinates in the vertical and orthogonal curvilinear coordinates in the horizontal and is a more realistic than other marine models.
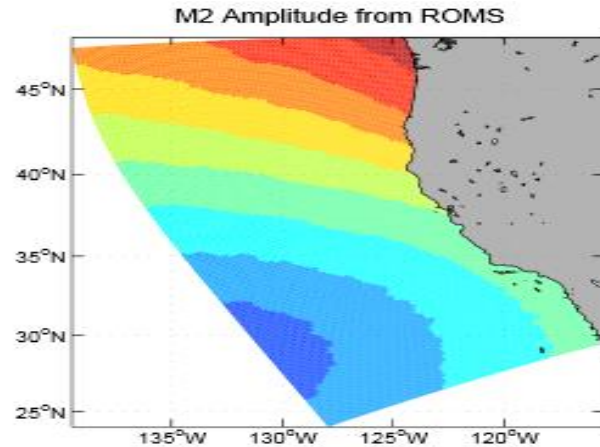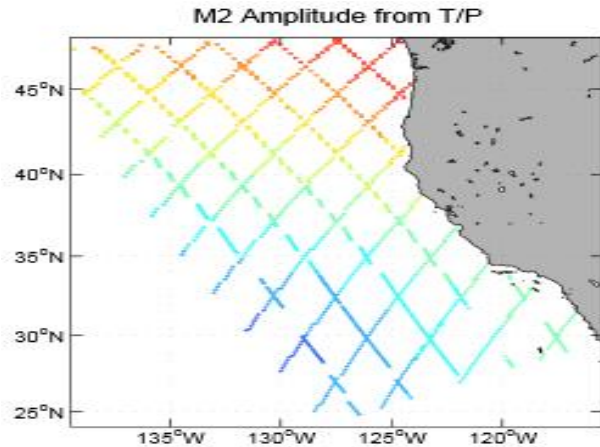
Tidal and Surface Current Model of Dubai

The major use for tide model is to find tidal currents which also known as tidal streams. If you had a tidal model of Dubai waters, you could identify the tidal currents at any point in the model domains

DM Tidal model is 2D water level and surface current model of Arabian Gulf and Dubai water
The model is numerical hydrodynamic model base on proven regional ocean model system (ROMS) Platform with three deferent levels of resolution DM 1 is one km DM100 is 100m and DM380 is 380m

The model out put in cloud water surface elevation, positioning information and current velocity

Map Feature Viewing ROMS Output
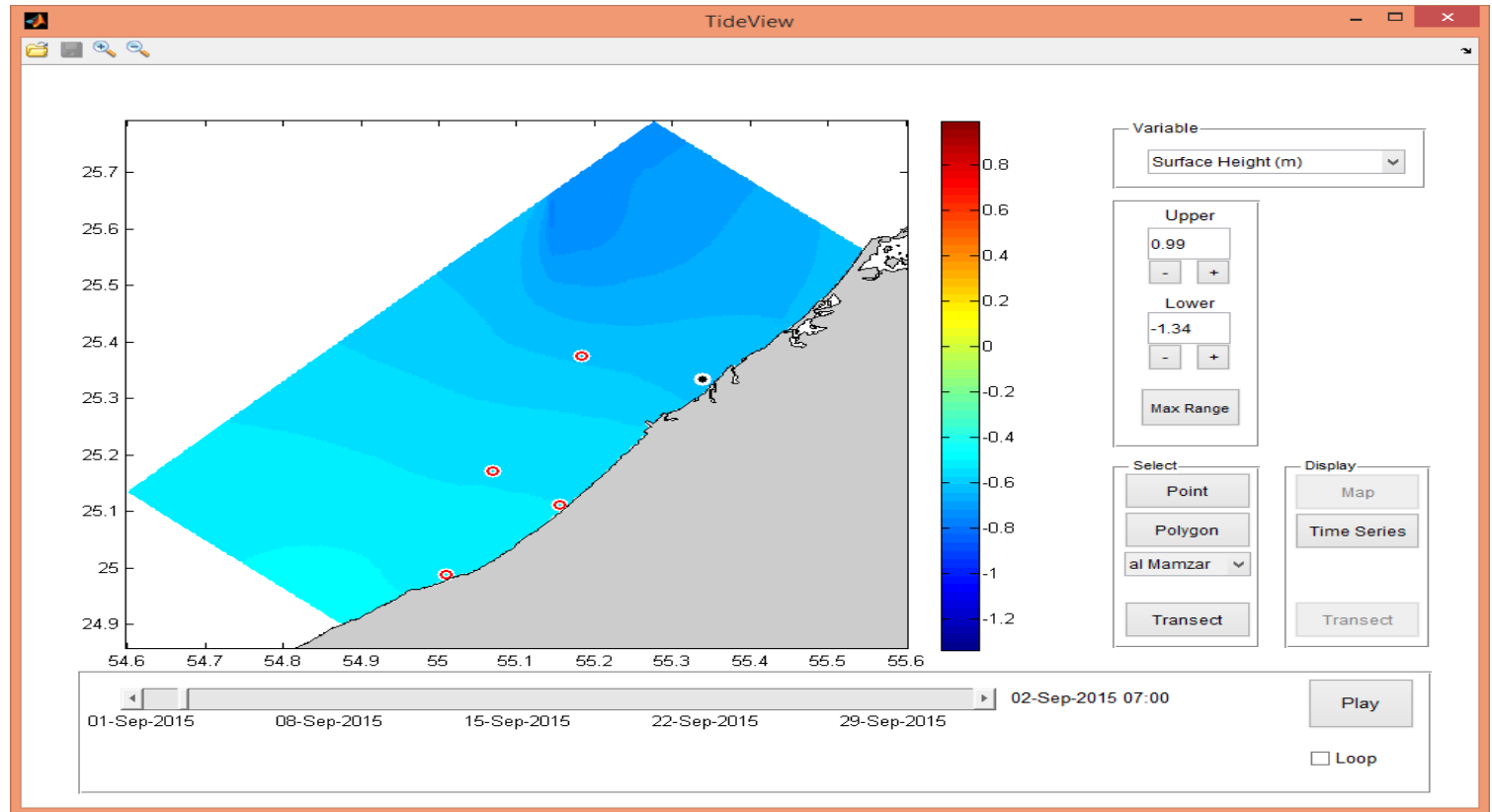
Map Feature Viewing ROMS Output
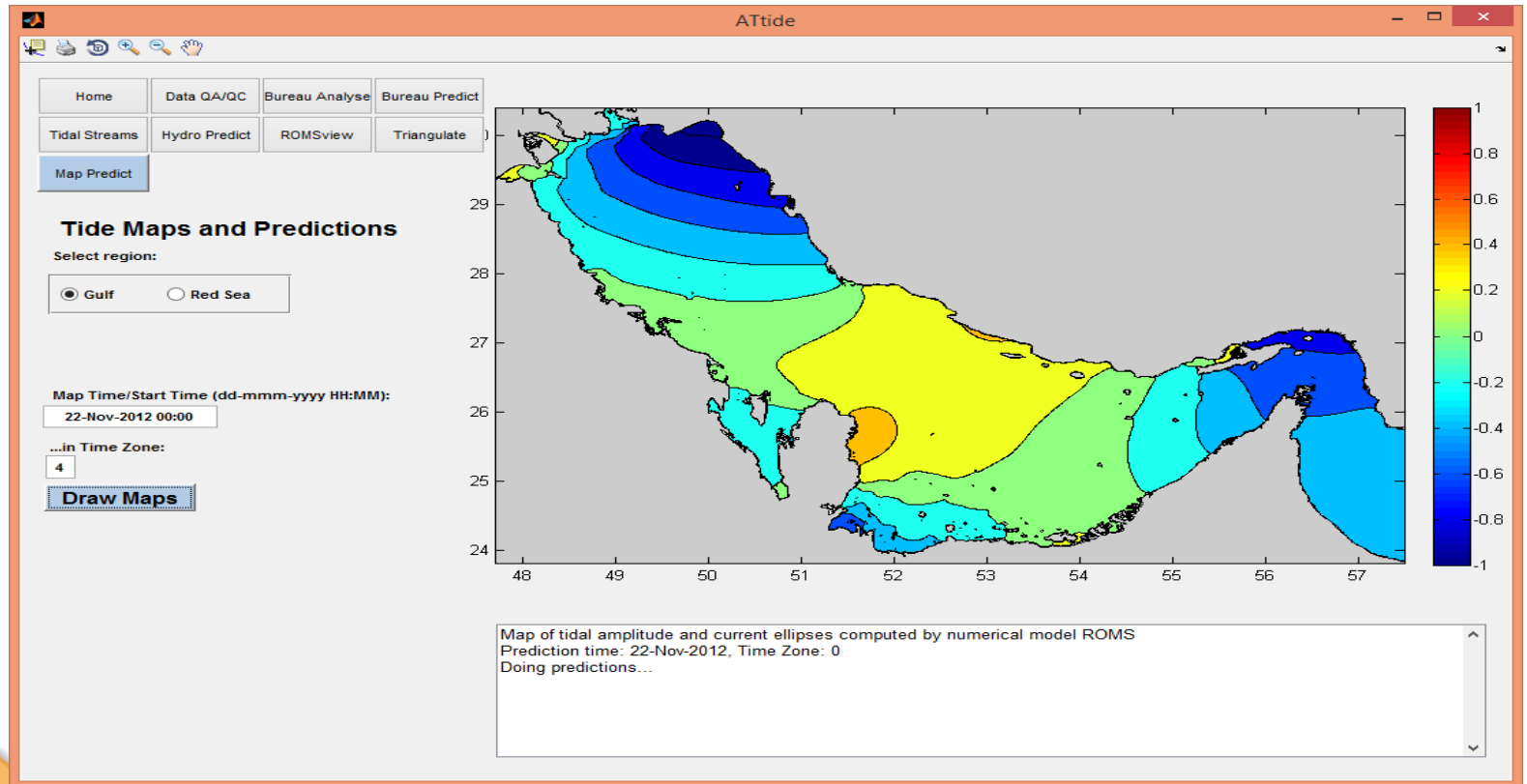
Seismic webpage
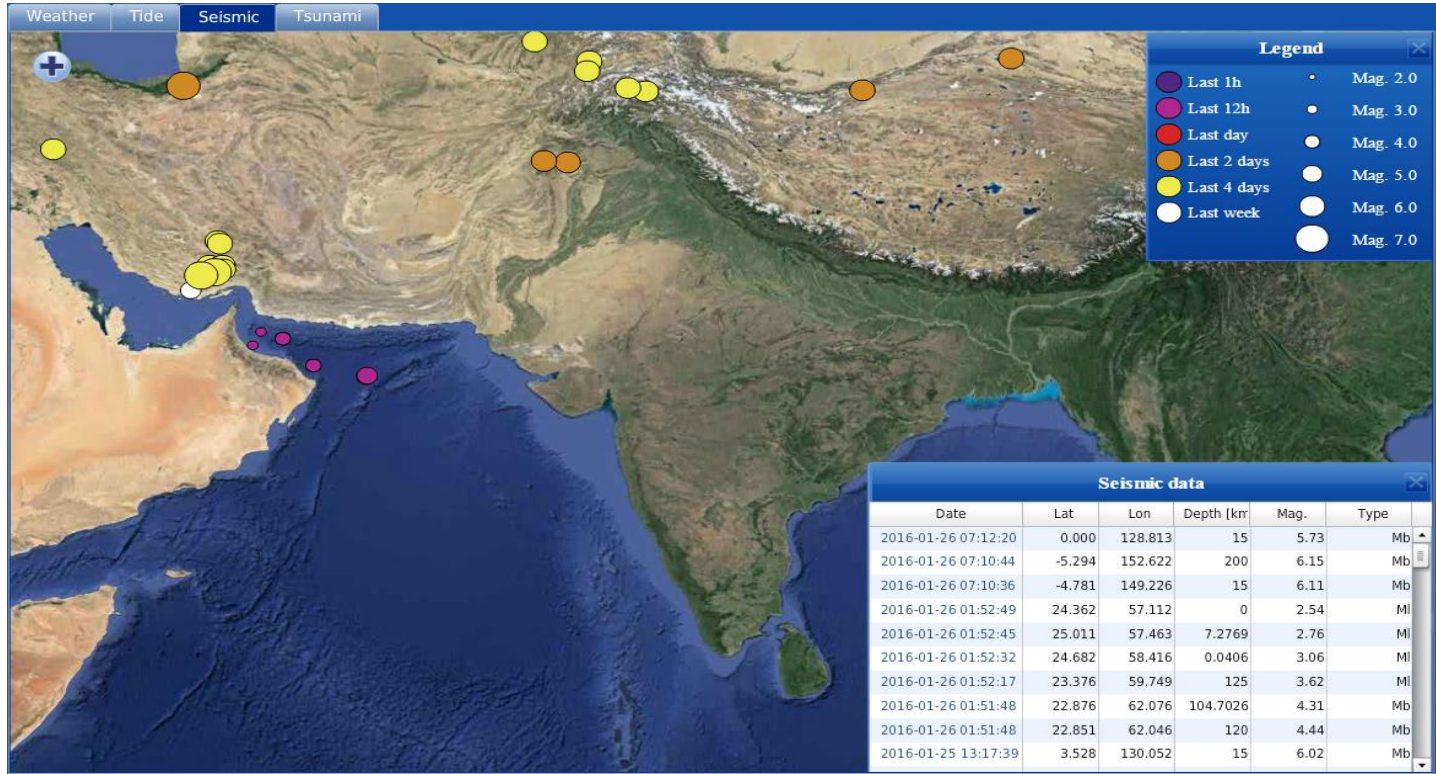
Seismic webpage -event information

Tide new webpage
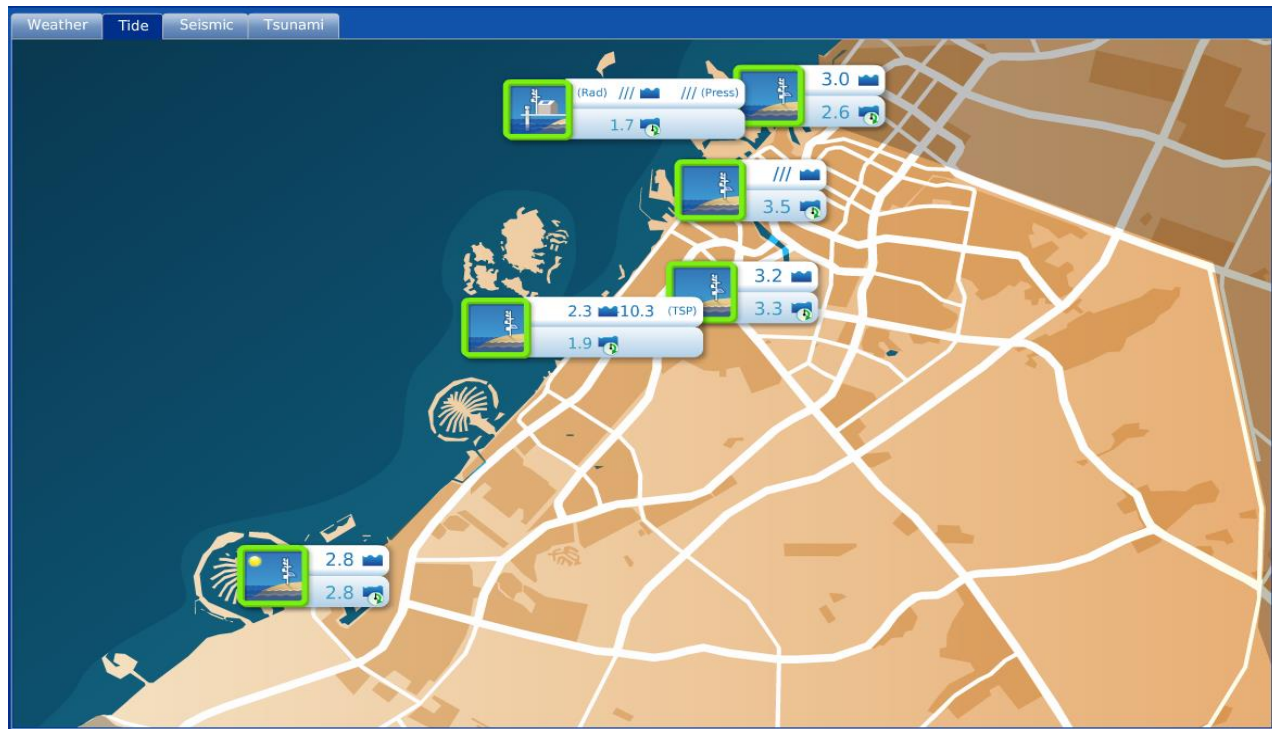
Tide webpage– advance real time prediction

Tide webpage– advance real time prediction

Tsunami main webpage

Tsunami scenario inside Gulf

Seismic event						
Scenario:	Inside Arabian Gulf	Magnitude (ML):	7	Epicentre location:	53E 26N30	Seabed depth: 75m

Earthquake tsunami			
Dubai Coast arrival time:	1cm @ 1:15, Al Mamzar	Max wave height:	27cm @ 3:55, Umm Suqeim
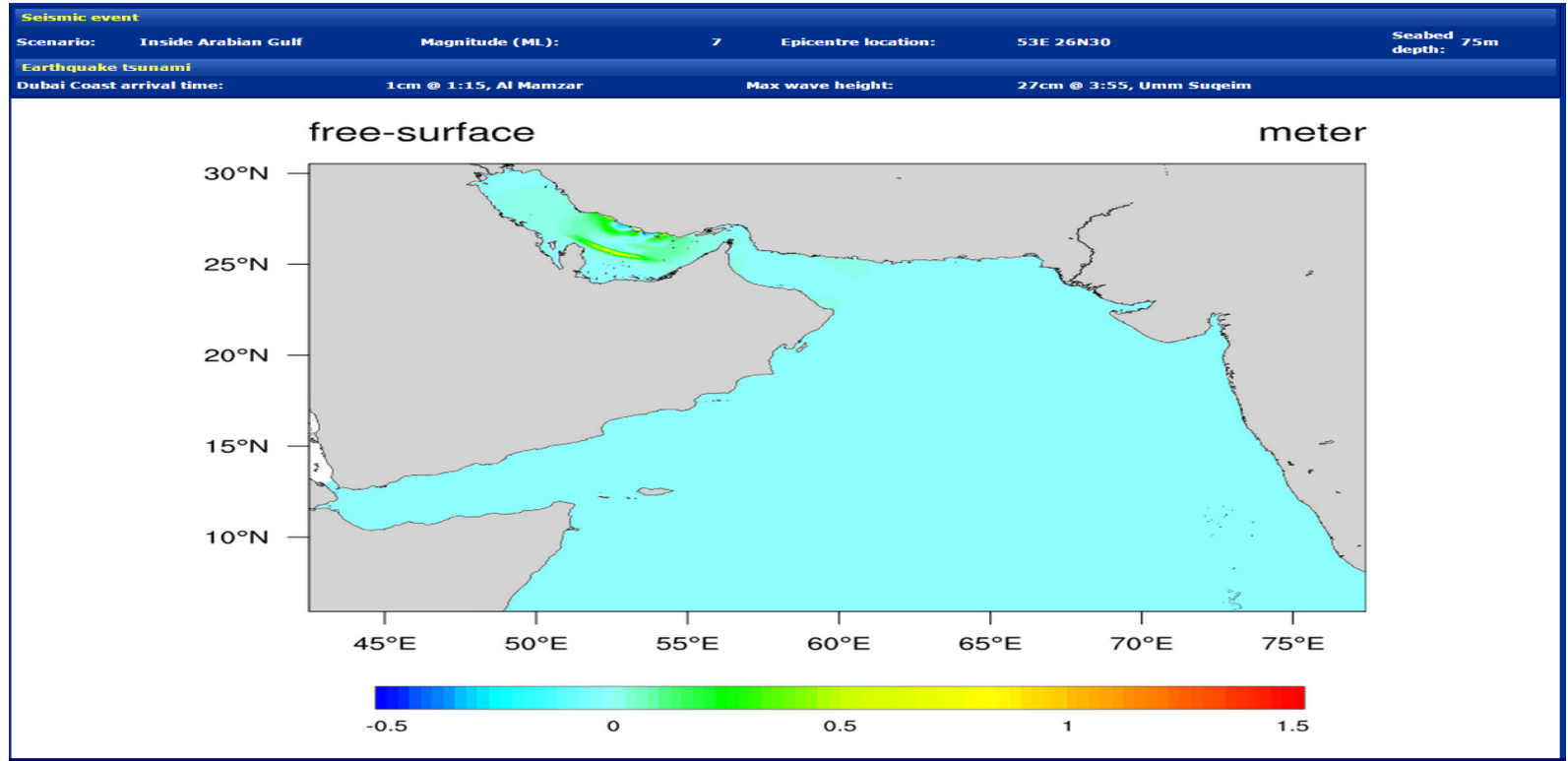
Tsunami aspect at Indonesia side

Thanks