

**Indian National Centre for Ocean information Services (INCOIS)
(An autonomous institute under the Ministry of Earth Sciences
Government of India), Hyderabad**

A note on the performance of Indian Early Tsunami Warning system during the Earthquake occurred Near East Coast of Honshu, Japan on 11-March-2011 at 11:16:23 IST (05:46:23 UTC)

A great earthquake of magnitude 8.7 Mw (mB) occurred Near East Coast of Honshu, Japan on 11-March-2011 at 11:16:23 IST (11-March-2011 05:46:23 UTC). This was an undersea earthquake about 130 km E off Honshu, 330 km NE of Tokyo, Japan with the epicenter at 38.42° N and 142.45° E at a focal depth of 5.0 km. The water column depth at the location was 1242.0 meters. INCOIS issued two bulletins on this event one at 11:24:00 IST (ie with in 7 minutes of the occurrence of event). At this point of time the estimated magnitude was 7.9 Mwp, and the estimated focal depth was 10 km. Other centers such as USGS also reported similar magnitudes initially. On the arrival of more data from seismic stations the magnitude was re-estimated as 8.6 Mw(mB) and focal depth 05 km. This information was issued through the second bulletin at 12:15 IST. In both bulletins (enclosed) it was indicated that the "Tsunami Threat does not exist for Indian Ocean" and "This centre will monitor sea level changes near epicentral region and report in case of tsunami threat" .

Both bulletins were disseminated to MHA, MoES, NDMA, A&N and other regional contacts. Following the main shock till today (12 March 0900 AM), about 130 aftershocks of more than 6.0 magnitudes have been recorded.

All systems, (i) control centre at INCOIS that receives and processes the data from seismic stations, (ii) sea level gauges, (iii) bottom pressure recorders (tsunami buoys) and (iv) the numerical model to predict the water level changes expected at various locations along the coast worked well. Twenty two sea level gauges (see the enclosed list and figures) deployed along the Indian coast, three bottom pressure recorders all worked and reported data to the warning centre at INCOIS. Two bottom pressure recorders (STB1 in Bay of Bengal and STB2 in Arabian Sea) got triggered to tsunami mode due to the arrival of seismic waves (see the enclosed figure). In addition to the Indian systems, INCOIS also accessed the data in real-time/ near real-time from similar observing systems maintained by other countries in the Indian and Pacific Ocean to follow the progress of tsunami wave.

Model simulation for this event indicated that maximum tsunami wave height at coast of Japan is about 6.5 meters. The maximum expected wave to the Indian shore was less than 10 cm and the expected travel time to Andaman & Nicobar Islands was about 14 hours from the epicenter. The maximum energy due to this event was directed towards South East into the Pacific Ocean (see figure 2). The observed wave heights (at any point of time) were comparable with the model estimates. Based on the observations of Sea level gauges in the Pacific and model simulations it was confirmed that there exists no significant tsunami threat to India.

INCOIS continued the monitoring of this event well over 20 hrs and reconfirmed that the sea levels in the Indian Ocean are not different from expected from model simulations.

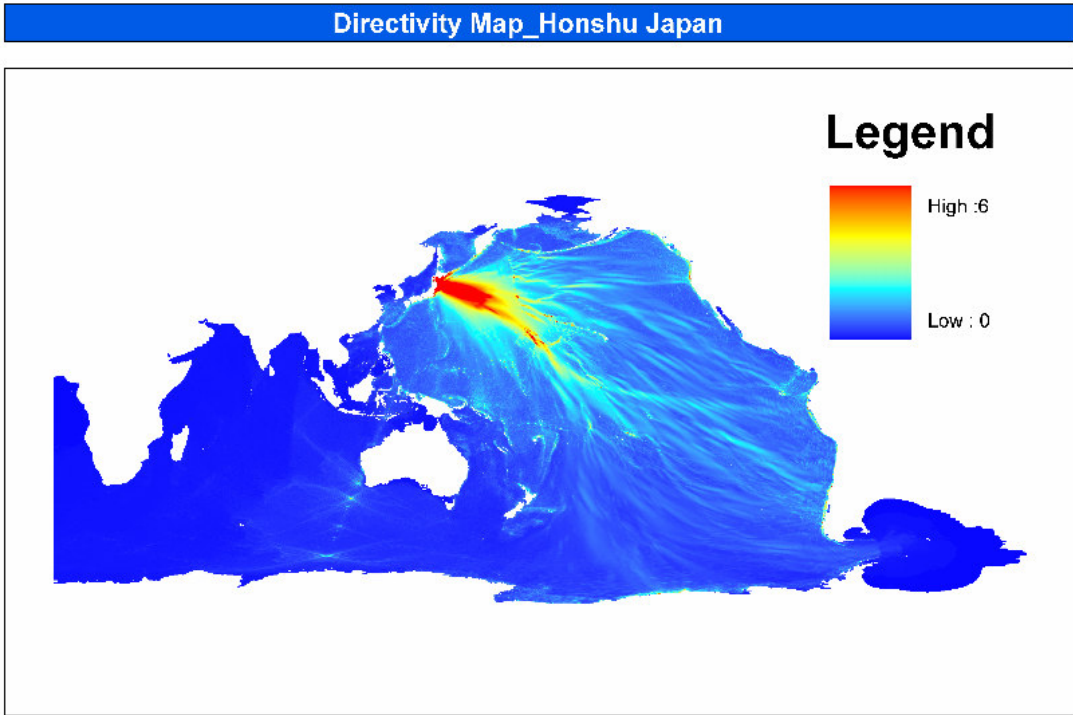


Figure 1: Model simulated directivity map depicting the direction of maximum tsunami wave energy

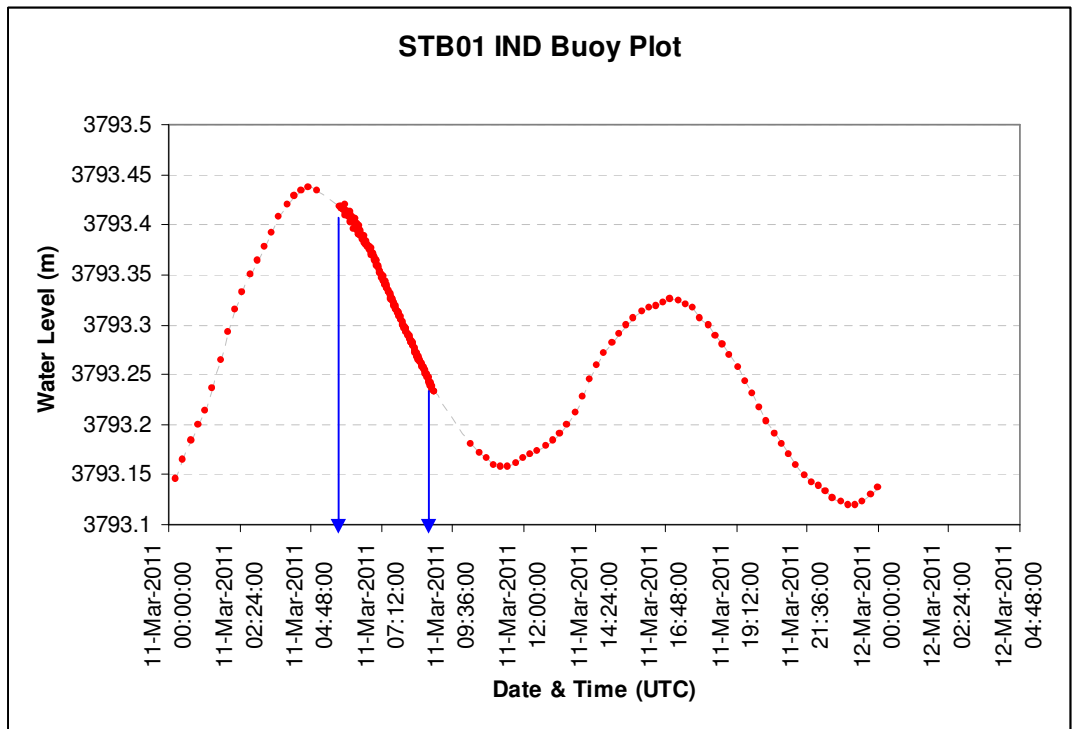


Figure 2: Plot of sea level recorded by the bottom pressure recorder in the Bay of Bengal (STB1). Note the wiggles on the smooth curve occurred due to triggering to tsunami mode due the arrival of seismic waves.

List of Indian Sea level gauges reported data to tsunami warning centre.

1. Aerial Bay
2. Chennai
3. Ennore
4. Garden Reach
5. JNPT
6. Haldia
7. Kandla
8. Karwar
9. Kavaratti
10. Krishnapatnam
11. Marmagao
12. Machilipatnam
13. Minicoy
14. Nagapattinam
15. NewMangalore
16. Noncowry
17. Okha
18. Paradeep
19. PortBlair
20. Tuticorin
21. Vadinar
22. Vishakhapatnam

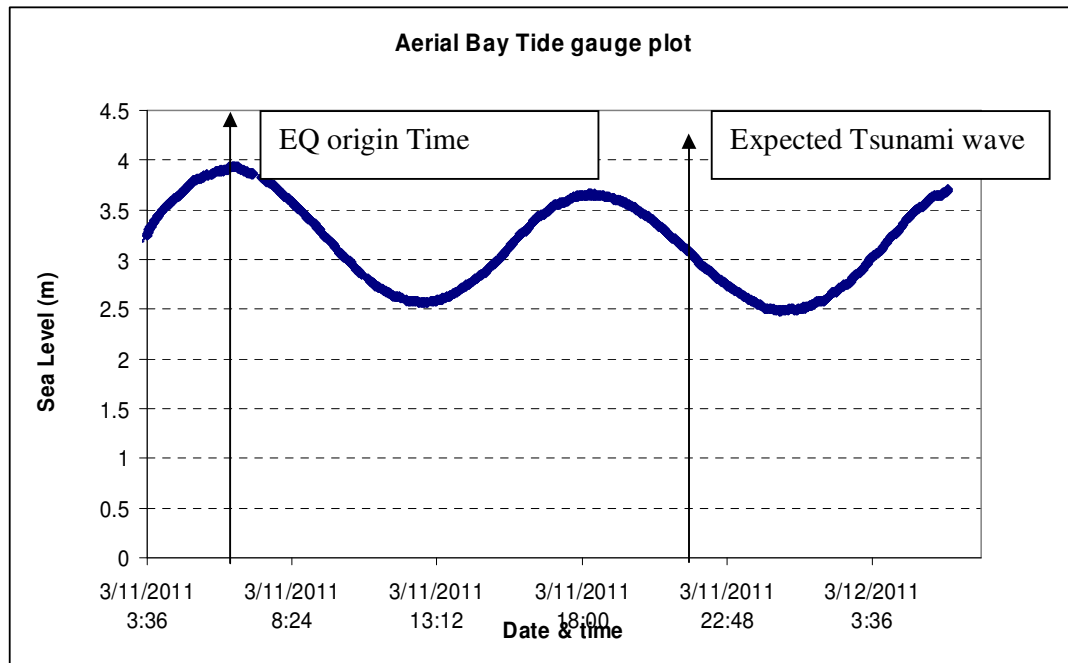
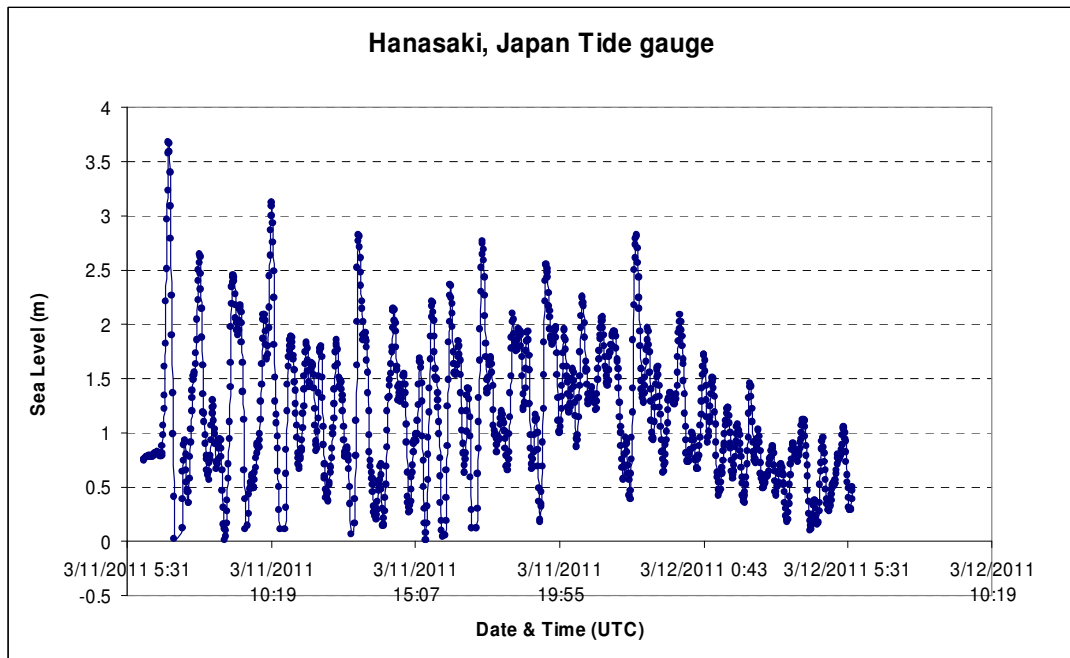


Figure 3: Plots of sea level recorded by the gauges at Hanasaki, Japan and Aerial Bay, Andaman Noobar. Note that the sea level at Aerial Bay is not showing any changes due to the tsunami wave.

EARTHQUAKE INFORMATION BULLETIN

TWC BULLETIN NUMBER: 01

Date of issue: 11-Mar-2011

Time of issue: 11:24:04

Earthquake Information

Earthquake Origin Time: 11-Mar-2011 11:16:23 (IST) 11-Mar-2011 05:46:23 (UTC)

Magnitude:7.9 Mwp (preferred) Category (MODERATE / GREAT): Great

Network Magnitude(s): 8.0 (MLv), 7.9 (Mwp), 8.4 (Mw(Mwp)), 8.1 (mB), 8.4 (Mw(mB))

Location: Latitude: 38.24 N Longitude: 142.57 E

Focal Depth: 10 km

Land/Ocean : Ocean part Water Level Depth (if Ocean): 1218 m

Region: Near East Coast of Honshu, Japan

Focal Mechanism: NIL Source of Information: INCOIS

This is computer generated message. This event is NOT REVIEWED by a Seismologist

Based on historical earthquake and tsunami data, Tsunami Threat does not exist for Indian Ocean. This centre will monitor sea level changes near epicentral region and report in case of tsunami threat. This will be the final bulletin unless additional information becomes available.

(Signature of Shift Incharge)
(Name of Shift Incharge)

Bulletin

EARTHQUAKE INFORMATION BULLETIN

TWC BULLETIN NUMBER: 02

Date of issue: 11-Mar-2011

Time of issue: 12:15:04

Earthquake Information (Revised)

Earthquake Origin Time: 11-Mar-2011 11:16:23 (IST) 11-Mar-2011 05:46:23 (UTC)

Magnitude: 8.6 Mw(mw(mB)) (Revised) Category (MODERATE / GREAT): Great

Network Magnitude(s): 8.0 (MLv), 7.9 (Mwp), 8.6 (Mw(Mwp)), 8.1 (mB), 8.6 (Mw(mB))

Location: Latitude: 38.36 N Longitude: 142.54 E

Focal Depth: 05 km

Land/Ocean : Ocean part Water Level Depth (if Ocean): 1218 m

Region: Near East Coast of Honshu, Japan

Focal Mechanism: NIL

Source of Information: INCOIS

This is computer generated message. This event is REVIEWED by a Seismologist

Based on historical earthquake and tsunami data, Tsunami Threat does not exist for Indian Ocean. This centre will monitor sea level changes near epicentral region and report in case of tsunami threat. This will be the final bulletin unless additional information becomes available.

