Press Release

Real-time tsunami simulation system for Indonesia, Philippines and Chile becomes available

The National Research Institute for Earth Science and Disaster Prevention (President: Yoshimitsu Okada) announces the start of operation of a new system for the real-time simulation of tsunamis, based on the automatic estimation of earthquake source parameters (SWIFT system), in Indonesia, Philippines and Northern Chile regions.   This new system integrates a tsunami simulation code and visualization systems developed at NIED, as well as automatic and manual earthquake source parameters estimated by SWIFT. This kind of system is being developed for the first time in the Indonesia, Philippines and Chile regions, and we highly expect it can contribute to the disaster mitigation in the region.

Source parameters obtained by SWIFT (Mw>4.5) as well as tsunami simulations are disseminated to the public at the following URL:

http://www.isn.bosai.go.jp/index.html

1. See annexes for details.

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The National Research Institute for Earth Science and Disaster Prevention (President: Yoshimitsu Okada) announces the start of operation of a new system for the real-time simulation of tsunamis, based on the automatic estimation of earthquake source parameters (SWIFT system), in Indonesia, Philippines and Northern Chile regions.

The new system performs the real time calculation of local tsunamis in Indonesia, Philippines and Northern Chile using a tsunami simulation code and visualization system developed at NIED, as well as earthquake source parameters estimated by SWIFT, for events with moment magnitude (Mw) larger than 4.5.

The goals of the system are to provide a rapid and reliable earthquake and tsunami information in particular for large seismic events in the region, and produce an appropriate database of earthquake source parameters and tsunami simulations for research. This kind of system, which might be suitable for regions without a dense tsunami observatory network like the one under installation in Japan, is being developed for the first time in the Indonesia, Philippines and Chile.　We highly expect the system can contribute to the disaster mitigation in the region.

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・Outline of the system

The system uses the automatic calculation of moment tensors by SWIFT in Indonesia, Philippines and Chile (origin time, location moment magnitude, mechanism) for earthquakes with magnitude larger than 4.5, as well as empirical scalings of fault length, width and slip, to carry out the automatic simulation and visualization of tsunami for the two fault plane solutions obtained by SWIFT. The system generates maps of maximum tsunami heights within the target regions and along the coasts and display those along with the fault model parameters used for tsunami simulations. Tsunami calculations are performed for all events with available automatic SWIFT/CMT solutions using the linear long-wave model (Figure 1).

To check automatic calculations of tsunami access the link below and select the event in the Tsunami SWIFT column by clicking in **solutions**. An enlarged version of the figures is displayed by clicking on each panel.
(http://www.isn.bosai.go.jp/events_auto/home_sparameters.html)

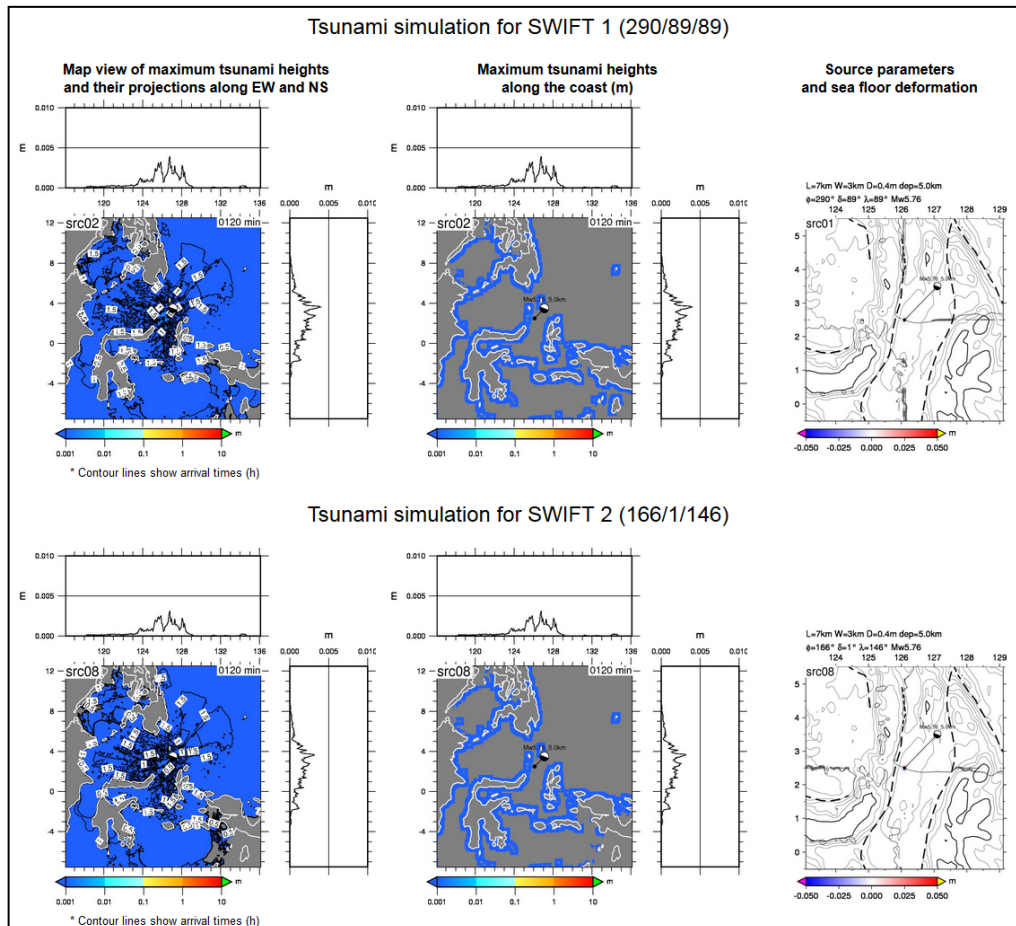**2014/1/25, Northern Molucca Sea, Indonesia, Mw 5.8**

Figure 1.   Automatic tsunami calculations based on automated SWIFT source parameters

Tsunami calculations are re-computed using SWIFT manual solutions for events with Mw ≥5.5. Revised maximum tsunami heights as well as animation of tsunami propagation are also calculated and displayed for the two fault plane solutions by SWIFT (Figure 2).

To check the re-computed calculations of tsunami access the link below and select the event in the Tsunami SWIFT column by clicking in **solutions**. An enlarged version of the figures is displayed by clicking on each panel.

(http://www.isn.bosai.go.jp/events/home_sparameters.html)

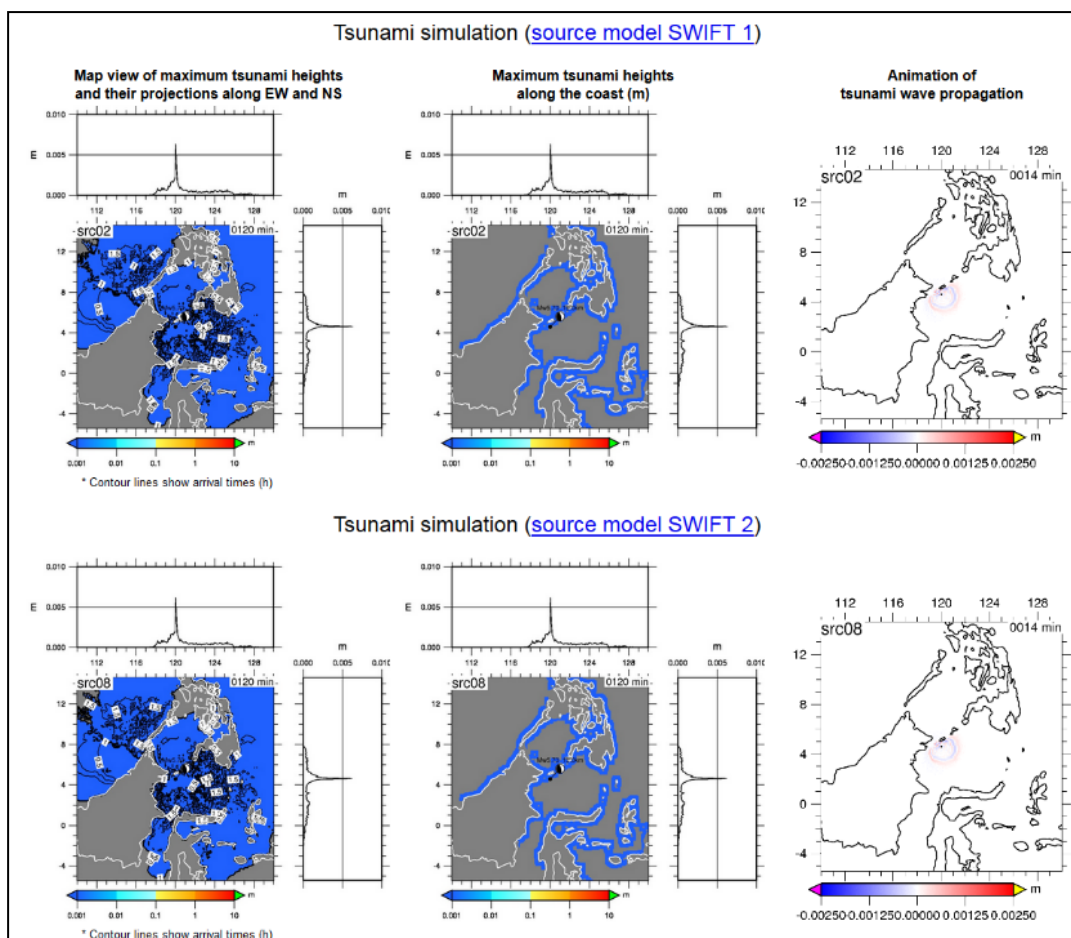### 2015/01/19 17:19 Sulu Archipelago, Philippines, Mw 5.7

Figure 2.   Re-computed tsunami calculations based on manual SWIFT source parameters
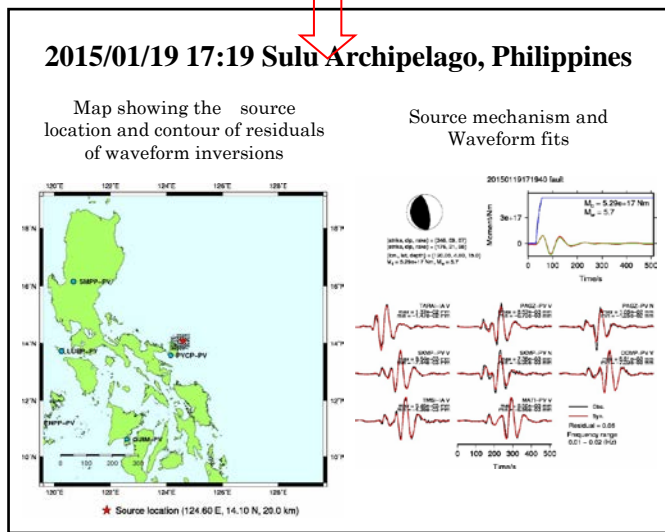
SWIFT system

To contribute to the understanding of source process of earthquakes and long term seismic activity, the National Research Institute for Earth Science and Disaster Prevention NIED maintains the international seismic Network (ISN) in the Asian-Pacific region. Continuous seismic waveforms from broadband seismic stations in Indonesia, Philippines, and Northern Chile are currently received in real time at NIED, and used for automatic location of seismic events. Using these data we perform automatic as well as manual routine estimation of moment tensor of seismic events (Mw>4.5) by using the SWIFT program developed at NIED (Nakano et al. 2008).
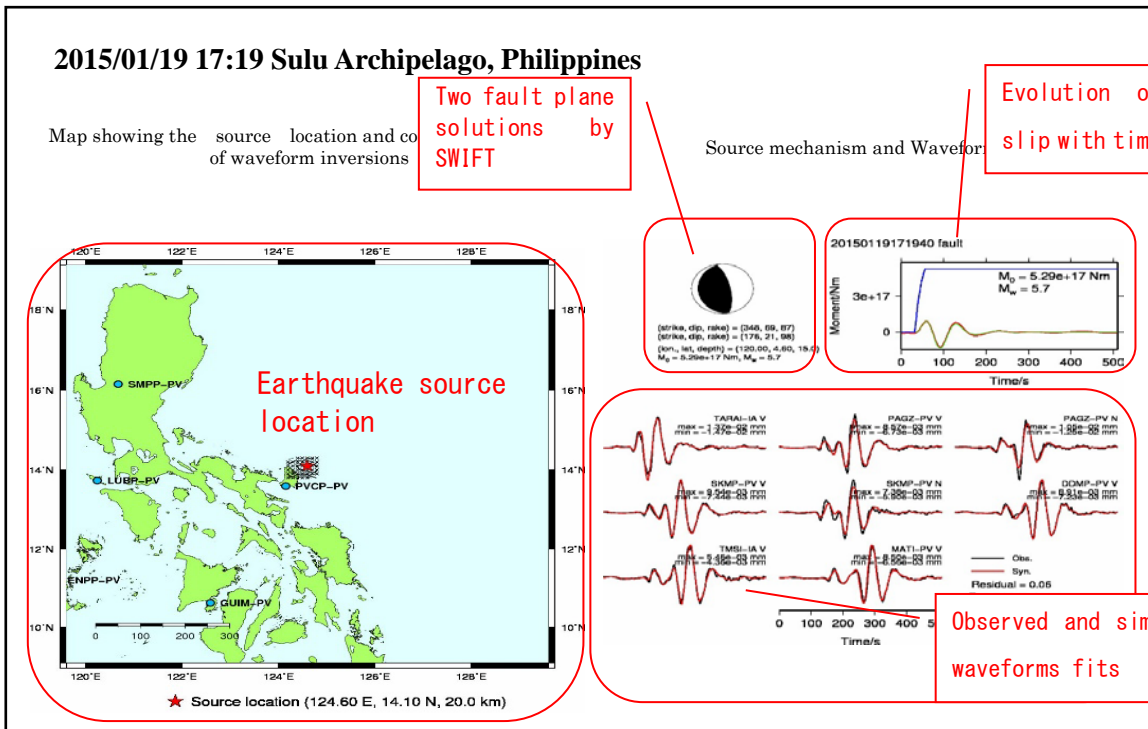
Date (UTC)	Longitude	Latitude	Depth (km)	Mw	Analysis
2015/01/19	120.0 E	4.6 N	15	5.7	Manual (Rapid

List of source locations and mechanisms obtained from waveform inversions (Indonesia, Philippines and Chile regions).

Date (UTC)	Longitude	Latitude	Depth (km)	Mw	Location	Tsunami SWIFT	Analysis
2015-02-04 17:41	125.0°E	0.1°S	30	5.2	Southern Molucca Sea	solutions	Auto
2015-02-02 15:13	124.6°E	14.1°N	20	5.5	Luzon, Philippines	solutions	Auto
2015-01-31 17:30	124.2°E	8.4°S	250	6.0	Banda Sea	solutions	Auto
2015-01-29 02:48	126.7°E	2.1°N	5	4.8	Northern Molucca Sea	solutions	Auto
2015-01-28 02:57	133.5°E	12.5°S	5	6.2	Arafura Sea	solutions	Auto
2015-01-27 00:53	95.5°E	2.0°N	55	5.8	Northern Sumatra, Indonesia	solutions	Auto
2015-01-26 00:17	124.3°E	0.7°N	80	5.3	Mindanao, Philippines	solutions	Auto
2015-01-25 09:20	126.1°E	2.5°N	5	5.8	Northern Molucca Sea	solutions	Auto
2015-01-21 05:20	124.5°E	6.4°N	5	5.6	Mindanao, Philippines	solutions	Auto
2015-01-20 03:02	127.0°E	5.8°N	85	5.1	Philippine Islands Region	solutions	Auto
2015-01-19 17:19	119.2°E	4.5°N	250	5.9	Sulu Archipelago, Philippines	solutions	Auto
2015-01-18 00:27	120.6°E	14.0°N	100	5.2	Luzon, Philippines	solutions	Auto
2015-01-17 23:39	130.2°E	8.8°S	350	6.6	Banda Sea	solutions	Auto
2015-01-17 05:09	120.6°E	14.0°N	100	5.3	Luzon, Philippines	solutions	Auto
2015-01-12 20:25	133.7°E	5.7°S	5	5.9	Aru Islands Region, Indonesia	solutions	Auto
2015-01-11 16:07	125.9°E	11.6°N	30	4.5	Samar, Philippines	solutions	Auto
2015-01-10 19:31	120.1°E	14.8°N	70	5.9	Luzon, Philippines	solutions	Auto
2015-01-10 17:55	69.0°W	21.5°S	70	5.6	Chile-Bolivia Border Region	solutions	Auto
2015-01-09 11:48	69.3°W	21.1°S	150	5.7	Northern Chile	solutions	Auto
2015-01-02 20:11	124.7°E	0.6°S	5	5.9	Northern Molucca Sea	solutions	Auto
2015-01-02 20:09	123.4°E	1.2°N	5	4.8	Minahassa Peninsula, Sulawesi	solutions	Auto
2015-01-01 22:20	121.0°E	2.0°S	20	4.8	Sulawesi, Indonesia	solutions	Auto

List of source parameters by SWIFT

2015/01/19 17:19 Sulu Archipelago, Philippines

Map showing the source location and contour of residuals of waveform inversions

Source mechanism and Waveform fits

★ Source location (124.60 E, 14.10 N, 20.0 km)

2015/01/19 17:19 Sulu Archipelago, Philippines

Map showing the source location and co of waveform inversions

Two fault plane solutions by SWIFT

Source mechanism and Wavefor

Evolution of slip with time

Earthquake source location

(strike, dip, rake) = (348, 69, 87)
(strike, dip, rake) = (176, 21, 98)
(lon., lat., depth) = (120.00, 4.60, 19.0)
$M_0 = 5.29e+17$ Nm, $M_w = 5.7$

$M_0 = 5.29e+17$ Nm
$M_w = 5.7$

Obs.
Syn.
Residual = 0.05

Observed and simulated waveforms fits

★ Source location (124.60 E, 14.10 N, 20.0 km)

References

Pulido, N., D. Inazu, T. Saito, J. Senda, E. Fukuyama and H. Kumagai, Real time earthquake information and tsunami estimation system for Indonesia, Philippines and Chile regions, Japan Geoscience Union meeting, 2015.

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Nakano, M., H. Kumagai, and H. Inoue, Waveform inversion in the frequency domain for the simultaneous determination of earthquake source mechanism and moment function, Geophys. J. Int., 173, 1000-1011, 2008.