

MIS036-P118

Room:Convention Hall

Time:May 27 14:15-16:15

Tsunami source of the 2011 off the Pacific coast of Tohoku earthquake estimated from tsunami back propagation

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We estimate the tsunami source of the 2011 off the Pacific coast of Tohoku earthquake (M9.0) by using tsunami back propagation. As a result, tsunami source is about 400km long along the Japan trench, and almost reach the trench axis. The tsunami source of highly characteristic tsunami have great amplitude (about 5m with 1618m water depth) and short cycle (about 10 minute) is estimated off Miyagi, near trench area.

The tsunami caused by 2011 off the Pacific coast of Tohoku earthquake immensely damaged Pacific coast of Japan. Highly characteristic tsunami is observed at Ocean bottom tsunamimeter off Kamaishi (Tokyo University) and GPS wave gauge (MLIT) off pacific coast of Iwate. The records showed large amplitude (about 5m with 1618m water depth) and short cycle (about 10 minutes) wave came after long cycle (several tens of minutes) wave. we estimate tsunami source by tsunami back propagation from Ocean bottom pressure gauge data (NOAA and JAMSTEC) and tide gauge data (JMA, JCG and GSI) in addition to these Ocean bottom tsunamimeters data and GPS wave gauges data. Tsunami back propagation is drawing wavefronts propagate from observation station from arbitrary time back to origin time of earthquake. 40 observation stations we use surround the hypocenter.

First, we estimate length and width of the tsunami source by using tsunami back propagation from first break. Estimated tsunami source is about 400km long and almost reach the Japan trench axis. However, in north part of tsunami source area, back propagation wavefronts showed complicated pattern. More detailed investigation is needed to estimate the north edge of the tsunami source.

Next, We estimate the source of highly characteristic tsunami by using tsunami backpropagation from first break and end of characteristic tsunami. As a result, the source of characteristic short cycle tsunami is located off Miyagi, near trench area. From tsunami phase velocity (200m/s) in this area and period(5 minute) from start to end of characteristic tsunami, we estimate horizontal scale of the characteristic tsunami source is about 60km.

Keywords: tsunami, the 2011 off the Pacific coast of Tohoku earthquake, back propagation