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Huge seafloor movements associated with the 2011 off the Pacific coast of Tohoku Earthquake

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A mega-thrust earthquake took place on March 11, 2011, off the coast of northeastern Japan, resulting in catastrophic disaster. In Japan crustal movements have been estimated by the nation-wide GPS network on land, but large subduction-zone earthquakes occur in ocean areas. Therefore we have developed a GPS/acoustic seafloor geodetic observation system and we had five reference points above the source region of this huge event.

Here we report on unprecedentedly large seafloor movements associated with this event. Comparison of the positions estimated before and after the earthquake revealed a co-seismic displacement of about 24 m toward ESE and about 3 m upward at the reference point located above the hypocenter. At the reference points located 40 km and 120 km away from epicenter, co-seismic displacements were about 15 m and 5 m toward ESE, respectively. These results are extremely useful to understand what happened in the subduction zone.

Keywords: seafloor geodetic observation