

Sea surface gravity changes observed prior to March 11, 2011 Tohoku earthquake

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The 2011 Tohoku earthquake occurred at the subduction of oceanic tectonic plate, where we had no historical record of this size of huge earthquake. We have examined ship board geophysical observations conducted above the source rupture area if there are any indications of large slip before the earthquake. We have examined ship board geophysical observations conducted above the source rupture area if there are any indications of large slip before this earthquake. We have found that there were two cruises, which pass almost the same tracks above the source rupture area near the oceanic trench, where many researches indicate that there were coseismic large slip, and compared sea surface gravimeter measurements along these tracks. Sea surface gravity measurement conducted one month before the earthquake shows that there was an increase of sea surface gravity with about 10 mGal (1Gal=1cm/s²) compared to the sea surface gravity value measured three months before the earthquake. The measured gravity changes can be interpreted as a density increase along the fault surface of which time scale of evolution is about three months. This observation provides physical mechanism to explain how this large and slow slip can be generated along this fault

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