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The 2011 off the Pacific coast of Tohoku Earthquake inferred from TRIES observation network

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¹TRIES

In 11th March 2011, huge earthquake occurred at northeast part of Japan, named "The 2011 off the Pacific coast of Tohoku Earthquake." This earthquake was the largest earthquake in observational recorded history in Japan. In Tono area, which located approximately 600km away from the epicenter, large ground acceleration (maximum seismic intensity 4) and large dynamic strain (10^{-5} strain; approximately 1000 times larger than the tidal change) was observed. In this paper, we inferred the rupture process of the 2011 off the Pacific coast of Tohoku earthquake from the ground acceleration and dynamic strain.

We have been operating some crustal activity observatories with in deep borehole strainmeters (BYB, TRIES, and TOS) at the Tono area, Gifu prefecture, central Japan. We used the dynamic strain records, which obtained by the The 2011 off the Pacific coast of Tohoku Earthquake, in order to estimated the rupture process. In the analysis, at first, we determined the the principal strain azimuth with from four horizontal strain records for each frequency by using the Fourier Strain Analysis (Okubo, 2007). The results of the principal strain azimuth changes and the distance inferred from the principal strain amplitude derived that the strain release source gradually moved from off Miyagi to off Ibaraki. In addition, we assumed that the longest period of the principal strain azimuth with small analytical errors (~ 2.5 degrees) means the rupture duration of earthquake. We derived the results that the rupture continued over a period of approximately 180 seconds after initial arrival and revealed that total has been released seismic moment equivalent to $M_W 8.7$. Seismic moment that we obtained from the dynamic strain is smaller than the JMA reported moment ($M_W 9.0$).

On the other hand, we have been also operating the more than 50 seismic stations (ground acceleration) in the Tono area. Tono area observed seismic intensity 4 by mainshock. we obtained more than 30 seismic intensity distribution records, which caused by induced earthquake and subsequent aftershocks, in about a month after the earthquake.

Keywords: dynamic strain, acceleration, Seismic Intensity, Source process