Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)
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SGD021-02 Room:201A Time:May 23 08:45-09:00

Polar motion due to the 2010 earthquake in Central Chile and long-term polar motion due to earthquakes

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Mass redistribution associated with earthquake faulting causes the shift of the Earth's rotation axis and changes in LOD (Length of day). In Chile, the great earthquake occurred on 27 February 2010. GRACE gravity observations showed a negative jump with the largest drop of ~5 micro gal, and this corresponds to ~8 cm shift of the Earth's inertial axis (Heki and Matsuo, GRL 2010). In the meetings in the last autumn, we reported our attempt to detect this polar motion by geodetic observations. Atmosphere and ocean are the main factors to excite polar motions. We tried to remove their contributions (both motion and mass terms) using NCEP data and ECCO model, respectively. However, the 2010 ECCO model was not available then, and we could not correct the oceanic contribution before and after the 2010 Chilean earthquake. Hence, the discussion on the polar motion was not adequate. In the present meeting, we hope we can correct for the oceanic excitation during 2010 and discuss the issue fully.

In addition to this topic, we will also discuss the excitation of long-term polar motion due to earthquakes. We calculated the earthquake-induced polar motion excitation. Seismic excitation of the polar motion is smaller than the observation by two-orders of magnitude, and in the opposite direction to the observed motion toward Greenland. It was pointed out that the seismic excitation has a strong tendency to move the pole towards ~140E (Chao et al., 1996, Spada, 1997). Large earthquakes in subduction zones generally makes dent in geoid, and move the pole (the north pole if the earthquake occurred in the northern hemisphere) toward the epicenter. The preferred direction would reflect the occurrence of such earthquakes in the northwestern (~140E, mid-latitude) and southeastern (antipodal to it) rims of the Pacific Ocean.

Keywords: The 2010 Chilean earthquake, polar motion, mass redistribution, earth rotation parameters