

GEOMETRICAL INTERPRETATION OF PLATE MOTIONS IN JAPAN DURING JUNE 2008 AND MARCH 2011 EARTHQUAKES

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Crustal movements in Japan are continuously observed by GPS and collected in almost 1200 permanent stations (Kamiyama et al., 2012). The network of these stations is called the GEONET. The data collected in GEONET is the sequence of 3-D Conventional Terrestrial (CT) Cartesian and geodetic temporal positions of the permanent stations versus time. The time intervals of June 2008 and March 2011 are selected for the interpretation of plate movements since two big earthquakes happened in between. To show the general movement of the North American (NA) plate as a whole in the Japan region, all partial displacements (movements) calculated for the stations on the plate in the East and North directions and in consecutive epochs of time are averaged for every epoch to represent the plate displacement at that epoch. The average displacements in the E-N directions are all mapped in the direction that generally plate moved. This general direction of movement is calculated as the average of all azimuths of the displacement vectors at different stations and different epochs. It is worth noting that the partial displacements at the stations are all already corrected for other geodynamic movements of high frequency nature and are filtered for the systematic errors (Djamour et al., 2010). Figure 1 shows the partial displacements of the NA plate in the Japan region during the time interval of June 1– June 25, 2008, viewed from both sides of an assumed fault containing the June 14, 2008 earthquake epicenter.





Figures. 2 (a, b and c) show the NA plate horizontal motion at different stations during June 14, 2008 earthquake at west and east side of the epicenter. All the motions extend towards the epicenters of the earthquake from the both west and east banks of the epicenter. The epicenter happened in the middle of Japan island implying a fault crossing the island (Figure 2 b).



Figure 2. a) Co-seismic NA plate motion in the west bank the 2008 earthquake epicenter. b) approximate location of the fault. c) Coseismic NA plate motion in the east bank the 2008 earthquake epicenter

Figure 3 shows the NA plate horizontal motion at different stations during the March 11, 2011 earthquake at west bank of the epicenter happened on the Japanese trench, (Takeshi Sagiya, 2004). All the motions extend towards the epicenters.



Figure 3. Co-seismic motion of NA plate motion in the west bank of the 2011 earthquake epicenter

As shown in the Figure 2, the horizontal partial displacement close to epicenter on the day of June 14, 2008 earthquake grows to almost 1.5 m on the horizontal direction and 2 m (not shown on the map) in vertical direction. On the day of March 11, 2011 earthquake (Figure 3), the horizontal displacement attains almost 5 m in horizontal direction and 1 m in the vertical direction close to the epicenter that is the indication of faulting.

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