

On the recent slow down of the abnormal crustal movements in Tokai Region by the analysis of GPS observations

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Abnormal crustal movements associated with the slow event on the plate boundary are occurring in Tokai Region, Central Japan, since the midst of 2000. The area and the amplitude of the abnormal crustal movements were wide and large during the midst of 2000 and the end of 2001, became narrow and small during the beginning and the end of 2002, and again became wide and large between the beginning of 2003 and spring of 2004 (for instance, Shimada and Kazakami, 2004). Since around June 2004, the movements again became narrow and small, and at September 6, 2004 the M7 class earthquake occurred at south-east off Kii Peninsula. Associated with the earthquake, co-seismic step generally to the southward motion occurred with the amplitudes up to 30 mm. We estimated the co-seismic step vector for each GPS station in Tokai Region using the daily coordinates solution for one-week periods before and after the earthquake and using the GLOBK Kalman filtering program. Then removing the estimated co-seismic step vectors, the time series of the most sites in the Tokai Region are seemed to vary constantly before and after the earthquake, that is, the narrow and small movements. It is interpreted that the strain field in wide area, where GPS network and the epicentral area of the south-east off Kii Peninsula earthquake are included, have changed since three months before the earthquake occurrence and the earthquake occurred associated with the strain field change. On the another view point the precursory strain field change arose since around June 2004 and the post-seismic changes are continuing with the same sense as the precursory.

The changes since June 2004 are obvious for the Tenryu site (TNR) of NIED, Mori site (3089), Inasa site (3050), Hamakita site (3097) of GEONET and other sites. We calculated annual velocity vectors using the weekly coordinates dataset by GLOBK, and plotted the vectors on map. The abnormal crustal movements indicate maximum area and amplitude for a year since January 2003, become shrink the area and amplitude for a year since February 2004 as same as those for a year since January 2002. The shrink of the velocity vectors are significant for the E-W components and not for the N-S components.

For the borehole tiltmeter observations, that are the independent observations from the GPS measurements, at Mikkabi site (MKB) time variations of the daily values are changed to become small since around April 2004 according to Yamamoto and Ohkubo (the abstract of this meeting).

In the investigation of the time variations of the GPS measurements we adopt the Shimizu site (3077) of GEONET as the reference site. In the time variations of the annual velocity fields, for the sites in the western Kanagawa Prefecture and on the Izu Peninsula, those locate east of the reference site, the velocity vectors show clockwise rotation since April 2003, suggesting the southern motion of the reference site. Thus we plot the time series of the baseline vector between the 3077 site and the USUDA site (USUD) of IGS in the Central Nagano Prefecture. Before the midst of 2000 since 1996 when the analysis started, the 3077 site moved south-westward, and since the midst of 2000, when the abnormal crustal movements started, any significant time variations are seen in the baseline vector time series, which suggests the wide area are moving same way including the 3077 and USUD sites in southern Central Japan. Actually checking the time series of the baseline vector between the USUD site and the Tsukuba site (TSKB) near Tokyo, the USUD site did not moved until around September 2004, turned to southward since then in the N-S component.