Temporal variation of tidal constituents prior to earthquakes and volcanic activities (part2)

Issei Hirose[1], Ichiro Kawasaki[2], Shuzo Takemoto[3], Yoshiaki Tamura[4], Yoshimitsu Okada[5], Kazushige Obara[5], Fumio Yamamizu[6]

[1] Grad. School of Sci. and Eng.,Toyama Univ., [2] RCEP, DPRI, [3] Earth and Planetary Sci., Kyoto Univ, [4] NAO, Mizusawa, [5] NIED, [6] Natl. Res. Inst. for Earth Sci. & Dists. Prev.

In the previous paper of Hirose et al. (2002), we reported temporal variation of the tidal constituents of continuous observation of crustal strains and tilts prior to the 1986 Izu-Oshima Eruption, the 1995 Kobe Earthquake (Mw6.8) and the 2000 Miyake-jima Eruption.

In this study, we analyze laser strainmeter records at Rokko-Takao observation station of Kyoto University relevant to the 1995 Kobe Earthquake (Mw6.8), extensometer records at Esashi Earth Tide Observatory of NAO relevant to the 1994 Sanriku-oki Earthquake (Mw7.5), tiltmeter records of the Kanto-Tokai Crustal Tilt Network of NIED relevant to the 2000 Miyake-jima eruption, and tiltmeter records of High Sensitivity Seismograph Network Japan (Hi-net) of NIED.

Applying the Bayesian Tidal Analysis Program (e.g. Tamura et al., 1991) to the hourly data sets of 30 day length of a mutual time lag of 1 day, we obtain temporal variation of amplitudes and phases of diurnal O1 and semi-diurnal M2 constituents.

Summary of our analysis is as follows:

(1) By taking the difference of EW and NS components at Esashi to minimize atmospheric pressure effects, we recognize the donuts-pattern variation of the O1 constituents in an amplitude-phase diagram associated with the 1994 Sanriku-oki Earthquake like the 1995 Kobe Earthquake. There is no significant change in M2 constituent.

(2) To the 2000 Western Tottori Earthquake (Mw6.6), the 2001 Middle Niigata Earthquake (Mw 5.2) and the 2001 Middle Kyoto Earthquake (Mw4.8), we analyze Hi-net tiltmeter records near their epicenters. On O1 constituents of these records, anomalous changes show up in the phase and amplitude from several days or several months prior to the events. However they are not significant because the periods of the records are not sufficient.

(3) In 1-3 years prior to the 2000 Miyake-jima eruption, the delay of the phase and increase of the amplitude are significant in the O1 and M2 constituents at a few crustal tilt observations sits in Izu-Oshima and Izu Peninsula, although the initial time of these changes are not common to the sites.

(4) We analyze temperature, atmospheric pressure and sea level records at or near the sites by same procedure. Because their variation patterns in the amplitude-phase diagram are different from (1)-(3), the donuts-patterns are not caused by the weather disturbances.

(5) We speculate that the donuts-pattern variation could be attributed to preparation processes of the earthquakes and the volcanic eruptions.