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Postseismic Deformation following the 1995 Kobe, Japan, Earthquake Detected by Space Geodesy

Manabu Hashimoto (1), Taku Ozawa (2), Takuya Nishimura (1), Hiroshi Munekane (3), and Mikio Tobita (4)

(1) Kyoto University, Disaster Prevention Research Institute, Uji, Japan (hashimoto.manabu.7e@kyoto-u.ac.jp), (2) National Research Institute for Earth Science and Disaster Resilience, (3) Geospatial Information Authority, (4) Japan Aerospace Exploration Agency

A Mw 6.8 earthquake hit the city of Kobe, southwest Japan, and its surrounding area on January 17, 1995, and claimed more than 6,400 fatalities. The source faults, trending in the NE-SW direction, are estimated beneath the foothill of the Rokko Mountains, which are located north of the city and the highest peak is 931 m high, but it has a dominant right lateral strike slip components. The Rokko Mountains may have been built by the motion of active faults, but the uplift during the 1995 earthquake may not be enough. Therefore there is a possibility that postseismic deformation contributes to the building of the Rokko Mountains.

In order to study the postseismic deformation following the Kobe earthquake, we collected all available space geodetic data during about 20 years, including ERS-1/2, Envisat, JERS-1, ALOS/PALSAR and ALOS-2/PALSAR-2 images and continuous GPS data, and reanalyzed them. Especially, temporal continuous GPS observation made by the Geographical Survey Institute (present the Geospatial Information Authority), Japan in and around the Kobe area is important. We recalculated coordinates of these continuous GPS stations with recent PPP procedure using reanalyzed orbits and clocks of satellites. We made DInSAR and PSInSAR analyses of SAR images using ASTER-GDEM ver.2 or GSI DEM.

Time series analysis of JERS-1 images revealed line-of-sight (LOS) decrease of the Rokko Mountains. PS-InSAR results of ALOS/PALSAR also revealed slight uplift north of the Rokko Mountains that uplifted by $\sim$20 cm coseismically. These observations suggest that the Rokko Mountains might have uplifted during the postseismic period.

LOS increase in a wedge shaped region between two active faults east of the Rokko Mountains in the vicinity of the NE terminus of the source fault of the Kobe earthquake. The LOS increase is also confirmed by ERS-1/2, Envisat and ALOS/PALSAR images. These facts indicate that the subsidence between these two faults continued up to 2010. Continuous GPS observation during the first two years of the postseismic period shows north-south extension with right lateral motion between these two faults.

These observations suggest that the Rokko Mountains may have uplift till 2010. On the other hand, active faults near the NE terminus continued to slip with the formation of graben-like structure, due to coseismically loaded stress.