Principal Component Analysis for GEONET data in Kanto and Tokai Districts in Japan

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Principal component analysis (PCA) is applied to GEONET(GPS Earth Observation NETwork) data (the displacements recorded by more than 100 GPS stations) in the Kanto and Tokai Districts in Japan for the period including the following three major events. (1) The Miyake-Kozu event in 2000, which includes large-scale dyke intrusion between Miyake and Kozu volcano to the south of Japanese main island. This event was accompanied by five phreatic eruptions in Miyake Volcano, and intensive earthquake swarm near Kozu volcano. (2) The Tokai slow slip event, which started and is still continuing at a plate boundary between the Eurasian plate and the Philippine Sea plate in the Tokai District in 2000. (3) The Boso slow slip event, which lasted for less than a month in October 2002 at a plate boundary between the North American plate and the Pacific plate near the Boso Peninsula. Such events have been detected as displacements of GPS stations around their sources. Using PCA, we attempt to decompose the data into representative spatial modes and their temporal modes. We apply PCA to the following two data sets to check the reliability of the analysis; (A) Horizontal and vertical components from January 2000 to December 2002 (B) Only horizontal components from January 2000 to December 2002. We successfully decomposed the data into the modes corresponding to the Miyake-Kozu event, the Tokai slow slip event and the Boso slow slip event, as a major contribution to the total displacement field. Some prominent characteristics are as follows. In the temporal mode corresponding to the Miyake-Kozu event, the ramp-like step is followed by a prolonged tail which asymptotically approaches a constant level up to now. The development of the Tokai slow slip event is revealed to be initiated soon after the Miyake-Kozu event from its temporal mode. Eastward motion in the Kanto District also synchronizes with the Tokai slow slip event. The Boso slow slip event is clearly observed both in the corresponding spatial mode, in which a center of subsidence regions is in the eastern part of Boso Peninsula, and in its temporal mode, which abruptly changes in October 2002. The total contribution of the above three modes to the data is more than 80% for data (B) and about 70% for data (A).

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