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Kinematic Analysis of GPS Data in SE Asia During the Sumatra-Andaman and Nias Earthquakes

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Seismological studies revealed that the Sumatra-Andaman earthquake has as a long duration of rupture as 600 seconds due to its unusual size. Static GPS detected rapid postseismic deformations during the first week following the mainshock. However it is unclear what happened during the 24 hours after the seismic waves passed and how postseismic deformations commenced. We apply a kinematic analysis with GIPSY to data from continuous GPS sites in SE Asia during the period including December 26, 2004, and detect temporal variation in their coordinates. We also use continuous GPS from Wuhan in China and Karratha in Australia for the reference of coordinates and Mizusawa in Japan for the reference of clock. Since there are similar patterns of temporal changes in coordinates, which may be attributed to constellation of GPS satellites, among different days, we apply a sidereal filter to the time series on December 26 to reduce them. Even though the sampling rate is 30 seconds at these sites, coseismic deformations from the Sumatra-Andaman earthquake were detected most sites in Thailand and northern Sumatra. The large first motions arrived at 01:00:30(UT) at Sampari, northern Sumatra, and 01:07:30 at Chiangmai, northern Thailand. If we assume this first motion comes from the epicenter, its velocity is estimated as 3.2km/sec that is a bit slower than that of Rayleigh wave. The first motions at Phuket, southern Thailand, and Sampari have much more southerly components than the static displacements. We can observe remarkable vibration around 01:20:00(UT) at several sites in Thailand including Bangkok that cannot be found in the time series on different days. We also made a kinematic analysis of GPS data on March 28, 2005. Unfortunately data from Wuhan is unavailable and we do not apply sidereal filter in this case. Since there are large disturbances in the data before and after the Nias earthquake at 16:09 on March 28, 2005, it is hard to recognize arrivals of seismic waves at most sites except Padang on the west coast of Sumatra. However large offsets that are consistent with static displacements(∼20cm southwest ward) can be seen at Sampari when we take the difference between mean coordinates about 1 hour before and after the origin time. Acknowledgements: This work is done by the cooperation with the following people in Thailand and Myanmmar: Dr. AungKyi(Department of Meteorology & Hydrology, Myanmar), Prof. Sununtha Kingpaiboon(Khon Kaen University), Prof. NarongHemmakorn(King Mongkut's Institute of Technology Ladkrabang), Prof. Tharadol Lomolmis(Chiang Mai University), Drs. Yoichi Fukuda, Kunio Fujimori and Hiroshi Takiguchi(Kyoto University), Drs. Takashi Maruyama and Masabumi Kawamura(NICT), Dr. Peiming Wu(JAMSTEC) and Prof. Mikio Satomura(Shizuoka University). We are indebted to Drs. Shin'ichi Miyazaki(ERI) and Kazutoshi Sato(DPRI) for the preparation of kinematic GPS analysis.