

Analysis of the low-frequency seismic modes after the Mw = 9 Sumatra earthquake using superconducting gravimeters

Severine Rosat[1]; Tadahiro Sato[2]; Yoshiaki Tamura[3]; Yuichi Imanishi[4]; Jacques Hinderer[5]; Herbert McQueen[6]; Koichiro Doi[7]; Kazuo Shibuya[7]; Masatake Ohashi[8]

[1] Mizusawa, NAO; [2] NAO; [3] NAOJ, Mizusawa; [4] ORI, Univ. of Tokyo; [5] Physique du Globe, Strasbourg; [6] Earth Sciences, ANU; [7] NIPR; [8] ICRR, Tokyo univ.

The high resolution and low noise level of superconducting gravimeters (SGs) data at frequencies less than 1 mHz have allowed the high quality observation of the degree harmonic two seismic mode 0S2, the so-called 'football mode', and the first detection, by stacking, of the degree one seismic mode 2S1 after the Mw = 8.4 Peru earthquake that occurred on 2001 June 23rd (Rosat et al., 2003). The recent Mw = 9 Sumatra earthquake on 2004 December 26th has strongly excited the low-frequency seismic modes and, in particular, the degree one 2S1 mode is observed for the first time without any stacking. This mode corresponds to the first overtone of the sub-seismic mode 1S1, the so-called Slichter triplet (Slichter, 1961). The core-sensitive mode 3S2 and the fundamental radial mode 0S0 were strongly excited. This means that the earthquake radiated energy preferentially towards the core, so there is great hope that this huge earthquake has triggered the translational motion of the inner core: that is a chance to detect the Slichter modes. We show high-resolution analyses of the gravest seismic modes using time-varying gravity data recorded on the Earth's surface by the SGs installed at Canberra (Australia), Esashi (Japan), Matsushiro (Japan), Strasbourg (France), Syowa (Antarctica) and Kamioka (Japan). The seismic normal modes of frequency less than 1 mHz, which are related to the whole Earth, are one way to improve the density profile inside the Earth without any trade-off with elastic parameters as their frequency splitting is directly linked to the 1D density structure (Widmer-Schmidrig, 2003). Moreover their splitting possesses high sensitivity to the 3D density structure in the Earth's mantle and core, so their observation can also help to constrain the Earth's lateral density structure.

References:

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