

Comparison of long-period surface wave Kamioka LASER strain meter records and synthetic strain records during large earthquakes

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The Kamioka LASER strain meter started recording since June 11, 2003. To avoid the environmental noise caused by rainfall and temperature change, the instruments are installed by excavating Mt. Kamioka 1 km below the surface. The instruments detect the change of the lengths of the two points fixed to the basement rock in the two directions NS and EW, and the strain resolution reaches up to $1\text{E-}13$. The ultra-broadband from DC to 20Hz and the ultra-wide dynamic range of this LASER strain meter enable us to record the microearthquakes as well as the Earth tide.

Good free oscillations and long-period surface waves from two large earthquakes, 2003/09/25 M8.3 Tokachi-Oki and 2003/08/21 M7.5 south of New Zealand, were recorded. The difference of NS and EW component strain, which is less sensitive to the barographic pressure change, of the Tokachi-Oki earthquake registered clear amplitude spectrum peaks up to mode OT6 with a period of about 900 seconds. The surface waves in the 1 mHz through 4 mHz frequency band, the observed strain records significantly differ from the synthetic strain records for a spherically symmetric Earth model. Observed strain waveform of the orbiting-Earth Love waves are five times as large as the synthetic strain waveform for a spherical Earth mode. The strain amplitude of observed G_{2,3} are about four times as large as that of observed R_{2,3}, while in the synthetic strain amplitude for a spherical Earth model the strain amplitude of G_{2,3} is predicted to be about a half of that of R_{2,3}. We newly developed a new code to compute the synthetic strain records including the effect of the rotation, elliptic figure, and internal large-scale seismic heterogeneity of the Earth for a given earthquake. The new code explains well the observed strain amplitude anomalies. For the south of New Zealand earthquake the observed arrival time of the G₂ wave packet is about 20 seconds earlier than the spherical Earth prediction, but the travel time difference disappears for the rotating elliptic and heterogeneous Earth model.