

High quality low-degree free oscillation observations with strainmeters at the Black Forest Observatory

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The two most energetic earthquakes since 1964 occurred in the subduction zones off the W-coast of Northern Sumatra in 2004 (Aceh) and off the E-coast of Northern Japan in 2011 (Tohoku). These quakes excited the free oscillations of the Earth with large amplitudes and thus they could be recorded with unprecedented resolution. Besides the global networks of GSN and GGP these oscillations could also be observed at some stations with instruments not included in these networks. Among those are the 10 m invar-wire strainmeters at the Black Forest Observatory (Schiltach, SWGermany). We compare the free mode spectra from these instruments and for the two seismic events with the spectra obtained from the broadband seismometers at the same station and with synthetics for a spherically symmetric Earth (PREM), but including the effects due to rotation and ellipticity. The signal-to-noise ratio obtained with the strainmeters for the low-degree modes is at least as good as the one from the horizontal seismometers. In particular, all singlets of the mode ${}_0S_2$ are completely resolved, splitting of ${}_0T_2$ is for the first time seen in individual seismograms, and ${}_0S_0$ with a strain amplitude of 10^{-11} is recorded with good signal-to-noise ratio for the first time since 1960.