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Discovery of the torsional hum of the Earth

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Ten years ago, Nawa et al. (EPS, 1998) provided evidence that the fundamental spheroidal modes of the Earth (${}_0S_l$) are continuously excited, even in times devoid of large earthquakes. Meanwhile, numerous studies tried to identify characteristic properties and the source of these background oscillations between 2 and 7 mHz, often called the "Hum of the Earth".
All of these studies were based on data from broad band seismometers and gravimeters with particularly low noise levels. Horizontal component seismic data have not been considered yet, since they are much noisier than the vertical component at periods T > 30 sec. Thus, the horizontal movements from the spheroidal background oscillations have not been observed up to now, and a much more important question could not be answered: Is there a permanent excitation of toroidal modes ?
Despite the difference in noise levels between vertical and horizontal components, we analyzed horizontal component seismic data from the quietest stations and found indications for the continuous excitation of fundamental torsional modes between 3 and 7 mHz (Kurrle and Widmer-Schnidrig, submitted to GRL, 2008). We could identify numerous peaks at both fundamental spheroidal and toroidal mode frequencies in seismic noise spectra. Both kinds of modes exhibit similar amplitudes. There is no clear indication of the excitation of overtones.
Furthermore, using a method based on the cross correlation of seismograms with their inversely dispersed counterparts (Ekström, JGR 2001), we detected globe circling Love and Rayleigh waves in the data. Because of the duality between fundamental spheroidal modes and Rayleigh waves and between fundamental toroidal modes and Love waves, this finding confirms that the horizontal hum of the Earth is composed of both fundamental spheroidal and toroidal modes together.

Regardless of whether the spheroidal and the toroidal modes are excited together or not, new theoretical models will be necessary to explain the torsional hum of the Earth (Widmer-Schnidrig and Kurrle, EGU 2008).