Geophysical Research Abstracts
Vol. 12, EGU2010-6249, 2010
EGU General Assembly 2010

Seismic noise investigation in Kuril-Kamchatka-Japan region: tidal modulation and connection with regional seismicity

Vadim Saltykov

Geophysical Survey of Russian Academy of Sciences, Kamchatka Department, Petropavlovsk-Kamchatsky, Russian Federation (salt@emsd.ru, +7-415-2258898)

Tidal modulation of seismic noise proves that it's structure includes the endogenous component (seismic emission). This fact presumes the seismic noise self-descriptiveness and allows us to consider it as the self-dependent informational geophysical field. The high-frequency seismic noise (HFSN) is the seismic radiation in the range of the first tens of Hz with amplitude of 10^-9-10^-12 m. The HFSN is a complicated superposition of endogenous and exogenous microseismic signals. The factors affecting the intensity of the HFSN are human activity, wind, warming of the earth's surface, earth tides, and tectonic processes.

At present, the observation of the highly sensitive geophysical field is complicated by industrial noise of large territories, which made it impossible to separate the natural signals from the obtained records in many cases. In Kuril-Kamchatka-Japan region the investigation of the HFSN are carrying out more then 20 years. During this time, four points of long-term observation were established in the areas with low level of anthropogenic cativity: «Nachiki» (1987, Southern Kamchatka), «Karymshina» (1999, Southern Kamchatka), «Erimo» (1993, Hokkaido) and «Shikotan» (2003, Lesser Kuriles). A resonance narrow-band vertical seismometer with a sensitive piezoceramic element was used as a sensor of the HFSN signals. Similar detectors are used at all four points of HFSN recording (the sensitivity with consideration for the preliminary amplification is not worse than 5×10^{9} V/m, the frequency of the characteristic oscillation is f = 30 Hz, Q-factor=100).

The most interesting object for investigation is the response of the HFSN to long-period deformation processes, in particular, to the Earth tides. The recorded data were processed using different time-windows. High-resolution coherent signal stacking clearly singled out the noise intensity variations with periodicity of tidal waves: O1 (main lunar, period T=25.82 h), K1 (lunar-solar declination, T=23.93 h), P1 (main solar, T=24.07 h), Q1 (large lunar elliptical, T=26.87 h), M2 (main lunar, T =12.42 h), S2 (main solar, T=12.00 h), and N2 (larger lunar elliptical, T=12.66 h). Thus effects of other eventual factors with nearly 24-hour and 12-hour periods were reliably excluded. The noise modulation depth typically ranged from 1 to 10 percents. This value is extremely big in comparison with tidal strains in the Earth crust (having typical magnitudes about 10^-8). The revealed effect is the example of non-linearity in active geophysical medium: (1) HFSN nonlinear response upon weak deformation and (2) energy redistribution from low-frequency to high- frequency range.

By HFSN structure study it was found: (1) the response on tide impact is not stable in time; (2) the synchronization of the SE and tides is observed during some time (usually one-two months) before large (with magnitude $M\geq6.0$) earthquakes; it is manifested as stabilization of phase shift between tidal component of the SE envelope and tides on certain level. This specific feature of the SE response on tides is used for investigation of SE connection with large earthquakes. During the SE observations period (1992-2009) 23 earthquakes with $M\geq6.0$ occurred on Kamchatka. The obtained experimental data in hydrothermal fields confirm the hypothesis about correlation between values of stabilization level of the SE tide parameter with source characteristics of preparing earthquake and its geographic position.

Study is supported by RFBR (grant 08-05-00962).