Changes of low-frequency seismic noise after large earthquakes

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The records from identical broadband seismic stations located in the different regions of the world after large earthquakes off the Sumatra Island on December 26, 2004 with the magnitude M = 9.1, in Chile on February 27, 2010 with M = 8.8, and the Tohoku earthquake in Japan on March 11, 2011 with M = 9.0 are studied. Oscillations with a period of the several hours are analyzed. They are observed as pulsations in the free radial oscillations of the Earth lasting for more than one week. At the interstation distances of about 3800 km the records at the stations have opposite phases, and at the distances of 7600 km the phases coincide. This is reflected in the spatial structure of the areas of positive and negative phases of the oscillations on the Earth's surface. This structure recurs at the same time instant after the three considered earthquakes, which indicates that this effect is independent of the properties of the sources. The spatial positions of the areas of positive and negative phases are also not correlated to the geological conditions in the vicinity of the stations which are located both in the subduction zone and within the platform. The structure of the pulsations and their spatial distribution differ from the variations of the Earth's tides. Passing to the mechanism of the real source, we note the following. The oscillation period of 11 h is by an order of magnitude larger than the longest period of the theoretically predicted and experimentally detected free spheroidal oscillations 0S2 (53.9 min). Hence, it is unlikely that the source of the 11-h oscillations is located in the solid Earth. These oscillations can probably be generated by the perturbations in the Earth's external envelopes. . Among the probable sources there can be excitation of internal gravity waves (IGWs) in the atmosphere. In the case of IGW excitation, the atmosphere which is under the action of the Earth's gravity field is disturbed from the equilibrium, and fluctuations emerge in density, pressure, temperature, and air motion velocity. The vertical displacements of air masses in the hour period range will affect the readings of the broadband seismographs responding to the changes in gravity. The work was supported by the Russian Foundation for Basic Research project no. 18-05-00026).