The effect of long lasting micro-seismic activity and the irregularities of the bottom on the formation of strong oceanic waves

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Microseisms (seismic noises) have been studied on land for a long time, but on the ocean floor attempts of their registration, analysis of signals and specifics of distribution began to be undertaken only in the last quarter of the last century. About the nature and causes of microseisms, the stability of their spectrum (min at 0.04-0.1 Hz near and 10 Hz, and the maximum at 0.15-0.2 Hz) there are about a dozen different hypotheses.

Long-term microseisms in the form of volumetric and modified by the presence of a water layer of surface waves are recorded from remote earthquakes (for example, from the Himalayan EQ 19.10.1991 with a magnitude of 7+ microseisms were steadily recorded on the research vessel “Academician Ioffe” in the Atlantic ocean near the Azores at a depth of 1600m for more than 250 seconds). There were also 4 “microseismic storms” of unknown nature (the nearest strong cyclones were at a distance of more than 3000 km) lasting up to 1 hour.

At a depth of more than 4 km, it is possible to form Stoneley waves with a frequency of about 1 Hz, which at these frequencies extend to farther distances than Rayleigh waves due to less decaying.

The work attempts to solve the inverse problem: to find out the conditions when stable and long microseisms (for example, from strong EQ) can generate strong and even catastrophic waves on the sea surface.

The compressible fluid flows are investigated when compressibility plays a crucial role, especially in resonance effects, when the frequencies of the vibrating boundary can coincide with the frequencies in the liquid and when such parameters as velocity, pressure, density, mass flow of the liquid increase significantly with time. Similar effects can also be caused by periodic structures on the bottom. The linearized Navier–Stokes equations are used for analytical solutions. They allow us to obtain conditions on the parameters of the problem for resonance phenomena. Numerical solutions of the ’nonlinear’ Navier–Stokes equations confirm the analytical conclusions and give a further insight into the problem.