

EGU21-15513

<https://doi.org/10.5194/egusphere-egu21-15513>

EGU General Assembly 2021

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## The tsunami energy radiation directivity on the example of the 1994, 2006 and 2007 events

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Determining the tsunami source danger is currently one of the most urgent tasks. The vast majority of recorded tsunamis are of seismic origin. Part of the energy released during an earthquake passes into the energy of the initial tsunami source. The tsunami excitation efficiency depends on a number of factors: the depth of the sea above the source and its location relative to the coast and continental slope; the shape and area of residual post-seismic bottom displacements, as well as the bottom relief directly in the zone of the seismic source; inhomogeneities of the ocean floor relief along the path of tsunami propagation (for estimating wave heights in the zone farthest from the source); time inhomogeneities of tsunami wave radiation from the source zone; non-isotropy of the tsunami radiation spectrum.

To study the tsunami source efficiency, we considered three tsunamis in the Kuril ridge region: the Shikotan tsunami of 1994, and two Simushir tsunamis of 2006 and 2007. The choice of events was largely determined by the close geographical location – all of them belong to the Kuril-Kamchatka subduction zone. Also, these events are well studied, and there is quite a large amount of data on tsunami measurements onshore and in the deep ocean. At the same time, all three sources differ in the mechanisms of the seismic focus and location relative to the coast and the continental slope.

We analyzed the tsunami wave field for three events near the Russian Pacific coast. Tsunami energy flow calculations show that frontal energy flow is mainly directed to the southeast. The flux magnitude decreases with distance from the source as a result of geometric divergence and scattering. At longer distances, the effect of refraction becomes more significant – the flow is divided into separate rays due to the focusing on the irregular bottom relief.

The radiation patterns of each source that also were created show the part of wave energy that penetrated the Sea of Okhotsk through the Kuril Straits. It is easy to indicate the effect of the capture of tsunami waves by the shelf and the formation of edge waves that carry the wave energy away from the source area along the Kuril Ridge shelf. For 2006 and 2007 events a relatively small part of the wave energy went into the captured waves, but for 1994 the initial sea surface displacement area was in the shelf zone and a significant part of the energy was transferred to the captured edge waves, radiated mainly in the northeast direction.

