

# Use of opportunities of the local seismic network of the South of Sakhalin to clarify hypocenter using the seismic tomography method

---

**Boginskaya N. (1), Kostylev D. (1, 2), Ichiyanagi M. (3), Takahashi H. (3)**

(1) Institute of Marine Geology and Geophysics, Far East Branch, Russian Academy of Sciences, Yuzhno-Sakhalinsk, Russia

(2) Sakhalin Branch, Geophysical Survey, Russian Academy of Sciences, Yuzhno-Sakhalinsk, Russia

(3) Institute of Seismology and Volcanology (ISV), Hokkaido University, Sapporo, Japan

e-mail: fly77@mail.ru

Since 2000, continuous instrumental observations have been carried out in the southern part Sakhalin is a local network of field stations consisting of nine autonomous seismic stations of the type DAT-4 complete with LE-3Dlite seismometers. Field observations in the south of Sakhalin are carried out to identify the weak seismicity of the most densely populated part of the island. Highly sensitive stations allow the full registration of weak earthquakes in the south of the island, to monitor the seismic regime in the epicentral zones of strong earthquakes.

Sakhalin is characterized by small-focus crust seismicity with depths of hypocenters from 5 to 30 km (Ulomov, Bogdanov, 2013). An example of high seismic activity in the south of the island is the 2006 Gornozavodsk earthquake with  $M = 5.6$  and the 2007 Nevelsk earthquake with  $M = 6.2$ . The high seismic activity of the island allows for research using seismic tomography.

As is known, the velocity model of the lithosphere makes it possible to estimate the time of the path of the seismic ray from the source to the recording station. In reality, the structure of the Earth is much more complicated than any velocity model describes it. Therefore, in the calculated wavetime from the event to the seismic station errors appear due to the deviation of the velocity model from the structure and properties of the real medium. To smooth out this kind of inconsistencies and adjust hypocenters, the double difference method is used (Waldhauser, 2000).

In this study, studies were conducted from 2007 to 2015 TomoDD (Double-Difference Tomography) seismic tomography method developed by (Zhang, Thurber, 2003), which is used to redefine the position of hypocenters by the method of double differences. To use this method, first of all, a dense seismic network is needed. The essence of the method is that seismic waves generated by sources located close to each other, propagate to the recording station approximately along the same path, and the difference between the travel times of waves from two close earthquakes is due to the difference in the position of these events hypocenters. The double difference method redefines the coordinates of the hypocenters of events.

The one-dimensional velocity structure model was determined by the method (Crosson, 1976). To further clarify the position of hypocenters the Hypomh method was used (Hirata, Matsura, 1987). It is revealed that with respect to the selected one-dimensional model, the time of passage of seismic waves to the group of stations on the west coast is slower than to the group of stations on the east coast of Sakhalin. This is probably due to the peculiarities of the geological structure of the earth's crust along the routes.

The tomography results showed that the depth of the hypocenters of the studied earthquakes increased to 30-35 km. At the same time, it was noted that the foci of seismicity in the western part Sakhalin, are mostly deeper than on the east. This is consistent with earlier results for northern Hokkaido (Tamura, 2003).