The author constructed the first regional P- and S-P-wave hodograph for the Kuril-Okhotsk region in 1964. After the publication (Izv. AN SSSR, ser. Fizika Zemli № 7, 1965) it was accepted as the working hodograph for determination of the Kuril earthquake parameters. This hodograph has been used in SOMSP RAS up to the present day.

Sharp reducing of a network of the Far Eastern seismic stations required attraction of remote stations of Japan, China, Pribaikalie and North-East for determination of earthquake parameters. For this purpose Jeffrey’s hodograph, which does not reflect regional features of the Far Eastern zone, was used.

Taking into account great complication of velocity structure within the continent-to-ocean transition zone and great discrepancy in determination of earthquake parameters from the data of different seismological surveys it was decided to build a reliable system of azimuthal hodographs and velocity sections for this region.

In order to execute this work it was necessary to obtain reliable empiric hodographs in the interval of epicentral distances 0-4000 km and to apply more improved methods of velocity section constructions. In this connection a great scope of preparation works has been made.

Additional data (seismograms) on the Kuril-Kamchatka earthquakes were obtained from seismic networks of Kamchatka, Yakutiya, Japan, Pribaikalie and North-East and moments of P- and S-wave arrivals (about 1000 determinations) were re-determined. Parameters of 50 selected earthquakes were re-determined by the methods independent from hodograph (use of Wadati’s plots, difference of pP-P and sP-P phases reflected at the epicenter, methods of medium lines and epicentrales). The available data on velocity features of both continental and oceanic megablocks and also of seismic focal zone were analyzed and generalized for giving P-wave velocities on the 2D network.

The following scientific results were obtained during the investigation of velocity features of the Far East region:

1. Empiric hodographs of P-waves were constructed for focal depths 40 km and 80 km for 9 geotraverses, among which the empiric data for only 3 long profiles appeared to be representative. They are South Kamchatka-Yakutiya, South Kurils-Pribaikalie and South Kamchatka-Japan. The constructed velocity models for these geotraverses were the basis for calculation of theoretical hodographs of P-waves in the interval of epicentral distances (0-4000) and depth interval (0-700 km).

2. A generalized relationship \( V_P/V_S = f(h) \) was constructed for deep earthquakes (100-600 km) of the Far East zone with very clear records of P and S-waves. This curve coincides with the similar Jeffrey’s curve with accuracy 0.03. The above \( V_P/V_S = f(h) \) relationship was used for the velocity section construction of S-waves and hodographs of S-P = f (Δ,h) of the Far Eastern zone..

3. Use of the difference empiric correction curves \( \delta t_p = t_{emp} - t_{grid} = f(\Delta) \) allowed us to take into account thin velocity structure along the given geotraverses including effect of the anomalous layers: high-velocity seismic focal zone and high-velocity layers at depths 410 km and 660 km caused by polymorphic transformations.

It was shown that correction empiric curves of P-waves have a complicated pseudosinusoidal character with several extrema corresponding to rooves and bases of the anomalous layers.

4. The data obtained by unique experiments with bottom stations were analyzed. They testify to abnormally high velocities of seismic waves beneath the regions of deep-sea trench up to depths 200 km. The abnormally low gradient of P-wave velocity is fixed at great depths.
5. Isolines of P-wave velocity up to the depth ~ 300 km have a tendency to repeat the Earth’s surface relief, which can testify to the genetic relation between deep and surface structures.

6. From the computer model experiments it was revealed that high-velocity boundaries related to polymorphic transformations have the following parameters: roof of the first boundary is located at the depth 360 km, the layer thickness is 20 km, velocity drop is + 0.6 km/sec; roof of the second boundary is located at the depth 660 km, the layer thickness is 20 km, velocity drop of P-waves is + 0.5 km/sec.

In order to verify two-dimensional velocity sections of P-and S-waves of tectonosphere along the given geotraverses we used the method of solution of a direct kinematic problem developed by O.K. Omelchenko. This method allows us to approximate smoothly two-dimensional velocity breaks given at the irregular networks by means of application of convex splines and the unit expansion. This method allows us to take into account not only vertical, but also horizontal velocity heterogeneities of the medium.

In future in order to solve the reverse kinematic problem it is supposed to construct a system of hodographs for several focal depths. To reduce the ambiguity of this problem solution it is necessary to draw other types of waves (converted, reflected etc.) and also their dynamic characteristics.