Mantle seismic tomography beneath East-European Platform

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3D P-velocity model of the mantle under East-European platform was received as the solution of the seismic tomography problem by Taylor approximation method, which was supposed by V. S. Geyko [Geyko, 2004]. The solution don't depend from the referent model selection and can be imagine in Cartesian and spherical coordinate system. The used tomography method permits recovering the mantle model being optimal in the given metric in respect with the whole totality of P-wave first arrival traveltime data within the frame of selected basic model of interpretation. It includes the apriory assumptions? Theory and algorithms of numerical inversion, parameterization of velocity function, the smoothing method and other regularizing factors. The results are imagine in horizontal, longitude and latitude sections of the model. The generalized velocity-depth caracteristics $V_{\text{aver}}(z)$ were used in definitions high and low velocities and residual of velocities

$$V_{\max} = \sup_{\varphi,\lambda\in S} V(\varphi,\lambda,z), \qquad (1)$$

$$V_{\min} = \inf_{\varphi,\lambda\in S} V(\varphi,\lambda,z), \qquad (2)$$

$$V_{aver}(z) = z\left(\int_0^z \frac{d\zeta}{\sum(\zeta)} \iint_{S(\zeta)} \frac{d\varphi d\lambda}{V(\varphi,\lambda,\zeta)}\right)^{-1}, \qquad (3)$$

where $S(\zeta)$ is the domain into horizontal section at the depth ζ, and $\sum(\zeta)$ is its space in the coordinates φ, λ.

The first time arrival from the ISC from 1964 to 2005 year were used as the input data.

The 3D P-velocity model analysis shows the next properties:

1) common velocities characteristic for received mantle model under EEP is layer velocities structure, which defined by inverse changing of phone velocity for each layer: high velocity tomographic lithosphere layer(upper mantle velocity characteristic), low velocity Golitsin — Geyko layer (transition zone velocity characteristic), high velocity zone of division-1? low velocity middle mantle, high velocities zone of division-2, low velocities low mantle, Mantle under EEP surrounding, except eastern part, characterized by common inverse relate to mantle velocities characteristics under EEP;

2) by velocities characteristics tomographic lithosphere under EEP can be devided on three layers: 50—100±25 km, 100±25—200±25 km, 200±25 km — tomographic lithosphere bottom;

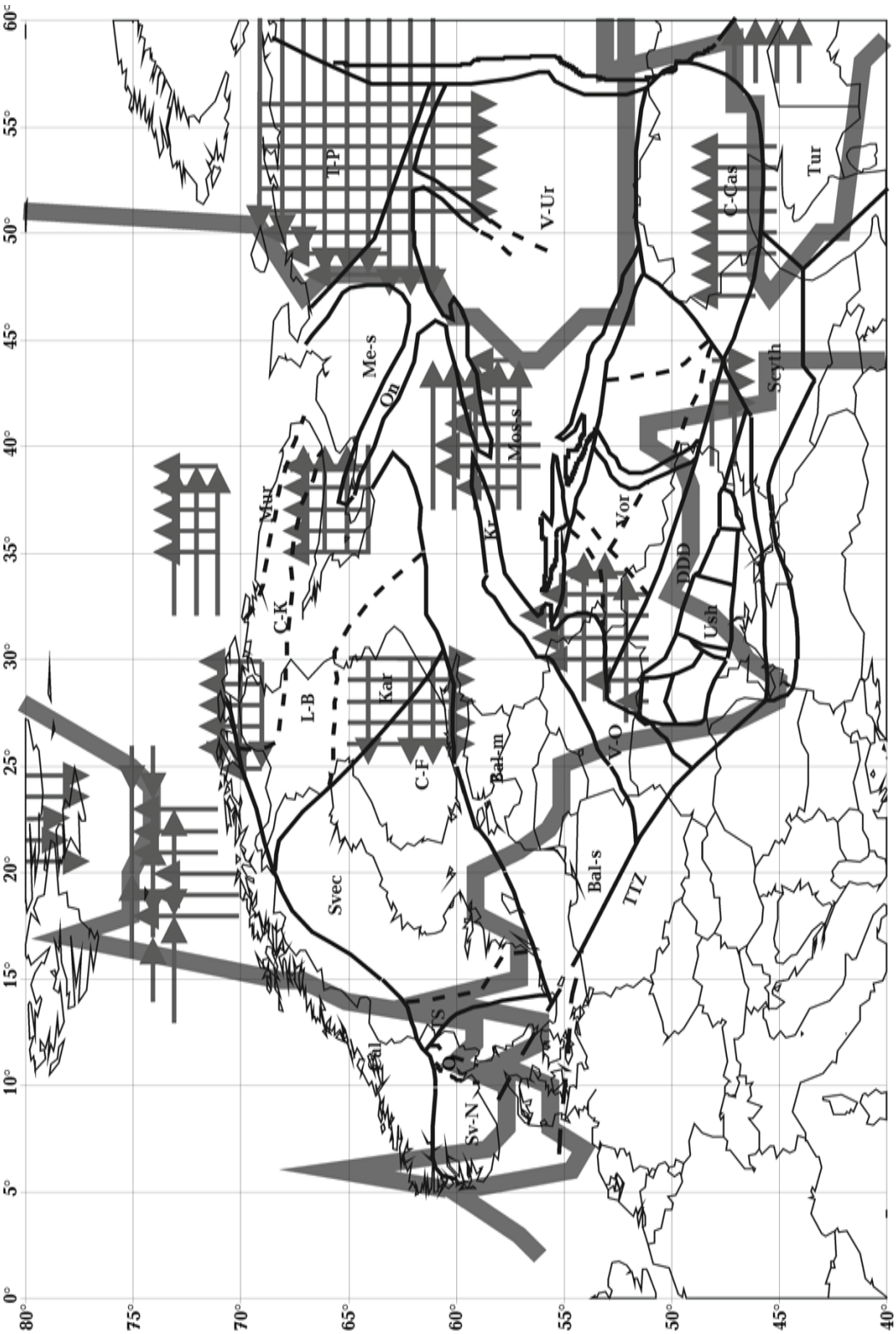
3) mantle velocity boundary under EEP don't coincides with EEP tectonic boundary. Maximum agreement is on the depth 50 km, and maximum changing at the Golitsyn — Geyko depth;

4) as a whole by velocity characteristics mantle under EEP can be divided into three parts:

- boundary mantle velocity region of interaction with 1 type activation;
- main part with two type mantle velocity activations;
- east part of mantle under EEP, which has different velocity characteristics from another mantle part. The first type of velocity activations correspond to propagation of high velocity layers from the Golytsin — Geyko layer under surrounding regions to the low velocity Golytsin-Geyko layer under EEP and increase the part of high velocities in upper mantle layers under surrounding zone to EEP. Second type of velocity activation correspond to subvertical low velocities layers propagation from the middle mantle to the upper mantle. It is pick out inclined layers, which mainly corresponded boundary mantle velocity region of interaction (Figure);

5) mantle under Barents-Pechora Platforme units with mantle under EEP by velocity characteristics

So that by velocity characteristics we have both horizontal process and the vertical process in the mantle under East European Platform.



Velocity boundaries of 1 and 2 types of activations: Bal-m — Baltic monocline, Bal-s — Baltic syneclise, C-Cas — Cis-Caspian depression, C-F — Central-Finland massif, C-K — Central-Kola block, DDD — Dniper-Donetsk depression, Kal — Scandinavian Caledonides, Kar — Karelian block, Kr — Krestovsky avlacogen, L-B — Lapponial-White sea belt, Me-s — Mezen syneclise, Mos-s — Moscow syneclise, Mur — Murmansk block, O — Oslo graben, On — Onega graben, Scyth — Scytian plate, Sv-N — Sveconorwegian block, Svec — Svecofenian block, T-P — Timan-Pechora plate, T-S — Transscandinavian belt, TTZ — Teyseyr-Tornquist zone, Tur — Turanian plate, V-O — Volyn-Orsha avlacogen, V-Ur — Volgo-Uralia, Vor — Voronezh massif, USh — Ukrainean Shield.

References

Geyko V. S. A general theory of the seismic traveltime tomography // Geophys. J. — 2004. — **26**, № 2. — P. 3—32 (in Russian).