VARIOUS APPROACHES TO FORWARD AND INVERSE WIDE-ANGLE SEISMIC MODELLING TESTED ON DATA FROM DOBRE-4 EXPERIMENT

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In 2009, the 500 km-long seismic wide-angle profile DOBRE-4 was conducted in southern Ukraine, using 13 shot points and 230 recording stations. In the seismic wavefield, the striking feature is observed, double PmP phases, with different reduced time (7.5-11 s) and apparent velocity. They are interpreted as reflections from strongly dipping Moho fragments with opposite dip. Two steps were used for the modelling. At first, method of trial-and-error forward modelling was done using refracted and reflected phases. Next, the amplitudes were analysed using finite-difference full waveform method. A specific feature of the model are high-amplitude (8-17 km) changes in Moho depth in form of successive downward and upward bends, with wavelength of the order of 150 km. Seismic data on such an unique structure are a valuable material to test several approaches of 2D wide-angle modelling.

Seismic inversion methods are less subjective than manual trial and error forward methods. However, tomographic methods are often based on first arrivals only, which gives limited information, as is the case e.g. for inversion package FAST applied. In obtained model, the Pg phase produced ray coverage down to 10-20 km depth and Pn phase constrained the uppermost mantle.

Other inversion approaches, the JIVE3D code, can use also later refracted arrivals and reflections, especially PmP, to build a layered model.

Another variant of solution based on both first arrivals and reflected phases was produced using forward and inversion code RAYINVR, The Moho discontinuity was modelled mainly based on PmP reflections. In cases of double (overlapping) PmP arrivals (due to strong Moho topography), individual PmP fragments were inverted for in separate inversion steps.

In this study, comparison of the above modelling results is presented.