



Velocity model of the crust and upper mantle along the profile PANCAKE from Pannonian basin across Carpathians towards the cratonic Europe

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The seismic wide-angle reflection/refraction project PANCAKE was carried out in October 2008. The profile runs from the Pannonian basin in Hungary through the Ukrainian segment of the Carpathian orogen to the south-western part of the East European craton. The total profile length was 645 km: 157 km on Hungarian territory and 488 km in Ukraine. The field acquisition included 14 shotpoints every 35-50 km (3 shotpoints in Hungary and 11 in Ukraine), and 261 recording stations, every ~2.5 km. The data quality of the experiment was variable, depending primarily on local geological conditions but also on charge size. Two methods were used for the modelling of the seismic data. At first, ray-tracing trial-and-error modelling was performed. Next, the amplitudes of the recorded phases were analysed using finite-difference full waveform calculation. The resulting velocity model can be divided into three main crustal units, based on the velocity structure and geological considerations. The boundaries of the units can be represented as two lines inclined to south-west. From the south-west to the north-east, the units correspond to: the Pannonian basin, the unit which consists of Carpathians, Carpathian foredeep and Trans-European suture zone, and the East European craton. At the Pannonian basin the thickness of the crust reaches approximately 22-23 km, it consists of 2-5 km thick sediments ($V_p=2.4-3.7$ km/s), and two crustal layers with velocities $V_p \leq 6.45$ km/s. In the upper crystalline crust, the velocities are 5.9-6.3 km/s, and in the few kilometers thick lower crystalline crust $V_p=6.4$ km/s. The area between the East European craton and Pannonian basin could be called a "transition zone" and is characterised by a crustal thickness that is intermediate between that of the adjacent units. In the central part of the unit, we observe a 10-24 km thick uppermost crust with a relatively low velocity ($V_p \leq 6.0$ km/s). Few high velocity bodies (with $V_p = 5.35, 5.95$ km/s, and 6.05 km/s) were detected in the uppermost 5 km. In the south-western part of the model, below Pannonian basin, the depth to the Moho boundary is rather uniform and reaches 22-25 km. In the north-eastern part (the EEC), a much deeper Moho boundary was found, located at 42-48 km. The sub-Moho velocities are slightly lower than 8.0 km/s for the Pannonian basin, while beneath the Eastern Carpathians they are slightly higher, 8.0-8.1 km/s. The highest (~8.3 km/s) upper mantle velocities are observed beneath the East European Craton.