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Modelling of the deep structures of the upper mantle in Poland

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In our research, we are using the old, but good quality data from large-scale international experiments performed in Poland in the last twenty years. That data has been previously interpreted in 2D dimension manner along profiles. Moreover, only basic filtering has been used as a pre-processing. Our idea is to interpret this data to get the three-dimensional model of the whole crust and the upper mantle. Now it is technically possible because better computers with high performance and new software with parallelization have appeared recently. For this, we are using TOMO$_3$D parallel code. We also propose to use pre-processing methods well-known and widely used in the seismic imaging to enhance signal and verify observed traveltimes of individual phases. However, standard industrial methods are difficult to apply to crustal scale data, because this data is sparse and irregular. Consequently, we use an approximation in the form of simple linear moveout, to avoid the regularization problem, and coherent flat signal enhancement. For better visibility of refraction waves on long offsets, we use AGC and f-k filtering. The manual trace editing procedure has also been done as the first step, that has a significant impact on the final result. We present our results, both synthetic and based on the real data, along 2D profiles and preliminary analysis in 3D. We generate our synthetic velocity models using the ray-tracing approach (SEIS83) and manually pick the phases to ensure high accuracy. During tomographic inversion of the synthetic dataset as the starting model, we use the 1D linear vertical velocity gradient. Additionally, we are testing our velocity models by the Finite Difference modelling (SOFI2D) and comparing obtained wavefields with observations. Our final goal is to recognize the velocity in the upper mantle after verifying the traveltimes and including 3D effects. This research was funded by National Science Centre, Poland (NCN) Grant UMO-2015/19/B/ST10/01833.