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Quantitative imaging of the Permo-Mesozoic complex and its basement by frequency domain waveform tomography of wide-aperture seismic data from the Polish Basin

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In this study we present the workflow and results of 2-D frequency domain waveform tomography (WT) applied to the global-offset seismic data acquired in central Poland along a 50-km long profile during GRUNDY 2003 experiment. The WT method allows full exploitation of the wide-aperture content of these data and produces in a semi-automatic way both the detailed P-wave velocity model and the structural image (i.e., perturbations in respect to the starting model). Thirteen frequencies ranging from 4 to 16 Hz were inverted sequentially, gradually introducing higher wavenumbers and more details into the velocity models. Although the data were characterised by relatively large shot spacings (1.5 km), we obtained clear images both of the Mesozoic and Permian sedimentary cover. Velocity patterns indicate facies changes within the Jurassic and Zechstein strata. A high velocity layer (ca. 5500 m/s) was found near the base of Triassic (Scythian), which makes the imaging of deeper layer difficult. Nevertheless, we were able to delineate the base of the Permian (i.e. base of the Rotliegend), which was not possible to derive from conventional common-depth-point processing, as well as some deeper events, attributed to the Carboniferous. The sub-Permian events form a syn-form which favours our previous interpretation of a depression filled with Upper Carboniferous molasse. Validity of the WT-derived model was confirmed by well-log data. Forward ray-tracing modelling and synthetic seismograms calculations

provided another justification for the key structures present in the WT model.