



The uncertainty in seismic traveltimes tomography

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Everyone, who have used seismic traveltimes tomography, is aware of need for the uncertainty analysis. We understand that velocity obtained from the seismic tomography strongly depends on an initial model of velocity, regularization, inversion path, model parameterization etc. However we usually forgot about influence of the picking precision. Moreover, in our research we consider two uncertainty distributions of disturbed statistically P wave first-arrival traveltimes: symmetric and asymmetric. A grid search has been used to test number of initial models and determine how it influence the final result. To test influence of the picking precision we used the Monte Carlo approach. We have found relations between these mentioned factors on the final results. We state that the effect from different initial models is greater than from the picking precision; however both are not negligible in the analysed spatial scales. Whereas results from different distributions of disturbed statistically traveltimes are very similar. During our studies we exploited the data sets from two different spatial scales: geo-engineering and industrial scale investigation. The geo-engineering one was performed at the test side of the Institute of Geophysics, Polish Academy of Sciences with the sledgehammer source with 1 meter spacing for sources and receivers resulting in total length of 340 metres. The industrial profiling was carried out using the set of vibroseises for the oil and gas exploration. Besides a standard cable recording system we used an additional full-spread station deployment resulting in 14 km long profile. We are aware that presented examples do not exhaustive the problem of seismic traveltimes inversion, but explain the need to consider both of these factors, the initial model of velocity and the picking precision. This research was funded by National Science Centre, Poland (NCN) Grant UMO-2015/19/B/ST10/01833. Part of this work was supported within statutory activities No. 3841/E-41/S/2017 of the Ministry of Science and Higher Education of Poland.