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Assessment of continuous offset sampling acquisition geometries for imaging complex structures by combined first-arrival travel time and full waveform tomography: application to the Overthrust model.

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The objective of this study is to assess the reliability of first-arrival travel-times tomography (FATT) and continuous offset sampling surveys for building accurate starting (or initial) models for acoustic full waveform tomography (FWT). Previous results using as starting model a smoothed version of the true velocities show that the quality of the results strongly depends on the accuracy of the initial model's shallow layer. Two points need to be adressed in order to obtain consistent results: the footprint of the continuous offset coverage on the resolution in depths of FATT and the footprint of the receiver shot spacing on the resolution at shallow depths. The goal of the first point is to determine the minimum offset needed to cover -in a ray sense- the whole target zone, while the second point focuses on the heterogeneities of the subsurface for onshore exploration. Results show that FATT is a useful tool to build such starting models although, obviously, the accuracy of the models obtained is lower than for those computed with the smoothed true velocities. The general conclusion is that first arrival travel time tomography appears to be an appropriate tool to build starting models for FWT if the acquisition geometry covers a significant enough offset range. In this context, the influence of subsurface weathering can be overcome by tunning the offset-dependent and depth-dependent weighting parameters.