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Specific target determination by planting anomalous densities applied to seismic migration-velocity improvements

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Over the years, time and depth migration has been regularly applied to seismic imaging, where good starting velocity models are expected. However, automatic and/or efficient velocity model construction tools are still a challenge. Most present-day model-building techniques are iterative procedures that improve a starting model based on intermediate results. We present a new tool for initial seismic migration-velocity model building based on a new gravity inversion method. This inversion process consists of an iterative algorithm that provides a 3D density-contrast distribution on a grid of prisms, being the starting point an user-specified prismatic elements called "seed". By this planting anomalous densities technique, we are able to interpret multiple bodies with different density contrasts. Therefore, the present method does not require the solution of a large equation system, which greatly reduces the computational demand. In this work, we discuss the application of the estimated density-contrast distribution, i.e. the geometry of the body, as a first guess for the velocity model. Our suggestion is to extract the skeleton of the inverted body and fill each prism with a velocity consistent with the presumed geology. This is an alternative way to improve the knowledge of complex structures, for example, salt structures and sub-salt sediments, regions where the seismic imaging is limited by the effects of wavefield transmission, scattering and absorption. To evaluate the capability of this tool, we modeled the gravimetric effect of several 3D bodies with different geometries and different densities while jointly producing similar 2D seismic models that simulate slices of the three-dimensional model. By means of these models we performed the robust gravity inversion and 2D depth- and time-migration for the seismic data using the velocity models constructed as previously described. Our results show the capacity of the proposed velocity-model-building algorithm to generate initial velocity models for migration velocity analysis, including those for specific geological targets.