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2D fine-scale imaging of the subduction channel in Gulf of Guayaquil by Integrated iterative PSDM and Simulated Annealing optimization

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To analyze the physical properties of seismic reflectors as possible indicators of the presence of fluids, we apply a processing sequence based on preserved amplitude prestack depth migration/inversion (PSDM) coupled with a post-processing of the depth migrated image. Aim of the post-processing is to remove the effects of the limited source bandwidth, that is, to build a structural velocity model and an impulsional migrated section from the limited-bandwidth migrated image and to estimate the uncertainties of velocities and layer thicknesses. During the post-processing sequence the model space exploration is made automatically via random search, and optimal velocity models are determined using the very fast simulated annealing (VFSA) algorithm. We present an application of this depth-domain processing sequence to a 2D multichannel seismic reflection dataset for the study of the décollement reflector in the Gulf of Guayaquil (Ecuadorian margin). Results show that the décollement mainly corresponds to a layer of 80-100 meters in thickness with a mean and maximum negative velocity contrasts of -50 m/s and -150m/s respectively on top of it. Along the décollement, we have observed three zones of different seismic signatures: (1) a zone with negative velocity contrasts on top of the décollement interpreted as the channeling of fluids, (2) a zone with positive velocity contrasts at the base of décollement, interpreted as diffusion of fluids and (3) a zone with very small amplitudes, possibly related to dry décollement segments. Uncertainties in the velocities have been also estimated from multiple VFSA. We conclude that this approach could be an useful tool to detect fine-scale variations of physical properties along seismic reflectors. These small-scale variations in velocity could be used to map variations in fluid pressure.