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Travel time tomography along the EPR axis using arrivals picked from downward continued MCS shot gathers

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We present tomographic models for closely spaced (~200 m) multichannel seismic (MCS) profiles collected in 2008 along the axis of the East Pacific Rise (EPR) at 9°41' – 9°57' N during cruise MGL0812. The investigated profiles target the locations of documented hydrothermal venting as well as the area where layer 2A is believed to thin north of 9°52' N. We downward continued shot gathers collected during this 3D MCS survey to simulate the seismic sources and receivers being located near the seafloor. This allows for extracting travel time information from near-offset refractions that are normally obscured by the seafloor reflection. 1D modeling of shot gathers shows that, despite the thinness of seismic layer 2A at the ridge axis, some refracted arrivals that turn in layer 2A arrive ahead of the seafloor reflection and can be picked on the downward continued shot gathers. Thus, the velocity structure of both seismic layers 2A and 2B is constrained well and can be solved for during the inversion. After downward continuation, arrivals can be picked across most of the shot gather, from the near offsets to offsets of approximately 5 km; this is approximately twice as much as can be picked on the original shot gathers where refractions arrive before the seafloor reflection in only the farthest 2.5-3 km of the streamer. P-wave tomography models of the uppermost crust are obtained from the observed traveltimes using a regularized non-linear inversion scheme (i.e., FAST software, Zelt & Barton [1998]). We anticipate our results will yield insight on focused hydrothermal discharge and recent eruptive events at the axis of the EPR.