AGU FALL MEETING
San Francisco | 12–16 December 2016

T31D-2932: Travel Time Tomographic Imaging of Shallow Fore-arc Basin Structure at the Cascadia Subduction Zone Offshore Washington and Oregon

Wednesday, 14 December 2016
08:00 - 12:20
Moscone South - Poster Hall

- ePoster - AGU_poster2016_azarm.pdf

We conduct a P-wave tomography study of shallow fore-arc basin structure at the Cascadia subduction zone using first-arrival travel times from two multi-channel seismic (MCS) profiles acquired with an 8-km long streamer in the frame of the 2012 Juan de Fuca Ridge to Trench program. The first profile extends offshore Gray's Harbor in Washington and the second extends offshore Oregon at the latitude of Hydrate ridge, with the fore-arc basin imaged below ~60 and ~70-km long shallow water (< 500 m) portions of these profiles, respectively. We use the travel time tomography method of VanAvendonk et al. [2004], which is based on the shortest path method for ray tracing, and iterative inversions driven by gradual reduction of the chi-square misfit (root mean square value of the difference between predicted and observed travel times normalized by pick uncertainty). We construct our starting model by hanging from the seafloor a 1D velocity profile based on interval velocities derived from semblance analysis of MCS data. Resolvability of the final model is assessed using checkerboard pattern tests with different anomaly sizes. We then compare our tomographically-derived velocity models to coincident seismic reflection images post-stack time migrated and converted to depth using our results. On the Washington shelf, where the fore-arc basin is segmented into three sub-basins, ray coverage mostly extends to ~1.2–1.5 km below seafloor. Velocities in the shallowmost sediments show, at the large scale, a gradual decrease towards the shelf edge (from 2.1 to 1.8 km/s). At depth, regions devoid of clear reflections such as an ~5 km large anticline core are associated with lower velocities than that obtained within mildly deformed sedimentary layers on either side (2.3 vs 2.7 km/s, measured at 1.2 km depth), suggesting the presence of localized fluid-rich regions within the basin. Analysis of the Oregon line is ongoing and results will be presented at the meeting.

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