AGU FALL MEETING
San Francisco | 14 – 18 December 2015

T51D-2900: Seismic velocity structure of the sediment seaward of Cascadia Subduction Zone deformation front

ABSTRACT

Friday, 18 December 2015
08:00 - 12:20
Moscone South - Poster Hall

We present seismic velocity structure of the sediment section seaward of the Cascadia Subduction Zone deformation front (DF), derived from multichannel seismic data acquired during the 2012 Juan de Fuca Ridge to Trench experiment. Detailed velocity analyses are conducted on every 100th prestack-time-migrated common reflection point gather (625 m spacing) within 45 km seaward of the DF along two ridge-to-trench transects offshore Oregon at 44.6˚N and Washington at 47.4˚N respectively, and on every 200th common mid-point gather (1250 m spacing) along a ~400 km-long trench-parallel transect ~15 km from the DF. We observe a landward increase of sediment velocity starting from ~15-20 km from the DF on both Oregon and Washington transects, which may result from increased horizontal compressive tectonic stress within the accretionary wedge and thermally induced dehydration processes in the sediment column. Although the velocity of near-basement sediments at 30 km from the DF is similar (~3.1 km/s) on both transects, the velocity increases are larger on the Washington transect, to ~4.0 km/s beneath the DF (sediment thickness ~3.2 km), than on the Oregon transect, to ~3.6 km/s beneath the DF (sediment thickness ~3.5 km). The long-wavelength sediment velocity structure on the trench-parallel transect confirms this regional difference in deep sediment velocity and also highlights variations related to a group of WNW-trending strike-slip faults along the margin. Offshore Washington, where higher sediment velocity seaward of the DF is observed, the accretionary wedge is wide with a decollement located close to the basement and landward-verging thrust faults. By contrast, offshore Oregon, the lower sediment velocity seaward of the DF is associated with a narrow accretionary wedge, a shallow decollement ~1 km above the basement, and seaward-verging thrust faults. The regional differences in deep sediment velocity may be related to the along-strike variation in sediment composition, esp. clay mineral content, which may modulate the pore fluid pressure in the sediment through dehydration reactions, and affect the mechanical properties of the accretionary wedge further landward.

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