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Comparing the Nature of the Lithosphere in Alternating Regions of Slow Earthquakes in South America

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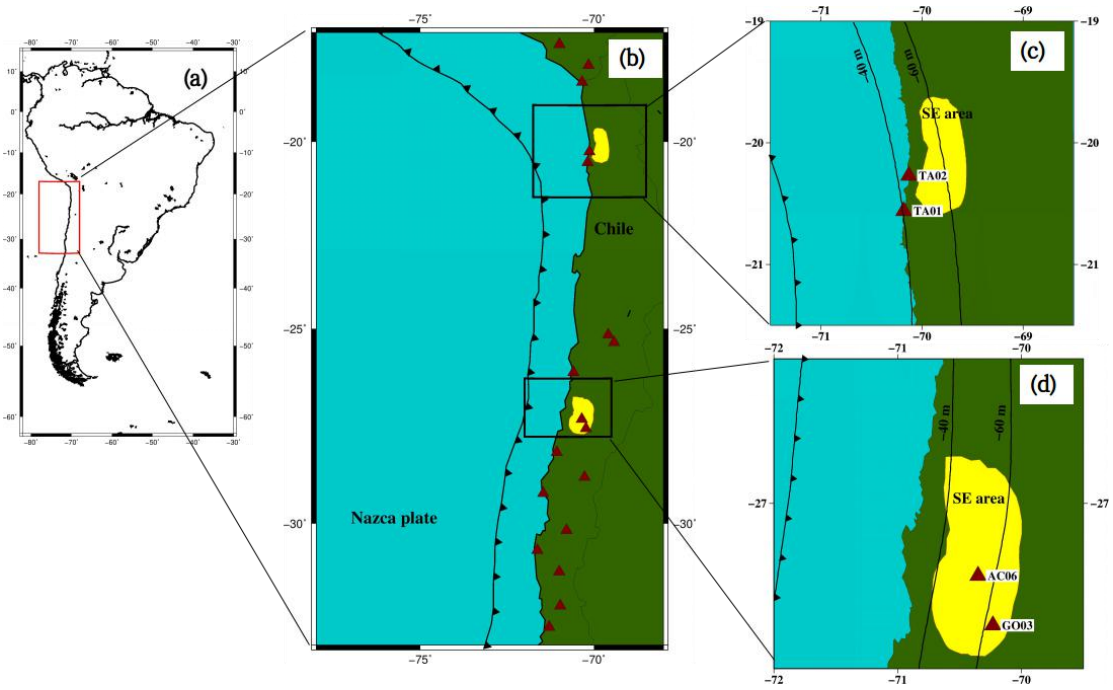
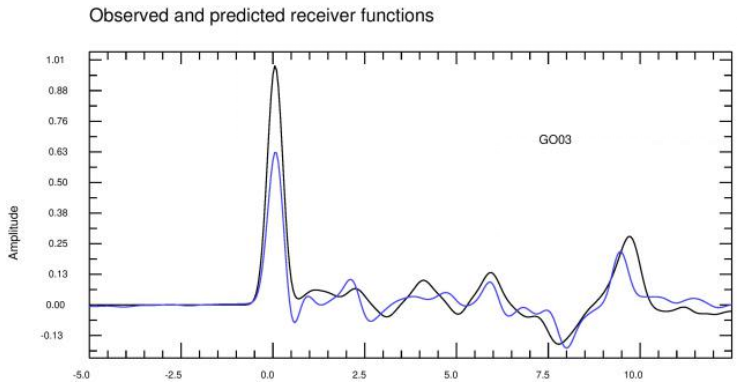
Subduction zones host some of the greatest megathrust earthquakes in the world. Slow earthquakes have been also discovered around the subduction zones of the Pacific rim very close to megathrust earthquakes in several subduction zones in Chile, Cascadia, Mexico, Alaska, and New Zealand (Obara and Kato, 2016). Investigating the lithosphere of the slow earthquake area versus non slow-earthquake area in subduction zones is crucial in understanding the role of the internal structure to control slow earthquakes. Deep transient slow slip had been detected in the Atacama region in Chile (Klein et al., 2018). Socquet et al. (2017) suggested that aseismic slow slip is one of the potential precursors of the 2014 M_w8.1 2014 Iquique earthquake. In this study, we investigate the lithospheric structure beneath stations in and around the slow earthquake area in Atacama and Iqueque. We also study the non slow-earthquake areas in the South America subduction zone using receiver function analysis and inversion method using teleseismic earthquakes. Here we focus on, especially the Vp/Vs ratios from both the slow and non-slow earthquake areas, because the Vp/Vs ratio is sensitive to the fluid distribution in the lithosphere; the fluid distribution possibly controls the potential occurrence of slow earthquakes. Additionally, the nature of the slab can also play a crucial factor. At the boundary of the slab, the Vp/Vs results show variation in the slow earthquake area, and far off from the slow earthquake area. The Vp/Vs ratio results across depth shows significantly higher value in the deeper oceanic slab region beneath the stations in the slow earthquake areas with higher contrast at the boundary. The stations very close to the slow earthquake areas also preserves high Vp/Vs contrast at the boundary of the slab. On the other hand, the Vp/Vs contrast at the slab boundary significantly reduces for the stations lying in the non slow-earthquake area.

Figures are illustrated in next page



SE=slow earthquake area.

(a)The red colour box inset shows the study area in South America.(b) The brown colour triangles are the stations in this study. The black squares shows the region around the slow earthquake area in yellow. Yellow region are the slow slip areas around Iqueque (c) and Atacama (d).



Observed(black) and modelled (blue) receiver Functions of station GO03 (slow earthquake area)

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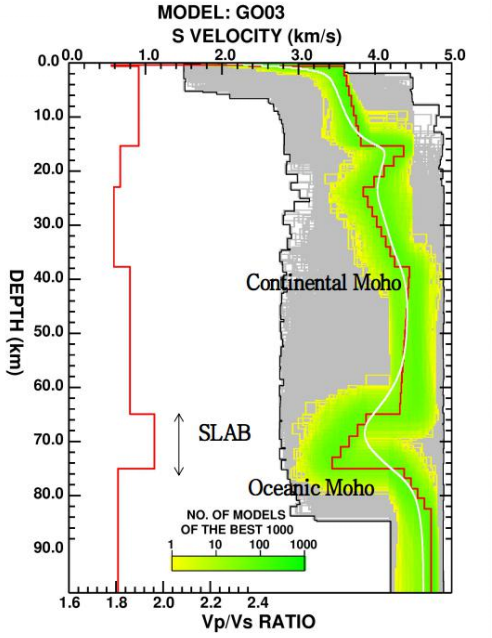

Inversion results of station GO03. The red line indicates the modelled Vp/Vs (left) and Vs (right) across depth. The total models are depicted in grey shaded areas and the best models are shown in green areas.