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Subduction offshore Northern Sumatra: crustal structure and earthquake ruptures segmentation.

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The studies of the 2004 and 2005 Sumatra earthquakes showed the presence of the segmentation boundary limiting the rupture areas offshore Northern Sumatra. Recent geophysical studies provide new insight on the structure of this boundary and the changes in the subduction processes around Northern Sumatra. In this study we present new model obtained from refraction/reflection seismic modeling, MCS data, and relocated seismicity. The comparison with the crustal scale profile located in the rupture area of the December 2004 Sumatra earthquake reveals principal differences in the structure of the accretionary complex, as well as in the structure of the forearc crust. The segmentation boundary is linked to the differences in the sediment supply at the trench and the variations in the Sumatra block crustal thickness. In the southern segment frontal prism is well developed and manifested in the clear trust faulting, it is separated from the accretionary prism by a pronounced splay fault, which are not clearly observed in the northern segment. The width of the accretionary complex is much narrower in the southern segment, while having similar depth extend. The Vp velocity analysis suggests that in the southern segment the Mentawai fault is active, while north of Simeulue it is not or less active. The crustal thickness of the Sumatra basement is increasing towards south, which influences the backstop geometry and the dip angle of the downgoing plate; resulting in the steeper subduction in the south.