



Variable detachment strength and morphology changes along the Hikurangi margin offshore New Zealand: insights from critical taper analysis

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GPS data provide evidence for variable plate coupling and slow slip events along the Hikurangi margin offshore New Zealand. However, very little is known about the relationship between effective strength of the Pacific Australian Plate interface and the morphology of the submarine accretionary wedge. Also, the transition between erosive and accretionary material transfer modes along the Hikurangi convergent margin and the influence of subducting seamounts on wedge mechanics is not completely understood. A critical taper analysis of the entire submarine slope from the transition to strike-slip faulting in the south of North Island to subduction erosion off the northernmost part of North Island reveals significant variation of the strength parameter F along the detachment. The basal detachment is very weak $F < 0.2$ in the southern portion of the Hikurangi margin where the accretionary wedge is formed and low permeability with resulting fluid overpressuring is inferred. Further, there is evidence for a compressive wedge with pop-up structures. Here, detachment strength increases towards the deformation front. In contrast, along the north Hikurangi margin where subduction erosion occurs, F values exceed 0.5. There is evidence for an extensional wedge with large-scale slides and avalanches. The region with repeated slow slip events is characterized by moderate F values. The results of our critical taper analysis are in good agreement with the regional variation of the coupling coefficient as estimated from GPS data.