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What do the forearc peninsulas tell us about the coupling at the subduction plate interface?

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The deformation of subduction zone forearc regions is governed by 1) a short-term component that occurs during co-seismic, postseismic and interseismic deformation (seismic cycle), and 2) a long-term component that accumulates anelastic strain and is observed in the geomorphology in the form of basins and peninsulas. Particular attention has been paid to basins that appear to correlate with maximum slip. Peninsulas are often at the edge of the basins and seismogenic zones but seem to play an important role in the initiation of seismic ruptures. In Northern Chile, the Mejillones peninsula separates two seismic segments of the subduction interface. To the south, the 1995 M8 Antofagasta earthquake initiated at 45-50km depth below the Mejillones peninsula before propagating southward. To the north, the Iquique segment recently slipped on the 15th of November 2007 after seismic quiescence since 1877.

Through numerical modelling, the relationship between the deformations of different timescale focusing on peninsulas is investigated. Using boundary element modelling, the seismogenic thrust fault is implemented as a dislocation of varying along-strike geometry in an elastic homogeneous medium. Simulated interseismic stress accumulation leads to subsidence above the updip limit of the coupled interface and uplift above the downdip limit. Modelled uplift pattern is compared to the observed forearc morphology and geologic rates. This study shows how forearc geomorphology may be correlated to variations of along-strike coupling as derived by geophysical data, such as seismic, GPS and InSAR data.