Plate coupling at the northern Hikurangi margin: new results from magnetotellurics

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At the Hikurangi subduction margin, on the east coast of New Zealand’ s North Island, the inter plate coupling changes from locked in the south to weakly coupled in the north. In the weakly coupled area, a complicated pattern of slip behaviour (and resistivity) is observed. The change in coupling and slip behaviour is attributed to structural and physical changes at the plate interface, in particular the fluid content of the subduction interface shear zone.
3-D inversion modelling of magnetotelluric (MT) data from a 300 km long segment of the Hikurangi margin shows that the electrical resistivity of the subduction interface shear zone is heterogenous, however, the degree of heterogeneity decreases from north to south. The resistivity heterogeneities correlate well with the distribution of near-plate interface seismicity, v_p/v_s values and the pattern of areal stain rate derived from GPS data and are consistent with variations in the fluid content of the subduction interface shear zone. In the northern part of this segment, conductive areas interpreted to be fluid rich occur where seismicity is sparse, v_p/v_s ratios are high and the areal strain rate is extensional. In contrast, where the areal strain rate is compressional the plate interface is more resistive, and seismicity is more abundant suggesting inter-plate friction is greater. In the south, the resistivity of the plate interface is more homogenous, and the overlying plate is more resistive at shallower levels than in the north. Our analysis further supports the hypothesis that the fluid and/or hydrated clay content of the subduction interface shear zone is correlated with plate coupling.

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