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Long-term tectonic segmentation along the Chilean marine forearc and its implications for the short-term deformation process

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The latitudinal variation of the parameters, derived by the use of the Non-Cohesive Coulomb wedge theory, reveals a long-term tectonic segmentation of the Chilean offshore subduction zone. At large scale, the results shows a general increase of the slope angle, a decrease of the effective basal friction coefficient, and an increase of the fluid pressure inside the continental wedge to the north of 33ºS. This general behavior is interpreted as a result of a more pervasive fracturing at the base and within of the continental wedge in the zone where the Nazca-South America subduction zone is characterized by tectonic erosion. Analyzing the results on a smaller scale, it is possible to observe a sequence of segments with different basal effective friction coefficient and/or internal fluid pressure conditions, which are limited by the presence of bathymetric oceanic highs, fracture zones and peninsulas. This second order tectonic segmentation shows a spatial correlation with the distribution of the rupture areas of large historical earthquakes in the Chilean margin and, in the case of 2010 Maule and 1960 Valdivia mega-earthquakes, a relation between zones of high slip and segments of low basal friction coefficient. This correlation supports the concept that segments with different long-term evolution can have different stress states during the seismic cycle, affecting the complex sequence of seismic activation and also the location of inhomogeneities during large coseismic ruptures. The results motivate multiscale studies of the deformation processes and highlight the relevance of a detailed characterization of oceanic and continental crustal inhomogeneities around the interplate contact to a better understanding of the seimotectonic process.