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Forearc deformation induced by aseismic ridge subduction: Parameter study using 3D finite-element models

Stefanie Zeumann and Andrea Hampel
Leibniz Universität Hannover, Institut für Geologie, Hannover, Germany (zeumann@geowi.uni-hannover.de)

Subduction of aseismic oceanic ridges considerably influences the forearc deformation. To better understand the ridge-related forearc deformation, we performed a series of three-dimensional finite element models, in which we varied different parameters as the ridge shape, the friction coefficient and coupling width of the plate interface, the mechanical strengths of the forearc. The experiments were carried out for migrating and nonmigrating ridges oriented normal or 60° oblique to the margin. The results show that the ridge subduction uplifts the forearc and induces horizontal displacements. Shortening prevails in front of the ridge, while extension and shortening exist above the ridge. Stationary ridges show high uplift rates only above the ridge tip, whereas migrating ridges induce uplift above the leading ridge flank and subsidence above the trailing flank. The ridge geometry, i.e. ridge height and width, as well as the friction coefficient along the plate interface have large effects on the forearc deformation, whereas the mechanically strengths of the forearc plays a lesser role. Forearc indentation at the trench is largest for high and broad ridges, high friction coefficients along the plate interface and/or weak forearc material. Above the ridge, shortening and extension are intensified by high and narrow ridges.