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The role of backarc shortening and extension on forearc deformation induced by aseismic ridge subduction

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Forarc deformation is considerably influenced by the subduction of aseismic oceanic ridges. We created three-dimensional finite-element models to investigate the role of backarc shortening and extension, respectively. Generally, ridge subduction uplifts the forearc, indents the forearc, and induces horizontal displacement, as well as shortening and extension in front and above the ridge, depending on the ridge orientation and the convergence direction of the subducting plate. For stationary ridges oriented normal to the trench the forearc deformation is symmetric, whereas it becomes asymmetric for migrating ridges and ridges oriented oblique to the trench. Both, backarc shortening and extension intensify the shortening in front of the ridge. Extension above the ridge tip increases for backarc extension, but decreases in case of backarc shortening. Both, backarc shortening and extension increase the total horizontal displacement. In case of a non-migrating ridge oriented normal to the margin, 1 cm/a of backarc shortening increases the total uplift near the trench by 3 % and doubles the amount of shortening in front of the ridge. In contrast, backarc extension of 1 cm/a decreases the total uplift by 4 % and increases shortening by only 33 %. The results will be compared to natural examples like Nazca Ridge migrating along the Peruvian margin.