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Short and long term stress transfer from the subduction interface to the Central Andes

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The western margin of the South American plate is the locus of intense deformation caused by oblique convergence with the Nazca Plate at about 70mm/yr. Shortening in the Central Andes led to the formation of the 4000m-high and 600km-wide Altiplano-Puna plateau symmetric around the trench bend. During the past 10 Myrs the shortening has been accommodated mainly by a fold and thrust belt (FTB) in the eastern Sub-Andes. The Central Andes are characterised by GPS velocity fields that are not parallel to the direction of convergence. The fields tend to converge toward the symmetry axis of the bend in the forearc and to diverge in the backarc region. Added to this spatial pattern, paleomagnetic data show a temporal rotation, i.e. clockwise south of the bend and anticlockwise north of it, which may be still active. In elastic dislocation models, the deformation recorded by the GPS velocity fields was interpreted mostly as the result of a) short-term interseismic deformation in the forearc and b) long-term underthrusting by the Brazilian shield in the backarc at the FTB which neglects the permanent deformation related to the weak rheology of the Andes. Using the Finite Element method we develop a viscoelastic model that combines both the variation of mechanical strength and viscous flow in the Andes as well as the locking of the subduction interface. In this unifying model, the part of short- and long-term deformations can be better separated by simulating the observed spatial and temporal variations of the velocity field.