Geophysical Research Abstracts, Vol. 8, 04334, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04334

Three-dimensional Finite Element Modelling of the Andean Subduction Zone

J. Bolte, J. Klotz, M. Baes, and TIPTEQ Research Group

GeoForschungsZentrum Potsdam, Telegrafenberg, D-14473 Potsdam, Germany.
(jan.bolte@gfz-potsdam.de / Phone: +49-331-2881150)

We use a three-dimensional finite element (FEM) model to reproduce the measured present-day surface deformation in the Andean subduction zone related to earthquakes and to correlate the plate motion with the plate boundary forces.

We use a heterogeneous visco-elastic/elastic quasi-static model, implemented with the general-purpose FEM code ANSYS. The numerical modelling improves our understanding of the plate tectonics and gives estimates for Young's modulus and mantle viscosity as well as estimates for the ridge-push and slab-pull forces. Furthermore, it gives further insight into the underlying geoprocesses. Our approach allows the inclusion of a density and temperature field, friction, and varying Young's moduli. The model includes the real topography and structure of the subduction zone based on best available data. Our 3D spherical model has a rheological layering, i.e. it describes the mantle as a visco-elastic material while the slab is pure elastic. As boundary condition we use only the ridge-push and slab-pull forces. Between mantle and slab and continental crust and slab, respectively, we have a low friction contact-interface.

The simulation results of the finite element modelling fit the surface deformation measured with GPS very well. Moreover, we obtain lower and upper limits for ridge-push and slab-pull forces.