Geophysical Research Abstracts, Vol. 9, 04081, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-04081

Topography growth drives stress rotations in the Central Andes - observations and models

O. Heidbach (1), G. Iaffaldano (2) and H.-P. Bunge (2)

(1) Geophysical Institute, Karlsruhe University, Germany, (2) Section of Geophysics, Ludwig-Maximilians University, Germany

Recent models of global lithosphere dynamics used in conjunction with 3D mantle circulation models show a 30% reduction of conver-gence rate between Nazca and South America plates over the past 10 Ma consequent to the growth of the Andean mountain belt. This in-crease in gravitational potential energy increased resisting frictional forces in the brittle portion of the interface between downgoing and overriding plates. Our predicted plate velocities are fully consistent with independent estimates obtained through paleomagnetic as well as geodetic data. This suggests taking a step further and using the model results to compute predicted stress variations due to the growth of to-pography. In this study we compare 258 data records from the World Stress Map (WSM) with the model results in the Central Andes be-tween 5°N and 35°S. The mean deviation between the WSM data and model results at present day is 23.4°. As the fit of the tectonic regime is quite satisfactory as well, and given the confidence in plate veloci-ties prediction, we argue that our models allow estimating paleo-stress field also 10 Ma ago, when topography was very small. The mean de-viation between model results 10 Ma ago and the present-day WSM data records increases to 44.6°. The rotation is counter clock-wise where topography arises and clockwise elsewhere. Interestingly enough, the stress field orientation 3 Ma ago is not so different from present-day orientation even though topography increased by about 25% over the past 3 Ma, as suggested by numerous studies. This indi-cates that the stress field orientation we observe today was already adjusted 3 Ma ago.