Geophysical Research Abstracts,
Vol. 11, EGU2009-764, 2009
EGU General Assembly 2009

Numerical modeling of horizontal stress distribution in a moving continent: the evolution in the process of motion self-consistent with the mantle flows

A. Bobrov

Institute of Physics of the Earth, Department of Theoretical Geodynamics, Moscow, Russian Federation (bobrov@ifz.ru)

In 2D statement we investigate the evolution of spatial field of overlithostatic horizontal stresses in vertical sections of a solid undeformable continent moving self-consistently with changing mantle flows. The study is a part of numerical modeling of supercontinental cycle (evolution of mantle velocity field, temperature field, continents velocities, and others). In the process of movement, velocity of a continent changes in accordance with time-dependent forces which act from underlying viscous mantle as well as from the mantle surrounding continental end-sides (i.e., the thickness of a continent takes into account). In the framework of our model, the computations demonstrate the following results. If, at a given moment, mantle ascending flow is located under central area of the continent (because of such a position, resulting velocity of continent is small) then horizontal tensile stresses in central area averaged by thickness of continent are maximal and amount to approximately 40 MPa (at 10e7 Rayleigh number). Later, a continent shifts from upgoing mantle flow; as result, velocity of continent grows and comes nearer to the velocities in the underlying mantle. As consequence, horizontal stresses in the continent begin to decrease by modulus measuring about $\pm$ 20 MPa in various continental sections. Within the front edge of continent, in the process of overriding of subduction zone, significant compressive stresses appear (up to 60 MPa). For all the stages the area of maximum tensile stresses (or, later, the area of minimum compressive stresses) is just above the upper part of the upgoing subcontinental mantle flow. The computations demonstrate that the forces acting on the vertical bounding surfaces of a moving continent must be taken into account as well as the forces acting on its bottom surface. The calculations are also carried out for various Rayleigh number values and continent dimensions.
This work was supported by the Russian Foundation for Basic Research, Project No. 09-05-00319-a.