Geophysical Research Abstracts, Vol. 8, 04153, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04153

4-D evolution of deep mantle flow and continental topography

H.-P. Bunge

Department of Earth and Environmental Sciences, Munich University, Germany
(bunge@geophysik.uni-muenchen.de)

Deep-seated mass anomalies in the Earth's mantle are an important source of continental topography, because they initiate up- and downwelling flow and thereby elevate or depress the surface over extended regions for prolonged periods of time. There exists ample evidence for this so-called dynamic topography signal in the record of continental platform stratigraphy in Europe and the adjacent parts of Africa, Asia and the Middle East. Until recently it seemed impossible to reconstruct the history of mantle flow and thus model the secular variation of dynamic topography. Recently, however, some fundamental difficulties in the 4-D reconstruction problem of mantle flow have been overcome. The progress is due to simultaneous advances on three related fronts. First, far more detailed images of mantle heterogeneity are coming into existence through current or planned efforts in seismic tomography, such as EuroArray. The images provide us with constraints on the spatial distribution of mantle mass anomalies. Second, rapid advances in compute power allow geodynamicists to simulate 3-D spherical mantle flow at high numerical resolution, and global models that fully resolve the thickness of the thermal boundary layers are within reach. Third, powerful data-assimilation techniques - pioneered in meteorology - are now available for dynamic models of the solid Earth. These techniques involve an inverse problem of fluid flow. They relate mass anomalies and dynamic topography in mantle flow models over time periods of up to 100 million years. This talk will review fundamentals of the 4-D reconstruction problem of mantle flow and link it to the evolution of topography in Europe and the adjacent areas.