Geophysical Research Abstracts
Vol. 15, EGU2013-7009, 2013
EGU General Assembly 2013

Geopotential Stress: A global approach with focus on the North-Atlantic region

Christian Schiffer and Søren Bom Nielsen
Aarhus University, Department of Geoscience, Aarhus, Denmark (christian.schiffer@geo.au.dk)

Density heterogeneity in the Earth's lithosphere causes lateral pressure variations. Horizontal gradients of the vertically integrated lithostatic pressure, the Geopotential Energy (GPE), are a source of stresses (Geopotential Stress) that contribute to the Earth's Stress Field.
In theory the GPE is linearly related to the lithospheric part of the Geoid. The Geopotential Stress can be calculated if either the density structure and as a consequence the GPE or the lithospheric contribution to the Geoid is known. The lithospheric Geoid is usually obtained by short pass filtering of satellite Geoid measurements. However, this approach depresses signals from long-wavelength lateral density variations within the lithosphere (e.g. the oceanic lithosphere and large scale geological provinces) while deeper situated wavelength contributions might still be included.
Existing global density models are not entirely suitable for the stress calculations but can be compiled and adjusted.
We present an approach in which a global lithospheric density model based on CRUST2.0 is obtained by simultaneously fitting topography and surface heat flow in the presence of isostatic compensation and long-wavelength lateral pressure variations at the base of the lithosphere.
From this density model we calculate global Geopotential Stresses by solving the equations of stress equilibrium using a finite element code with triangular thick shell elements with 15 degrees of freedom each.
We present global results and focus more detailed on the North Atlantic state of stress and its significance for the unique geodynamical setting including a spreading system, the Icelandic magmatic anomaly and surrounding passive margins. The results show excellent agreement with the present observed stress directions.