Geophysical Research Abstracts, Vol. 7, 04383, 2005
SRef-ID: 1607-7962/gra/EGU05-A-04383

Comparative geodynamic modelling concerning physical mechanisms of earthquake swarms worldwide

M. Naujoks, T. Jahr and G. Jentzsch

Institute of Geosciences, Friedrich-Schiller-University Jena, Germany
(M.Naujoks@uni-jena.de / Fax: +49 3641 948662 / Phone: +49 3641 948673)

Earthquake swarms are observed worldwide, especially in connection with fluid movement and volcanism. Using the finite element analysis software ABAQUS numerical investigations regarding appearing stresses and deformations in the earth's crust were performed to clarify possible physical mechanisms that lead to the phenomenon of earthquake swarms. A geodynamic model was developed for the Magadi area in the Kenya Rift. The model takes into account the regional stress field and thermal stresses as well as creep and plasticity with a porous elastic rheology. Statements were made about the interaction between pore pressure variations, fluid movements, temperature changes, stress accumulation and deformations, because it is suspected that these processes play an essential role in the generation of earthquake swarms. The results of the modelling for the Magadi area were compared not only with existing geodynamic models for the Vogtland area but also with information from other earthquake swarm areas. Conclusions were drawn to general as well as to area-specific mechanisms. Consequently the modelling leads to an improved understanding of the processes and interactions that contribute to the occurrence of earthquake swarms.

An essential result of the modelling is that the existence of the regional stress field alone neither explains the occurrence of the earthquake swarms in the Vogtland area nor in the Magadi area. The consideration of the influence of temperature changes, probably caused by magma intrusions, were confirmed by the modelling, because increasing temperatures are responsible for a significant increase of the occurring shear stresses. Furthermore, an effect of periodic pore pressure variations, e. g. caused by degassing of magma intrusions or fluid movements in the earth's crust, could be proved. These results are valid in both the Magadi area as well as in the Vogtland area. They are consistent with observations made in different earthquake swarm areas.