Geophysical Research Abstracts,
Vol. 11, EGU2009-11961, 2009
EGU General Assembly 2009

Regional Crustal Deformation and Lithosphere Thickness Observed with Geodetic Techniques

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The solid Earth, including the lithosphere, interacts in many ways with other components of the Earth system, oceans, atmosphere and climate. Geodesy is a key provider of data needed for global and environmental research. Geodesy provides methods and accurate measurements of contemporary deformation, sea level and gravity change. The importance of the decades-long stability and availability of reference frames must be stressed for such studies. In the future, the need to accurately monitor 3-D crustal motions will grow, both together with increasingly precise GNSS (Global Navigation Satellite System) positioning, demands for better follow-up of global change, and local needs for crustal motions, especially in coastal areas. These demands cannot yet be satisfied.

The project described here is a part of a larger entity: Upper Mantle Dynamics and Quaternary Climate in Cratonic Areas, DynaQlim, an International Lithosphere Project (ILP) -sponsored initiative. The aims of DynaQlim are to understand the relations between upper mantle dynamics, mantle composition, physical properties, temperature and rheology, to study the postglacial uplift and ice thickness models, sea level change and isostatic response, Quaternary climate variations and Weichselian (Laurentian and other) glaciations during the late Quaternary.

We aim at studying various aspects of lithospheric motion within the Finnish and Fennoscandian area, but within a global perspective, by the newest geodetic techniques in a multidisciplinary setting. The studies involve observations of three-dimensional motions and gravity change in a multidisciplinary context on a range of spatial scales: the whole of Fennoscandia, Finland, a regional test area of Satakunta, and the local test site Olkiluoto. Objectives of the research include improving our insight into the 3-D motion of a thick lithosphere, and into the gravity effect of the uplift, using novel approaches; improving the kinematic 3-D models in the Fennoscandian area; detailed observations of intraplate deformation; and to offer reliable information on local deformation. Local and regional studies will offer information also for societal needs, such as nuclear waste deposit plans and precise reference frame for cities and municipalities in the area.

The on-going project is partly funded by the Academy of Finland.