Satelliten als Spione im Erdschwerefeld

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For the first time in satellite geodesy, three dedicated gravity field missions are being realized during this decade. The three missions are based on different observation concepts and have one element in common: the high-low satellite-to-satellite tracking (SST) based on GPS. The differing elements among the three missions are the low-low SST and a gravity gradiometer sensor.

The three missions focus on different aspects of the Earth's gravity field: the determination of the static field with utmost precision and resolution (GOCE mission) versus the monitoring of the dynamic field with reduced resolution (GRACE mission).

The presentation focusses on the key elements and the anticipated performance of the GOCE mission of ESA, and provide a performance comparison with the German CHAMP mission and the GRACE mission of NASA.

Dynamics of the Alps reconsidered: orogenic processes as told by meteorological analogies

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Beside of its well-studied (therefore, by definition, mosaicked) character, the dynamic evolution of the Alpine orogen shows extraordinary complexity. The partly unclear, partly diffuse plate tectonic situation with several proposed microplates, rotating indentors, zones of contraction and distension, of uplift and subsidence, of seismic and volcanic activity and tranquillity are comprised in a relatively small region. The complicated geological pattern paved the way for numerous models to appear. These models operate with differently moving microplates of variable size and cannot provide a general principle or mechanism which governs the whole system.

More than a quarter of a century ago, Gidon (1974) published a short contribution stating that the Western Alpine-Apenninic chain resembles to a meteorological low pressure zone about to be occluded. This theory was reinvented recently (Székely, 2001) in a wider framework: supposing a meteorology-like dynamical system termed lithospheric weather, most of the orogens can be explained with a single principle.

The advantage of the hypothesis is its capability to explain several temporally and spatially differently scaled processes and observations. In the case of the Apenninic-Alpine-Carpathian highly curved orogenic chain the model, using the analogy of a meteorological low pressure zone, predicts the short time-scaled recent earthquake pattern, the uplifting and subsiding regions; it is in good concordance with the palaeomagnetic results, explains some extraordinary exhumation rates.

The major disadvantage of this model is that it conflicts the present-day knowledge about rheology and physical processes in the crust. However, model predictions seem to fit to various observations in many active orogens of the world, a fact which cannot be neglected inspiring further investigations in this field.

Gidon, M., 1974: L'arc alpin a-t-il une origine tourbillonnaire? Compt. Rend. Hebdo., Serie D, 278, 21-24.

Székely, B., 2001: On the surface of the Eastern Alps – a DEM study. Tüb. Geowiss. Arb., Reihe A, 60, 1-157.