Geophysical Research Abstracts
Vol. 14, EGU2012-1701, 2012
EGU General Assembly 2012

Large scale 3D geometry of deformation structures in the Aar massif and overlying Helvetic nappes (Central Alps, Switzerland) – A combined remote sensing and field work approach

R. Baumberger, Ph. Wehrens, and M. Herwegh
University of Bern, Institute of Geological Sciences, Bern, Switzerland (roland.baumberger@students.unibe.ch)

Allowing deep insight into the formation history of a rock complex, shear zones, faults and joint systems represent important sources of geological information. The granitic rocks of the Haslital valley (Switzerland) show very good outcrop conditions to study these mechanical anisotropies. Furthermore, they permit a quantitative characterisation of the above-mentioned deformation structures on the large-scale, in terms of their 3D orientation, 3D spatial distribution, kinematics and evolution in 3D.
A key problem while developing valid geological 3D models is the three-dimensional spatial distribution of geological structures, particularly with increasing distance from the surface. That is especially true in regions, where only little or even no “hard” underground data (e.g. bore holes, tunnel mappings and seismics) is available. In the study area, many subsurface data are available (e.g. cross sections, tunnel and pipeline mappings, bore holes etc.). Therefore, two methods dealing with the problems mentioned are developed: (1) A data acquisition, processing and visualisation method, (2) A methodology to improve the reliability of 3D models regarding the spatial trend of geological structures with increasing depth:
1) Using aerial photographs and a high-resolution digital elevation model, a GIS-based remote-sensing structural map of large-scale structural elements (shear zones, faults) of the study area was elaborated. Based on that lineament map, (i) a shear zone map was derived and (ii) a geostatistical analysis was applied to identify sub regions applicable for serving as field areas to test the methodology presented above.
During fieldwork, the shear zone map was evaluated by verifying the occurrence and spatial distribution of the structures designated by remote sensing. Additionally, the geometry of the structures (e.g. 3D orientation, width, kinematics) was characterised and parameterised accordingly. These tasks were partially done using a GPS based Slate PC and the FieldMoveTM software, in order to ease the subsequent data processing.
2) Findings from the field work were visualised in 3D using the MoveTM software suite. Applying its specific tools and incorporating own field data, the structure’s near-surface 3D settings was modelled. In a second step, the combined use of surface and subsurface data helped to predict their trend with increasing distance from the surface, bypassing a height difference of partially more than 2000m.

Field work shows that the remote-sensing structural map fits very well with the field observations. Nevertheless, the shear zone map underwent an iterative refinement process, based on own observations in the field as well as on already existing maps. It now clearly describes the lithological subdivision of the study area.
The incorporation of the data into the 3D modelling software points towards the fact, that own large-scale data fits very well with small-scale structures provided by recent studies in the same area. Yet, their exact interplay in terms of orientation, kinematics and evolution is not clear. Additional analysis is needed in order to gain more detailed insight into the deformation history of the rocks in the study area.