

## Structural analysis using DEM and COLTOP-3D computer program

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Assuming that the landscape is mainly shaped by its geologic and tectonic characteristics, the analysis of the topography provides some of its main morphologic features.

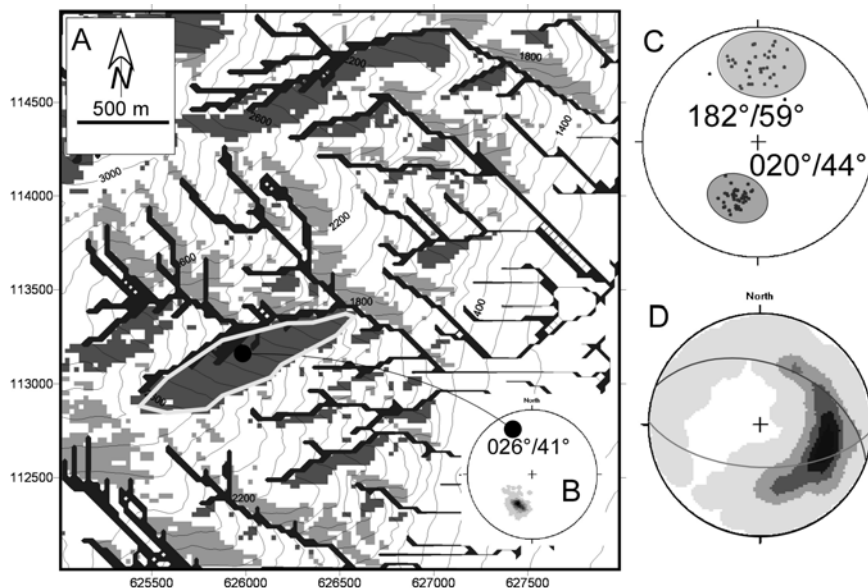


Figure 1: (A) Location of the areas oriented  $182^{\circ}/59^{\circ}$  within a range of  $30^{\circ}$  (dark grey) and oriented  $020^{\circ}/44^{\circ}$  within a range of  $30^{\circ}$  (light grey). Rivers are shown in black. The density stereonet (B) of all cells lying within the hatched area indicates a remarkable constancy in orientation. The stereonet (C) is produced by the COLTOP-3D software, based on a series of selected points on the map showing the two main discontinuity sets shaping the landscape. The stereonet (D) displays the river flow directions, compared with the orientations of the two main discontinuity sets (DHM25© 2004 swisstopo (BA045928)).

The analysis of a Digital Elevation Model (DEM) with the software COLTOP-3D makes it possible to create 3D shaded, coloured relief maps. These maps combine both slope angle maps and slope aspect maps, highlighting the orientation of the topography. The topography can thus be interpreted by means of a stereonet. Further topographic analysis enables to identify structural features. Faults, as well as folds, can for instance be recognized using DEMs.

The accuracy of the interpretation depends on both the mesh size and the accuracy of the considered DEM. In most of the cases, the field data and the results provided by the COLTOP-3D software are in good agreement. Nevertheless, the orientations obtained from the DEM are usually less steep than the ones measured in situ.

The results can be displayed in a GIS environment using a range of tolerance. This method makes it possible to show the strong control of tectonic features on the location of rivers, as it is illustrated in the Mattertal (Fig. 1). Another application consist in measuring fold axis on a precise DEM as it is shown in the Jura (Fig. 2). These examples show that COLTOP-3D appears to be a powerful tool for structural analysis.

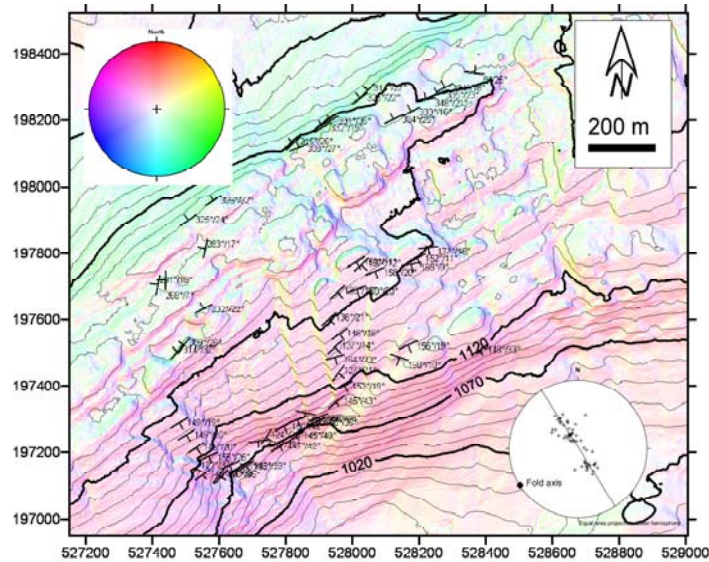


Figure 2: Fold axis determination of the anticline of de la forêt des Cornées les Fontenettes within Kimeridian Marls using the COLTOP-3D computer program (Data from MNA-Laser terrain DOM-AV 2003)

## References

- DEM Laser terrain DOM-AV,2003 : Service d'information du territoire de Neuchâtel (<http://sitn.ne.ch/>) and Swisstopo ([www.swisstopo.ch](http://www.swisstopo.ch)).
- Jaboyedoff, M., Baillifard, F., Couture, R., Locat, J., and Locat, P. 2004: New insight of geomorphology and landslide prone area detection using DEM. In: Lacerda, W.A., Ehrlich, M. Fontoura, A.B. and Sayo, A (eds): Landslides Evaluation and stabilization. Balkema, 199-205.