Geophysical Research Abstracts
Vol. 17, EGU2015-10713, 2015
EGU General Assembly 2015

3D mapping of geological contacts by coupling Aerial Laser Scanning, Gigapixel photography and open access pictures

Liliane Nguyen, Antoine Guerin, Antonio Abellán, Dario Carrea, Marc-Henri Derron, and Michel Jaboyedoff
Risk Analysis Group, Institute of Earth Sciences (ISTE), University of Lausanne, Switzerland (liliane.nguyen@unil.ch)

Multiple sources of geological data exist nowadays, most of them are in 2D (e.g. geological maps, geological panoramic sketch), and only a few are in 3D (e.g. block diagram). One of the current challenges in geological mapping consists not only in providing a more consistent 3D data, but also in pursuing a gathering and a harmonisation of the geological information in order to obtain a more consistent interpretations of the 3D geological models. New remote sensing techniques have significantly improved the representation of three-dimensional surfaces during the last decade, especially for steep and inaccessible rockcliffs. Therefore, we present an exploratory study aiming to find a reliable method for carrying out a three-dimensional mapping of geological contacts using a High Resolution Digital Elevation Model (HRDEM) with a 1 meter cell size.

To this end, we selected the "Scex Rouge Mountain" as pilot study area. This outcrop, which is located in the Diablerets Massif (Vaud, Swiss Alps), has the particularity to present very distinguishable folded geological boundaries on its Southern face. The Southern slope belongs to the Wildhorn nappe, which is mainly composed of sedimentary rocks. The top-layer is composed of siliceous limestones, the well-visible fold layer is the "Pygurus layer" and consist of sandy limestone. Finally the bottom-layer includes marly schist and clayey limestones.

At first, different sources of information has been draped on the HRDEM of the Scex Rouge Mountain, including not only classical geological maps (1:25 000) but also different sources of imagery (e.g. gigapixel panoramas, open access images, etc.). In a second step, several three-dimensional polylines have been drawn following the geological limit on each drapped HRDEM. Then we investigated the accuracy of 2D classical geological maps by comparing these geological limits with the drawn 3D polylines.

Furthermore, in order to evaluate the accuracy of the method, a ground truth needs to be defined. Therefore a 3D polyline has been drawn directly on the mesh without any texture of the HRDEM, since any error is added by the draping procedure. The influence of the operator on the procedure is also assess. We asked to different users to proceed either the all procedure, either the drawing of the polylines with one mesh previously textured with the gigapixel image. Finally, the inverse method has also been tested: the polyline has been firstly drawn, and then textured on the mesh.

Our results show that the 2D geological map (1:25 000) of the area does not provide an accurate representation of the local geology on steep areas, this effect being more remarkable in sub-vertical rock walls. Thus, there exists a strong interest in mapping the limits between the different geological units directly in 3D point clouds or in HRDEM in Alpine areas, especially when dealing with high detailed mapping of complex geologic bodies such as folded stratigraphic series, magmatic intrusions and/or fractured reservoirs.