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# Sharing Digital Outcrop Models with smartphone-based Virtual Reality

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Building high-resolution Digital Outcrop Models (DOM) has become an essential tool for modern field geologists. Such 3D models show widespread applications across the geosciences, such as the characterization of inaccessible geological structures, the investigation of geomorphological processes, the evaluation of natural resources and geohazard assessments. Conventional methods for 3D data acquisition and model reconstruction consist of (i) laser-based (LIDAR/TLS) scans and (ii) Structure from Motion (SfM) photogrammetry technology using photographs captured from Unmanned Aerial Vehicle (UAV) and/or combined to field Digital SLR camera. The latter has considerably grown in the last decade due to its low-cost implementation and the rise of many affordable software packages producing DOMs (e.g., Agisoft Photoscan, MicMac, VisualSFM). Even if such models are easy to acquire, taking full advantage of 3D rendering during data presentation may be trickier. This is where Virtual Reality (VR) systems step in aiming as being used as supporting tool for scientific presentations. Indeed, VR headsets such as Google Cardboard - or more sophisticated ones - create an immersive virtual field experience by which realistic geology outcrop and/or post-processed 3D models can be explored for geosciences training, teaching and geocommunication.
We built such DOMs for several case studies illustrating multiple field scales: (i) large-scale open-pit mine (Lessines, SW Belgium), (ii) medium-scale Lorette Cave (SE Belgium), as well as (iii) oriented hand-samples. We focus this presentation on the second case for which we built a high-resolution 3D model (396 M points and 40 M polygons) using SfM photogrammetry, combining pictures from DSLR field- and onboard drone- (or Unmanned Aerial Vehicles) cameras. The main goals of these projects were to better constrain the orientation of inaccessible geological and geomorphological (e.g. faults and slickenlines, tectonic, gravitational and cooling joints, and sediments beddings) and to compare them to structural data surveyed on the field and in fine, to go through lithological and structural interpretations using both geometric and colorimetric clustering of the Digital Outcrop Model polygons. We thus present here the general workflow and detailed guidelines in order to help field geoscientists to create and build their own 3D digital models from the field up to its integration in a virtual world using Unity software framework and a smartphone-based VR headset.