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Structural modelling of thrust zones utilizing photogrammetry: Western Champsaur basin, SE France

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Recent advances in photogrammetric technologies allow geoscientists to easily obtain a high-resolution 3D geospatial data across multiple scales, from rock specimen to landscape. Although resolution and accuracy of photogrammetry models are dependent on various factors (a quality of photography, number of overlapping photo images, distance to targets, etc), modern photogrammetry techniques can even provide a comparable data resolution to laser scanning technologies ($< \sim$1cm resolution) if conditions are complete. Such high-resolution datasets enable to perform accurate and detailed mapping or modelling of various geological objects. Another advantages of photogrammetry techniques, high portability and low costs for infrastructures, ease to incorporate these techniques with conventional geological surveys. Photogrammetry techniques have a great potential to enhance performances of geological surveys.

We present a workflow for building basin-scale 3D structural models utilizing the ground-based photogrammetry along with field observations. The workflow is applied to model thrust zones in Eocene-Oligocene turbidite sequences called Champsaur Sandstone (Gres du Champsaur) filling an Alpine fore-deep basin, Western Champsaur basin, in southeastern France. The study area is located ca. 20km northeast from Gap, and approximately extends 10 km from east to west and 6 km from north to south. During a 2-week fieldwork, over 9400 photographs were taken at 133 locations by a handheld digital camera from ground, and were georeferenced with a handheld GPS. Photo images were processed within software PhotoScan to build a 3D photogrammetric model. The constructed photogrammetry model was then imported into software Move to map faults and geological layers along with georeferenced field data so that geological cross sections and 3D surfaces are produced.

The workflow succeeded to produce a detailed topography and textures of landscape at $\sim$1m resolution, and enabled to characterize thrust systems in the study area at bed-scale resolution. Three-dimensionally characterized architectures of thrust zones at high resolution permit to read structural evolution history and kinematics of thrust faults in multilayered sandstone-shale sequence in detail.