Abstract

This study presents a field-based lab learning module for introductory geology students using a rendered 2.5-dimensional photogrammetric virtual outcrop mode (VOM) from the Blakely Sandstone Formation in the area of Lake Ouachita State Park, Bear, Arkansas. The outcrop is a highly-deformed quartz arenite body located at the top of the Blakely Dam, approximately 40 miles northwest of Hot Springs, Arkansas. The structure of the outcrop is the result of the Ouachita Orogeny. The folds present in the outcrop generally trend to the to the northwest and range from primarily tight and isoclinal folds to less frequent open folds. Fracture sets are also common within the outcrop with a notable conjugate set that correlates to a maximum stress in the now sub-horizontal direction, consistent with the nearly upright to moderately tilted folding expressed in the rocks. Field work was conducted with a DJI Mini 2 to collect 267 aerial images from different viewpoints within the outcrop vicinity. These images were optimized and modeled in Agisoft Metashape Standard. The accuracy of the 3D model was measured in CloudCompare against field data that was taken on visible joins and fractures in the outcrop using a Brunton compass. Using the Blakely Dam VOM an interactive class activity was created which focused on basic structural geology. This activity is aimed at introductory students and has them analyze geometries within the outcrop and allows students to visualize geologic concepts without requiring in-person field work. The lesson involves finding individual folds in the outcrop, labeling the components and measuring their orientations. This workflow and ability to navigate realistic outcrop model allows for student development in recognizing fold components and using those components to identify fold types in outcrops. Our hope is that the process of working with and analyzing a realistic VOM will allow students to gain better spatial awareness and, potentially, an increased competency in the field.