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The future of structural fieldwork - UAV assisted aerial photogrammetry

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Unmanned aerial vehicles (UAVs), commonly referred to as drones, are opening new and low cost possibilities to acquire high-resolution aerial images and digital surface models (DSM) for applications in structural geology. UAVs can be programmed to fly autonomously along a user defined grid to systematically capture high-resolution photographs, even in difficult to access areas. The photographs are subsequently processed using software that employ SIFT (scale invariant feature transform) and SFM (structure from motion) algorithms. These photogrammetric routines allow the extraction of spatial information (3D point clouds, digital elevation models, 3D meshes, orthophotos) from 2D images. Depending on flight altitude and camera setup, sub-centimeter spatial resolutions can be achieved. By "digitally mapping" georeferenced 3D models and images, orientation data can be extracted directly and used to analyse the structural framework of the mapped object or area. We present UAV assisted aerial mapping results from a coastal platform near Cape Liptrap (Victoria, Australia), where deformed metasediments of the Palaeozoic Lachlan Fold Belt are exposed. We also show how orientation and spatial information of brittle and ductile structures extracted from the photogrammetric model can be linked to the progressive development of folds and faults in the region. Even though there are both technical and legislative limitations, which might prohibit the use of UAVs without prior commercial licensing and training, the benefits that arise from the resulting high-resolution, photorealistic models can substantially contribute to the collection of new data and insights for applications in structural geology.