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Application of Virtual and Augmented reality to geoscientific teaching and research.

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The geological sciences are the ideal candidate for the application of Virtual Reality (VR) and Augmented Reality (AR). Digital data collection techniques such as laser scanning, digital photogrammetry and the increasing use of Unmanned Aerial Vehicles (UAV) or Small Unmanned Aircraft (SUA) technology allow us to collect large datasets efficiently and evermore affordably. This linked with the recent resurgence in VR and AR technologies make these 3D digital datasets even more valuable. These advances in VR and AR have been further supported by rapid improvements in graphics card technologies, and by development of high performance software applications to support them.

Visualising data in VR is more complex than normal 3D rendering, consideration needs to be given to latency, frame-rate and the comfort of the viewer to enable reasonably long immersion time. Each frame has to be rendered from 2 viewpoints (one for each eye) requiring twice the rendering than for normal monoscopic views. Any unnatural effects (e.g. incorrect lighting) can lead to an uncomfortable VR experience so these have to be minimised. With large digital outcrop datasets comprising 10's-100's of millions of triangles this is challenging but achievable.

Apart from the obvious "wow factor" of VR there are some serious applications. It is often the case that users of digital outcrop data do not appreciate the size of features they are dealing with. This is not the case when using correctly scaled VR, and a true sense of scale can be achieved. In addition VR provides an excellent way of performing quality control on 3D models and interpretations and errors are much more easily visible. VR models can then be used to create content that can then be used in AR applications closing the loop and taking interpretations back into the field.