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Topographic modelling of caldera analogues using Structure from Motion – Multiview stereo-photogrammetry

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Analogue caldera models have long been used in volcanology to investigate structural evolution of volcanoes during tumescence and collapse periods. Influence of tectonic forces on volcanic features are also in the scope of those experiments. As well as interior modelling of the caldera experiments, topographic modelling is essential for digital monitoring and quantification purposes. Topographic modelling of those sandbox models is possible using laser scanning techniques. Particle tracking using still images is another way to demonstrate and quantify the structure and movement during the experiment. The quantum leap in the digital photography and computation tools and ease of access to both, provides the use of a new modelling technique in various scales and applications in Geology. Although the roots are older, Structure from Motion – Multiview stereo-photogrammetry (SfM-MVS) is a relatively new technique for surface modelling via several high resolution photographs. We have used SfM-MVS to digitally model the elevation of the tumescence and collapse cycles in analogue caldera experiments. Several sandbox experiments have been modelled using SfM-MVS technique stage by stage during tumescence and collapse periods. It has been possible to evaluate the structural evolution of the collapse models. Additionally, using particle tracking via still images acquired during the experiments, we have modelled the superficial evolution of the caldera structure. SfM-MVS is an effective low budget method for modelling in decimetric scale down to millimetre/micrometre precision.