



Monitoring Changes in Coastal Morphology: 3D Reconstruction with Structure-from-Motion

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The combination of Structure-from-Motion with Multi-View Stereo (SfM-MVS) photogrammetry has become an increasingly popular method for the monitoring and 3D reconstruction of coastal environments. Climate change is driving the potential for increased coastal erosion and recession meaning geomorphological monitoring using methods such as SfM-MVS have become essential. SfM-MVS has been well-researched with a variety of platforms and spatial and temporal resolutions using mainly rectilinear digital cameras in coastal settings. Previously considered unsuitable for accurate 3D reconstructions, fish-eye lenses are being used more regularly in photogrammetry research. Optical corrections functionality has become a standard inclusion in commercial SfM-MVS software showing increased demand and understanding of distorted images.

In this study, a camera with fish-eye lens is used with an innovative method of systematic image acquisition at a small-scale site of coastal recession with the aim of understanding image interaction and its effect on the resultant dense point cloud. Positional parameters are examined and quantitatively compared to the equivalent Terrestrial Laser Scanner results (assumed ground-truth).

Results show the SfM-MVS using a fish-eye lens produced dense point clouds with millimetre accuracy when compared to the TLS benchmark. Equivalent point cloud accuracy can be achieved with a small number of images stationed in appropriate positions. Initial results show a small number of well-positioned cameras could provide high levels of accuracy. These findings point to the potential for cameras with fish-eye lenses to be used to provide a low-cost method of small-scale coastal monitoring. This is broadly relevant to the most vulnerable coastal environments in developing countries where frequent, lower cost coastal monitoring may be desirable.