



## **Monitoring the changes of mud volcano landscape in the Wushangding mud volcano natural reserve in the southern Taiwan by using unmanned aerial vehicle (UAV)**

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The natural reserve of the Wushangding mud volcano in the Yanchao of Kaohsiung is the first natural reserve for conserving the active mud volcano landscape in Taiwan. In recent years, domestic sightseeing tourism and eco-tourism has increased the pressure on the nature reserve. For a better nature reserve management, it is important to understand the short-term changes of mud volcano landscape and the factors that may cause the changes. Total station and LiDAR techniques were both used for mud volcano landscape monitoring in this reserve before, but time-consuming and high costs make short-term repeat monitoring less possible. With the rapid development of unmanned aerial vehicle (UAV) technology, it is possible to carry out a quick and low budget landscape monitoring with high resolution results for mud volcano landscape.

Due to the small area of the Wushangding Mud Volcano natural reserve (less than 5 ha), we used UAV to take photographs from a flying height of 30 meters with >80% image overlap. The latitude, longitude, and elevation of the ground control points are measured by the total station with the coordinate reference system of TWD97. Then the images are processed by the Agisoft Photoscan software to create digital elevation model (DEM) for terrain difference comparison. We will carry out one survey approximately every 2 to 4 weeks for one year, and collect the monthly number of the visitors to the reserve and the meteorological data from the meteorological stations nearby to discuss the main factors that may attribute to the changes of mud volcano topography.