

Estimating Eruptive Volumes of Mud Volcano Southwestern Taiwan by Using UAV and SfM-MVS Photogrammetry

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Mud volcanoes are special geologic features occurred in tectonic areas with horizontal compression. Complete research for mud volcanos can help us to understand the interaction of the crust and surface. In Taiwan, mud volcanoes are present on-land and off-shore southwestern Taiwan around the transitional area from subduction to orogeny. Among all mud volcanoes in Taiwan, the Wandan mud volcano erupts sporadically with significantly large amount of effluent mud. However, the mechanism of the eruption remains unclear because we lack fundamental information such as eruptive volumes, duration of mud eruption, impact factors and recurrence intervals. Therefore, it is important to estimate the eruptive volumes and further to examine the spatiotemporal pattern of the Wandan mud volcano eruption. We first compile literature and newspapers for historic eruption events to estimate two groups of recurrence interval: 150-180 days for highly active period and 300-600 days for less active period.

Since the sporadic eruption make different for rapid survey by using traditional methods, we take advantage of unmanned aerial vehicles (UAV) to design a survey network specifically. Therefore, we estimate the eruptive volumes of recent eruptions for the Wandan mud volcano by using aerial images taken from UAV, and 3D models derived from the structure-from-motion (SfM) photogrammetry technique. We use RTK-GPS and leveling for horizontal and vertical measurements of ground control point, respectively. We use the SfM software to generate DSMs, point clouds, and orthophotos with cm-level accuracy. We estimate the eruptive volume by subtracting the pre-eruption DSM from the post-eruption DSM. Our results show that for the event on 15 May, 2018, the eruptive area is 12,761 m² and the volume is 13,106.3625 ± 13.0105 m³.

Keywords: UAS, GNSS, digital surface modeling, control survey