

Investigation into the crater of Sakurajima volcano during eruption using UAV

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1. Introduction

Measuring the active crater topography can obtain important information on volcanologically and disaster prevention, but the flight over the crater is risky involved in the eruption and is dangerous. The Minamidake crater of Sakurajima has repeated vigorous eruptions over a long period of time, and the topography change is intense. The Minamidake crater has A crater and B crater, and on the east slope there is Showa crater. Ministry of Land, Infrastructure, Transport and Tourism has regularly conducted airborne laser surveying to clarify the geometry shape. However, airborne laser surveying has become difficult due to the activation of eruption activity. Especially it was difficult to measure the topography of Minamidake crater, west of the Showa crater. Therefore, in this study, in order to grasp detailed crater circumstances of Minamidake crater and Showa crater on Sakurajima, we tried near-field photographing by UAV and terrain measurement utilizing SfM / MVS.

2. Investigation of Showa crater and Minamidake crater of Sakurajima by UAV

The UAV used is Matrice 210 (manufactured by DJI), and the installed camera is ZENMUSE X4S (visible light) and ZENMUSE XT2 (thermal infrared). DJI's UAV has an altitude limit of 500 m above ground level from the takeoff and landing point as a safety measure. For this reason, the takeoff and landing site was the upper stream of the Amida River (around 600 m altitude) outside the entry restriction. The photographing by UAV was performed three times in total, about 15 minutes using the moving picture photographing method. In UAV photographing of visible light, we were able to confirm the state inside the Showa crater, which is unknown by the surveillance camera at the foot. On the other hand, inside the Minamidake crater, due to the influence of the plume, it was impossible to photograph clearly. In the thermal infrared photography, resolution as much as visible light could not be obtained, but we could confirm the movement of the plume inside the Minamidake crater. Moreover, in the thermal infrared, it was possible to capture a high resolution movie rather than photographing with a helicopter, and at Showa crater the stratification of the crater wall could also be confirmed.

3. Create 3D model and orthoimage

An image was cut out from the movie of the visible light that was shot, and an orthoimage of 0.5 m resolution of the Showa crater and a 3D model were made by SfM / MVS. Actually the Showa crater was almost stopped, except for some fumaroles, it was possible to clearly shoot the crater bottom. On the other hand, the Minamidake crater was greatly affected by the plume, a lot of clouds appeared above the crater, and the crater bottom was unknown. We are going to try SfM / MVS analysis using measurement results of thermal infrared with less influence of plume compared with visible light.

4. Conclusion

In order to eliminate the influence of the plume and to obtain a clearer image, it is thought that low-altitude flight to the crater's sky or inside the crater is necessary. Currently, since images are recorded on the SD card, collection after returning is a major premise, but in the future it is desirable to create models from images obtained by wireless communication.

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