

## Volcano monitoring using a flying boat

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The most important feature of flying boats is the ability for quick and flexible observation in the air and on the sea at large distance from the main land. In order to conduct urgent observation of the eruption activity in the remote sea area, it is expected that the characteristics of the flying boats described below are needed, and flying boats are expected to open up various possibilities for volcano research in the sea area.

In the event of sudden disasters such as eruption, grasping the phenomenon and its transition from the earliest stage is necessary for countermeasures against disasters and for earth science research, and urgent initial observation is required. At the same time, a preliminary observation from a safe area to grasp the situation beforehand is also necessary to prevent secondary disasters during the observation. In an eruption activity in a sea area, observation using a ship can be performed after grasping the situation by aircraft observation. Since observation on the sea can be promptly carried out by a flying boat after grasping the situation from the air, a flying boat is suitable for the quick initial investigation of sudden disaster in the sea area, including volcanic eruptions.

I myself mainly performed observation of the composition and flux of volcanic gas. A flying boat, which can fly at various altitudes at relatively low speed, is also suitable for these observations. At present, the volcanic gas observation using an aircraft is carried out by borrowing ordinary Cessna aircraft, but the equipment needs to be installed only in the aircraft not outside according to the aeronautical law, and observation conditions are limited. In order to obtain optimum observation conditions, it is desirable to modify installation of observation equipment including remodeling of the aircraft in advance.

Improvement of flying boats aimed at earth science observation enables observations under optimum conditions.

The biggest feature of the flying boat is that it is possible to landing water. In the survey of volcanoes in the sea area, usually ships are used to install instruments such as ocean bottom seismographs, to sample seawater and sea floating matter, and to perform landing operations using rubber boats, etc. All these operation is possible from the flying boat on the water. Compared to ships, the flying boat moves more rapidly, so that the site work can be started quickly, visual observation from the aerial before the arrival of the water allows us to judge the situation immediately before, and it can be evacuated from the site quickly when a danger was detected during the work. Installation of continuous observation equipment is indispensable for grasping changes of volcanic activity. In the case of Nishinoshima eruption, observation of the activity changes was initially depends on visual observations repeatedly by jet aircraft, making it difficult to grasp quantitative trends and detect detailed changes. After that, the frequency change of the eruption was grasped by continuous infrasonic observation at Ogasawara which is 130 km away, and the ocean bottom seismographs were installed around Nishinoshima only after 2015. Continuous observation data such as ocean bottom seismographs are not only necessary for quantitatively evaluating activity changes, but also are essential data for understanding of eruption processes. Recently, observation method of ocean bottom crustal movement is put into practical use. Also, using a wave glider that can autonomously navigate the sea surface with wave power alone. Utilization of a flying boat is indispensable in order to promptly deploy these devices to the surrounding sea area after volcanic activity activation. In order to realize the urgent volcano monitoring in the remote sea area, in parallel with the development of these observation methods, it is desirable to develop observation methods using flying boats.

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