

Basic Characteristics of Crustal Deformation Measurement in a Vault of the Tokachi - dake Volcano, Hokkaido, Japan

Makoto Murakami^{1*}, Takeshi Hashimoto¹, Satoshi Okuyama¹, Hitoshi, Y. Mori¹, Hiroshi Aoyama¹, Atsuo Suzuki¹, Teruhiro Yamaguchi¹, Muneo Okayama¹

¹Institute of Seismology and Volcanology, Hokkaido University

Tokachi-dake volcano sitting in the central Hokkaido is one of the most active volcanos in the region. In the recent 100 years, it frequently erupted including 3 major ones in 1926, 1962, and 1988. Among them the 1926 eruption triggered a lahar driven by melting snow and ice and claimed 144 lives. A lesson we can learn from the erupting history of this volcano is that each eruption was preceded by a series of small events suggesting gradually magnifying volcanic activity. In each eruption manifestations of precursory signs started to appear and then grow about several years before the eruption. Because almost 25 years, that are comparable to recent recurrence period, have passed since the last major eruption, we should be prepared for the future eruption that might come soon. It is noteworthy that there are already some signs of increased activity that probably suggest growing volcanic potential for the next eruption. Such signs are self-illumination of a spot on a wall of the 1926 crater and sporadic increase of micro seismicity around the active crater including magnitude 2.8 (JMA preliminary estimation) earthquake on February 2, 2013. The ongoing inflation localized around 1962-II crater since 2006 might have to be reconsidered as one of the manifestations indicating ongoing development of volcanic potential.

The high likelihood of having precursory signals before Tokachi-dake climactic eruption encourages us to set up a network of monitoring instruments of sufficient spatial density. For the mitigating purposes it is also crucial to achieve temporally continuous monitoring with real time data transfer capability. Because of the high altitude and location in the northernmost island of Japan, the deployment of such monitoring network is difficult in reality. The biggest hindrance is originated from the heavy accumulation of snow and ice during the winter season. Instruments installed on the surface are likely to be covered by thick snow accumulation and sometimes are destroyed by avalanche or moving ice. To avoid such a risk a vault observation is preferable. For that purpose Tokachi-dake vault observatory (TKC) was constructed on the southwest flank of the volcano in 1985. Tiltmeters and extensometer for continuous crustal deformation measurement were installed. The acquired data are being transferred to the laboratory using telemeter system working on microwave frequency.

To make the volcano monitoring reliable we should be able to distinguish signals coming from the volcanism from noises of different nature. For example precipitation is a common error source for vault measurement. For the purpose of evaluating the stability and identifying of possible error sources, we analyzed the recorded crustal deformation data (tilts and linear strain) of recent years. The data indicated that basically the measurements are quite stable. Yearly repeating variation and linear trend are found in each deformation component but those evolutions are relatively smooth and easy to identify. No variations that might be related to precipitation were recognized. On the other hand, steps were found only during winter season. A possible explanation is that crustal deformations are excited by massive motion of snow and ice, but further studies are necessary for the confidence. In the presentation, we will discuss the stability of the observation further in detail.

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