Ground deformation associated with the 2000 eruption of Usu Volcano-An application by multiple spherical sources-

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In the 2000 eruption of Usu Volcano various geodetic observations that include conventional precise leveling and new techniques as GPS, Air-borne lidar survey and SAR had conducted. So far on these broad and dense observations each observer submitted preliminary study reports or results for their analysis. Edifice scale inflation which concentric deformation center, located at western summit, and additional western flank inflation, which is, localized deformation by new cryptodome growth are the most remarkable characteristics for the deformation associated with the eruption.

However, these researches don't attain to the stage, which we examined and discussed about total deformation field using many composite data. Prior to precise study of deformation field, it is very important to check and reexamine basic features of total deformation field from various points of view by available composite data. In this study for the purpose of understanding of total deformation field those data were used, which includes not only the data by previous works but also additional new data as the data set. This compiled data set has better broad distance coverage for the source. After separating the effects of two sources that is characterized by edifice scale inflation at summit area and localized deformation at the western flank, basic data were examined for model fitting.

The vertical displacement pattern shows more sharp decrease for the distance range of 5 – 6 km and farther from the source on their logarithmic expression. This sharp decay trend of the data cannot be explained by single Mogi's source, because single Mogi's source model predict constant decay slope with distance in logarithmic graph. So, an another deeper source was introduced. This idea is consistent with the petrological study (Tomiya,1995) or broad-band seismological study (Yamamoto et al.,2002) or for horizontal contraction at large area around Usu (Churei and Kobayashi,2000). By considering another deeper source, both vertical displacement and horizontal displacement can be explained for each parameter. It was confirmed that sources under the summit is not single source but basically multiple sources where deeper multiple deflation source. Other previous study (such as Murakami et al (2001), Watanabe (2003)) also supported this interpretation.

However it is difficult to determine precise depth estimation depth of deeper deflation source, because very small displacement at farther distance played more important constraint. In other words, it shows more importance precise survey like conventional leveling for the estimation about deeper sources. Problem also arise that vertical and horizontal model fitting is essentially different. The results were applied for the past 3 time eruptions of Usu Volcano in 1910,1943-45 and 1977-82, Strong similarity between the 2000 and the 1910 eruption is notable as a result.