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Extraction of caldera rims from gravity data using GIS

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The Iwate-Miyagi Nairiku Earthquake caused a complex faulting along eastern foot and innumerable landslides on the southern flank of Mt. Kurikoma. The Neogene caldera structure around the mountain was considered to participate to these events (Nunohara et al., 2010). Assuming that calderas have regional depressions in the spatial distribution of gravity anomalies, Prima and Yoshida (2010) delineated caldera rims of Northeast Honshu by applying a hydrological analysis to the data. However, for some calderas, the interpretation of their rims may vary because preserved rim is not always obvious. Furthermore, the gravity anomalies contain noises that cause differences between the extracted and the estimated caldera rims. The amplitudes of the spectral distribution of gravity anomalies can be divided into three components: trends, signals and noises. The trend and signal components represent surface and subsurface structures below the seismic basement while the noise is considered as errors occurred in the generation of the data (Nozaki, 1997). In this study, a band pass filter was applied to the gravity anomalies to improve the extraction of caldera rims from the data. For gravity anomalies, this study used the data (Gravity CD-ROM of Japan, 2000) published by the Geological Survey of Japan. The gravity anomalies were corrected using 2.0, 2.3 and 2.67 g/cm³ of assumed densities. In this study, gravity anomalies corrected using 2.67 g/cm³ of assumed density was used for the analysis. Band pass filters with cut off wavelength ranging from 1 to 10 km were applied to the gravity anomalies. The lower cut off wavelength produces detailed edges of the extracted caldera rims while the higher produces rough edges. The calculations of band pass filtering and caldera rims extraction were conducted using GMT and ArcGIS. These calculations were automated to allow interactive observations for the changes of extracted caldera rims according to each cut off wavelength.

Keywords: Caldera rim, GIS, gravity anomaly, band pass filter