Spatial and temporal variations of soil CO_2 flux in geothermal areas of the Tatun Volcano Group, Northern Taiwan

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Soil CO_2 flux variation in volcanic area has been considered as a useful tool to investigate the volcanic activity in a safe distance. In this work, we have measured the soil CO_2 flux by closed-chamber method in representative geothermal areas of Tatun Volcano Group (TVG) and further to discuss its spatial and temporal variations.

Soil CO_2 flux can be obtained ca. 537 g m^{-2} day^{-1} at Geng-tze-ping (GTP), ca. 122 g m^{-2} day^{-1} at Da-you-keng (DYK), ca. 425 g m^{-2} day^{-1} at She-haung-ping (SHP) and ca. 24.6 g m^{-2} day^{-1} at Tatun Natural Park, respectively. The results show that the soil CO_2 flux at DYK is much lower than the values of GTP and SHP, although the DYK fumaroles exhibit highest emission flux with highest $^3He/^4He$ ratios. It could be explained that most CO_2 gas can be released to the surface through the highly permeable conduit/pathway (fumaroles) at DYK and hence, less soil CO_2 flux can be observed. Furthermore, we can estimate the total amount of 113 t day^{-1} of soil CO_2 in the geothermal area of TVG. It is close to the values from other active geothermal areas in the world.

The Hsiao-You-Keng (SYK) area was chosen for continuous monitoring of soil CO_2 flux. The station, located about 50 meters away from the major fumaroles, is equipped with two CO_2 sensors covered and protected with plastic box, and then can be used for long term monitoring under corrosive environments. The system has continuously worked from 2008 until recent; during the monitoring period, the soil CO_2 flux is from ca. 0.012 to 3350 g m^{-2} day^{-1}. The results of soil CO_2 flux showed significant variations and also closely related to local rainfall. The flux apparently reduced after heavy rainfall. This could be explained by the decrease of the soil permeability, and consequently blocked the degassing pathways, due to the heavy rain. Meanwhile, no clear relationship between the flux variation and local earthquake activities can be observed in this study.