Temporal change of the coefficient of geothermal flux used in the heat balance technique

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The heat balance technique (Sekioka and Yuhara, 1974) is one of the methods for measurement of heat discharge rate from geothermal fields. In order to comprehend the temporal change of micrometeorological conditions and the coefficient of geothermal flux, which is essential for the heat balance technique, we manufactured an automated continual measurement system and measured micrometeorological data at the Kyu-Hachiman-Jigoku geothermal unit in the Unzen geothermal area in Nagasaki Prefecture, the Komatsu-Jigoku geothermal unit in Oita Prefecture, Aso Volcano in Kumamoto Prefecture and Hakozaki Campus in Fukuoka Prefecture. The values of the coefficient of geothermal flux, which are calculated from the obtained micrometeorological data, showed turbulent changes in a wide range and in a short time, and also showed some diurnal variations. However, the trends of the diurnal variations are different between the geothermal areas and the non-geothermal area.

And the heat discharge rates of 6 geothermal units (Kyu-Hachiman-Jigoku, Seishichi-Jigoku, Hachiman-Jigoku, Oito-Jigoku, Daikyokan-Jigoku and Ko-Jigoku) in Unzen geothermal area were estimated by the heat balance technique using the thermal images taken from a helicopter during the micrometeorological condition measurement in the Unzen geothermal area. The amount of heat discharge from the 6 geothermal units is 38.39 MW. This value is about 5 times greater, and the heat discharge rate of each geothermal unit is about 2 to 20 times greater than that estimated by Yuhara et al. (1981) by using the data obtained in 1978. In our estimation, Seishichi-Jigoku indicates the strongest average heat flux (1998 W/m^2) and Kyu-Hachiman-Jigoku is the weakest one (694 W/m^2). Generally, the heat discharge rates from the geothermal fields are positively correlated with their geothermal anomaly areas (Yuhara et al., 1987), and the results of our estimation also show the same relation.

In order to estimate the heat discharge rate from the geothermal fields more accurate, the micrometeorological data should be measured simultaneously whenever possible with the shooting of the thermal images.

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