Correlation between NIED Hi-net heat flow data and elevation, erosion and sedimentation

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Measurements of heat flow and geothermal gradient using boreholes on land are often concentrated in specific areas such as geothermal region, so the measured heat flow data in non-volcanic area is poorly mapped. We newly measured thermal gradients and heat flow all over Japanese Islands by using the National Research Institute for Earth Science and Disaster Prevention's (NIED) high-sensitivity seismograph network (Hi-net) boreholes.

Comprehensive heat flow distribution in Japan is as follows: low heat flow in forearc region, high heat flow in back-arc region, there seems to be the correlation between the seismogenic layer thickness in upper crust and terrestrial heat flow, and terrestrial heat flow and moment magnitude of intra-plate large earthquakes show a similar relationship. In the volcanic chain area, very high heat flow over 200mW/m^2 are observed. In the forearc area, low heat flow under 50mW/m^2 are observed. In Shikoku area also high heat flow over 100mW/m^2 are observed. Geographical distributions of terrestrial heat flow show that high heat flow stations are observed along the region where non-volcanic long-period tremors occur about 30km deep.

Terrestrial heat flow gives direct information about geothermal gradient, but it is significantly affected by erosion and sedimentation [Fukahata(2001)]. The rate of erosion (sedimentation) is generally in proportion to elevation. There is clear positive correlation between surface heat flow data in and around Japan compiled by Yamano (1995) and elevation.

We investigate relationship between NIED Hi-net heat flow data and elevation. So, we also find the good correlation indicates essential importance of the effects of erosion and sedimentation on surface heat flow. But some regional differences still remain.

The average of the heat flow data less than 100m, greater than 100m and less than 300m, and greater than 300m height are 70mW/m^2, 90mW/m^2 and 100mW/m^2, respectively. In the Kanto Plain where is sedimentation area, very low heat flow data under 40 mW/m^2 are observed. In the Hokkaido Hidaka area where is erosion area, very low heat flow data are also observed. In the southern Kii Peninsula, there are many non-volcanic hot springs, so around this area high heat flow over 150mW/m2 are observed. There is a high rate area of erosion along the fore-arc region in SW Japan, but too much high heat flow are observed.