Terrestrial heat flow distribution in Japan area based on the temperature logging in the borehole of NIED Hi-net

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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. NIED Hi-net is composed of about 800 borehole stations installed almost homogeneously over the Japanese Islands with an average spacing of 20km.

Although majority of the Hi-net stations have the boreholes of 100- 200m in depth, 55 deep (300-1000m) and 29 very deep (1000-3500m) observation wells were constructed at some specific sites if necessary. Because these Hi-net boreholes are designed for a long-term observation, these are structurally stable with using casing pipe. These borehole temperature profiles contain an influence of climate change, so we correct temperature profile for climatic change, the rapid warming of 1950-2000A.D.

Comprehensive heat flow distribution in Japan is as follows: low heat flow in forearc region, high heat flow in back-arc region, and there seems to be the correlation between the seismogenic layer thickness in upper crust and terrestrial heat flow. In the volcanic chain area, very high terrestrial heat flow over 200mW/m^2 are observed. In the fore-arc area, low heat flow under 50mW/m^2 are observed. In the South Kanto area where is metropolitan Tokyo and the Hokkaido Hidaka area, very low heat flow under 40 mW/m^2 are observed. In the southern Kii Peninsula, there are many non-volcanic hot springs, so around this area high heat flow over 150mW/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. In SW Japan, the slab-derived fluids, which cause fracturing within the crust, result in easier transfer of fluids, mixed with mantle helium, to the surface (Notsu et al., 2006). This movement of the slab-derived fluids also transports the heat of mantle wedge, which cause the terrestrial high heat flow anomaly.