Terrestrial heat flow anomaly at non-volcanic area in Southwest Japan based on the NIED Hi-net

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High terrestrial heat flow anomaly is observed at non-volcanic area in Southwest (SW) Japan. 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 SW Japan 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 (300-1000 m) observation wells and 29 very deep (1000-3500 m) were constructed at some specific sites if necessary. These Hi-net borehole temperature profiles contain an influence of climate change, so we correct temperature profile for climatic change, the rapid warming of 1950-2000A.D.

In the volcanic chain area, very high terrestrial heat flow over 200mW/m^2 are observed. In the forearc area, low heat flow under 50mW/m^2 are observed. There are many non-volcanic hot springs in the southern Kii Peninsula, 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. Shikoku is an island located on the forearc region of the western sector of the SW Japan arc that was formed by subduction of the Philippine Sea plate beneath the Eurasian plate. 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. Non-volcanic deep tremors indicate the existence of fluid generated by dehydration processes from the Philippine Sea slab (Obara, 2002).

Mantle helium has been observed in Shikoku area (Notsu et al., 2006) and the Kii Peninsula region (Matsumoto et al.,2003). 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.