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Global Map of Surface Heat Flow

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Global heat flux is a very valuable constraint on geodynamic processes. In an earlier work (Davies and Davies, 201) we made an estimate of the total global flux, using a large data-set of measurements and assumed a correlation with geology where data was absent. While the global answer of 47 +- 2 TW is a significant result, the work did not include a best estimate for the values of heat flow locally across the globe; i.e. a map.

This work uses the large global data-set to make such an estimate of heat flow across the globe. The estimate is developed on a 2 by 2 degree equal area grid. Where there are heat flow measurements in a cell, their arithmetic average is used (∼25% of globe). Like in Davies and Davies (2010), I use a constrained half-space model for the heat flow of young ocean crust – since most of those raw measurements are affected by hydrothermal circulation (∼40% of globe). For the remaining areas of the globe I have derived an estimate assuming that there is a correlation between the geology and the heat flow. The result is a complete map of the surface heat flow.

Using the result I have tested the assumption that geology correlates with heat flow. In grid cells with measurements I have compared the measurements with prediction from the geology and with the global average heat flow. I find that the geology-based estimate is better than the obvious neutral alternative (global average), but it reduces the scatter by less than 10%. This shows that while this correlation assumption has merit it cannot replace getting proper measurements in regions of no coverage. This map will be useful for a range of researchers; from workers wanting to constrain crustal properties, to lithosphere rheology, and I have had queries from climate modellers.

Davies, J H and D R Davies, Solid Earth, 1, 5-24, 2010
Open Access at http://www.solid-earth.net/1/5/2010/se-1-5-2010.pdf