Solid Earth Discuss., 6, C33–C35, 2014
www.solid-earth-discuss.net/6/C33/2014/

Solid Earth
Discussions
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Interactive comment on "Crustal heat flow measurements in western Anatolia from borehole equilibrium temperatures" *by* K. Erkan

Anonymous Referee #1

Received and published: 17 February 2014

1. Overall quality of the discussion paper ("general comments")

This paper is not of the quality required to be published in an international ISI journal. There are several crucial shortcomings. The most important limitation is the quality of the underlying data to quantify heat flow. The poor quality is linked (I) with the shallow depth from which temperature logs were available and the small intervals of presumably conductive heat transfer and (II) the poor knowledge of the lithology and thermal conductivity of the measured sections. Thus the intention to add knowledge on crustal heat flow in western Anatolia is not really fulfilled at that stage of study. Per definition, crustal heat flow or terrestrial heat flow is the heat conduction component of heat transfer in the Earth. Unfortunately, the paper does not follow strictly this goal and rather provides an overview of recently measured temperature logs, with both, sites of

conductive and combined conductive/convective heat flow and also sites not qualifying for crustal heat flow due to large convective/advective overprint. This makes the paper difficult to follow and dilutes the key results. In addition, the paper should discuss more explicitly the progress with the new data compared to a previous study by Pfister et al. (1998). Due to the rudimentary data for rock thermal conductivity most of the heat-flow values expose a high uncertainty that is not explicitly quantified. The classification of data into pre-defined quality groups does not make a numerical approach of error estimation indispensable. This also pertains to temperature gradient errors. The study needs some more data on the subsurface lithology, porosity, measured thermal conductivity to substantiate the heat-flow values and to calculate/estimate the true error. Given the generally poor quality of the data, the discussion of various influences (not quantified by hard data or models) on the heat-flow field is academic and not justified. The cited literature on generic heat-flow studies and methodology is very selective not addressing the latest achievements and standards in heat-flow science. This also is reflected by the approach selected for this study.

2. Individual scientific questions/issues ("specific comments")

The paper needs an introduction into the geodynamic and tectonic situation of the study area and into subsurface geology/lithology. One who is not familiar with the geology of Turkey is lost. Section 3 "Quality classification" is quite narrative and can be omitted. Issues pertaining to the data handling in this study should be provided concisely in section 4 "Data analysis". Error of determination should be given in this section and added in Table 1 (see Pfister et al., 1998) using some error propagation technique. If crustal heat flow is the goal of the paper, class D thermal data should be discarded (Table 1, Fig. 3) and not discussed in section 4. It remains questionable whether group C data would qualify as they originated from using literature thermal conductivity of questionable quality extrapolated to some underdetermined geology. For example, the use of a default thermal-conductivity value for alluvial (1.5 W/m/K, grey literature) is doubtful as these deposits usually are of variable lithology and porosity and even unconsolidated

rock so that a value determined elsewhere could be not appropriate for the situation here. This concerns seven heat-flow sites in the study. The measured thermal conductivity used at five other sites originates from a study of Balkan et al. not published yet. It is not sufficient to just use those values without the provision in this paper of background information on the samples measured, on measurement procedure and on data quality. For example, in comparison to other published values andesite thermal conductivity measured is very low even if measured in water-saturated samples. What is the porosity? Why does the andesite value differ in different intervals? Section 4 should be divided into temperature log analysis and thermal conductivity analysis. Although the author addresses that in some situations corrections of the measured temperature gradient are necessary (section “Introduction”), the annual temperature effect on subsurface temperature is not mentioned at all in data analysis (Table 1). One would expect that the logs are interpretable only below 20-30 meters. The location of the water table should be provided for each log so that it can be deduced whether the heat-flow interval was above or below it and whether the thermal-conductivity value for dry or water-saturated rocks needs to be used. How is intra-borehole flow explained for cased boreholes? Section 6 is already a discussion and moved accordingly into section 7. However, instead of just describing the possible effects they should be investigated numerically by some modeling. Some geological cross section explaining the situation and serving as conceptual model would also help. Section 6.3 is speculative for your study due to the data at hand. References are not adequate. The U content is just half of the story. What about Th and K?

Interactive comment on Solid Earth Discuss., 6, 403, 2014.