

Interactive comment on “The hydrothermal power of oceanic lithosphere” by C. J. Grose and J. C. Afonso

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Received and published: 18 June 2015

This paper suggests that the hydrothermal contribution to the oceanic lithosphere cooling may have been overestimated in the previous studies and re-evaluates the spatial distribution of the heat loss. The study is based on a sophisticated statistical analysis and on thermal models taking into account the axial hydrothermal cooling (0–0.2 Ma), better integration of petrophysical parameters and the insulating nature of the crust.

Although the topic and the results of this paper are of obvious interest, many aspects would deserve clearer presentation and more detailed explanations, especially those concerning the methodology, which is extremely hard to understand without (and even after) reading a previous paper of the authors (Grose & Afonso, 2013), but fundamental to evaluate the conclusions. The most unclear aspect is certainly the description of the

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statistical analysis, also complicated by a confusion between figure 2 and figure 3 in the text. In addition, the discussion on high resolution sites is oversized (7 pages, 3 figures) and should be shortened and better related to the first part of the paper. Illustrations are generally overloaded (specially figure 1 & 2), and need to be simplified or separated in several parts.

More specific comments:

1) p 1167, dataset filtering. The principal bias in oceanic heat-flow data comes from the deficit of discharge observation sites. If you remove high-resolution studies and near vent sites data, don't you increase rather than decrease this bias?

2) p 1168: "thermal rebound correction" ? do you mean correction for sedimentation effect ? or sediment thickness cutoff?

3) As already mentioned, you should detail the statistical analysis methodology. In equation 2, specify than q_m represents models heat-flow.

4) p 1170: explain the physics of models GH and GHC explicitly: not all readers want to check in a previous paper. It is not clear if these models are fully 2D or only 2D in the initial conditions (0-2 My).

5) p 1171: explain why you used a brittle domain for the Nusselt approximation up to 800°C when it is generally assumed to be 600°C or less. It is not clear if radiative heat transfers is included in the vigorous fluid circulation zone: how is it possible? Is there any reason for choosing 0.2 Ma for the limit of ridge axis rather than 0.1 in Spinelli-Harris?

6) Figure 1 is not of sufficient quality to distinguish dots of different colours. Figure is incorrectly called page 1172 line 15...

7) Figure 2 is extremely difficult to read! It is almost impossible to distinguish circles, squares, triangles, curves, colours (a_b-c). There is a confusion with figure 3: figure 2 is sometimes called figure 3 in the text (eg line 5 p 1172, p 1173 line 26) or alternatively

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figure 3 is called figure 2 (e.g line 21 p 1170). The Monte-Carlo analysis only appears in the legend of this figure with no other explanation! it should be detailed explicitly in the text (section 2.2).

8) p 1176: in Wei & Sandwell, $g = 480$, not 420.

9) p 1178 and figure 4: fit for GH and GHC is better for young sea-floor (0-4 Ma) where the isostatic assumption is generally considered as non valid, but GDH1 is better for old ages (>25 Ma). Can you comment on that?

10) p 1181 line 12: confusion between figures 2 and 3.

11) It's not clear what you want to show with high resolution surveys! In the four sites you choose, data clearly shows where and how much heat is removed by hydrothermal circulations, and where heat-flow is near conductive. I think by averaging everything, you introduce confusion and biases rather making light!

12) Can you discuss in more details the insulating role of the crust and how important would be its thickness variations in such an analysis.

Conclusion:

Interesting approach, which should be improved by a more detailed presentation of the methodology and a better integration of high resolution surveys. Figure 1 and 2 should be improved or simplified, and a careful check of figures call should be done.

Interactive comment on Solid Earth Discuss., 7, 1163, 2015.

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