Geosci. Instrum. Method. Data Syst. Discuss., 2, C380–C382, 2013
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Geoscientific Instrumentation Methods and Data Systems
Discussions

Interactive comment on "Calibration of non-ideal thermal conductivity sensors" *by* N. I. Kömle et al.

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Received and published: 28 February 2013

General comments.

The paper is a clear report of calibration of the new probe design, but I am not exactly sure of the scientific aim of the paper. I was left not feeling like an adequate discussion was given as to why the results showed the trends they did? Why were the non-ideal sensor measurements slightly higher than those of the long needle? How would the slope of the fit "f_cal" change with a change in probe geometry? Right now, I am left with measurements of this particular probe, but no useful theory I can use to predict how much I can change a probe from ideal geometry and still get easily interpretable results? Also, in general, many planetary thermal properties measurements will be done under near-vaccum or vacuum conditions at even lower thermal conductivities than presented here. As environments like Mars and the Moon or asteroid surfaces

appear to be the intended trget for such instruments could you address how these probes might differ under vacuum, where glass beads might measure 10ˆ-3 W/mK?

The paper is an odd format (line numbers begin at each new page), so I will separate the review by page number.

Pg 2, Abstract Line 8: needle, not needles Line 14: maybe not the TECP conical needle design from the Phoenix Mars Lander here?

Pg 3 Line 5: can you explain why it cannot be determined remotely? Or it cannot be determined remotely without an independent constraint on density? I think there are a lot of people that work very hard determining thermal conductivity remotely that might differ with this statement. Line 10: con you estimate how long or give a reference? i.e. Cull, 1978, “Thermal contact resistance in transient conductivity measurements” Line 21: please add a reference for the “length-to-diameter of 100 or more” statement.

Pg 4 No comments

Pg 5 No comments

Pg 6 Line 18: I would say when the agar is “solidified” – “frozen” implies a temperature change- or was it actually frozen at a sub-zero temperature? If they were frozen it seems confusing why the authors seem surprised with ∼2W/mK thermal conductivities, as ice typically has a thermal conductivity ∼2 to 2.5 W/mK. Were there any measurements of room temperature agar samples? Does Agar-ice expand when frozen- how to you maintain good thermal contact between the needle and the ice? This could be a reason for the non-linearity between the Agar-ice and the other values in Figure 5. Do you have any way to address this?

Pg 7: The sensors were heated for quite long timescales in cold samples- did these long heating events cause any thermal properties changes in the materials? What was the total temperature change (in plot 4 it looks like 1.2K, was that a larger than average change or typical one) ? Especially in the case of the Agar-ice measurements, can you

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prove that there was no phase change?

Pg 8: Why aren't the scatters in table 1 reflected in some sort of error bar in figure 5? This seems to be missing information for figure 5 which could be used to plot maximum and minimum slopes in figure 5 and determine the error stated at +/- 15% on page 9.

Pg 9: Is fcal exactly 0.8? It seems like the slope should be a little more precise. Also, we have no explainantion why it is 0.8? Would 0.8 change if the length to needle radius change? Can you at least make a prediction? Line 9: I agree that the prototype sensors give higher values but why? Is there some theory or reference that would predict a higher value? This is a report of a measurement, but should make an effort to explain the measurement so that future probe designs can be improved on the guidelines of the work done here. Otherwise, I am left only able to use this paper if I happen to design the exact same probe. If I want to make any changes in the design, I would need to do all the work presented in this paper from scratch.

Figures: It appears there is a typo in all the figures with an accidentally capitalized "I". Please fix this. It would be nice to have error bars in figure 5

Interactive comment on Geosci. Instrum. Method. Data Syst. Discuss., 2, 685, 2012.