

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

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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-vacuum or vacuum conditions at even lower thermal conductivities than presented here. As environments like Mars and the Moon or asteroid surfaces

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appear to be the intended target for such instruments could you address how these probes might differ under vacuum, where glass beads might measure  $10^{-3}$  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: can 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  $\sim 2$  W/mK thermal conductivities, as ice typically has a thermal conductivity  $\sim 2$  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  $f_{cal}$  exactly 0.8? It seems like the slope should be a little more precise. Also, we have no explanation 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

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