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Geoscientific Instrumentation Methods and Data Systems Discussions

Interactive comment on "Influence of probe geometry on measurement results of non-ideal thermal conductivity sensors" *by* P. Tiefenbacher et al.

Anonymous Referee #2

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The influence of the geometry of different non-ideal thermal conductivity sensors is interesting and an investigation of such sensors is useful. The paper describes thermal conductivity measurements with sensors that deviate from the ideal line heat source. Further the calibration of one of those prototypes is explained. For this a commercial needle probe sensor is used as a reference. But there are some open-ended questions about the design of the prototypes. The authors explain in detail how resistance values can be converted to temperature values but not why only the middle one of three RTD sensors is used for the thermal conductivity measurements with the two prototype sensors. How much do the temperature values of the three RTDs differ from each other and can further information about the sample be derived from that additional temper-

ature values? Can the temperature difference give an estimate how much the results will differ from the one of an ideal thermal conductivity sensor? Is there an explanation why the thermal conductivities measured with the prototypes are most of the time higher than the values measured with the reference sensor?

Further the choice of some of the sample materials used for the measurements is not comprehensible to me. The measurements should show that the prototypes described give the same results as a commercial sensor if multiplied by a scaling factor. In this content I cannot see how measurements with materials like firn and limestone were no accurate reference values are known are used, specially limestone were only measurements with one sensor type could be done and therefore not even the values of different sensor types could be compared. And why where, in case of glass beads, the measurements of the two bigger grain size ranges only be done with the commercial sensor, how is this helpful in proving the functionality of the prototypes? The paper in general gives a good overview of a wide range of thermal conductivity values of samples with different structures, but some of the results don't prove that there is only a minor influence of the sensor geometry and might have been better presented in a different paper. One further comment: it is mentioned in chapter 6 that the temperature increase due to heating is not high enough to get phase change in case of frozen samples. I think there should be a short note about this already in chapter 4 when the first measurement results for frozen samples are presented. The question if there is any phase change arises already at that point.

Minor corrections:

Page 8: The list of parameters is not necessary, except of P all parameters are explained already and P is not mentioned in the paper, the heating power is always given by I and R

Page 12, line 27: a length of 150mm and a diameter of 1.5mm lead to a length-to-diameter ratio of 100. I guess the authors mean the ratio of the length of the heated

segment to diameter which is 66.

Figure 7: top right: the red, green and black lines can hardly be seen. Bottom left: in the picture the green line is labelled nonlinear fit, in the figure caption the green line is labelled linear fit, this needs to be corrected. I suggest this figure to be enlarged.

Table 2: there are two different k-values for agar ice and water ice, according to your description it should be the same one.

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