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**Atmospheric Measurement Techniques Discussions**

# *Interactive comment on* "Fast-response high-resolution temperature sonde aimed at contamination-free profile observations" *by* K. Shimizu and F. Hasebe

**Anonymous Referee #1**

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The current paper discusses the performance of a newly developed temperature sensor for balloon-borne highly accurate temperature profile measurements. This exciting new technology is very relevant to current ongoing discussions in the community with respect to upper-air measurement uncertainty for CAL/VAL or climate monitoring and therefore merits publication. It fits very well to the scope of this journal. The paper is well written, the presentation is elaborate and the conclusions are generally traceable. Some details however need clarification. The issues raised below are mainly meant for helping to improve the overall quality of the manuscript with regard to comprehensibility.



*Major issues*

- Section 2 provides a theoretical discussion of the measurement method and derives the relevant time constant of the sensor. But it is not quite clear to me how this happens. At the end it seems that the time constant was measured in the lab and the presented formalism is not really used at all. The same holds for the radiation effect that was measured in the lab and not derived using equation (1). None of the relevant constants here have been discussed.

  The entire section therefore is more confusing then enlightening. It would be more appropriate to explain why this specific designed was chosen, what advantages to existing methods it promised and how the performance was tested in the lab and in the field. The formulas presented in this section might be useful to quantitatively explain the observed behavior, namely the independence of the time constant from pressure, and the radiative impact on measurement bias. In the current form, I don't quite see this connections.

  The content of table 1 should be explained in more detail in this section.

- Since a large extent of the discussion of the measurements depend on the GPS data it would be worthwhile to explain in more detail how this data is obtained and how accurate it really is. Questions that should be addressed are:

  - Is the GPS generally accurate enough to resolve the small scale motion of the radiosonde. Are there possible delays between the GPS time and the time stamps from other sensors, in particular the temperature measurement?
  - The observed pendulum motion seems to have a rather large amplitude. Is that realistic? Are there possible biases that might affect the scale?
  - Does the pendulum frequency match the expected value (to the first order: $f = \sqrt{\frac{g}{stringlength}}$) ?

- It impresses that measurements of the air temperature inside and outside the balloon have been made. This demonstrates that the authors tried everything to improve the understanding of the result of their measurement. It would be great if more details about these measurements were provided. Where exactly were the sensors located? How was the skin temperature determined? Please also discuss the results of these measurements in more detail.

*Minor issues*

- page 3295 line 24: I don't think there will be sensors free of a radiation effect, at least none of this kind. So the better way to put it would be something like: " ... a sensor with a radiation bias that is small (or negligible) with respect to the desired overall measurement uncertainty ..."
- page 3301, line 18: Please provide time zone (GMT + x)
- page 3302 line 12: Of what magnitude are these angles in the considered cases?
- page 3308 caption of table 1 second line: The term "error" seems inappropriate here, what is meant is most likely the bias (or "systematic error") caused by the radiation.

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Interactive comment on Atmos. Meas. Tech. Discuss., 3, 3293, 2010.