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Hydrology and Earth System Sciences Discussions

Interactive comment on "Assessment of a vertical high-resolution distributed-temperature-sensing system in a shallow thermohaline environment" *by* F. Suárez et al.

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General comments: This manuscript presents a method to, in their words, "manually calibrate temperatures along an optical fiber". Since this measuring technique is more and more used in hydrology it is of high relevance and therefore potentially worth publishing. However, there are a couple of things that need more attention:

Especially the calibration and verification (section 2.1.3) should be better explained since this is the main objective of the paper. I miss an exact explanation of the method the DTS software uses and I had problem in understanding which known temperatures are used during which step. Since others may want to reproduce this exactly, when cal-

ibrating their measurements, I suggest writing each step of the calibration procedure, without leaving gaps or room for misinterpretations.

A lot of attention is given in describing and explaining the temperature gradients in the solar pond (already in the introduction). However, it is 'just' a case study to demonstrate the calibration procedure and to show the advantage of DTS measurements above classical temperature observation techniques. It is outside the scope of this paper to explain in detail how and why the different temperature layers behave the way they do. See the specific comments which parts I suggest to shorten or eliminated.

My third general comment is that I miss a short sensitivity analysis: what happens when z1 and z3 are switched, or when T(z1) is the average of only 10m etc. These are things that can be done with the same dataset.

Specific comments:

Abstract: first describe the objective of the paper (as in line 13-16) before describing the case study. Emphasize that native and manual calibration methods are presented.

Introduction:

General: Keep a little bit broader scope in the first two paragraphs. Don't focus too much on the solar pond yet, but give more examples of the use of temperature in hydrology, such as vertical upwelling or downwelling water (see for example Constantz 2008). Clearly point out which studies used DTS and indicate what is lacking in their study to prepare the reader for the objective of this study.

P31 L18-23: This part should be in the methods sections

P32 L1-11: Shorten this part. Leave out all the detail and only tell that they wrapped a cable around a pole to obtain higher spatial resolution, and that radiative heating influenced the measurements

P32 L16-25: Same as previous comment: skip all the details.

P33 L3-14: Leave out. Just describe the case study briefly after the objective.

P33 L13-17: Eliminate: you have pointed out the need for higher spatial resolution before.

P33 L17-23: Again: don't go too much in detail, but describe in the methods section instead.

P33 L23-29: Indeed, this is part of the problem!

P34 L3: skip "vertically wrapped". The objective is also valid for non-wrapped cables.

P34 L10-13: add a short description of the case study.

P34 L21: I suggest combining section 2.1.1, 2.1.2 and 2.2 and calling it 'Experimental setup'

P34 L23: Does this mean that there are 2 fibers in 1 cable?

P36 L1: If you only used the single ended measurements, why did you employ a multiplexer?

P36 L5: 'we did not have damaged or strained fibers': There are a couple of splices in the cable that have an effect on the signal

P36 L16: Write the equation as a numbered equation to make the methods more clear: this equation is needed in Eq 2-4 again.

P36 L21-24: The native calibration also uses Eq 1-3, right? Explain how gamma is determined, and which points of known temperature they use. Are alpha and C determined for each time step or a priori (I think both are possible).

P37 L15-25: This should be in the section 'experimental setup'.

P38 L16: I would leave this section out, or much more detail about the calibration of a double ended measurement should be given. But since the main focus is on single ended measurements, I would leave this out.

P41 L12-13: It is clear that you use the average temperature over 10-25m, but which values of z1, z2 and z3 are used in Eq. 2-4? Also add a sensitivity analyses for different z values. For example: How are the temperatures influenced if z1=10m compared to z1=25; what if T(z1) is between 10 and 15m and T(z2) is between 20 and 25m; What if z3 = 30-45m etc.

P42 L23: As said before: I would leave this part out.

P44 L2-11: Shorten this part, because in principle this can be done with classical sensors as well. Just emphasize the main advantages of DTS above classical sensors (as is shown in Fig 5).

P44 L13-26: Leave this part out. It is outside the scope of the paper.

P45 L22-29: Outside the scope of the paper.

P46 L19-21: Leave out the sentence: 'This erosion . . . 2010a).'

P47 L21-22: leave out 'and zenith . . . 2010).'

P48 Summary and conclusions: Emphasize the advantages of DTS above classical T sensors and tell the difference in performance between native and manual calibrated temperatures.

Figure 1a: The picture of the constructed DTS pole does not add any information. Either put in another picture (maybe with a detail of splice 2) or leave it out. Figure 3c: zoom in to better show the differences between manual and native calibration. This is important, because the current figure doesn't convince me to put more effort in manually calibrating the signal.

Figure 4b: leave out, this is outside the scope of the paper.

Technical corrections:

P31 line 2: what kind of other practical limitations?

P31 L24: 0.01 degree C can be achieved when averaging over 30 min

P34 L2: skip 'main', unless there are more objectives.

P36 L3: change 'the presentation of' into 'to present'

P36 L12, 13 and 17: add units for DeltaE, k and Is

P36 L26: I wouldn't call it 'manually calibration', but something like improved or extended calibration.

P38 L11: a single trace is 1 measurement, right?

P40 L9: Is Fig. 2b obtained with the native or manual calibration method?

P42 L25: Are both single and double ended measurements calibrated with the native method?

P46 L22: give 'the radiative heating experiment' a different name, or change it into 'The effect of radiative heating is shown in Fig 6.'

P48 L6-7: Change 'not only in understanding the physics of solar ponds or other thermohaline environments but of the majority of shallow water bodies' into 'in many hydrological applications'.

P48 7-8: leave out

P48 L14: 'present' should be 'presented'

P48 L22: Add: 'In our experimental setup, radiation absorption was found. . .'

Table 1: Are these results of the native calibration?

Figure 1b: indicate the locations of z1, z2 and z3

Figure 2: indicate the locations of z1, z2 and z3 and indicate which calibration procedure was used to obtain Fig 2b.

Figure 5: Also indicate here which calibration procedure was used.

Figure 6: Also indicate here which calibration procedure was used. Looking at the noise below 50 cm (Fig 6b), I guess it is the native calibration, since the noise seems larger than 0.035 C.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 29, 2011.