ter Horst and coauthors describe the design strategy, their own implementation, and experimental validation of a novel technique for distributed temperature sensing (DTS) at unprecedented resolution with a tightly wound fiber-optic cable. They take an opensource approach, with design instructions and laser file generation freely available, which I find especially admirable for a project like this which could feasibly be kept proprietary and marketed as a private instrument for sale. Overall, I think the instrument is useful and well designed, and in my review I hope to elevate the reach that it could have to the many communities that surely need finer resolution temperature measurements. After minor revisions I can support the publication of this work.
*I will start my review by saying that I am not a regular reader of *Atmospheric Measurement Techniques* which I think is relevant based on some of the feedback that I have about writing style and target audience.*
We thank you for your peer review on our manuscript. We appreciate the encouraging words on the applicability of the method we have developed. We have addressed your suggestions and discussed them below. If a comment has been highlighted in green, this means that it has been directly implemented in the manuscript without the need for further comment.

Specifically, my two major points of feedback are:
1) The article is too fixated on a single use case for the instrument. I am aware that this use case for measuring near surface air temperature in a short canopy is particularly relevant for the readership of the journal, but I can imagine the instrument being useful in so many different ways, and you do mention a few of them (e.g., L82-84). To name a few that would be relevant in my work in the cryosphere:
a. soil temperature
b. snow temperature (gradients particularly important for avalanche forecasting)
c. sea-surface temperature gradient (set up this platform on a floating bouy)
d. sea-floor temperature gradient
e. ice-shelf front (temperature gradients and micro-currents are extremely important for understanding melt and currently poorly understood).
The point here is not that you need to fully describe every possible use case, but your introductory content should not limit the scope of possible uses. Lead with a paragraph that is generally about how there are often very strong temperature gradients at natural material boundaries but those are generally poorly measured (which is true), then describe DTS in the way you have and reserve and finally that you chose one relevant case as field validation which happened to be this grass canopy environment.
Indeed we have mentioned some other applications in other regions (e.g., L82-84 and L417-L420). However, we explicitly choose to keep the current narrative on account of the journal in which we aim to publish and our own expertise on the interpretation of these observations

2) The manuscript feels like an instruction manual rather than a scientific article. That may not be a terrible thing, especially for this journal (as I said I am not a regular reader), but it may be a bit dry for a lot of readers. If you choose to limit the instruction manual feel, my suggestions would be to:
a) Cut down the design section in favor of the reader's attention on subsequent

sections which I do think feel more scientific and narrative driven.
b) Turn the lists for threshold and optimization criteria into a table or schematic.
c) Remove some of the overly specific details such as this sentence: "When the desired cutout path is achieved, the file is exported in an .SVG file." I don't think that the file type is particularly important in a narrative style article but would be important in the instruction manual. I give some other similar examples in the line items below.

We agree with the fact that some parts of the design section dive into too much detail, which should indeed be left to the instruction manual. Some overly specific lines in this section have been deleted or simplified.

Also, we agree with your suggestion to reformat the criteria into a table. They are now presented in a more organized way.

I also think it would be neat if you had a fun name for this device, and could consider including that as a part of your title. You call it "the coil" or refer to "the design" and "the frame" throughout, but it would capture the attention of more readers if you had a strong name for the design/devise. Something like:
Fine Resolution Adaptable Distributed Temperature Sensing (FRADTS)
Ha, I don't know, just an idea.

Indeed, we have thought about a suitable acronym for a long time, but did not come up with anything both catchy and meaningful. It is difficult to find an acronym that encompasses so many different terms 🙂. However, we really liked your suggestion for and decided to include it in the manuscript. The method is now referred to as FRADTS and most instances of 'the method' have been replaced by 'FRADTS' (not all to avoid being repetitive in some sections. Note that this is the name for the method as a whole (as that is what we are presenting) and that we still refer to 'the coil' where just the physical frame is concerned. Finally, as some key words are missing in 'FRADS' that are important to the method, we chose to not use the acronym for the title of the manuscript, but rather introduce it later in the text. It is however mentioned in the abstract.

Title - "parametric" is sort of jargon-y in the sense that you are using it and pretty much means the same thing as adaptable.

We do agree that these two terms convey similar concepts. However, we prefer to keep the term 'parametric' as it stresses the fact that this design is centered around a parametric design script. Many different physical parameters can be quickly adjusted. We believe that "parametric" conveys this concept a bit better than "adaptable".

L8 – "down to" instead of up to?

L8-9 – This sentence about the laser cutout path needs something to make it clear that it is for creating the instrument frame. Something like: "Our method uses a parametric script to specify the laser cutout path for the instrument frame components are assembled in a coil-like structure to hold the DTS fiber."

L10 – "different" and "identically reproducible" are close to each other in an awkward way. I would say that the parameters can be changed to "customize the design" and always in a reproducible way.

L16 – Successful based on what? Specifics here will be more convincing to a reader.

Overall, I would say the abstract should focus more on your FAIR approach and how that could make the product useful to many communities, and don't lead with thermal properties of the grass environment, save that for your description of the field test case.
We have decided to fully rewrite the abstract, taking into account this comment and that of other reviewers.

L106-107 – The numbers 5 mm and 2 mm seem arbitrary here. Is there a physical reason you chose those (i.e., based on the environment to measure)? Or this is just a reasonable goal and you believe your design wouldn't be a sufficiently significant improvement from other methods if this prescribed resolution were not met.
Indeed, the 5 mm and 2 mm are somewhat arbitrary, as they are not derived from anything physical. As stated in your comment: we believe that we can speak of a significant improvement over older methods if these requirements are met.

We did add a line:
"... accuracy required for the application at hand. For the application presented here, steep temperature gradients in a grass layer, we set the minimum requirements at 5 and 2 mm, respectively."

L120-121 – That the temperature measurements should be consistent with the temperature of the medium feels like it should be a threshold criteria to me, perhaps because of how it is phrased? If you dropped this sentence (or moved it to threshold) then the rest of this bullet makes it more clear that you are want to 1) minimize thermal mass to lower the equilibration time of the intrsument and frame to the temperature of the medium, and 2) minimize the conductivity so that the frame is not moving heat across the temperature gradient you are trying to measure.
The suggestion is very well phrased and explains the concepts well. We therefore chose to add it to the criterion. We do however believe that this criterion is best categorized as an optimization. For example, figure 3 clearly illustrates that an optimization is required to attain the best material for the design.

L131-132 – Can you give estimates for cost and fabrication time here? "minimized" is vague.
When setting up criteria, we aim to be specific and brief. Giving examples or estimates within a criterion will move it towards the threshold category, as a certain cost or fabrication time may not be exceeded. Rather, we prefer to say that we try to keep these aspects as low as possible in the design.
We understand that 'minimized' may be associated with a mathematical optimization, which is not done here. However, we feel this is the best way to phrase optimization criteria

L135-139 – The description of laser cutting is wordy and not really needed here. Just a brief statement that you have open source laser cutting files and maybe a reference to the laser cutting technique if that exists, those would suffice.
We believe this section to be important in developing an understanding of the methods used. Especially since this is the central technique around which this method revolves, we prefer to keep this section, in spite of the fact that it may be slightly wordy. Finally, many sentences

such as "Laser cutters are available at most modern workshops and makerspaces" supply direct proof of the fact that the accessibility criterion has been met, which is important to explicitly state.

L170 – Just call it the "threshold criteria" since you set that up above, no reason to change to new language for "discrete constraints".

L181 – "we" not capitalized

L181 – "generation" and "generates" feel weird together, and what is a "new generation script" anyway, just say your approach is novel.

Equation 1 – I didn't fully appreciate until getting to here that you are treating this as a 1-dimensional measurement. That is, that the temperature variation within one coil wrap is effectively averaged over because the along-cable resolution is more like 25 cm, as you say in the abstract. It may be worth more plainly stating this and the assumptions that go with it (i.e., that you are looking for scenarios with a strong temperature gradient in only a single direction).
We've specifically added "one-dimensional" to the first criterion to further stress the fact that we are only measuring temperature along the vertical.

L192 – "[of] a given step"?

Table 1 caption – Restate "cable height" with the 1000 mm to make it clear that is what you are talking about (third sentence).

1.25 mm resolution along the cable? Is that true or am I misunderstanding what you are stating here? In the abstract you say 25 cm.
Indeed you are right that this is a typo. Thanks for catching it. It has been corrected.

L196 – I don't think that this sentence adds anything of substance. Describe the fabrication and installation and the user can decide for themselves whether it is simple or if they will need some patience.
We have slightly shortened this sentence to take away some unnecessary text. However, we disagree that this sentence is not important. We aim to stress that any researcher can build such a setup without the need for great technical skills. We believe this point to be of great importance, as otherwise readers may be dissuaded from trying this method in their own groups.

L204 – How important is it that the winding is consistent or at a specific tension? Does the cable need to be precisely lined up with the wrap above and below it?
While these aspects are generally important, the design makes sure of all these things already. This is due to the notches on the ribs which ensure proper alignment. Furthermore, tension merely needs to be sufficient for the fiber to stay on the coil, which is very obvious while winding the coil. We therefore chose not to explicitly state these things as they are not important to anyone wanting to create a coil.

L208 – I would save this reference of Figure 5, and perhaps even the mention of the

field test, for section 3.2. It feels weird that Figure 5 comes before Figure 6.
The aim behind figure 5, and the setup description section as a whole, is to describe all details pertaining to the physical construction and setup of the coil, before doing any measurement. Figure 6 illustrates the configuration hooked up for measurement, which should logically come only after the physical installation in our opinion.

L249 – CESAR acronym never defined

L262 – Interrogator malfunction? Or?
Unfortunately, the exact cause of the malfunction is still not known to us. During the surveying period the DTS machine would occasionally shut down. As with many things, a software update seems to have fixed it :)

L264 – the statement that "the data is still considered sufficient for validation" would be stronger if it was explicitly linked to the next statement: "sufficient for validation because…"

L272 – Is that described in Figure 5? Maybe include some annotation to make it more clear what you are talking about here.
"Described" was not the correct word to use here. We have changed it to 'depicted' to more closely match the intended meaning.

L315 – Is this parenthetical exclamation intentional? I am not sure it is appropriate for this writing style.
We were not sure to include it, even amongst ourselves. It was intended to stress the remarkably large amount of data within the canopy. However, we realise it is more appropriate to leave out the exclamation point and have removed it from the manuscript.

L319 – is the bold intentional?
Same as the comment above

L327 – WMO acronym not defined

L332-334 – The measurements are also significantly more variable than in the non-rain case. Do you have a simple explanation for that?
We were quite shocked to find that, even after multiple rounds of proofreading, the panels in figure 9 were swapped. We highly suspect that this is the reason for this, and other comments. Our apologies for this error.

To specifically address this comment: variability in the radiation case is very high as a horizontal temperature gradient exists on the coil. This is an effect that is not present with rain, as those effects are not horizontally dependent.

L339 – These can be removed, agree, but presumably you would agree that the vertical support structure has the same effect as the horizontal rings and that is much more difficult to remove (also possibly more problematic as it moves heat in the vertical as you mention).

Indeed overall biases, as created by the vertical support ribs, are much more difficult to filter out than the artifacts. We believe we addressed this issue with the following line:

"Hence, it
is recommended that coil observations are accompanied by traditional (shielded) temperature and radiation observations as to
estimate the magnitude of potential biases."

L346 – I am confused about this discussion on horizontal variability since I see more variability in 9a than 9b and that was not mentioned.

Again, this is a result of the swapping of figures.
Once more, our apologies for the confusion.

L353 – but at 1.5 meters it is an extrapolation instead of a true measurement, correct? Need to say that if true.

Indeed we will work to make this more obvious. We will redo the plots and change from a blue point to a dotted line for the extrapolations.

Figure 2. You say that fiber position and spacing is accurately defined "as can be seen in the image", but it is not entirely clear what you mean by that. You are saying that the spacing between fiber wraps is consistent? Maybe some annotations on the image here would be helpful.

We've added to the figure caption:

"The distance between the fibers is very consistent, meaning that its position is precisely defined."

Figure 6. It is not entirely clear how you are extracting the location of maximum gradient from the temperature data. You calculate a numerical gradient between points and select the maximum? And how are the uncertainty bars which you plot calculated? Adding a 1-d temperature plot that indicates the maximum gradient might be helpful here.

The following was added:

"The position of this large gradient can be found by calculating the numerical gradient and tracking the spatial position of its maximum."

"The mean absolute error is taken to be the positional accuracy of the configuration."

To avoid cluttering the already crowded figure, we decided against including another panel. Rather, we prefer further clarification in text, as was done by the aforementioned lines.

Figure 7. More notes and annotations added to the figure would be helpful. For instance, it is not immediately obvious to a reader what is night/day so adding annotations for those would help them see that instantly, also that the horizontal scale between (a) and (b) is very different. Add an arrow pointing out the very thin insulated layer in the grass at the bottom of (b).

We would argue that the time scale under the plot is sufficient for the reader to assess when night/day occurs and to get a sense of temporal scale. We chose to add a small note in the caption. Furthermore, we believe the bright yellow indication of an insulating layer is sufficient to draw the readers attention to this region. While we understand your comment, we prefer not to clutter the figure.

Figure 8. Am I understanding correctly that the large blue dot at the top of the grass is a measurement but that at 1.5 m is the extrapolation? If so, I would suggest plotting them differently. Perhaps consider plotting the full line that you are extrapolating, from your measurements to 1.5 m continuously.

As mentioned before, the plots will be changed to a dotted line for improved clarity. As you mention, this communicates more clearly that we are extrapolating data.

Figure 9a. Is the anomalous gradient at the top of your profile one of the “spike-like” artifacts caused by the rings? That one is particularly prominent and warrants more description.

This effect arises as a result of radiative effects. We see the spread in temperatures (which are a result of a horizontal temperature gradient due to half the coil being shaded by itself) decrease towards the top of the coil, as the sun hits both sides of the coil here. The height at which this happens depends on the solar zenith angle. At the top, the temperature profile dramatically dips to a cooler temperature at the top, as a result of the top support ring. This effect is explained in the manuscript as follows:

"Furthermore, a spread in the data is observed, which is caused by a horizontal temperature gradient on the coil. This gradient results from one side of the coil being irradiated while the other side remains shaded. The spread effect diminishes toward the top of the coil, where both halves absorb radiation due to the angled incidence of solar radiation."