Thank you for taking the time to review our manuscript. We have replied point by point below (comment in grey, reply in black).

In this study, the authors introduce a DTS-based soil temperature probe which allows for the estimation of thermal diffusivity at high spatial resolution. I found the paper to be interesting and well written. I enjoyed the fact that the design of the probe is open-access. I found that the results of the DTS system compared to reference sensors are consistent and promising.

I only have a few comments and questions :

- *The authors claim that " It was possible to determine the thermal diffusivity of the soil in resolutions down to 2.5 cm". Could the authors explain where this "2.5 cm" interval comes from ? What is the spatial sampling of the DTS measurements ? and how do you determine the position/location of the temperature point measurements around the probe ?*

  Please see our answer to the next comment for the question on the resolution.

  The determination of the vertical positions of the temperature measurements is explained in L. 158 – L. 165. We could not study the location of the points on the horizontal plane (e.g., the north or south side of the probe) as we do not have a sufficient spatial resolution to do this.

- *A crucial consideration is the spatial resolution of DTS measurements.*

  First, I find that the manuscript does not clearly take into account the difference between the sampling and the spatial resolution (10.3390/s20020570; 10.1029/2008WR007052) (what is the performance of the DTS unit here ?)

  Then, I wonder how the spatial resolution of measurements affects the results ? The collected data at sample spacing is not truly independent of their adjacent samples. Here, considering the size of the probe, the issue should be addressed.

  We indeed did not include sufficient information on the spatial resolution of the DTS measurement and the probe in the manuscript.

  The DTS unit used is able to sample at a 25 cm resolution, and has a spatial resolution of ~65cm. The diameter of the fiber groove is 80 mm (Fig. 1c), which leads to a circumference of ~250 mm. Thus we have a vertical *sampling* resolution of 1.0 cm, corresponding to a vertical spatial resolution of 2.6 cm.

  With this vertical spatial resolution of 2.6 cm we are actually *not* able to determine the thermal diffusivity of the soil in resolutions down to 2.5 cm as we stated before, as we need three independent measurements. The actual spatial resolution of diffusivity is thus ~8 cm. We will correct this in the manuscript and add the information on the resolution of the probe to the revised manuscript.

With a higher resolution DTS machine (e.g., the Ultima-S), the vertical spatial resolution of diffusivity can be as low as 5 cm. We sadly did not use this device in this study.

- *L. 237 "For the DTS probe data we chose to estimate the diffusivity over increasingly large intervals, from a 2.5 cm wide interval near the surface, to a 10 cm wide interval near the deeper measurement points". Could you show the results for each interval ? It would be interesting to see the differences. Why did you decide to present the results with a 5 cm interval (Figure 8) ?*

  We chose to aggregate the diffusivity to ever larger intervals for the deeper measurements, as the gradients become smaller over depth. With smaller gradients it becomes more difficult to accurately determine the diffusivity due to measurement uncertainty. To overcome this worse signal-to-noise ratio we chose to aggregate. However, if the diffusivity is determined over a longer interval the spatial resolution can be increased, at the cost of temporal resolution. We will explain this in the revised manuscript.

- *It seems that results are not consistent in the first cm of soils. Could it be due to the spatial resolution of DTS measurements ? The temperature measured near the surface also depends of temperature measurements outside the soil.*

  The near-surface measurements of diffusivity could indeed be slightly influenced by the spatial resolution of the measurements, due to the 2.6 cm spatial resolution of each measurement point. This means that the data point at -2.5 cm will still be influenced by the temperature at around -3.8 cm, which could be above the litter layer. We will add this caveat to the revised manuscript.

Minor comments :

- *In streams, some studies already proposed to wrap the FO cable (1016/j.jhydrol.2009.10.033 ; 10.1029/2011WR011227)*
- *In completement of Bakker and des Tombe, you should cite 1029/2020WR028078, as the study includes the estimation of thermal conductivity.*
- *Concerning references, I have the feeling the most references are works of teams from The Netherlands. It would worst strengthen the past literature (https://doi.org/10.1016/bs.agron.2017.11.003)*

Thank you for providing these references. We do have an unintended bias towards works from the Netherlands, and adding the references provided will improve the manuscript.