Author Comments to Referee Comments #1:

We thank the referee for thoughtful comments that will improve the clarity of the paper. We address each of the comments below, with more detailed responses when appropriate. Reviewer comments are in black text with our responses in blue text.

The manuscript describes the promising development of a low-cost, fast-response tunable-diode laser spectrometer for measuring water vapor in the atmospheric boundary layer. As the instruments hard and the software design is based on readily available components, lightweight, and energy-efficient it can be easily reproduced and exhibits a broad spectrum of potential atmospheric measurement applications. The laboratory calibration and first atmospheric measurements show a high accuracy and precision of 10 ppm at 10Hz allowing for sampling with high spatial and temporal resolution.

Thank you. We are excited about the new instrument and feel that it is important to share sufficient details so that others who are interested may be able to build a similar one.

General:

- The consistency of naming should be improved throughout the manuscript. Some names are changed multiple times as an example: Teensy = Teensy 4.1 = data collection microcontroller = receiver. Also introduced acronyms should be used or left out. More consistency here would be very helpful.

These are noted and will be rectified throughout the manuscript.

- The quality of language/sentence syntax should be improved. Many typos, slips of the pen, and complicated/convoluted sentences.

Thank you. We will proofread the manuscript with an eye on improving the readability.

- The plotting ticks should be changed using to a more standard style as they are confusing that way. E.g.: Fig 5, yaxis highest tick should be 30, above the axis a common coefficient with $1x10^{-3}$.

The figures will be modified to be more consistent with other recent publications in AMT.

- Also cross check references if missing and use correct citation style: Textual citation XXX et al. (YYYY) vs. parenthetical citations (XXX etl al. YYYY)

In-text references will be changed to address this issue and use textual citation when appropriate.

2.1 Hardware Description

- The captions of Fig.1 to Fig. 3 should be extended to be self-explanatory and not reference to the text.

For example: Fig 1, please explain the different components shown: are drive input and TEC input circuits by themselves, how does the TIA look, are the laser driver and data collection unit the two Teensy microcontrollers…

The figure captions will be expanded or modified to stand alone and not reference the main body of the paper. figures in the caption to explain more of what they depict.

- L 103: The laser *wavelength* is tuned via temperature?

This statement will be improved.

- L 105: add ± before 0.002 K

Thank you; ± will be added.

- L 127: adapt trigger pulse direction in Fig 1. From driver to data collection if the text is correct

This will be corrected in the figure.

- L129: After 5V reference to figure

This reference will be added and describes a custom circuit whose location is depicted in figure 1.

- L 141 – 146: Please clarify: Was the laser collimated or divergent? How much bigger is the laser beamwidth compared to the InGaAs sensor active area? Have there been any tests regarding vibrations? (Even collimated laser beams show a distinct Gaussian profile which could induce signal variations upon vibration)

Thank you for this important comment. We will clarify the approach. In fact, the collimating lens can be adjusted to expand the laser beam to more fully illuminate the detector. In this case, it would be divergent. We also performed tests with a collimated beam and found that the sensitivity to vibration was greater with more collimation. While this is not necessarily surprising, the main goal of this paper is to provide other practitioners with sufficient details of the electronics and control software so that they can develop their own systems for other applications. We used a simple lens/detector optical arrangement to prove that the method was both accurate and highly precise. It was mounted on a bracket that virtually eliminated vibration, and so the measurements did not experience noise due to vibration. A more flexible optical mount would, in fact, be more sensitive to vibration and we advise the experienced practitioner to design the optics with care. There are multiple examples of different optical designs in the literature, and we have added a few to the reference list.

- L 149: Syntax wrong or double sentence

This will be corrected.

2.2 Spectral Processing

- L 163: please cross check values on where the offset/drift is determined 30 & 20 points vs. 10 point in fig 4 caption.

This inconsistency will be addressed, and the figure caption will be corrected.

L 165 – 169: This part requires more clarification on how to convert scan steps into wavelength.

We agree. Although it is a straightforward process, it is relatively detailed. We will expand on this description.

- L 170: What do you want to say with the "[..] are then placed in an array?

This sentence will be deleted as this level of detail is unnecessary.

- Fig4 (b) Unit should be wavenumber

This will be corrected.

3. Results:

- Fig 5: Does the x-axis represent values measured by the Picarro or converted values from the TDLS?

  Please also state the lin-regress function parameters (slope, intercept, $^{r2)}$ or a plot of the converted H2O-ppm from TDLS over H2O-ppm measured by the Picarro together with a 1:1 line and respective regression slope. Similar as for Figure 8 (b)

Information for fit parameters will be added to figure 5 caption. X-axis represents values measured by Picarro.

- L 216 – 220: This part needs more clarification. Was a different InGaAs sensor used for the calibration of the instrument than the actual measurement? That could yield a different conversion coefficient.

Thank you for pointing this out. We used multiple detectors throughout the course of this work, and we will clarify our usage of detectors in this work.

L 239: Wu et al 2015 citation does not present in references

The citation to Wu et. al 2015 will be added.

- Fig8 (a). Please convert the x-axis to actual time in UTC

Time will be converted to UTC.

- L 278: Doesn't the averaging over 30s smooth all variation on a spatial scale of 1.5m? Hence I am not surprised that that values align even the locations had a 1.5m separation.

We agree, and we will add a short statement to this effect.

Some Typos:

- L 104: remove dot after "([…], MT)"
- L 111: add quotes " after receiver
- L 122: resister -> resistor
- L 209: remove dot after "(black points)"
- L 256: lowercase a before 25-m long
- L 298: Remove dot after power
- L 320: mission word(s) after water
- L 325: Either tested or powered
- L 333: remove with before TEC
- L 337 delete "configuring for use"
- L 342: ABL was already introduced in the introduction

Thank you for the careful review of the paper. These typos would be corrected.