Justification of Changes

Note: Unless noted, line numbering refers to original document in AMT Discussions. "New" line numbering refers to the track-changes pdf version of the document.

Per: Referee #1 (response in red)

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.

We have corrected the use of acronyms throughout. "Atmospheric Boundary Layer" has been defined once and used throughout the manuscript. "Tunable diode laser spectrometer" has been defined once and used throughout as the name of the developed instrument. Labeling of Teensy microcontrollers have been clarified.

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

We have corrected a number of typos and some sentences to improve the quality of the paper. They appear in the track-changes version of the revised manuscript and will not be listed in detail here unless the changes were significant. We will summarize any additional significant changes at the end of this document.

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 format of the axes for Figure 5 (as well as Figures 6 and 8) has been changed, as recommended.

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

We have corrected citation style for the following in the text:
L27: Santanello et al., 2018 moved to end of sentence. (New L29)
L28: Larsen et al. 2002 has been removed. (New L29)
L31-32: Fabry, 2006; Ogunjemiyo et al., 2002 moved to end of sentence. (New L37)
Couvreux et al., 2009 has been added. (New L36-37)
L41: Wulfmyer et. al 2015 moved to the end of sentence. (New L44-45)
L55: Miloshevich et al., 2009 and 2004 reversed. (New L61-62)
L58: "(Helbig et al., 2021; Petersen, 2016)" moved to end of sentence. (New L65)
L65-66: Multiple references combined and placed at end of sentence. (New L74-75)
L75: Multiple references changed to in-text citations. (New L84-85)

L114: Rainwater 2022 moved to end of sentence. (New L135).
L241: "(e.g. see Aslan et. al)" changed to "(Aslan et. al)". (New L294)

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…

Figure 1 caption (New L112-117) has been expanded to read the following:

"Schematic diagram of the new TDLS. Arrows represent the direction of information flow between individual components, including microcontrollers, laser, and temperature controller, or individual circuits, such as the transimpedance amplifier (TIA) and laser driver circuit. The components surrounded by the bold dashed line are contained on a single printed circuit board (schematic shown in Fig. 3). The output fiber from the laser is passed to the external optics through a FC/APC style fiber optic bulkhead coupler, and a twisted wire pair brings the detector signal back into the electronics box through a hermetic seal."

Figure 2 caption (New L155-159) has been expanded to include the following:

"Important elements of the TDLS laser scans as a function of time. The detector output (top panel) is the continuous voltage from the TIA. About one-third of the time the laser is powered off, and the signal is the background for the detector and TIA circuit. The laser drive (middle panel) represents the voltage output by the Teensy 3.6 used to set the current of the laser. A trigger pulse signal (bottom panel) sent by the Teensy 3.6 is read by the Teensy 4.1 to initiate sampling and recording of the scan."

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

This has been changed to "The laser is tuned to the wavelength of a strong water absorption feature at 1368.59 nm by changing the temperature of a TEC in the laser butterfly package…" (New L119-120)

L 105: add ± before 0.002 K

"±" has been added. (new L122)

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

Figure 1 has been corrected to be consistent with the text. Text at new L145.

L129: After 5V reference to figure

The old Figure 2 has been replaced with a new figure, now numbered Figure 3, which is a circuit diagram of the complete electronics used in the instrument. The following sentence has been added (New L143):

"A complete electronic circuit diagram of the instrument is shown in Fig. 3."

L155 has been changed to

"Alternatively, it can be run indefinitely from a 7.5 V (or greater) DC power supply, as well as either of the Teensy microUSB 5V inputs." (New L180-181)

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)

This has been changed to:

"The lens was configured so that the laser beam was divergent to fully illuminate the active area of a low-noise broadband indium gallium arsenide (InGaAs) semiconductor photodiode and reduce variations in intensity due to vibration and turbulent fluctuations of air density in the optical path. Several photodiodes from different manufacturers (FDGA05, Thorlabs; and FC1500, Fermionics, Simi Valley, CA) were used in this work at various times with no significant difference in results or performance." (New L164-170)

L 149: Syntax wrong or double sentence

Duplicate wording in L149 has been removed. (New L173)

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 has been changed to:

"Briefly, a small detector/amplifier offset is determined from 10 points at the start and 10 points at the end of each scan while the laser is powered off." (New L192-193)

The following sentence has been added to Figure 4 caption:

"The fit is made between the points highlighted in red (30 points at the start of the scan and 20 points at the end)." (New L239-240)

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

The following paragraph has been added:

"To account for possible drift of laser wavelength (e.g., the position of the absorption feature in a scan), the relationship between scan position and laser wavelength was estimated using a pair of closely spaced water absorption lines at 1373.3002 and 1373.2878 nm emitted by a similar model DFB laser centered on a different wavelength than the one used for the measurements in this paper. The position of this pair was systematically scanned across the full temperature range of a single current ramp by slowly varying the setpoint of the laser TEC temperature controller, and the spacing between the two lines (i.e.,

Δλ=0.0124 nm) was determined in units of scan index (e.g., see Fig. 4). A linear fit to the ratio of this spacing to the difference in scan index was determined as a function of scan position:

$$s(\mathrm{x})\ (\Delta nm/\Delta step) = 0.00052 + \mathrm{x}*5.00*10^{-7}$$

where s(x) is the change in wavelength per scan index (of the 445 points) and x is the scan index value. Using this function results in a near-constant line width as a function of wavelength if the position of the absorption feature shifts due to variations in laser baseplate temperature. Although such a shift was never observed in these experiments, it is a consideration for measurements in an environment where ambient temperature may vary significantly (e.g., by many tens of degrees). This method also allowed for the determination of the full width of the scan to be 0.279 nm for the specific scan start and end points and scan rate used in these experiments. (New L196-214)

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

We decided that this level of detail is unnecessary and so the following was deleted:

"The observed signal (i.e., Iobs(t)) and calculated background I0(t) are then placed in an array [i, Io(i), I(i)]." (New L214).

Fig4 (b) Unit should be wavenumber

The x-axis units in Figure 4b are now wavelength in nm, and we do not use wavenumbers in any part of the manuscript.

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, r^2) 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)

Fig. 5 x-axis label changed from "H_2O mixing ratio (ppm)" to "Picarro H_2O mixing ratio (ppmv)" and the following has been added to the caption of Figure 5 caption:

"Fit Parameters: slope = 0.0006, intercept = 0.0039, R^2 = 0.9999." (New L263-L264)

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.

The following has been added earlier in the manuscript:

"Several photodiodes from different manufacturers (FDGA05, Thorlabs; and FC1500, Fermionics, Simi Valley, CA) were used in this work at various times with no significant difference in results or performance." (New L168-170)

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

Wu et al. 2015 has been added to the references. (New L292)

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

Figure 8 x-axis has been 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.

Old L281: The following has been added.

"…including variability due to the CRDS inlet and optical cell being separated by 1.5 m." (New L335-336)

Some Typos

- L 104: remove dot after "([…], MT)"
- L 111: add quotes " after receiver
- L 122: resister -> resistor
- L209: 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

These have all been corrected in the revised manuscript, and are not listed individually here.

Per Referee #2:

Specific comments:

L8: First sentence could be restructured to remove redundancy of "high spatiotemporal variability" and "abundances varying…"

"The high spatial temporal variability of" has been deleted, and the sentence now reads:

"Water vapor in the atmospheric boundary layer poses a significant measurement challenge with abundances varying by an order of magnitude over short spatial and temporal scales." (New L8)

ABL should be defined here rather than L11, and then L11 could just use "ABL"

"Atmospheric boundary layer" appears first on New L8 in the abstract and again on New L26 in the Introduction, and the abbreviation "ABL" is used for the remainder of the text.

L8: "possesses" should be "poses" (or "presents")

"possesses" changed to "poses". (New L8)

L11: "in situ" is a Latin term and not hyphenated. I would think that you would want to include "open-path" in the description here since that is a critical aspect enabling the fast response time.

"Open-path added", and "in situ" corrected. (New L10 and L11)

L11: "tunable diode" is generally not hyphenated (although I see it also was in Dorsi et al 2014).

"Hyphen deleted"

L11: You define 'TDLS' first in the abstract as "tunable diode laser spectroscopy", but then use it and subsequently define it as "tunable diode laser spectrometer". Perhaps use "tunable diode laser

absorption spectroscopy" in the abstract since that is the technique utilized and then TDLS as the spectrometer.

The instance where "TDLS" was used to refer to the method has been removed (New L12), and we retain the abbreviation of the instrument as "TDLS" throughout.

L12: you only need to include the acronym definition here if you will use the acronym alone later in the abstract. Comment also applies to L16 and L21.

"(SWIR)" is deleted as it is not used in other locations in text. (New L12)

L16: "proportional – integral", as appears in L104 of the text

"proportional-integrating" is changed to "proportional-integral" (New L16-17)

L17: "comprised of" should technically be "composed of" or "comprises"

"comprised of" is changed to "constructed from" (New L18)

L18: perhaps "agreed"

"agrees" is changed to "agreed" (New L19)

L19: perhaps "will allow" and preface with something like "The instrument is robust and simple to operate"

"allows" is changed to "is robust and simple to use and will" (New L20)

L29: "tropics"

"Tropics" is changed to "tropics" (New L30)

L32: "underlying mesoscale processes"—meteorologically, mesoscale is typically 10 to 100s of km, which doesn't seem appropriate here

"mesoscale meteorological" changed to "micrometeorological" (New L34)

L39: "DIALs and Raman lidars" or "differential absorption and Raman lidars"

"DIAL and Raman lidars" changed to "differential absorption LIDARs and Raman LIDARs." (New L43)

.

L45: "such as infrared gas analyzers (IRGAs)"

"the" removed (New L49)

L46: "have come to" -> "are typically used to"

Change is made (New L49)

L47: it is really the cost (~x10, and for some applications the size/weight), not the limited number of vendors or some "highly specialized" nature that is the limitation, right? And potentially differences in required maintenance/recalibration? You expect the new TDLS to not require recalibration (does require initial calibration per L177) or regular maintenance, correct?

Text has been added or edited to address this point:

"These research-grade instruments, which are used predominantly at multi-instrumented flux towers and weather stations and tend to be expensive, often costing $20,000 or more. In addition, they can incur additional costs for factory service to maintain high accuracy. Consequently, their use in remote locations has been relatively limited." (New L50- 53)

"High-resolution in situ observations of H_2O are essential for numerical weather prediction and for investigations of the evolution of the ABL and its turbulence characteristics (e.g. large eddy simulations), and there is a need for more frequent measurements from remote locations (Helbig et al., 2021; Petersen, 2016). We report here on the development of an economical new fast-response laser spectrometer. The instrument is capable of high-resolution measurements of water vapor in the ABL while demonstrating high accuracy and precision comparable to that of commercially available research-grade instruments. Built from low-cost components that are readily available commercially, the instrument exhibits relatively low up-front costs with the ability to replace critical components, thus bridging the gap between the more expensive and highly accurate fast-response instruments and the relatively inexpensive, but slower response capacitive instruments." (New L63-72)

L57: "prediction"
L57: "capable of"
L60: "development and performance"?
L61: "high accuracy and precision matching that of" and "lower cost and greater flexibility that would allow widespread deployment for routine observations"

These changes are included in the new revised wording noted above (New L63-72)

L67: "laser diode"? and what is meant by a "generic" package since it does require built-in TEC and tight coupling of the fiber?

"generic" replaced with "common butterfly" (New L76)

L69: "components"? and "components and exhibits"

"technology" is changed to "components" (New L78)

L71: I'm a little skeptical of the emphasis on the use of the instrument by fully inexperienced operators.

"with research grade instruments" is changed to "in laser spectroscopy" (New L81)

L76: "2023), the reported instruments have had a slow response, resulting in limited vertical resolution"

This is changed to "the instruments used have slow response times, resulting in limited vertical resolution" (New L85)

L78: an example of a location?

We have added "remote land and ocean regions" and include a new citation to J. Brotzge, et al., 2023, a reference we have added to our list (New L88)

L81: what is meant by "terrain and variable inhomogeneity"?

At the recommendation of the Editor, this has been clarified to "large spatial and temporal gradients in humidity due to adjacent complex terrain that contributes to significant errors in latent heat fluxes derived from those measurements" (New L90-92)

L89: "based on" would be more appropriate

This is changed to "based on" (New L100)

L90: the clause "a schematic of which is shown in Fig. 1." currently references the previously reported (Dorsi et al 2014) instrument. The clause could be inserted immediately after "described here" in L89 to be clear.

We have changed to “An overview of the instrument is depicted in Fig. 1.” (New L108)

L92: “is rapidly scanned”; “variations, a short”

Changes are made. (New L103)

“(NLK1E56AA, NTT Innovative Devices, Yokohama, Japan)” has been moved to New L101-2 to improve clarity.

L100: Figure 1 shows the trigger pulse passing from the receiver microcontroller to the laser drive, but the text states that the trigger pulse for data collection originates from the laser driver board.

Figure 1 has been corrected to be consistent with the trigger signal described in the text.

L104: “TEC controller”

This change is made. (New L120)

L105: “temperature of 0.002K” should be “temperature of XX.XXX ± 0.002 K” or say “A temperature stability of ±0.002 K, consistent…”

“±” has been added (New L122)

L107: “DFB” should be “laser” (or “DFB laser diode”)

This is changed to “laser” (New L125 and L134)

L108: “a digital-to-analog (DAC) output” since the 3.6 has two, although the 4.1 does not have a DAC, so only from the 3.6 (although, as noted, now discontinued).

This sentence is changed to “If desired, a voltage from a digital-to-analog (DAC) output can be used for dynamic temperature control.” (New L125)

L110: “Arduino-compatible” hyphenated? But not “laser driving” or “data acquisition”

As recommended by the Editor, this sentence has been clarified. It now reads: “Two independent Arduino-compatible microcontrollers were chosen for separately driving the laser (a Teensy 3.6) and for data acquisition (a Teensy 4.1).”(New L127)

L111: “based on”

This is changed to “employ” (New L129)

L112: “previous instruments” developed in your lab? Or universally?

We have changed to “developed in our lab that employ the same measurement technique as reported here” (New L130-L131)

L117: “scans to ~10 kHz and faster, resulting in high precision of the measurements”—precision from averaging over multiple scans? Current operation is only 10 Hz (100 msec) scans? L320 says “tests showing that full scans over the water [line] at ~1000 Hz are possible” and that higher scan (measurement) rates result in reduced precision (for individual scans)

This has been changed to “up to 1 kHz” and “resulting in high-precision of the measurements” has been deleted. (New L136)

L120: Reference to Figure 2 is missing from the text (~L129?). Fig 3 is already mentioned on L126. Reorder sentences to put “Prior to…” after the circuit discussion? Would it make sense to

include Figure 2 in supplemental material? That would allow additional inclusion of the custom TIA circuit and supporting circuit board.

Based on this and the Editor's comments, we now include a circuit diagram of the entire instrument, now numbered Figure 3. The following has been added:

"The middle panel in Fig. 2 shows an example of a series of linear ramps used as the drive function, each consisting of 1366 discreet one-bit steps from 0.80 V to 1.9 V. This voltage is conditioned with an operational amplifier (LT1101, Analog Devices, Wilmington, MA) that controls the current required to scan the laser from a transistor (TIP 32AG n-channel transistor) in a textbook voltage-to-current converter circuit (Figure 6.31 of Horowitz and Hill, 1983). A complete electronics circuit diagram is shown in Fig. 3. The scan rate, current range, and a pause for background time are configured in software." (New L139-144)

We added Horowitz and Hill, 1983 to the reference list.

We have also added "The top panel in Fig. 2 shows the continuous output of this circuit." (New L173-174).

L129: "A Teensy model 4.1 with a built-in Micro-SD card feature was used…"; "a trigger pulse"

L131: ADC not defined at first use; "data acquisition analog-to-digital conversion (ADC) is started."?

L132: There is some discrepancy regarding the discussion of Fig 3. It says here that the plot contains 445 points, but the figure shows 4 complete scans. Figure 4 shows 445 points without showing a complete scan (~10+425+~10?). It would be best to clearly describe the sequence of one scan (475 points? 30 + 425 + 20?) and show the complete scan in Figure 4.

This paragraph has been edited for clarity. It now reads:

"Before the start of each scan, the Teensy 3.6 produces a voltage pulse ("trigger"), shown on the bottom panel of Fig. 2, that initiates the data acquisition and storage process on the Teensy 4.1. At this time, the internal clock is recorded into a buffer, and the output from the detector TIA is recorded onto a MicroSD card as a single scan consisting of 445 discreet samples at 12-bit resolution. Although the Teensy 4.1 samples at 300 ksps, we oversampled 32 times using a software function that reduces noise inherent in the analog-to-digital converter (ADC)." (New L145-151)

L132: How does the math for 7.2 kHz "raw" ADC work with 475 pts / 100 msec at 32x oversampling? Does 7.2 kHz already include the 32x and so is faster than the 4750 samples / sec?

The change described above should address this comment.

L144: omit "on the opposite side of optical path both operated in photovoltaic mode"? A following sentence begins "The photodiode is operated in photovoltaic mode"

The phrase "(either Thorlabs FDGA05 or Fermionics FD1500) on the opposite side of optical path both operated in photovoltaic mode" has been deleted. (New L165-L166)

L148: It seems like the "AD1101, Analog Devices" is actually "HMCAD1101"? I could not find a part at Analog Devices that was just "AD1101".

This is changed to "LT1013" (New L172)

L165: description here is “1st-order polynomial” while the caption in Fig 4 uses “linear fit”—these are indeed the same thing, but it might be clearer to be consistent.

This is changed to “linear” (New L194)

L166: It would be useful to have a little more clarity on the process of converting the temperature – wavelength determination to the current ramp scan to account “for the possible drift of the tune temperature by removing the nonlinear output laser wavelength response to a linear current ramp” and determination of the scan wavelength range.

New L196-214 was added to address this point (see response to Reviewer 1).

L182: Accuracy metrics of the BMP280?

We have added “with an accuracy of ± 1 % when compared to laboratory standards.” (New L226-7)

L187: Does “These calculations” refer to the real time processing that is planned for future implementation and not the present version that is the focus of the manuscript?

“These calculations take” changed to “Processing of spectra in real time takes” (New L232)

L190: The units of the x axis in Figure 4(b) are wavenumber, not wavelength as stated. Since wavelength is otherwise used consistently in the manuscript; I would suggest using wavelength here as well.

Units in Fig. 4b have been changed to nm (i.e., wavelength)

L190: In Figure 4(A), it might be helpful to use color on the trace to highlight the region of the scan used for the baseline fit. As noted in L132 comment, it would be clearer to plot a full scan including the 30 and 20 detector zero (laser off) points at the beginning and end of the scan.

“Points are colored red in Figure 4a to show which were used in the fit.” added (New L239-40)

L198: no hyphen needed between number and unit “25 L” even when used as an adjective.

Hyphen removed (New L244)

L200: “saturated to a mixing ratio of ~27,000 ppm”—was the air in the chamber saturated (potential condensation)? Or was the saturation temperature of the generator lower than the ambient temperature? What is/are the values (uncertainty) of the mixing ratio reported by the reference CRDS measurement rather than “~”?

This description now reads:

“The TDLS integrals were calibrated by sampling a range of mixing ratios in an unsealed 250 L Polycarbonate chamber from 6,970 ppmv to 25,700 ppmv as reported by a Picarro CRDS. The TDLS optical cell was placed in the center of the chamber, and a fan was used to ensure the chamber was well-mixed. The sampling line of the CRDS was aligned with the mid-point of the TDLS open-path cell and positioned just outside the path of the laser beam. A beaker containing warm water was placed inside the chamber to humidify the air to a value just below the saturation point at lab temperature. Over the next two hours, mixing ratios were reduced to 13,520 pmv by stepwise addition of relatively dry ambient air from the laboratory into the chamber. Values below 13,000 ppmv were produced by further dilutions using a flow of dry air

from a cylinder of Ultra Zero Air (H_2O < 2 ppm, total hydrocarbons < 0.1 ppm, Airgas, Dacono, CO).” (New L244-54)

L201: “admitted to the chamber”—also flow out of the chamber as well to maintain P?

We now specifically state the chamber is unsealed (New L244)

L207: It would be good to include information about the linear regression as text in Figure 5

The fit parameters (slope = 0.0006, intercept = 0.0039, R^2 = 0.9999) are now listed in Figure 5 caption. (New L263-4)

L209: remove period following “points)”; omit reference
L213: “Allan variance”
L222: sensitivity is not affected by averaging— “detection limit”?

Period and reference have been deleted. (New L261-2)
The hyphen has been removed. (New 265-6)
“sensitivity” has been changed to “precision” (New L275)

L256: Omit “A long electrical line”? This was replaced with the “10 m twisted pair cable”? No comma needed after “cell” or hyphens between numbers and units; the word “long” could be omitted.

This sentence now reads:
“A 25 m fiber optic patch cable connected the output of the laser to the collimating lens on the input of the optical cell and a 10 m twisted pair of wires brought the detector signal back to the TDLS electronics box which was housed in the shipping container.” (New L310-312)

L307: “Teensys”
L320: “tested powered”
L336: “include”
L342: ABL already defined in introduction

Now “Teensys” (New L362)
Changed to “successfully powered” (New L381)
Changed to “include” (New L393)
Changed to “ABL” (New L398)

In addition to the changes to address the referees’ comments, we have made the following revisions:

Minor changes were made throughout text to correct typographical errors discovered in final proofreading.

Figure 1 caption modified to: “The components surrounded by the dashed line are contained on a single printed circuit board (schematic shown in Fig. 3).”

Figure 2: The contrast was increased, and the acronym “GRIN” was deleted in the figure as it was incorrect.

Figure 4: The X-axis label has been changed to “Scan Index”

Figure 5: The units of the X axis have been changed to “10^3 ppm”. The units of the Y-axis (top) have been changed to “10^{-3} nm”. The Y axis on the top panel was rescaled to reveal

one data point that was missing in the original figure.

Figure 6: The Y-axis (top) changed to 10^3 ppm

Figure 8: The units of Figure 8a have been simplified from "date/time" to "time" and the caption has been edited to clarify the starting date. The units have been changed to "10^3 ppm" on 8a and 8b.

L33-36, L50-53, and L57-60: We have improved clarity by careful editing. New text reads:

"Observations of this variability are essential for elucidating the underlying micrometeorological processes and quantifying local-scale (100 m) radiation budgets important to the prediction of turbulent and convective processes and their impacts (Couvreux et al., 2009; Fabry, 2006; Ogunjemiyo et al., 2002). However, observations have been limited by the relatively high cost of existing instruments and the lack of high-quality data from more economical ones (Geerts et al., 2018)." (New L33-38)

"At the other end of the cost spectrum are various versions of capacitive humidity sensors that employ thin-film water-sensitive polymers sandwiched between two electrodes." (New L56-7)

"High-resolution in situ observations of H_2O are essential for numerical weather prediction and for investigations of the evolution of the ABL and its turbulence characteristics (e.g. large eddy simulations), and there is a need for more frequent measurements from remote locations (Helbig et al., 2021; Petersen, 2016)." (New L63-65)

"There is a need to increase the density of measurements on specific reservoirs to map out the large spatial and temporal gradients in humidity due to adjacent complex terrain that contributes to significant errors in latent heat fluxes derived from those measurements (Friedrich et al., 2018)." (New L89-93)

L206: We added:

"This is larger than the precision of the CRDS, which is ~10 ppmv, and so the deviation is mostly due to small differences in water vapor in the paths sampled by the two instruments. (New L257-9)

L311: In Table 1 we added part numbers for the optical cell and the manufacturer and part number for electronics box. (New L365)