We agree with most of remarks and thank the reviewer who helped us to eliminate an important mistake in the text. We present hereafter the corrected sentences with modified text marked by yellow.

Specific comments

(1) Spectral resolution issue

The authors emphasize a high spectral resolution of λ/δλ~107-108,whileonce the corresponding laser linewidth is less than the electronic filter bandwidth, the LHS spectral resolution is determined by the used electronic filter bandwidth. The authors never discuss on the real spectral resolution: what was the used electronic bandwidth and what was its impact on the spatial (vertical) resolution obtained in the retrieved vertical profiles of wind speed? Please make a detailed discussion.

Careful analysis of the instrument has shown that the real electronic filter bandpass is 0.2….3 MHz, rather than 10 MHz, which corresponds to spectral resolving power $\lambda/\delta\lambda = 6\cdot10^7$. However, as the spectral point spreads function of the spectrometer, determined by the convolution of laser emission line with the electronic filter bandpass, is highly stable, it does not limit the accuracy of wind retrieval. This accuracy is mainly determined by the emission line stability, which has been explored separately and found to stay in the limit of 1 MHz. In turn, vertical resolution of wind profile retrieval does not relate to filter bandwidth, being completely determined by the pressure broadening mechanism. The filter parameters are corrected and corresponding sentences are added to the manuscript.

Lines 12-14: Heterodyne spectroradiometric measurements of the solar radiation passed through the atmosphere provides an unprecedented spectral resolution up to $\lambda/\delta\lambda \sim 6\cdot10^7$ with a signal-to-noise ratio more than 100.

Line 51-53: With the resolved bandwidth B = 3 MHz and reasonable exposure time τ up to few minutes, the quantum limit constrains heterodyne detection by a minimal level of spectral brightness of $p = \frac{hc}{\lambda\sqrt{B\tau}} \approx 10^{-24}$ W/Hz.

Lines 127-128: After the transimpedance preamplifier, the signal is passed through consecutive low-pass filter, another amplifier and high-pass filter, that limits its bandwidth to 0.2…3 MHz.

Lines 94-96: Taking into account that LO linewidth has an order of 2MHz, the spectral resolution of heterodyne detection is sufficient to measure Doppler shift of the absorption line in the atmosphere due to air mass motion with velocities greater than 3 m/s, provided high LO stability and sufficient accuracy of intermediate frequency (IF) signal analysis.

Line 230: Note that average kernels and, hence, vertical resolution of wind retrievals is determined by collisional linewidth and signal-to-noise ratio rather than on spectral resolution of the instrument, which is excessively high for such retrievals.

(2) Experimental spectral comparison between LHS and ICOS spectra

The measurement technique presented in the paper relies on Doppler shift analysis of a measured LHR spectrum line related to the same absorption line recorded in a reference cell. It should be important to show an experimental LHS spectral line in comparison with the reference spectrum and make some discussion because this is the key technical element to support this paper.

ICOS reference cell has been only employed to stabilize LO, and ICOS line shape does not affect neither spectral resolution nor retrieval procedure. The only useful information from the reference channel is a position of ICOS line peak vs. laser pump current. The shape of reference line is presented in Figure 2(a). Corresponding discussion is added to the text.

Line 125-127: Although line shape in the ICOS cell is different from the Voigt profile, it does not affect LO stabilization procedure, as the only information used in the feedback concerns with the peak position.

(3) *Please provide more detailed information on the used devices in the LHS setup, such as laser power, model, etc.*

As the description of the LHS setup has been already published in maximal detail in Zenevich et al., 2019, here we focus on the measurement method and wind retrieval technique.

Technical corrections

Со всеми правками соглашаемся?

(1) Page 1, line 13: "provides" should be "provide"

Corrected

(2) Page 2, line 57: recent work of Wang et al.on LHR-CH4,in Opt. Ex. 27(2019) 9610-9619,should be included.

Done

(3) Page 4, line 108 : please check the English usage in the following sentence "single mode fiber geometric aperture factor ~2.6·10-8cm2, corresponding to field of view ~0.006°, is close to the maximum available for heterodyne detection expressed by....?"

The awkward phrase is broken by two:

According to antenna theorem (Siegman, 1968), single mode fiber geometric aperture factor ~$2.6 \cdot 10^{-8}$ cm^2, which corresponds to field of view ~ 0.006º. This is close to the maximum available for heterodyne detection and therefore does not limit the instrument sensitivity (Rodin et al., 2014).

(4) Page 5, line127: "is passed through consecutive low-pass filter, another amplifier and high-passfilter" should be "is passed through consecutive high-pass filter, another amplifier and low-passfilter" according to Figure 1?

In fact, the error is in Figure 1 rather than in the description. The instrument scheme is corrected

(5) Page 5, line129: it would be better to replace "after the filter chain" by "after the IF receiver" according to Figure 1?

Corrected

Preamplifier circuit is connected to Rohde & Schwarz RTO 1012 digital oscilloscope at two points: after the IF receiver and just after transimpedance preamplifier.

(6) Page 6, line155: "The ratio of heterodyne signal with subtracted dark signal and baseline approximated by square polynomial....", the sentence is not clearly stated;

Corrected

After subtraction of dark signal, heterodyne signal should be normalized by assumed spectral continuum (baseline) approximated by square polynomial to obtain the final transmission spectrum of the atmosphere.

(7) Page 6, line162: "In addition to the target CO2line R2 1401←0000 at 6230.22 cm-1, other CO2lines at 6230.25cm-1, 6230.02 cm-1and 6229.98 cm-1have also been included in calculations": under atmospheric pressure, how is presented the CO2line at 6230.25cm-1related to the line at 6230.22cm-1?It would be better to show the simulation spectrum in combination with the measured LHR spectrum.

The accounting for additional weak CO2 lines only slightly affect the line shape, so their effect is invisible in the graph. The comparison of simulations with the measured LHR spectra is presented in Figure 2(c).

(8) Page 6, lines 165: Please provide more detailed information on the constructed "model of the atmospheric transmission spectrum".

It is not clear which details could be provided in addition to the presented information on this simplistic model. The number of layers, line list and line shape approximation are provided in the text. To me more clear, a phrase is added:

The model only included gas absorption in the lines mentioned above, whereas scattering processes have been neglected.

(9) Page 7, line198: remove "-"after nu0;

Done

(10) Page 8, line233 : "where J is ....", where is J in equation (10)?

Corrected:

Then the Jacobian of the regularized inverse operator may be written in a matrix form, where I is a Jacobian matrix of the subintegral function in (7):

(11) Page 8, line236: please add the reference(s) in "(ref)";

Done

Where α is a regularization parameter which can be determined according to the residual principle (Tikhonov, 1998).

(12) Page 13, Table 1 :please add the used electronic bandwidth

In all measurements, electronic bandwidth is 0.2..3 MHz