

#1 Reviewer

We sincerely thank the reviewers for taking the time to give our manuscript such a careful and detailed evaluation. Your insightful and really important suggestions have helped us fix several mistakes we didn't notice at first. This has made our study much stronger and more complete. We're so grateful for all the great help you've given us!

Comments & Reply

1. Fig 4 and Fig 6 show the parallel incident illumination, but the beams are not parallel anymore after the telecentric systems and in front of the detector. To my knowledge, it should be parallel if the telecentric systems relay the fringe localization plane onto the detector. Although there is a diffuser in the setup, it only shows a parallel view after the diffuser in the figures.

Reply:

Your concern is indeed valid. We have made the necessary modifications in Figures 4, 6, and 8. Once the parallel light traverses the diffuser, it will exhibit a certain degree of divergence. The influence of the diffuser is not depicted in the provided figure. Within this configuration schematic diagram, the representation lacks the stringent precision typically found in a light path diagram.

2. Figure 4 contains numerous abbreviations, such as ND, G, P, S, etc. To facilitate understanding, could you provide the explanations of those abbreviations directly after the figure caption?

Reply:

We have supplemented the explanations after the figure caption.

#2 Reviewer

We would like to express our heartfelt gratitude to the reviewers for their diligent and thorough assessment of our manuscript. Your perceptive and pivotal recommendations have successfully rectified a number of oversights in our initial conceptualization, thereby substantially elevating the rigor and inclusiveness of our research. We are immensely thankful for your invaluable input.

Comments & Reply

1. In Figure 2, it is stated that ‘The specification of the ASHS Interferometer is listed in Table 1.’ First, I think this should be ‘The specifications of the ASHS interferometer are listed in Table 1.’ Second, I do not see these specifications, e.g., lengths of components (t and d) in Table 1. Please include these values.

Reply:

We have corrected the word and supplemented the specifications in Table 1.

2. Figure 12: the x-axis label is clipped and not fully visible.

Reply:

The figure has been corrected.

3. Figure 13: the meridional and zonal winds have different slopes (when accounting for the uncertainties), do you have a physical explanation for this behaviour. Please comment on this.

Reply:

We have supplemented the comments after Figure 13: Noting that in Fig. 13, the slopes of the fitted lines for meridional wind and zonal wind are inconsistent, which may stem from two factors. The field of view and detection scope exhibit differences between ASHS and lidar systems. ASHS detects winds in the four cardinal directions separately and then combines these measurements to derive the meridional and zonal winds. LiDAR measures winds in two orthogonal directions to obtain the meridional and zonal wind components. Under the assumption of a uniformly distributed wind field near the observation region, the slopes of the meridional and zonal winds in Fig. 13 should theoretically be identical. However, during the five-night observation period presented, fluctuations in the wind field distribution near the observation region may have occurred, potentially influenced by small-scale gravity waves, for instance. Another contributing factor could be the assumption of homogeneous airglow volume emissivity distribution in the area during the weighted - average calculation of LiDAR data. As the actual distribution is asymmetric, it causes a greater discrepancy between estimated and actual values in one direction. Consequently, this may result in the zonal fitting slope being lower than the meridional one.

4. Finally, just a comment, though not something that I think necessarily needs to be addressed in this manuscript, but did you consider the thermal drift when decreasing the temperature. Essentially, do you expect/observe any hysteresis in the thermal drift?

Reply:

If you are referring to the experiment described in Section 5.1, we conducted it by gradually increasing the temperature in a controlled manner, as this approach offers better controllability

compared to reducing the temperature. Once the sensor readings reached the target temperature, the instrument was allowed to stabilize for nearly 4 hours. Subsequently, the instrument's parameters were measured. Therefore, no "hysteresis" was observed in our experiment. The phase offset and spatial frequency characterized in this experiment precisely represent the primary effects of thermal drift. Through this methodology, we evaluated the extent to which thermal drift influences wind measurements.