 # 2nd Reviewer's comments

Dear Reviewer,

We sincerely appreciate the time and effort you have devoted to reviewing our paper. Your constructive comments have been helpful in improving the quality of the paper. We have revised the manuscript accordingly and provided our detailed responses to your comments below.

Best regards

Hong, on behalf of all co-authors.

Zhao et al gives a thorough description of the data collection and processing for data collected at the first Loobos tower. Data users will find this to be a comprehensive presentation of the sensor characteristics, location, and calibration.

It would be helpful to present the information about instrument changeover in a more easily digested way. For the eddy covariance measurements this is noted in the narrative text and Table 1, but showing this graphically would be easier for readers to absorb. Could you also comment on whether there was any overlap when sensor types were changed so that the data from each sensor could be compared. If there was no overlap, then note that in the text.

Reply: Thanks for your suggestions. We have added a figure showing an overview of the changeover information for the main instruments described in this study.

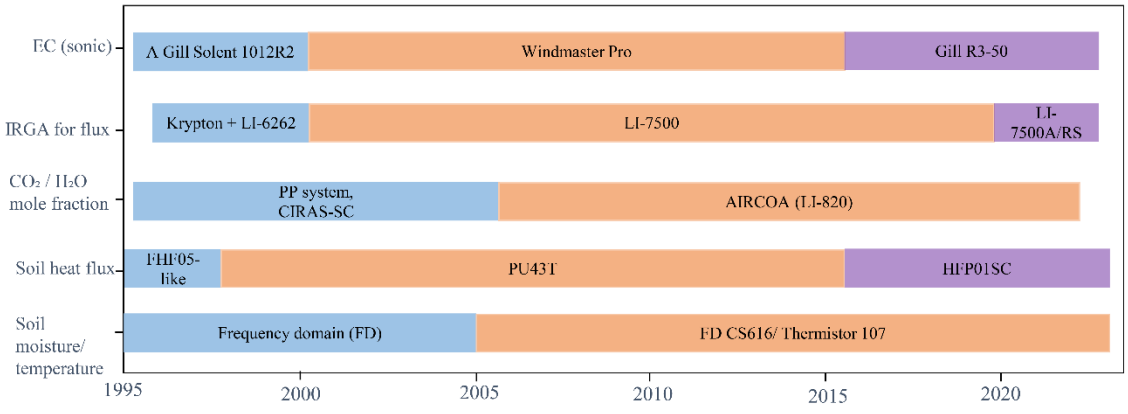

Figure A2 An overview of the changeover information for the main instruments deployed at the Loobos first tower site.

Unfortunately, there was no overlap when sensor types were changed. We added the sentence below to the end of section 2.1.2.

"Unfortunately, there were no overlapping measurements available during the anemometer replacement, precluding direct intercomparison between the two sensors. An overview of main instrument changes is presented in Fig. A2."

It is helpful to see some graphical examples of the typical diel patterns of CO2 flux. Could you include some examples of a mean CO_2 concentration profile, which would help assess whether the selected sampling heights were suitable for representing the profile shape and calculating the column integral?

Reply: We thank the reviewer for this suggestion. We have added a figure showing the mean diurnal cycles of the CO_2 mole fraction gradients (dCO_2/dz) as below. The figure demonstrates a coherent and physically consistent vertical structure, with the strongest gradient occurring near the surface during nighttime and early morning hours, and a progressively weaker gradient towards higher levels. In extreme situations, i.e. in the summer months June, July and August, when the respiration fluxes are large and with u* < 0.3 m s^{-1}, the gradients are typically 1 ppm m^{-1} between 25 and 7.5 m, 2 ppm m^{-1} between 7.5 and 5.0 m and 5 ppm m^{-1} below there. These findings indicate that the selected sampling heights adequately resolve the dominant features of the vertical CO_2 concentration profile relevant for calculating the column-integrated storage term.

We have added the above content to section 3.1.

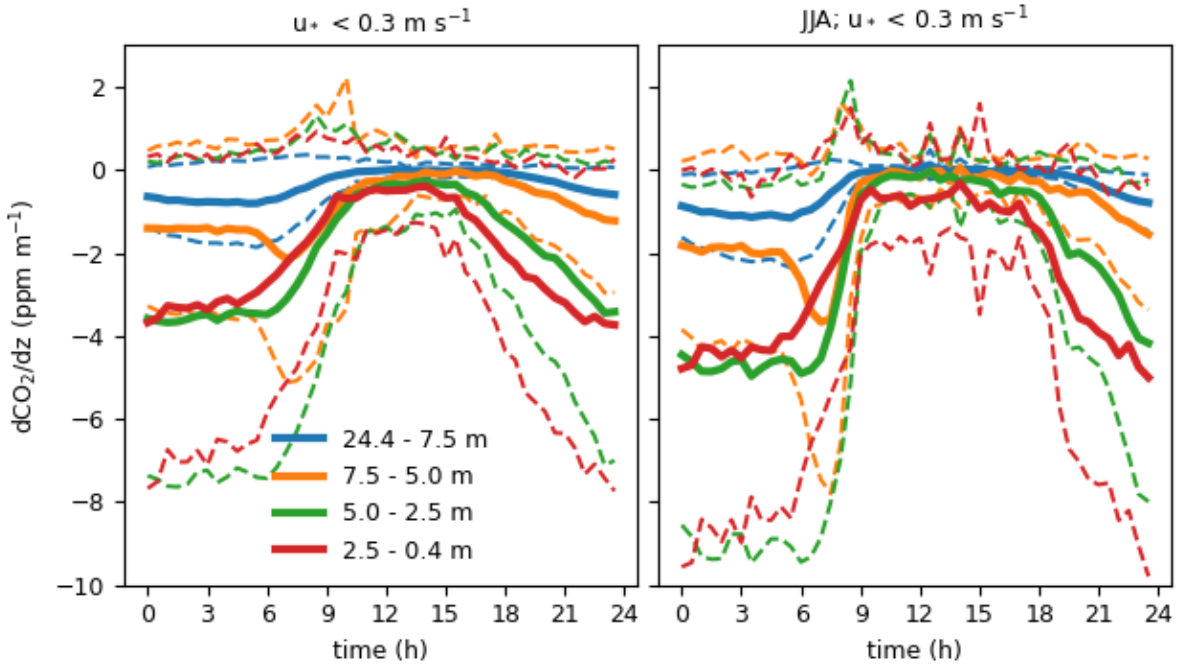

Figure S2. Mean diurnal cycles of the CO_2 mole fraction gradients. Left: for all data with u* < 0.3 m s^{-1}. Right: for all data in June, July and August with u* < 0.3 m s^{-1}. The solid line refers to mean values and the dashed line denotes the mean ± 1 time standard deviation.

Other than that I just note a few typographical errors

Some instances at line 152 and thereafter where mole should replace model

line 444 carbon dioxide should be singular

Use of subscript in CO_2 should be consistent

Reply: Thank you. Done.