Comment on egusphere-2022-384
Anonymous Referee #1

Referee comment on "Eddy-covariance carbon fluxes of a heterogeneous forest: one tower - two heights" by Alisa Krasnova et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-384-RC1, 2022

General comments

The question of the impact of source area heterogeneity on carbon (and other species) fluxes is highly relevant and interesting. Flux sites are often chosen where the heterogeneity is as small as possible but in reality, there are always some heterogeneity to consider. The title is however a bit misleading – it is not only heterogeneity of a forest but of a landscape. The first thought when reading such a title is that this must deal a lot with land cover and footprint analyses. But this is not the case. It is mainly a description of differences in fluxes in different wind sectors without any attempt to quantify differences in land cover and footprints in relation to these land cover variations and how this might impact the fluxes.

It is well known that the footprint area varies a lot depending on day/night unstable/stable conditions but this is hardly mentioned or only indirectly. Some of the figures, for instance Fig. 7e&f, where the difference in NEE between the two heights are plotted against u* and/or u for two different radiation levels gives a strong indication that stability has a large impact on the difference.

Another issue which might have impact on the fluxes are vertical and horizontal advection. It is not clear from the methods if there are concentration measurements at different heights in the tower but there are some mentioning of ‘plumbing’ which indicate that there might be such data available. If it is, then also total advection could be estimated. See for instance Yi et al Influence of advection on measurements of the net ecosystem-atmosphere exchange of CO2 from a very tall tower JGR Vol. 105, No. D8, 9991-9999, 2000.
The conclusion that it is the carbon enriched air from the clear cutting along the guy wires that are causing the spatial pattern of CO2 fluxes that are observed for the 30 m system is speculative without firm evidence. In the conclusion they also state that their hypothesis is confirmed and with the hypothesis that “the EC system located closer to the canopy will detect local features while the higher positioned system will detect naturally integrated CO2 flux”, this is obvious and no need to be 'confirmed'.

Specific comments

Line 67-68: Describe the type of tower that is used. Please specify the width of the clearing along the guy wires. It is hardly visible in Fig. 2. You don't mention if you have removed data from situations when the wind come through the tower. It would be good if you could indicate boom direction in some of your figures as well.

L 75: You present measurements over four years (which is good). Please state how often the gas analyzer was calibrated.

L 81: Here you mention that ‘soil efflux’ is measured with a transparent chamber. Later you refer to these measurements as ‘soil respiration’. If you are using a transparent chamber then you are measuring net exchange rather than respiration. Please clarify.

L 87: No measurement of net radiation? You don’t say anything about energy balance closure which is a common kind of quality measure for flux measurements.

L 106: Net ecosystem exchange NEE should include the storage term as well. You should make this clear if it was not and then name the flux otherwise.

L 155: Why not write out V/A instead of ‘h’ in eq. 4 to avoid the reader from reacting.

L 195 & Fig. 3. I don’t see that the wind profile is used at all anywhere in the paper. So you can remove it.

L 294-296: Here it become important to know if you really measured ‘soil respiration’ or net flux from the forest floor.

L 375-376: There are papers on multi-level EC measurements from high towers. For

Fig. 2. It would be much more informative if the footprint climatology was divided in night & day and if more isolines were presented (e.g. 20, 40, 60, 80%). And a map of land uses would also be more informative than an aerial photograph (which also can be shown for itself).

Fig. 11-12: here it would be really interesting with a proper footprint analyses.