General comments:

This manuscript simulates CO_2 concentrations in Belgium and surrounding areas and conducts sensitivity tests using different emission inventories and in situ and remote-sensing CO_2 observations. The topic is interesting and meaningful, but many statements and explanations in the manuscripts are not rigorous enough. I suggest more modifications and improvements before acceptance.

Special comments:

1 The title includes Western Europe, but this study only focuses on Belgium and the surrounding areas. Is it reasonable to use Western Europe in the title?

2 This paper also mentioned that the drought could increase CO_2 concentrations. I think it is necessary to include precipitation in the research period and compare it with the year before and after.

3 I think Figures 1 and 2 can be combined.

4 Lines 130-135: I suggest consistency in the parameters used in the equation and the text. For example, "T_{scale}" in Eq and "Tscale" in text. Maybe "T_{scale}" is more suitable. Also, other parameters such as Wscale, Pscale, Ts, Tmin, Tmax, …

5 Lines 158-159, Here are two downscaling methods used. What are the differences between them?

6 Table 1. I suggest adding some words in the column of the aberrative. Also, the CBW attitude is 0?

7 Figures, the figures in the main text are not clear as the Figures in the Appendix.

8 Figure 3. What are the sunrise and sunset times in these ICOS stations? The highest temperature occurred at 18:00 local time, and the PBL reached its maximum height between 15:00-17:00 (line 319). It seems unreasonable.

9 Figure 5. I think it is better to keep the y-axis of CO_2 concentrations the same across different emission inventories at the same height.

10 Figure 6. It seems there is no contribution from biomass burning in these figures. Why are biogenic contributions nearly negative from 10:00- 23:00 at all sites? Why are biogenic contributions only positive around 10:00?

11 Figure 7. It is better to give the slope and correlation coefficient in Figure 7c for the three TCCON sites.

12 Figure 8. Although the STD and RMSE increase from S to P, MBE becomes large. Which parameters are more critical to evaluate the model's sensitivity?

13 Line 378. What does SNAP mean in this paper?

14 Figure 11. There is a large gap between SNAP 1 for CAMS and EDGAR. Figure 10d also showed more emission sources than Figure 1a. Why did this gap occur? Were the emissions included in other emission sectors in CAMS?

15 Figure 12. It seems that in late July and August, the land system was also active as a carbon source (Figure 12c), but anthropogenic emissions nearly disappeared from Figure 12b. Usually, drought can increase temperatures and the electricity demand for air conditioning, hence the anthropogenic emissions could increase in this period.

16 Lines 438-439, please add ° before N and E for the GPS location. Also, add this to the GPS location in Table A3. What does "acid fen" mean here for FR_LGt?