Review of the paper (revised version):

"Global distribution of CO2 in the upper Troposphere and Stratosphere"

written by M. Diallo et al.

General:

The paper in its revised version improved a lot. The most important results (3D Lagrangian reconstruction of CO2, its validation, analysis of the propagation of the annual cycle into the stratosphere, formation of inverse gradients of CO2) are well documented. The paper is supported by very good figures. However, still some "polishing work" is necessary. Especially the introduction is too long and not really focused on the following text. The paper may be acceptable after some "editorial and polishing work" by including a native speaker. One major point and some minor points are listed below.

Major points:

1. Your introduction is too long. E.g. the detailed description of all in situ campaigns/satellite observations and their results (which are not used in the paper) is not necessary, e.g. P3/L27 - P4/L28 - here is some potential to shorten your introduction.

Minor points:

1. P2 /L1
   ...a new 3D data database...of carbon dioxide (CO2) extending from...

2. P3/L3-6
   satellite validation, inverse modeling - you are almost not talking in your paper about these points. However, you talking much more about the circulation, inverse gradients, seasonal cycle. Please reformulate this sentence.

3. P3/L2
   ...can also be diagnosed...

4. P3/L12
   ...anthropogenic emissions, deforestation, biomass and fossil fuel burning...

5. P3/L14
   Tans and Keeling, 2015 - I did not find this citation in your literature list

6. P3/L15
   "that represent" x2

7. P3Ł20
   ...were hold...

8. P3Ł28
   The SPURT campaigns were...

9. P6Ł21
   ...section section...

10. P7Ł4-5
    ...to assign CO2 to air parcels transported along the backward trajectories. During the 1989-1999 time period, data from...are applied. The WDCGG is an international...

11. P7Ł14-20
    Remove some repetitions. This part of the text should be reformulate

12. P8/L6
    “CO2” is not correctly written

13. P8/L19
    ...in the northern polar regions

14. P9/L17
    ...in the Northern Hemisphere...

15. P9/L19
    “air particles” or “air parcels” (please unify this notation everywhere, I would prefer “air parcels”)

16. P9/L20
    ...and integrated backward in time

17. P10/L7
    ...the whole stratosphere at any latitude and longitude, 30 levels...

18. P10/11-14
    “Trajectory starting” - you consider backward trajectories. Please reformulate this part with too much technical jargon.

19. P10/L19
    “is impacted” - it does not sound good. Maybe “was hit during the backward integration”

20. P11/L8
    ...and that remain within... - and staying within

21. P11/L11-12
    I do not understand your sentence with standard deviation. Maybe 2 sentences would be better

22. P12/3.3
    Instead of “evaluation” I would recommend to use “validation” in the title and everywhere in the text

23. P12/L22
    ...that a single trajectory processed by... - sounds very strange. Maybe: ...that a single probe can be understood as a mixture of sub-parcels...

24. P13/Formula (3)
    You should also explain u(X,t)

25. P13
    The reconstruction of CO2 observations is with mixing and the global reconstruction is without mixing. I think you should explain it little bit.

26. P14/L6 and L10
    same sentences

27. P14/L19
    ...the two curves almost superimpose but for small-scale fluctuations... - you probably mean:
    ...the two curves agree fairly well even for small-scale fluctuations...

28. General
    For the sub-panels of the figures you sometimes use (a) or a. Please unify your notation

29. P16/L16
    ...and we recover a delay of 2 months... - ...and we diagnose a delay of 2 month...

30. P17/5.1
    ...and lowermost stratosphere (please unify large and small characters in titles)

31. P20/L2 and 4
    “inherited” - please replace by a different verb

32. P21/L4
    “to uniformise” - to be uniformly mixed at isentropic surfaces

33. P21/L9
    “in opposition” - opposite

34. Fig 1
    The upper green line is shifted

35. Fig 4
    Black curves, Green squares without brackets. You write 17 September but in your figure I see 1th September, please correct

36. Fig 5/L5
    average of what