We would like to thank referee #1 for the helpful and constructive comments. Following are the specific referee comments (in blue) together with the replies of the authors. Additions and changes to the paper text are written *italic*.

Referee comment:
1. It will help the reader to better appreciate the importance of the error discussed here if the paper provides some information (either through citation of papers or the authors' own inversion) about how much error in inverse CO2 fluxes can be caused by the 3ppm model bias associated with PBL mixing.

Author reply:
We agree, the next logical step in this context is to use these estimated errors with a typical Bayesian inversions to propagate it to the estimated fluxes as is stated in the discussion section (p28190,l14). We see the present study as required first step in which we relate model-data mismatch in vertical mixing to CO_2 tracer space. We believe that this next step has to be carefully executed and thus would have been out of scope of the present paper. However, there are is literature known to us which can give an indication of the CO_2 error impact on the fluxes. As suggested by the referee we refer to an earlier study by adding in the conclusion section (p28192 l12) the paragraph:

Ultimately one is interested in the impact of these CO_2 biases on the flux inversions. What is needed are sensitivity tests with an inversion set up incorporating the full error characteristics like it was demonstrated by Rödenbeck et al. (2006). However, to get a first idea for our study, we can scale the tagged tracer corresponding to NEE in order to compensate for the reported CO_2 bias. The monthly average signal from NEE within our domain (0.45 PgC/month) causes a regional signal (draw down relative to the lateral boundary condition) of 2 ppm. Taking a transport model bias of 1 ppm, which is 50 % of the signal, the corresponding error in fluxes would be 0.225 PgC/month in NEE.

Referee comment:
2. Clarify when dry air mixing ratio is used and when total mixing ratio is used, especially for equations.

Author reply:
In general we refer to dry air mixing ratios and densities. We added the following sentence to section 2.2 (p28177 l18) for clarity:

In this paper we refer to dry air densities and CO_2 mole fractions.

We removed the words *"dry air"* from sentence 28179 l1 to prevent confusion (see also reply to the next comment).

Referee comment:
3. Page 28178 line 25, below Equation (3), "entrainment and vertical advection: : :". Is the wi part referred to as advection here, or the other part?

Author reply:
Here w_{zi} refers to vertical advection (subsidence) at the height of the mixed layer (z_i). The entrainment is represented with the term including change z_i with over in time.
We altered the paragraph after the equation for clarity to:

The mean mixing ratio (C_m) of CO_2 in the mixed layer with height (z_i) is balanced by the surface biospheric fluxes F_{NEE}, entrainment (dzi/dt) and vertical advection (subsidence, w_{zi}). For simplicity we keep the molar air density ρ vertically and temporally constant, and contributions to the mass balance from horizontal advection are neglected. The subsidence term on the RHS accounts for vertical advection at the top of the ML (with mean velocity w_{zi}) that mixes concentrations directly above the ML (C_+) and the ML concentration (C_m).

References:

Rödenbeck, C., T. J. Conway, and R. L. Langenfelds (2006), The effect of systematic measurement errors on atmospheric CO2 inversions: A quantitative assessment, Atmos. Chem. Phys., 6, 149–161, doi:10.5194/acp-6-149-2006.