Reply to reviewer #1

We would like to thank the reviewer for the critical reading and valuable suggestions. In the following, we address the points one by one presenting our replies in dark blue and changes to the manuscript in dark red.

The manuscript titled “Estimation of CO_2 fluxes in the cities of Zurich and Paris using the ICON-ART CTDAS inverse modelling framework” is a comprehensive paper presenting a sophisticated inverse modelling study using the ICON-ART CTDAS framework to estimate urban CO_2 fluxes in Zurich and Paris. The topic is highly relevant for the ICOS Cities project and for ongoing efforts to develop observation-based methods for tracking urban greenhouse gas emissions. The manuscript is clearly structured, methodologically sound, and rich in technical detail. It contributes significantly to advancing urban-scale inverse modelling capabilities in Europe.

Minor comments:

Figures8–11:

It would be good to add shaded bands for one-sigma uncertainty to help visualize the posterior improvement. Label axes clearly with units.

We agree that visualizing uncertainty with shaded bands improves clarity. Shaded bands showing one-sigma posterior uncertainties have been added to Figures 8–9 to illustrate the reduction in uncertainty after the inversion. We decided not to add uncertainty values to Figure 10, as it is already quite busy with eight lines indicating background updates for each of the eight different wind directions. For Figure 11, we added a note to the caption in order to clarify how the uncertainties were calculated: ‘Uncertainties were propagated from weekly flux uncertainties as described in the Data and Methods section‘. We have added labels with units where they were missing.

Sect.3.1.2:

The text could benefit from a concise comparison of model–observation statistics before and after inversion in a summary table.

We added a concise comparison of model–observation statistics before and after inversion in a summary table (new Table 3). This includes mean bias, RMSE, and Pearson correlation coefficients for both Zurich and Paris, highlighting the improvements due to the inversion.

Technical comments

The manuscript is generally well written. A few sentences in Sect 4 are lengthy and could be split for clarity (especially around lines 440–460).

We have split several long sentences in Section 4 (lines 440–460) to improve readability.

We hope that these revisions address the reviewer’s suggestions and overall improve the clarity of the manuscript.