

Interactive comment on “On the relationship between tropospheric CO and CO₂ during KORUS-AQ and its role in constraining anthropogenic CO₂” by Wenfu Tang et al.

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We have revised the manuscript in response to reviewers comments.

- 1) Title: We added 'potential' to the role of CO since our inversions are intended to be only demonstrative.
- 2) Abstract: We have edited the abstract to reflect this study as a demonstration and to emphasize the global nature of our simulations which is being mainly evaluated for a given region.
- 3) Introduction:

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a) We shortened this section by removing general references on CO₂ inversions. b) We also added some statements regarding the link of CO to ffCO₂ and highlighted more the motivation of this study. c) We clarified our objectives and removed unnecessary text.

— 4) Methods

2.1 We added references to EDGAR emission inventories. 2.2 We also added a clarifying statement regarding our the scope of our CAM-chem evaluation

— 5) Results

— Section 3: We added a header statement regarding our aim to evaluate CAM-Chem. Added some minor edits to improve clarity (also removed confusing statements).

— Section 4: We added a header statement regarding why we use flight groups. Added some minor edits to improve clarity (also removed confusing statements).

— Section 5: Refining ffCO₂ estimates using CO and CO₂ data We added a couple of equations to highlight the link of CO to ffCO₂ inversion (see Figure 4 of our response to RC1 and RC2).

Added some minor edits to improve clarity –e.g., point to specific section number. Also removed confusing statements.

Added statements about covariance localization and the use of a constant 1ppm for ffCO₂ offset.

Added statements on the link of CO to ffCO₂ through error correlation in a priori error covariance matrix.

Noted as well that the emission inventories of CO and CO₂ have been taken from different sources and that our inverse analysis focuses on CO constraints on ffCO₂ total emissions (not emission ratio).

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— Section 6: Discussion and limitations

Replaced Figure 10 with a figure showing sensitivity of ffCO₂ estimates to prior error correlation. Moved original Figure 10 to Figure S11.

Also added Figure S10. This is a plot of the gain matrix for non-zero error correlation and zero error correlation of a priori error covariance matrix. Deleted confusing statements.

— 6) Conclusions: Shortened section 7.

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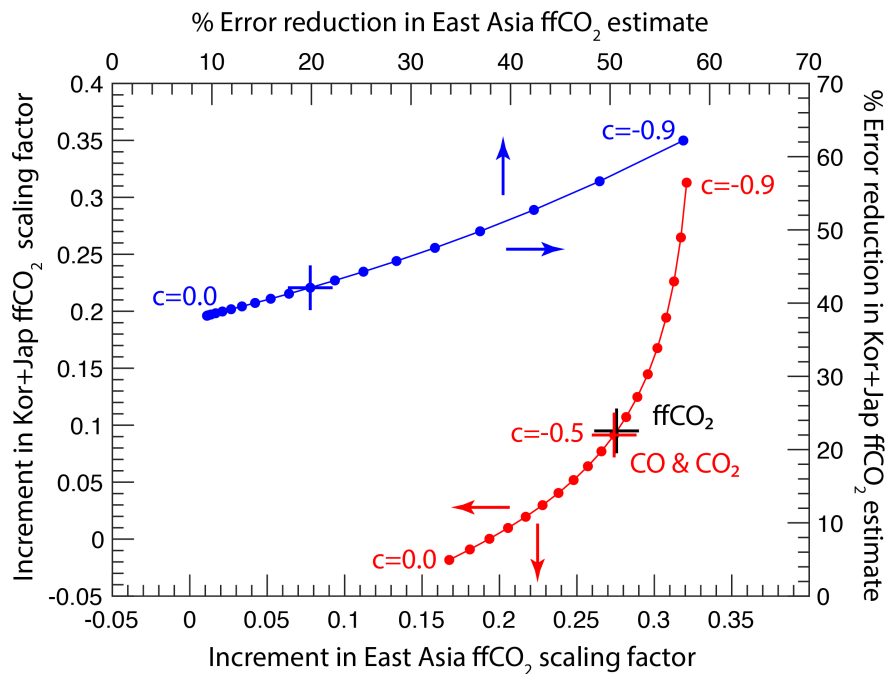


Fig. 1. Analysis increments for East Asia and Kor+Jap ffCO₂ a posteriori estimates (red) and associated error reduction (blue) as a function of CO:CO₂ error correlation values in a priori error covariance (re

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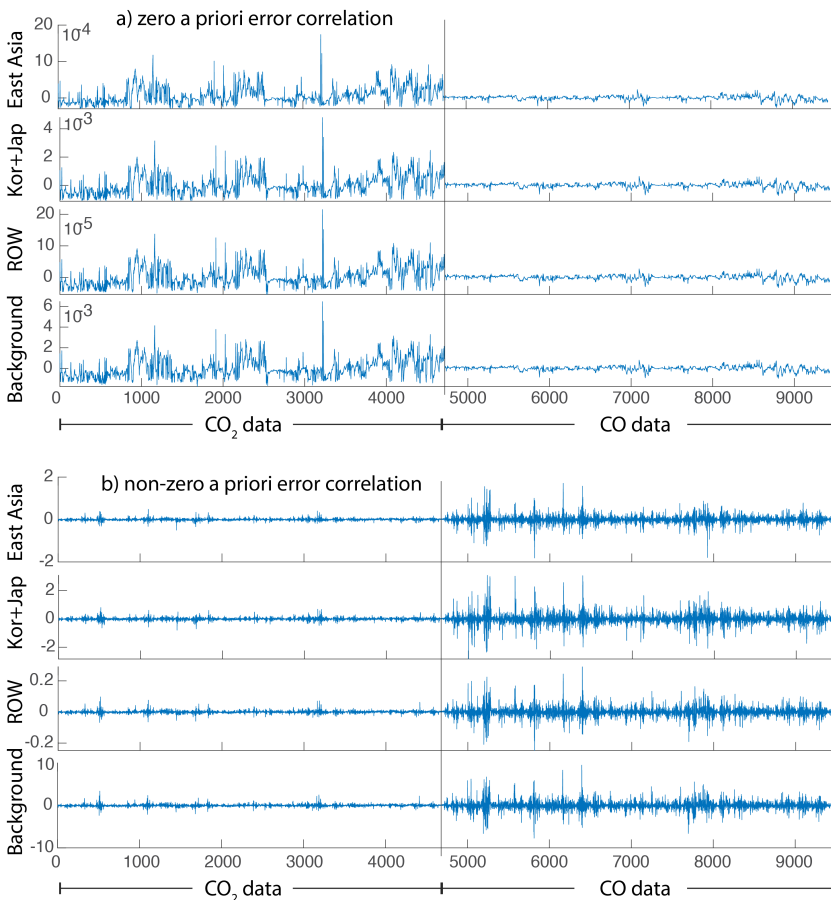


Fig. 2. Mean vertical profiles of ffCO_2 response functions from Kor+Jap (blue), East Asia (red) and ROW (yellow-orange) for each flight group. Dashed and solid lines correspond to a priori and a posteriori estimates.