Responses to Editor’s Comments

Dear Editor,

We would like to thank the editor for carefully reading our manuscript and for the helpful comment. This has greatly assisted us in strengthening the paper. We have revised the manuscript accordingly (highlighted in red) and included our specific response in blue below.

The authors have done a good job of responding to most of the referees' comments. However, in my opinion they have not fully addressed one key comment, which I ask them to take another look at now.

The comment is as follows:

1) Reviewer 1's comment #3 about the ocean/land uncertainties was not fully addressed in my opinion. The referee states that " The primary reason ocean retrievals have been excluded in many previous inversion studies is therefore not simply their random uncertainty, but rather the concern that ocean retrievals may exhibit larger systematic biases compared to land retrievals."

The key point here is the potential systematic biases in the ocean data relative to the land data, not only their random uncertainties. The authors point to the usefulness of the ocean data in their results, but do not discuss bias. The authors should respond fully to the referee's comment, including discussion of the potential for ocean biases to affect their results.

→ We added the following discussion of ocean bias.

Lines 62–74: Whereas Wang et al. (2019) excluded oceanic soundings due to concerns over glint-mode retrievals (Wunch et al., 2017), such exclusions may not be optimal for East Asia, where strong anthropogenic emissions are transported eastward over adjacent oceans, making ocean soundings particularly informative for constraining continental outflow signals. We acknowledge that ocean-glint retrievals can exhibit systematic biases distinct from those over land, which has motivated their exclusion in previous inversion studies. However, the ACOS v9 product applies mode-specific bias correction that reduces global mean biases to below 0.2 ppm, with residual seasonal biases of 0.2–0.6 ppm against OCO-2 v10 and single-sounding scatter (~1 ppm) that is comparable to or smaller than over land (Taylor et al., 2022). These residual biases are modest relative to the XCO_2 gradients that drive regional flux inversions. To further assess the impact of potential systematic biases in ocean retrievals, we conducted sensitivity experiments by perturbing ocean XCO_2 by +0.2, +0.4, and +0.6 ppm, following the range reported by Taylor et al. (2022). The sensitivity tests suggest that the inferred fluxes are not substantially affected by these perturbations (Figure S1). We therefore retain both land and ocean soundings, weighting them through their reported retrieval uncertainties in the observation error covariance matrix.

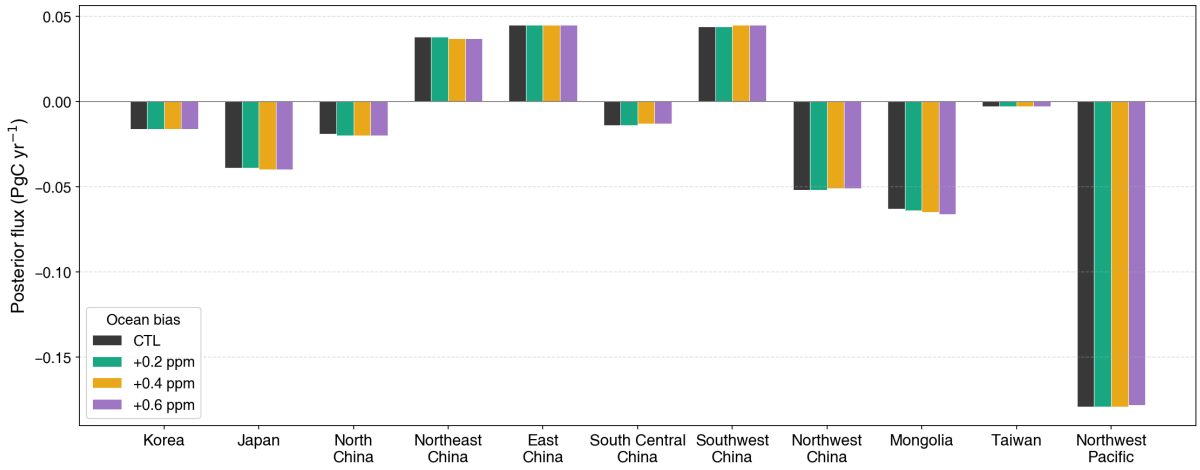

Figure S1. Regional posterior CO_2 fluxes for 2019 under four ocean observation scenarios. The control (CTL) is compared with sensitivity tests applying +0.2, +0.4, and +0.6 ppm biases to ocean XCO_2, consistent with the range of residual seasonal biases in GOSAT ACOS v9.