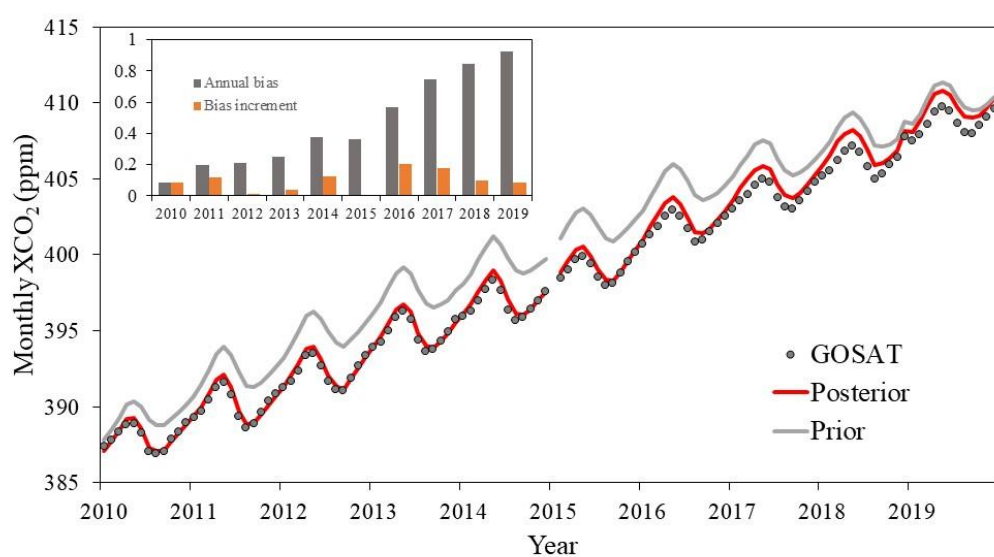


**Comment:** I thank the reviewers for addressing all of my comments. I'm a little perplexed by the trend in bias against in situ data. The fact that a very similar trend is found when estimating the sink from the fluxes and when comparing the CO<sub>2</sub> fields against the in situ CO<sub>2</sub> measurements suggests that the trend is a result of either (1) a CO<sub>2</sub> growth rate trend in ACOS v9 GOSAT that is inconsistent with the in situ CO<sub>2</sub> measurements or (2) a residual trend in the inversions fit to the GOSAT data. I think that it would be worthwhile to determine which of these factors is driving this. I would encourage the authors to add a timeseries plot of the mismatch between the posterior CO<sub>2</sub> fields and GOSAT ACOS v9 XCO<sub>2</sub> data to see if there is a relative trend similar to the in situ CO<sub>2</sub> data used for validation.

**Response:** Many thanks for this suggestion, which is really helpful for the analysis of the inversion results in this study and the improvement of our system in the future. We analyzed the timeseries of the global averaged monthly mean posterior XCO<sub>2</sub> and GOSAT XCO<sub>2</sub> concentrations. As shown in Figure 1, the mismatches between the posterior XCO<sub>2</sub> fields and GOSAT ACOS v9 XCO<sub>2</sub> data also have an increasing trend from 2010 to 2019, with an annual mean increment about 0.09 ppm yr<sup>-1</sup>, indicating that the trend in bias against in situ data is a result of a residual trend in the inversions fit to the GOSAT data.

We have added the following sentences in the revised manuscript (see lines 472-475, page 16) and added Figure 1 in the revised Supporting Information as Figure S13.

“... On global average (74 sites), the annual mean biases increase from -0.36 ppm in 2010 to 0.75 ppm in 2019, with uptrend slope of 0.115 ppm yr<sup>-1</sup> (Figure S12). By multiplying by a factor of 2.124 PgC ppm<sup>-1</sup> (Ballantyne et al., 2012), this bias accumulation rate is equal to 0.244 PgC yr<sup>-1</sup>, which is very consistent with the 10-year averaged bias in the inverted global AGR given in Section 5.1 (0.25 PgC yr<sup>-1</sup>). **This uptrend is a result of a residual trend in the inversions fit to the GOSAT data. We analyzed the timeseries of the global averaged monthly mean posterior XCO<sub>2</sub> and GOSAT XCO<sub>2</sub> concentrations, and found that the mismatches between the posterior XCO<sub>2</sub> fields and GOSAT data also have an upward trend from 2010 to 2019, with an annual mean increment about 0.09 ppm yr<sup>-1</sup> (Figure S13).”**



**Figure 1** Global mean monthly XCO<sub>2</sub> from 2010 to 2019 (the small figure shows the annual mean biases and bias increment in each year)