Referee #1, Reply #2, Final Minor Comments before publication

Referee comments in bold/non-ital and *author replies in nonbold/italics.*

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within diagnosed planetary boundary layer □
within the diagnosed planetary boundary layer

Done.

Hovmoller □ Hovmöller

Done.

Line 212: anomalously strong fossil fuel emissions over China: what is anomalous?
Why not "strong"?

Agree with reviewer; changed to "strong".

Line 245: Hence a focus on improving the
modeling of convective mixing of trace gases, particularly in CTMs,
Why particularly in CTMs?

Dropped. Both are important but as we've argued throughout the text, the leading cause here would appear to be parent model convective mass flux differences, so we agree.

Line 247: ecological hypotheses. Strange construct: what is an ecological hypothesis? Please be clear.

Agreed.

Changed :

"constrain high-latitude seasonality and inform ecological hypotheses."

to:

"constrain high-latitude seasonality."

Line 256: critical ecological and biological importance….same as previous…what is the added value over "biological".

Removed "ecological and" from text.

Line 267: "may help to provide the needed constraint on vertical distribution to identify a correct balance of these mixing processes.". Worth mentioning aircraft observational programs? IAGOS?

Added subsequent sentence to manuscript:

"In particular, this is an area where aircraft observations, both campaign data (e.g. Atmospheric Tomography Mission (ATOM), Atmospheric Carbon and Transport – America (ACT-America) and more operational data (e.g. In-Service Aircraft for a Global Observing System (IAGOS), NOAA light aircraft profiles) could provide useful constraint."

Line 286: 2014) missing a full stop.

Added period.

Line 288: Comparisons to long lived trace gases like SF6 might allow more definitive conclusions about how differences in parent model convection, and differences in their implementations in CTMs, drive the large-scale differences seen in this paper: here it would be good to refer to earlier work on SF6, and maybe also intercomparison studies on age of air (e.g. Age of air as a diagnostic for transport timescales in global models. Geoscientific Model Development, 11(8), 3109–3130. https://doi.org/10.5194/gmd-11-3109-2018).

We agree with the reviewer about the utility of SF6 and age-of-air metrics, but their application for the current research is strongly limited. SF6 in particular is being explored in independent work with GEOS-Chem, TM5, and the newer high-resolution variants of these models, but that is not within the scope of the current manuscript. Previous published works using SF6 unfortunately do not use the current generation of TM5 and GEOS-Chem models being discussed here. The Krol et al. age-of-air paper does not include a GEOS-Chem submission, so no direct comparison is possible. We have added references to previous works on SF6 and age of air, and we look forward to more applicable research with those constraints.