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Earth System Science Data Discussions

Interactive comment on "Global atmospheric carbon monoxide budget 2000–2017 inferred from multi-species atmospheric inversions" *by* Bo Zheng et al.

Anonymous Referee #1

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Zheng et al present an analysis of the global CO budget for 2000 – 2017, based on satellite retrievals of total column CO, CH4 and formaldehyde. The study uses a Bayesian inversion approach to optimize CO sources and the sink in a 3-D chemistry-transport model. A detailed analysis of CO budget trends by region is presented, allowing for some conclusions regarding the types of CO sources driving the trends. The authors also compare their results to bottom-up CO emission inventories, other inversion studies as well as surface-based observations.

Summary Statement

CO is an important trace gas, both because of its key role in global atmospheric chem-

istry and because it is a regulated pollutant; the study topic is thus of high interest. I am not an expert in satellite retrieval approaches, but the good overall agreement of the results with both bottom-up emission inventories and surface-based observations is convincing. The confirmation of the continuing decline of the atmospheric CO burden and CO emissions is a useful result that is well suited for publication in ESSD. The analysis is very thorough, in my opinion, unambiguously identifying a downward trend in anthropogenic CO emissions and also reinforcing earlier work that suggested that biomass burning emissions likely also declined overall.

Specific Comments:

Comparison with ground-based observations is an important part of validating the model. I would recommend moving one of the associated figures (e.g., S8) into the main paper to increase its visibility.

While the modeled results agree well with surface CO measurements for most stations (WDCGG comparison), there are many outliers as well. Some discussion of these disagreements (which are quite large for some stations) is needed.

Several of the figures and tables (Figs 6, 7bcef, 8, 9, 10, S11, Table S5) do not present uncertainty estimates. These should be added to the figures / tables. For some of the figures (e.g., Fig 8) perhaps just uncertainties for a subset of the traces (or just one of the traces, such as Inversion 1 in Fig 8) could be added to avoid overloading the figure.

Page 8, line 12. I think the value given here for the CO sink trend is wrong – it is inconsistent with what is described in Section 3.2.1 for Inversion 1; also if the sink is declining faster than the source, atmospheric CO would be going up, not down.

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