

Interactive comment on “Representing Model Uncertainty for Global Atmospheric CO₂ Flux Inversions Using ECMWF-IFS-46R1” by Joe McNorton et al.

Anonymous Referee #1

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This paper describes the detailed uncertainties in atmospheric CO₂ estimates based on inversions from a particular ECMWF weather prediction model. This type of uncertainty analysis of model products is important and useful. The model experiment setup is well conceived and the results may help in the uncertainty analysis of CO₂ inversions from other models and meteorology. The main issue I have with the paper is in some of the results discussion that is too heavy on citing numbers and some figures that need to be made more clear and have more discussion of their specific features. Specific comments are listed below. In general, the topic of this paper is appropriate for Geoscientific Model Development and I recommend publication provided the results discussion and figures can be made more focused and easily readable.

Specific comments

Lines 37 and 272: 'typically' instead of 'typical'

Lines 60-64: This paragraph (“Here, we investigate. . .”) seems like it should be in the abstract. I understood better and more quickly what you are doing in the paper after reading this paragraph compared to any part of the abstract. You might consider removing some of the specific numbers and results in the abstract and replacing it with this paragraph and perhaps also some of the sentences in lines 103-107.

Section 4.1: This section is a bit hard to read. I got bogged down with all of the citing of error numbers, trying to find the quoted errors on the plots and looking for descriptions of some of the details of Figures 1 and 2. Maybe the monthly mean errors could be put in a table so they don't have to be listed in the text? The acronyms aren't always consistent between the labeling on the Figures and in the text. The eight different model experiments and acronyms are a lot to keep track of so consistency and repetition helps the reader.

Figure 1: I understand each of the colored lines represent individual ensemble members but I was initially trying to figure out if there was any information in the red lines vs. the blue or green lines since that's generally the case in line plots with multiple colors. An alternative coloring scheme that would seem to emphasize the main point of the figure and connect it better to Fig. 2 is to color all of the ensemble members the same shade of gray or some other color, then add an average of the 50 ensembles with a thicker line and darker color along with the standard error at each time as whiskers on the mean. The standard error whiskers would then correspond to the lines on Fig. 2 for each model case.

It would be helpful to label the plots using the same acronyms as in Table 1 and Figures 2 and 3. What are the numbers at the bottom of each plot? I don't see any mention of them in the caption or text.

Figure 2: It's hard to differentiate between the darker colors in the top row of plots. Does $IME+PME=TME$?

Figure 3 and lines 267-71: The maximum values mentioned in the text are much larger than the color scale on Figure 3. Maybe a logarithmic scale would be better?

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