Review of "Assessment of WRF-GHG model simulations during the CAFE-Brazil Campaign in Amazonia"

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General comments:

The manuscript addresses an important problem in regional greenhouse-gas modeling over the Amazon Basin. By combining kilometer-scale WRF-GHG simulations with surface observations from ATTO and vertical and spatial measurements from the HALO aircraft, the study provides a useful assessment of how meteorological transport, biogenic CO_2 flux parameterizations, and alternative estimates of wetland CH_4 emissions influence simulated GHG concentrations.

A further strength is the regional adaptation of the model configuration, including replacing the default land-cover representation with MapBiomas data, using regionally adapted CO_2 biogenic flux parameters, and evaluating multiple CH_4 wetland emission configurations. These modifications are expected to enable the model setup to better reflect the heterogeneous land-surface and ecosystem characteristics of the Amazon region. The systematic evaluation and refinement of WRF-GHG for tropical regional applications, therefore, represent an important contribution, particularly as the authors aim to establish a recommended configuration for future downscaling and SSP-based GHG simulations.

Given the extensive use of regional land-cover information and biogenic flux representations, it would nevertheless be useful for the authors to more clearly compare their approach with previous Amazonian and tropical GHG modeling studies and specify which aspects of the proposed configuration constitute the principal methodological novelty.

Specific comments:

Data availability: The study benefits from a valuable combination of observations from the INMET network, ATTO-Campina, the INSTANT tower, and the CAFE-Brazil aircraft campaign. The statement regarding an "average of 10 radiosondes launched at different times of the day (Line 92)" could also be clarified to indicate whether this refers to the total number of launches or the sampling frequency during the campaign.

WRF-GHG-PrepPy: The use of WRF-GHG-PrepPy is a useful component of the modeling framework, as it provides a systematic way to preprocess and integrate multiple CO_2, CH_4, and related emission inventories required by WRF-GHG.

The treatment of convection at 6 km resolution. It is an important aspect of the model configuration. Since this resolution lies within the convective gray zone, it may be helpful for the authors to provide a little more justification for disabling the cumulus parameterization in the nested domain and to discuss whether scale-aware convection schemes were considered. The

manuscript also attributes the poor representation of vertical velocity to limitations in convective parameterization and parameterized vertical mixing; however, since the cumulus scheme is disabled at 6 km, this interpretation may require further clarification, maybe with supportive literature. Other factors, including model resolution, microphysics, boundary-layer processes, and the representation of explicitly resolved convection, may also contribute to the vertical-velocity biases. In addition, the statement that this configuration improves precipitation and convection forecasts could be phrased more cautiously unless such improvement is directly demonstrated by the sensitivity analysis.

The precipitation evaluation presented in Figs. S5 and S6. They are useful; however, it would be helpful to clarify how the model–observation comparison was performed. In particular, please specify the observational dataset used for the spatial evaluation in Fig. S6, whether the WRF output was interpolated or aggregated to the observational grid, and which metrics were used to quantify the reported over- and underestimation. For the ATTO time-series comparison in Fig. S5, it would also be useful to indicate whether the comparison is based on hourly, daily, or accumulated precipitation.

The intensive observational dataset available for January 2023: It provides a valuable basis for evaluating WRF-GHG during the campaign period. However, since the evaluation covers only one month of the wet season, it may be helpful for the authors to clarify the extent to which the recommended model configuration is representative of broader Amazonian conditions. In particular, CO_2 and CH_4 surface fluxes, boundary-layer development, convection, and atmospheric transport can exhibit substantial seasonal variability. A brief discussion of this limitation, and of whether additional seasonal evaluation would be desirable before applying the configuration to longer-term would strengthen the manuscript.

Technical:

Line 7-10: Confusing. Please paraphrase.
Line: 156: Replace ‘2023b), respectively.’ to ‘2023b), respectively.
Line 276: Replace ‘session’ with ‘section’
Figure 2: better to indicate the missing observation in the figure caption.
Figure sublables (a), (b), (c) could improve readability.
Line 285: More suitable to give a citation to studies considering this.
All figures: It is better to show the analysis in a standard time frame, either in UTC or LT
Figure 3: The model and observation frequency are different. It may not be advisable to put two datasets with different frequencies in the same analysis