Review of "Instantaneous radiative forcings due to the first indirect effect linked to warm clouds in the Amazon" by Pegliesi et al. (egusphere-2026-996)

This manuscript estimates instantaneous radiative forcing due to aerosol–cloud interactions (IRFaci) associated with the first indirect effect of anthropogenic aerosols on low-level warm clouds over the central Amazon, using observations from GoAmazon2014/5 combined with libRadtran simulations. The work addresses an important problem, leverages a rich and well-documented dataset, and introduces a two-reference-state approach to explore the role of the clean background in IRFaci estimates. The topic is well within the scope of the journal.

The study is promising and the main IRFaci magnitudes appear physically plausible and consistent with previous regional and global estimates. However, several aspects of the methodology and interpretation require clarification and, in some cases, additional analysis or more explicit caveats. In particular, (i) the construction and physical meaning of the two clean reference states, (ii) the extrapolation of LWC–r_eff relationships in time, (iii) the daily cloud representation and IRFdaily calculation, and (iv) the definition and robustness of the "sensitivity under clean conditions" deserve more scrutiny. Based on the above, I recommend major revisions before the manuscript can be considered for publication.

Major comments:

1. Physical consistency of the two clean reference states: the analyses relies on two different clean reference states: (1) a fixed irradiance reference (689.9 W m^{-2}) derived from 19 "cleanest days" across 2014–2015, and (2) a "seasonal" reference derived from two HALO flights (AC09 and AC18) in September 2014, with linearly interpolated irradiance between 689.9 and 767.9 W m^{-2} over the two years. One may wonder how representative they are. To justify the consistency between the two reference states, please consider providing more quantitative evidence demonstrating that the two reference constructions represent physically consistent "clean background". For example, it might be useful to show distributions (e.g. boxplots or PDFs) of LWP, r_eff, CBH, CTH, AOD, and β_sct for the two approaches. After that, you may discuss whether these two sets of days sample similar "natural" aerosol and cloud conditions, or whether the HALO days represent a specific regime (e.g., season, meteorological state, or cloud type).

2. Seasonal reference and linear interpolation (Fig. 4): the seasonal reference is constructed by linearly varying the clean reference irradiance between 689.9 and 767.9 W m^{-2} as a function of calendar day (Fig. 4). This assumes a linear evolution of "natural" clean-state TOA flux through the year. Please justify the linear interpolation more explicitly. For example, can you show that when only the cleanest days are considered, the observed F_corr or r_eff displays an approximately linear seasonal evolution?

3. Comparability with IPCC Twomey ERFaci estimate: you mention that the campaign-mean IRFaci for the second reference (−1.3 W m^{-2} with IQR −5.8 to 0.59 W m^{-2}) is close to the IPCC AR6 estimate of Twomey ERFaci (−0.7 ± 0.5 W m^{-2}). Please clarify that your quantity is a regional, top-of-atmosphere, daytime-only IRFaci for warm clouds, whereas the IPCC value is a global, all-sky, annual-mean effective radiative forcing, including adjustments (changes in cloud fraction,

lifetime, etc.). I'd recommend rephrasing the comparison to emphasize that the agreement is in order of magnitude and that your results are best viewed as observation-based benchmarks for models in the Amazon rather than direct constraints on the global ERFaci.

4. Daily slab cloud representation and sub-daily variability: warm clouds are represented as a single "daily" two-layer slab, with base/center/top heights derived from CBH/CTH percentiles and LWC/r_eff percentiles. All radiative transfer is computed at local noon assuming full cloud cover (fc = 1), and later scaled by the daily mean fc. Please discuss more explicitly that this is a first-order approximation that neglects sub-daily variability in cloud fraction, LWP, and r_eff, as well as differences between cumulus and stratiform elements.

5. Robustness of IRF sensibility analysis: the manuscript concludes that low warm clouds in the Amazon may be more sensitive to aerosol perturbations under clean conditions than under already polluted conditions. This conclusion is primarily obtained based on Table 5 which relates |mean IRFdaily| to percentage changes in AOD for clean vs. polluted periods. While it aligns with recent reports that ERFaci uncertainty is dominated by clean conditions, the metric mixes absolute |IRF| in one regime with relative AOD changes between regimes, and the denominator (ΔAOD%) ties to arbitrary period definitions.

Moreover, there are no uncertainty bars or significance tests provided along with the sensitivity values (e.g., 12.12 vs 4.08 W m^{-2}/ΔAOD% in 2014). Given relatively small numbers of days and the presence of positive IRFdaily tails, it is not clear that clean vs. polluted sensitivities are statistically distinguishable.

Specific comments:

L85: Have you cross-validated the LWP derived via the algorithm proposed by Turner et al. (2007)? Would the relatively smooth vertical gradients in the temperature and moisture profiles obtained by the method impact the quality of LWP retrievals?

L118: Could you clarify if only samples taken just above the T3 site were used in the study?

L265: Related to major comment #4, Is there any justification for this assumption? Moreover, what's the sensitivity of simulated clouds to the value of fc?

Figure 5: Might be useful to again mark the periods of clean and polluted periods.

L333: There might be a typo in the title of Section 3.2 ("Seasonal")

L374: It's good to mention the interannual variability in IRFaci here. However, one would wonder what the reasons could be causing the distinct variation. Please consider elaborating it more as this may help generalize the approaches used in this study for other periods.

L375: Can you elaborate more on what do you mean by the microphysical structure of clouds here? may vary based on the existing statistics?

L385: This suggests the assumption in irradiance and algorithm for derivation of reference state can significantly modulate the IRF values. Therefore, as given in the major comments, it is critical to ensure the robustness of the proposed algorithms.

L415 and L423: I guess fc=1 is identical with fc=100%. If so, please use the consistent way of expression throughout the manuscript to avoid potential confusion.

L430: It's essentially above and near the T3 site. In terms of the region over the Amazon, most likely there is large spatial variability which is not addressed in the study. One may wonder how the spatial variability may alter the overall conclusion made here. Please clarify.

L435: Please list all the applicable datasets specifically in the “Data availability” section.