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Comment on amt-2022-305

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Community comment on "Diurnal carbon monoxide observed from a geostationary infrared hyperspectral sounder: First result from GIIRS onboard FY-4B" by Zhao-Cheng Zeng et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2022-305-CC1>, 2022

This article used the GIIRS, which is the first geostationary Infrared hyperspectral Sounder over the world, to retrieve the diurnal carbon monoxide. CO is very important atmospheric pollutant and a tracer of CO₂. This work is very meaningful and the paper is well-written and well organized. This would be the second work on atmospheric trace gas retrieval after Lieven Clarisse (2021) (<https://doi.org/10.1029/2021GL093010>), and also is the first work on GIIRS-FY4B and CO.

As a community comment, I highly recommend publication to raise awareness of thermal infrared detection of trace gases.

I also have the following suggestions and questions.

The colormap in Figure 10(a) and Figure 11(b) should be changed. The viridis colormap is hard for reading and knowing the spatial change. May jet, rainbow, or some other colormap are suitable.

The GIIRS of FY4A has a certain degree of wavelength calibration offset. Is the GIIRS of FY4B better in wavelength calibration? How is this considered in the inversion? Should the wavelength be calibrated first, or should it be brought into the inversion model for optimization iterations? See the GIIRS FY4A wavelength calibration problem on: <https://www-cdn.eumetsat.int/files/2021-01/8%20-%20Coheur%20-%2017h15%20-%20Preliminary%20results%20on%20NH3%20retrievals%20using%20GIIRS.pdf>

P12,L320. The x_a , x_{true} in the formula should be differentiated from the previous formula (Eq 5). The same express x_a and \mathbf{x}_a may lead some confusion. May CO_a or CO_{true} be better. This may be helpful for some readers. \mathbf{x}_a in Eq 5 including CO_a and other state vectors.

Are there any plans to apply the algorithm to FY4A with data from 2019? (Although FY4B has better instrument performance.)

GIIRS completes a scan cycle in about 2 hours, so the data at a certain position within 0-2h is just an instantaneous value within the cycle. Although there is no difference in value, it may be better to remind readers to pay attention.

The temperature profile is a key physical quantity for CO inversion, and the ERA5 reanalysis data was used in this study. How sensitive is the algorithm to the temperature profile? The CO₂ absorption band of GIIRS has the ability to invert temperature profiles. Would the inversion results for trace gases be better using their inversion temperature profiles?

P5, Figure 1c. (bottom) Jacobian for CO May add the matrix would be better (Jacobian matrix).

Overall, this article is very valuable and meaningful. I highly recommend publication.