Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2022-37

Anonymous Referee #2

Referee comment on "Spectral replacement using machine learning methods for continuous mapping of the Geostationary Environment Monitoring Spectrometer (GEMS)" by Yeeun Lee et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2022-37-RC2, 2022

<General comments>

This study proposes methods for replacing GEMS radiances measured at bad pixels. The manuscript is well written, with an informative description of GEMS measurements. However, I believe the demonstration of the method validity can be improved. In particular, the qualitative discussion about the performance of reproduction, described with Figs. 11-12, needs to be improved and more objective. Also, in addition to the prediction errors presented in Figs. 7–9, it is recommended to show how well the proposed methods reproduce known good spectra (i.e., actual measurements). For example, panels can be added in Figs. 11-12 to show examples of reproduction for known good spectra. (The message would be more straightforward if measured spectra were overlaid with the reproduced data.) Besides, how can the spectral sampling of input/output (0.1 nm) be finer than the original GEMS data (0.2 nm)? More detailed descriptions about this are recommended. Overall, I suggest this manuscript be reconsidered after major revisions.

<Specific comments>

- Line 78: Please give the full names of the gaseous species (i.e., O_3, SO_2, NO_2, and HCHO).
- Line 82: The authors refer to each of ~700 east-west pixels as a "scan," but probably this term is not accurate. Isn't the whole ~700 pixels considered to be in one scan? Also, can GEMS cover the entire field of regard by one scan? It seems that is what the authors are implying.

- Line 84: Do the CCD pixel numbers presented here represent those for only photoactive pixels?
- Line 89: The general description of the bad pixel detection method is informative. But how about presenting how long the GEMS integration time is (by adding another sentence)?
- Line 99: This sentence sounds as if the results of 1-D interpolation were presented earlier, which is not true. How about rephrasing this sentence, using a verb like "imply" instead of "indicate"?
- Line 104: The subject affected by the defective pixels is the quality of ozone retrieval, not the ozone properties themselves.
- Line 148: How can the spectral interval of input and output (0.1 nm) be narrower than that of original GEMS measurements (0.2 nm)? How are the GEMS measurement spectra sampled onto the finer grids? Please give more details here.
- Line 149: Did you investigate how much the results changed when trained without SZA and VZA? Please describe the impacts of including these variables.
- Figure 5: The caption and the color bar title do not correspond. Which wavelength was used between 310 and 354 nm?
- Line 264: How can we tell if spectra look "reasonable"? This statement is vague. Please consider changing Figs. 11-12 to include any reference (know, good, measured) spectra for the reconstructed parts.
- Line 269: I believe the term "noise" itself implies randomness, which would not necessarily be canceled in the normalized radiance. Please consider replacing the term with another, e.g., error, bias, artifact, etc.

- Please consider re-writing the units in the figures as W cm^{-3} sr^{-1}.
- Please consider minor English corrections below.
  - Lines 42, 49, 50, 100: affect to -> affect ?
  - Lines 109, 148, 184, 185, 199, 214, 221, 238, 241, 243, 250, 254, 258, 268: Defect -> Defects
  - Line 225: Fig. -> Figs.
  - Line 242: N-S -> North-South
  - Line 276: A period (.) missing between sentences