## Comment on amt-2022-127

Anonymous Referee #1

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Referee comment on "A $CO_2$-independent cloud mask from Infrared Atmospheric Sounding Interferometer (IASI) radiances for climate applications" by Simon Whitburn et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2022-127-RC1, 2022

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This manuscript describes a new algorithm to discriminate cloudy versus cloud-free scenes in IASI pixels. It uses a neural network approach, trained to reproduce the current last version of the EUMETSAT IASI level 2 cloud product, and ends up indeed with similar results as that training product, with the benefit that it can easily be processed along the whole IASI time series and provide therefore a homogeneous cloud mask time series, while the EUMETSAT IASI cloud product undergoes a number of discontinuities during the whole IASI time period. This data will be useful for all other types of climate data records reprocessing based on IASI data, all requiring cloud-free scenes.

The paper is well organized, well written, well presented, and the scientific work is sound and well described. To my point of view, it will be suitable for publication after the following comments are addressed.

**Major comments**

- The IASI-related bibliographic references should be made a bit larger than citing work from the co-authors and their teams. This is especially obvious in the introduction, lines 29 to 32, where discussing in general trace gas, aerosols and radiation retrieval/work (not even specifically from IASI) and citing only 3 papers, all from the team(s) authoring the current manuscript. I also quickly scanned the full bibliographic list: all cited papers containing the word "IASI" (except 2, one on IASI assimilation and one on AVHRR within IASI pixels) contain co-authors from the current manuscript. This feels weird.
- Lines 54-56 Could you add a reference to support your statement (last sentence of the paragraph) and maybe mention what was the IASI-CIRS developed for, if not for cloud masking in satellite retrievals?
- Line 187: what are those "emissivity features associated with a lower sensitivity" and why does it only affect night-time data? Is this also present in the other IR cloud retrievals?
- For the intercomparison, I find a bit problematic to have all data from 2016 except two.

I understand the reasons to have the IASI-L2 from 2020 but then why not all data for 2020? – for AMSU it is impossible, then obviously you should keep 2015, but then I would have a second plot for 2015 with AMSU and IASI NN. In any case, comparing yearly averages for different years does not make much sense, except if you can prove that those yearly averages do not change over time

- In the intercomparison with IASI-L2: when comparing the year 2020, which was used for the training, could you specify which percentage of the full year data was used in the training, and if it is small enough that the comparison is not skewed towards being "perfect" because it was the training set?

- Is there any way to assess which algorithm makes a better job (IASI-L2 or IASI-NN) in the cases where they do not agree? For example, select a number of specific cases and compare with MODIS Terra as is done for the dust aerosols? That would be a great addition to the paper, I think, being able to discern if the NN makes a better job than its training data, or if it is "only" similarly good but with easy long time series consistent processing.

- In the comparisons, the NN with the double threshold compares better to some other products. There is no discussion afterwards which threshold should be retained for the IASI-NN mask. I guess it is the "non doubled", but I think it is worth a sentence or two.

- In the time series, it is clear that the IASI-L2 sea undergoes a "drop" at the launch of v6.5; however, I am surprised to see that the CIRS-LMD matches quite nicely the IASI-L2 before v6.5 from 2013 onwards (before that, anyone would agree that the IASI-L2 has issues); so has it been proved that the latest IASI-L2 yields better results than the prior versions? If not, maybe the IASI-NN should be trained with the prior IASI-L2 version 6.4? And if yes, maybe the CIRS-LMD team could be consulted to try to understand why their (independent) data matches better the previous IASI version?

- About the specific "dust training set" (17 selected dust storms), could you confirm that the events taken to analyse the performance, in Fig 7, were not part of these 17 events used to select the best NN training with respect to dust?

- In data availability, please be more specific about which data will be available: the cloud mask, or the output of the NN (and then the user has to decide of the threshold, as line 137 mentions that "this threshold can be adjusted depending on the application" – but then, except the double sea threshold for comparisons, no threshold depending on application is ever discussed)

**Typos and small corrections**

Line 37 – at 9.30 AM and PM -> maybe add that this is local solar time and not UTC?

Line 75 "algorithm that retrieveS" (s is missing)

Figures 2 and 7: could you add the lat/lon as in Fig 3?

Line 152 providing a computational time without the technical information on the machine is a bit weird; I understand that the goal is to show it is pretty fast, without having to describe technically a system, but you could just mention "on a typical personal computer" or "on a type xxx HPC machine"

Line 166 exhibit (remove the s)

Figure 4 caption: missing the last )

Table 2, first line: could you provide the start date of the version 6.5?

Line 248 typo in "together"

Figure 6: the y axis title says it is in %, while the numbers are clearly not in %

Figure 7: the days in the caption do not match the days written on the plots; maybe also mention it is day-time data (9:30 AM)?

Line 315: "dust" (without the s) or "dust aerosols"

Line 406 (biblio) the IASI l2 PG citation would need some kind of number version, DOI, or weblink and access date, I think

**Thoughts and suggestions – entirely left to your appreciation**

- The title is slightly misleading (at least to me), as if maybe the cloud mask worked only in the absence of $CO_2$ (which makes no sense), or does not contain $CO_2$ (again, not much sense); I would suggest maybe using something like "$CO_2$-independent" instead of "free"?
- In the cloud mask plots, I find it counter-intuitive to have the clouds in yellow, especially when discussing the dust (which will usually call the colour yellow/orange in

people's minds). Obviously, white would not be a good choice, but what about some kind of grey?

- Lines 156 to 159 why have 3 different words for the same concept? It is good to mention they mean the same thing, but I think it would be even better to use consistently the same term
- Often, I find the figures come a bit late with respect to the text addressing them, but I guess this is anyway dealt with during the final preparation by the journal crew