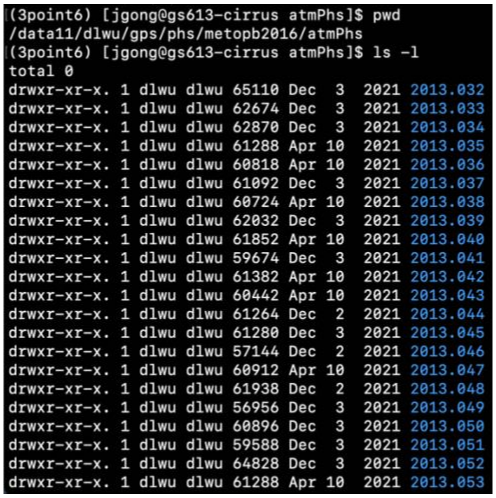
Thank you for scrutinizing the revised manuscript, our responses and provide your constructive suggestions from the original version all the way through. Please see our refinements/response below in blue letters. We also proofread the revised manuscript and corrected several grammar errors.

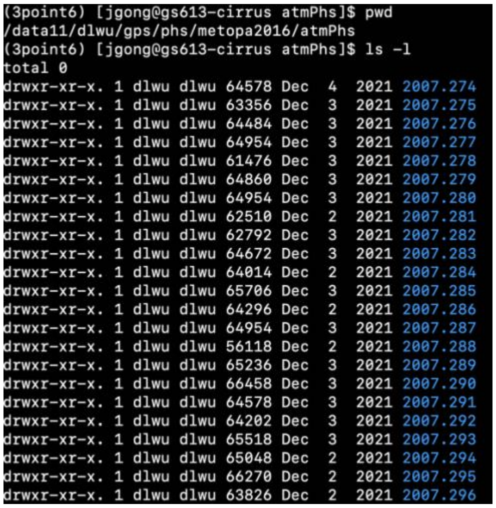
Public justification (visible to the public if the article is accepted and published):
Thank you very much for the updated version of your paper.

You have addressed nearly all of my concerns; in particular, the figures 9 and 10 are finally drawn in a way that your argumentation in the text can be followed, and the latter has alse greatly improved. I am also grateful for you stating the limitations and shortcomings of the work described in the paper. With that, the paper is nearly ready for publication, with the exception of the following details:

1. I mentioned in my previous communication that Metop-B was launched in late 2012; you can find the precise date by googling. I thus do not understand why even in your corrected version, you claim you used (non-existent) data from that satellite during 20212. Please correct the entry in Table 1 by checking which data you really used. While the correction will not change your results and conclusion, it may create doubts on your thoroughness and integrity for some readers; don't give them such an argument.
Thank you so much for reiterating this point, which I apparently overlooked in the previous response. You are absolutely correct. After checking back (see below), our SNR data are indeed only available since 2014.032 for Metop-b, and 2007.274 for Metop-a. This mistake has been corrected in Table 1. In addition, the inconsistent writings of "Metop" and "METOP" have now been all changed to "Metop".



```
(3point6) [jgong@gs613-cirrus atmPhs]$ pwd
/data11/dlwu/gps/phs/metopb2016/atmPhs
(3point6) [jgong@gs613-cirrus atmPhs]$ ls -l
total 0
drwxr-xr-x. 1 dlwu dlwu 65110 Dec  3  2021 2013.032
drwxr-xr-x. 1 dlwu dlwu 62674 Dec  3  2021 2013.033
drwxr-xr-x. 1 dlwu dlwu 62870 Dec  3  2021 2013.034
drwxr-xr-x. 1 dlwu dlwu 61288 Apr 10  2021 2013.035
drwxr-xr-x. 1 dlwu dlwu 60818 Apr 10  2021 2013.036
drwxr-xr-x. 1 dlwu dlwu 61092 Dec  3  2021 2013.037
drwxr-xr-x. 1 dlwu dlwu 60724 Apr 10  2021 2013.038
drwxr-xr-x. 1 dlwu dlwu 62032 Dec  3  2021 2013.039
drwxr-xr-x. 1 dlwu dlwu 61852 Apr 10  2021 2013.040
drwxr-xr-x. 1 dlwu dlwu 59674 Dec  3  2021 2013.041
drwxr-xr-x. 1 dlwu dlwu 61382 Apr 10  2021 2013.042
drwxr-xr-x. 1 dlwu dlwu 60442 Apr 10  2021 2013.043
drwxr-xr-x. 1 dlwu dlwu 61264 Dec  2  2021 2013.044
drwxr-xr-x. 1 dlwu dlwu 61280 Dec  3  2021 2013.045
drwxr-xr-x. 1 dlwu dlwu 57144 Dec  2  2021 2013.046
drwxr-xr-x. 1 dlwu dlwu 60912 Apr 10  2021 2013.047
drwxr-xr-x. 1 dlwu dlwu 61938 Dec  2  2021 2013.048
drwxr-xr-x. 1 dlwu dlwu 56956 Dec  3  2021 2013.049
drwxr-xr-x. 1 dlwu dlwu 60896 Dec  3  2021 2013.050
drwxr-xr-x. 1 dlwu dlwu 59588 Dec  3  2021 2013.051
drwxr-xr-x. 1 dlwu dlwu 64828 Dec  3  2021 2013.052
drwxr-xr-x. 1 dlwu dlwu 61288 Apr 10  2021 2013.053
```



```
(3point6) [jgong@gs613-cirrus atmPhs]$ pwd
/data11/dlwu/gps/phs/metopa2016/atmPhs
(3point6) [jgong@gs613-cirrus atmPhs]$ ls -l
total 0
drwxr-xr-x. 1 dlwu dlwu 64578 Dec  4  2021 2007.274
drwxr-xr-x. 1 dlwu dlwu 63356 Dec  3  2021 2007.275
drwxr-xr-x. 1 dlwu dlwu 64484 Dec  3  2021 2007.276
drwxr-xr-x. 1 dlwu dlwu 64954 Dec  3  2021 2007.277
drwxr-xr-x. 1 dlwu dlwu 61476 Dec  3  2021 2007.278
drwxr-xr-x. 1 dlwu dlwu 64860 Dec  3  2021 2007.279
drwxr-xr-x. 1 dlwu dlwu 64954 Dec  3  2021 2007.280
drwxr-xr-x. 1 dlwu dlwu 62510 Dec  2  2021 2007.281
drwxr-xr-x. 1 dlwu dlwu 62792 Dec  3  2021 2007.282
drwxr-xr-x. 1 dlwu dlwu 64672 Dec  3  2021 2007.283
drwxr-xr-x. 1 dlwu dlwu 64014 Dec  2  2021 2007.284
drwxr-xr-x. 1 dlwu dlwu 65706 Dec  3  2021 2007.285
drwxr-xr-x. 1 dlwu dlwu 64296 Dec  2  2021 2007.286
drwxr-xr-x. 1 dlwu dlwu 64954 Dec  3  2021 2007.287
drwxr-xr-x. 1 dlwu dlwu 56118 Dec  2  2021 2007.288
drwxr-xr-x. 1 dlwu dlwu 65236 Dec  3  2021 2007.289
drwxr-xr-x. 1 dlwu dlwu 66458 Dec  3  2021 2007.290
drwxr-xr-x. 1 dlwu dlwu 64578 Dec  3  2021 2007.291
drwxr-xr-x. 1 dlwu dlwu 64202 Dec  3  2021 2007.292
drwxr-xr-x. 1 dlwu dlwu 65518 Dec  3  2021 2007.293
drwxr-xr-x. 1 dlwu dlwu 65048 Dec  2  2021 2007.294
drwxr-xr-x. 1 dlwu dlwu 66270 Dec  2  2021 2007.295
drwxr-xr-x. 1 dlwu dlwu 63826 Dec  2  2021 2007.296
```

Fig. R1: screenshots of SNR data that we processed for Metop-b (left) and Metop-a (right). We started processing Metop-b data since 2013.032 and Metop-a data since 2007.274.

2. Editorial: Line 326: "Firstly, The quality of..." -> "Firstly, the quality of..." (turn the capital letter 'T' into lower case).
Corrected. Thanks.

With these changes, the paper can be published.

Allow me a few additional remarks on your paper; I do not expect you to include a discussion on these points in the final version.

Grinsztajn et al. (2022) (also see references therein) demonstrated that the "old-fashioned" Statistical Learning methods like Gradient Boosted Trees regularly outperform deep learning approaches on tabular data. Only very recently, Hollmann et al. (2025) published a transformer-based neural network that seems to overcome this problem. As you are using a much simpler neural network design than the one proposed in the latter paper, it might well be that your desire to be more fashionable and follow the hype on deep learning methods made you miss better results you might have been able to achieve simply by performing hyperparameter tuning. That is a pity.

Thanks for recommending this paper. While I do not have bandwidth to read this paper closely right now, I agree totally with you that newer ML methods not necessarily work better than old ML methods. In this paper, we put some efforts in the early stage of this work for hyperparameter tuning with random forest and gradient boosting. As mentioned in the current manuscript, the best performance in terms of minimizing RMSE is quite comparable across simpler ML models and deep-learning models, and we chose CNN as our final model mainly because it learns the cross-correlation between different pressure layers, not because it outperforms other simpler ML models. For your interests, we do have ongoing works adopting transformer-based or diffusion-based models into Earth science application domains, which simple MLs cannot be used anymore (e.g.,

https://doi.org/10.48550/arXiv.2411.17000). However, due to funding cycle limitation, we cannot extend efforts into adopting these new ML models into this specific problem.

Data leakage has been identified as a significant issue in ML-based scientific applications; see Kapoor et al. (2023), who even refer to a "reproducibility crisis" in machine-learning-based science. The workshop page at https://sites.google.com/princeton.edu/rep-workshop/ offers additional insights, particularly through its annotated reading list. That is why it is essential to avoid data leakage, or at least discuss it if it has occurred (as you are doing now).
Thank you very much for bringing this paper to our attention. We have added it as an addition citation in the updated manuscript.

References:

Grinsztajn, Leo, Edouard Oyallon, and Gael Varoquaux. 'Why Do Tree-Based Models Still Outperform Deep Learning on Typical Tabular Data?' Advances in Neural Information Processing Systems 35 (6 December 2022): 507–20. https://proceedings.neurips.cc/paper_files/paper/2022/hash/0378c7692da36807bdec87ab043cdadc-Abstract-Datasets_and_Benchmarks.html

Hollmann, Noah, Samuel Müller, Lennart Purucker, Arjun Krishnakumar, Max Körfer, Shi Bin Hoo, Robin Tibor Schirrmeister, and Frank Hutter. 'Accurate Predictions on Small Data with a Tabular Foundation Model'. Nature 637, no. 8045 (January 2025): 319–26. https://doi.org/10.1038/s41586-024-08328-6.

Kapoor, Sayash, and Arvind Narayanan. 'Leakage and the Reproducibility Crisis in Machine-Learning-Based Science'. Patterns 4, no. 9 (8 September 2023). https://doi.org/10.1016/j.patter.2023.100804.