Response to EGUSPHERE-2023-637 Review

Wei Huang, Lei Liu, BinYang, Shuai Hu, Wanying Yang, Zhenfeng Li, Wantong Li and XiaofanYang

Dear editor,

We appreciate the editor very much for his/her constructive comments and suggestions on our manuscript entitled "Retrieval of temperature and humidity profiles from ground-based high-resolution infrared observations using an adaptive fast iterative algorithm" (ID: EGUSPHERE-2023-637). We have addressed the issues noted by the editor, to which we respond in italicized font below. We hope that the editor will find our responses satisfactory, and we are willing to further revise the manuscript regarding any additional suggestions that the editor may have. Please find below the editor's comments in light blue with our responses after each comment.

C1. Line 32: "denser sounding coverage" sounds ambiguous. Geographical coverage or vertical coverage? Please be specific and use the correct adjective.

R1. Thank you for pointing out this problem. We have revised the "denser sounding coverage" to "*wider geographical coverage and higher horizontal resolution*" in line 32 in the improved paper.

For your convenience, the corresponding revised part in our revised submission is given as follows:

Satellite-borne instruments are able to provide wider geographical coverage and higher horizontal resolution than ground-based balloon radiosonde observations.

C2. Line 49: "radiative transfer process" --> radiative transfer calculation or radiative transfer simulation

R2. We have revised the "radiative transfer process" to "*radiative transfer simulation*" in line 50 in the improved paper.

For your convenience, the corresponding revised part in our revised submission is given as follows:

Physical retrieval algorithms utilize the radiative transfer simulation and the iterative optimization strategy, which exhibit higher retrieval accuracy compared to the statistical retrieval algorithms.

C3. Line 62: delete "However"

R3. We have deleted the word "However".

C4. Line 63: "strategy of progressively setting regularization parameters from higher to lower values". Do you mean that the regularization parameters are iteration-dependent and are defined as a monotonically decreasing sequence? If yes, please reformulate this sentence and refer this approach (iteratively regularized gauss--newton method) to Bakushinskii (1992) and Xu et al. (2016).

R4. Thank you for your suggestion. The sentence in line 63 has been rephrased. We

have read the references recommended by the editor carefully and added them to the revised sentence.

For your convenience, the corresponding revised part in our revised submission is given as follows:

To achieve good stability and accuracy, the regularization parameters in the AERIoe algorithm are defined as a monotonic sequence, which contains at least seven values, leading to a minimum of seven iterations for convergence because the regularization parameters are iteration-dependent (Bakushinskii, 1992; Xu et al., 2016).

C5. Line 64: "minimum of seven iterations"? I would guess that you mean maximum number of iterations is 7.

R5. Thank you for your comments. As described in Sect. 3.1, the regularization parameters selected by Turner and Löhnert (2014) come to be a fixed sequence of γ factors— 1000, 300, 100, 30, 10, 3, 1, 1, 1, ..., which is used as a function of iteration number. The retrieval is not allowed to converge until γ decreases to 1 and meets the convergence criterion, which makes the AERIoe algorithm require at least 7 iterations.

C6. Line 122: To select regularization parameters more wisely, one can choose the initial regularization parameter from the singular values of the Jacobian matrix. Nevertheless, this is more like a suggestion, which may be considered in your future work.

R6. Thank you for the constructive suggestions. The regularization parameter chosen from the singular values of the Jacobian matrix may help the retrieval converge more efficiently and reduce computational time. The method proposed by the editor gives us good enlightenment, and we will explore it in our future work.

Kind regards.
Wei Huang
E-mail: whuang_edu@outlook.com

Corresponding author: Lei Liu
E-mail: liulei17c@nudt.edu.cn