

Response letter

Dear Editor and Reviewers:

We greatly appreciate your efforts in the previous version of the manuscript (Title: Antarctic atmospheric Richardson number from radiosoundings measurements and AMPS, Manuscript ID: acp-2022-352). We have made point-to-point responses to all the comments/suggestions raised in your review reports and made the corresponding revisions in the context. All the replies in this document are colored in blue, and the revisions/changes in the revised manuscript are marked in red.

-----Reviewer Comments-----

General Comments

The author has sufficiently addressed my comments on the prior manuscript draft. I have only a few remaining minor comments.

Response:

We appreciate the reviewer's comments and advice. We have revised the manuscript accordingly.

Minor comments

Line 33: I don't understand what this means: "corresponding to the measured astronomical seeing is small"

Response:

A small astronomical seeing means the intensity of optical turbulence is small, optical turbulence is the effects of atmospheric turbulence on wave propagation. For example, Atmospheric turbulence is a major problem in optical astronomy as it drastically reduces the angular resolution of telescopes (Roddier, 1981).

Revision in the manuscript:

We have replaced

"the simulated Ri basically behaved as expected as the Ri is generally large when the atmosphere is less turbulent (corresponding to the measured astronomical seeing is small; Yang et al., 2021)"

with

"the simulated Ri behaved as expected since the Ri is generally large when the disturbance effects of atmospheric turbulence on wave propagation (called optical turbulence) are weak (Yang et al., 2021)." in the revised manuscript (lines 32-33).

References:

Roddier F.: The Effects of Atmospheric Turbulence in Optical Astronomy, Progress in Optics, 19, 281-376, 10.1016/S0079-6638(08)70204-X, 1981.

Line 88: I don't think it is necessary to mention what Vaisala sensor used to be used or how its sensitivities compare to the Vaisala RS41, if measurements from the older version were not utilized in this study, as this makes the message more convoluted.

Response:

Thank you for the Reviewer's suggestions. We have removed comments on the older version (Vaisala RS41) to avoid making the message more convoluted.

Revision in the manuscript:

We have deleted

“Vaisala RS41 radiosondes have gradually replaced an older version (Vaisala RS92) starting in late 2013. These two radiosondes agree well with global average temperature differences $<0.1-0.2$ K in the lower stratosphere, but RS41 appears to be less sensitive than RS92 to changes in solar elevation angle (Sun et al., 2019). Besides, RS41 (1-1.5% dry bias) has better performance than RS92 (3-4% dry bias) relating to the infrared atmospheric sounding interferometer as a practical reference (Sun et al., 2021).” in the original manuscript (lines 88-92).

Line 93: Not necessary to write out Richardson number and boundary layer height, as these have previously been defined with acronyms.

Response:

This sentence located in Line 93 of the original manuscript has been omitted. Please refer to the response below for further information.

Nevertheless, we have utilized abbreviations for Richardson number and boundary layer height in other instances.

Revision in the manuscript:

We have replaced

“The Richardson number is used to determine the boundary layer height using a critical value” with

“The Ri is used to determine the $PBLH$ using a critical value” in the revised manuscript (line 299).

Line 92-94: What is the point of this sentence? Clarify the significance of the fact that the Ri and $PBLH$ from the radiosondes are positively correlated with that from reanalysis.

Response:

It seems that the significance of this sentence is not obvious, Then we have deleted it.

Nevertheless, we would like to explain the point of this sentence here. Reanalysis can be used as the model initial and boundary conditions for AMPS (or AMPS inputs). We previously think it may be worth mentioning how it performs when compared with the results from the radiosondes. However, this content does not stick to the topic of this paper, as this paper focuses on evaluating the AMPS outputs, then this description has been removed.

Revision in the manuscript:

We have deleted

“Near-global radiosonde measurements have been used to calculate the Richardson number and derive the boundary layer height, which is positively correlated with the results of four reanalysis products” in the original manuscript (lines 92-94).

Figure 4: In every other x-axis label, it says $\log Ri(10)$ – shouldn't this be $\log_{10}(Ri)$?

Response:

We have revised the x-axis label in Figure 4 and replaced $\log_{Ri}(10)$ with $\log_{10}(Ri)$.

Figure 8 caption: not necessary to state “(instead of {theta})”

Response:

We have deleted “(instead of {theta})”.

Revision in the manuscript:

We have deleted
“(instead of θ)”
in the original manuscript (Figure 8 caption).

Line 302: Should use abbreviation for Richardson number instead of writing it out.

Response:

We have used an abbreviation for Richardson number.

Revision in the manuscript:

We have replaced
“Richardson number”
with
“ Ri ”
in the revised manuscript (294).