Manuscript Number: egusphere-2022-986

Title: Evaluation of a wind tunnel designed to investigate the response of evaporation to changes in the incoming longwave radiation at a water surface

Response to second round of reviews

Original review comment in ITALICS.
Author Response in bold.

Associate Editor (Dr Daniela Famulari)

***Public justification (visible to the public if the article is accepted and published)**: Further small corrections are required following the recommendations provided by Reviewer #2.*

Technical corrections:
I thank the authors for their rapid response, however I have to point out that, contrary to what was suggested, only a small part of what the reviewer#2 asked was satisfactorily addressed. In fact, only 2 small sentence modifications were made on the manuscript. I request that AT LEAST point 1 and 7 should be satisfactorily addressed before you resubmit your revised version. I understand that this has been a long process, but a last small effort to close the work would be preferable, especially considering the efforts both reviewers made to improve the manuscript.
Please, provide the following:
1-"In the discussion and conclusion sections of the manuscript, however, it remains unclear the specific research questions which are addressable via the setup described here. Zooming out even further- what is the impact of this work? I strongly recommend fleshing this out." Provide at least one sentence in the conclusions that clearly states what is the aim of the experimental device: currently you have provided a summary and synthesis of your setup, but which scientific question would you like to answer with this apparatus? What would it be useful for?

We have completely rewritten the final paragraph to directly address this comment. The new paragraph now reads:

In summary, the experimental system described here has been designed to investigate how evaporation is coupled to longwave radiation. In the traditional (Dalton-like) bulk formulae, evaporation is held to depend on the wind speed and the difference in specific humidity between the (near-saturated) surface and the ambient air. The traditional bulk formulae does not explicitly acknowledge any dependence on the longwave radiative fluxes. The experimental system can be used to hold the wind speed and specific humidity in the adjacent air at constant values while independently altering the incoming longwave radiation. By this design we are able to isolate any

direct coupling of evaporation to the longwave radiative fluxes. In the paper we have shown that the steady state wind tunnel system provides reliable measurements and we can impose a controlled longwave radiative forcing of around 49 W m^{-2} that is known to within ±3.1 W m^{-2}. When combined with a measurement accuracy of the evaporative response to that forcing that will be better than 2 W m^{-2} we conclude that the new wind tunnel system is suitable for the experimental investigation of the coupling of evaporation to longwave radiation.

2-3- You have responded to point 2 and 3, two possible suggestions on how to put into a wider context your work, however not introduced any change to the manuscript. The points raised would have been an improvement, but nothing strictly necessary to justify what you have done so far, you mentioned this is a methodology and experimental description, and the suggested points can also be addressed in a future contribution, therefore I accept your reply.

Noted.

4- You have not added what was asked, but not being a necessary point that is acceptable as well.

Noted.

5- You have not provided what was asked by the reviewer.

We have substantially modified the text (see lines 50-61 in the new track changes manuscript) to incorporate the idea of including the exponential dependence for the longwave absorption and by also noting that this applies even in perfectly still conditions.

6- OK, changed according to the suggestion.

Noted.

7- Not changed. The reviewer asked an aesthetic change to the chart in Fig 15, in order to make it more easily readable. The suggestion is to change the range of the y axis on the left (1000-6000) to 1000-8000), while leaving the axis on the right unchanged (range 5-40, as in the original chart). In the new chart provided in the reply, the right y axis range is also changed (5 to >50), defeating the purpose of the reviewer request. The point here is that the gridlines make it easy to be read on the left y axis, but not on the right: the

request is obviously NOT TO CHANGE ANY VALUES OF THE CURVE, but rather changing scales on the axes in order to make the plot more readable. Can you keep the range of right-y axis fixed, and change the left-y axis?

There is a misunderstanding here. The axes cannot be independently changed in the manner suggested since for a given total air pressure (= 1 bar), *e* (left hand axes) defines *q* (right hand axes) and vice versa. To help with the discussion below we note the following equivalent values:

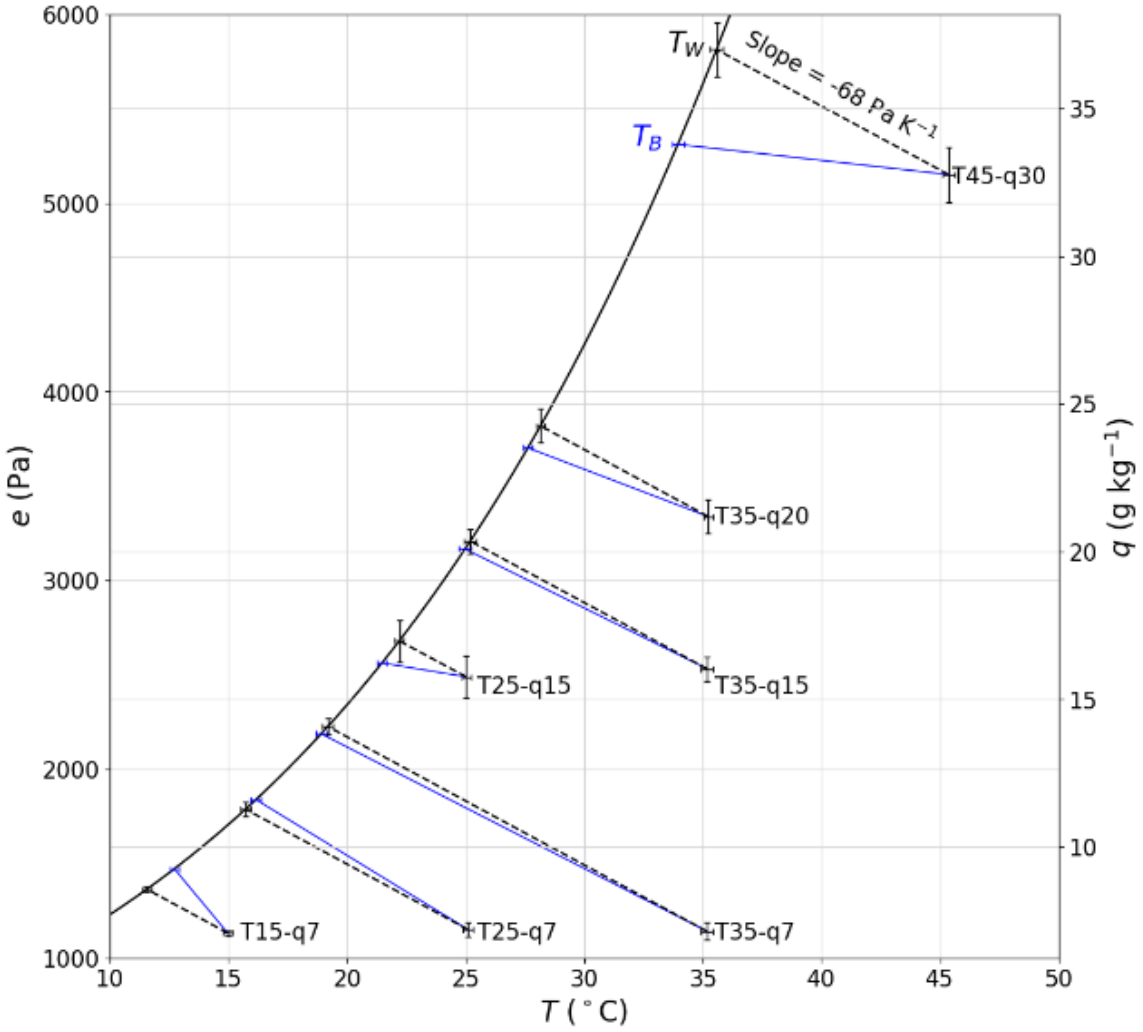
e **(Pa)**	***q*** **(g kg^{-1})**
801.4	**5**
1000	**6.24**
6000	**38.19**
6278.0	**40**
8000	**51.31**

Now let us start with the original plot where the left hand axes has a range in *e* of 1000-6000 (Pa). On this choice the right hand axis range is automatically defined to be from 6.24 g kg^{-1} (= 1000 Pa) to 38.19 g kg^{-1} (= 6000 Pa). There is no choice.

Now assume we were to change the left hand axes range to be 1000-8000 (Pa) as originally suggested by reviewer 2. On this choice the right hand axes range will now be from 6.24 g kg^{-1} (= 1000 Pa) to 51.31 g kg^{-1} (= 8000 Pa).

Conversely if we set the right hand axes range to be 5 to 40 g kg^{-1} then the left hand axes range is automatically defined to be 801.4 to 6278.0 Pa.

If we added grid lines for both sides the plot would like this:



We personally find that having two sets of grid lines (one for each y axes) is a little more confusing than the original plot.

For that reason we have left the original plot but we can easily change it to the above if required.

Michael L. Roderick & Callum J. Shakespeare (on behalf of all authors)

10th September 2023