Dear Dr Messori – thank you for considering our manuscript again and for your additional comments, repeated below.

Our main changes are in Section 3, where we have worked to reduce the word length describing the three scientific challenges (atmospheric convective modelling, land-atmosphere carbon cycle exchange, and large-scale oceanic circulations).

For all three issues, by tightening the wording and, in some instances, referring back more comprehensively to the literature, we have removed just over a full page. All these alterations can be seen in the uploaded "track changes" document.

We have also amended the Figure captions to refer more directly to the proposed AI-led equation discovery. Specifically, at the end of Figure 2 (that illustrates a convective event), we now add to the caption: "*A key possibility for AI is to derive equation sets, potentially with stochastic components, that broadly aggregate these complex processes to scales of order 100 km, and so appropriate for inclusion in ESMs*".
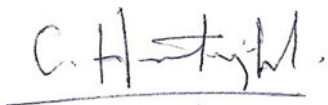
Then, for Figure 4, which illustrates very large-scale ocean-atmosphere couplings, we add to the caption: "*We suggest that AI-led equation discovery is well-positioned to investigate oceanic datasets, in order to determine if the simplified model presented here remains the most appropriate to maximally represent the ocean-atmosphere system at very large scales*"

We apologise about the poor wording and replace "*stronger*" with "*more useful*". We have also amended the code availability statement as requested.

We very much hope that the manuscript is now in a state to be accepted by ESD. Please contact me if there are, however, any further questions.

Thank you again for all of your help, time and support on our Perspective article.

With kind regards,

Chris Huntingford (chg@ceh.ac.uk) and on behalf of all co-authors

> *Dear Authors,*
>
> *Thank you for your detailed replies to the Reviewers, and for including the new Figure 5. Even following your revisions, the paper is still quite lengthy for a perspective, and I agree with the concern expressed in some of the reviewer comments that there are passages in Sect. 3 which go into a lot of details not directly related to the proposed AI equation discovery approaches. I appreciate the point you make in your replies in wanting to show a clear connection to physical applications, but this needs to be balanced with the perspective format and accessibility to a broad*

readership. I would thus encourage you to make a further effort to make the text as concise and easily readable as possible in this section. I would also recommend clarifying for the readers how the figures relate to the topic of the paper. Right now the captions to Fig. 2 and Fig. 4 make no clear link to AI equation discovery.

Two additional minor suggestions:

ll. 24-26 Please review this sentence; I struggled to understand what the term of comparison for "stronger" was.

Code availability: Please review the statement to read "This is a perspective article".

Best Regards,
Gabriele Messori