Response to Reviewer 1

Thanks for the authors' responses. The authors have addressed most of my concerns very well. However, one issue remains from the last point of my first major comment: "The above sensitivity contrast also indicates weaker thermodynamic adjustments … Are there any reasons for the inconsistency?"

We thank the reviewer for the additional comments. We will address the reviewer's previous major comment with our answer to the following comment.

I am still unclear about the assumption of a stronger m∞,h at low N. In the authors' responses, they mentioned that at low N, evaporating precipitation stabilizes the boundary layer, thereby weakening entrainment. Based on this, I would expect that reduced entrainment would lead to a weaker thermodynamic adjustment or m∞,h. Could the authors provide further clarification on their assumption at low N?

Two things are to consider. First, we will address the negative slope of $m_{\infty,h}$ at low N. Entrainment is proportional to the integrated buoyancy flux (Nicholls and Turton 1987). Evaporating precipitation negatively contributes to the buoyancy flux. Thus, entrainment decreases as precipitation increases. This stabilizing effect of precipitation has been outlined in Caldwell et al. (2005) and Wood (2007) before. Since precipitation and hence the potential for its evaporation decreases with increasing N, entrainment increases with N, which decreases L with N, and results in a negative $m_{\infty,h}$. Note that this is very similar to the previously described sedimentation- or entrainment feedbacks which increase entrainment with increasing N (Bretherton et al. 2007, Wang et al. 2003). Second, we must consider that precipitation is only present for sufficiently low N < 100 cm^{-3}. For higher N, there is no precipitation and no evaporation to stabilize the boundary layer. Thus, the $m_{\infty,h}$ from evaporating precipitation is only restricted to low N, while the $m_{\infty,h}$ from sedimentation- and evaporation-entrainment feedback might exist for all N. Combining these two facts, the $m_{\infty,h}$ at low N should be stronger (more negative) at low N than at higher N. We extended our manuscript as: "Moreover, deviations can hint at changes in the sensitivity of thermodynamic processes to N, e.g., the stabilizing effect of evaporating precipitation on boundary-layer dynamics and hence entrainment at low N, which naturally vanishes for higher N due to decreasing precipitation (e.g., Nicholls and Turton 1984; Caldwell et al. 2005; Wood 2007; Hoffmann et al. 2023)."

Additionally, I suggest that the authors include a table of heuristic model parameters, listing their names and physical meanings, to enhance the readability of the paper.

This is a great suggestion. We added the table.