Supporting Information for "Effects of circulation on tropical cloud feedbacks in high-resolution simulations"

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1. Figures S1 to S6

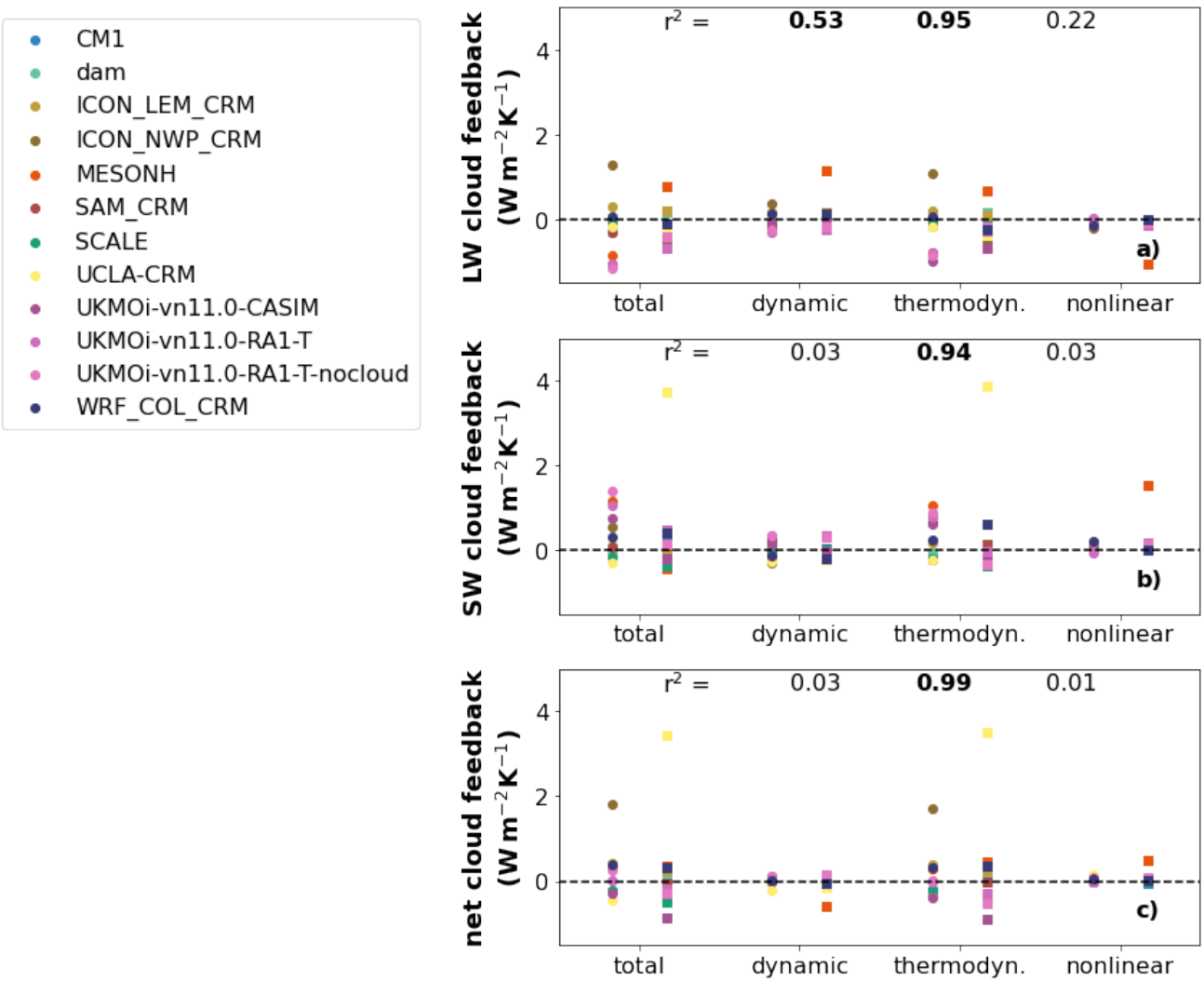

Figure S1. Similar to Figure 4, but without the outlier points removed. Two sets of feedbacks are computed: between the 295 K and 300 K simulations (circles) and between the 300 K and 305 K simulations (squares). Colours indicate different models, as in legend of Fig. 4. The identified anomalous feedbacks are for the UCLA-CRM model (computed between the 300 K and 300 K simulations, yellow squares), which has an anomalously large shortwave thermodynamic component, and the MESONH model (also computed between the 300 K and 300 K simulations, red squares), which has anomalously large thermodynamic, dynamic and nonlinear components. Inset text in this and subsequent figures gives the Pearson's r^2 value, with the text in bold if statistically significant (p<0.01).

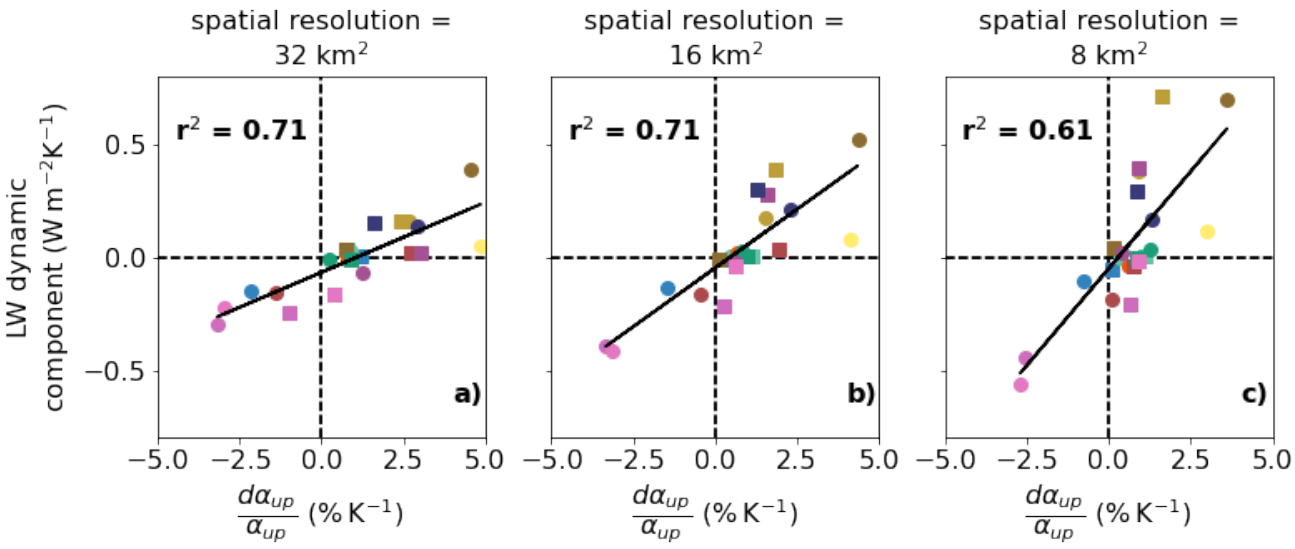

Figure S2. Testing the sensitivity of Figure 6a [reproduced here for comparison as panel (a)] to the resolution of spatial averaging. Dynamic components computed for the 300 K minus 295 K simulations (circles) and the 305 K minus 300 K simulations (squares). Colours indicate different models, as in legend of Figure S1.

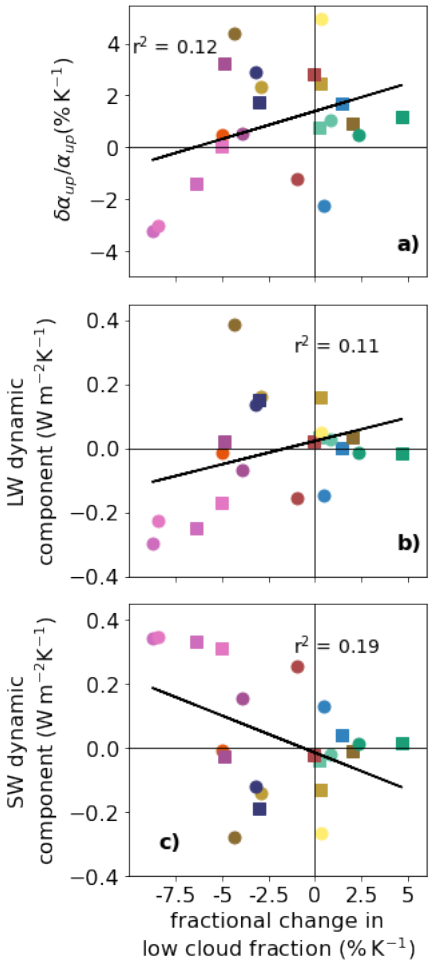

Figure S3. As in Figure 6 but here for low-cloud fraction.

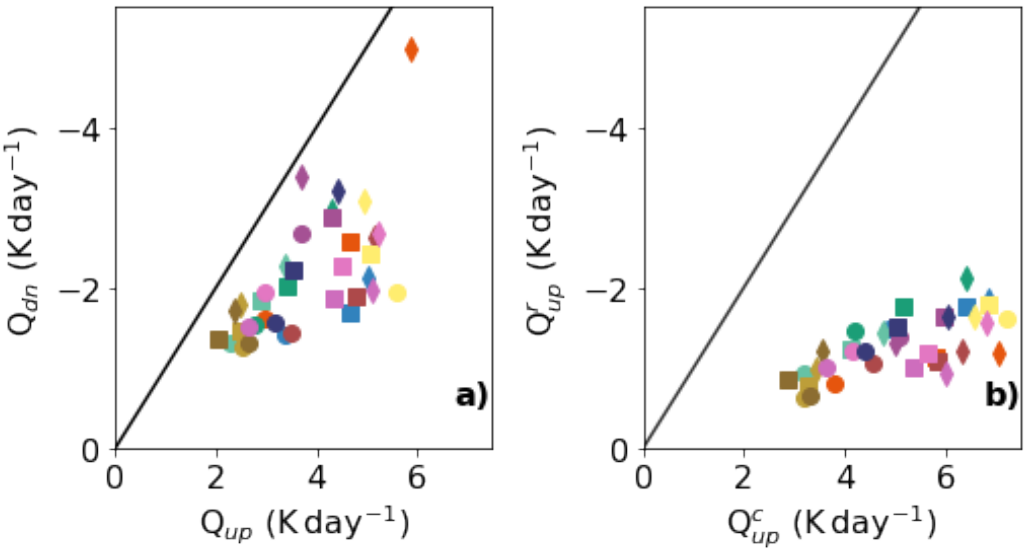

Figure S4. (a) Model values of Q_{up} against Q_{dn}, circles, sqaure and triangles indicate the 295 K, 300 K and 305 K simulations, respectively. Black lines show where $|Q_{dn}| = |Q_{up}|$ to aid comparison of magnitudes. Panel (b), as for panel (a), but for Q^r_{up} versus Q^c_{up}

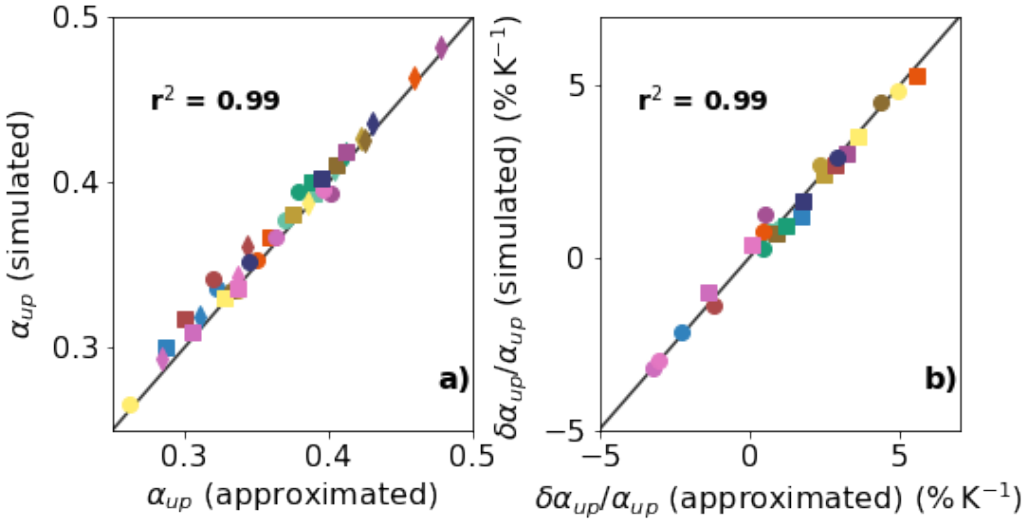

Figure S5. (a) Ascent fraction α_{up} as approximated by (7) (Jenney et al., 2020) versus simulated ascent fraction. Symbols represent different temperatures: circles indicate the 295 K simulations, squares the 300 K simulations, and triangles the 305 K simulations. (b) Fractional changes in approximated versus simulated α_{up}, circles indicate 300 K minus 295 K, squares indicate 305 K minus 300 K. UCLA-CRM and MESONH at 305-300 K have been removed from the analysis as they are significant outliers (Fig. S1).

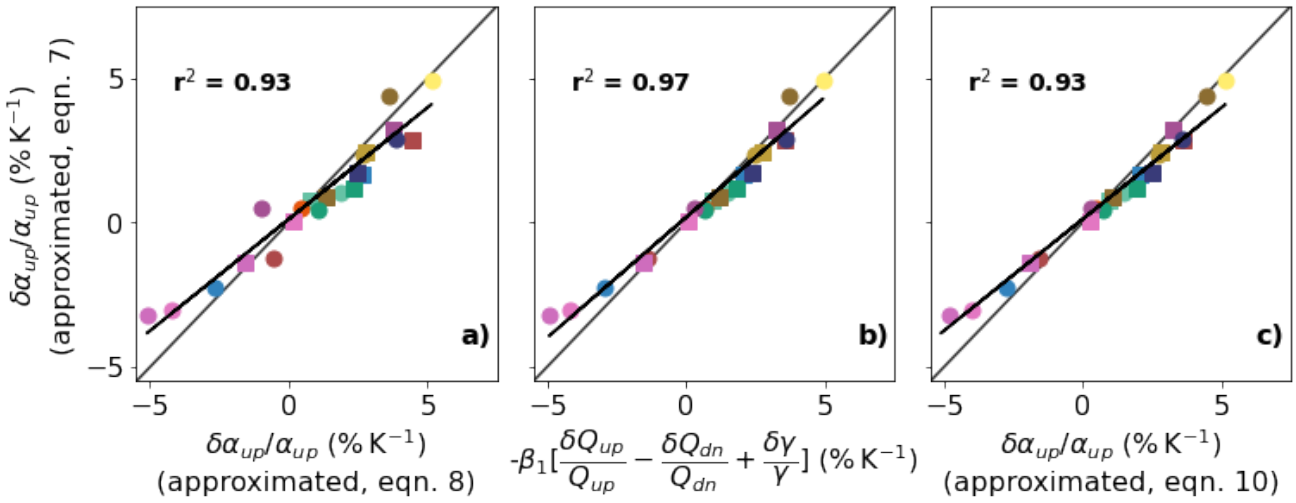

Figure S6. (a) Approximation of the fractional change in ascent fraction by (8) versus that computed from (7) and calculating the fractional changes. The 1:1 line is marked, as is the regression line from the approximation, which has a slope of 0.77. (b) As for panel (a) but the x-axis values are calculated including fractional changes in γ; the slope of this regression line is 0.83. (c) As for panel (a) but the x-axis values are calculated using (10); the slope of this regression line is 0.77. UCLA-CRM and MESONH at 305-300 K have been removed from the analysis as they are significant outliers (Fig. S1).

References

Jenney, A. M., Randall, D. A., & Branson, M. D. (2020). Understanding the response of tropical ascent to warming using an energy balance framework. *Journal of Advances in Modeling Earth Systems*, *12*(6), e2020MS002056. doi: 10.1029/2020MS002056