Supplemental Material

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Supplementary Materials

Shallow cumulus properties as captured by adiabatic fraction in high-resolution simulation

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1. Horizontal cross-sections at lower altitude:

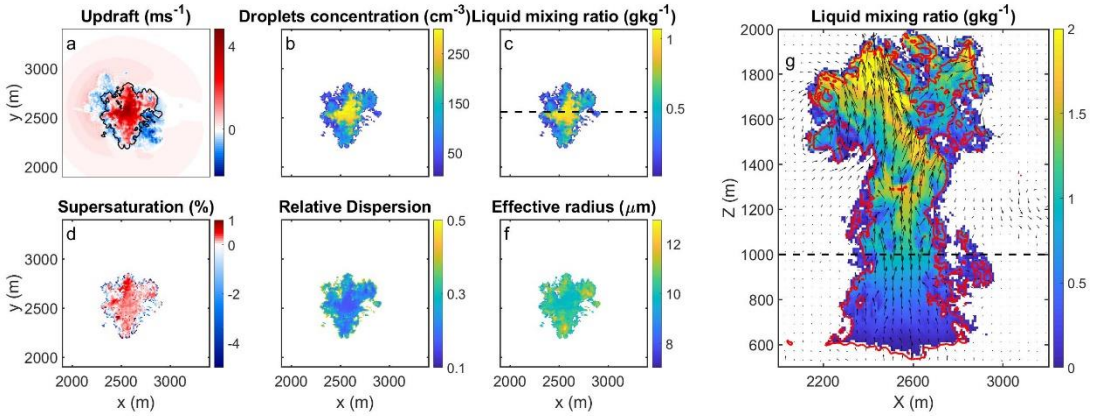

Figure S1. Horizontal cross-sections at 1000 m. Referenced in the main text at the discussion about Figure 1. Horizontal cross-sections of **(a)** the vertical velocity at an altitude of 1000 m (marked by the dashed line in 1g), the black contour marks the cloud edges where q_c>0.01 g/kg), **(b)** droplets concentration (none-cloudy pixels are masked in white), **(c)** liquid water mixing ratio, **(d)** supersaturation values, **(e)** relative dispersion, **(f)** effective radius, and **(e)** vertical cross-section of the cloud's liquid mixing ratio at the center of the domain in the y-axis. The red contour marks the saturated zone where S=0. Black arrows present the zonal and vertical wind components. Black dashed line is the levels of the horizontal cross-section from previous panels.

2. Buoyancy driven subsiding shell:

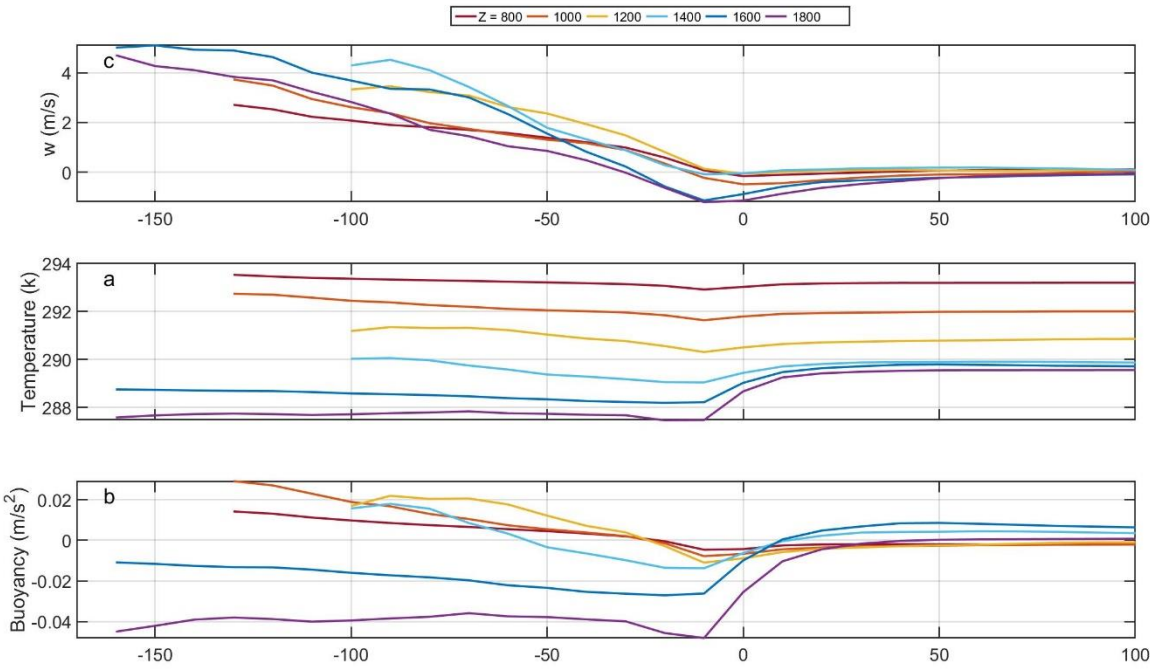

Figure S2. Buoyancy driven subsiding shell. Mean values of vertical wind (a), absolute temperature (b), and buoyancy (c), as a function of the distance from the cloud edge. (Same as Figure 2e-h in the main text). One can see that the subsiding shell, presented as negative values of vertical velocity near the edge of the cloud (DFCE=0) on both sides of the interface, correlates with negative buoyancy and colder temperatures.

3. DSDs measured in high resolution in cumulus clouds over India:

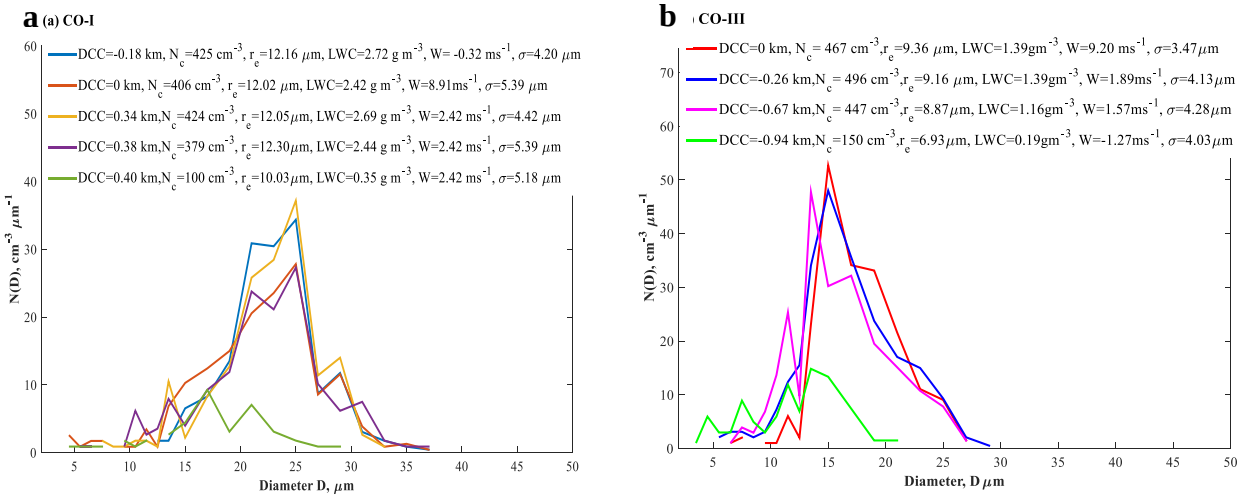

Figure S3. Examples of measured droplet size distributions. *The DSDs were measured in continental cumulus clouds in high-resolution of 25 Hz by Konwar et al., (2021). Cloud Microphysical Structure Analysis Based on High-Resolution In Situ Measurements. Journal of the Atmospheric Sciences 78(7), pp.2265-85. Each panel is of a different aircraft penetration.* ***(a)*** *CO-I and* ***(b)*** *CO-III (see Fig. 4a and 4c in the original paper, respectably). The distances from the cloud center (DCC), in cloud updrafts and weak downdrafts, droplets concentration (N_d), effective radius and DSD's standard deviation (σ) are given for each DSD and coded by color.*

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Konwar, M., T. Prabhakaran, A. Khain, M. Pinsky. 2021. Cloud Microphysical Structure Analysis Based on High-Resolution In Situ Measurements. *Journal of the Atmospheric Sciences* 78(7), pp.2265-2285.