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Technical note: Parameterising cloud base updraft velocity of marine stratocumuli

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Here in the supplement we show statistics about cloud development based on the difference between the initial and final states. Detailed evolution of individual clouds can be examined by using the publicly available raw data (Ahola et al., 2022). Ideally, cloud top (Fig. S1) and base (Fig. S2) height and total water path (LWP+RWP) (Fig. S3) would not be changing from the initial state but precipitation occur only after spin-up (Fig. S4). Cloud top and base hardly show any changes, but total water path decreases. This is because the cloud water content inside the stratocumulus decreases from the initially adiabatic profile due to entrainment mixing at the cloud top. Precipitation also removes liquid water especially at the highest initial LWP values for the SALSA simulations.

Figure S5 shows the histogram of the tendency of updraft velocity during the last simulation hour. The mean is close to zero, which means that updraft velocities are not changing much during the last hour, so the turbulence is fully developed.

In Figs S6 and S7 we have calculated decoupling analysis in the same way as in Jones et al. (2011). The lower left corner of Figs S6a,b,c,d (where most of our simulations lie) present cases that are not decoupled. Decoupling would show as a large difference between boundary layer bottom and top liquid water potential temperatures (Fig. S7). We used temperature nudging to avoid such situations.

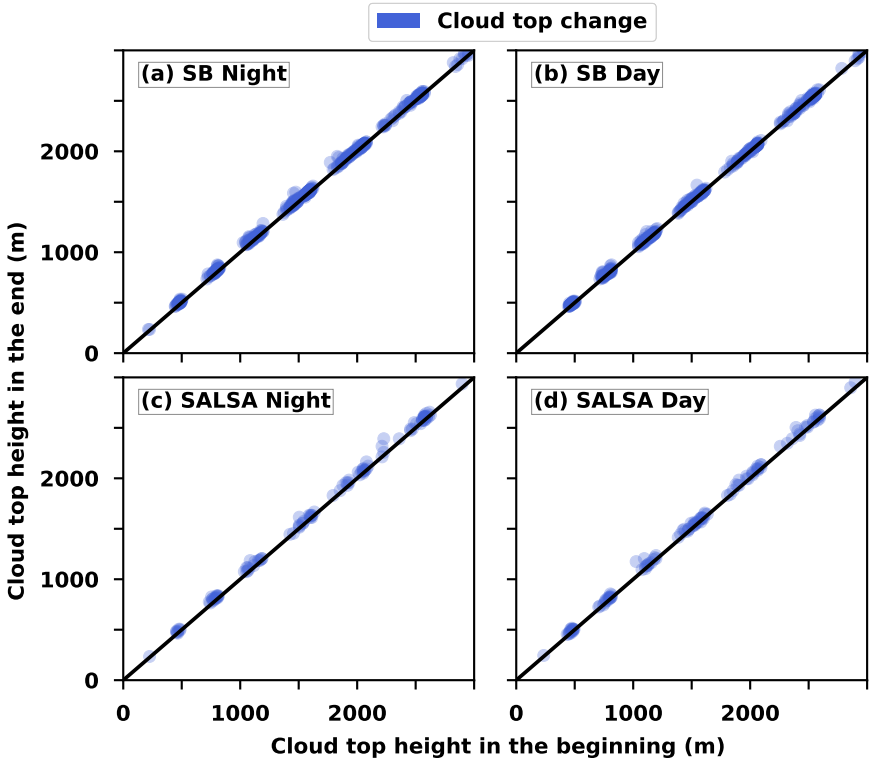

Figure S1: Cloud top change

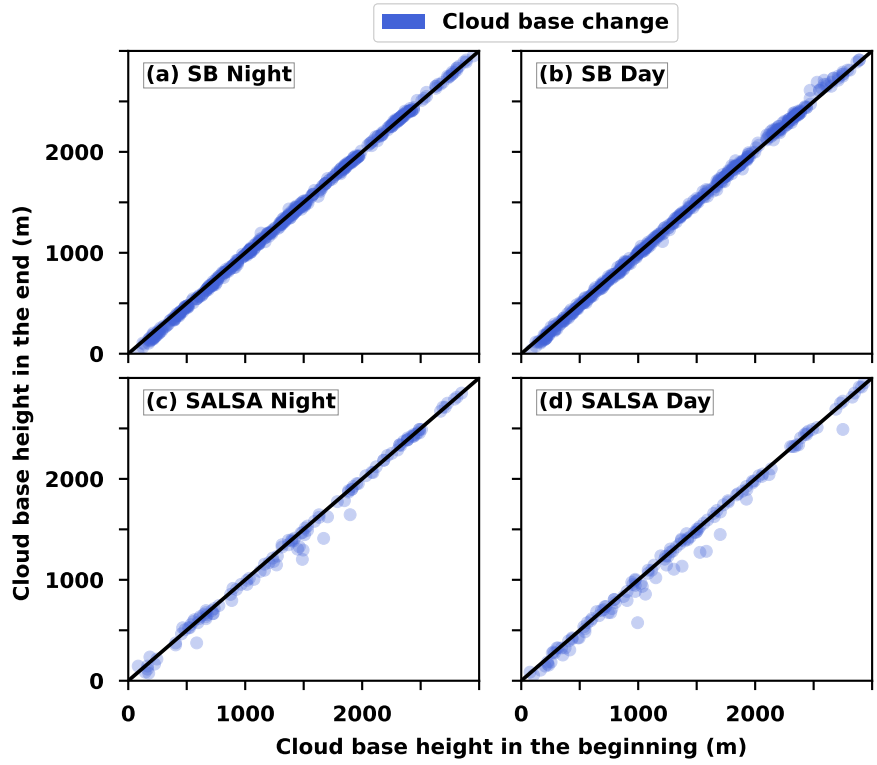

Figure S2: Cloud base change

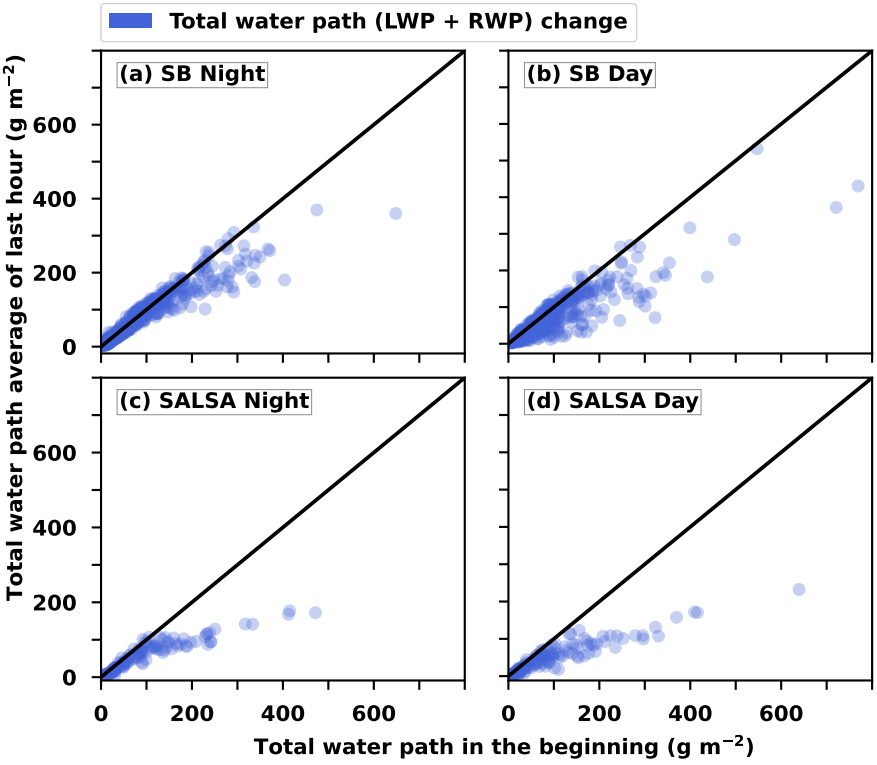

Figure S3: Total water path

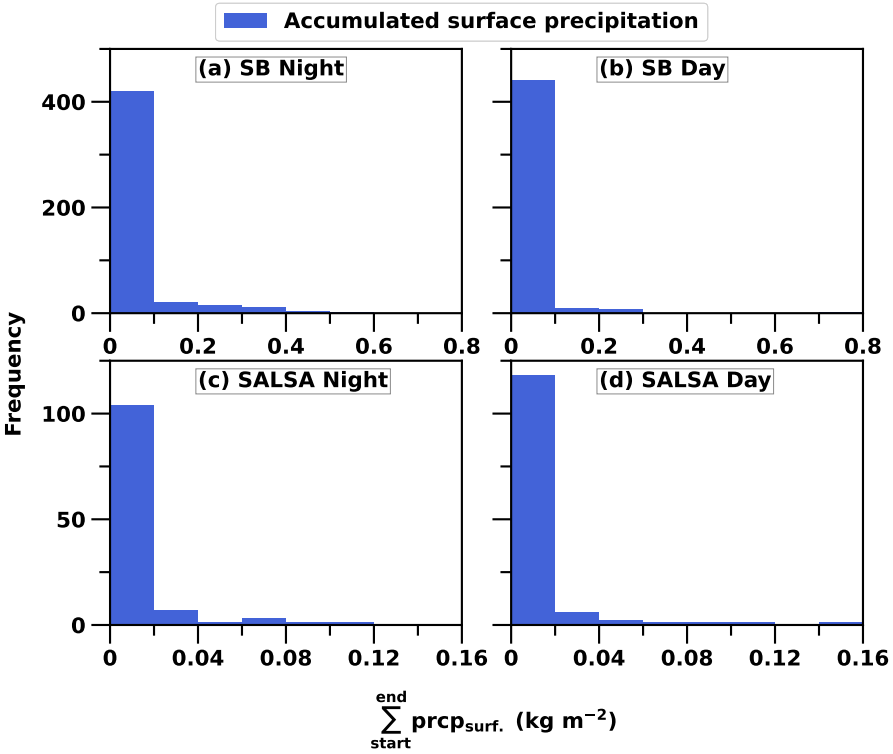

Figure S4: Accumulated surface precipitation.

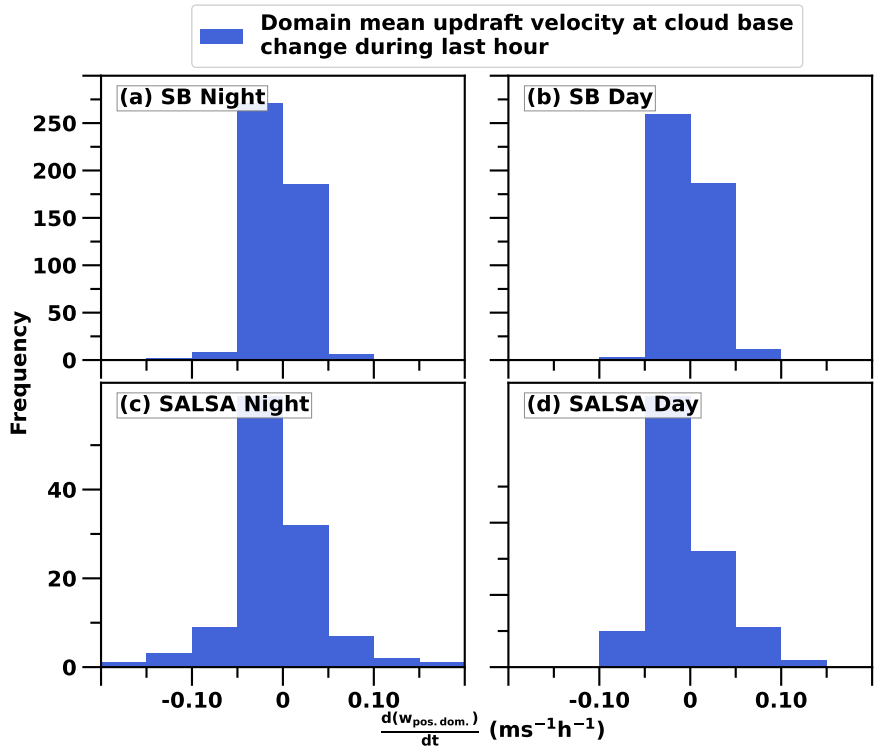

Figure S5: Tendency of updraft velocity during last hour

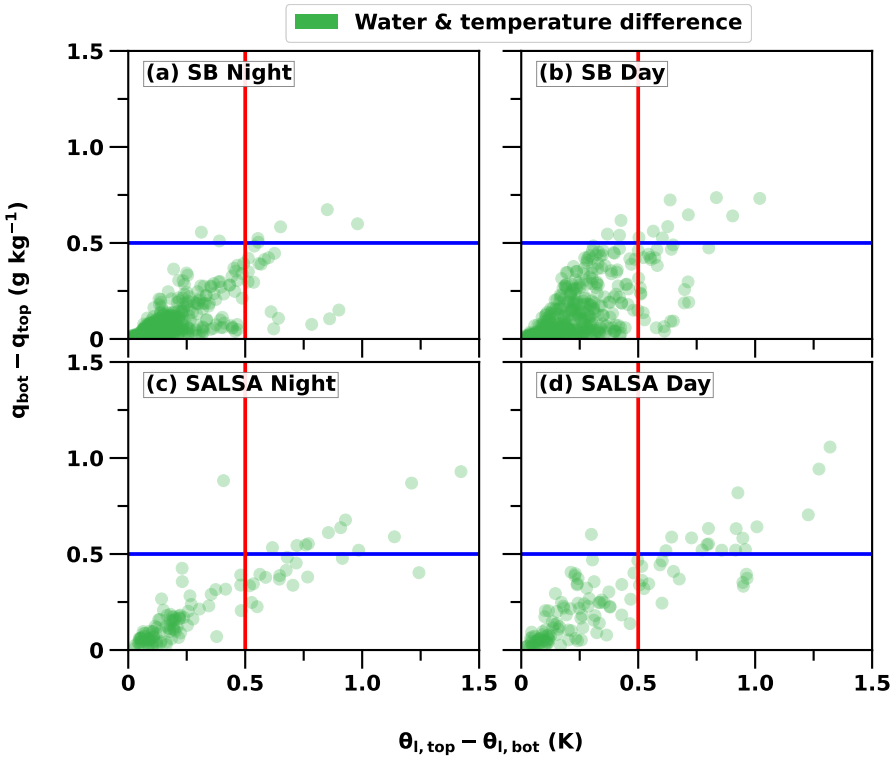

Figure S6: Scatter plot of decoupling measures

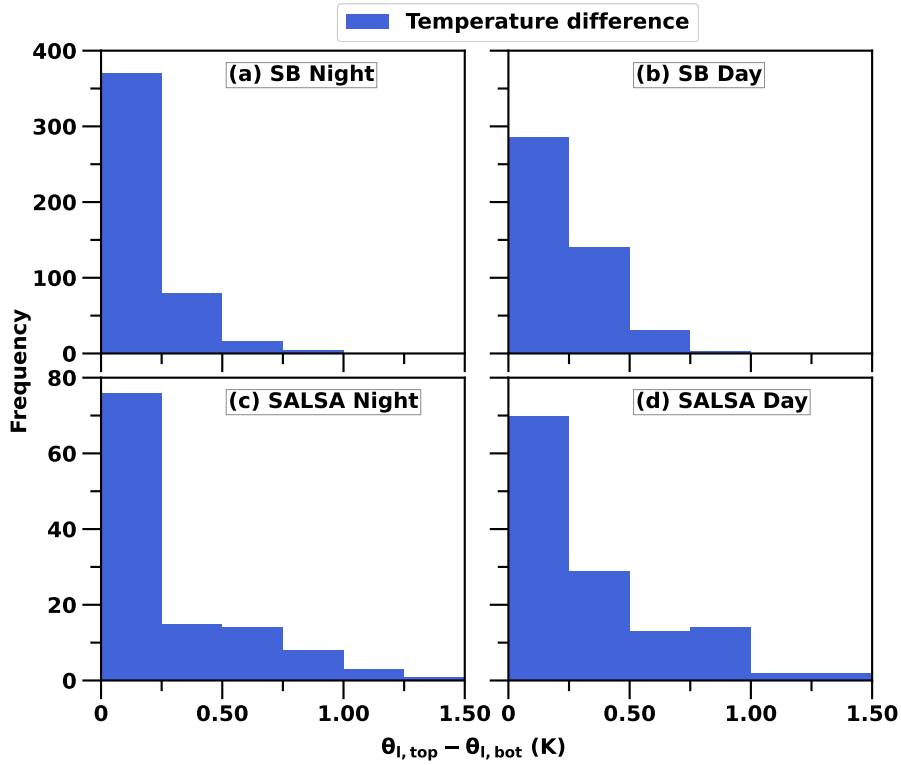

Figure S7: Difference between surface and cloud top potential temperatures

References

Ahola, J., Raatikainen, T., Alper, M. E., Keskinen, J.-P., Kokkola, H., Nordling, K., Partanen, A.-I., Romakkaniemi, S., Räisänen, P., Tonttila, J., and Korhonen, H.: LES simulations of "Parameterising cloud base updraft velocity of marine stratocumuli" -manuscript, doi: 10.23728/FMI-B2SHARE.179721B8F65643718FF4A5FECF230F7C, 2022.

Jones, C. R., Bretherton, C. S., and Leon, D.: Coupled vs. decoupled boundary layers in VOCALS-REx, Atmospheric Chemistry and Physics, 11, 7143–7153, doi: 10.5194/acp-11-7143-2011, 2011.