



Is evaporative cooling relevant for stratocumulus dynamics?

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The role of evaporative cooling on the dynamics of a non-precipitating stratocumulus boundary layer is explored with large-eddy simulations (LES), performed in a maritime nocturnal stratocumulus boundary layer (DYCOMS-II RF01 case study). The impact of evaporative cooling is assessed by suppressing the buoyancy anomaly produced by latent heat release in the vertical momentum equation, thus inhibiting the dynamical contribution of evaporative cooling to the buoyancy term without directly affecting the conserved variables.

By comparing the results from this simulation with a reference twin one, it is possible to evaluate the impact of evaporative cooling, finding that this is on average negligible and thus it does not directly influence boundary layer entrainment. Inspection of the vertical momentum budget equation shows that the contribution of evaporative cooling is two order of magnitude smaller than the buoyancy mixing term.

These results are important for the representation of stratocumulus in coarser scale weather and climate models, as they suggest that only the slab-average cooling associated with evaporative cooling is relevant for stratocumulus but that the exact spatial structure is not.