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Evaporation cooling and condensation heating quantification in high resolution large eddy simulations.

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The dynamics of boundary layer clouds is explored with large-eddy simulations (LES) which are able to evaluate the role of evaporation and condensation energy release. By comparing the liquid water derived from conserved variables with a pseudo-liquid water scalar which is only advected and diffused, it is possible to estimate at each time step and at each grid point the intensity and location of evaporative cooling and condensation heating produced throughout the simulation.
A case study exploring a high-resolution simulation for a maritime nocturnal stratocumulus boundary layer (DYCOMS-II RF01) is presented. Evaporative cooling is found to be occurring along the edges of the cloud and peaking at the cloud top, with values of the order of few Kelvin per hour. Also condensation reaches larger values in the upper portion of the cloud, but - as expected - larger values are found in the inner core. The increase of both horizontal and vertical resolution shows an increase in both evaporative cooling and condensation heating.
Such approach could be used to explore different case studies and to directly estimate the role of condensation and evaporation by suppressing their contribution into the simulation.