

Overlap statistics of shallow boundary layer clouds: Comparing ground-based observations with large-eddy simulations

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High-resolution ground-based measurements are used to assess the realism of fine-scale numerical simulations of shallow cumulus cloud fields. The overlap statistics of cumuli as produced by large-eddy simulations (LES) are confronted with Cloudnet data sets at the Jülich Observatory for Cloud Evolution. The Cloudnet pixel is small enough to detect cumuliform cloud overlap. Cloud fraction masks are derived for five different cases, using gridded time-height data sets at various temporal and vertical resolutions. The overlap ratio (R), i.e., the ratio between cloud fraction by volume and by area, is studied as a function of the vertical resolution. Good agreement is found between R derived from observations and simulations. An inverse linear function is found to best describe the observed overlap behavior, confirming previous LES results. Simulated and observed decorrelation lengths are smaller (~ 300 m) than previously reported (>1 km). A similar diurnal variation in the overlap efficiency is found in observations and simulations.