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Comparison of Convective Boundary-layer Characteristics from Aircraft and Wind Lidar Observations

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During the Convective Storm Initiation Project experiment, conducted in summer 2005 in southern England, the convective boundary layer (CBL) was probed simultaneously with the Dornier 128 research aircraft and a wind lidar in vertical stare mode. Besides profiles, the aircraft performed horizontal flight legs approximately parallel to the mean wind direction and centred over the lidar. This measurement setup allows comparing CBL characteristics (boundary-layer depth, zi, integral length scale, l, spectral peak wavelength, λm, vertical wind-speed variance) based on temporal (lidar) and spatial (aircraft) measurements.
To compare lidar and aircraft measurements, the time series were transformed into space applying Taylor's hypothesis. While the statistics of the aircraft data are all based on the length of the flight leg (34 km), two different averaging intervals for the lidar were chosen. The first interval (reference case) was intended to correspond to a 1-h (i.e. to a 10-km leg lengths), and the second corresponded to the 34-km flight leg (i.e. time intervals varied between 3 and 4 h).
With respect to the reference case, it was found that the zi values from aircraft and lidar observation agreed quite well (correlation coefficient r2 = 0.8). The correlation of l and λm, however, was only poor. For σ_w$\hat{}$2, the correlation coefficient between aircraft and lidar is r2 = 0.56. When the increased averaging interval of 34 km for the lidar was applied, a correlation coefficient of r2 = 0.71 was attained. Possible reasons for the differences in turbulence characteristics from temporal and spatial measurements are investigated.