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지표면 근처의 연직 열 및 수분속을 위한 평균시간규모

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Averaging Timescale for Near-Surface Turbulent Vertical Heat and Moisture Fluxes

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With a new approach, we measure the averaging timescales suitable for the eddy covariance estimates of the vertical transport of heat and moisture by near-surface turbulent eddies in the convective boundary layer (CBL). The turbulent vertical fluxes are dominated by updrafts of warm and moist air, and downdrafts of cool and dry air. Therefore, the cospectra between the fluctuations of vertical velocity (w) and temperature (T) Co_{wT}, between w and water vapor mixing ratio (r) Co_{wr}, and between T and r Co_{Tr} should be all positive. From the timescale τ_{tu} at which any of the three positive cospectra does the sign change into negative, one can evaluate that the vertical transport of heat and moisture by non-turbulent process surpass the turbulent vertical fluxes. We apply this cospectrum approach to 3.64-h long, 10-Hz time series of w, T and r centered at the midday at the height of 5 m above ground level on 16 fair weather days from the XPIA field campaign. The daily variation of the midday τ_{tu} broadly varies from 8 min to 41 min. The contribution of the non-turbulent vertical heat flux to the 30-min mean flux (or the maximum ogive flux) reaches up to 7% (or 10%). In terms of the vertical moisture flux, on the minimum τ_{tu} day, the 30-min mean flux explains only 87% of the turbulent flux. Except this case, the non-turbulent contribution to the 30-min mean flux are within 2%. But with respect to the maximum ogive moisture flux, the non-turbulent contribution goes up to 15%. By extending the estimation into the whole daytime, we observe a clear diurnal evolution of τ_{tu}. When the τ_{tu} value rapidly grows in the morning, the non-turbulent contribution to the maximum ogive vertical heat flux goes up to 34%, and the maximum ogive moisture flux to 18% with 3.64-h window centered at 0800 LT in the composite averaged over the 16 days.

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