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How Dry is the Lower Atmosphere: Finding Relations Between Various Moments in the Atmospheric Boundary Layer

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Abstract

The Atmospheric Boundary Layer (ABL), consisting of the bottom few kilometers of the troposphere, is a highly turbulent region with strong mixing of moisture and winds. This region's activity is driven by thermals, which rise to the top of the boundary layer and thicken it through entrainment of warm air from above. To better predict the behavior of the ABL, a good understanding of the distribution of heat, moisture and momentum is important. In this study, we use a high resolution computer model (LES) to determine those distributions. We were able to reproduce observations when using a temporal averaging that is close to the algorithm used in the observations. However, we found significant discrepancies between temporal and spatial averaging of the same model results. For example, skewness and kurtosis have a strong relationship that helps describe the shape of the distribution. It showed that there is significantly fewer points with both positive skewness and kurtosis. This is related to a strong change that is also present between the temporal and spatial third moments. A study of these differences was also conducted.