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Spatial and Temporal Scale Dependence of Atmospheric Boundary Layer Turbulence CHERYL KLIPP, US Army Research Laboratory — Turbulence affects wind turbine performance, often in ways that are not well understood. A better understanding of the atmospheric turbulence may help in understanding effects on the turbines. Analysis of atmospheric boundary layer turbulence needs to account for different scales of motion since turbulence occurs over a wide range of scales from dissipation scales to very large scale motion on the order of tens of kilometers. Using sonic anemometer data from the 60m tower from the CASES99 field experiment near Leon, KS, the variances and covariances are expressed as sums of the variances and covariances due to motions at a range of temporal scales through the use of a multiresolution decomposition. The temporal scales are converted to spatial scales by multiplying by the mean wind value. Turbulent kinetic energy (TKE) has the most energy in scales of motion about 600m at a location 50m agl. This peak is broad; the width at half max covers a range of turbulence scales from 20m to 2500m (1.5 sec - 3.5 min). Individual variances show peak energies at different scales; the vertical variance having peak energy at smaller scales than the TKE peak scales, and streamwise variances having peak energy at larger scales. Analysis of all three covariances shows that the assumption of 2D flow is not a good approximation for the 50m agl.

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