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Impact of Atmospheric Stability on Vertical Propagation of Submeso and Coherent Structure in a Dense Amazon Forest

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Observations of the vertical structure of the turbulent flow in different stability regimes above and within the Amazon Forest at the Amazon Tall Tower Observatory (ATTO) site are presented. The shear length scale at the canopy top together with the coherent turbulent structures time and separation length scale were evaluated to determine influence of stability on the inception and development of the roughness sublayer. Five stability regimes were identified. The definition of an intense table regime allowed the identification of a peculiar condition characterized by low-wind and weak coherent structures confined close to the canopy top and producing negligible transport. Submeso motions dominate the flow dynamics in this regime both above and inside the roughness sublayer.

The shear length scale increases with decreasing stability, presenting two asymptotes for large unstable and stable stratification and a linear behaviour close to neutral stratification. The coherent structure time and length scales are detected using an original method based on the autocorrelation functions of 5-min subsets of turbulent quantities. The vertical time scale is larger in neutral conditions and decreases for both increasing and decreasing stability, while the separation length scale at the canopy top presents a linear dependence on the shear length scale, whose slope is maximum in neutral conditions and decreases departing from neutrality. A new parameterization describing the dependence of the coherent eddies' separation length scale on the h/L stability parameter is presented.