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Orographic gravity wave and low-level jet interaction above a tall and dense Amazonian forest

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The Wavelet and the Multiresolution analysis are applied to ten nocturnal hours of observations of 3-D wind velocity taken within and above a forest canopy in Central Amazonia. Data from the ATTO Project, consisting in 7 levels of turbulence observations along both 81 and 325-meter towers, are used. The presented night is dynamically rich presenting three distinct periods. In the first one the boundary layer is characterized by canopy waves and coherent structures generated at the canopy top. In the second period an intense orographic gravity wave generated at around 150 m strongly influences the boundary layer structure, both above and below the canopy. In the third period, a very stable stratification at the canopy top enables the development of a low-level jet that interferes and disrupts the vertical orographic wave. During the night the wavelet cospectra identified turbulent and non-turbulent structures with different length and time-scales that are generated at different levels above the canopy and propagated inside it. The contributions of the different temporal scales of the flow above and within the canopy were identified using Wavelet and Multiresolution two-point cospectra. The analysis showed how turbulent and wave-like structures propagates in different ways and, further, the ability of low-frequency processes to penetrate within the canopy and to influence the transport of energy and scalar in the roughness sublayer and within canopy.

Keywords: Coherent structures, Canopy Waves, Gravity Waves, Stable Boundary Layer, Low-Level Jet, wave-turbulence interaction.