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Shear Capacity as Predictor of Nocturnal Boundary Layer Regimes

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Field observations and theoretical analysis are used to investigate the appearance of different nocturnal boundary layer regimes. Recent theoretical findings predict the appearance of two different regimes: The continuously turbulent (weakly stable) boundary layer and the 'quiet' (very stable) boundary layer. A large number of nights (approx. 4500 in total) are analysed using an ensemble averaging technique. From this it appears that indeed two fundamentally different regimes exist: Weakly stable (turbulent) nights rapidly reach a steady state (within 2-3 hours). In contrast, very stable nights reach a steady state much later after a transition period (2-6 hours). During this period turbulence is weak and non-stationary. A new parameter, the Shear Capacity, is introduced that unambiguously predicts the state of the stable boundary layer (weakly/very stable). Additionally it opens up opportunities for scaling turbulence in the very stable regime.