Geophysical Research Abstracts
Vol. 21, EGU2019-4412, 2019
EGU General Assembly 2019

Spatial dependencies of stably stratified nocturnal boundary layer regime occupation statistics in complex terrain

Carsten Abraham and Adam H. Monahan
University of Victoria, School of Earth and Ocean Sciences, Victoria, Canada (abrahamc@uvic.ca)

The stably stratified nocturnal boundary layer (SBL) can be classified into two distinct regimes: one with moderate to strong winds, weak stratification and mechanically sustained turbulence (wSBL) and the other one with moderate to weak wind conditions, strong stratification and collapsed turbulence (vSBL). Regime occupation sequences of the SBL (derived with a hidden Markov model analysis) at three different towers at the Los Alamos National Laboratory are investigated in order to understand the spatial dependence of regime occupation and transition statistics in the SBL. Across the tower sites (which are approximately 5-7 km apart) the local topography has a substantial influence on local flow patterns in the two different SBL regimes of wSBL and vSBL conditions. The atmospheric state at the network of towers has much higher joint probabilities of contemporaneous regime occupation than would be expected from statistically-independent regime sequences. These overall regime occupation dependencies are found to be largely insensitive to the wind directions. The probability of contemporaneous transitions between the regimes within a narrow time window across all towers is several orders of magnitude higher than would be expected from statistically-independent variables. For both turbulence collapse and recovery events (respectively wSBL to vSBL and reverse transitions) highest probabilities are found for simultaneous transitions occurring across the whole tower network domain. Thus, we find that on scales on which the regime statistics considered are dependent exceeds 10 km in this region of complex terrain.