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Structure of observable meteorological state variables during transitions in the stably stratified nocturnal boundary layer

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With the help of a hidden Markov model (HMM) the stably stratified nocturnal boundary boundary layer (SBL) can be classified into two states: 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). The HMM analysis calculates the most likely state occupation sequence based on the input state variable set of stratification, mean wind speeds, and wind shear which describe the turbulence kinetic energy consumption and production, respectively. Having this state path time series allows for detailed analysis of the changes across state transitions of the state variables observed at tower sites. We present how transitions in the SBL are captured by the HMM analysis and how different meteorological state variables behave in times of turbulence collapse (wSBL to vSBL transition) and turbulence recovery (vSBL to wSBL transitions). The HMM analysis also reveals some results of possible precursors and external forces which might be responsible for transitions in the SBL.