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Characteristics of nocturnal coastal boundary layer in Ahtopol based on averaged SODAR profiles

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The ground-based remote sensing instruments allow studying the wind regime and the turbulent characteristics of the atmosphere with height, achieving new knowledge and solving practical problems, such as air quality assessments, mesoscale models evaluation with high resolution data, characterization of the exchange processes between the surface and the atmosphere, the climate comfort conditions and the risk for extreme events, etc. Very important parameter in such studies is the height of the atmospheric boundary layer.

Acoustic remote sensing data of the coastal atmospheric boundary layer were explored based on over 4-years continuous measurements at the meteorological observatory of Ahtopol (Bulgarian Southern Black Sea Coast) under Bulgarian – Russian scientific agreement. Profiles of 12 parameters from a mid-range acoustic sounding instrument type SCINTEC MFAS are derived and averaged up to about 600 m according filtering based on wind direction (land or sea type of night fowls). From the whole investigated period of 1454 days with 10-minute resolution SODAR data 2296 profiles represented night marine air masses and 1975 profiles represented the night flow from land during the months May to September. Graphics of averaged profiles of 12 SODAR output parameters with different availability of data in height are analyzed for both cases. A marine boundary-layer height of about 300 m is identified in the profiles of standard deviation of vertical wind speed (σ_w), Turbulent Kinetic Energy (TKE) and eddy dissipation rate (EDR). A nocturnal boundary-layer height of about 420 m was identified from the profiles of the same parameters under flows from land condition. In addition, the Buoyancy Production (BP= σ_w^3/z) profiles were calculated from the standard deviation of the vertical wind speed and the height z above ground.