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0.1 Time evolution of Thorpe scale, Ozmidov scale and turbulent dissipation rate corresponding to PBL data.

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The interplay of phenomena on a wide variety of space and time scales makes the parameterization of unresolved processes in atmospheric models complicated. The interpretation of atmospheric turbulence data requires a way to assess the evolutionary stage at which a given turbulent event is sampled. With this aim, our focus is on characterising the small scale turbulence, and its evolutionary stage, in the planetary boundary layer (PBL) by means of the identification of its turbulent patches –vertical overturns-. Based on PBL profiles from several balloon soundings, the authors investigate the time behavior of overturns and their overturning length scales which are identified based on potential temperature measurements.

Vertical overturns, produced by turbulence in stratified fluids – as the atmosphere and the ocean-, are often quantified by the Thorpe scale, L_T. This scale is deduced of Thorpe displacements profiles which are calculated by reordering the PBL potential temperature profile to make it gravitationally stable.

The time evolution of overturns is studied from the up and down Thorpe profiles and they give us an approximate evolution of overturns which it has been measured directly. The down Thorpe profile at a fixed height compared with the up Thorpe profile at the same height provide a real idea of the turbulent stage of overturns and it also provides an approximation to the evolutionary stage at which the atmosphere was sampled. The authors also make other studies on time evolution of Thorpe profiles during a daytime with different stratification conditions.

The authors not only quantify PBL Thorpe's scale, they also investigate the maximum displacement length scale, L_{max}, and they study the ratio between these two scales which depends on the rate of turbulent kinetic energy dissipation. Moreover, the correlation between the Thorpe scale, L_T , and the Ozmidov scale, *Lo*, can be used to estimate rates of turbulent dissipation, so we also evaluate the PBL Ozmidov scale.

One of the aims is to clarify if L_{max} is a more appropriate length scale than L_T for the study of atmospheric turbulence based on displacements in potential temperature profiles. Another aim is to evaluate the time evolution of these scales (L_T, L_{max} *and Lo*) and, finally, to get an approximation to the turbulent dissipation rate.

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