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Stable atmospheric boundary layer heights from three different sources: tethered balloon soundings, micrometeorological mast observations and diagnostic equations

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Observations from 78 tethered balloon soundings up to 1000 m in height, obtained from SABLES 98 field campaign, are applied to some widely accepted definitions of the stable atmospheric boundary layer (SBL) height. These definitions are based on the following parameters: two critical values of the Bulk-Richardson Number, a standard value of the vertical gradient of potential temperature, the height of the surface temperature inversion and the height of the low level jet. The database used is only concerned to 10 nights characterised by different degree of stability. These results supply the heights (H_S) taking each criteria into account besides their evolution night by night. Then it has been analysed the behaviour of several definitions of the SBL height and comparing them. It was also evaluated a second stable boundary layer height from micrometeorological instrumentation deployed on a 100 m high mast calculating the height (H_T) above which the gradient Richardson Number is supercritical. Moreover, the outputs of 15 diagnostic equations, which were extracted from the scientific literature and obtained both by theoretical and experimental basis, provide us a third SBL height (H_D). It was assumed that H_D has a semi-empirical nature due to these diagnostic equations were fed with experimental data, that is mean meteorological data and turbulent parameters measured on the 100 m high mast. Therefore, two SBL experimental heights (H_S, H_T) and one SBL semi-empirical height (H_D) were compared by defining three quantitative coefficients (C_{ST}, C_{SD}, C_{TD}) whose analysis gave us some conclusions about the importance of having a good estimation of the SBL height, which is used as an input in dispersion and numerical modelling.