

Revisiting the Height of the Stable Boundary Layer over Land

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The height (h) of the stable boundary layer (SBL) is of major importance to understand the relevant processes that govern the SBL development. The SBL depth is the layer in which turbulence transport takes place, and thus governs the vertical structure of the lower atmosphere. Furthermore, release of pollutants below h during periods of weak mixing results in very high pollutant concentrations. For meteorological preprocessors for air quality models, h is the most critical quantity to estimate.

This study evaluates the performance of two so-called multi-limit equations for h , and presents an alternative formulation that depends on surface friction velocity, surface buoyancy flux, Coriolis parameter and the stratification above the boundary layer. The formulations are tested against four data sets (with varying roughness, latitude and land use) and Large Eddy Simulation from the first Gewex Atmospheric Boundary layer Study (GABLS). We find that the required parameters in the multi-limit Equations cannot be calibrated in a robust manner. The main advantages of the new formulation lies in a robust calibration, a significant reduced bias for small SBL depth and reduction of scatter compared over the whole range of observations to the two multi-limit Equations.