



Variability of the mixed layer height derived by ceilometer measurements in the Bavarian pre-Alps

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The mixed layer height is an important parameter in air pollution studies, for modeling atmospheric turbulences and might be related to the energy balance closure problem. It is known that the mixed layer height is varying above different surfaces and undergoes diurnal variations. About differences of the mixed layer height on small spatial scale, only little is known. This is, however, of particular importance for atmospheric modeling on regional and global scales. In our work, we studied the mixed layer height at three study sites in the Bavarian pre-Alps as part of the Terrestrial Environmental Observatories (TERENO) network. The sites are located along a north-south gradient within a distance of 30 km at an altitude between 600 m asl at the northernmost site and 865 m asl at the site located furthest in the south. The measurement systems were installed above flat meadows at each site. The surrounding topography at the sites, however, varies remarkably. The area around the northern site (Fendt) is rather flat apart from a plateau to the west that is elevated about 130 m compared to the measuring devices. At the central site (Rottenbuch) the surrounding can be considered as gentle hills. The site in the south (Graswang) is located in a valley bordered by mountains that reach altitudes of more than 1000 m above the valley bottom. In order to study the mixed layer height, ceilometers were installed at the three sites. Additionally, all sites are equipped with eddy-covariance energy balance measurement systems. In our analysis, we included data from July to October 2012. One focus was put on the variability of the mixed layer height from summer to autumn months and along with that the correlation of mixed layer height with global radiation. The effect of topographic differences on the mixed layer height was studied by a comparison between the study sites on a monthly scale, giving statistically different results at the three sites. Moreover, at one side we analyzed the effect of wind direction on the mixed layer height and here as well found effects of the surrounding topography. Overall, the mixed layer height shows both diurnal and clear spatial variations on a small scale which should be taken into account when working with the mixed layer height on a regional scale.