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Quality control on the mixing layer height retrieved from LIDAR-ceilometer measurements

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LIDAR ceilometers were primarily designed for cloud base height detection (for air traffic safety and weather forecasting). They greatly improved over the last years and now offer the opportunity to monitor the vertical profile of aerosols and the mixing layer height (MLH) on a continuous temporal scale. The knowledge of MLH can improve the forecasting of the dispersion of trace gases and aerosols in the lowest layers of the atmosphere and can also improve the accuracy of the greenhouse gas concentration budgets highly depending on MLH. Therefore, during the next years, operational MLH monitoring networks of LIDAR ceilometers are established around the world, and in particular in Europe. To perform this task, different algorithms have been developed to retrieve the MLH from the ceilometer measurements. However, under specific atmospheric conditions, these algorithms fail to retrieve a similar MLH than other remote sensing retrieval techniques. On the other hand, the ceilometers are sometimes located in places where no other remote sensing measurements are available to assess the accuracy of the MLH retrieved by the algorithm. In this context, the development of several MLH quality control flags based on the ceilometer measurements only is desirable to detect automatically the failure of the MLH retrieval algorithms without the support of additional measurements.
In Belgium, in 2013, three new ceilometers (Vaisala CL51) will be installed by the Royal Meteorological Institute of Belgium (RMI) in addition to the one in Uccle (Belgium) that has already been installed since May 2011. RMI developed its own MLH retrieval algorithm based on the gradient and variance methods. The computation of several quality flags will be presented.
In this work, an assessment of these quality flags is made by comparing the MLH retrieved by ceilometer measurements with the MLH retrieved by radio-sounding and the boundary layer height (BLH) directly computed by the ECMWF and the ALARO7 models. The comparison is made at daily and monthly temporal scale on the data set measurements of Uccle from May 2011 to January 2013. During this period, the atmospheric conditions have been identified for which the MLH retrieved by ceilometer becomes doubtful in comparison with the other methods. This information is used to define the thresholds for setting the quality flags.