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Mixing height derivation from aerosol lidar using machine learning: KABL and ADABL algorithms

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Atmospheric boundary layer height (BLH) is a key parameter for air quality forecast. To measure it, a common practice is to use aerosol lidars: a strong decrease in the backscatter signal indicates the top of the boundary layer. This work explains and compares two methods of machine learning to derive BLH from backscatter profiles: the K-means algorithm and the AdaBoost algorithm. As K-means is unsupervised, it has less dependency on instrument settings, hence more generalization skills. AdaBoost was used for binary classification: boundary layer/free atmosphere. It has been trained on 2 days, labelled by hand, therefore it has less generalization skills but a better representation of the diurnal cycle. Both methods are compared to the lidar manufacturer's software and to the BLH derived from collocated radiosondes. The radiosondes are taken as reference for all other methods. The comparison is carried out on a 2 years period (2017-2018) on 2 sites (Trappes and Brest). Data come from Meteo-France's operational network. The code and the data that produced these results will be put under a fully open access licence, with the name of KABL (K-means for Atmospheric Boundary Layer) and ADABL (AdaBoost for Atmospheric Boundary Layer).