A comparison among statistical and classical methods to obtain the planetary boundary layer height by lidar data

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The planetary boundary layer (PBL) is the lowermost part of the troposphere, which is characterized by large variability in its statical stability and turbulence along the day. This varying behavior makes the PBL height determination a key for a wide set of studies, including pollutant dispersion and weather forecasting. Due to its variability throughout the day, PBL monitoring requires instrumentation with high temporal and spatial resolution. During the last two decades lidar (light detect and ranging) systems have been largely applied to this kind of study.

However, the PBLH discrimination by lidar is not straightforward, because algorithms are necessary to interpret the experimental data and remove ambiguities in layer attribution. Nevertheless, under situations of high atmospheric complexity, the algorithms might misunderstand PBLH top with other sublayers.

In this study, we will compare the classical methods (Variance, Gradient and Wavelet Covariance Transform) with a statistical method based on Kalman filter, in an attempt to evaluate the strengths and weakness of each one. The measurements were recorded in the city of Granada – Spain during 2015 with the Raman lidar VELETA (Raymetrics Inc), operating at 355 and 387 nm with 1-min and 7.5-m resolutions. All methods were validated by Bulk Richardson Number obtained from simultaneous, collocated radiosounding data.

This study will give us background for further improvements of the algorithms used in order to solve the difficulties encountered in the process of PBL height detection. In particular, the results will contribute to improve synergic methodologies combining different instruments.