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A cloud masking algorithm for EARLINET lidar systems

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Cloud masking is an important first step in any aerosol lidar processing chain as most data processing algorithms can only be applied on cloud free observations. Up to now, the selection of a cloud-free time interval for data processing is typically performed manually, and this is one of the outstanding problems for automatic processing of lidar data in networks such as EARLINET. In this contribution we present initial developments of a cloud masking algorithm that permits the selection of the appropriate time intervals for lidar data processing based on uncalibrated lidar signals. The algorithm is based on a signal normalization procedure using the range of observed values of lidar returns, designed to work with different lidar systems with minimal user input. This normalization procedure can be applied to measurement periods of only few hours, even if no suitable cloud-free interval exists, and thus can be used even when only a short period of lidar measurements is available. Clouds are detected based on a combination of criteria including the magnitude of the normalized lidar signal and time-space edge detection performed using the Sobel operator. In this way the algorithm avoids misclassification of strong aerosol layers as clouds. Cloud detection is performed using the highest available time and vertical resolution of the lidar signals, allowing the effective detection of low-level clouds (e.g. cumulus humilis). Special attention is given to suppress false cloud detection due to signal noise that can affect the algorithm's performance, especially during day-time. In this contribution we present the details of algorithm, the effect of lidar characteristics (space-time resolution, available wavelengths, signal-to-noise ratio) to detection performance, and highlight the current strengths and limitations of the algorithm using lidar scenes from different lidar systems in different locations across Europe.