Monthly distributions of cloud base height measured with a ceilometer

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Clouds are a key factor in the processes that drive the climate, but it is well known the difficulty of determining how the clouds contribute to climate change, due to the complexity of the processes involved, the vast amount of information needed, and the uncertainty associated with the available data.

Related to these difficulties, a statistical analysis of the cloud base height records, obtained from a Vaisala CL-31 ceilometer placed in Girona (NE Spain) since December 2006, has been carried out to describe the behavior of cloudiness at this site. Among several physical characteristics of clouds, we have studied the cloud base height because cloud classification internationally accepted is mainly based on this parameter, which allows to distinguish among low, medium, or high clouds. The cloud base height can be defined as the height at which the signal returned to the ceilometer takes its maximum value.

Our study has been proven the instrument effectiveness during the operational period, the evolution of annual cloud cover, and the distributions of the cloud base height.

Specifically, cloud base height histograms have been built, which show the relative monthly frequency distribution; throughout the year, we can notice certain trends in these monthly frequency distributions. We attempted to statistically verify this trend, so we first tried normality tests to check whether the histograms, or their logarithmic transformations, fit a normal distribution. In all cases, results were negative. Therefore, nonparametric tests must be applied. Results seem to indicate that monthly distributions of the cloud base height, at least for the first cloud layer, follow an annual periodicity. Furthermore, there is an evolution in the monthly median cloud base height throughout the year (the median is the most representative statistic parameter because the distributions were non normal).

Moreover, annual evolutions of cloud cover fraction have been estimated, and then their consistency with evolutions obtained with other methodologies was checked. However, no climatic conclusions can be yet drawn from this limited (3 years) dataset.