

Cloud cover estimation based on ceilometer measurements: a comparison with visual observations

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Key areas:

1. Measurement techniques (of cloud and precipitation properties) and uncertainties
2. Clouds and climate (including radiative properties of clouds)

Standard ceilometers are being used at airports to assist in the take-off and landing maneuvers, as they provide an accurate measurement of the cloud base height (CBH) over the site. In this study, we analyze the use of the temporal averaging of ceilometer data (i.e., a measured CBH means that there is an occurrence of cloud overhead) as an estimator of cloud cover (CC). Indeed, although standard ceilometers only see in the zenithal direction, clouds usually move, so a temporal averaging of occurrence measurements must be an approximation of the areal extension of clouds. Eight years (2007-2014) of ceilometer measurements at a site in Girona (Spain) are combined with the corresponding human observations of cloudiness at two nearby sites to carry out this research. Sky images taken by a camera complement the suitable information. The comparison of CC values is performed at daily and monthly basis. Overall, there is an underestimation of around 20% in relative terms of the ceilometer when compared to visual observations, with a minimum and maximum during winter and summer, respectively. Part of the disagreement may be a result of the limited vertical range (7.5 km) of the ceilometer used in this research. Additional discussion is held on the optimal averaging time of ceilometer occurrence measurements to approximate instantaneous human observations. Despite the differences and limitations, results of this study could be of interest to extend long-term traditional measurements of CC as the number of human observers at meteorological stations tends to decrease.