



## **Temporal variability of total cloud cover at a Mediterranean megacity in the 20th century: Evidence from visual observations and climate models**

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Cloud cover is one of the major factors that determine the radiation budget and the climate system of the Earth. Moreover, the response of clouds has always been an important source of uncertainty in global climate models. Visual surface observations of clouds have been conducted at the National Observatory of Athens (NOA) since the mid 19th century. The historical archive of cloud reports at NOA since 1860 has been digitized and updated, spanning now a period of one and a half century. Mean monthly values of total cloud cover were derived by averaging subdaily observations of cloud cover (3 observations/day). Changes in observational practice (e.g. from 1/10 to 1/8 units) were considered, however, subjective measures of cloud cover from trained observers introduces some kind of uncertainty in the time series. Data before 1884 were considered unreliable, so the analysis was restricted to the series from 1884 to 2012. The time series of total cloud cover at NOA is validated and correlated with historical time series of other (physically related) variables such as the total sunshine duration as well as DTR (Diurnal Temperature Range) which are independently measured.

Trend analysis was performed on the mean annual and seasonal series of total cloud cover from 1884-2012. The mean annual values show a marked temporal variability with sub periods of decreasing and increasing tendencies, however, the overall linear trend is positive and statistically significant ( $p < 0.001$ ) amounting to +2% per decade and implying a total increase of almost 25% for the whole analysed period. These results are in agreement qualitatively with the trends reported in other studies worldwide, especially concerning the period before the mid 20th century. On a seasonal basis, spring and summer series present outstanding positive long term trends, while in winter and autumn total cloud cover reveals also positive but less pronounced long term trends

Additionally, an evaluation of cloud cover and/or sunshine duration/diurnal temperature range as depicted by regional climate models over Athens will be performed. Regional climate models are valuable tools for projections of future climate change but their performance is typically assessed only in terms of temperature and precipitation. The representation of non-standard parameters such as cloud cover and/or sunshine duration/diurnal temperature range has so far seen little or no evaluation in the models and can therefore be prone to large uncertainties. Regional climate models developed in the framework of recent EU projects, such as the ENSEMBLES ([www.ensembles-eu.org](http://www.ensembles-eu.org)) and the CIRCE ([www.circeproject.eu](http://www.circeproject.eu)) projects, will be used and an initial validation of these parameters against the historical archive of NOA will be performed.