



## **Intra-annual variability of cloud cover over the Mediterranean region based on NCEP/NCAR, MODIS and ECAD data sets**

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The seasonal variability of total cloud cover in the Mediterranean region is examined for the period 1948-2014 using a multivariate statistical methodology. The data used consist of: i) daily gridded ( $1.875^{\circ} \times 1.905^{\circ}$ ) values of total cloud cover over the broader Mediterranean region for the 66-year period 1948-2014, obtained from NCEP/NCAR Reanalysis data set, ii) daily gridded ( $1^{\circ} \times 1^{\circ}$ ) values of total cloud cover for the period 2003-2014 obtained from the Moderate resolution Imaging Spectroradiometer (MODIS) satellite data set and iii) daily station cloud cover data for the period 2003-2014 obtained from the European Climate Assessment & Dataset (ECA&D).

At first, the multivariate statistical method of Factor Analysis (S-mode) with varimax rotation is applied as a dimensionality reduction tool on the mean day to day intra-annual variation of NCEP/NCAR cloud cover for the period 1948-2014. According to the results, three main modes of intra-annual variation of cloud cover are found. The first mode is characterized by a winter maximum and a summer minimum and prevails mainly over the sea; a weak see-saw teleconnection over the Alps represents the opposite intra-annual marching. The second mode presents maxima in early autumn and late spring, and minima in late summer and winter, and prevails over the SW Europe and NW Africa inland regions. The third mode shows a maximum in June and a minimum in October and prevails over the eastern part of central Europe.

Next, the mean day to day intra-annual variation of NCEP/NCAR cloud cover over the core regions of the above factors is calculated for the entire period 1948-2014 and the three 22-year sub-periods 1948-70, 1970-92 and 1992-2014. A comparison is carried out between each of the three sub-periods and the total period in order to reveal possible long-term changes in seasonal march of total cloud cover. The results show that cloud cover was reduced above all regions during the last 22-year sub-period 1992-2014 throughout the year, but especially in winter.

Finally, given the different nature of the utilized NCEP/NCAR (Reanalysis), MODIS (satellite) and ECAD (stations) cloud cover data sets, an inter-comparison is made among them as it concerns the intra-annual variation of cloud cover for the common period 2003-2014. The results show a nice similarity among the three datasets, with some differences in magnitude during the cold period of the year.