



## **The unstable influence of the Indian Summer Monsoon on the Etesian winds since 1880**

Francisco de Paula Gómez Delgado (1), David Gallego Puyol (1), Cristina Peña Ortiz (1), Pascale Braconnot (2), and M. Carmen Álvarez Castro (3)

(1) Universidad Pablo de Olavide, Physical, Chemical and Nature Processes, Sevilla, Spain (fpgomdel@upo.es), (2) Laboratoire des Sciences du Climat et de L'environnement (LSCE/IPSL), Saclay, France, (3) Centro Euro-Mediterraneo sui Cambiamenti Climatici, and Istituto Nazionale di Geofisica e Vulcanologia, Bologna, Italy

Persistent low-level northerly winds, known as Etesians, characterise the eastern Mediterranean (EM) summertime circulation, having an important socio-economic impact on this region. On interannual and intraseasonal scales, the Etesians are influenced by the Indian summer monsoon (ISM) through a large-scale teleconnection referred as the “monsoon-desert” mechanism. However, this relationship had only been studied in detail for the second half of the 20th century. In this study, a new climatic index, the so-called Etesian Wind Index (EWI), is defined as the percentage of days with prevalent northerly wind in a fixed region [20E-30E, 32N-37N]. By using historical wind direction observations it has been possible to compute this index back to 1880, thus allowing the analysis of the long-term variability of the Etesians and its interaction with the monsoon with an unprecedented temporal coverage. Previous studies have reported a negative trend in the Etesians' frequency from 1960 onwards. Our new series for the Etesians indicates that this tendency appears as a part of a long term multidecadal variability. Besides, a shortening of the Etesians seasonal cycle is also evidenced along the second half of the 20th century.

To analyze the temporal stability of the monsoon signal on the Etesians, a running correlation analysis between the EWI and the All India Rainfall Index is performed in the 1880-2012 period. Our results shown a significant positive correlation during the 1960-1990 period, more markedly in July and August, in agreement with recent studies. However, the correlation fades out in the first half of the 20th century and in the 1990-2010 period, even showing significant negative values around the 1920-1950 subperiod. The analysis of the “monsoon-desert” mechanism indicates that, within the positive correlated period, strong ISM years are related to an enhanced Rossby-like circulation response to the monsoon convection. This configuration leads to an increase in the subsidence over the EM, thus promoting the Etesians at the surface. On the other hand, in periods of low or negative correlation, no changes in the subsidence due to the ISM variability are found. Indeed, during the 1990-2010 period, the Etesians appear to be modulated by changes in the high pressure system over central Europe.

Finally, the ability of CMIP5 models in reproducing this temporal unstable relation between the Etesians and the ISM is addressed. Preliminary results suggest that some of the models indicate a similar multidecadal variability in the influence of the ISM on the Etesians. Currently, the analysis of the dynamics involve in the Etesians-ISM linkage for these models is under investigation.