

Weekly cycles in Spain and their possible connections with changes in atmospheric circulation

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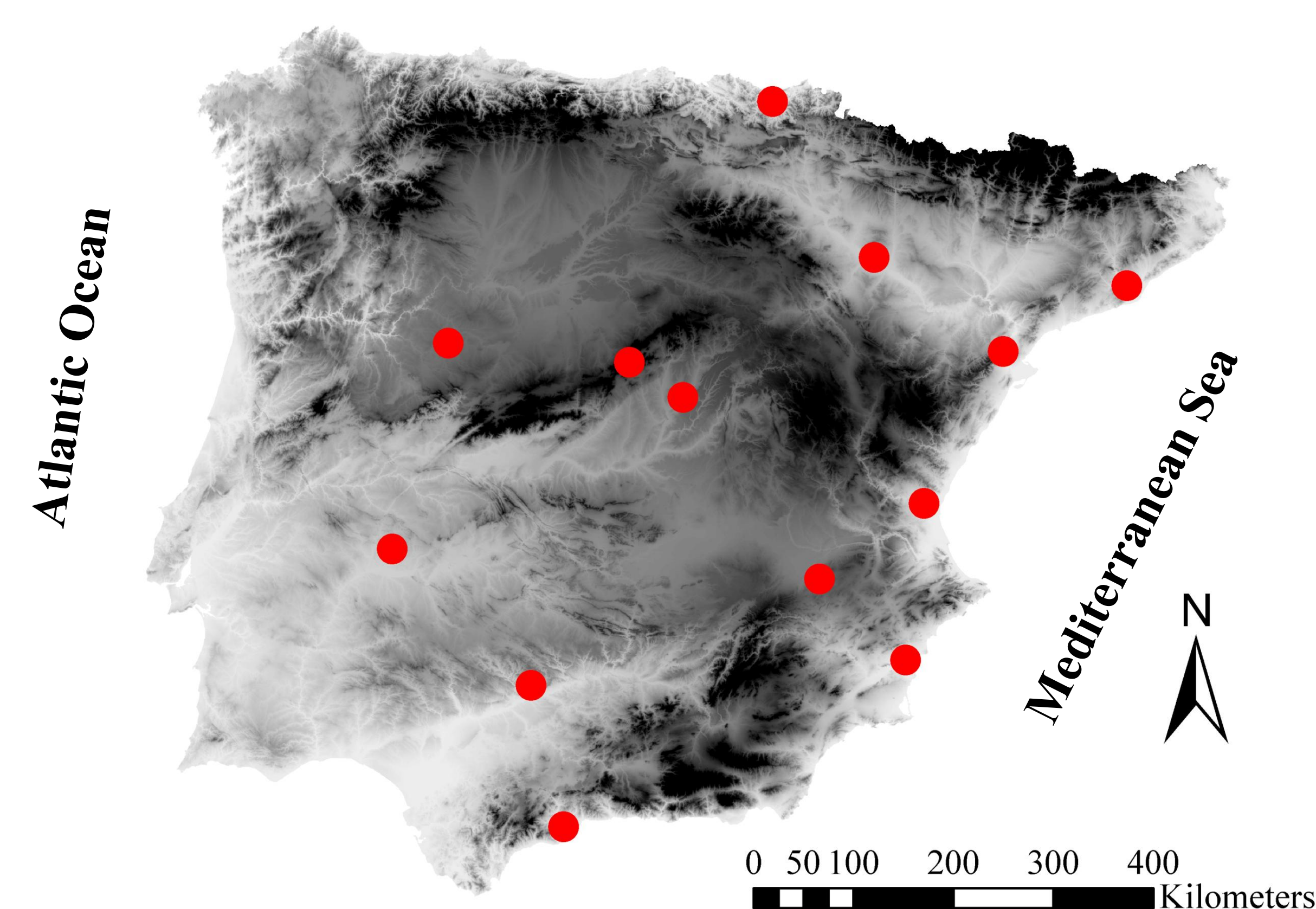
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Abstract

Winter weekly cycles of different climatic variables, such as temperature, rainfall, cloudiness or sunshine duration have been detected over Spain. The analyzed series are derived from stations located in different climatological and geographical areas with different level of urban influence. Therefore, the weekly cycles can hardly be related to direct urban effects. Contrarily, we suggest that the weekly cycles may be related with changes in the sea level pressure (SLP) associated to perturbations in the atmospheric circulation over Western Europe and the North Atlantic. In fact, we found an increase in SLP over Southern Europe during the weekends and a decrease of anticyclonic conditions during the central weekdays during the wintertime.

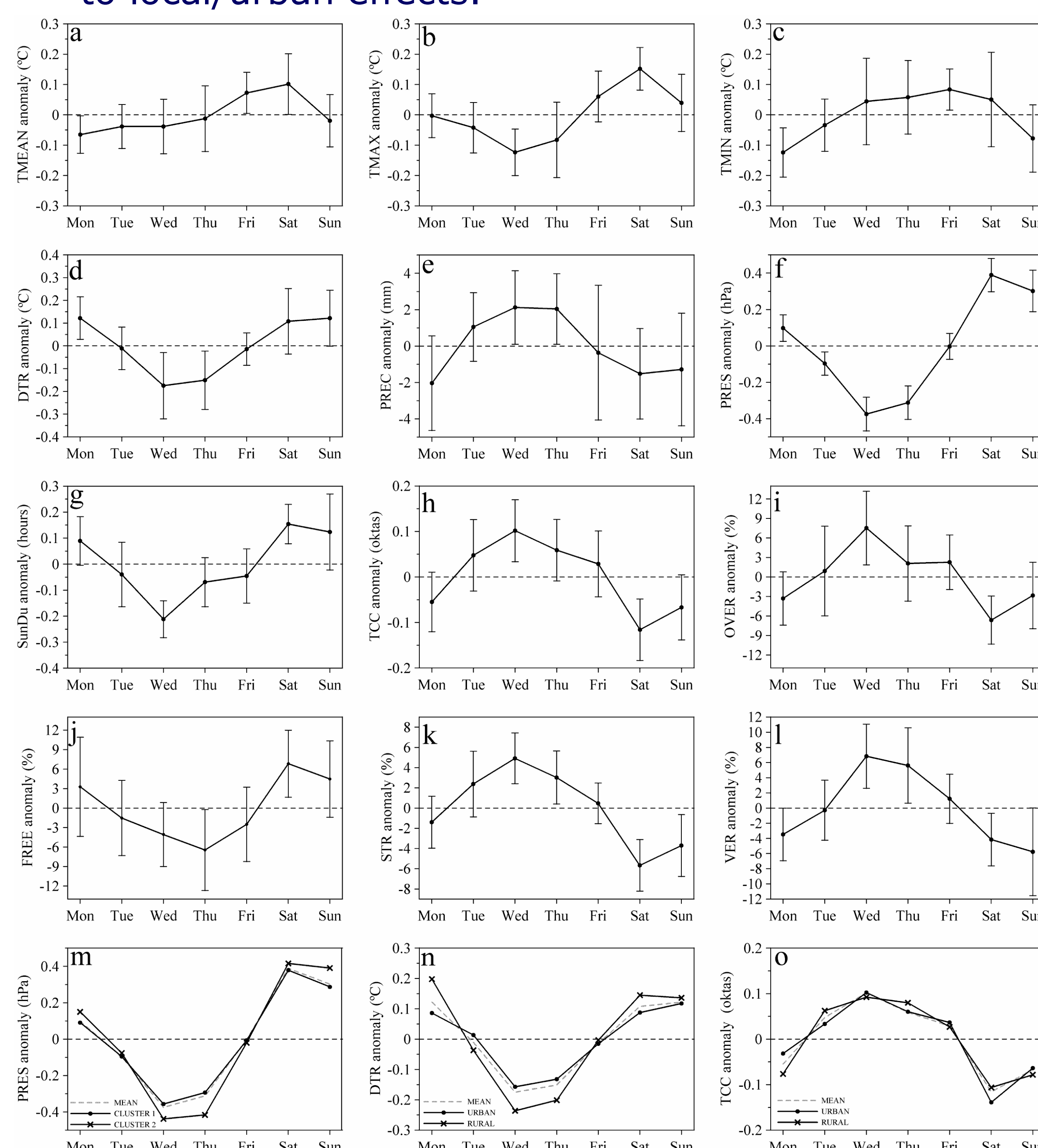
1. Data set and methods

- 12 climatic variables: temperature (maximum -TMAX-, minimum -TMIN-, mean -TMEAN- and diurnal temperature range -DTR-), precipitation (PREC), air pressure (PRES), sunshine duration (SunDu), and several cloud-related variables (total cloud cover -TCC-, overcast -OVER- and cloud free -FREE- days, and frequencies of low cloud types: stratiform -STR- (St, Sc and Ns) and vertical development -VER- (Cu and Cb)).
- We examined 44-year (1961–2004 period) winter (DJF) data for 13 stations placed in Spain.
- Several ANOVAs, t-test and Kruskal-Wallis non-parametric test were conducted to check the significance of the weekly cycles.



2. Winter weekly cycles in Spain

- Clear weekdays/weekend differences for most of the climatic variables.
- No differences by level of urban influence. Therefore, the weekly cycles can hardly be related to local/urban effects.

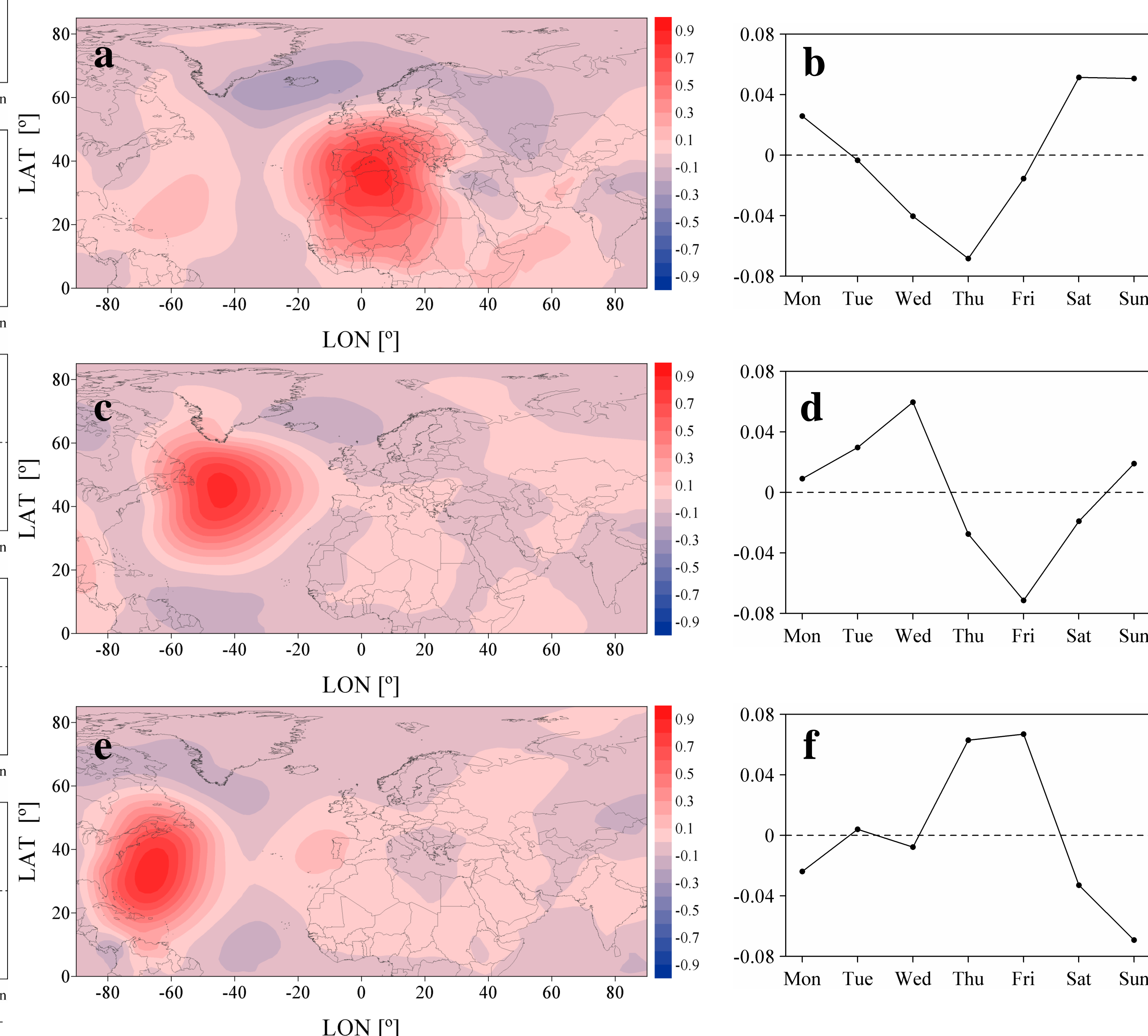


(a–l) Mean week anomalies, for the 12 considered variables, averaged over the 13 Spanish series in the 1961–2004 period. Error bars show the standard deviation of the everyday mean. (m) Mean PRES weekly anomalies for the stations grouped in the two clusters obtained by means of Cluster analysis techniques (using a k-means algorithm). (n–o) Mean DTR and TCC weekly anomalies for the urban and rural stations.

* More details in Sanchez-Lorenzo et al., 2008, *Geophys. Res. Lett.*, 35, L15711, doi:10.1029/2008GL034160

3. Possible cycles in atmospheric circulation

- PCA in S-Mode to the winter SLP from NCEP/NCAR reanalysis for the window (90°W–90°E; 0°–85°N).
- We rotated 20 EOF (> 80% of total variance), 3 of them with significant differences in the PC scores mean values during the week.
- EOF 8 (a-b) shows the most interesting results for a possible explanation of the weekly cycles over Spain.



(a, c, and e) Three EOF of the winter daily SLP anomalies over the selected domain displayed as PC loading. (b, d, and f) Mean week PC scores of each EOF in the 1961–2004 period. EOF8 (Fig. a and b), EOF15 (Fig. c and d), EOF16 (Fig. e and f).

* More details in Sanchez-Lorenzo et al., 2009, *Geophys. Res. Lett.*, 36, L13707, doi:10.1029/2009GL038041.