



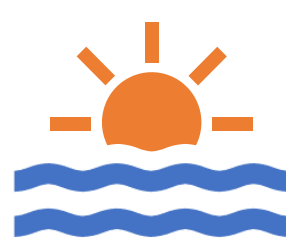
Extremely hot summers preceded by spring droughts in the Mediterranean

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1. Motivation



The Mediterranean is often affected by extreme weather (EW) events [1], such as droughts and heatwaves, which are two of the most frequent EW events in the Mediterranean [1], having negative impacts on different economic and social activities [1]. Several studies have stressed the role played by recent climate change in the increase likelihood of occurrence of some of these extremes [1,2], with emphasis on the fact that temperature extremes are expected to occur more frequently [3].

*A number of studies have put into evidence the existence of several positive feedback mechanisms between droughts and heatwaves [4,5]. Here, we propose to analyze if **the occurrence of summer extremely hot days and nights in the Mediterranean is preceded by the occurrence of drought events in spring and early summer.***

2. Data and Method

- SPI and SPEI are multi-scalar drought indicators which allow for the assessment of drought's duration and severity, where SPEI relies on both precipitation and evapotranspiration [6].
- SPI and SPEI were calculated from the CRU TS 4.01 database (0.5° resolution) for the 1980-2014 period [7] for three timescales (3, 6, 9 months). SPI and SPEI were selected for the months preceding the hottest months of each year.
- SPI and SPEI were used as proxy for surface moisture deficits to assess the impact of these deficits on the occurrence of subsequent hot days in the respective hottest months of each particular year and at each location using correlation analysis.
- The number of hot days and nights per month (respectively NHD and NHN) was determined as the number of days with maximum or minimum temperature exceeding the 90th percentile. Both NHD and NHN were computed based on daily temperatures (0.5° resolution) for the 1980-2014 period from the ECAD-EOBS v14 daily dataset [8].
- To avoid time discontinuities, the NHD (NHN) were summed up at each grid point over the two months (Fig. 1).

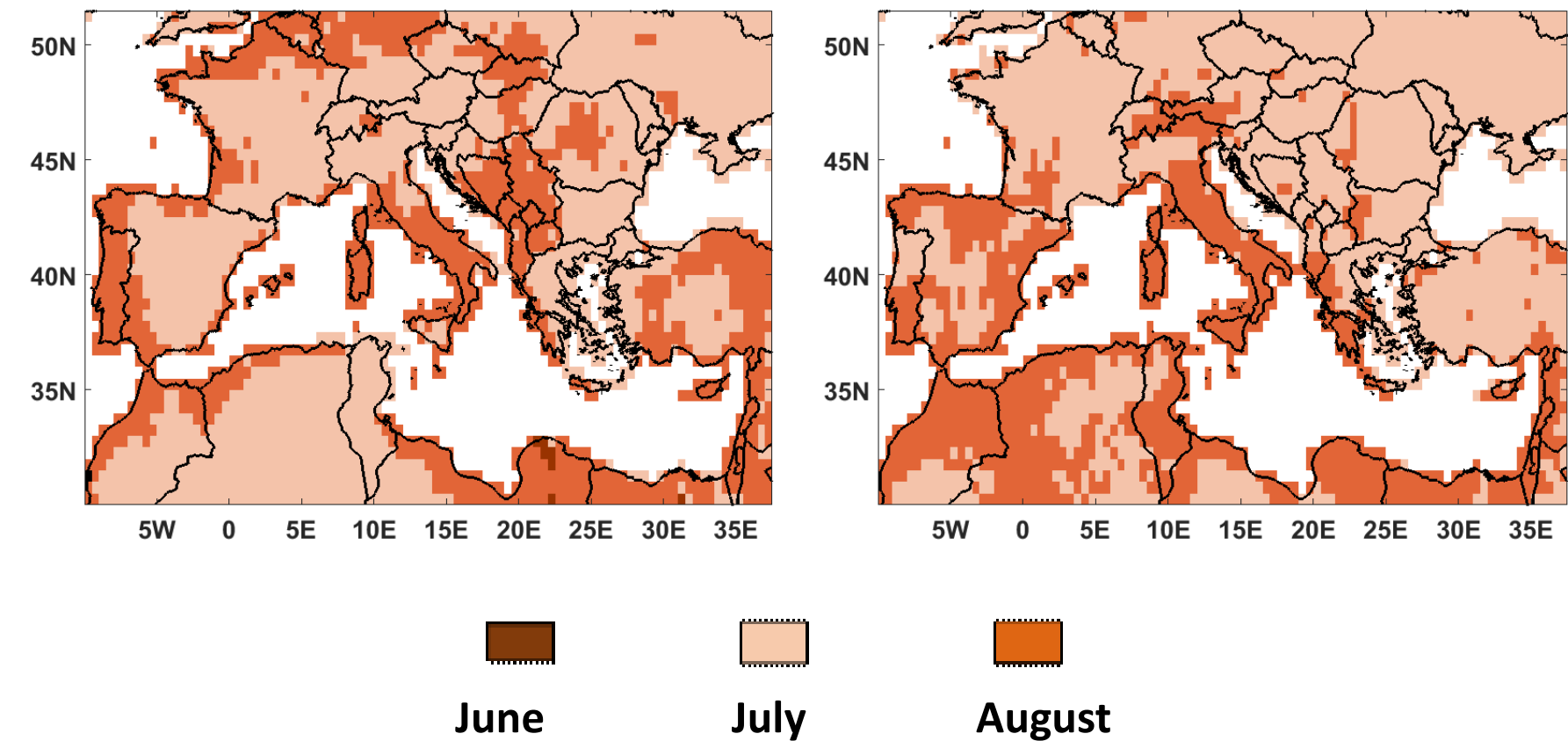


Fig. 1 Geographical distribution of most frequent hottest month based on (a) the maximum temperature; (b) the minimum temperature.

The most frequent hottest months in the Mediterranean are July and August (Fig. 1).

3. Results

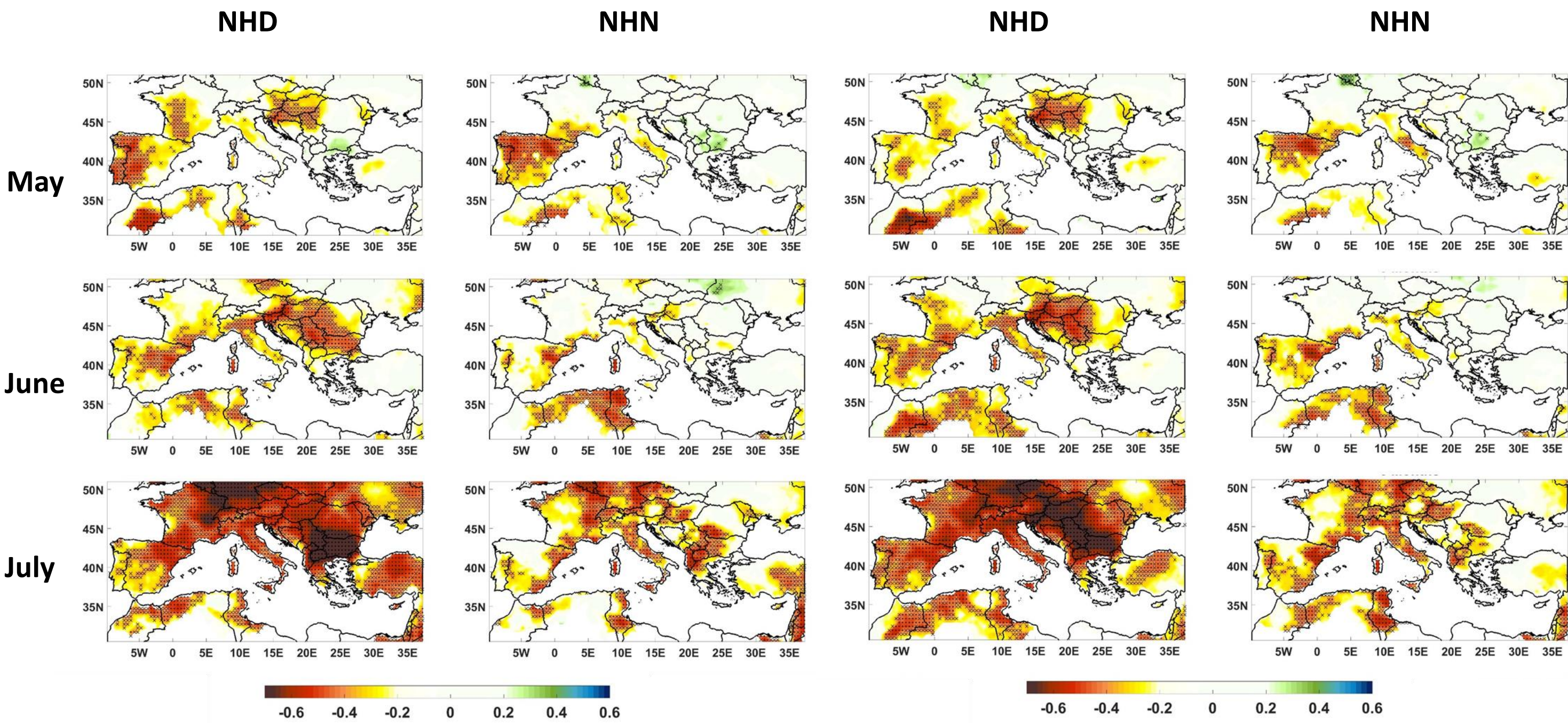


Fig. 2 Correlation between SPEI at 3-months' time scale in May (top), June (middle) and July (bottom) and the sum of NHD (left) and NHN (right) in July and August for the 1980-2014 period. Correlation values significant at 95% (99%) are marked with x (•).

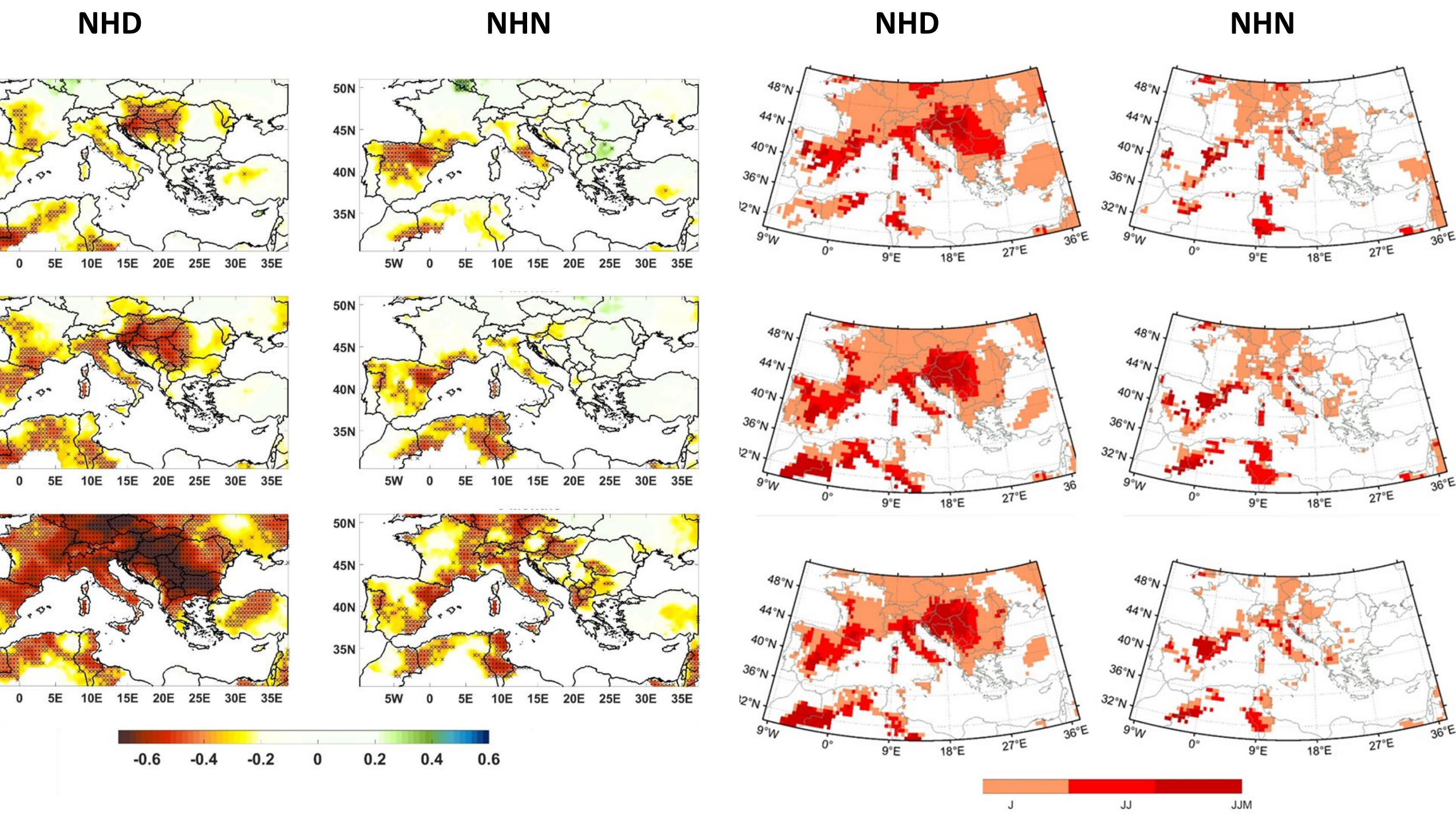


Fig. 3 As Fig. 2 but for SPEI at 6-months' time scale .

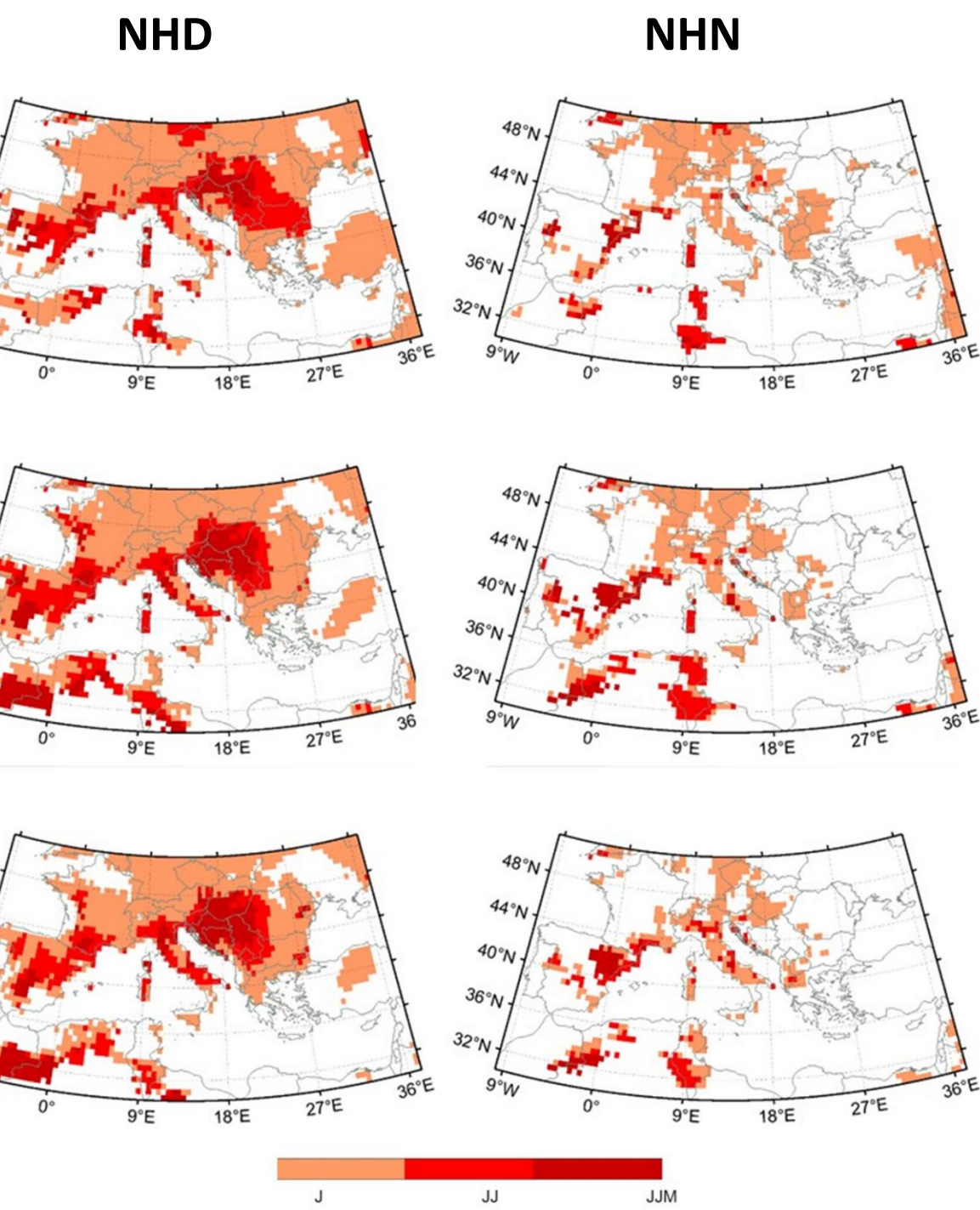


Fig. 4 Significant correlations in consecutive days

4. Conclusions

- Results show that the **most frequent hottest months** for the Mediterranean region occur in **July and August**.
- Most regions exhibit **statistically significant negative correlations**, i.e. high NHD/NHN following negative SPEI/SPI values, and thus a potential for NHD/NHN early warning.
- This analysis allowed to **identify** the Iberian Peninsula, northern Italy, northern Africa and the Balkans as the main **hotspots of predictability of extreme hot temperatures in the summer** preceded by the occurrence of drought events in the spring or early summer (Fig. 4).

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Acknowledgments

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