

Impact study of the influence of weather regimes on wind speed in January 2016

1 Objective

This study aims to understand the influence of atmospheric circulation, as represented by weather regimes, on observed 10-m monthly wind speed variability over Europe in January 2016.

2 Methodology

Weather classification was obtained by applying a k-means cluster analysis to the daily sea level pressure (SLP) anomalies derived from JRA-55 reanalysis during period 1981-2016, separately for each month of the year. Four clusters were retained, corresponding to the four more prominent monthly weather regimes. JRA-55 is updated once a week, and has a spatial resolution of 125 km.

A full description of the methodology employed in this study (albeit at seasonal scale) can be found at: https://earth.bsc.es/wiki/lib/exe/fetch.php?media=library:external:20170404_ncortesi_observed_seasonal_weather_regimes.pdf

3 Results

3.1 Observed monthly anomalies for January 2016

The observed monthly wind speed anomalies and SLP anomalies for January 2016 (the average of daily values) are shown in Figure 1. Anomalies are obtained as the difference between the absolute values and the monthly averages over the period 1981-2016.

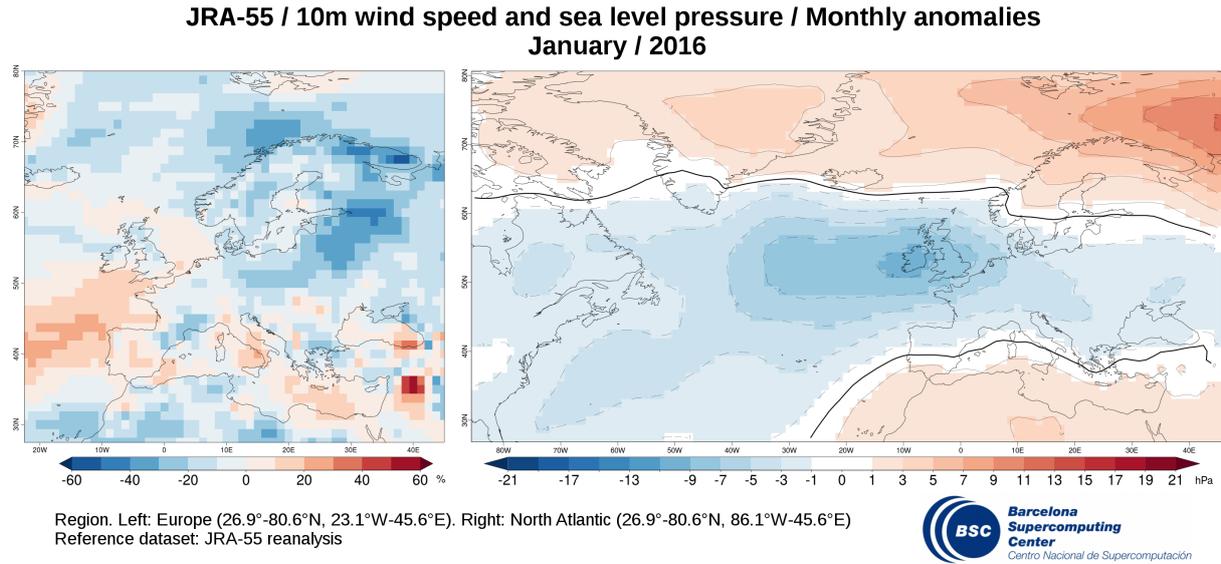


Figure 1: *Left*: observed monthly wind speed anomalies (in % relative to the wind speed average over the period 1981-2016) in January 2016 over Europe. *Right*: observed monthly SLP anomalies (in hPa) in January 2016 over the Euro-Atlantic region. (Source: JRA-55 reanalysis)

3.2 Regime impact on wind speed for January 1981-2016

Table 1. Short description of the SLP clusters (weather regimes) shown in Figure 2 (center column).

Cluster 1	High SLP anomalies over Scandinavia, highly correlated with the winter blocking regime.
Cluster 2	High SLP anomalies over Iceland and low over Azores. They are similar to those of the winter NAO- regime.
Cluster 3	Low SLP anomalies over the Atlantic Ocean.
Cluster 4	Low SLP anomalies over Iceland and Scandinavia and high over Azores. Their spatial structure is similar to that of the NAO+ regime in winter.

JRA-55 / 10m wind speed and sea level pressure / Monthly anomalies and frequencies
January / 1981-2016

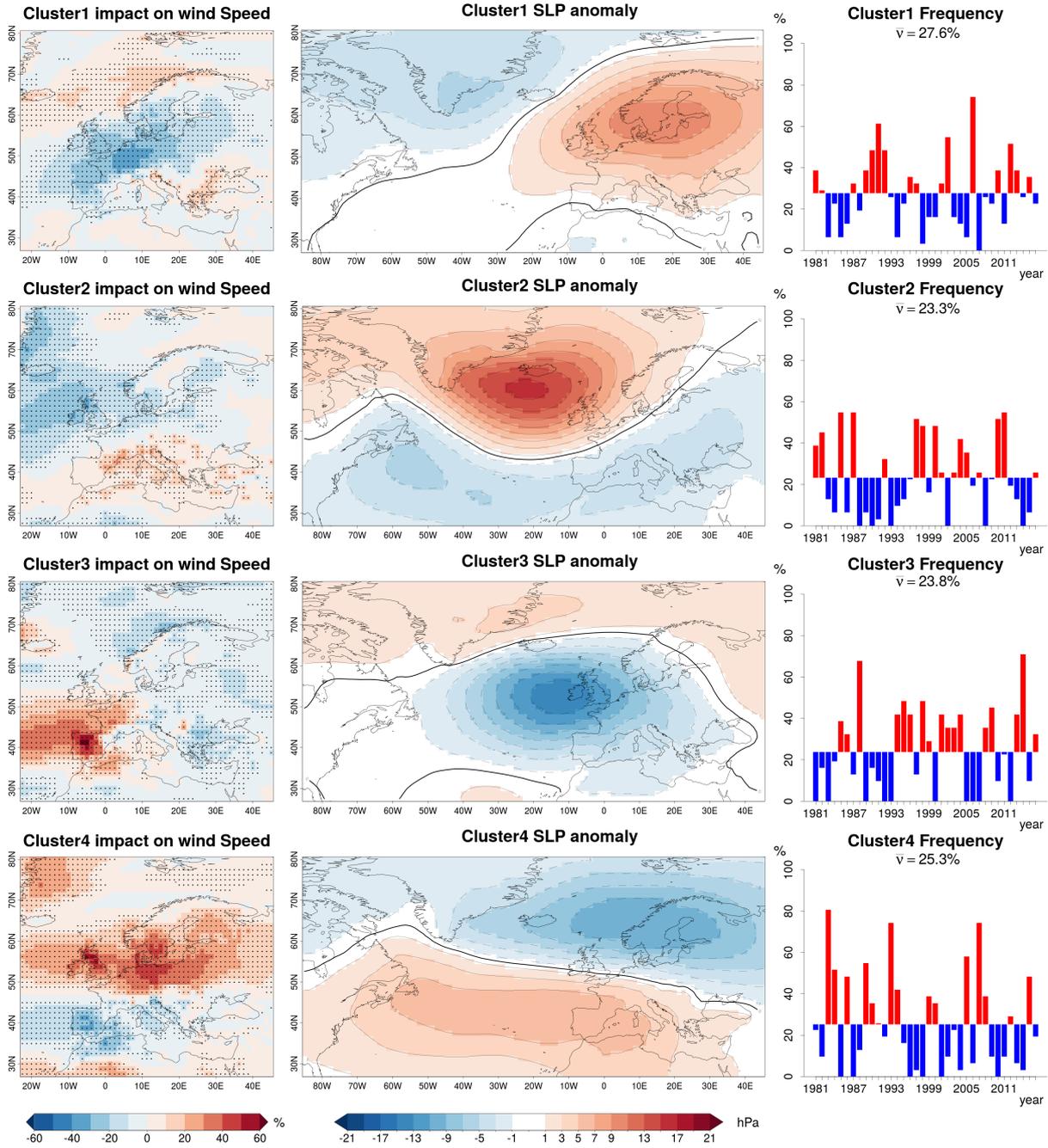


Figure 2: *Center column:* monthly SLP anomalies (in hPa) corresponding to the four Euro-Atlantic clusters (weather regimes) in January over the period 1981-2016, in decreasing order of explained variance. Black contours indicate null anomalies. *Right column:* monthly frequency of occurrence of the four clusters in January for 1981-2016. Eventual presence of black lines indicate significant trends. *Left column:* impact of the four clusters on 10-m wind speed. Impact (in %) is relative to the average wind speed for the month of January over the period 1981-2016. Black dots indicate significant points with a t-test at 95% confidence level. (Source: JRA-55 reanalysis)

3.3 Regime impact on wind speed for January 2016

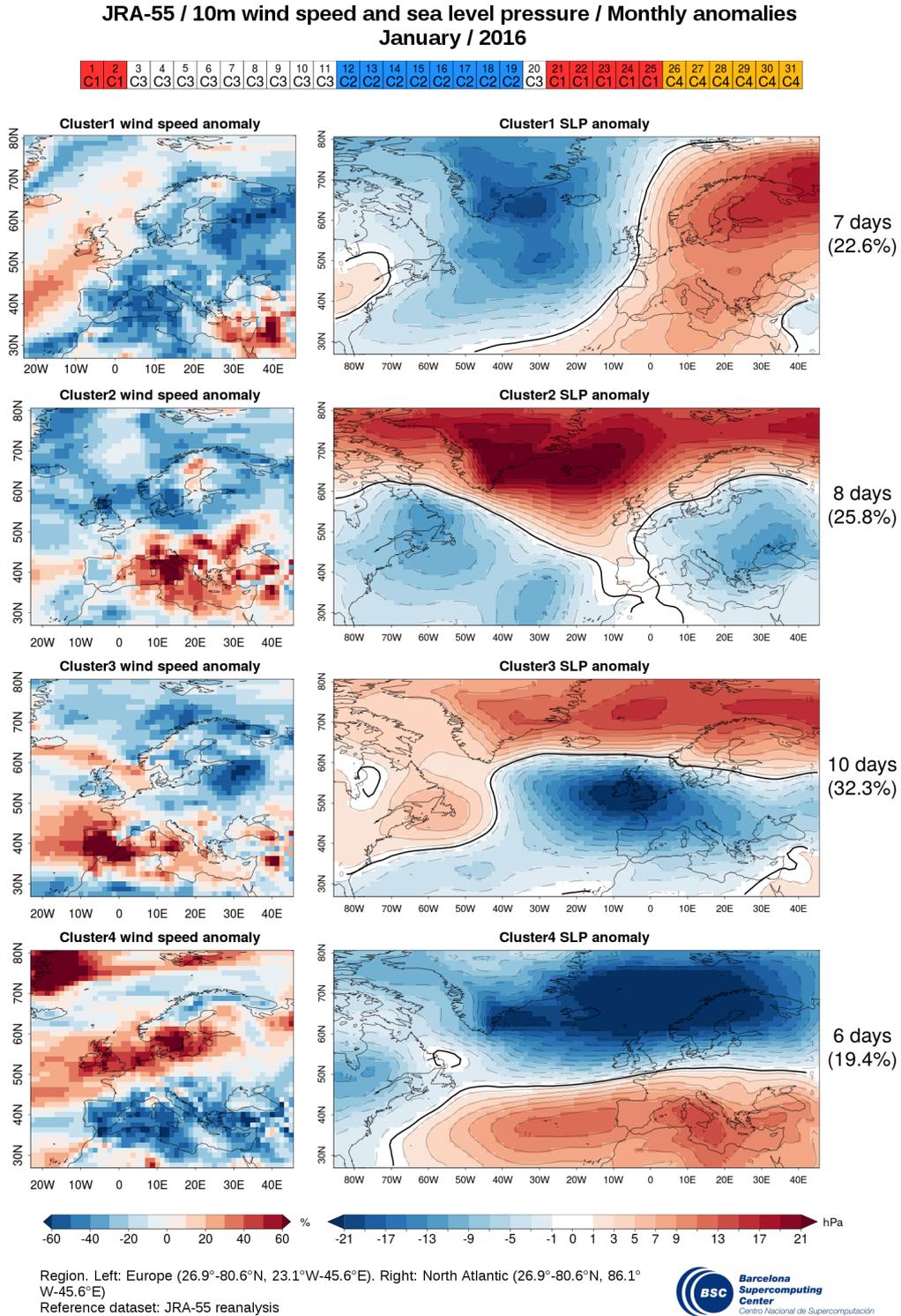


Figure 3: *Top bar*: daily cluster sequence for January 2016. *Center column*: monthly SLP anomalies (in hPa) corresponding to the four Euro-Atlantic clusters (weather regimes) for January 2016, in decreasing order of explained variance. Black contours indicate null anomalies. *Right column*: number of days in January 2016 for each cluster. *Left column*: impact of the four clusters on 10-m wind speed. Impact (in %) is relative to the average wind speed for the month of January over the period 1981-2016. (Source: JRA-55 reanalysis)