



## Ten-year lightning patterns in Catalonia using Principal Component Analysis

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The main goal of this study is the characterization of the thunderstorm patterns in Catalonia through their lightning activity. Principal Component Analysis (PCA) has been used to regionalize Catalonia (NE Iberian Peninsula) and characterize the main features of each region, based on ten-years of lightning activity recorded by the Lightning Location System of the Meteorological Service of Catalonia.

Lightning data has been processed based on a grid of 10 km resolution covering the region, and periods of 6 hours. Only the 6-hours periods with more than 100 cloud-to-ground-strokes have been used. A PCA in S-mode is applied to this matrix to achieve a regionalization of Catalonia. The method relies on the correlation matrix and the Scree-test criterion. The Orthogonal Equamax procedure is used for rotated the components which minimize the number of variables with high factorial loadings; the dependence among components is reduced and retains the orthogonality constraint of the model. A total of six different categories (components) have been obtained. The 6-hour periods have been classified using the score matrix obtained of the PCA, considering only those with a score higher than 1.0.

The categories obtained are the following: C1-Pyrenees, C2-Prepyrenees-Lleida, C3-NE-Central region, C4-North-Central coast area, C5-South coast area and C6-NE coast. It is worthy to highlight that it has been possible to discern between the storms in the Prepyrenees (C2) in spring and summer from the ones in the Pyrenees (C1) in summer. Moreover, it has been possible to obtain a group with the local storms in the central coast (C4) associated to the local convergences due to the northerly winds after crossing a cold front. The C3 and C5 clusters are more typical. Overall, the classification obtained rely on the hour, month and geographical distribution of the thunderstorms, and finally, on the synoptic situation.