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Classification into weather types for climate monitoring of temperatures over France

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The aim of this study is to develop a weather-types classification taking into account both the characteristics of atmospheric circulation on a large scale, and the variability of temperatures over France, the main goal being climate monitoring of temperatures, including the characterization of significant weather situations.

Temperature data were taken from thirty stations and large-scale fields from the ERA40 reanalysis for the period 1958 to 2001.

We adopted the method of canonical analysis, which allows exploring the relationships between different fields, to choose the parameter used for classification and the optimal geographical area in which the classification is carried out.

The canonical variables obtained with the most relevant parameters and domain form then the matrix of elements to classify. Two classification methods are coded, tested and compared in the context of this study. The first, strongly inspired by an article of Michelangeli et al. (1995), is based on the "k-means" technique. The second method, which we call "joint method", uses both partitioning methods and hierarchical ascending clustering.

Determination of seasonal classes is preferred. Two main seasons, hot and cold, are identified using a method based on the frequencies of weather types, defined separately for the four climatological seasons, for each month of the year throughout the period 1958-2001.

The classification validation is performed using, in addition to statistical tests, the relevance of climatic events like heat wave or cold spells over France in terms of, for example, frequency of weather types from such a classification.

The classification issued from this study will after approval become an operational product of the Climatological Department in Météo-France.