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Revisiting the Identification of Wintertime Atmospheric Circulation Regimes in the Euro-Atlantic Sector

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A number of methods exist for the identification of atmospheric circulation regimes. The most commonly-used method is k-means clustering. Often the clustering algorithm is applied to the first several principal components, instead of the full field data. In addition, many studies use a time-filter to get rid of high frequency oscillations before the clustering is executed. We discuss the consequences of these filtering techniques on the identified circulation regimes for the Euro-Atlantic sector in winter. Most studies identify four regimes: the Atlantic Ridge, the Scandinavian Blocking, and the two phases of the North Atlantic Oscillation. However, when k-means clustering is applied to the full field data of a reanalysis dataset, the optimal number of regimes is not found to be four, but six. This optimal number is based on the use of an information criterion, together with consistency arguments. The two additional regimes can be identified as the opposite phases of the Atlantic Ridge and Scandinavian Blocking, since they have a low-pressure area where the original regimes have a high-pressure area. Furthermore, the incorporation of a persistence constraint within the clustering algorithm is found to preserve the occurrence rates of the regimes, and thus maintains the consistency of the results. In contrast, applying a time-filter to enforce persistence of the regimes changes the occurrence rates. We conclude that care must be taken when filtering the data before the clustering algorithm is applied, since this can lead to biases in the identified circulation regimes and their occurrence rates.