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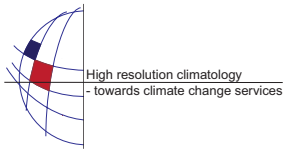

A Lagrangian circulation type classification based upon clustering

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Techniques for circulation type classification are usually based on a small number of meteorological fields like SLP or geopotential height. In particular, they most often do not take into account the 3d-structure of the flow and are based only on a single day, i.e. neglect any kind of day-sequence classifications.

In this work we present a classification method for northwest Iberia Peninsula, based on the analysis of backward trajectories arriving in this target area. The final aim is to have a classification of the representative flow for each day (at 12UTC). The backward trajectories are calculated with the 3-D Lagrangian particle dispersion model FLEXPART. Data from a global simulation were used, which contains 1,398,800 particle positions and their meteorological state proprieties recorded every six hours over a five-year period (1/12/1999 to 11/30/2004).

The methodology can be split in several distinct steps:

a) an initial horizontal (based on latitude and longitude) cluster analysis was performed with a method adapted from Dorling (1992) then, a second clustering was performed to the initial trajectory clusters mean, where now the clustering was based on the height of the trajectory, the distance to the target area, specific humidity and latitude;

b) some additional flow characteristics were computed (e.g.: curvature cyclonicity of the flow, and moisture evolution) for each cluster ; and based on physical grounds and on a correlation analysis, a subset of variables was selected to represent each cluster;

c) finally, each classifying variable was separated into several distinct classes (e.g. cyclonic or anticyclonic flow), hence enabling us to characterize each cluster with an “index” for each classifying variable.

As results, we get a daily catalog containing information about the air masses before they arrive to the target area. A comparison between summer/winter seasons and NAO+/NAO- days was carried out, in order to show if the method is able to identify the differences in the flows for each case.

Dorling, S.T., T.D. David, and C.E. Pierce, 1992. Cluster analysis: a technique for estimating the synoptic meteorological controls on air and precipitation chemistry — method and applications. Atmos. Env., 26A, 2575–2581.