



## European atmospheric circulation and temperature trends since 1850

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We studied atmospheric circulation in six European regions using the EMULATE reconstructed daily sea-level pressure database available for 1850-2003. The gridded data were used to calculate daily indices of flow strength, flow direction, and relative vorticity. The indices served for a simple threshold-based classification of circulation types into eight directions of flow, a cyclonic, an anticyclonic, and an unclassified type. Our previous analysis has shown that the EMULATE sea-level pressure dataset represents European circulation patterns fairly consistently with reanalyses, the accord being the best in winter over Western Europe.

Using daily maximum and minimum temperature at 29 European stations with century-long time series available, we then estimated overall seasonal temperature trends and trends within each of the 11 circulation types for running 30-year periods, shifted by one year. Within-type temperature trends generally follow the sign and magnitude of the (few) significant temperature trends, with a few exceptions: winter warming since the 1960s was accompanied by cooling within easterly, southeasterly, and in some places also southerly types; recent summer warming did not affect the cyclonic type that underwent strong cooling in many places; and in spring in Central Europe this was true for the southwesterly type. The Eastern European cooling in autumn in decades beginning in the 1950s and 1960s usually affected all circulation types.