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Modulation of the NAO influence on winter European rainfall by North American and Pacific factors

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The link between European rainfall variability in winter (from January to March, JFM) and the North Atlantic Oscillation (NAO) is investigated in the period 1900-2014, aiming at the identification of mechanisms explaining variations in the strength of the connection. Precipitation data are taken from the University of Delaware dataset, version 4.01 (Willmott and Matsuura 2001). Atmospheric fields from the 20th Century Reanalysis dataset, version 2 c (Compo et al. 2011) are also analyzed. In a first step, the European precipitation patterns linearly associated to the main Northern Hemisphere (NH) circulation modes (determined via Principal Component Analysis of the 500-hPa height JFM anomalies over the NH) were obtained by means of linear regression techniques. 29% of the variance in precipitation is explained by the NAO. A residual precipitation field is built by removing the linear regression on the main NH modes. Principal Component Analysis is applied to this residual, yielding a leading mode whose spatial pattern projects strongly on the NAO-related European precipitation pattern, while not being linearly correlated with the NAO. The time series corresponding to that pattern in the residual precipitation field is used to monitor intervals of enhanced or weakened NAO influence on European winter rainfall. Through composite analysis, a reinforced (debilitated) NAO precipitation pattern, either in its positive or its negative phase, is found to occur in connection with stronger (weaker) meridional temperature gradient over Newfoundland.

Compo GP et al (2011) The Twentieth Century Reanalysis Project. Q J Roy Meteorol Soc 137: 1-28.

Willmott CJ, Matsuura K (2001) Terrestrial Air Temperature and Precipitation: Monthly and Annual Time Series (1950 - 1999). http://climate.geog.udel.edu/∼climate/html_pages/README.ghcn_ts2.html.