Geophysical Research Abstracts, Vol. 7, 03601, 2005
SRef-ID: 1607-7962/gra/EGU05-A-03601

Combined winter climate regimes over the North Atlantic/European sector 1766-2000

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We present combined winter climate regimes for the 1766–2000 period over the North Atlantic/European sector. We expand previous studies on recurrent climate regimes by combining spatially high-resolved monthly independent reconstructions of the 500 hPa geopotential height, land surface temperature, and precipiation fields.
In order to account for the nonlinear dynamics of climate regimes, Nonlinear Principal Component Analysis is applied to the state space spanned by the first 10 leading combined linear principal components. They account for 76.7% of the total combined variance for the North Atlantic/European winter (D,J,F) since 1766.
Three recurrent winter climate regimes are detected. A first regimes resembles in its pressure, temperature, and precipitation pattern the positive phase of the North Atlantic Oscillation, whereas the other two regimes are European blocking situations.
The detected temporal regime evolution enables the connection of pronounced climate anomalies known from proxy and observational data with the occurrence of preferred climate regimes since 1766, long before the start of the observational period. Furthermore, a classification of atmospheric variability into climate regimes and transitions between them has potential to a significant improvement of monthly to seasonal climate forecast. This is shown using a simple Marcov chain model.