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Independent reconstruced European pattern climatology 1766-2000

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Using monthly independently reconstructed gridded fields for the 500 hPa geopotential height, temperature, and precipitation covering the last 235 years for Europe we aim at investigating the temporal and spatial evolution of these key climate variables and assessing the main combined patterns of climate variability. Independent means that no common data are used for the reconstruction of each climate variable. This allows us to study the climate dynamics on a much longer time scale than offered by modern gridded data over Europe.

Simple spatial correlation technique reveals that winter, spring, and autumn covariability between temperature and precipitation over Europe is mainly influenced by advective processes whereas during summer convection plays the dominant role. Empirical Orthogonal Function analysis is applied to the combined fields of pressure, temperature and precipitation. The dominant patterns of climate variability for winter, spring, and autumn resemble the North Atlantic Oscillation and show a distinct positive trend during the past 40 years for winter and spring. A positive trend is also detected for summer, but for the second EOF pattern, which reflects an increased influence of the Azores High towards central Europe and the Mediterranean coinciding with warm and dry conditions. The question to which extent these recent trends in European climate patterns can be explained by internal variability or are a result of radiative forcing is answered using cross wavelets on an annual basis. Natural radiative forcing (solar and volcanic) has no imprint on annual European climate patterns, whereas we report a positive influence of the CO2 forcing during the twentieth century when neglecting edge effects and signal detection problems over Europe.