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Identifying driving climate factors of wheat and maize yields inter-annual variability in France

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A canonical powered Partial Least Squares Regression (PLSR) approach is here used to estimate the relationship between meteorological variables and crop (durum wheat and grain maize) yield time series over France. This method combines the advantages of both the Canonical Correlation Analysis (CCA) and the PLSR. The latter is mainly based on the extraction of a subset of latent variables (having the best predictive power) from the full set of predictors. The method is applied to detrended (by using a LOESS approach) time series of crop yields and monthly mean temperature, cumulated precipitation and global solar radiation during the growing seasons from 1990 to 2011. Results show that, overall, temperature has a substantial influence on winter wheat yields in south-western and eastern France, while rainfall plays an important role in the northern and southern parts of the country. Finally, radiation is more important over the southern part of France. Concerning grain maize, the inferred statistical models show relatively low skill over the northern part of France, where inter-annual yield variability is low. Overall, results show that temperature is the most important variable influencing grain maize yields over the southern and eastern parts of France, while rainfall is more important in the central and northern parts of the country. Finally, global radiation is the main meteorological factor over the westernmost part of France.