



Reconstructed seasonal precipitation in Portugal vs. large-scale teleconnections

João Andrade Santos (1), Maria Fátima Carneiro (1), and Maria João Alcoforado (2)

(1) Centre for the Research and Technology of Agro-environmental and Biological Sciences, CITAB, Universidade de Trás-os-Montes e Alto Douro, UTAD, 5001-801 Vila Real, Portugal (jsantos@utad.pt), (2) Centro de Estudos Geográficos, IGOT, Universidade de Lisboa, Ed. Faculdade de Letras, 1600-214 Lisboa, Portugal

An analysis of the relationships between reconstructed seasonal precipitation series in Portugal and large-scale teleconnections is carried out in the present study over a five-century long period (1500-2012). Time series obtained from instrumental sources in the period from 1815 to 2012 are used for a preliminary calibration and validation of the seasonal time series extracted from Pauling's European-wide reconstructions. Subsequently, the calibrated seasonal precipitation series are related to large-scale teleconnection patterns in the atmospheric circulation, obtained from different North Atlantic flow reconstructions. The strong coupling between precipitation in Portugal and mean sea level pressure or 500 hPa geopotential height anomalies within the Euro-Atlantic sector is highlighted for the whole period. Furthermore, the key role played by the North Atlantic Oscillation and by the East Atlantic pattern in governing precipitation in Portugal is clearly reflected by these large-scale circulation anomalies. These outcomes are supported by both statistically significant Spearman rank correlation patterns and cross wavelet spectra between reconstructed seasonal precipitation in Portugal and mean sea level pressure/geopotential height at particular grid points (in the centres-of-action of the teleconnections). Overall, the isolated teleconnections are dynamically coherent for all seasons, with the exception of summer, when much weaker temporal consistency is found throughout the study period (1500-2012). In the assumption that these large-scale couplings, as well as their underlying physical mechanisms, remain nearly invariant in time, the present study validates the reconstructed precipitation series in Portugal for autumn, winter and spring. However, the present study also highlights some important incongruences in the reconstructed summer precipitation in Portugal, which is much more controlled by regional-to-local rain-generating processes than by large-scale forcing. This important shortcoming needs to be overcome in future reconstructions, e.g. by integrating new proxy sources collected in Portugal within the framework of the project 'Reconstruction and model simulations of past climate in Portugal using documentary and early instrumental sources – KlimHist'. Acknowledgements: This study was supported by the KlimHist project [PTDC/AAC-CLI/119078/2010] and by FEDER/COMPETE - Operational Competitiveness Programme [FCOMP-01-0124-FEDER-022692].