Geophysical Research Abstracts
Vol. 12, EGU2010-10792, 2010
EGU General Assembly 2010

Large-scale climatic control on European precipitation

David Lavers (1,2), Christel Prudhomme (1), and David Hannah (2)

(1) Centre for Ecology and Hydrology, Maclean Building, Crowmarsh Gifford, Wallingford, OX10 2BB, UK (davver@ceh.ac.uk), (2) School of Geography, Earth & Environmental Sciences, University of Birmingham, Edgbaston, Birmingham, B15 2TT, UK

Precipitation variability has a significant impact on society. Sectors such as agriculture and water resources management are reliant on predictable and reliable precipitation supply with extreme variability having potentially adverse socio-economic impacts. Therefore, understanding the climate drivers of precipitation is of human relevance. This research examines the strength, location and seasonality of links between precipitation and large-scale Mean Sea Level Pressure (MSLP) fields across Europe. In particular, we aim to evaluate whether European precipitation is correlated with the same atmospheric circulation patterns or if there is a strong spatial and/or seasonal variation in the strength and location of centres of correlations. The work exploits time series of gridded ERA-40 MSLP on a 2.5˚×2.5˚ grid (0˚N–90˚N and 90˚W–90˚E) and gridded European precipitation from the Ensemble project on a 0.5º×0.5º grid (36.25˚N–74.25˚N and 10.25˚W–24.75˚E). Monthly Spearman rank correlation analysis was performed between MSLP and precipitation.

During winter, a significant MSLP-precipitation correlation dipole pattern exists across Europe. Strong negative (positive) correlation located near the Icelandic Low and positive (negative) correlation near the Azores High pressure centres are found in northern (southern) Europe. These correlation dipoles resemble the structure of the North Atlantic Oscillation (NAO). The reversal in the correlation dipole patterns occurs at the latitude of central France, with regions to the north (British Isles, northern France, Scandinavia) having a positive relationship with the NAO, and regions to the south (Italy, Portugal, southern France, Spain) exhibiting a negative relationship with the NAO. In the lee of mountain ranges of eastern Britain and central Sweden, correlation with North Atlantic MSLP is reduced, reflecting a reduced influence of westerly flow on precipitation generation as the mountains act as a barrier to moist Atlantic air. The Balkans' precipitation shows a linkage with the Siberian High pressure system. With the onset of spring and summer the correlation patterns shift in location and the winter correlation dipole breaks down. In summer, fewer significant correlations between the MSLP (large-scale climate) and precipitation are found across Europe. This results in smaller scale correlation patterns and possibly suggests that warm-season precipitation is predominantly generated by local or regional scale convective systems. These convective systems are not likely to be captured by large-scale atmospheric patterns of MSLP.

In conclusion this research shows: 1) the detailed change in large-scale climatic control on precipitation across Europe, and 2) the geographic regions with strongest correlation between precipitation and MSLP shift from month-to-month, highlighting the dynamic nature of precipitation generating weather systems throughout the year. This study also shows that the utility of an in-situ index to describe precipitation occurrence, such as the NAO, is likely to be limited because the seasonal movements of the large-scale climate patterns are not captured.