Testing of NAO and ENSO signals in the precipitation field in Europe

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Abstract: The summer Palmer Drought Severity Index (PDSI) for the 1891-1991 period is considered in five from nine homogeneous regions, as they were defined by Briffa et al. (1994), and in a region representative for the Romania zone (ROMZ).

In order to test the influence of NAO (North Atlantic Oscillation) or ENSO (El Nino- Southern Oscillation) on the precipitation fields or on the drought index, the correlation technique has been applied using the lags from 1 to 12 months for NAO and from 1 to 4 seasons for ENSO. Only the results with a high statistical significance level have been presented in the paper.

As we expected the NAO signal is evident in wintertime, but the most influence is not simultaneous in the same month - but with some lags.

Generally, ENSO signal is weak in the precipitation field in Europe; only for some regions the connections are significant. A negative SOI in winter and springtime favours a wetter summer in northeast part of Europe.

1. INTRODUCTION

NAO is the dominant mode of the winter climate variability in the North Atlantic region. The corresponding index varies from year to year, but also exhibits a tendency to remain in a positive or negative phase for intervals lasting several years. Over the past thirty years, NAO has steadily strengthened, rising from its low index state in the 1960s to a historic maximum in the early 1990s. This trend accounts for a significant portion of the Northern Hemisphere wintertime temperature increase over Eurasia, a major component of the recent warming.
Recently Garcia’s et al. (2000) paper referred many publications related to NAO and its influence on the pressure field in the Atlantic-European region.

The NAO used in this paper is defined as the normalised pressure difference between Ponta Delgata (Azores) and Reykjavik (SW Iceland), according to Jones et al. (1997).

El Nino/Southern Oscillation (ENSO) is one of the most important phenomena occurred in the coupled interaction between ocean and atmosphere and it produces changes in the evolution of the air components at large spatial-temporal scales.

It is well known that the atmosphere and the ocean in the Pacific Ocean tropical basin have an interannual variability that affects the weather in many parts of the Earth.

Ropelewski and Halpert (1987) identified the regions of the globe that have relatively strong, consistent ENSO-related precipitation signals. The physical mechanism of the relation between ENSO and the precipitation in the southern Europe is difficult to establish, as also shown by Ropelewski and Halpert (1987). Fraederich (1994) made a review upon the latest investigations on the ENSO impact in Europe.

In order to obtain a quantification of ENSO effect we considered Southern Oscillation Index (SOI). The SOI is defined as the normalised pressure difference between Tahiti and Darwin. There are several slight variations in the SOI values calculated at various centres and in the present paper we used the SOI calculated by the method given by Ropelewski and Jones (1987).

The paper is structured in 2 parts: Data description (section 2) and Discussion of the results (Section 3) with two paragraphs related to NAO signal and Teleconnections between ENSO and precipitation. The NAO signal was investigated for monthly values and SOI impact by means of seasonal time series.

2. DATA

a) NAO and SOI values (1891-1997) obtained from The IPCC Data Distribution Centre, http: ipcc-ddc.cru.uea.ac.uk;

b) Precipitation (31 stations) and temperature fields (33 stations) in Romania between 1950-1997;

c) The Palmer Drought Severity Index (PDSI) for the summer time over the 1891-1991 interval, as it was calculated by Briffa et al. (1994) defined for 6 regions:
   - The northwestern Europe (NWEUR),