STUDY OF FREQUENCY VARIABILITY OF WINTER PRECIPITATION OVER THE SOUTH-WESTERN EUROPE AND ITS RELATIONSHIPS WITH TELECONNECTION INDICES

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1. BACKGROUND

OBJECTIVES:
- To obtain temporal and spatial relationships between atmospheric circulation in the Atlantic area and the precipitation variations over south-western Europe.
- To analyze the spatial and temporal modes of winter precipitation.

DATASETS:
We have considered as the winter precipitation, the average of the accumulated precipitation for three moving seasons: November-December-January plus December-January-February plus January-February-March. Figure 1 shows the precipitation pattern and the relative anomalies for different periods. Higher values correspond to north-west Iberian Peninsula and lower toward Mediterranean regions. The precipitation anomalies for the period 1930 to 1970 are negatives. However, since 1970 positive anomalies are obtained between southern France and north-eastern Spain.

2. CORRELATION BETWEEN CIRCULATION INDICES AND WINTER PRECIPITATION

The correlation between the precipitation field and indices such as the Arctic Oscillation, the North Atlantic Oscillation and East Atlantic/West Russian pattern provides a measure of the relationships between circulation and precipitation.
- The Arctic Oscillation (AO) pattern influences most regions of south-western Europe (Figure 2 a). The negative phases of AO are associated with an increase in precipitation over the Iberian Peninsula with higher values toward south-western regions.
- The North Atlantic Oscillation produces an increase in precipitation over the Iberian Peninsula with higher values toward south-western regions.
- The East Atlantic/West Russian (EA/WR) pattern is also associated with winter precipitation toward west regions.

3. SPATIAL PATTERNS OF WINTER PRECIPITATION

To analyze the temporal behavior of precipitation, the dimensionality of the time series has been reduced by applying linear principal component analysis.

4. CIRCULATION REGIMES AND PREFERRED MODES OF WINTER PRECIPITATION VARIATIONS

The Empirical Orthogonal Functions (EOF) of precipitation could be interpreted by:
- Obtaining the correlation between each time series or principal component of the precipitation field and the principal components of the circulation indices.
- The relationships with the circulation indices.

5. SPECTRAL ANALYSIS

Singular Spectral Analysis (SSA) was applied to obtain the temporal modes of winter precipitation and teleconnection indices.
- The first principal component shows two significant peaks, one very strong at about 6 years and another one at about 10 years. These oscillations are also detected in the Arctic Oscillation (Figure 7a).
- The second principal component shows three significant peaks at about 10, 4 and 2.5-years. The quasi-decadal and quasi-biennial oscillations are also detected in the North Atlantic Oscillation (Figure 7c).

6. CONCLUSIONS

- The spatial and temporal modes of winter precipitation over south-western Europe has been obtained.
- The modes were interpreted considering the atmospheric circulation: NAO, AO and EA/WRUSS indices were associated with positive precipitation variations.
- The association has been obtained in spatial, temporal and frequency domain.
- The spatial and temporal modes of winter precipitation over south-western Europe have been obtained.
- The results of this research are being used for providing potential precipitation predictions.

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