

# CLIVAR-SPAIN contributions: Seasonal drought variability over the Iberian Peninsula and its relationship to global sea surface temperature and large scale atmospheric circulation

Constanta Boroneant<sup>1</sup>, Monica Ionita<sup>2</sup>, Manola Brunet<sup>1</sup>, Norel Rimbu<sup>2</sup>  
<sup>1</sup>Center for Climate Change, University Rovira I Virgili, Campus Terres de l'Ebre, Tortosa, Spain  
<sup>2</sup>Alfred Wegener Institute, Bremerhaven, Germany  
 Leading author: constanta.boroneant@urv.cat



## Abstract

Drought variability over Iberian Peninsula (IP) is investigated using two monthly global datasets, the self calibrated Palmer drought severity index (scPDSI) and the newly developed Standardized Precipitation-Evapotranspiration Index (SPEI). Both datasets have a spatial resolution of 0.5° and provides temporal coverage for the period 1901-2002 and 1901-2006, respectively. Comparison between spatially averaged scPDSI and SPEI over the IP grid points at time scales of 3, 6, 12, 24, 36 and 48 months, for each season is made in terms of temporal evolution and correlation coefficients. The variability of seasonal scPDSI and 12-month SPEI is compared in terms of explained variance, patterns of variability and temporal evolution of the time series of PC coefficients of the first three principal modes. Composite maps of the large scale anomalies of the mean sea level pressure (MSLP) and the global sea surface temperature (SST) were calculated for the current and the previous two seasons based on the years when the values of PC1 series of coefficients of the seasonal 12-month SPEI were  $\leq -1$ stdev. The results show coherent large scale field anomalies associated to IP seasonal drought.

## Data

- Drought indices data sets (0.5° x 0.5°)**
  - Self calibrated Palmer drought severity index scPDSI (van der Schier, 2006) for the period 1901-2002 from
  - Standardized Precipitation-Evapotranspiration Index SPEI (Vicente-Serrano, 2010) for the period 1901-2006 from
- Global gridded data (2° x 2°) (1901-2006)**
  - MSLP Sea Level Pressure - Twentieth Century Reanalysis 20CR V2 data (Compo et al., 2009, 2006) from
  - SST Extended Reconstructed Sea Surface Temperature (Smith et al., 2008) from

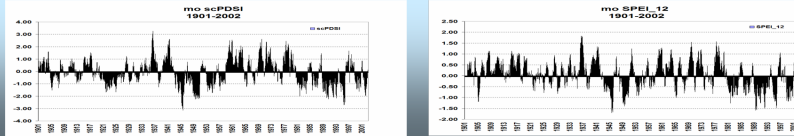
## Methods

- Correlation coefficient between seasonal scPDSI and 3, 6, 12, 24, 36 and 48 month SPEI
- EOF analysis of seasonal scPDSI and 3, 6, 12, 24, 36 and 48 month SPEI
- Composite maps of the anomalies of the mean sea level pressure (MSLP) and the global sea surface temperature (SST) for a current and the previous two seasons based on the years when the values of PC1 series of coefficients of the seasonal 12-month SPEI were  $\leq -1$ stdev.

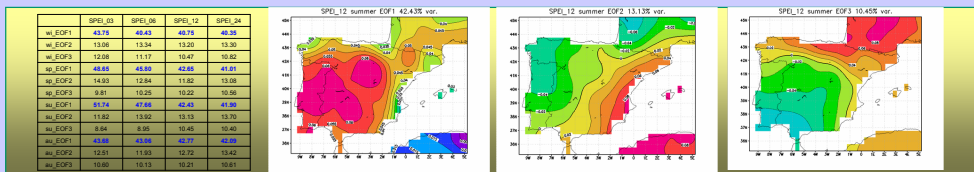
## RESULTS

Correlation coefficients between monthly and seasonal series of scPDSI and SPEI (1901-2002)

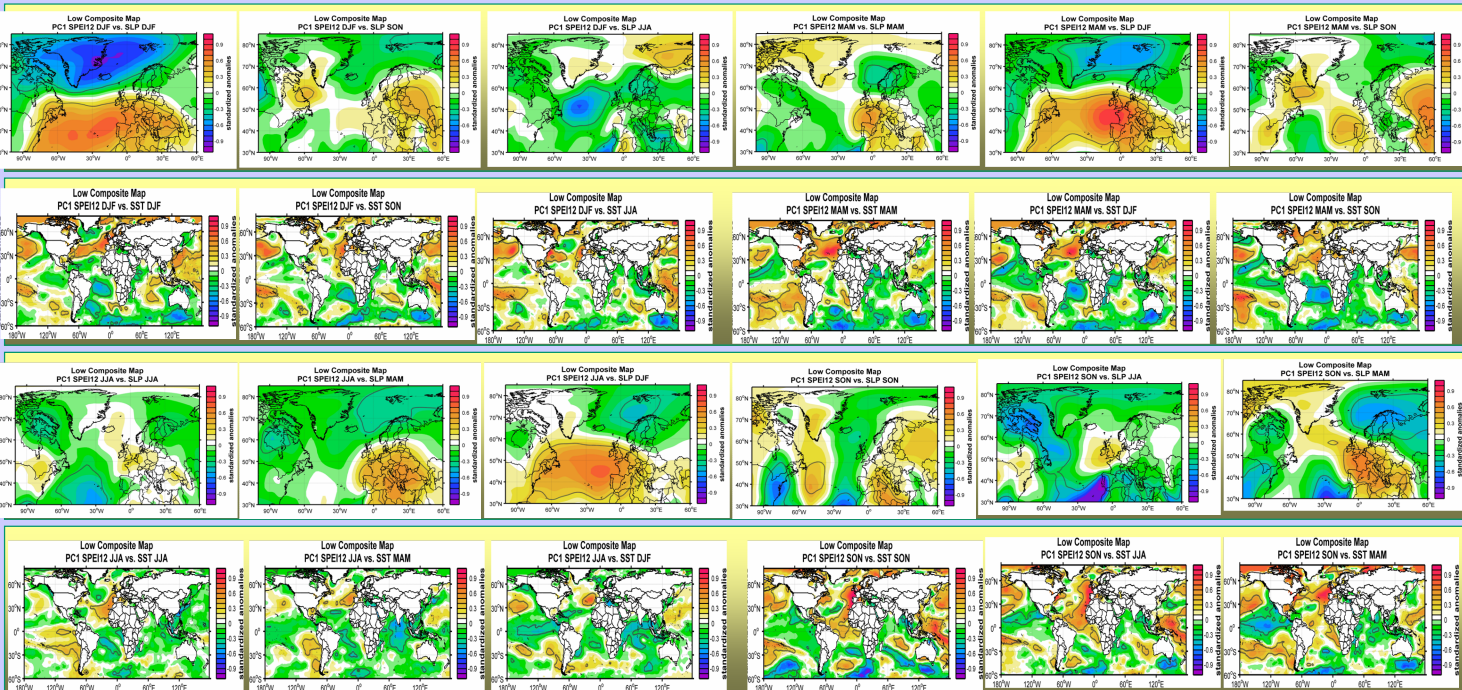
	SPEI_03	SPEI_06	SPEI_12	SPEI_24	SPEI_36	SPEI_48
mo_scPDSI	0.658	0.758	<b>0.841</b>	0.729	0.667	0.610
w_scPDSI	0.789	0.603	<b>0.803</b>	0.698	0.604	0.587
sp_scPDSI	0.743	0.885	<b>0.876</b>	0.632	0.678	0.593
su_scPDSI	0.687	0.854	<b>0.882</b>	0.811	0.717	0.637
au_scPDSI	0.545	0.731	<b>0.862</b>	0.776	0.662	0.636



Explained variance of seasonal SPEI EOFs (1901-2006) and the patterns of variability over the Iberian Peninsula of during summer



Seasonal composites PC1 SPEI<sub>12</sub>  $\leq -1$ stdev for MSLP and SST anomalies



## Conclusions

- The best correlation between scPDSI and SPEI over the Iberian Peninsula has been identified for scPDSI and 12-month SPEI both at monthly and seasonal timescales.
- The spatial modes of variability of seasonal SPEI calculated for 3, 6, 12 and 24 months are similar.
- The spatial coefficients of the EOF1 have the same sign over the IP, the EOF2's spatial coefficients have alternate signs separating the regions under the Mediterranean and North Atlantic influence and, the EOF3's spatial coefficients have alternate signs separating the northern and the southern part of IP. The explained variance of the EOF1 varies between 41% and 52% for the seasonal 3 to 36 month-SPEI.
- Seasonal drought conditions in the IP are associated with coherent large scale SLP and SST anomalies: NAO like pattern for current winter, previous winter for the current spring and previous winter for current summer. Positive SST anomalies with various spatial extensions in the North Atlantic along the IP coast are observed during current and previous two seasons.
- Some El Niño years (1929, 1931, 1976, 2005) coincide with the driest seasons over the IP.

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