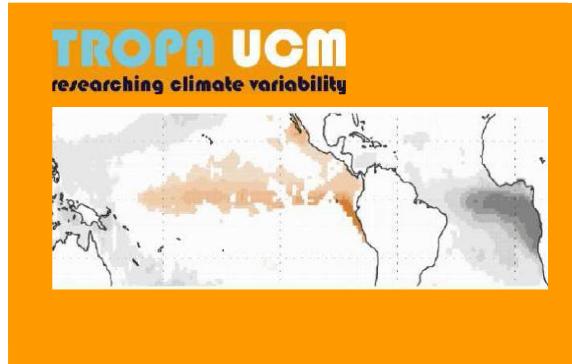


Multidecadal modulation of El Niño influence on the leading Euro-Mediterranean rainfall mode.

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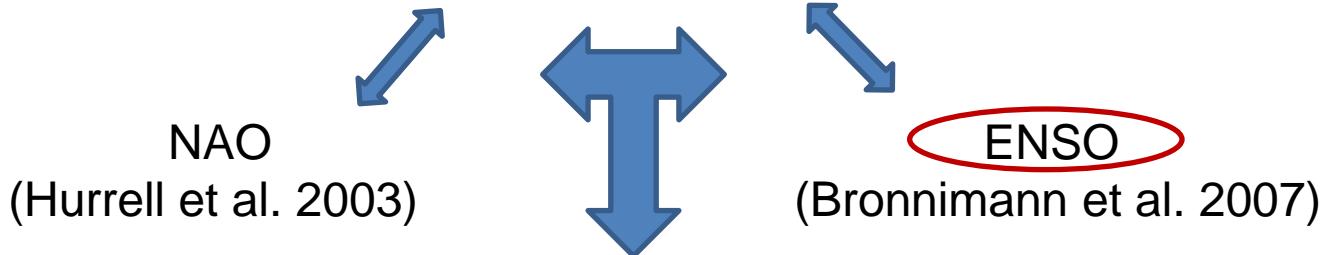
<http://tropa.fis.ucm.es/web/>



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Multidecadal modulation of El Niño influence on the Euro-Mediterranean rainfall
(López-Parages & Rodríguez-Fonseca, GRL, 2012)

1. Motivation and state of the art

The Euro-Mediterranean rainfall (**EMR**) is linked to:



These relationships are not stationary

Interdecadal shifts in the location of the NAO centers (Vicente-Serrano et al. 2008).

ENSO signal over the Euro- Atlantic sector much more stronger after the 1970's (Greatbatch et al. 2004).

Multidecadal variations characterize the ENSO western-Mediterranean relationship during the 20th century (Mariotti et al. 2002).

Switching behaviour of ENSO effects driven by the PDO (Zanchettin et al. 2008).

Importance of reducing the degrees of freedom (Zanchettin et al. 2008).

2. Objective

To evaluate the stationarity of the EMR modes and its associated oceanic forcing by analysing the Principal Components of the interannual rainfall.

3. Data and methods

Precipitation

University of Delaware (1 X 1), (Matsuura and Willmott, 2009).
GPCC (0.5 X 0.5), (Schneider et al. 2008).

SST

NOAA ERSST V3b (2 X 2), (Smith et al., 2008).
HadISST1 (1 X 1), (Rayner et al., 2003).

SLP

NCAR (5 X 5), (Trenberth and Paolino. 1980).

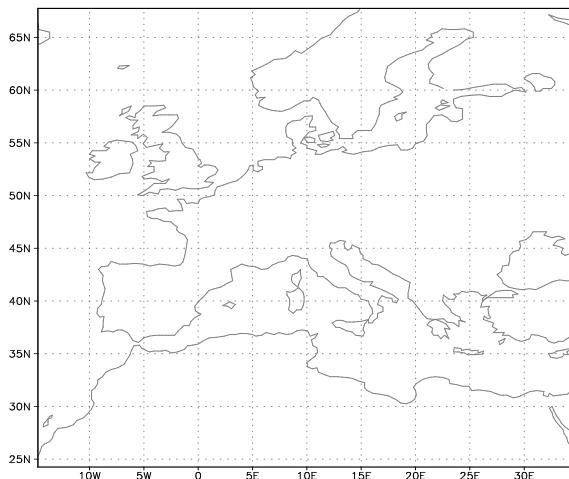
Period analyzed:
1900-2008

PCA

$$\xrightarrow{\text{Applied to}} X'_{inter} = X'_i - X'_{i+1}$$

(Stephenson et al. 2000)

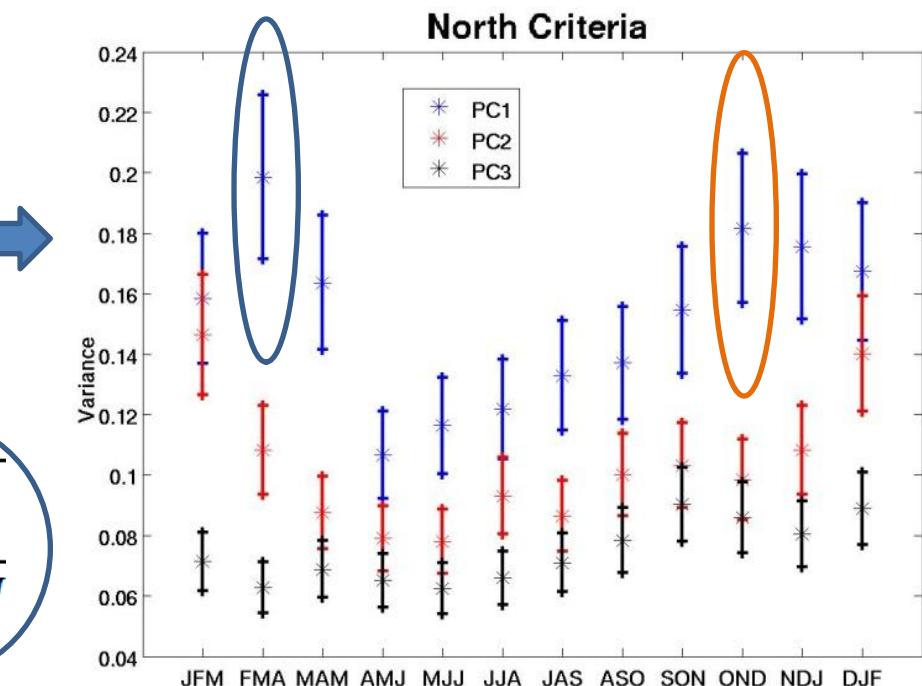
JFM, FMA, MAM.....DJF



λ = eigenvalues

$$\lambda_i - \lambda_{i+1} > \lambda_i * \sqrt{\frac{2}{N}}$$

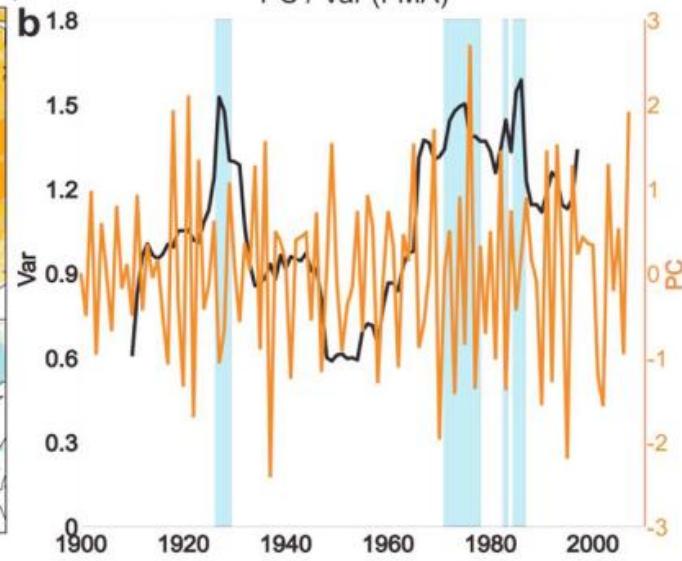
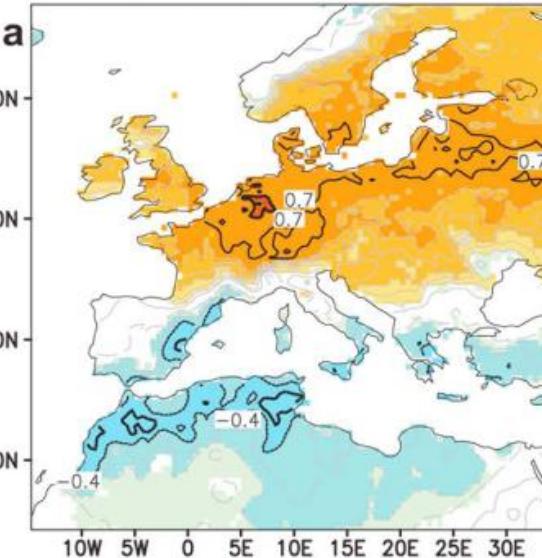
North Criteria (North et al., 1982)



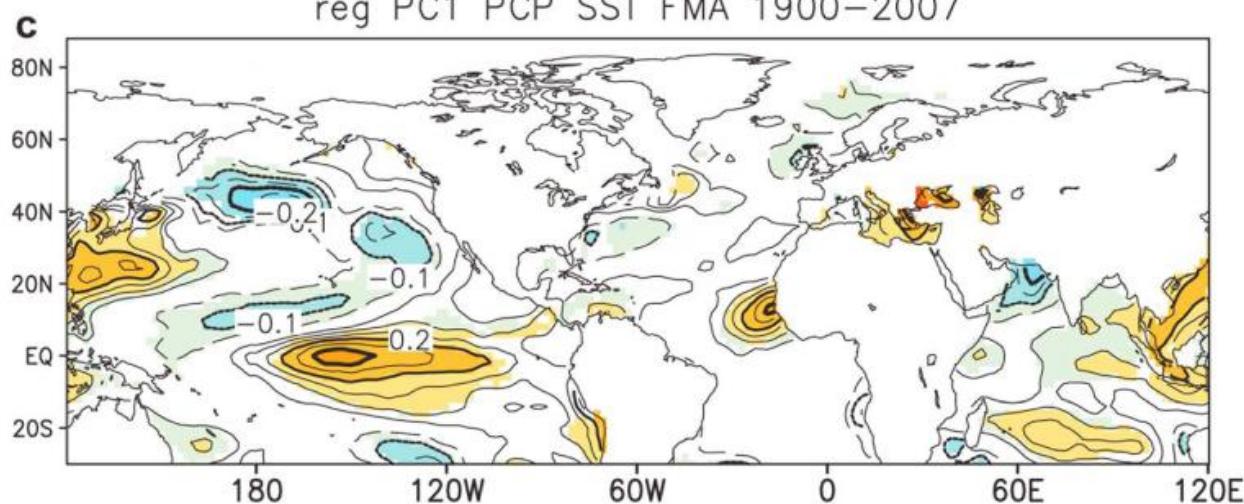
(López-Parages & Rodríguez-Fonseca, GRL, 2012)

4. PCA of the iEMedR (FMA)

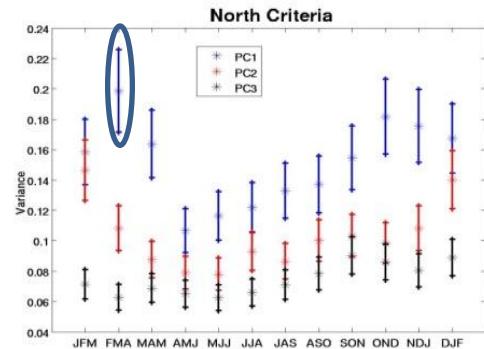
EOF1 PCP 1900–2007 / fvar=19.9% (FMA)



reg PC1 PCP SST FMA 1900–2007



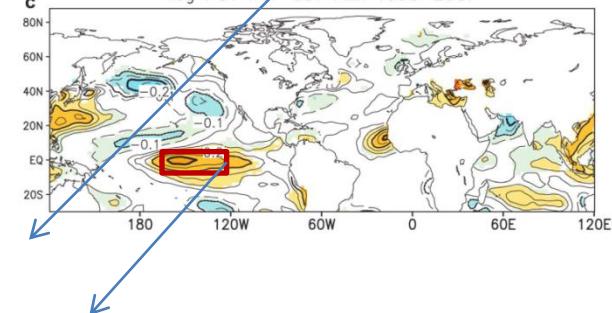
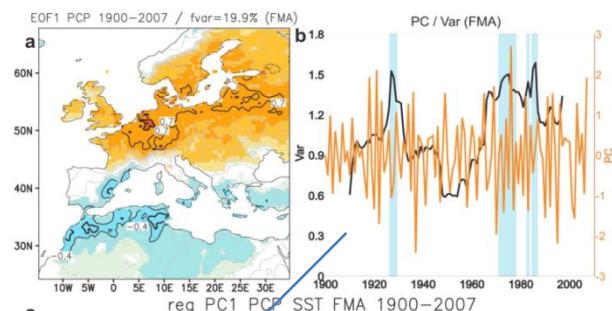
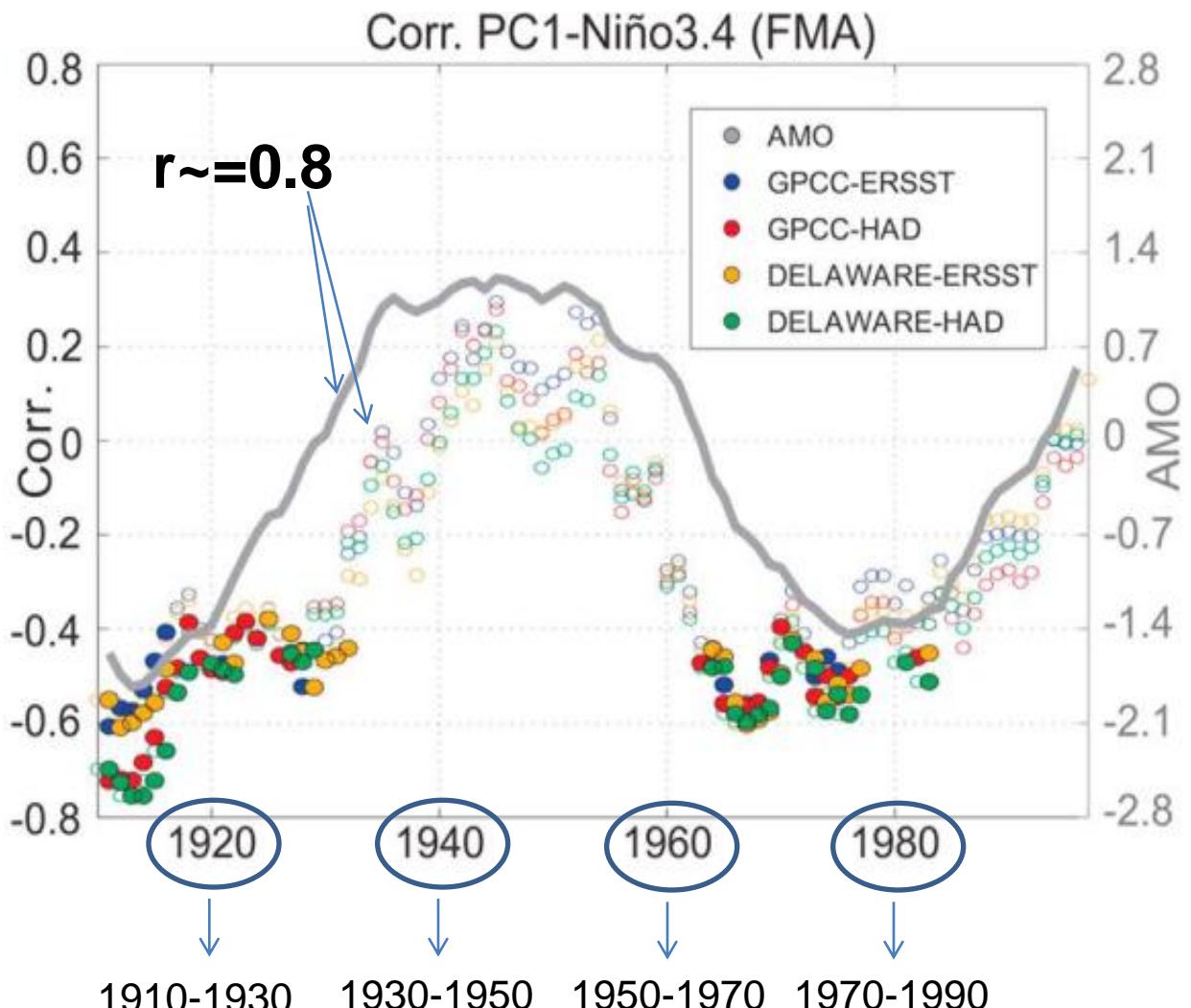
95% significance Monte-Carlo test



Is the El Niño influence stationary?

4.1. EL NIÑO Influence in FMA

**21 y. moving window
correlations PC1-Niño3.4**

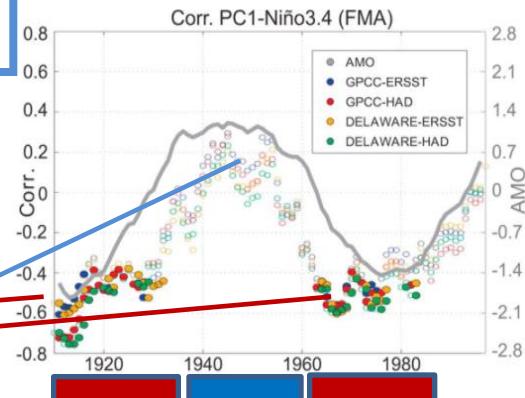


95% significance Monte-Carlo test

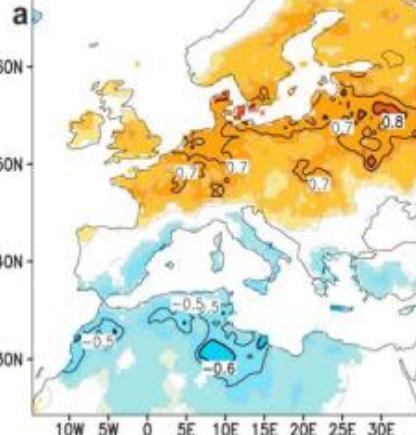
4.2. EL NIÑO Influence in FMA : Regression maps by periods

1900-1929/1964-1989

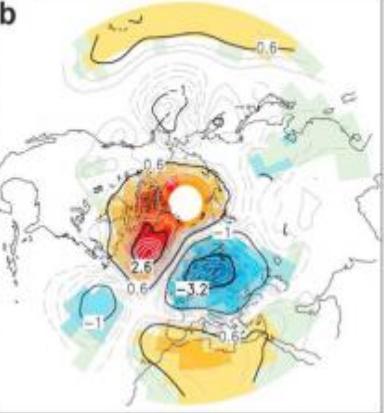
1930-1964



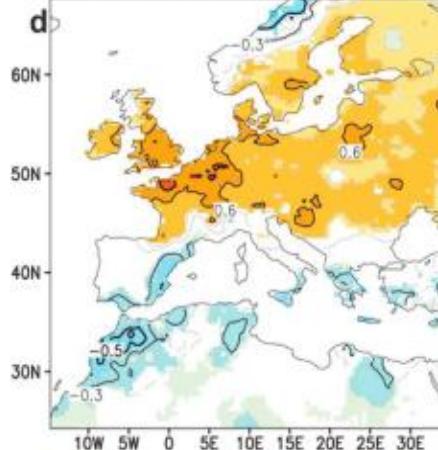
reg PCP FMA 1900–1929/1964–1989



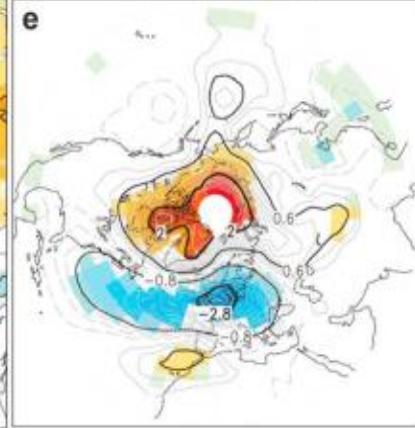
reg SLP FMA 1900–1929/1964–1989



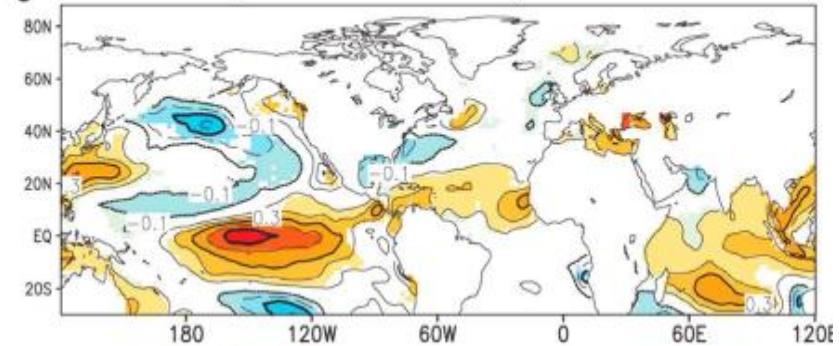
reg PCP FMA 1930–1963



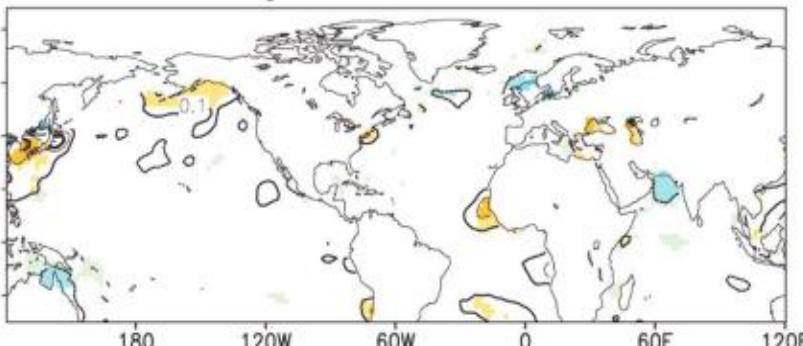
reg SLP FMA 1930–1963



reg SST FMA 1900–1929/1964–1989



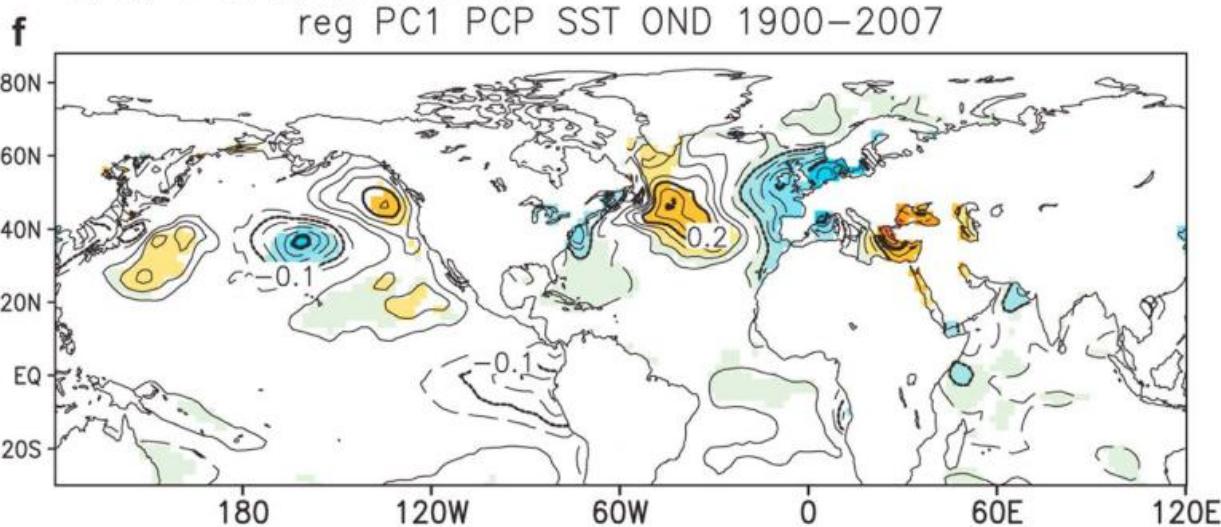
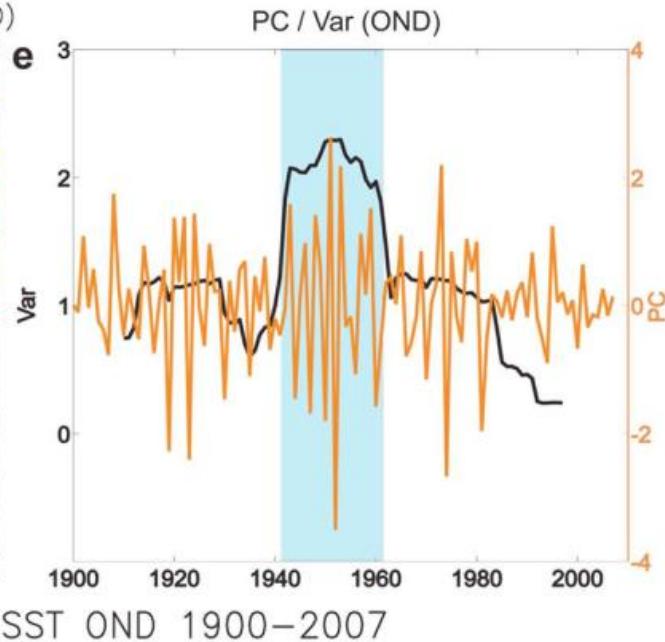
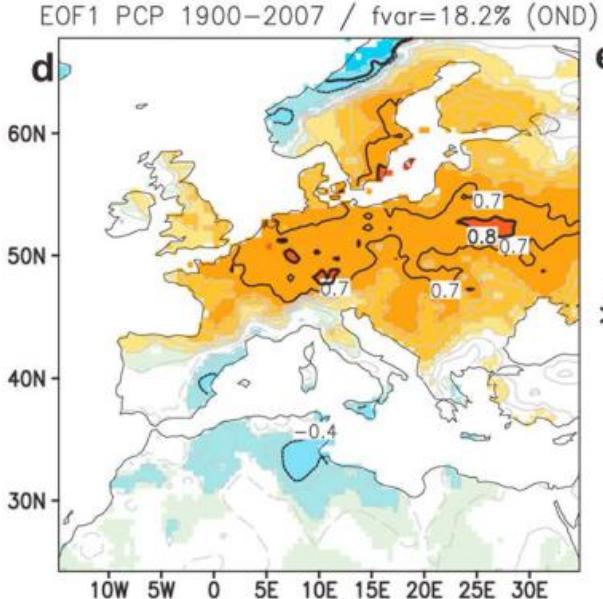
reg SST FMA 1930–1963



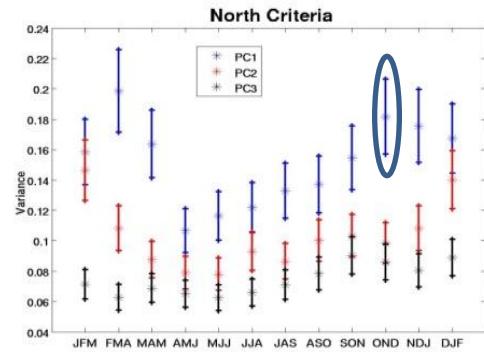
95% significance Monte-Carlo test

(López-Parages & Rodríguez-Fonseca, GRL, 2012)

5. PCA of the iEMedR (OND)



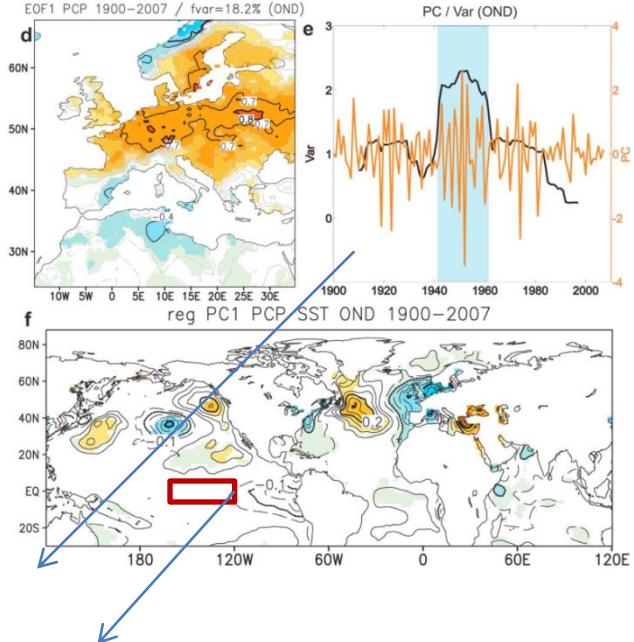
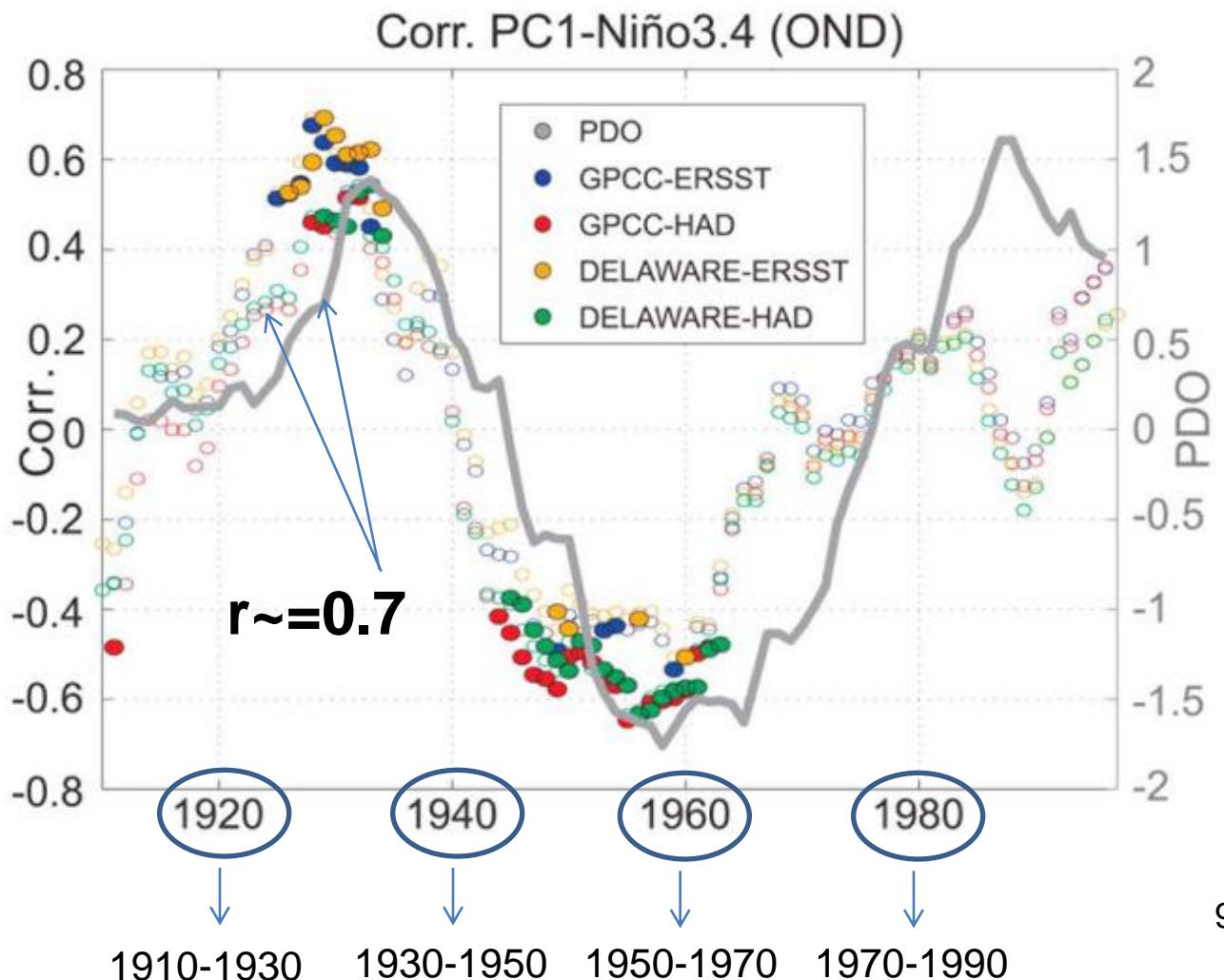
95% significance Monte-Carlo test



Is the leading
iEMedR mode
(OND) not related
to El Niño?

5.1. EL NIÑO Influence in OND

**21 y. moving window
correlations PC1-Niño3.4**

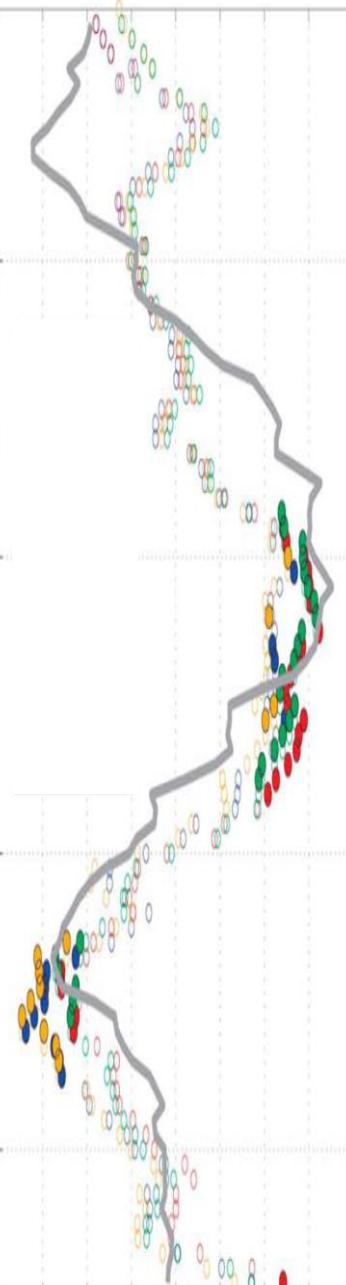


PC1-Niño3.4
relationship evolve
in phase with
IPO/PDO

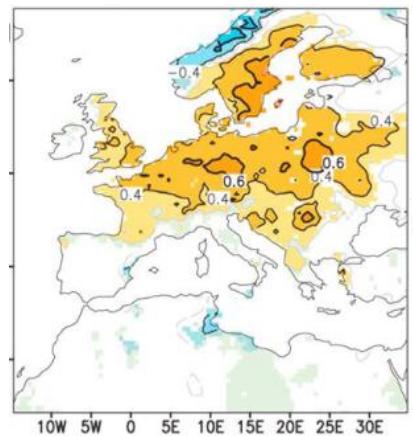
95% significance Monte-Carlo test

5.2. EL NIÑO Influence in OND: Regression maps by periods

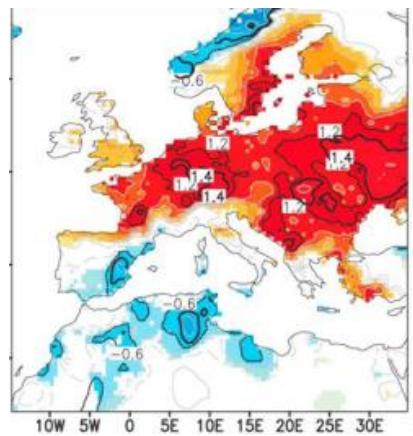
Corr. PC1-Niño3.4 (OND)



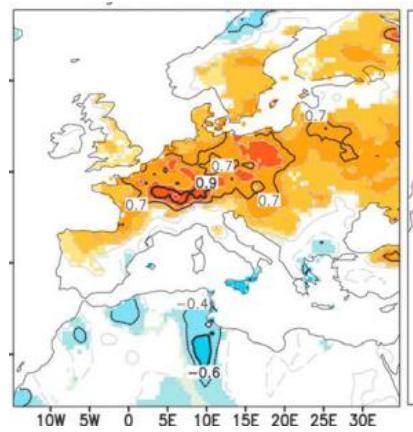
1980



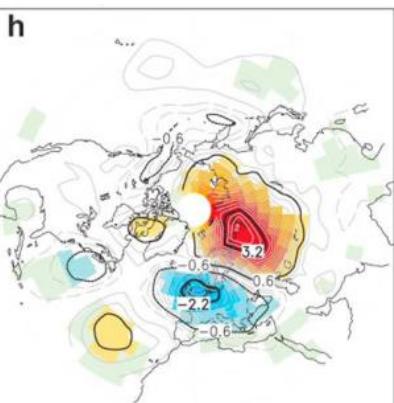
1960



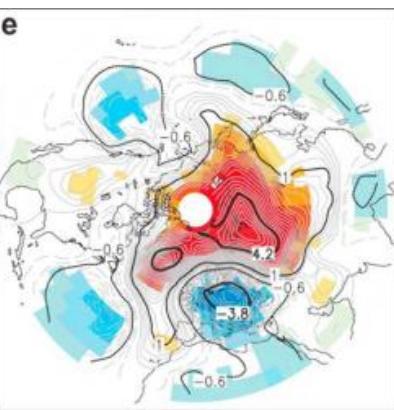
1940



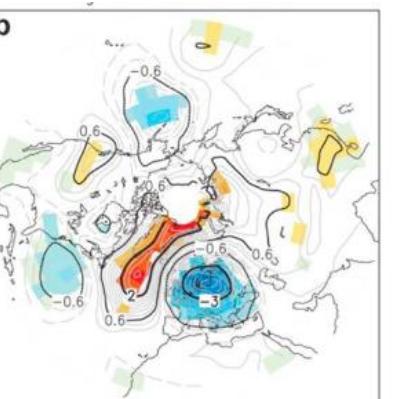
1920



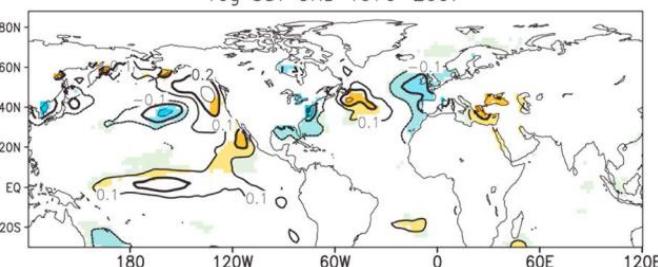
e



b

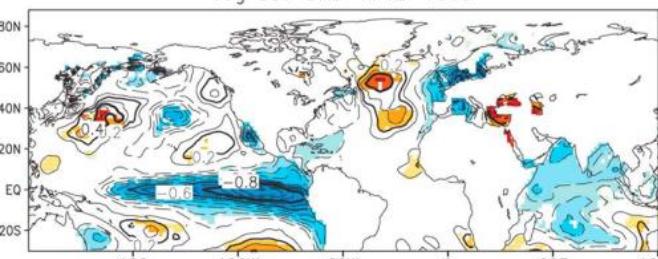


reg SST OND 1970–2007



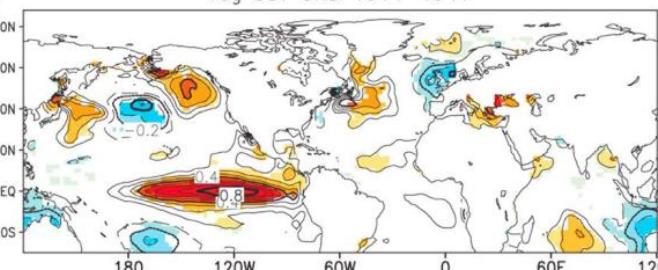
1970-2008 ~PDO +
Weak relation to El Niño
like in 1914-1941

reg SST OND 1942–1969



1942-1969 ~PDO -
Negative (positive) relation to
Central Eur. (Mediterranean)

reg SST OND 1914–1941



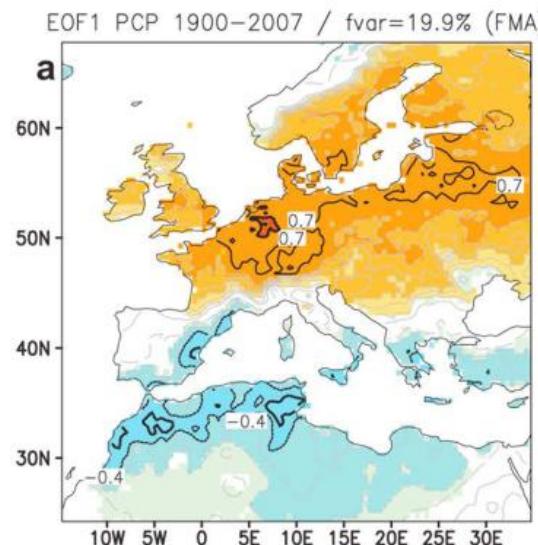
1914-1941 ~PDO +
Positive (negative) relation to
Central Eur. (Mediterranean)

6. Conclusions

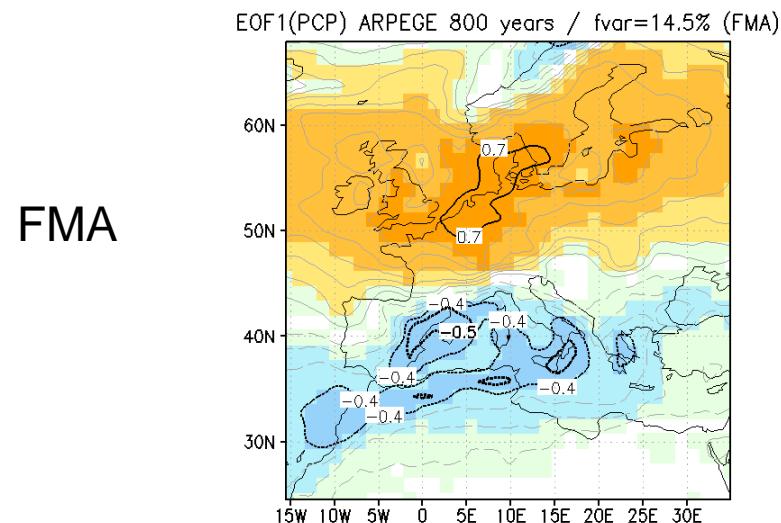
- The leading modes of iEMR, in FMA and OND, undergo changes in amplitude along the time period analyzed (1900-2008).
- These leading modes are significantly related to El Niño in a nonstationary way. The study finds an observational hint of multidecadal modulation of the El Niño influence.
- In spring (FMA), the El Niño-iEMR relationship evolve in phase with AMO. Significant correlations appears only during negative phases of AMO.
- In fall (OND), the El Niño-iEMR relationship evolve in phase with PDO. Significant correlations appears in both, negative and positive phases of PDO, being opposite for each the phases .
- CMIP5 models are going to be used to better understand the role of natural variability in the nonstationary relationships identified.

7. Ongoing study in collaboration with CERFACS: ARPEGE/ORCA Model

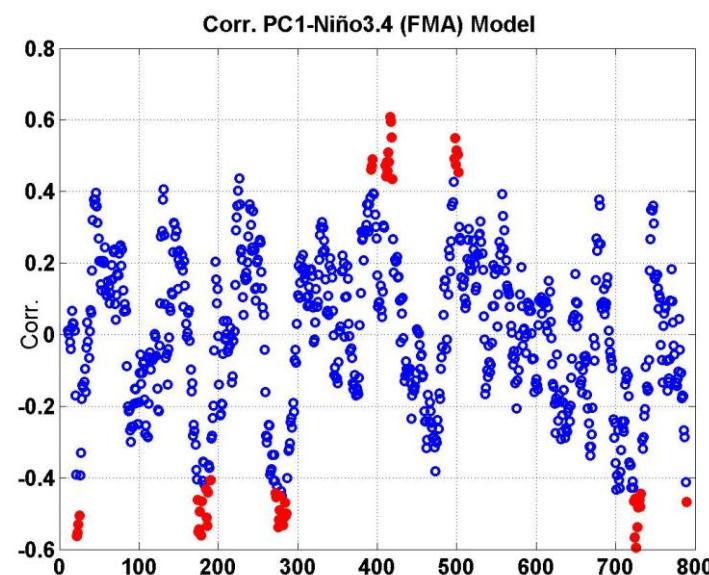
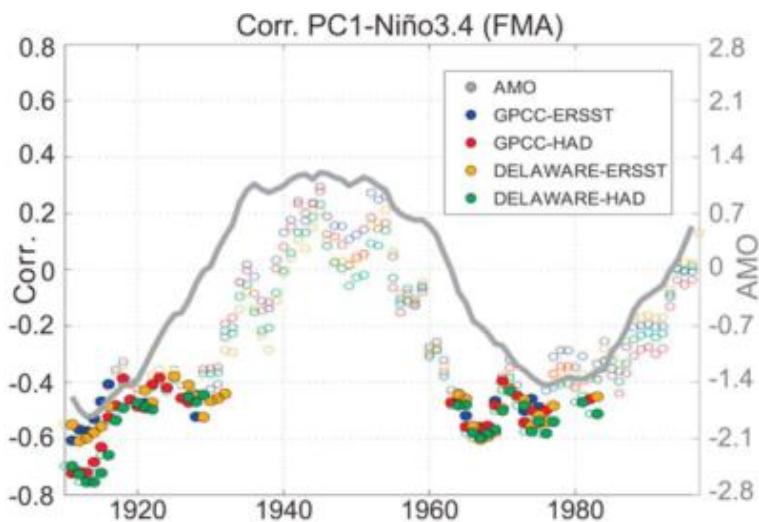
Observations (108 years)



Arpege/Orca control running (800 years)



FMA



Thanks for your attention!