S4CAST: SST-based statistical ForeCAST. Description an application within PREFACE

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1.Introduction

Sea surface temperature is the key variable when tackling seasonal to decadal prediction. Thus, links between anomalies in sea surface temperature in remote areas with other climate- related variables determine predictability.

In this work, the recently developed **S4CAST v2.0** (Sea Surface temperature based Statistical Seasonal ForeCAST model; Suárez-Moreno and Rodríguez-Fonseca; 2015) is described.

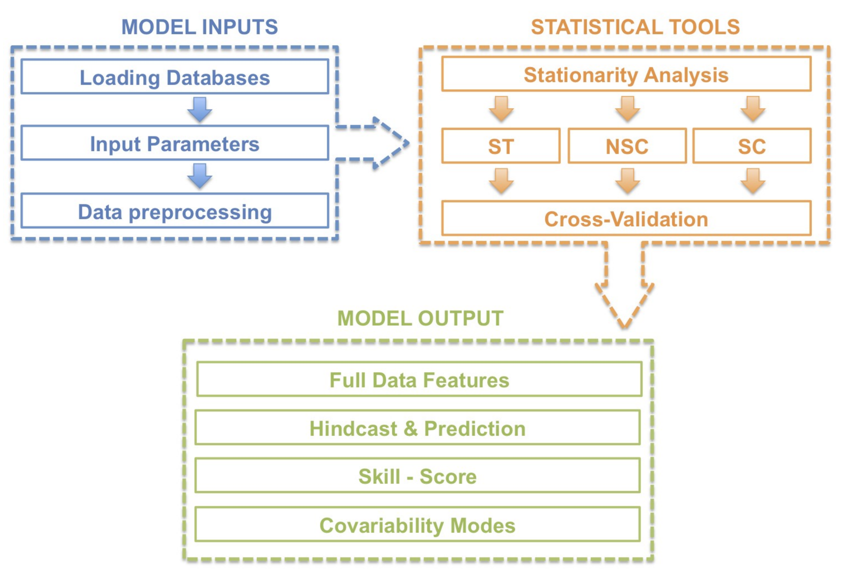
A pair of cases are applied to test the predictability of Sahelian rainfall and tropical Pacific SST from tropical Atlantic SST, from which a non-stationary relationship has been found (Mohino et al., 2011; Losada et al., 2012; Rodríguez-Fonseca et al., 2011, 2015; Martín-Rey et al., 2014) .

2. Data and methodology

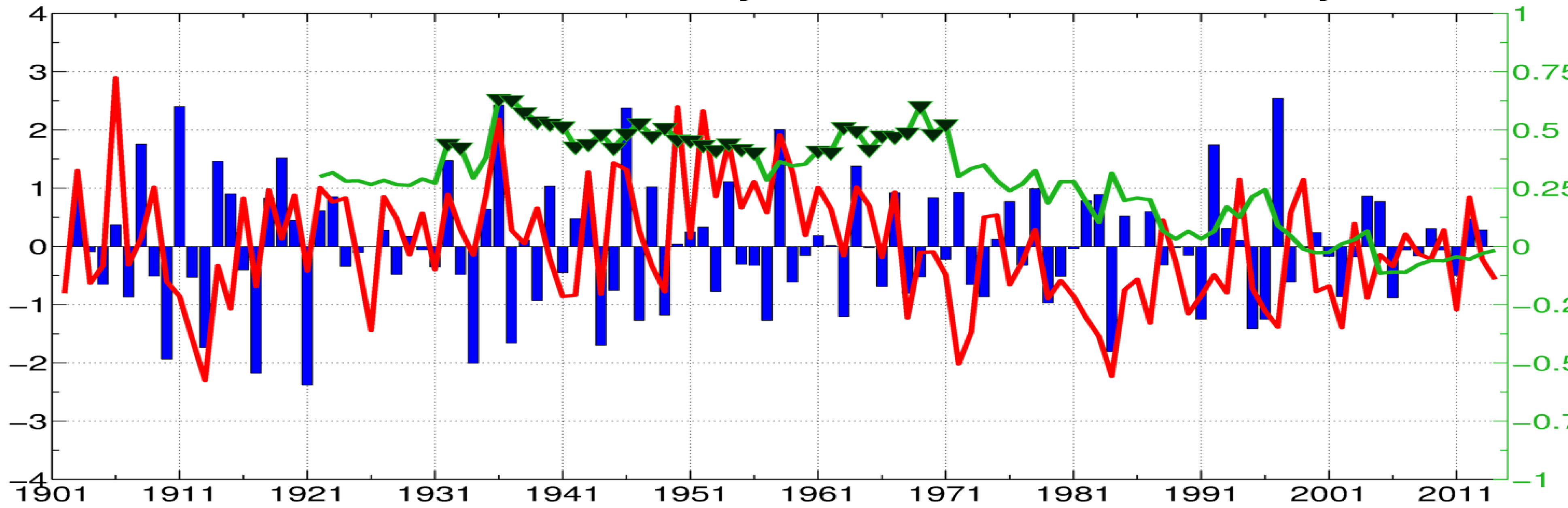
Monthly sea surface temperature (SST) from NOAA Extended Reconstructed SST data set (ERSST) V3b with a resolution of 2.0° x 2.0° (Smith and Reynolds, 2003, 2004; Smith et al., 2008).

Precipitation from GPCC Full Data Reanalysis monthly means appended with GPCC monitoring dataset from 2011 onwards with a resolution of 1.0° x 1.0° covering (Rudolf et al., 2010; Becker et al., 2013; Schneider et al., 2014)

DESCRIPTION OF S4CAST



TROPICAL ATLANTIC (AMJ) – SAHELIAN RAINFALL (JAS)



TROPICAL ATLANTIC (JASO) – TROPICAL PACIFIC (DJFM)

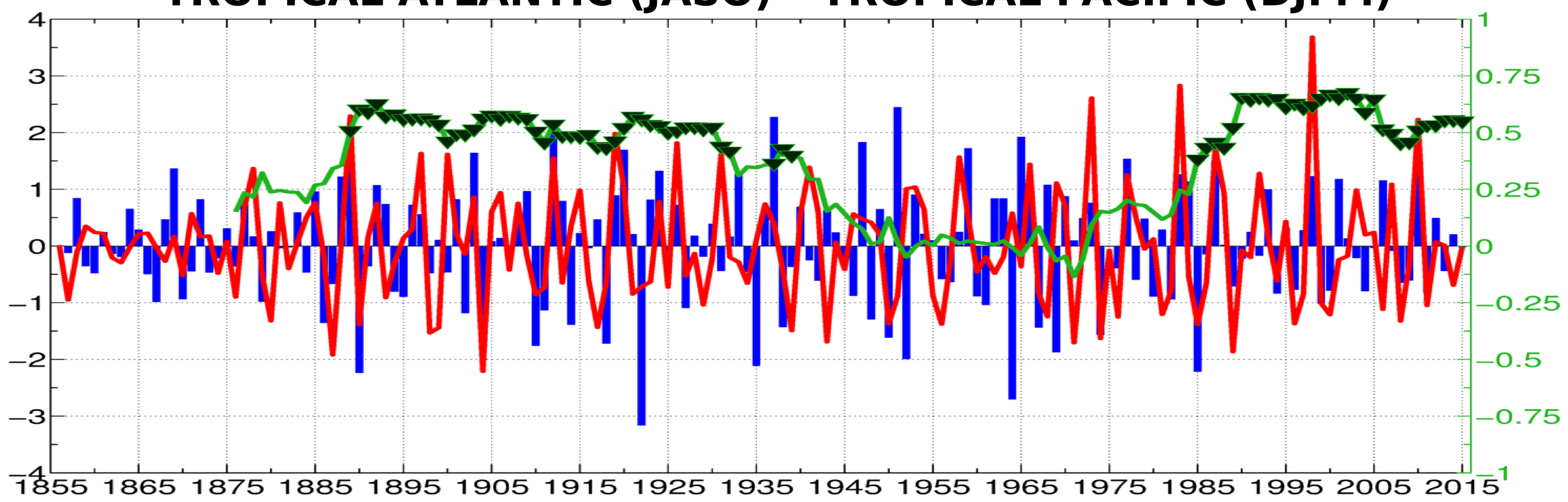


Fig 1. 21 years moving correlation windows (green line) between the expansion coefficients U corresponding to predictor field (SST, blue bars) and V corresponding to predictand field (PCP, red line) obtained from the leading mode of co-variability from MCA analysis between both anomalous fields. Shaded triangles indicate significant correlation under a Montecarlo Test at 90%.

SIGNIFICANT CORRELATION PERIOD **SC**

ENTIRE PERIOD **EP**

NO-SIGNIFICANT CORRELATION PERIOD **NSC**

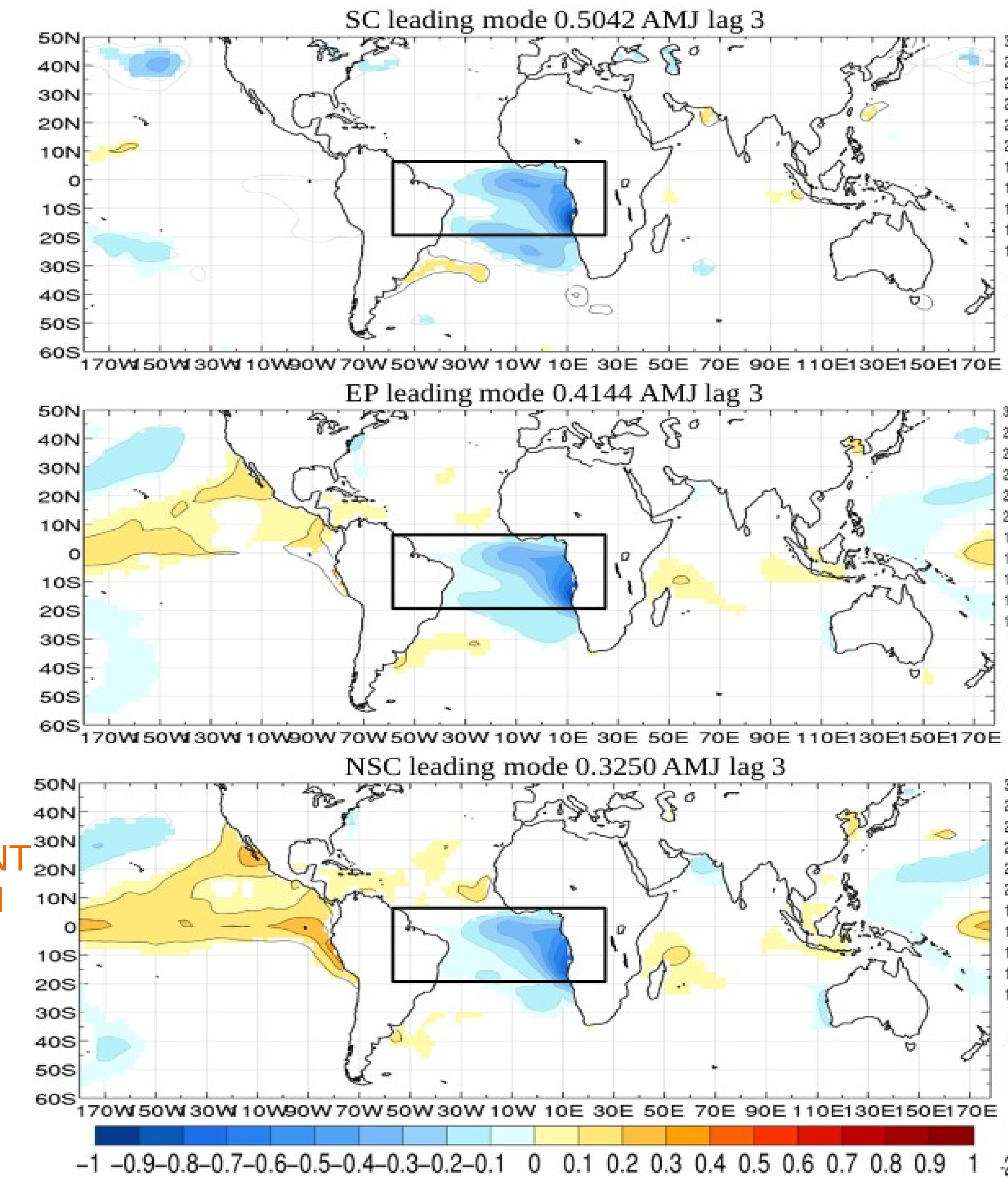


Fig 2. SST homogeneous regression map for the leading MCA mode of co-variability between SSTA in the tropical Pacific and rainfall in Europe. Season: AMJ. °C std^{-1}

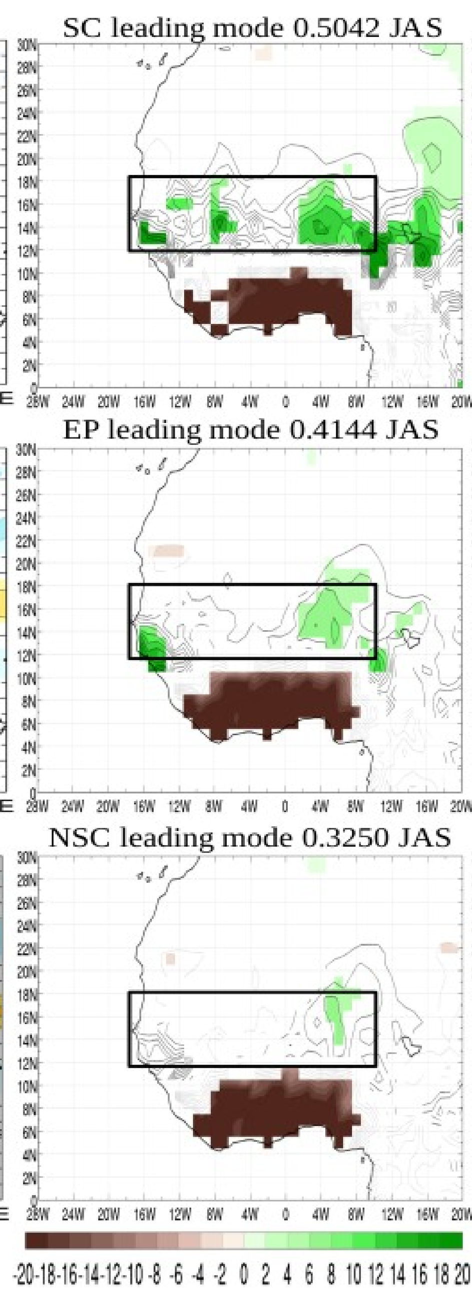


Fig 3. Rainfall heterogeneous regression map for the leading MCA mode of co-variability between SSTA in the tropical Pacific an rainfall in Europe. Season: JAS. Units: mm day^{-1} std^{-1}

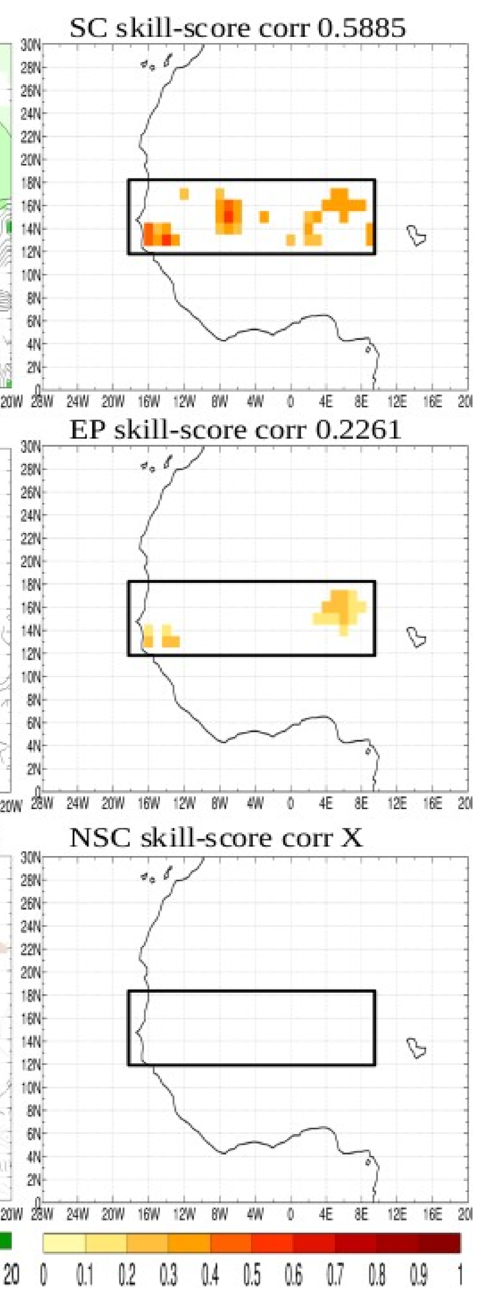


Fig 4. Significant correlation between hindcast and observed rainfall for each considered period.

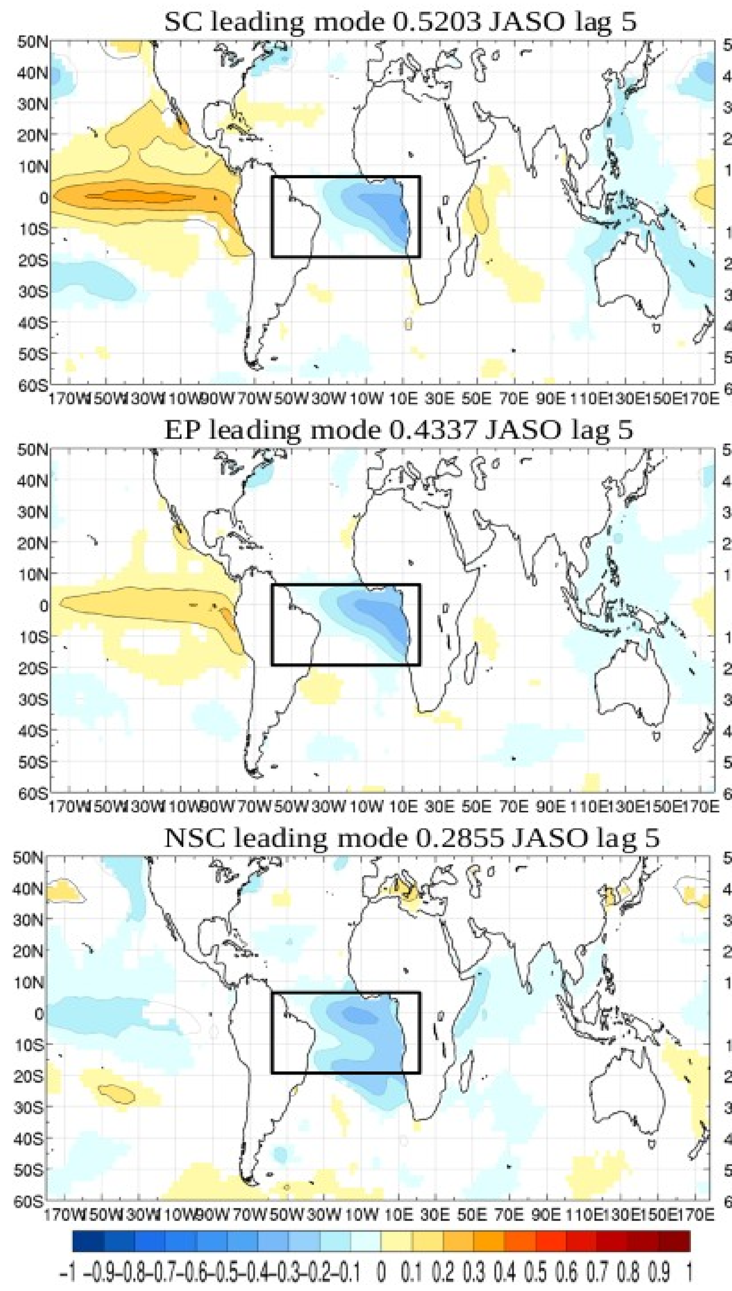


Fig 5. SST homogeneous regression map for the leading MCA mode of co-variability between SSTA in the tropical Atlantic and SST in the tropical Pacific. Season: JASO. Units: °C std^{-1}

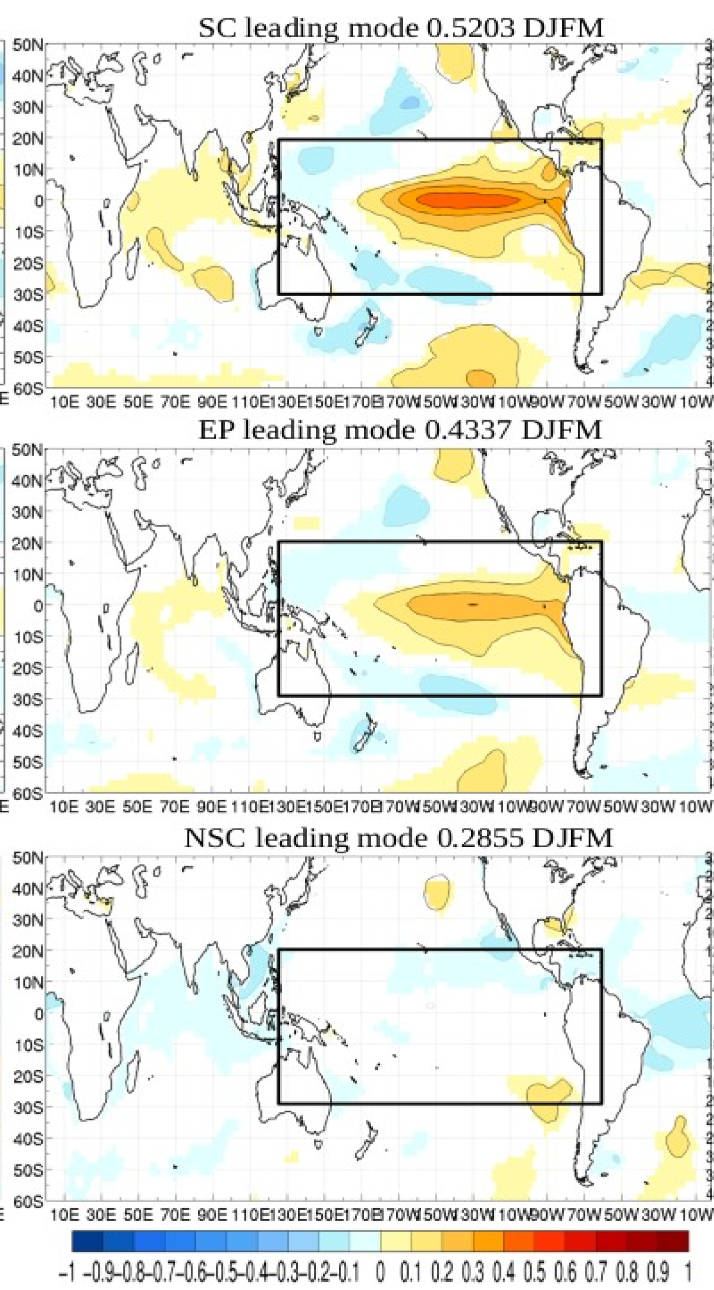


Fig 6. SST homogeneous regression map for the leading MCA mode of co-variability between SSTA in the tropical Atlantic and SST in the tropical Pacific. Season: DJFM. Units: °C std^{-1}

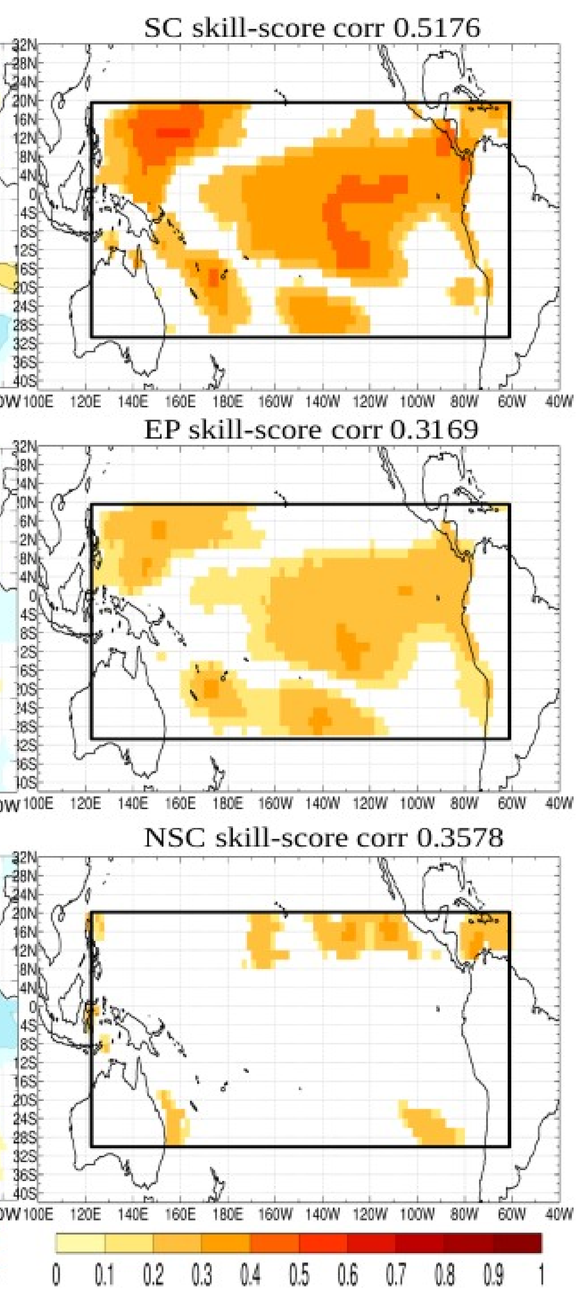


Fig 7. Significant correlation between hindcast and observed SST for each considered period.

3. Discussion and conclusions

Potential predictability of Sahelian rainfall during the monsoon season increases between the 1920s and 1970s, coinciding with the positive phase of the Atlantic Multidecadal Oscillation (AMO).

During that decade the Atlantic is not linked to the tropical Pacific SSTs. For that period, tropical Atlantic is considered as predictor of Sahelian rainfall but not of Pacific Ssts. An isolated signal is observed related to the rainfall dipole in West Africa (Mohino et al., 2011; Rodríguez-Fonseca et al., 2011,2015; Losada et al., 2012) which does not appear in other periods. In AMO negative periods the Atlantic is able to predict Pacific SSTs but not Sahelia n rainfall. It could be concluded that non-stationary relationships must be considered when tackling the Atlantic influence on global climate. On the other hand, improvements in predictability are independent of significant relationships between predictor and predictand fields pointed in figure 1. Besides stationarity, the multidecadal modulation of interannual variability is a key factor determining predictability.

Acknowledgements
This work has been possible due to the PREFACE-EU project (EU FP7/2007-2013) under grant agreement no. 603521, Spanish national project MINECO (CGL2012-38923-C02-01) and the VR: 101/11 project from the VIII UCM Call for Cooperation and Development projects.

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