Universitat de Barcelona

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

EXCELENCIA SEVERO OCHOA

11th MedCOF / 2018

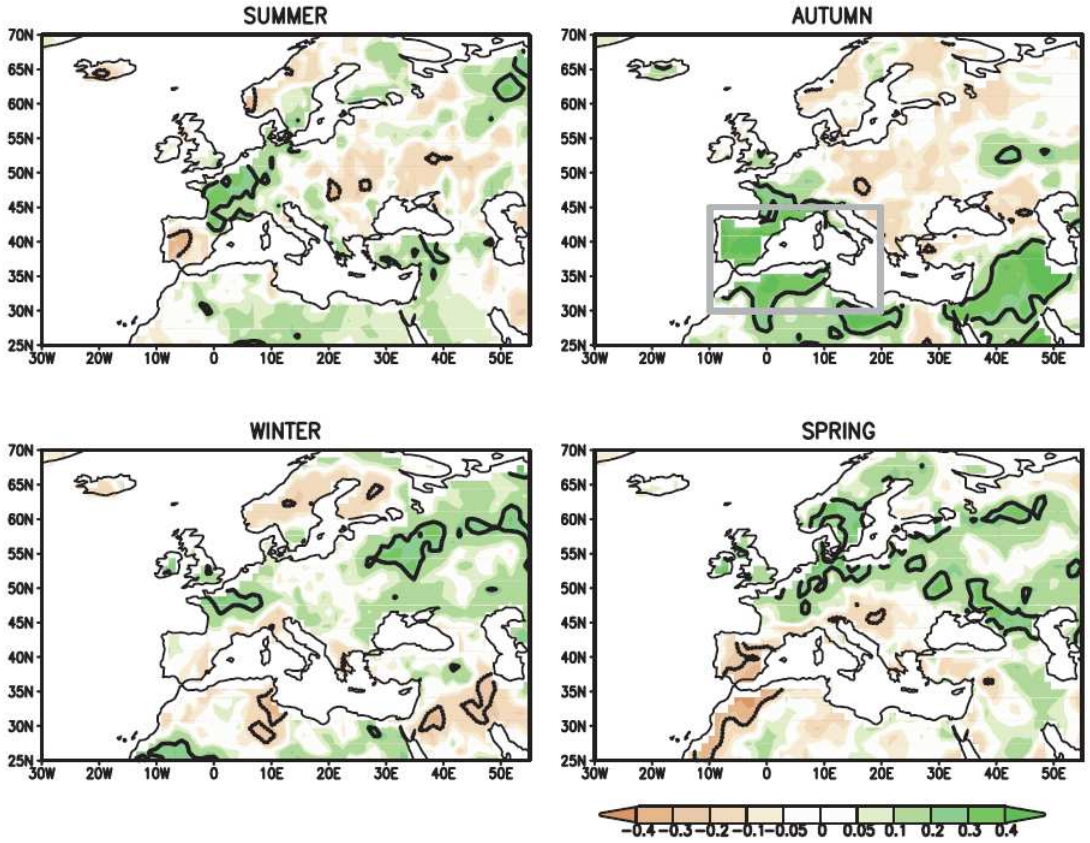
Role of ENSO at seasonal timescale over the Mediterranean region: MEDSCOPE experiments

Javier García-Serrano (UB, BSC)

MEDSCOPE
MEDiterranean Services Chain based On climate PrEdictions

ENSO is the leading mode of climate variability on seasonal-to-interannual timescales

ENSO is the most important source of predictability at seasonal timescale
[e.g. Doblas-Reyes et al. 2013]



correlation maps of precipitation with Niño3.4
[Mariotti et al. 2002]

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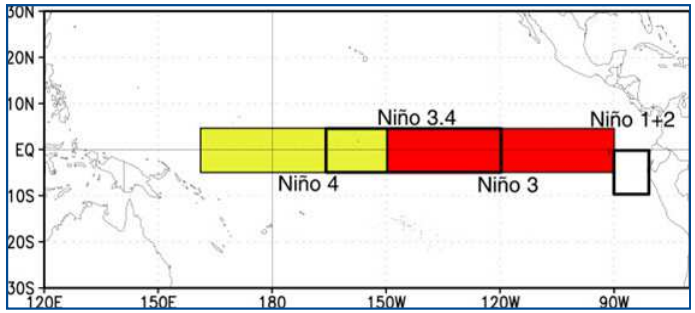
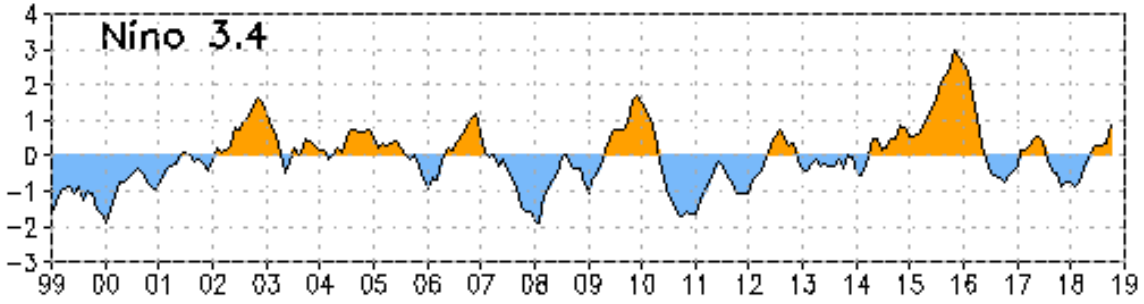
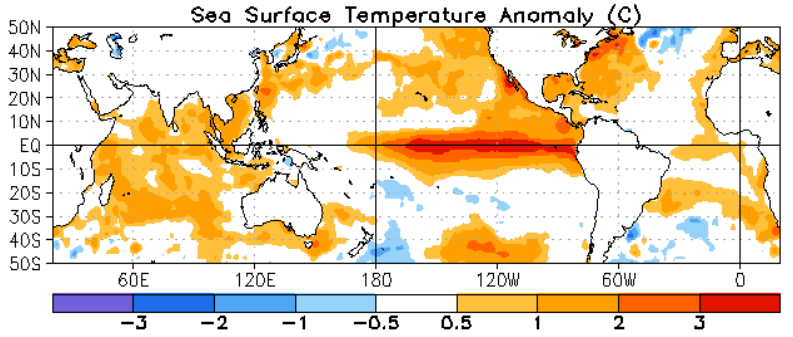
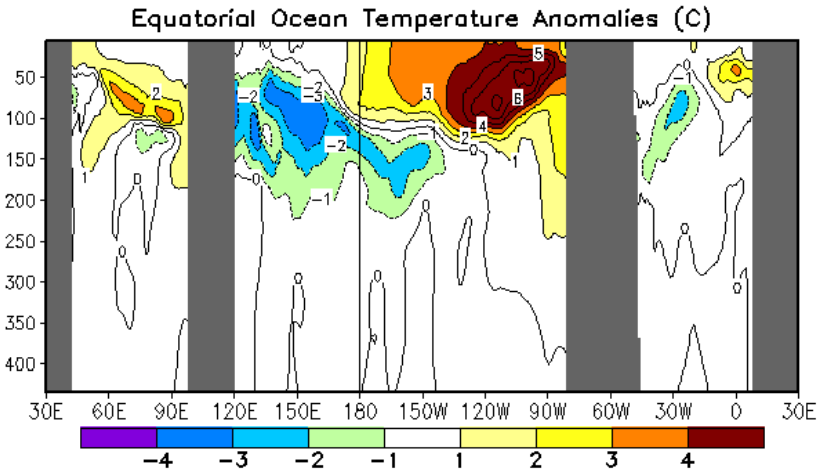


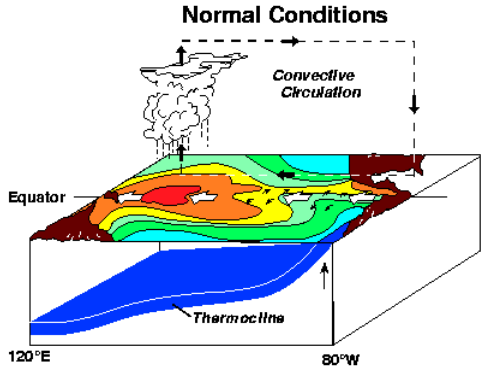
SST anomaly up to October 2018

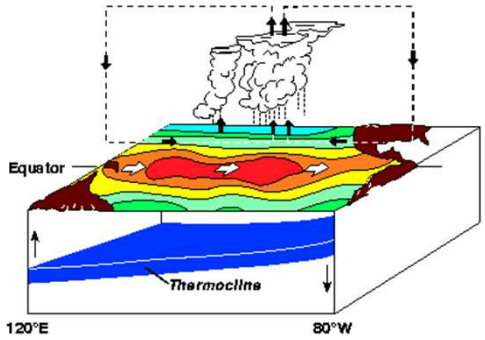




Dec 2015







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[www.cpc.ncep.noaa.gov]

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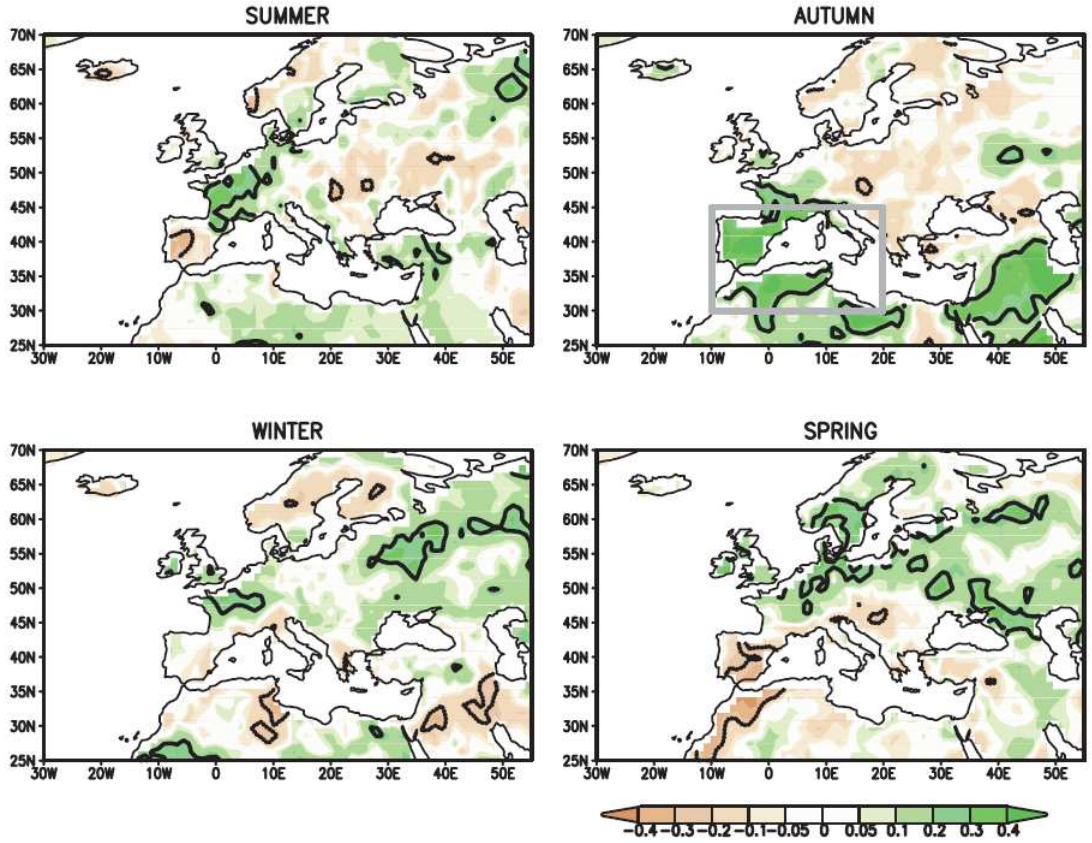

correlation maps of precipitation with Niño3.4

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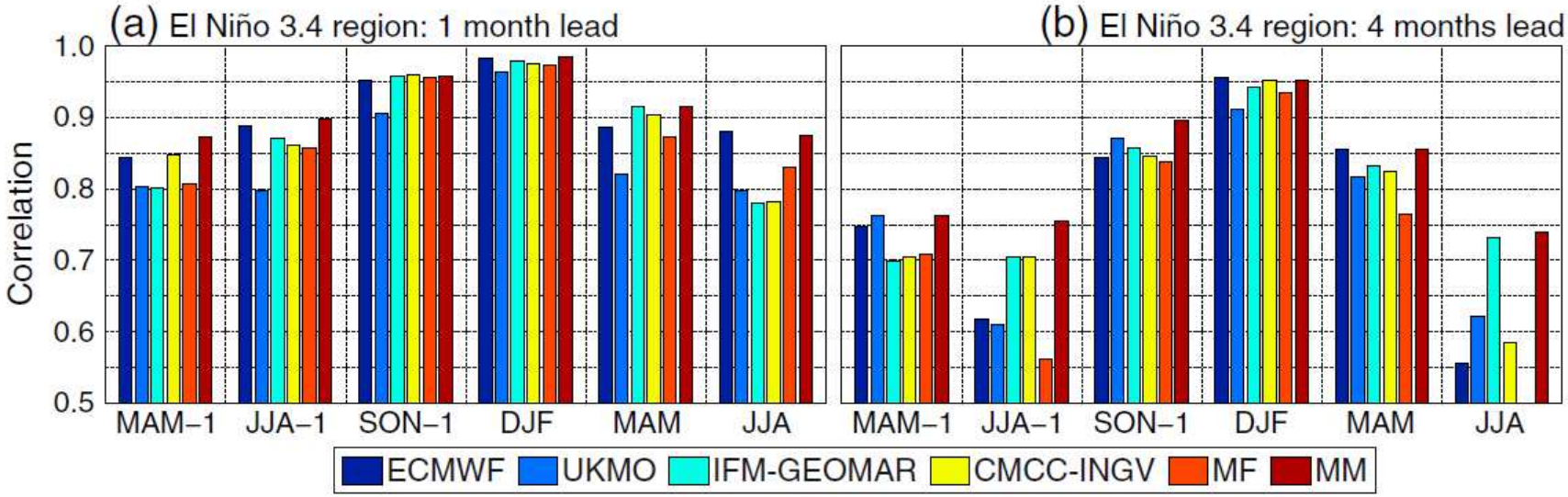

correlation skill of Niño3.4 in ENSEMBLES
[Manzanas et al. 2014]

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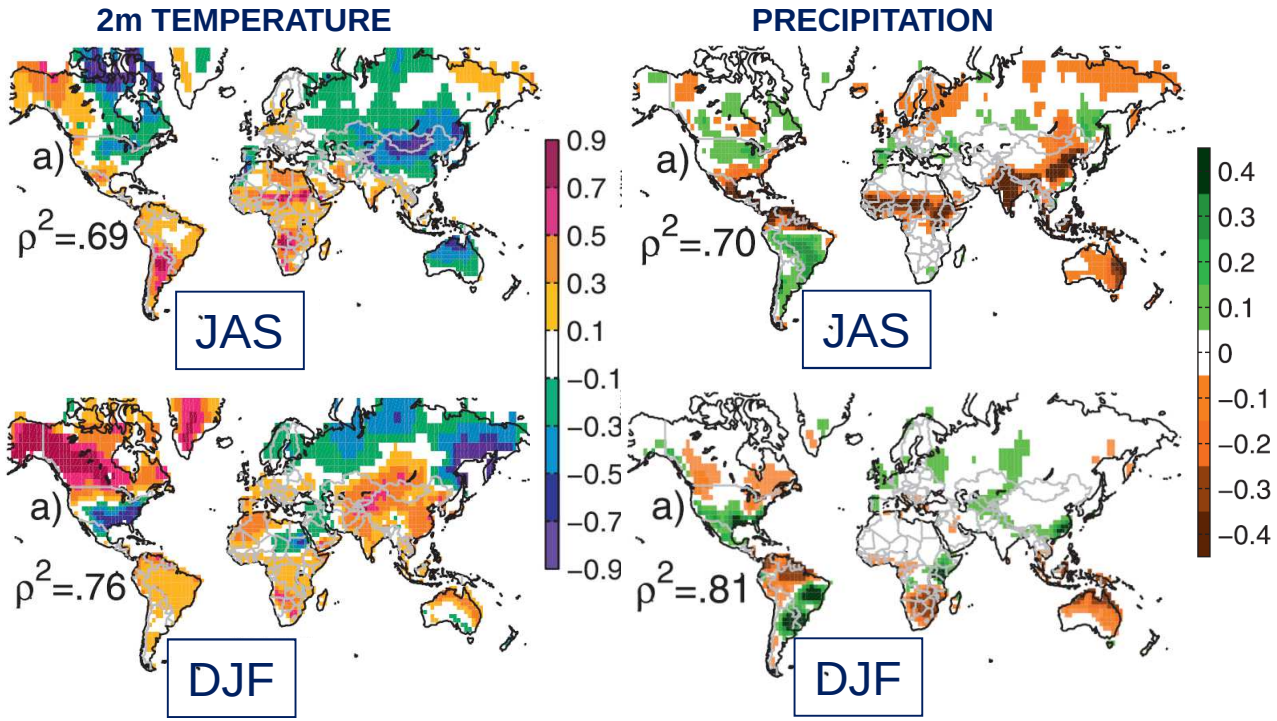

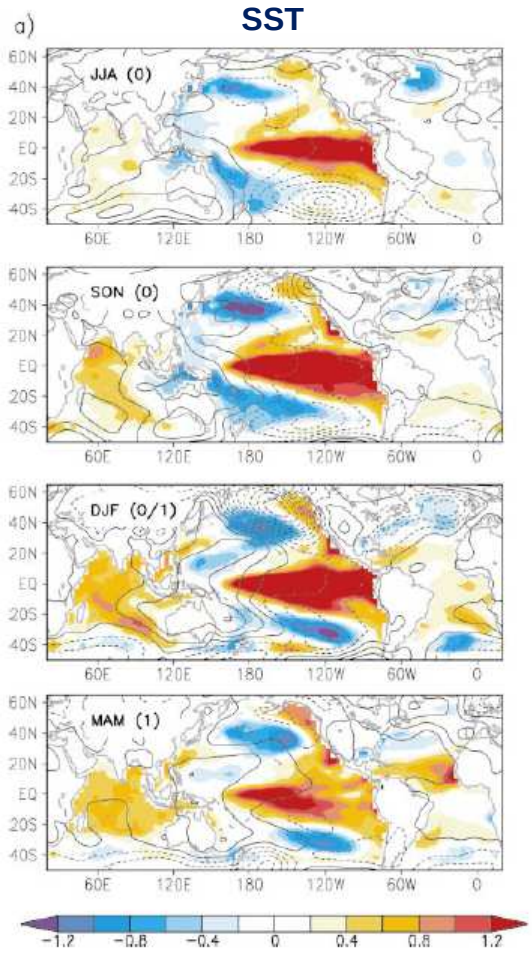

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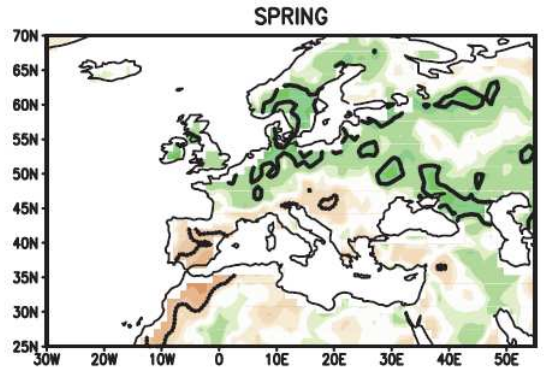
ENSO teleconnections: regressions onto Niño3.4

[Yang and DelSole 2012; Alexander et al. 2002]



correlation map of precipitation with Niño3.4
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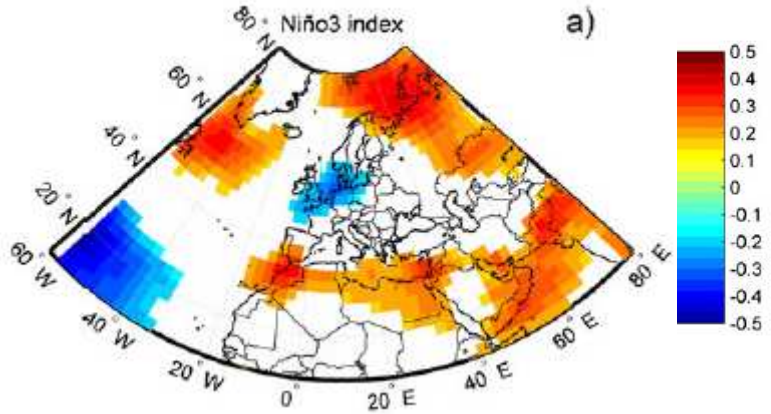
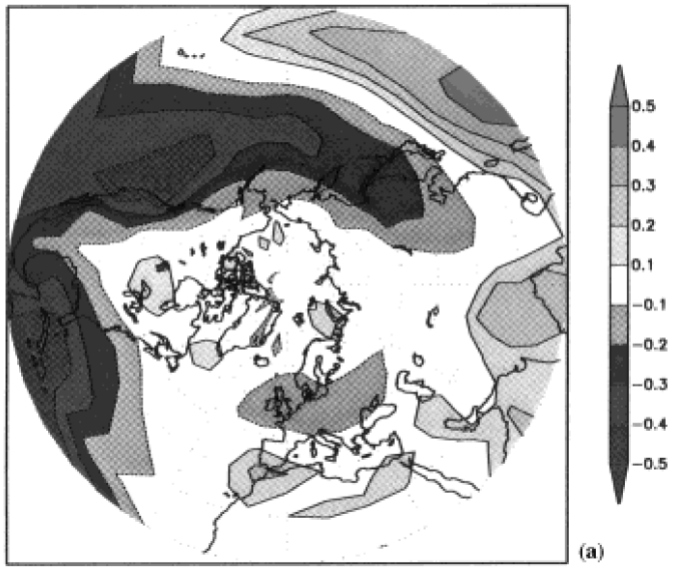


correlation map of MAM-SLP with DJF-Niño3
[Lorenzo et al. 2011]

SPRING



correlation map of SLP with Niño3 (in MAM)
[van Oldenborgh et al. 2000]

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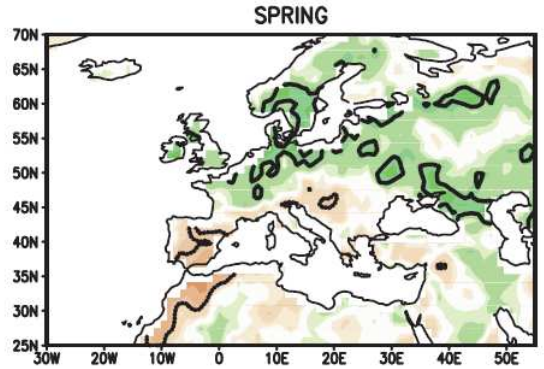

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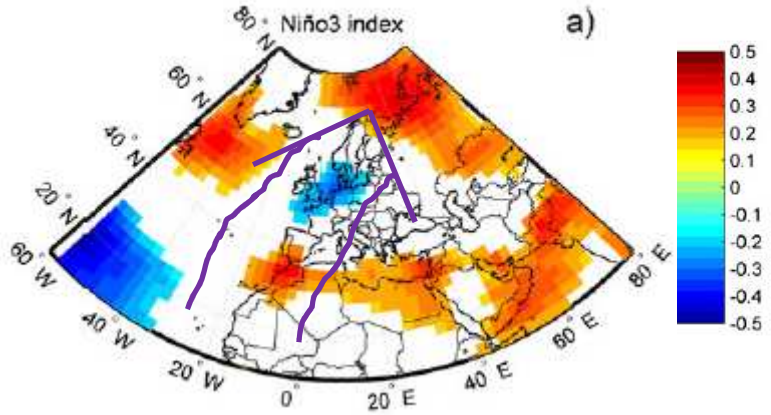

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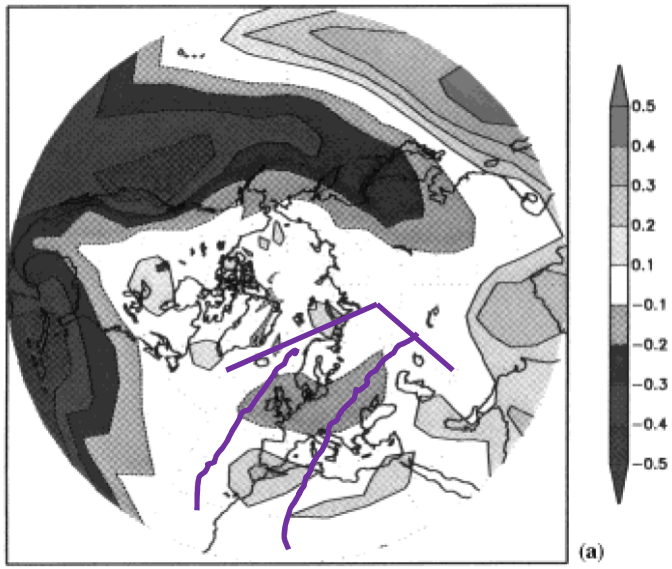

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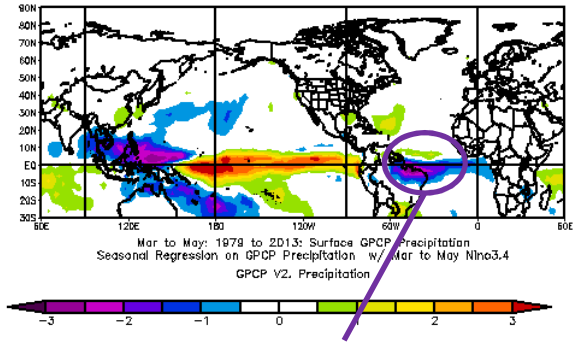
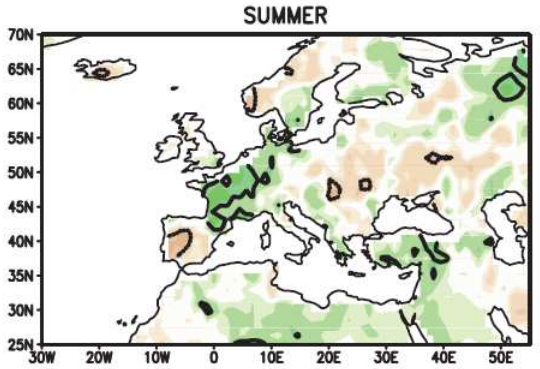
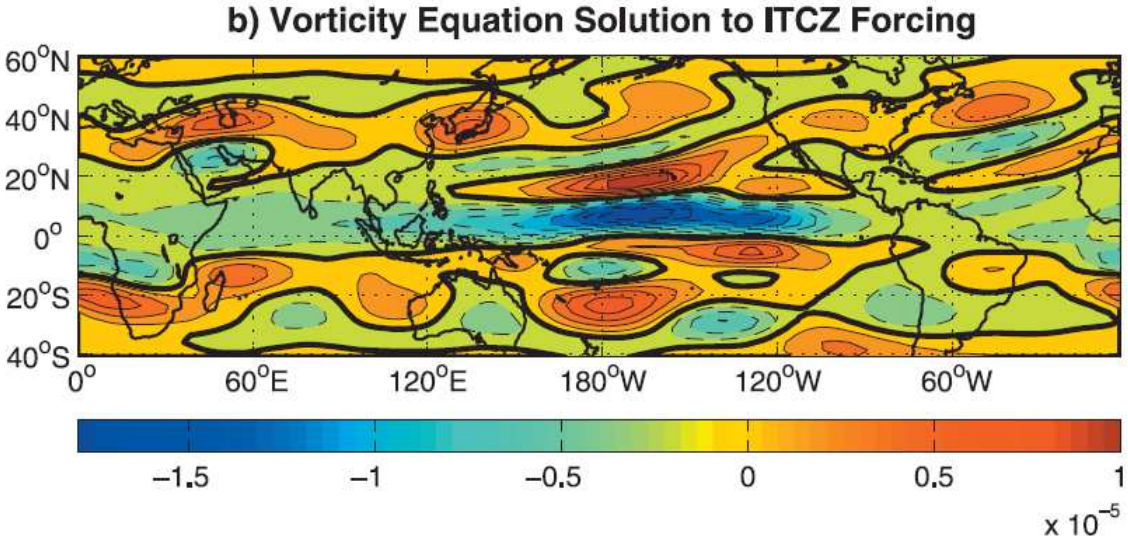


secondary Rossby wave source
[García-Serrano et al. 2017]

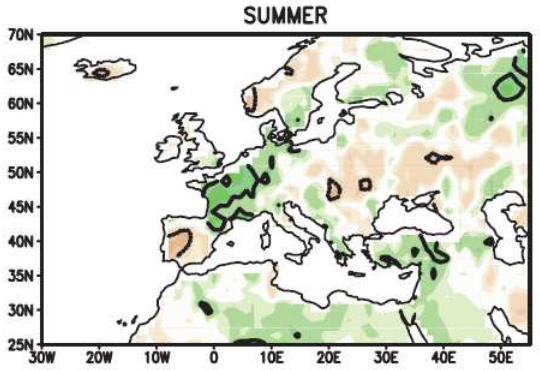


SUMMER

correlation map of precipitation with Niño3.4
[Mariotti et al. 2002]



resembling El Niño-La Niña composite (JAS)
[Shaman and Tziperman 2007]



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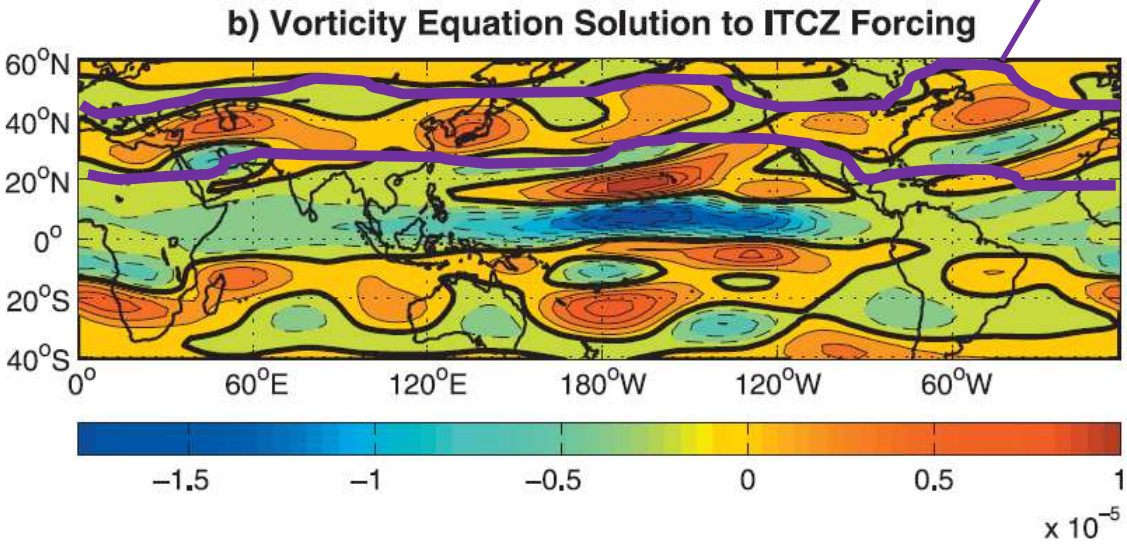
SUMMER

waveguided, zonally-propagating Rossby wavetrain



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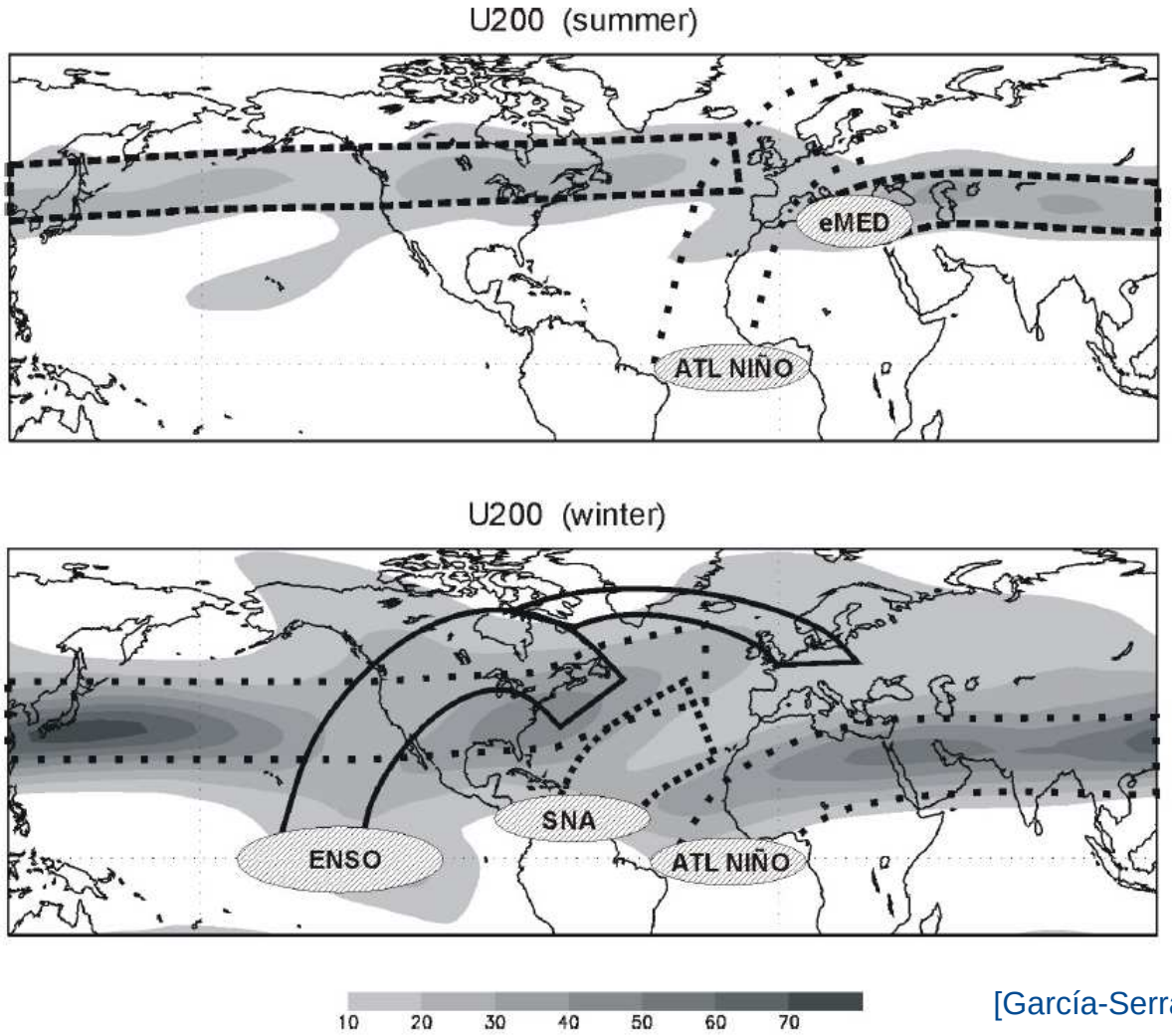

[García-Serrano 2010 PhD]

Fig. V.1. Schematic diagram summarizing the Rossby wavetrain propagations associated with the Atlantic Niño (ATL NIÑO), the Subtropical North Atlantic (SNA), the eastern Mediterranean basin (eMED), and the ENSO phenomenon; shading, in background, represents the westerly jetstreams during summer (July) and winter (January) by means of zonal wind climatology at 200hPa (m/s).

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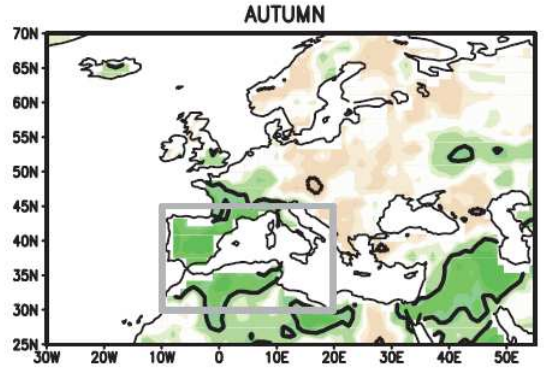

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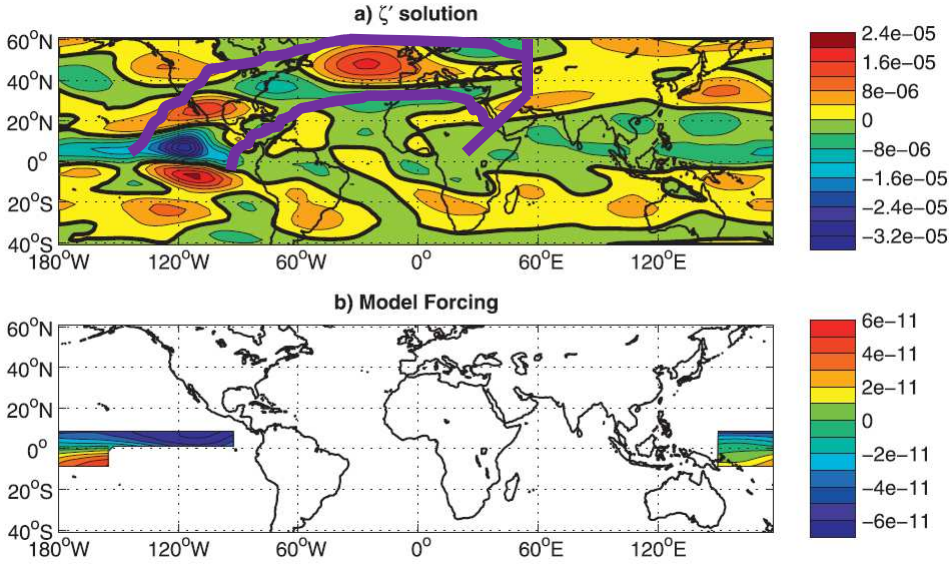
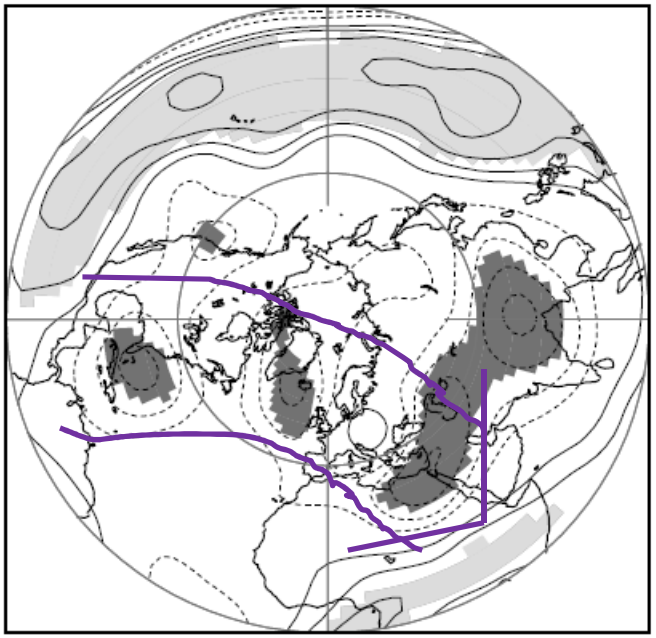
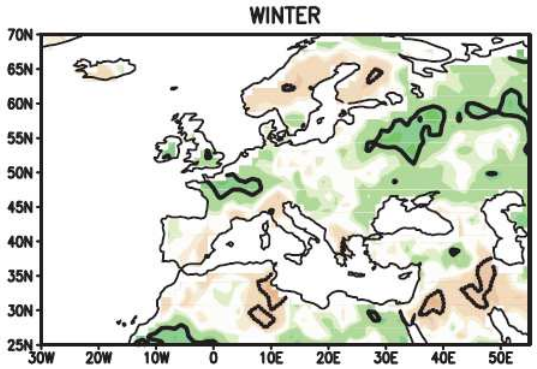


[Shaman and Tziperman 2011]

AUTUMN

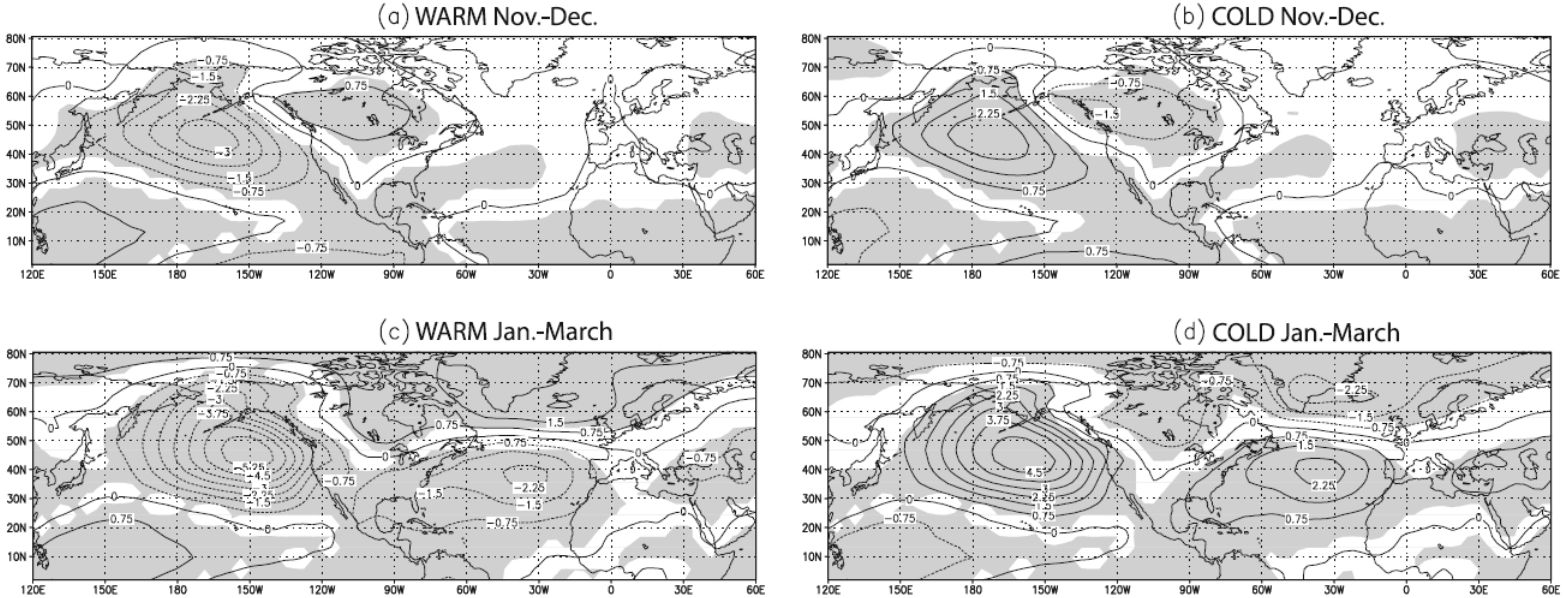


composite of PSI200 linked to El Niño
[Mariotti et al. 2005]

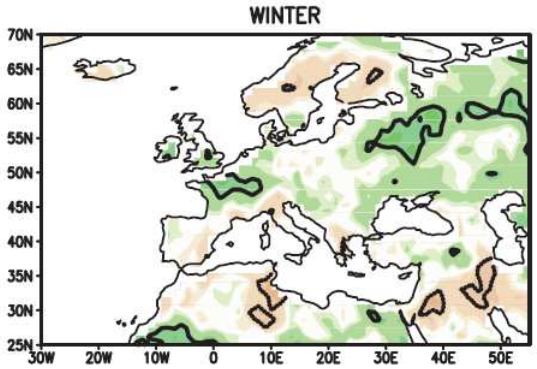


WINTER

correlation map of precipitation with Niño3.4
[Mariotti et al. 2002]



strong intra-seasonal modulation: early-winter (ND) vs mid/late-winter (JFM)
[Moron and Gouirand 2003; Gouirand et al. 2007; King et al. 2018; Ayarzagüena et al. 2018]



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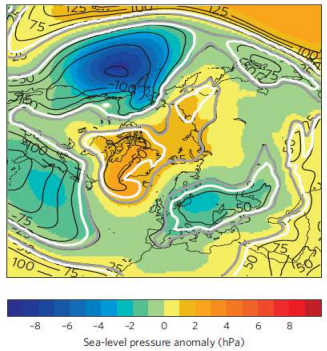
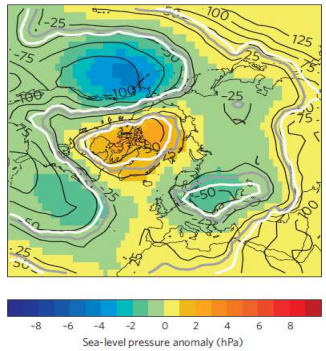
WINTER

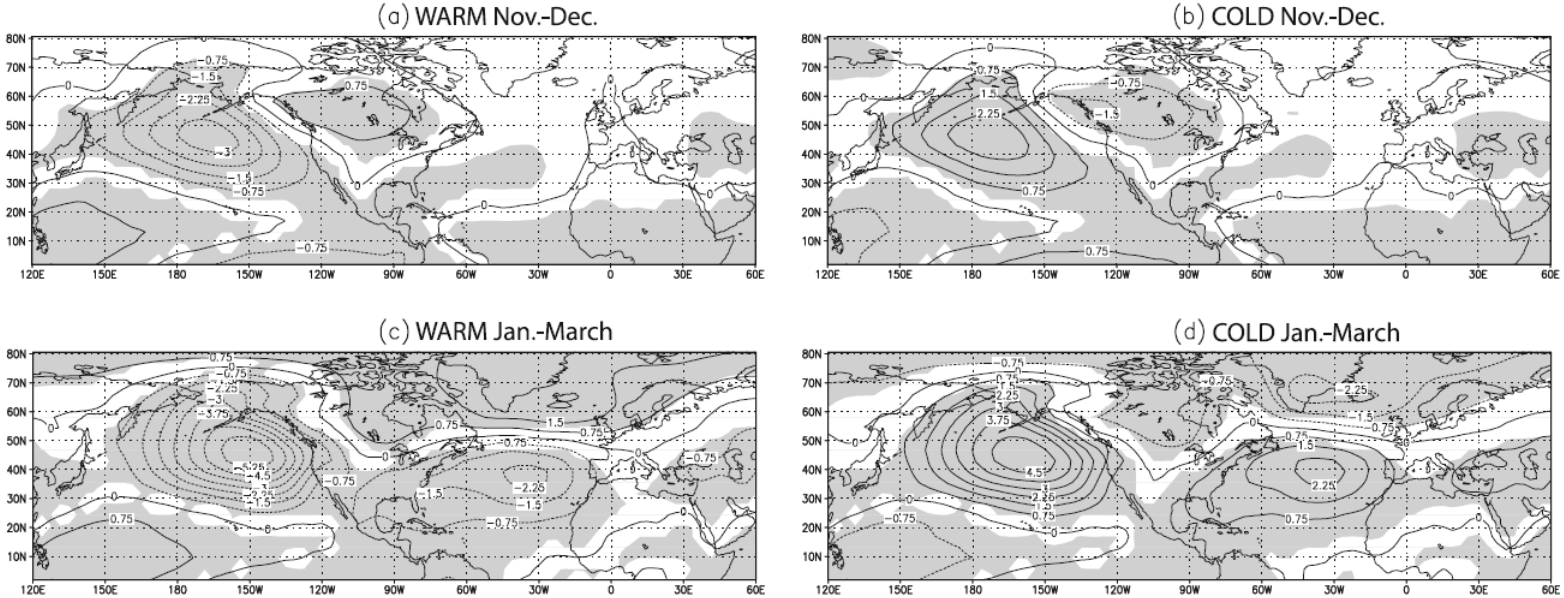
MOD



OBS



canonical signature in JFM [Ineson and Scaife 2009]



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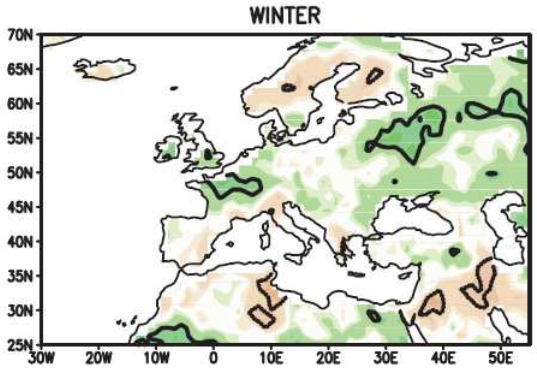

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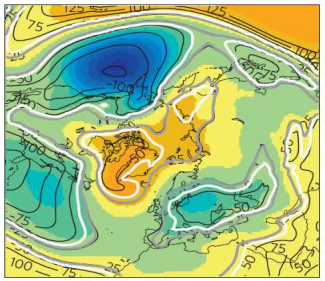

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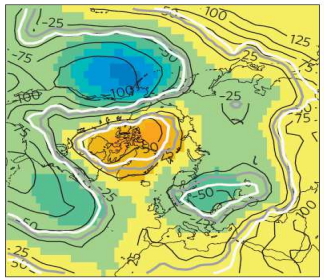

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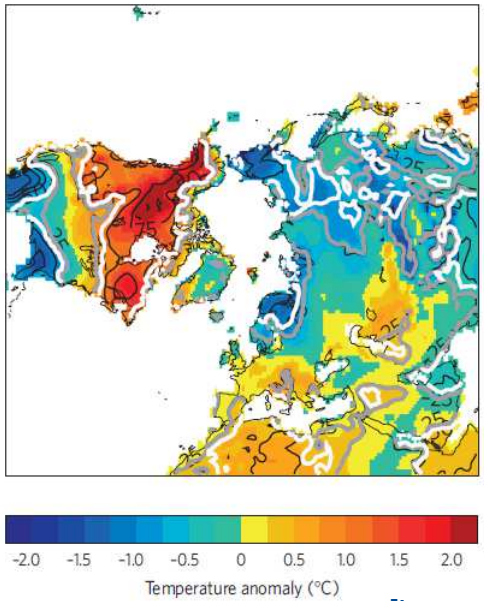
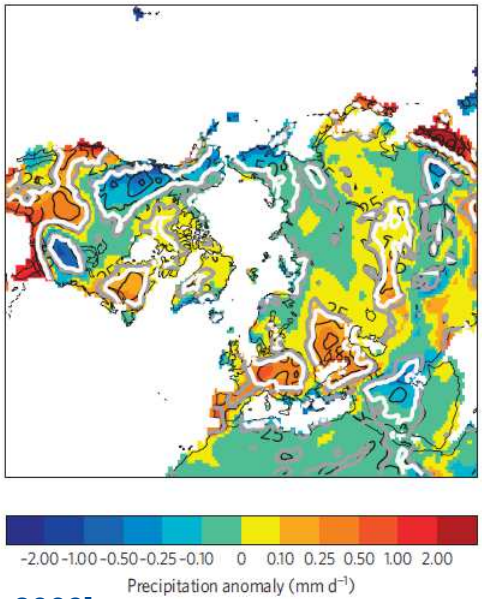


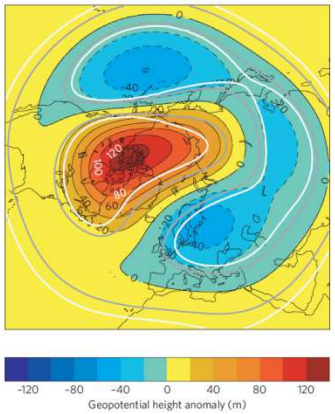
MOD



[Ineson and Scaife 2009]

JFM: linear, robust and stationary over the past 300 years [review by Brönnimann 2007]

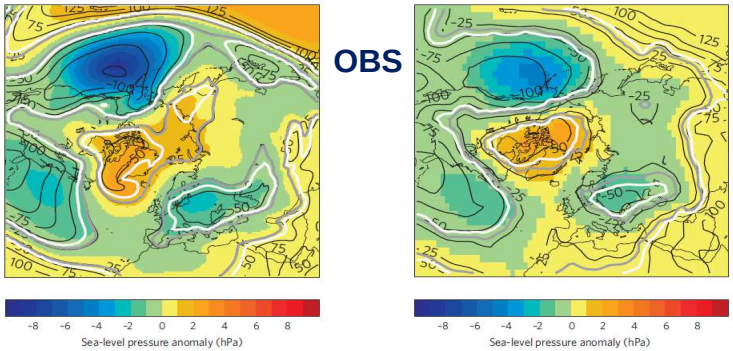
Z50 (lower stratosphere)



weakened polar vortex
[Ineson and Scaife 2009]

WINTER

MOD **OBS**



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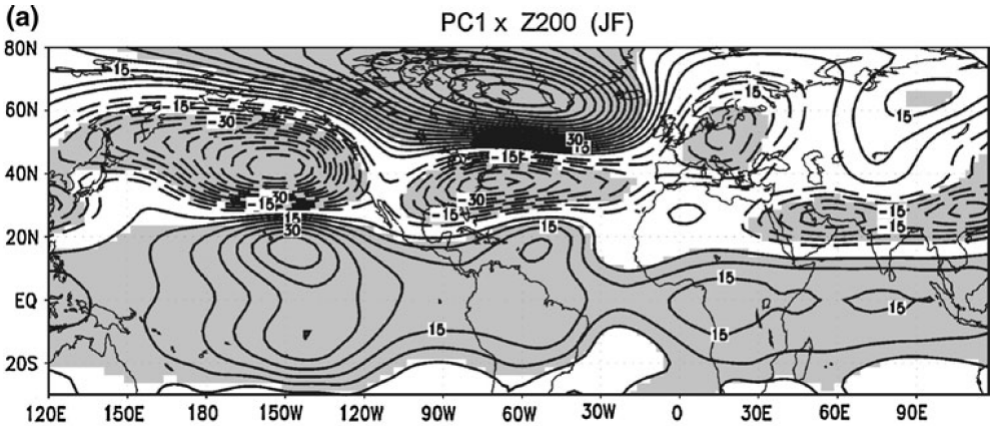
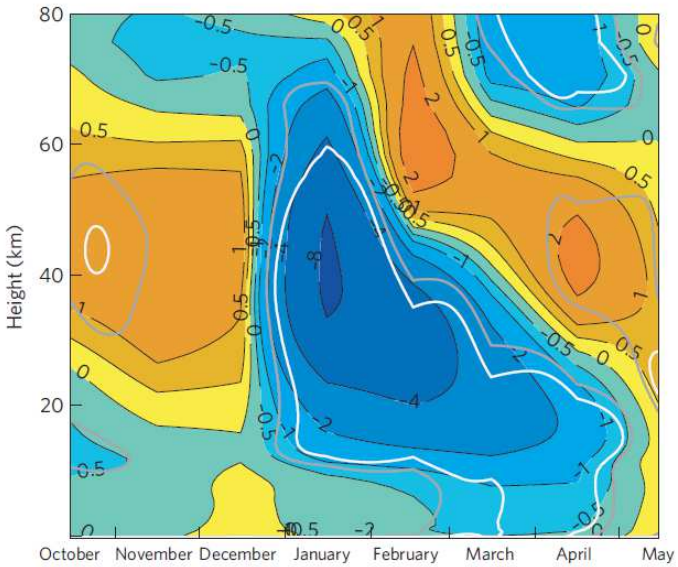


tropospheric pathway
[García-Serrano et al. 2011; Mezzina et al. 2018]



stratospheric pathway
[Ineson and Scaife 2009; Bell et al. 2009]

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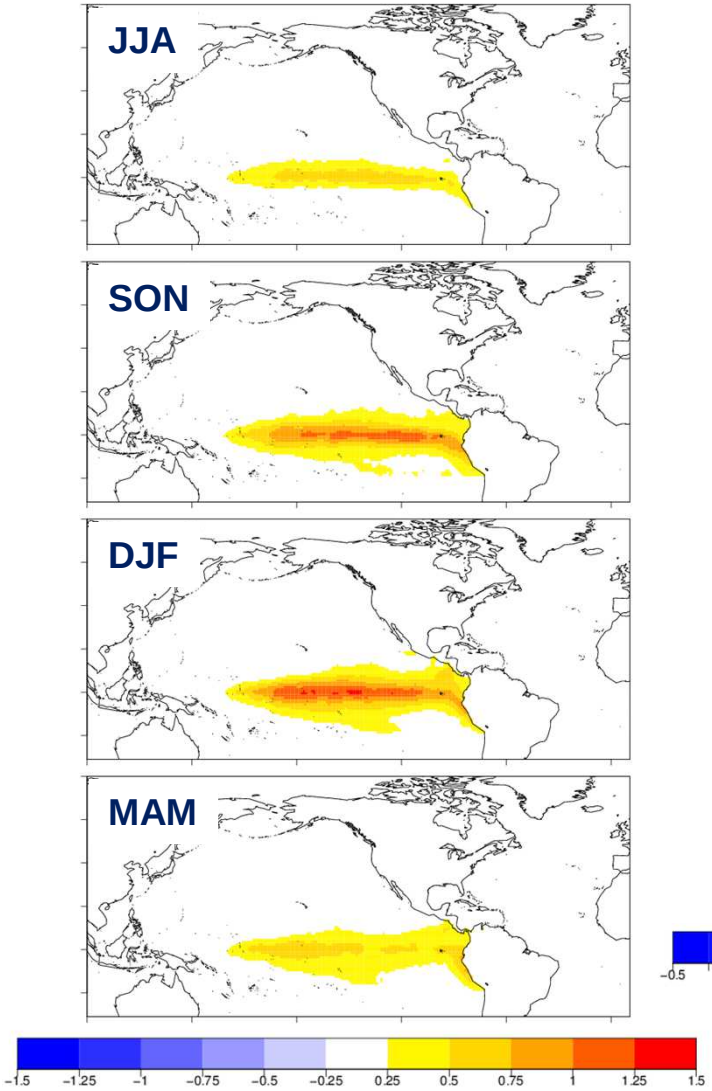
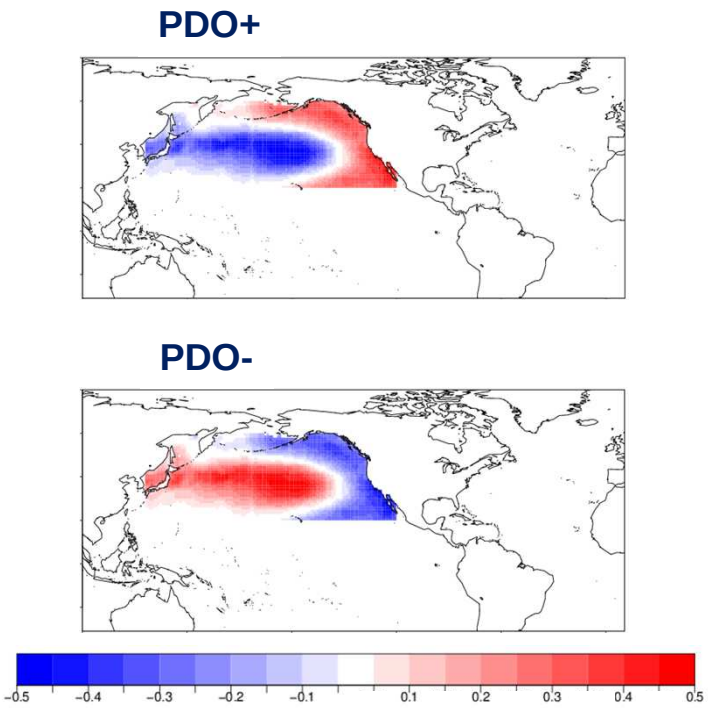
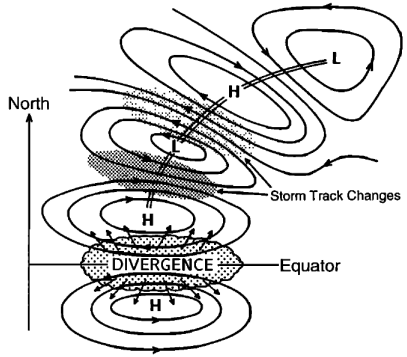
stratosphere as feedback for persistence
[Cagnazzo and Manzini 2009]

MEDSCOPE sensitivity experiments

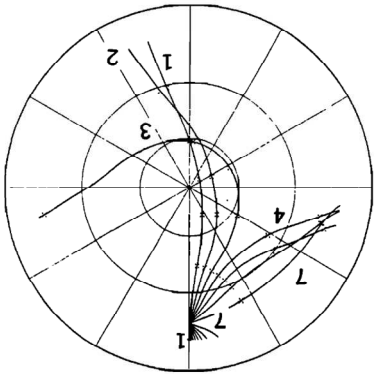
is there a modulation of the ENSO teleconnections?







[Trenberth et al. 1998]

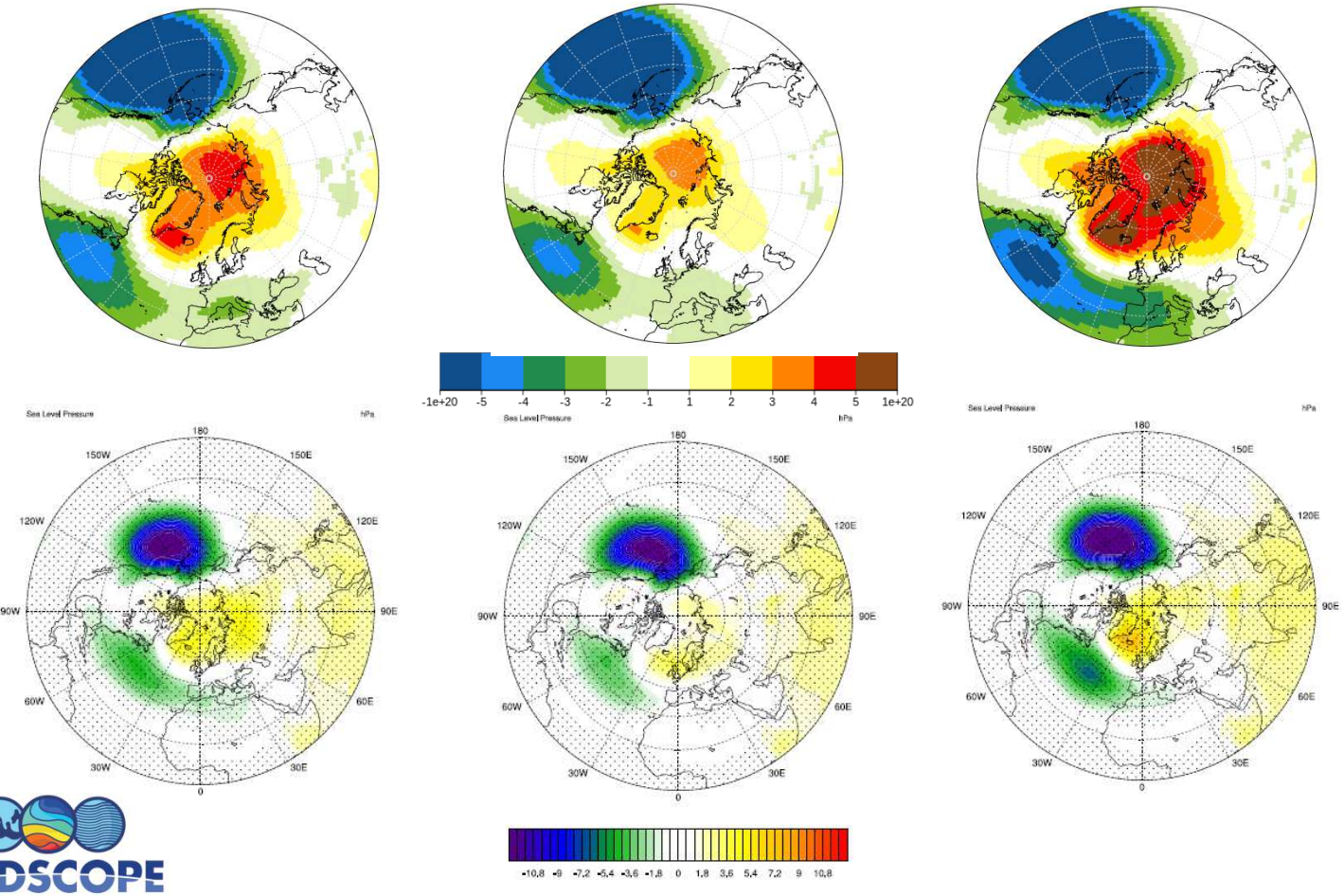


[Hoskins and Karoly 1981]

MEDSCOPE sensitivity experiments

is there a modulation of the ENSO teleconnections?

El Niño	El Niño/PDO+	El Niño/PDO-



CNRM / ARPEGE
(L91 – top 0.01hPa)

CMCC / CAM5.2
(L46 – top 0.3hPa)

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Universitat de Barcelona

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EXCELENCIA SEVERO OCHOA

SUMMARY:

- ENSO is the most important source of predictability at seasonal timescale…

- …other oceanic basins may also provide predictability (e.g. Atlantic, Indian)

- …other forcings may play a larger role in seasons when ENSO signal is weak

- …other atmospheric phenomena might be important (e.g. MJO; QBO)

→ dynamical forecast systems require a proper representation of the stratosphere

→ there is room for comprehensively improving empirical prediction models

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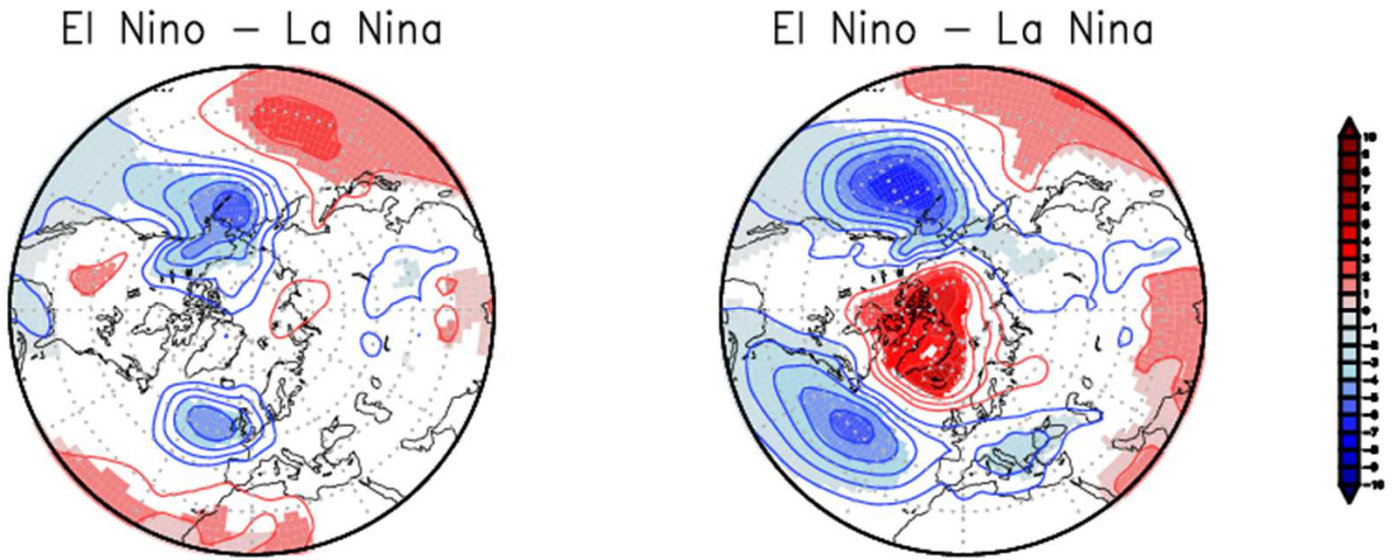
Intra-seasonal change in the ENSO teleconnection

early-winter (ND) vs. late-winter (JFM)

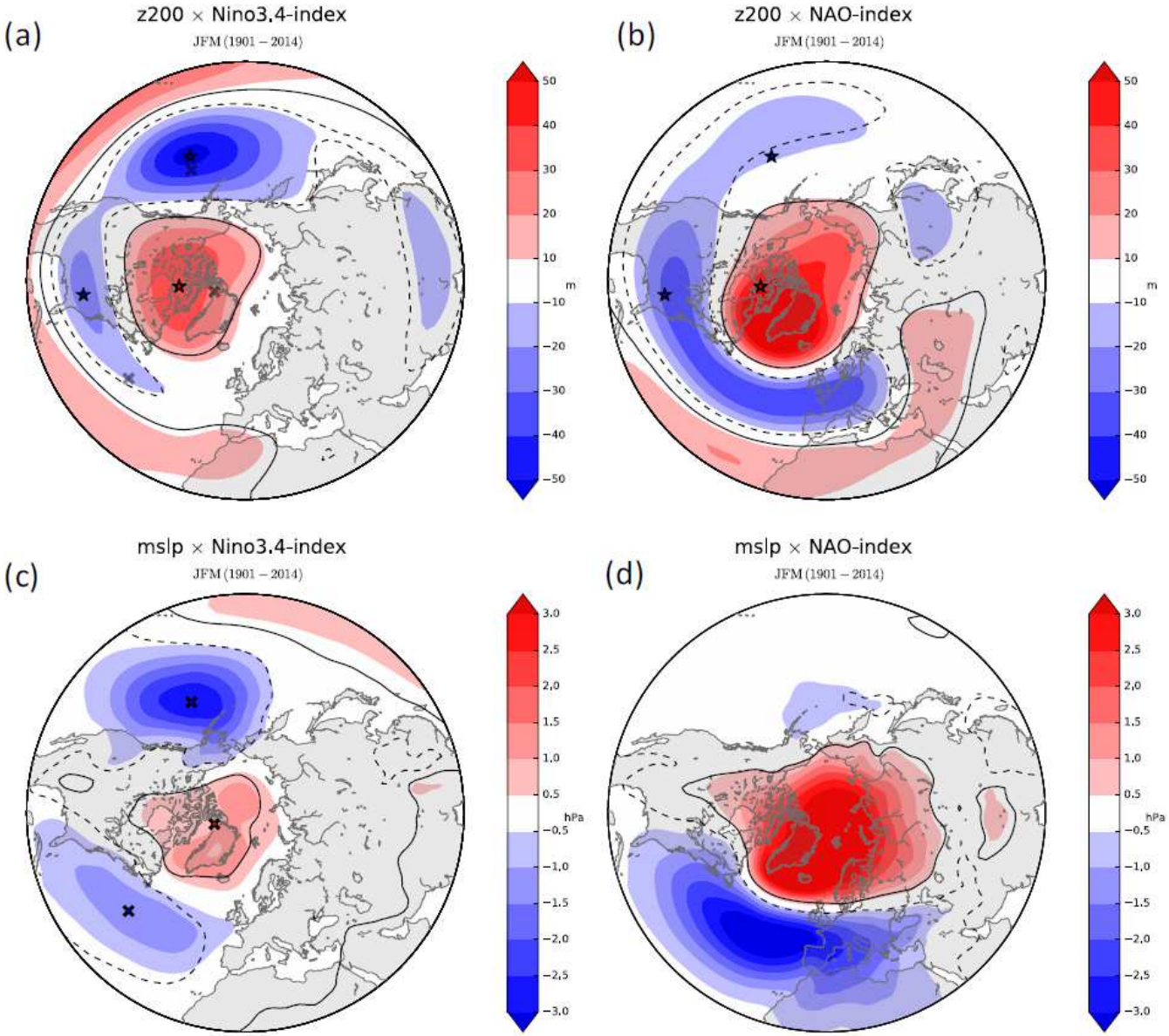


Bladé et al. (2018, in preparation) – using NOAA-20CR

PREVIOUS EVIDENCE: observed (Moron and Gouirand 2003, IntJClimatol) and simulated (Gouirand et al. 2007, GRL)

REVIEWED: Brönnimann (2007, Rev Geophys)

REVISITED: King et al. (2018, BAMS); Ayarzagüena et al. (2018, JClim)



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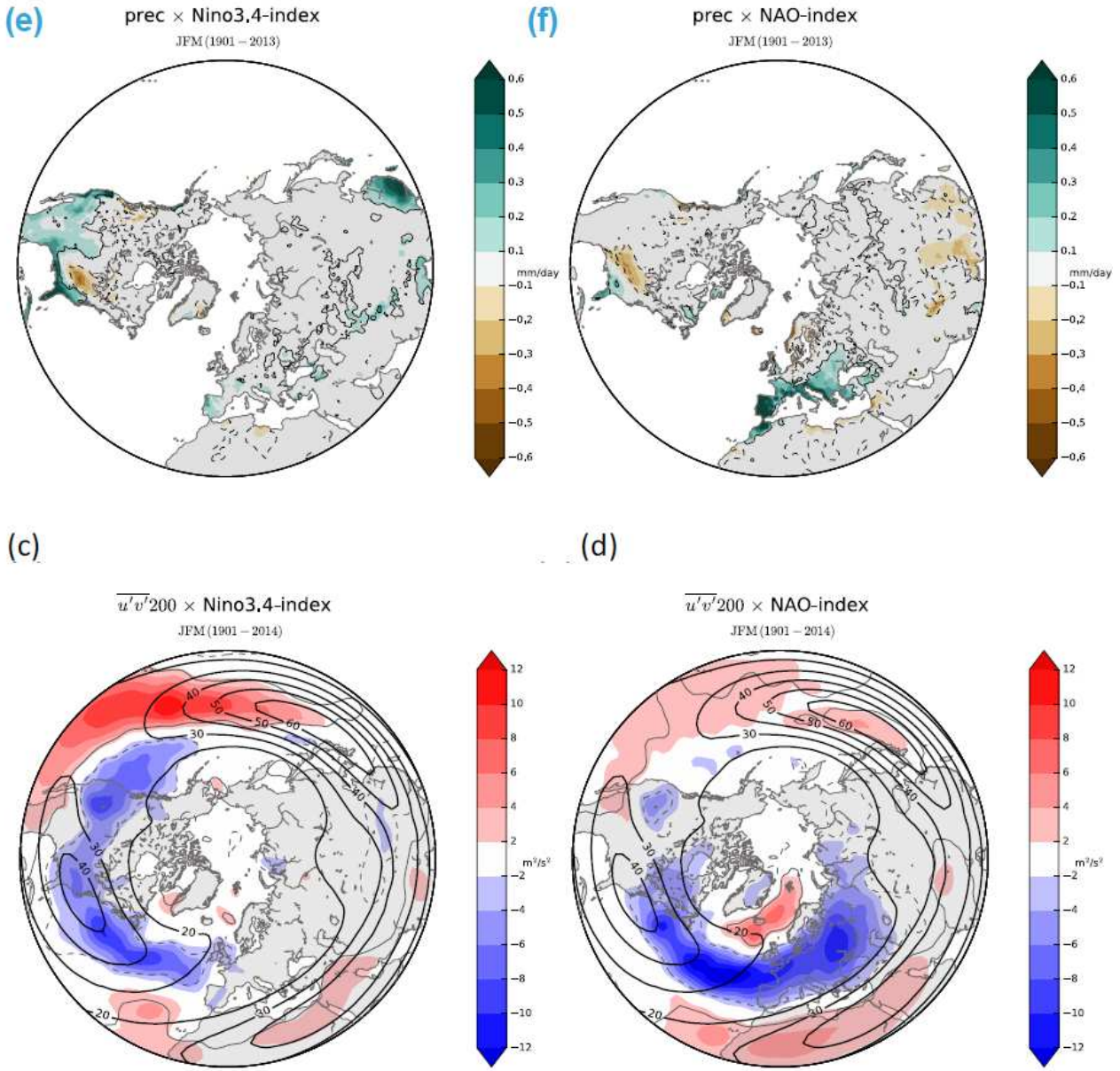

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