

# On the role of Atlantic Nino/Nina in seasonal Atlantic tropical cyclone activity

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**PIRATA-24/TAV workshop**

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# Well-recognized climate variability related to Atlantic TC activity

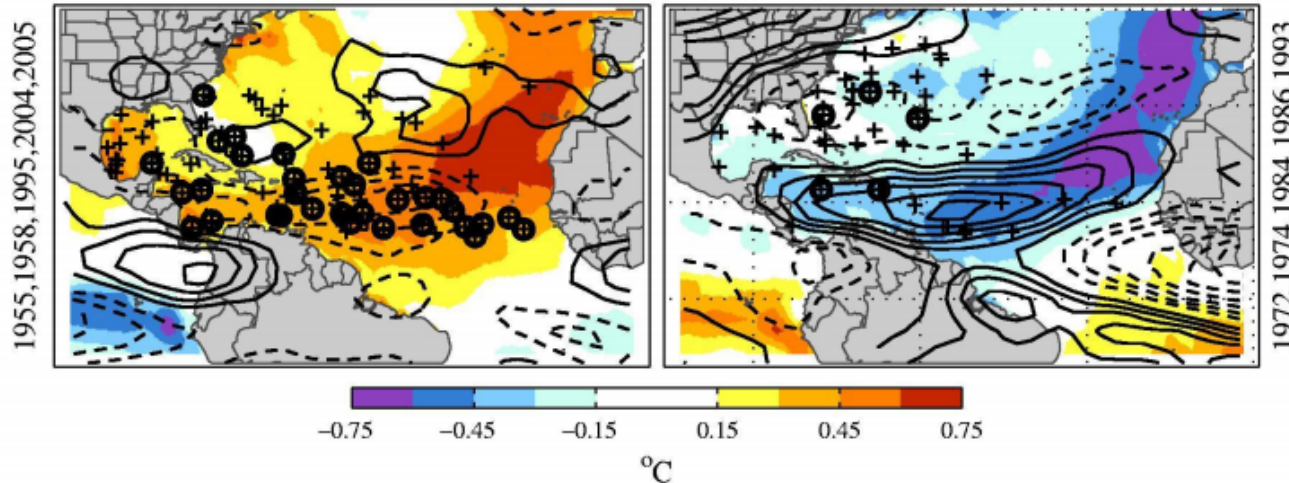
Climate variability  
(e.g., AMM, AMO,  
ENSO and others)

Atlantic TC activity

Peak : boreal spring

AMM(+)

AMM(-)



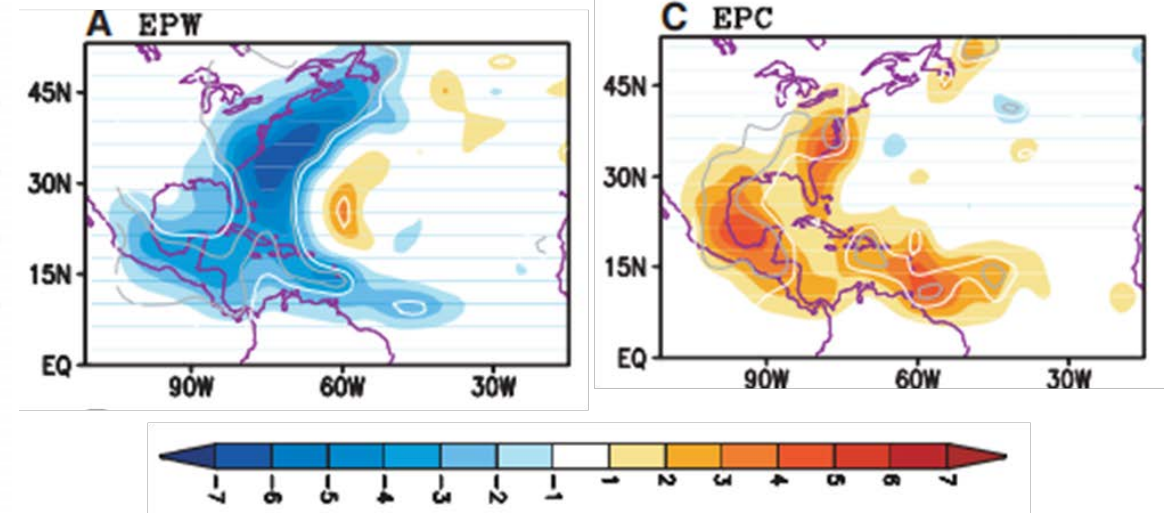
Kossin and Vimont (2007)

SSTAs (shaded), wind shear (contours),  
Crosses (TCs), bold dots (major TCs)

Peak : boreal winter

El Nino

La Nina



Kim et al. (2009)

Track density (shaded)

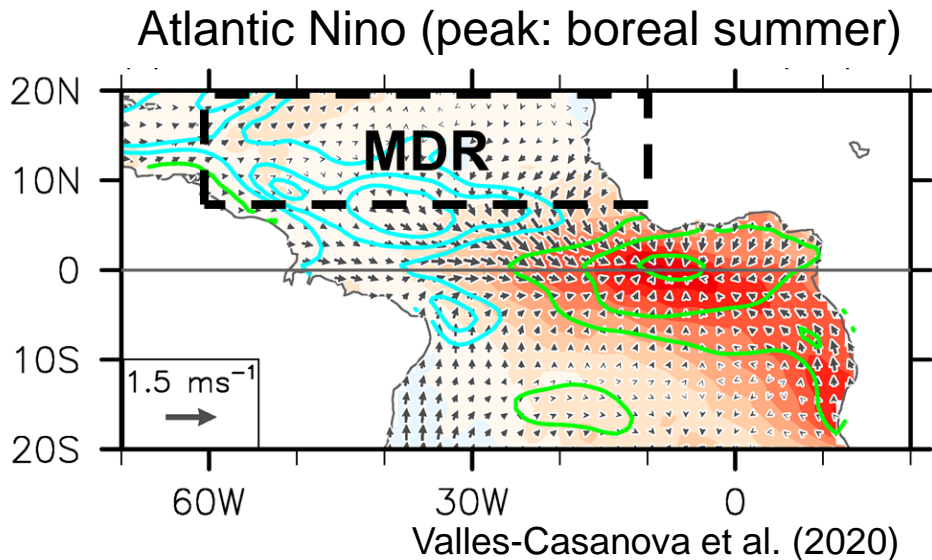
# Relationship between the Atlantic TCs and Atlantic Niño/Niña

Climate variability  
(e.g., AMM, AMO,  
ENSO and others)

Atlantic TC activity

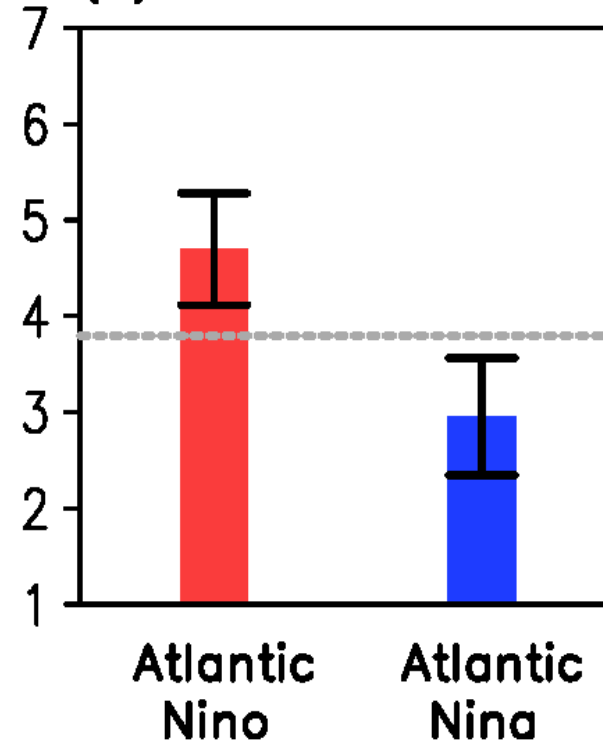
Atlantic  
Niño/Niña

?



SSTAs (shaded), SSH (contours), and 10m-winds

(c) Atlantic Niño

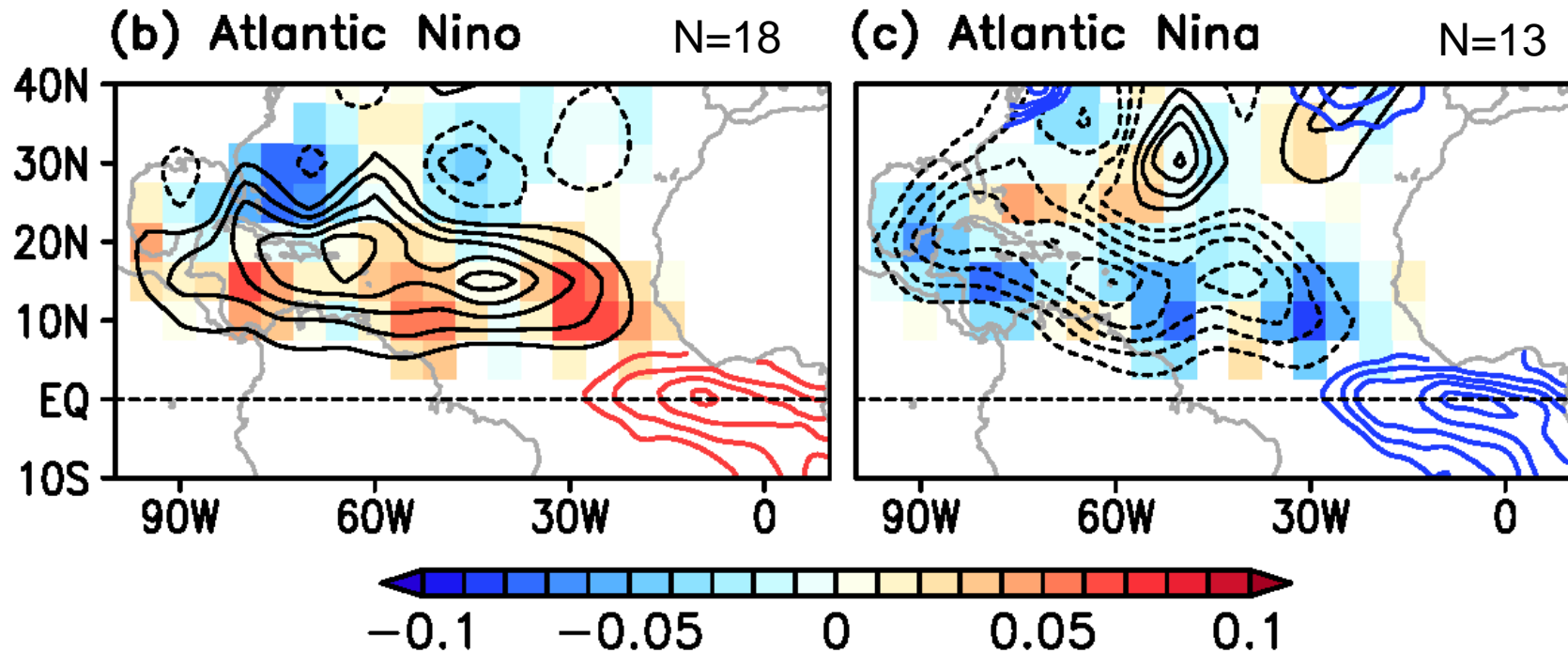


- The purpose of study is to examine the physical relationship between Atlantic Niño/Niña and Atlantic TC activity.

# Atlantic tropical cyclone activity during Atlantic Niño and Niña

## Data (1948-2018, 71 years)

- Sea surface temperature (SST) : HadISST
- Atmospheric variables : NCEP1 reanalysis
- Precipitation : NOAA's Precipitation Reconstruction
- Atlantic tropical cyclone data : IBTrACS data, Wind speed over the 34 knots
- All data are averaged for MJJASON



TC genesis (shaded, adjusting spatial smooth method),  
Track density (black contours),  
SSTAs (red and blue contours, K)

**Atlantic Niño:**

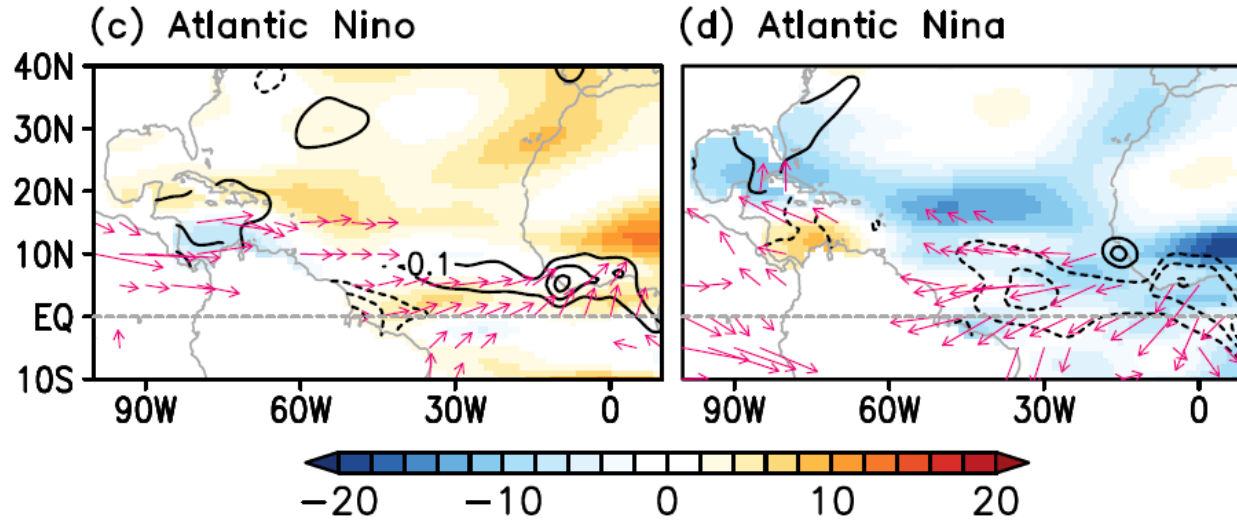
Increases Atlantic TC

**Atlantic Niña:**

Decreases Atlantic TC

# Atmospheric conditions during Atlantic Niño and Niña

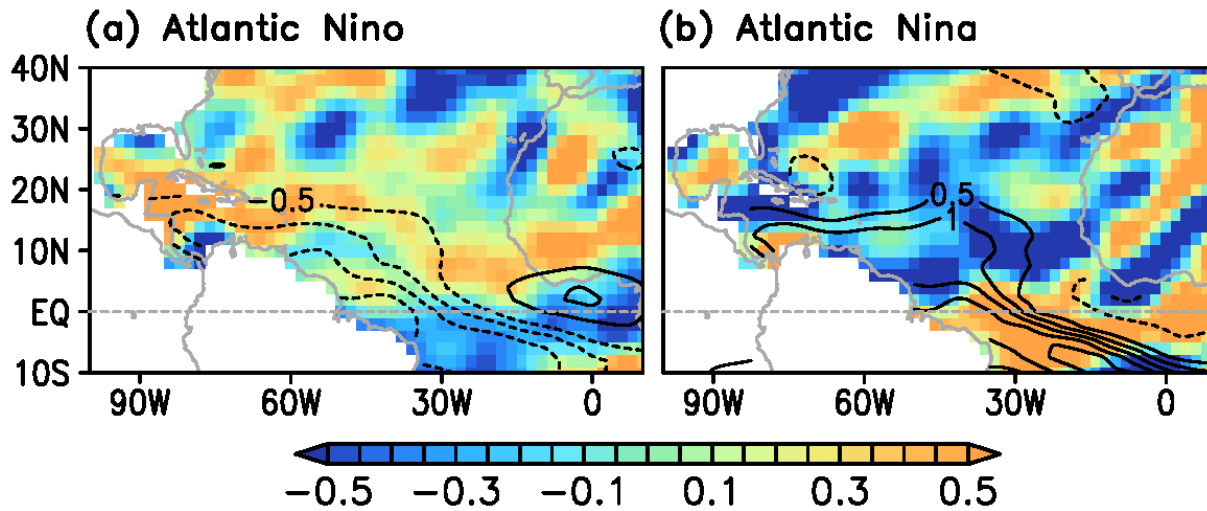
700 hPa EKE (shaded), precipitation (contours), 850 hPa wind (vectors)



## Atlantic Niño:

- increases precipitation
- increases the low-level RV
- decreases the vertical wind shear
- increases 700 hPa EKE

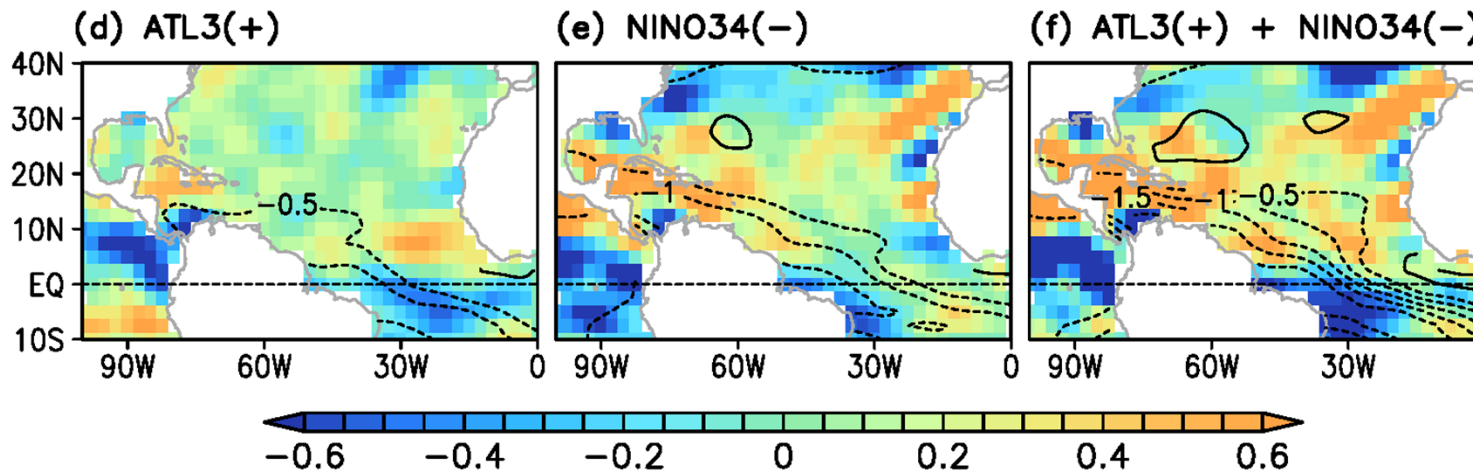
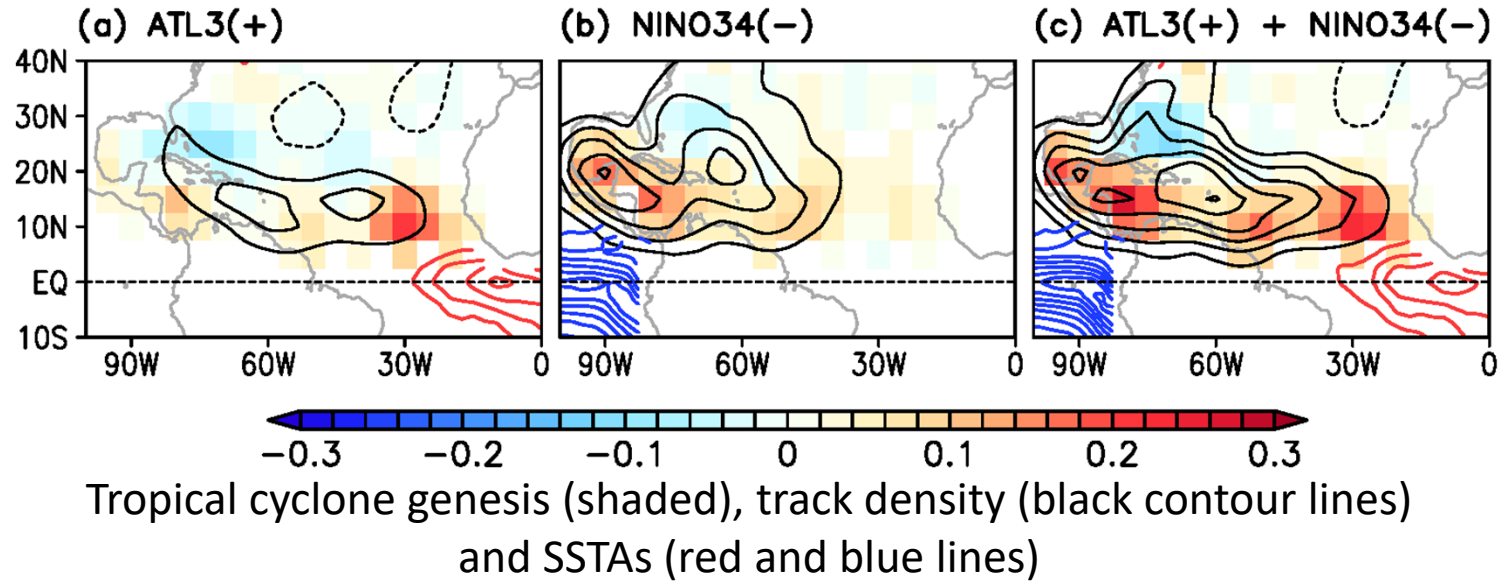
850 hPa relative vorticity (shaded), wind shear (contours)



## Atlantic Niña:

- decreases precipitation
- decreases the low-level RV
- increases the vertical wind shear
- decreases 700 hPa EKE

# Partial regression of the Atlantic hurricane to NINO3.4 and ATL3

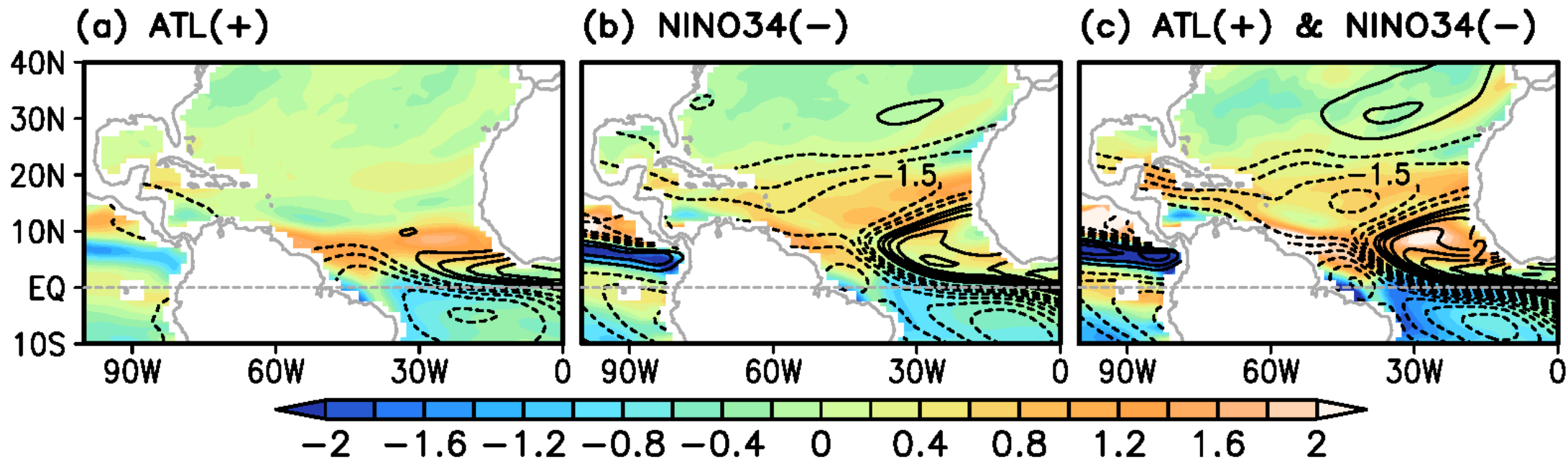


- Atlantic Niño increases TC and the associated atmospheric conditions over the MDR (especially eastern part of MDR).
- La Nina increases TC and the associated atmospheric conditions over the GoM and Caribbean Sea.
- Tendency for La Nina to increase Atlantic TC activity is amplified during Atlantic Niño and weakened during Atlantic Niña.

# Results derived from CESM-LENS

CESM-LENS  
1,100 model years:

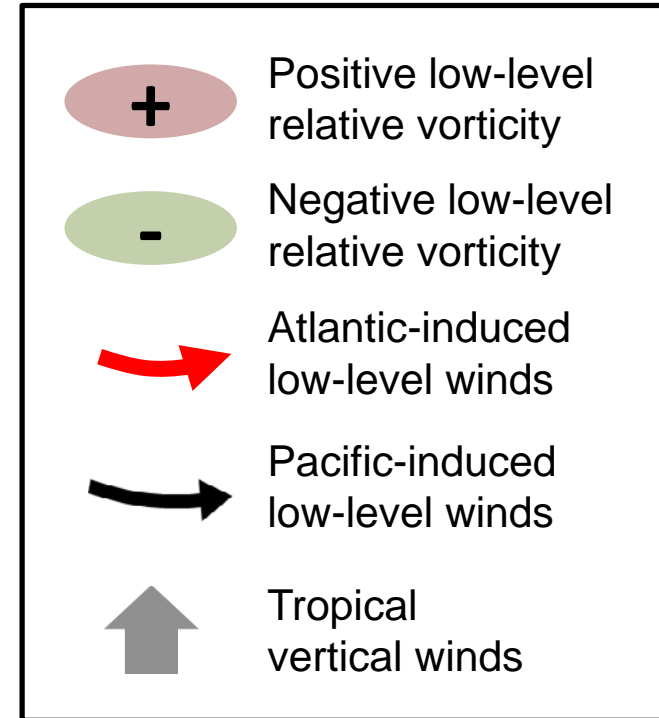
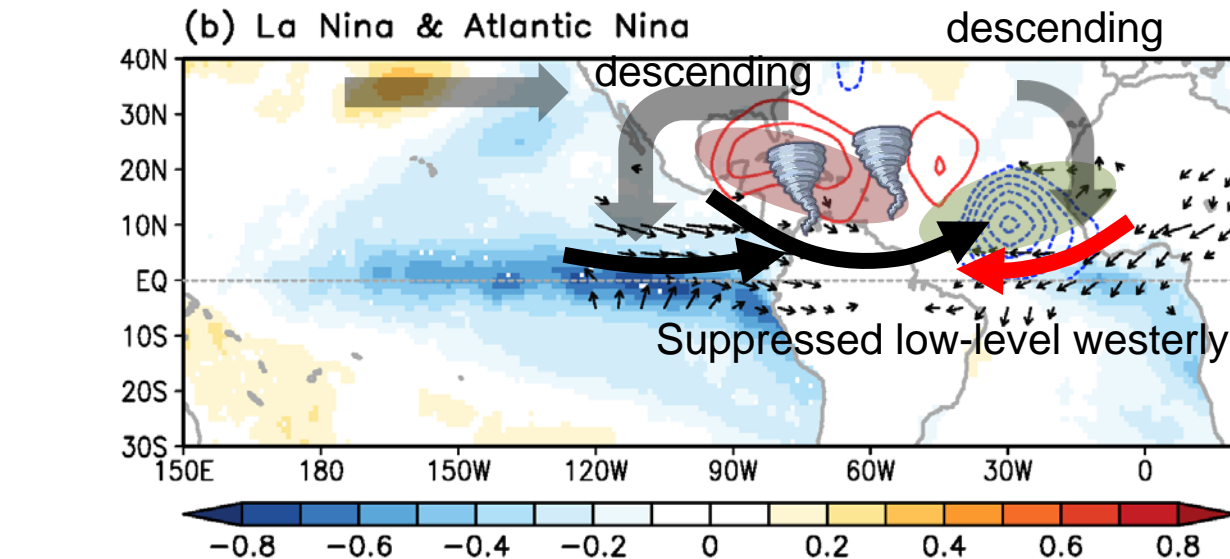
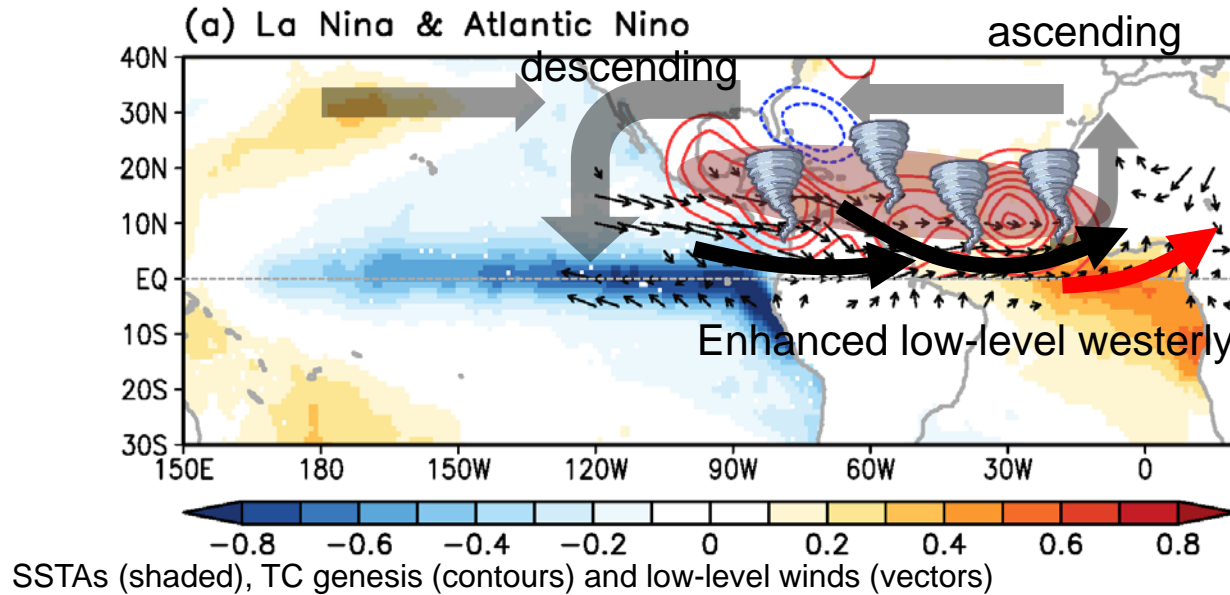
- El Niño : 210 years
- La Niña : 236 years
- Atlantic Niño : 198 years
- Atlantic Niña : 190 years



Relative vorticity (shaded,  $10^6 \text{ s}^{-1}$ ) at 850 hPa and wind shear between 850 and 200 hPa

- Results derived from CESM-LENS are consistent with those from observation and reanalysis dataset.

# Summary



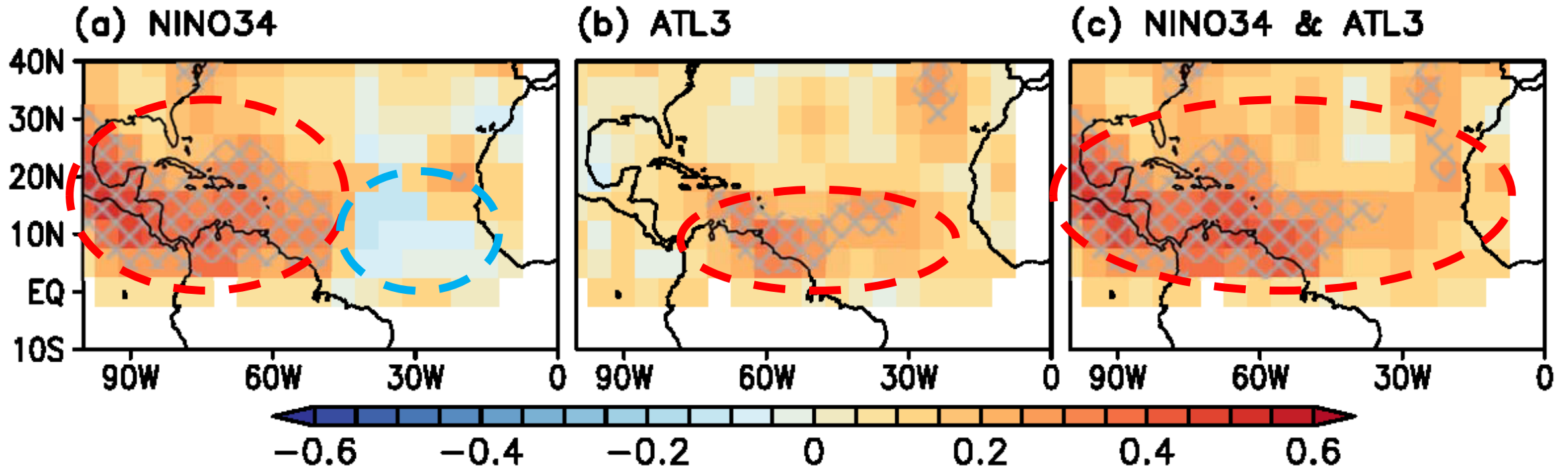
**La Niña & Atlantic Niño :**  
Enhance Atlantic TC activity

**La Niña & Atlantic Niña:**  
Moderate Atlantic TC activity



# Impact of Atlantic Niño/Niña on TC track density forecast

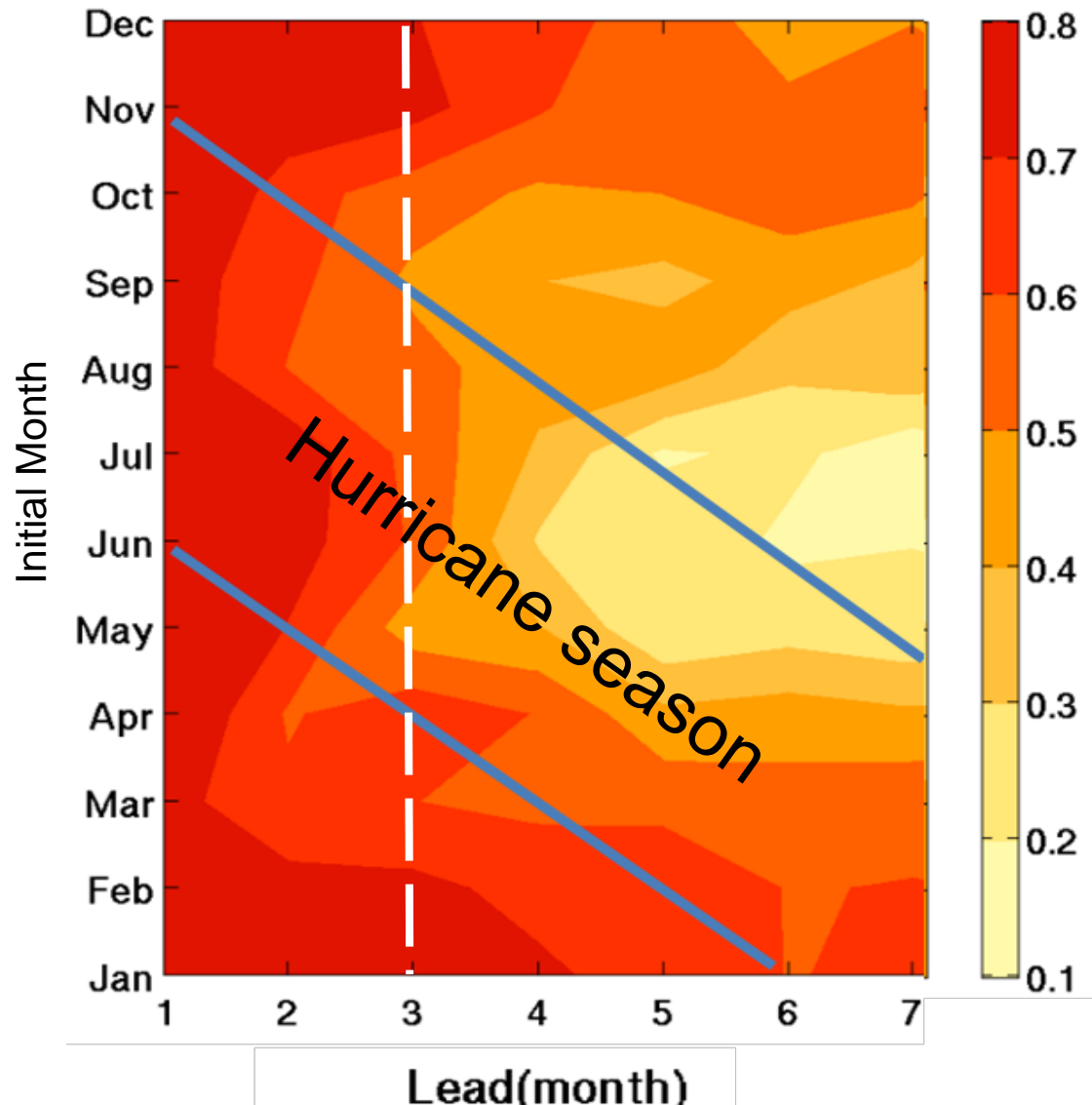
Correlation of track density between observed track density and reconstructed track density



- ATL3 index can be a potential predictor for Atlantic TC genesis and track.

# Predictability barrier for Atlantic Niño/Niña

Prediction skill of ATL3 index in NMME



- There is a predictability barrier in ATL3 index during Atlantic hurricane season.
- This suggests that an intense observation-based research is needed to improve prediction skill of Atlantic Niño/Niña.

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# Thank you for attention

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