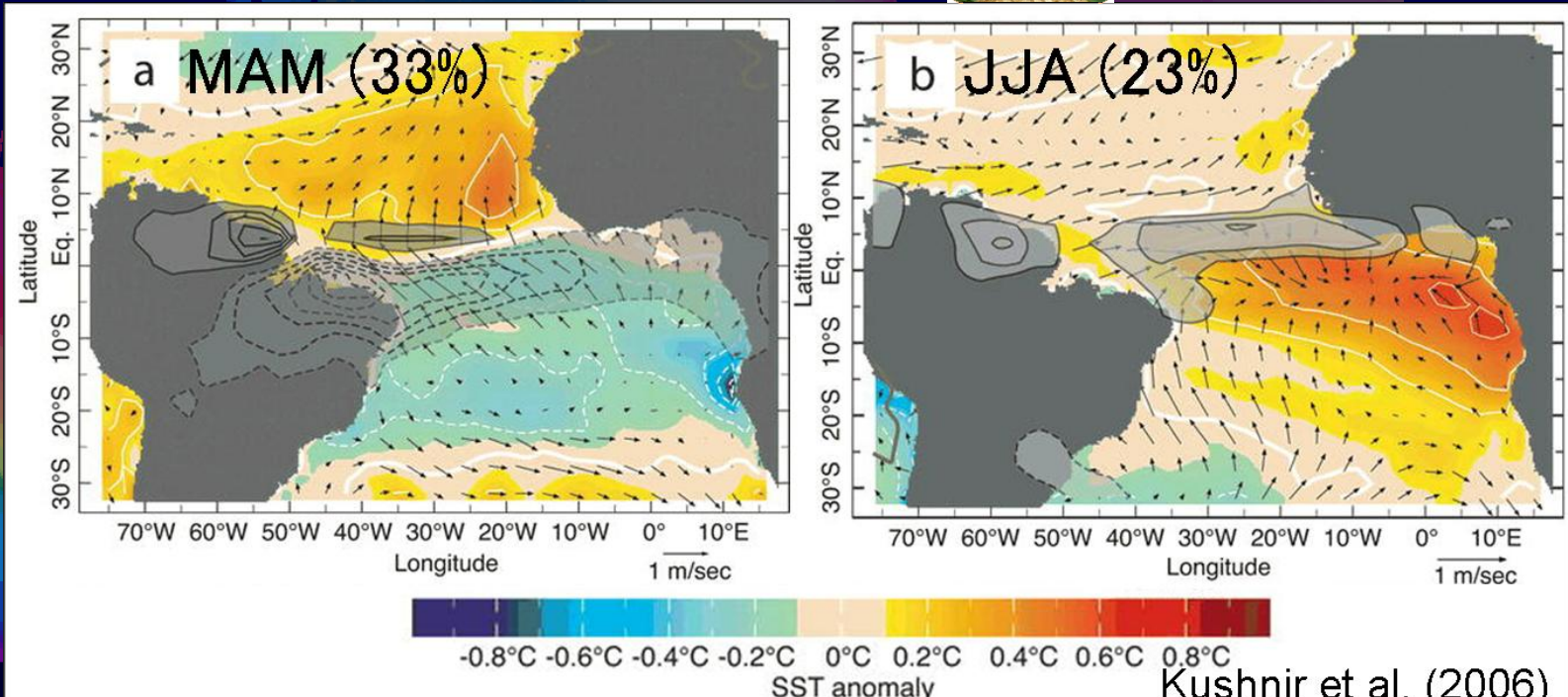




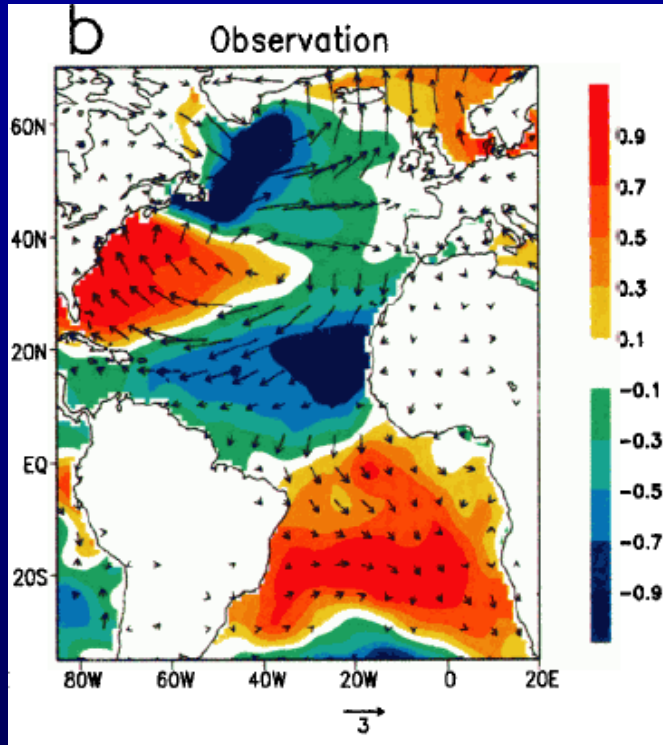
# Interannual Predictability of Tropical Atlantic Rainfall Variability

Masahide Kimoto  
 Yoshimitsu Chikamoto, Masahiro Watanabe  
 Atmosphere and Ocean Research Institute  
 University of Tokyo  
 and  
 Team SPAM

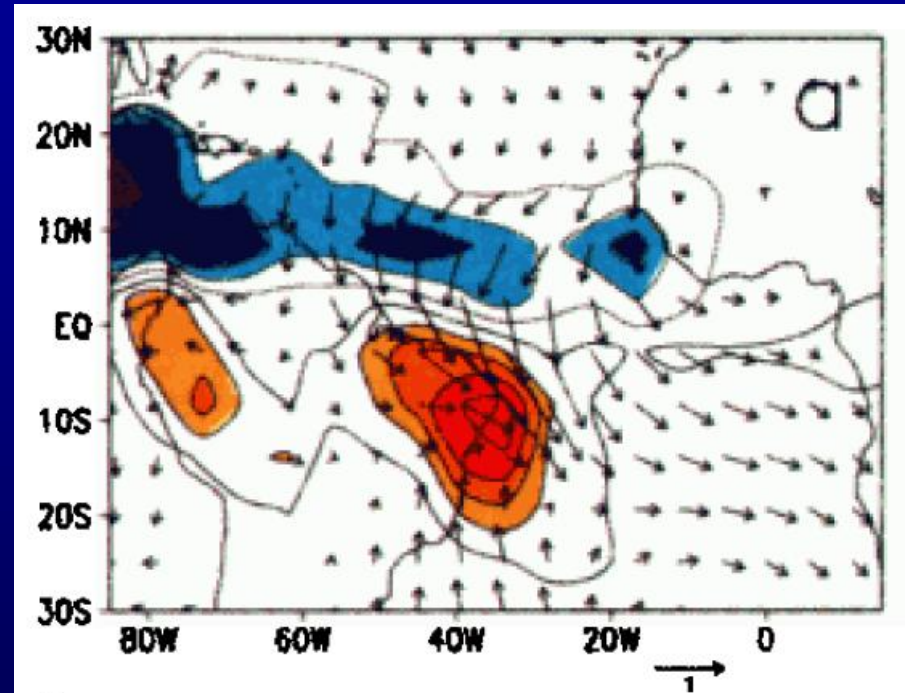


# SST dipole mode in the tropical Atlantic

dipolar SST anomaly



Rainfall response in AGCM to the dipolar SST anomalies

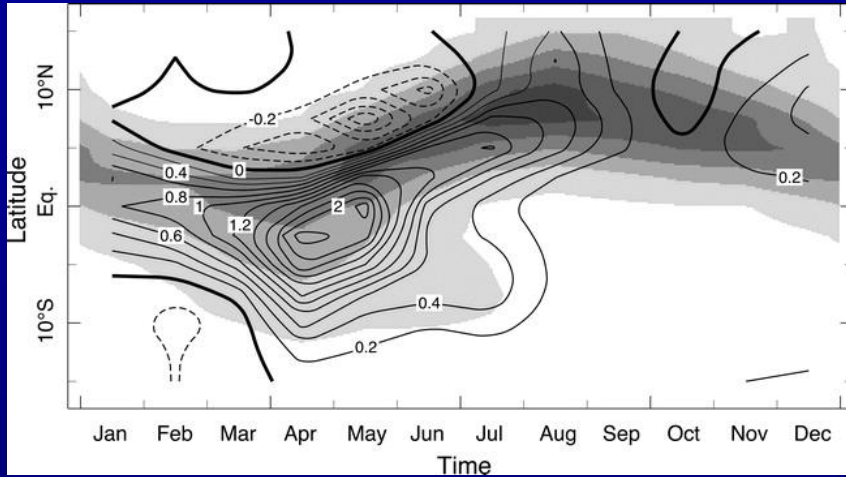


Okumura et al. (2001)

Meridional migration of the Atlantic ITCZ controlled by the Atlantic SST anomalies may have a predictive skill for several years.

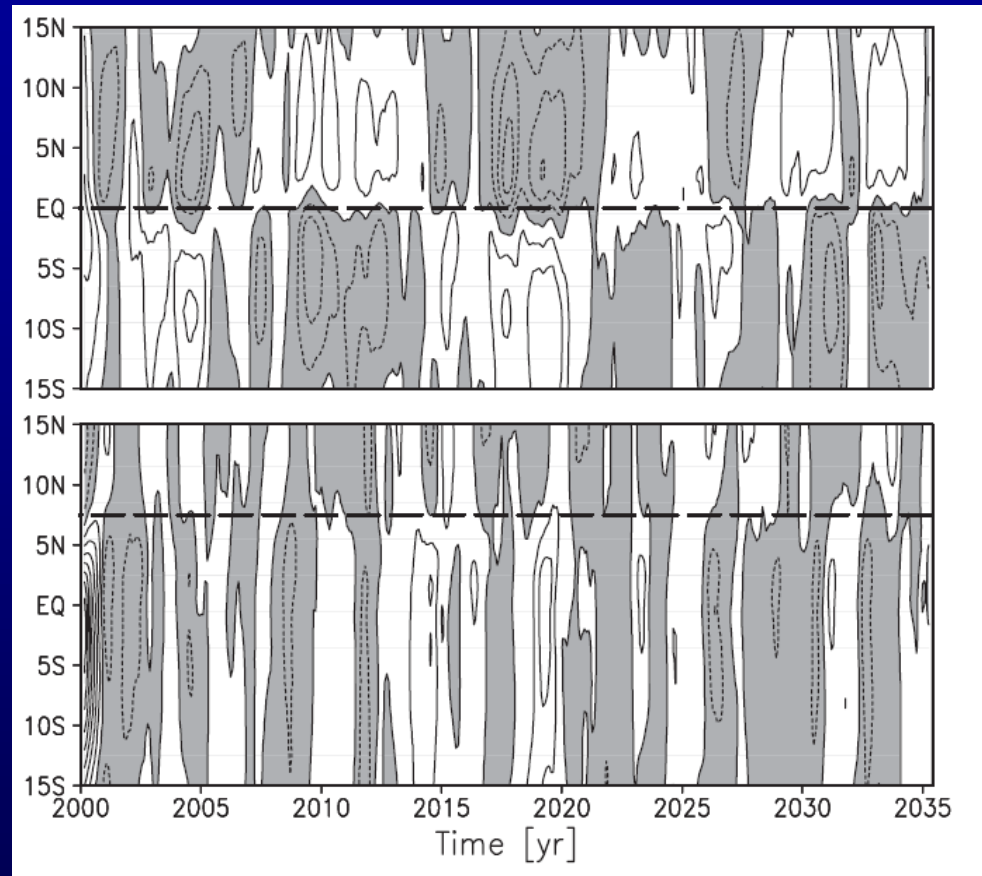
# A note on seasonality

## ITCZ & EOF1 of PRCP

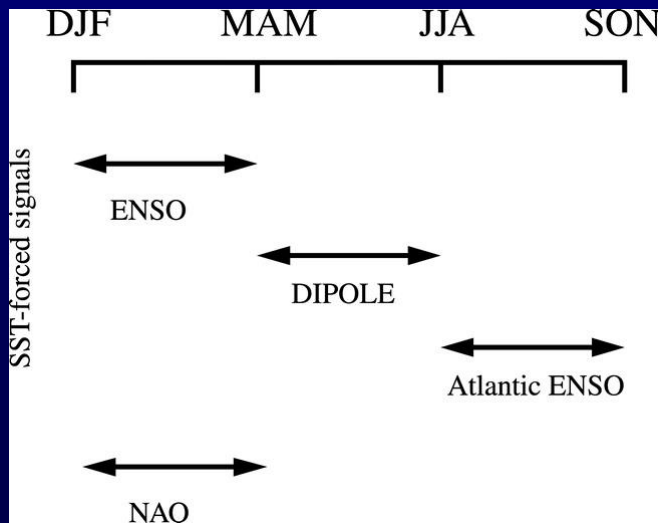


Kushnir et al. (2006)

## Lat of ITCZ & WES-induced SSTA



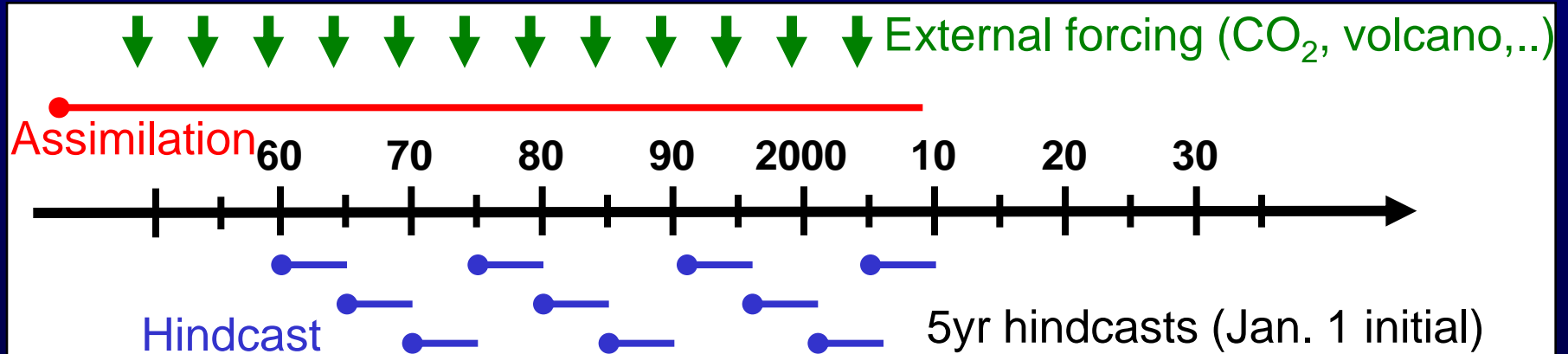
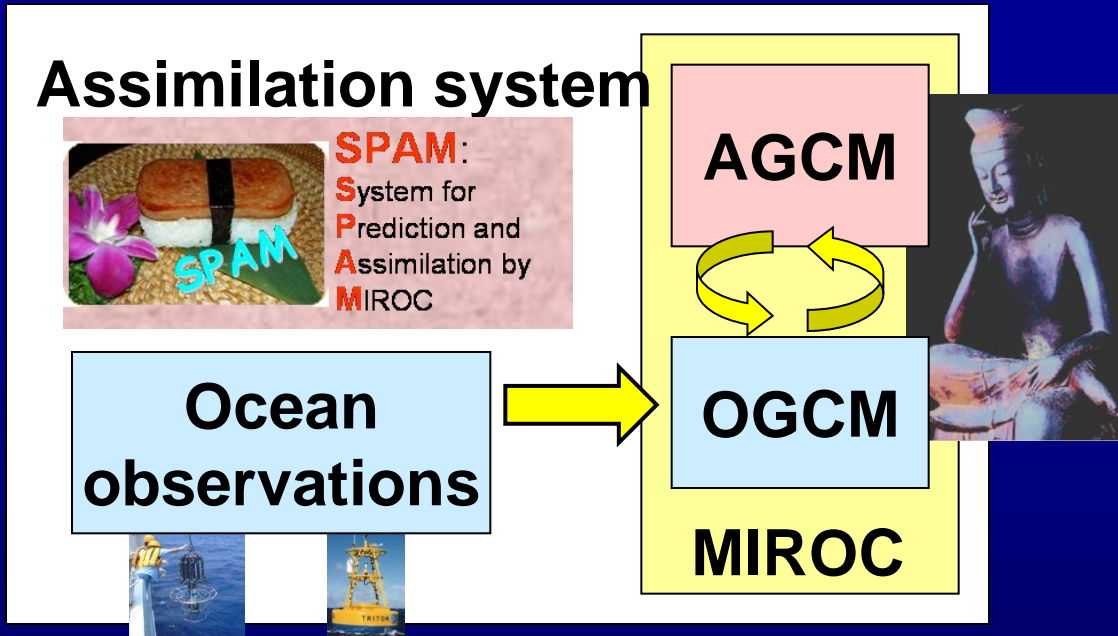
Okajima et al. (2003)



Sutton et al. (2000)

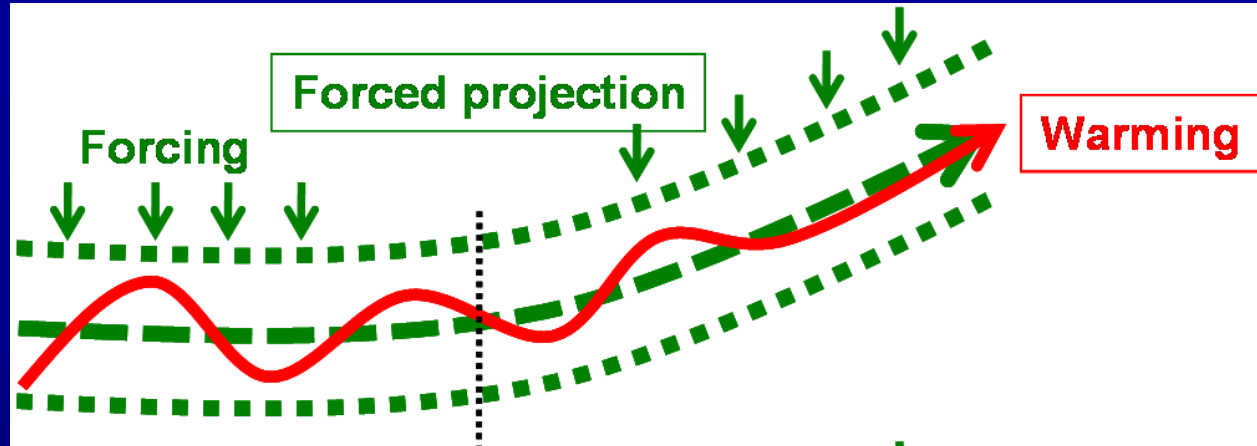
Both internal (tropical Atlantic) & external influences show seasonality

# Hindcast experiment

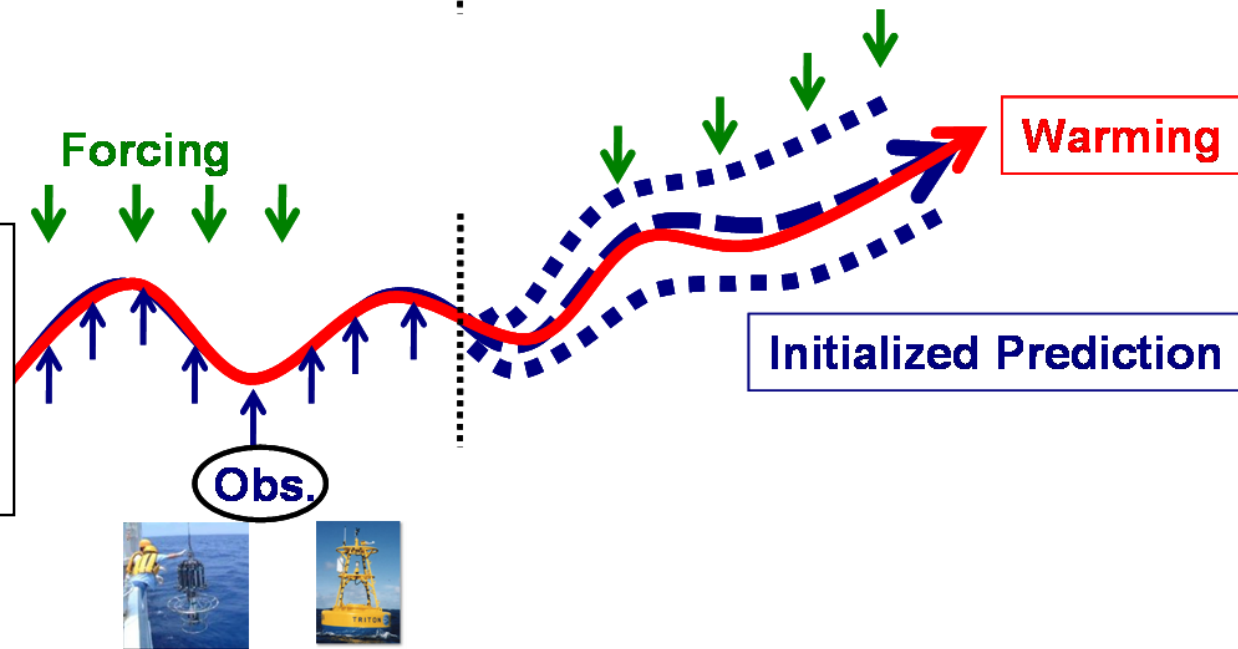


# A strategy for decadal climate prediction

External forcing

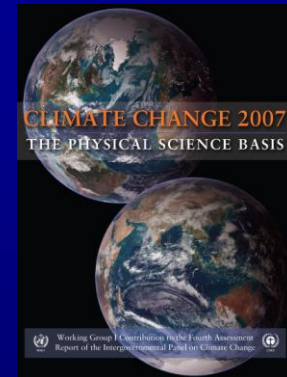
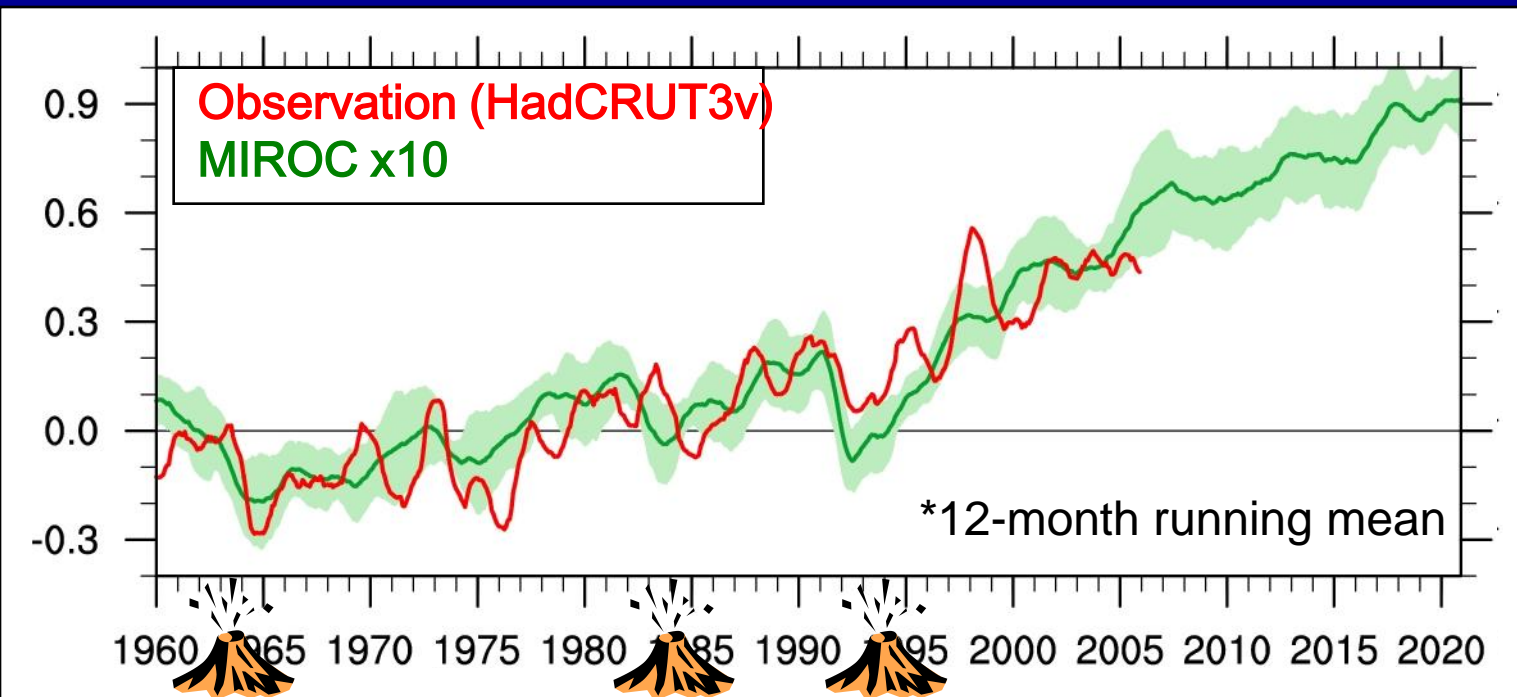


External forcing  
+  
Internal variability



# Successful simulations of 20<sup>th</sup> century climate change in IPCC AR4

## Globally averaged surface air temperature anomalies



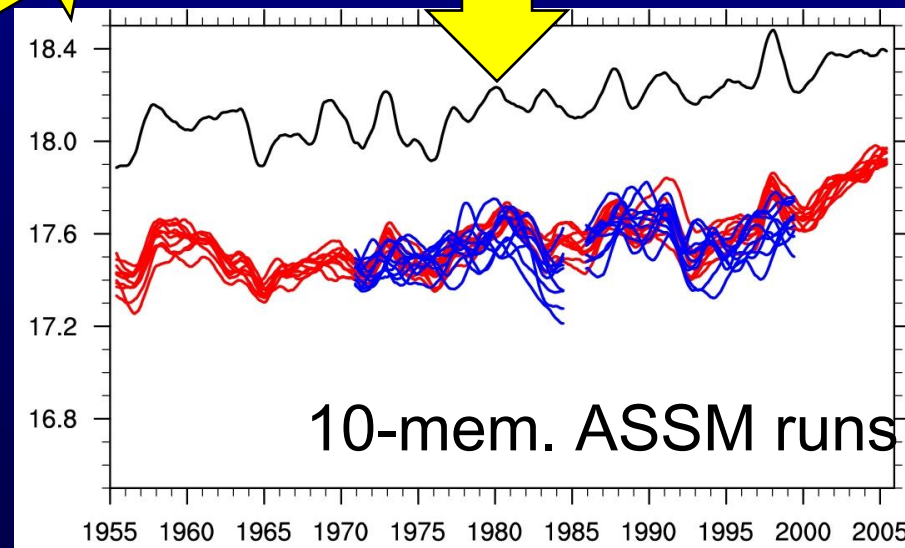
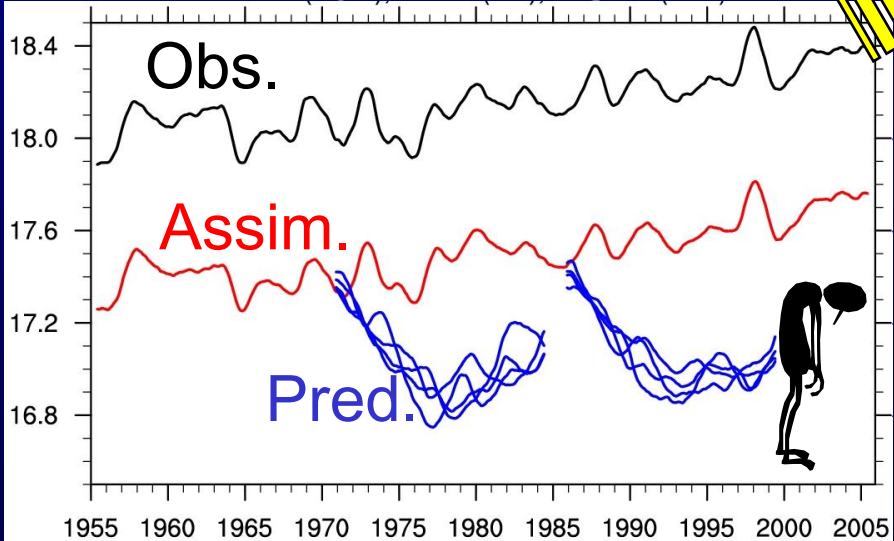
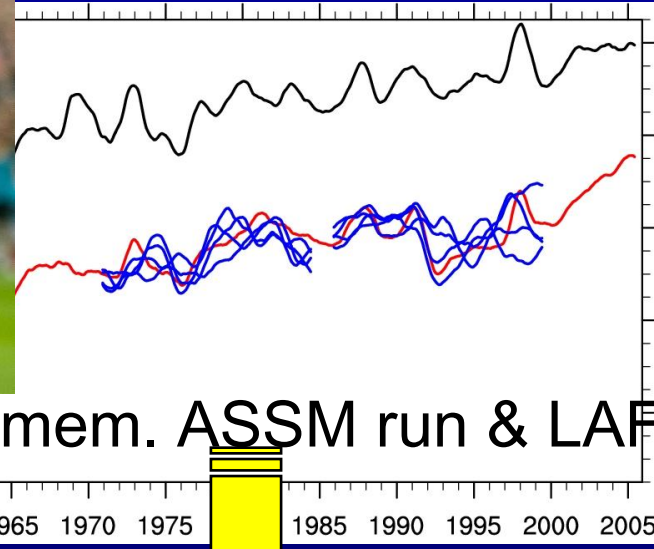
- **Externally forced component** : greenhouse gases, aerosols, volcanic activity, and solar cycle variations.

# Preventing climate drift

- Anomalies of ocean temp. & sali. are assimilated into coupled model
- Nudging
- Weak assimilation



Globally averaged SST

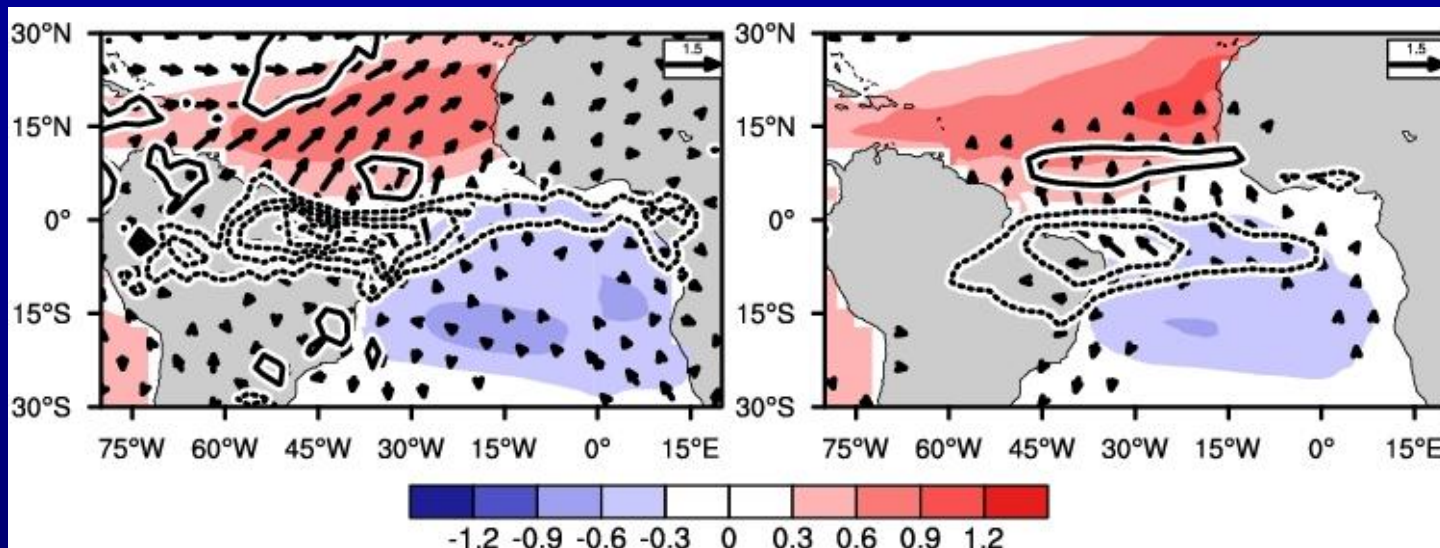


The anomaly assimilation: Smith et al. (2007), Keenlyside et al. (2008)

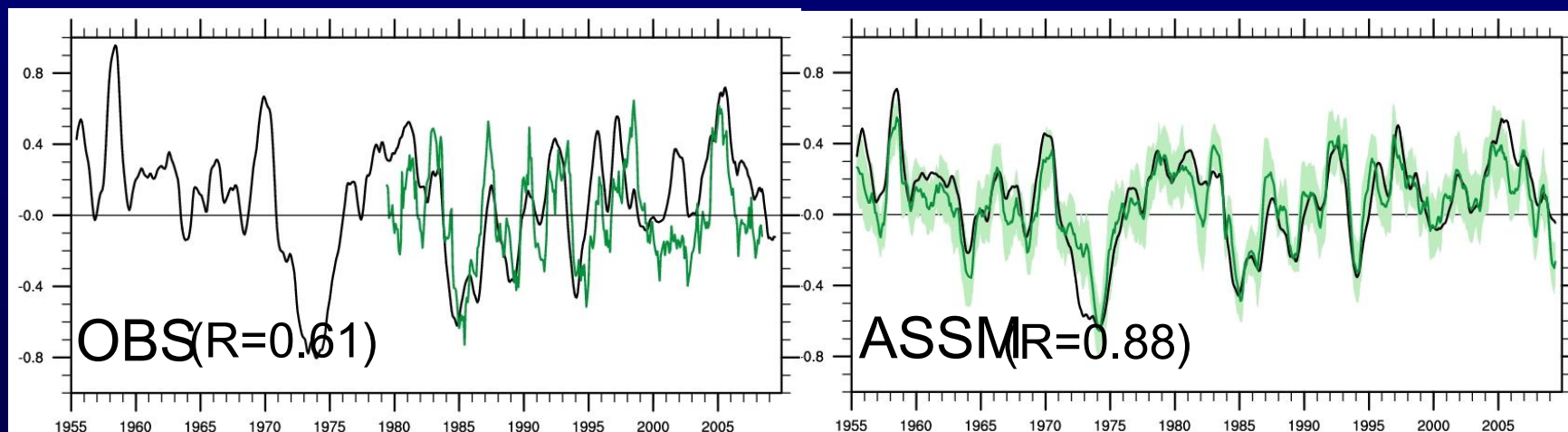
# The Atlantic climate change with the dipole mode ( annual mean )

OBS.

ASSM.



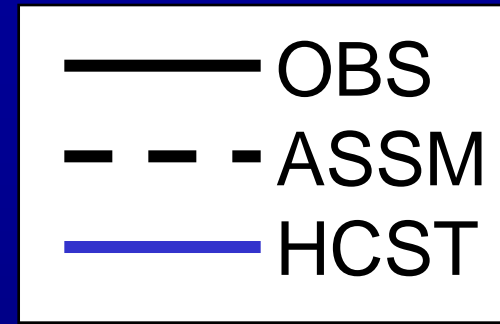
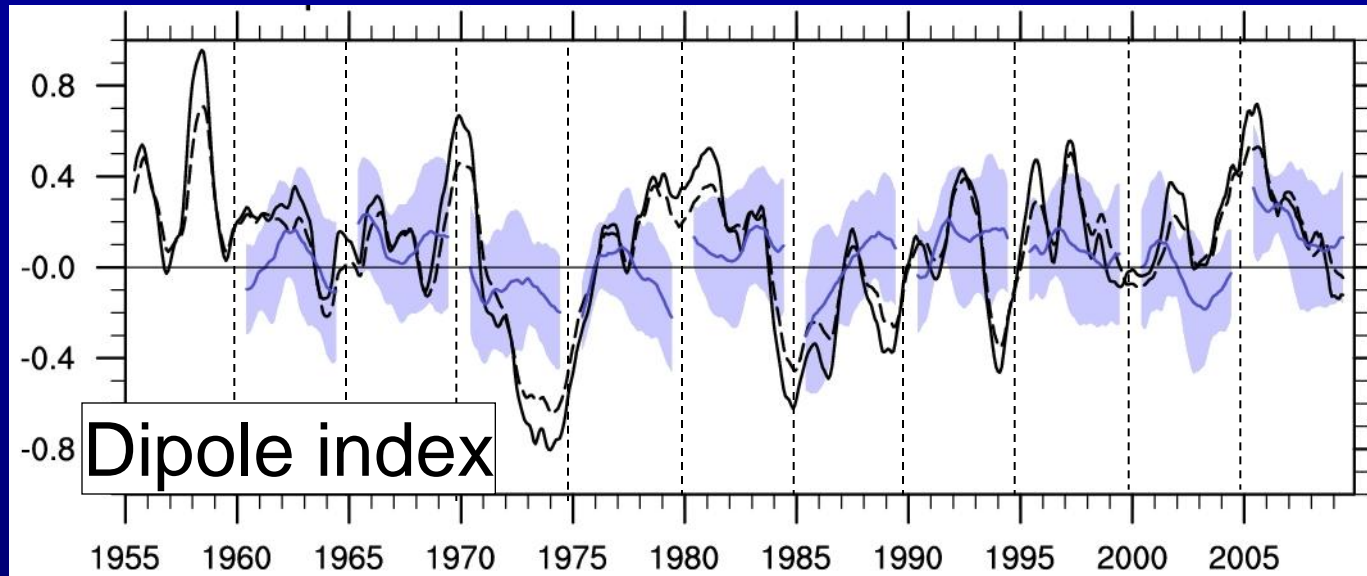
SST: color  
rainfall : contour  
surface wind : vector



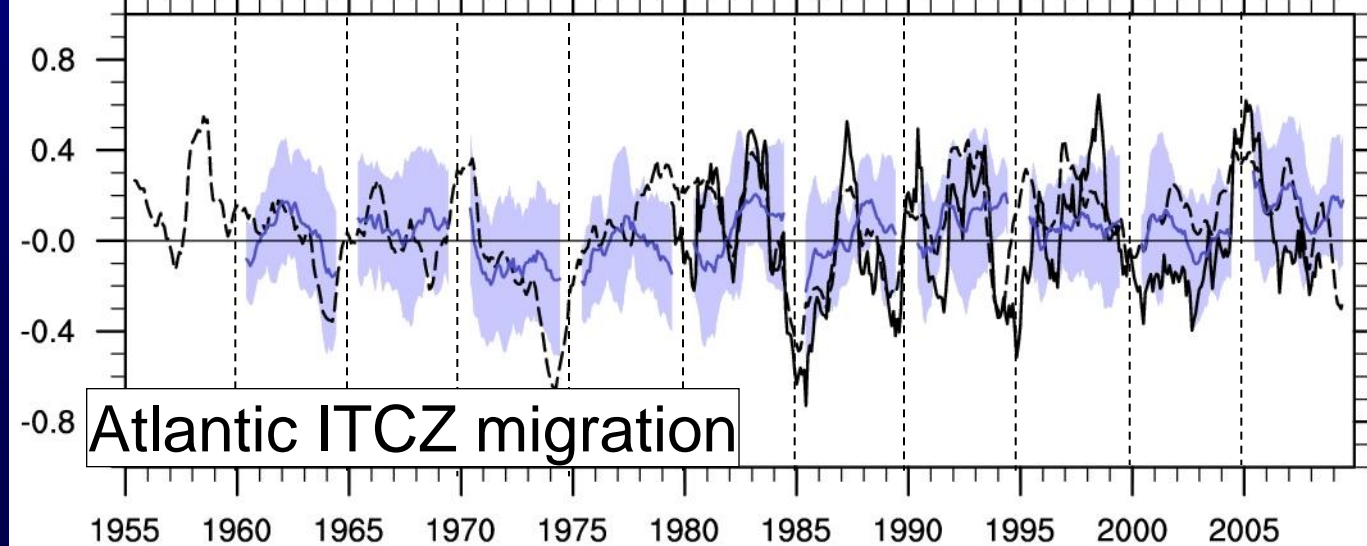
× 12-month running mean

Rainfall variability is simulated by assimilating the oceanic observations

# Hindcast for the dipole index



12mo running mean



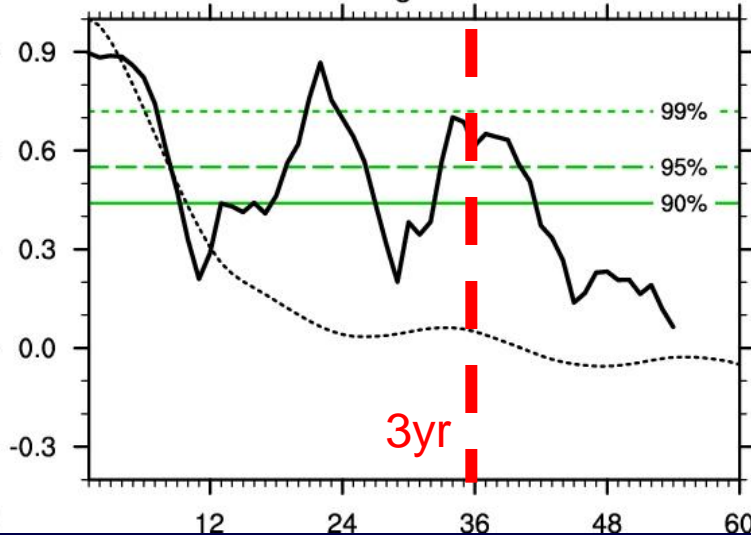
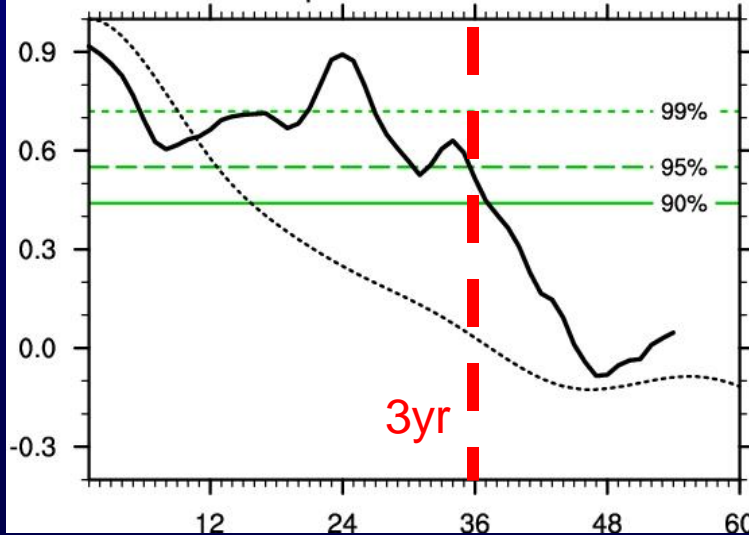
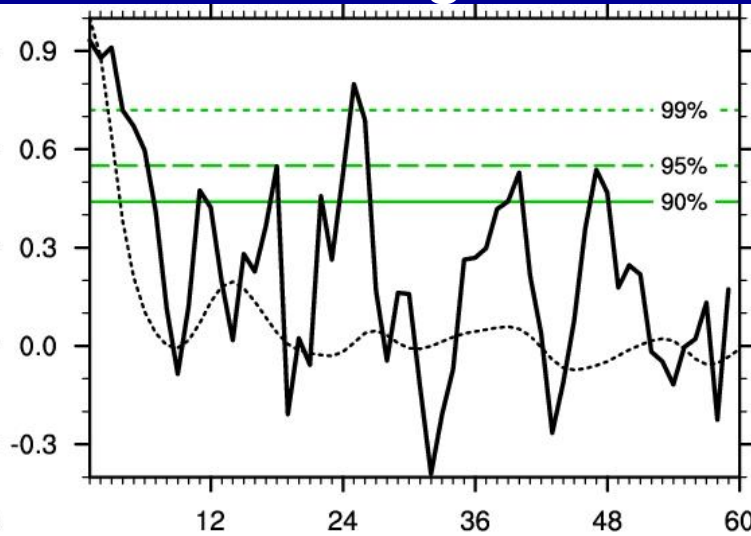
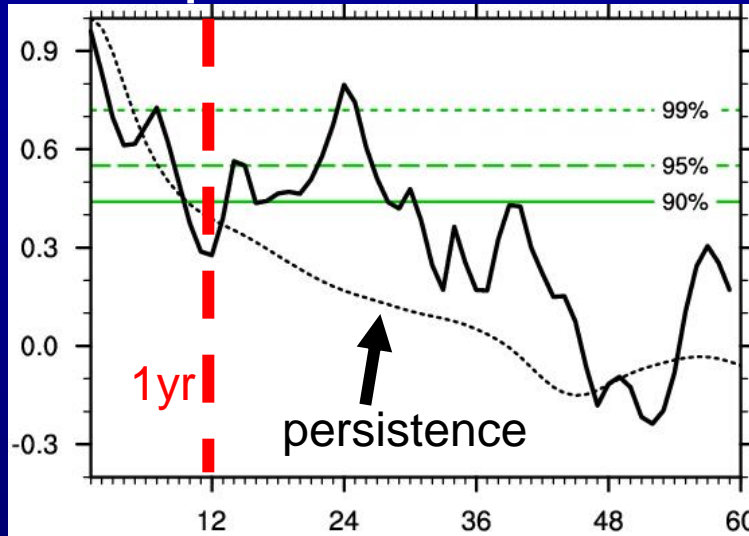
# Hindcast skill: ACC

## Dipole index

## ITCZ migration

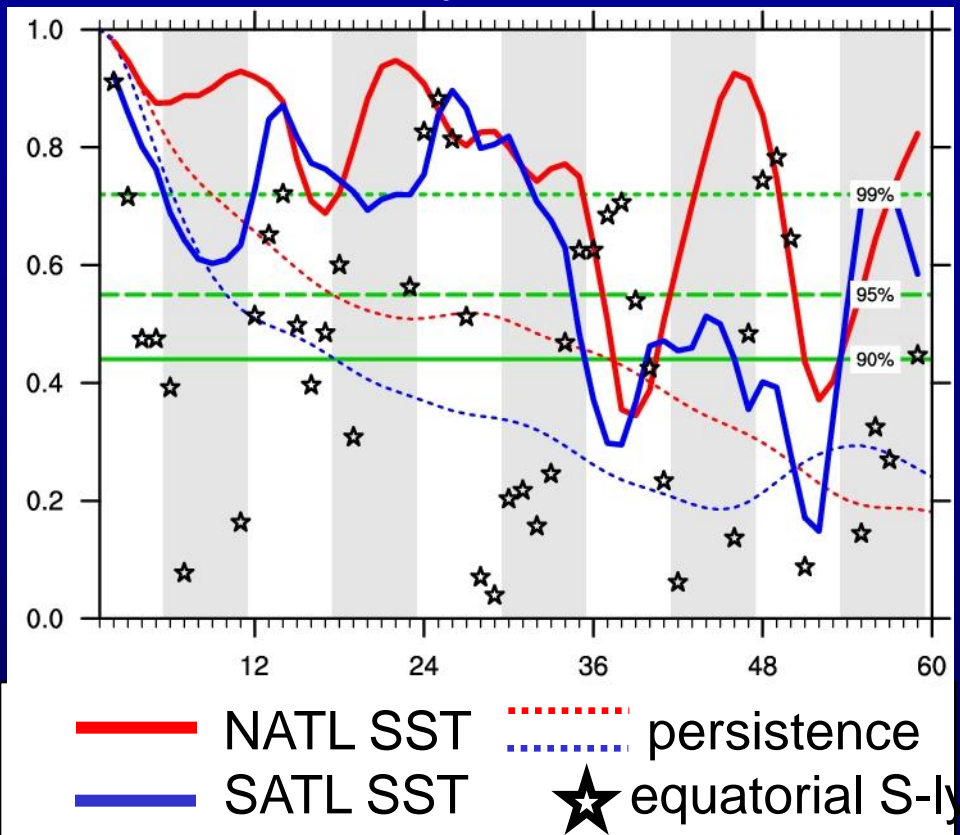
3mo  
running  
mean

12mo  
running  
mean

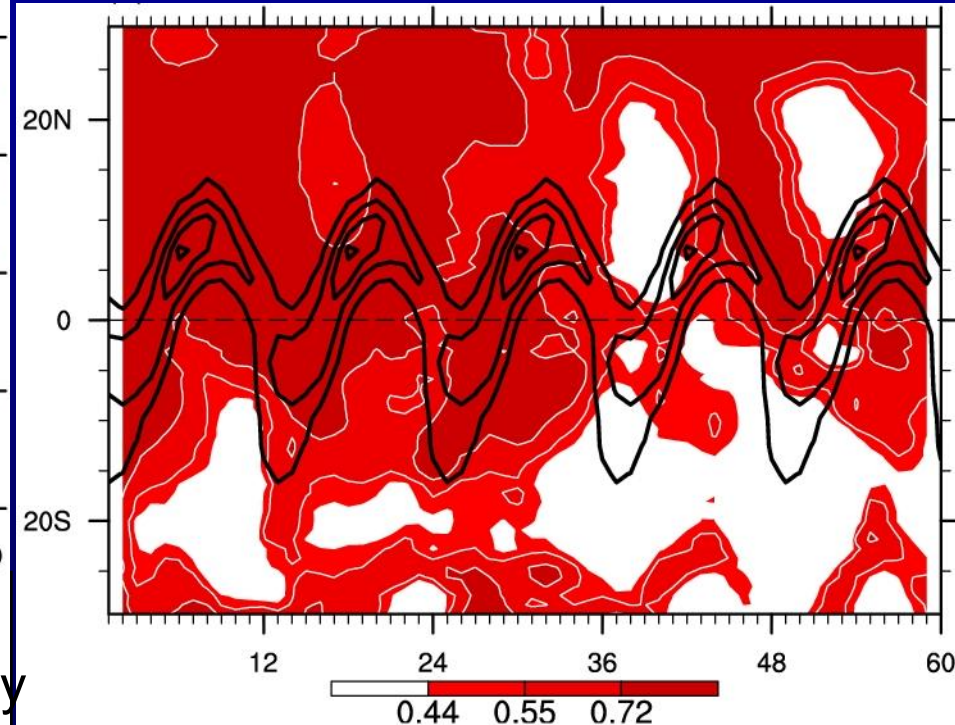


# Hindcast skill for NATL and SATL

## Anomaly Correlation

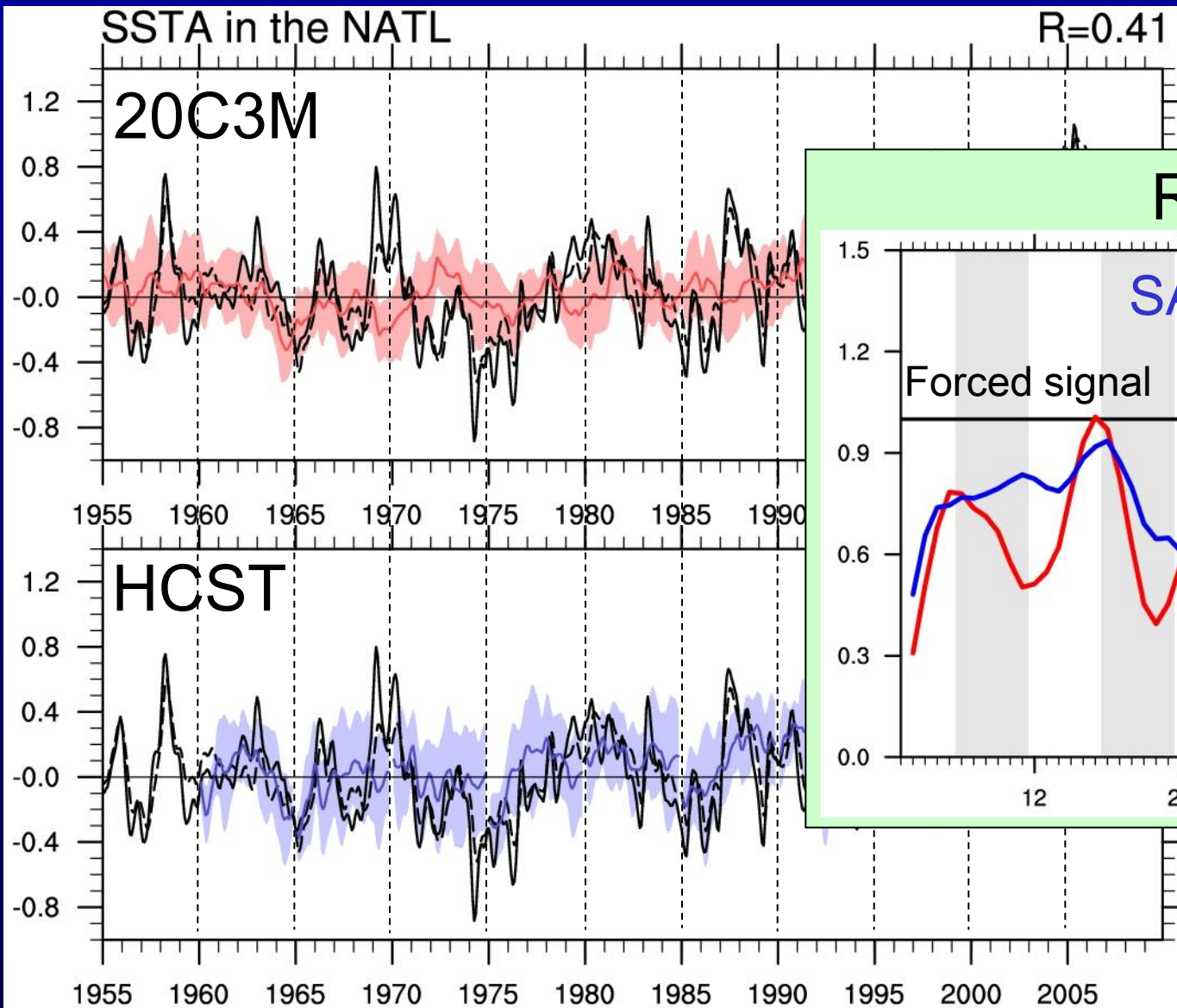


## Anomaly correlation for zonally averaged SST

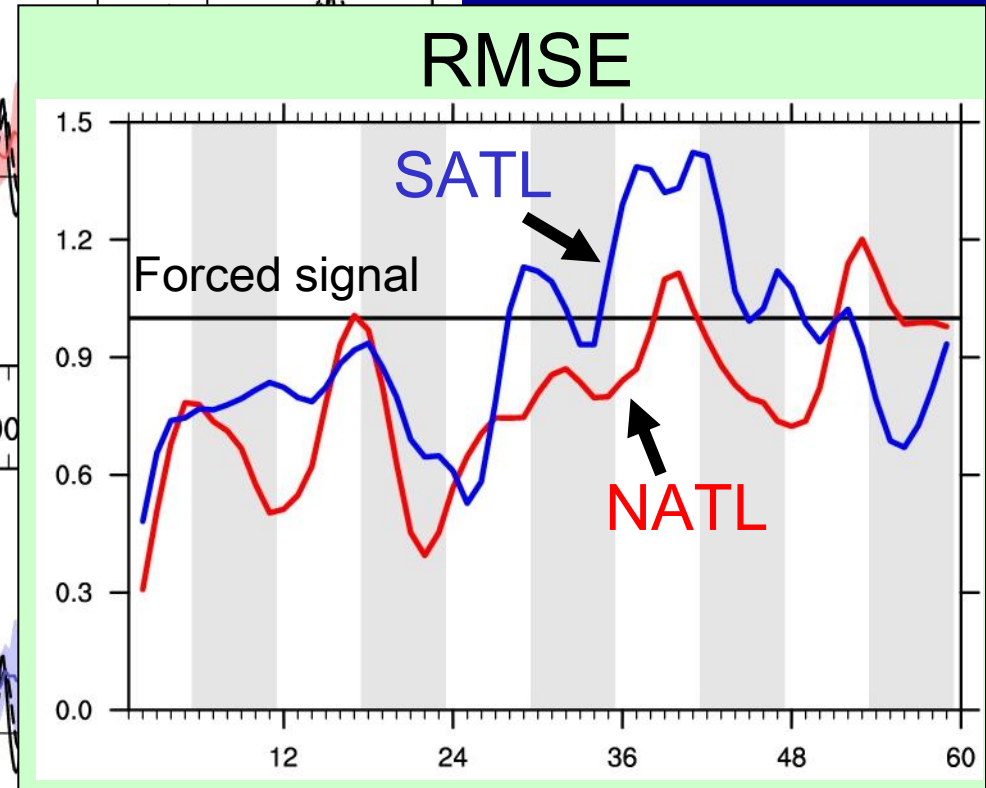


The loss of predictability for the interseasonal SST dipole variability is prevented by activating the WES feedback

# Warming signal: NATL SSTA

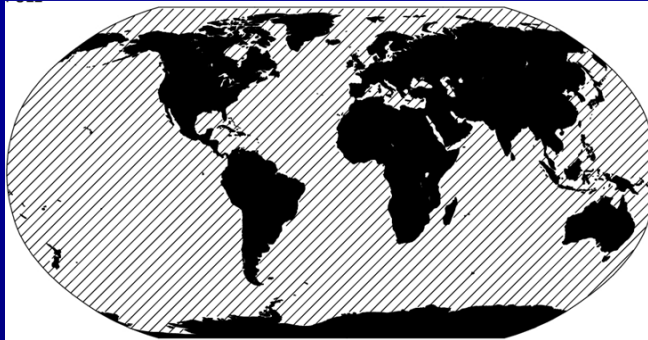


× 3 mo running mea

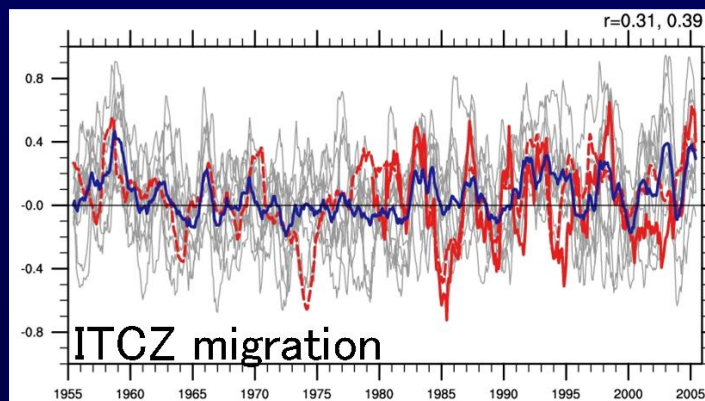
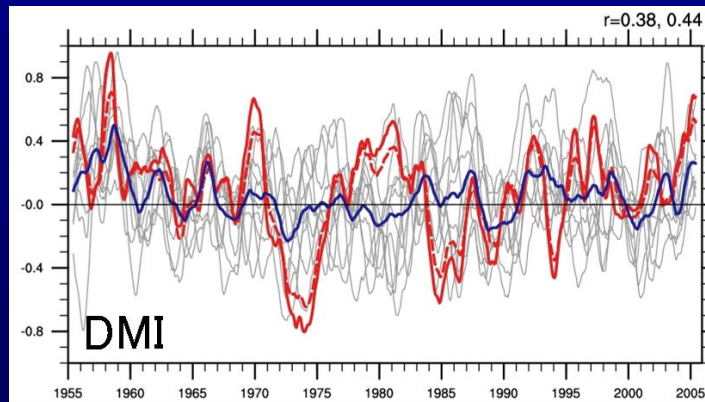
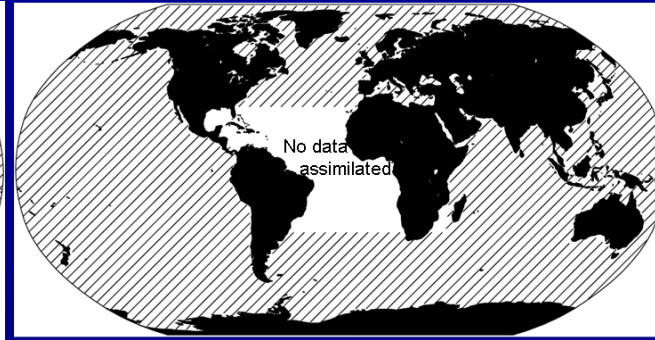


# External influences: an experiment

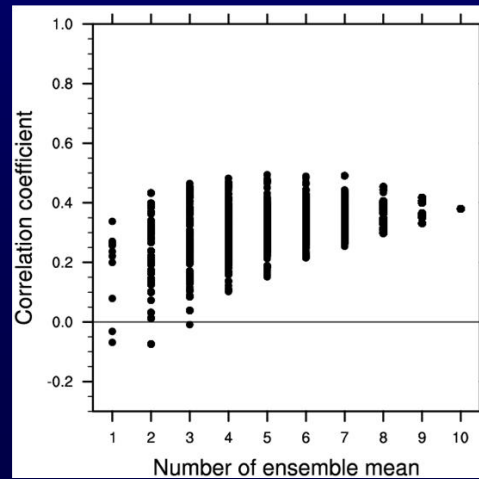
FULL



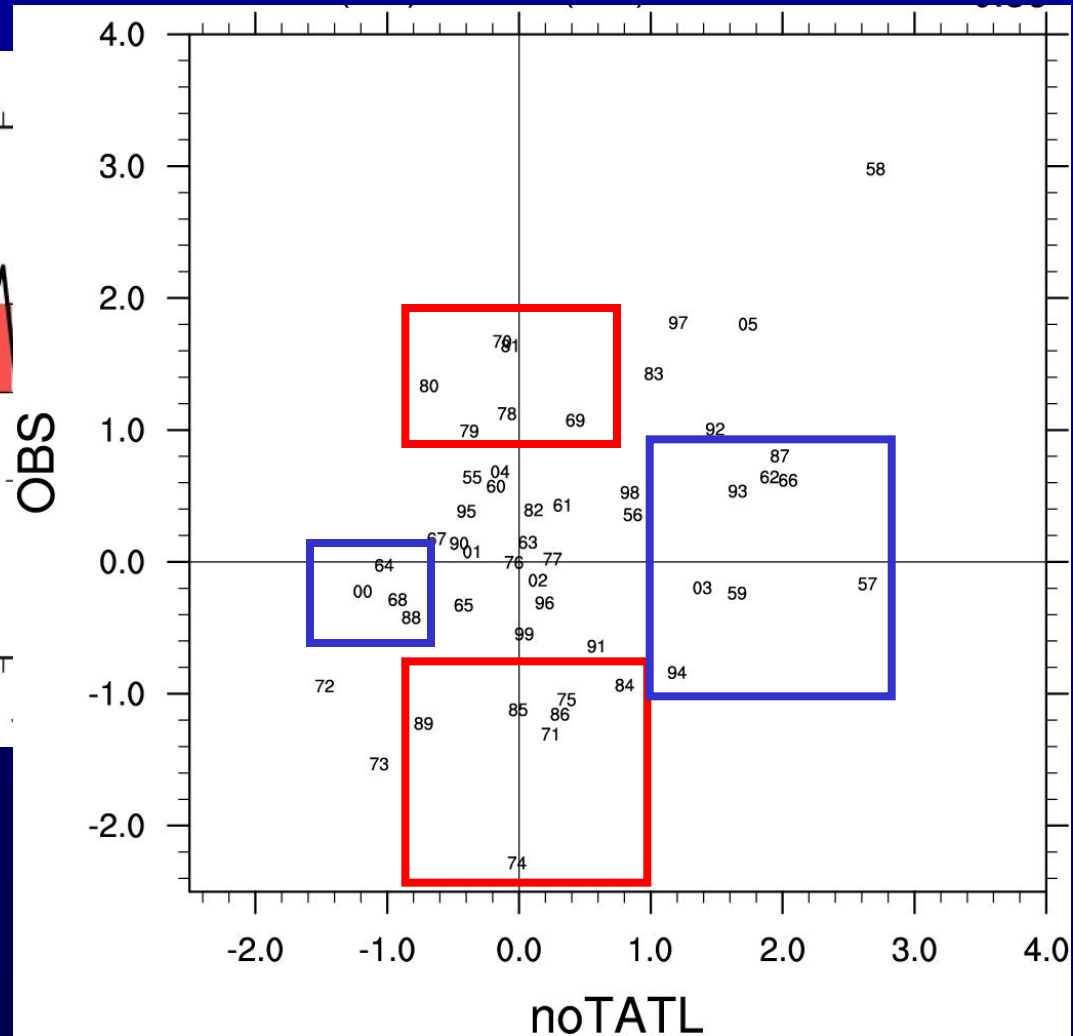
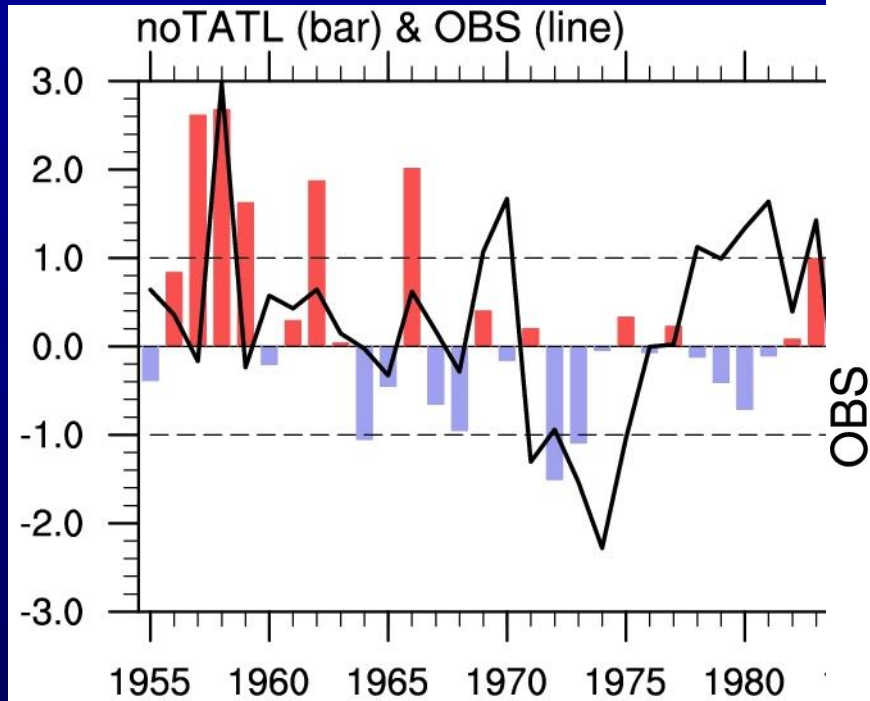
noTATL



DMI (OBS vs noTATL)



# Time series of DMI(AMJ)

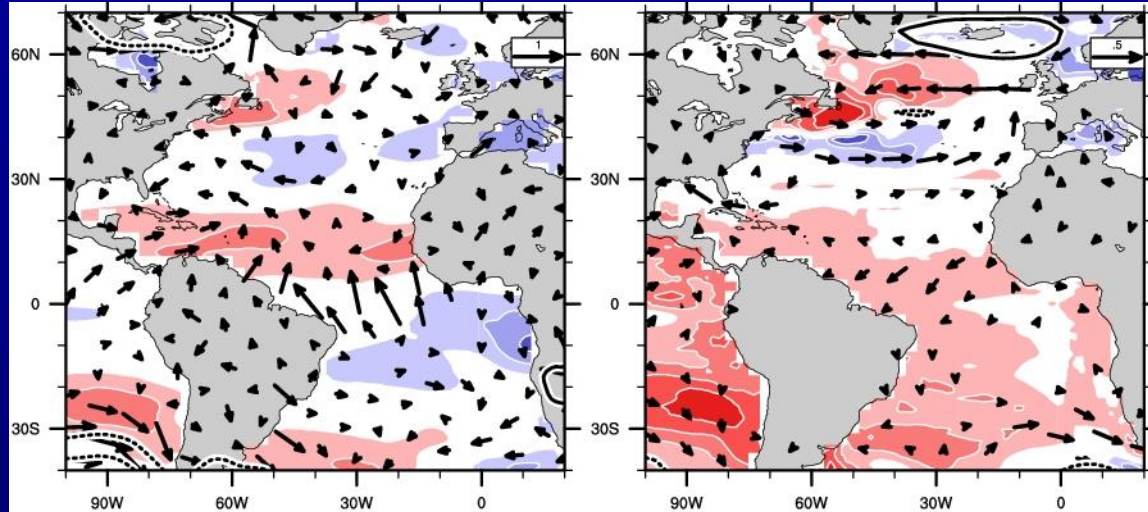


# Dipole: Observed, not simulated

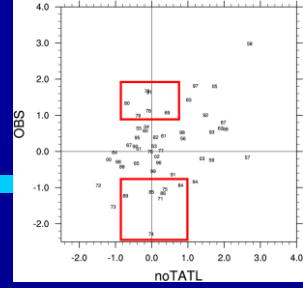
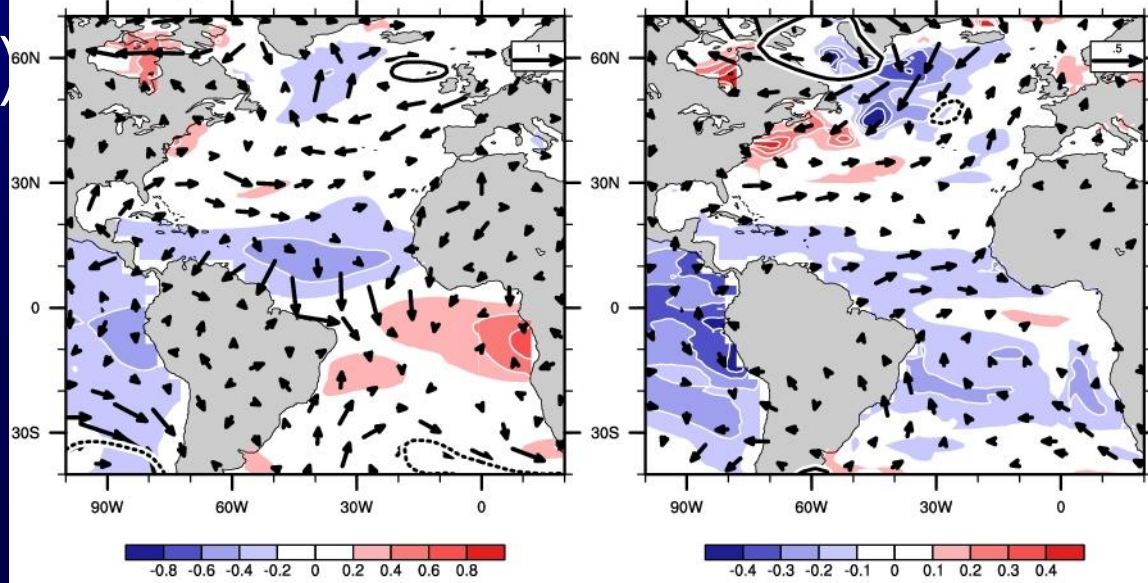
LAG: 0 mon (AMJ) OBS

noTATL

Positive(6)



Negative(7)



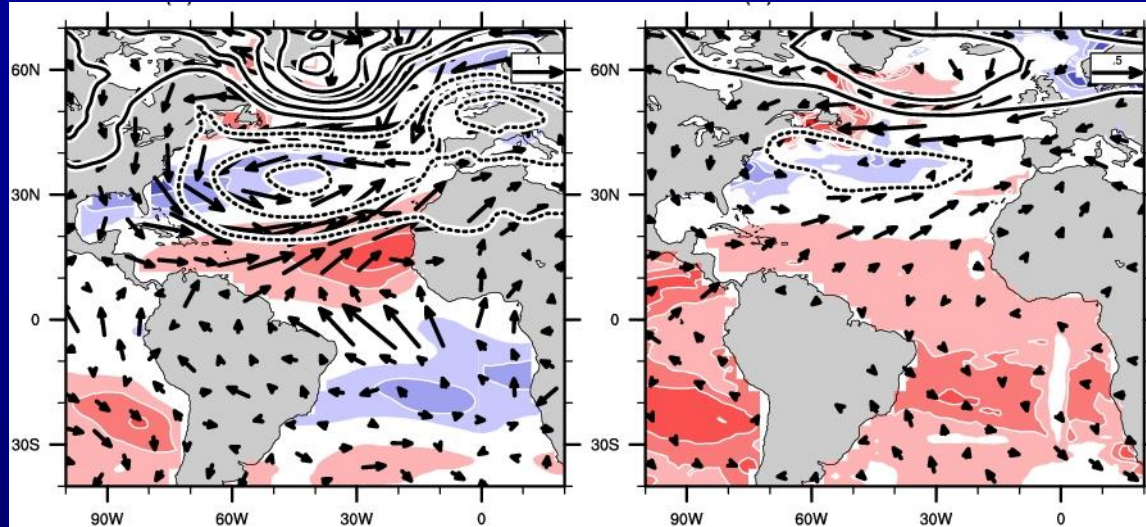
# Dipole: Observed, not simulated

LAG: -4 mo (DJF)

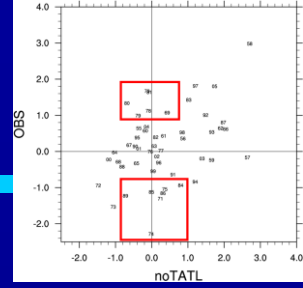
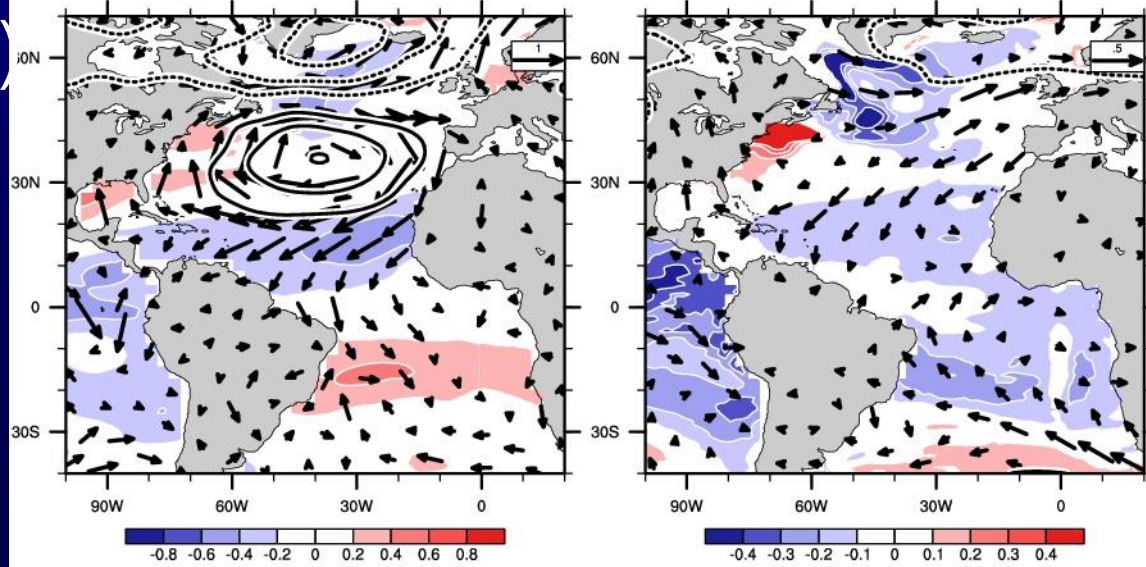
OBS

noTATL

Positive(6)



Negative(7)



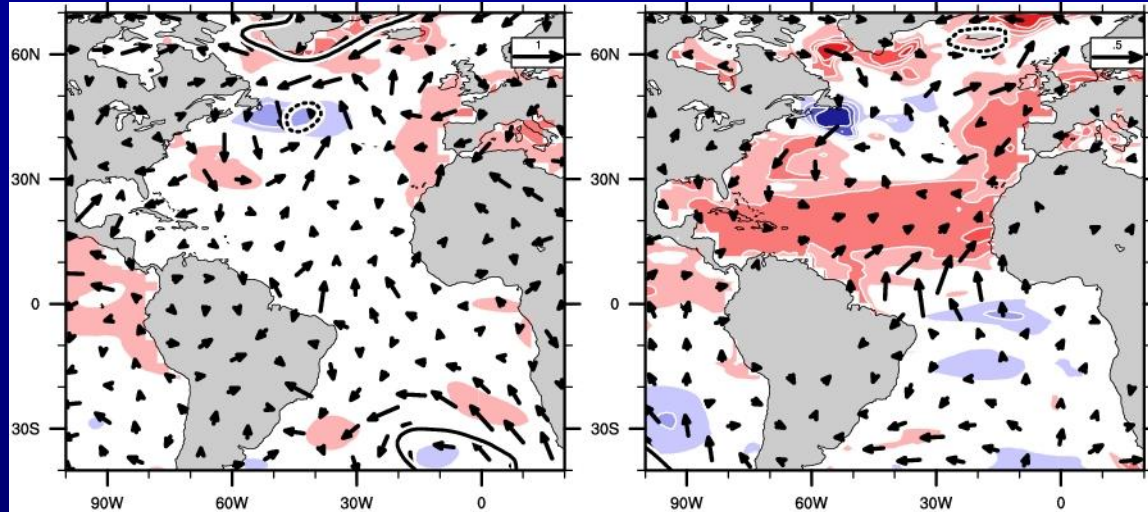
# Dipole: not observed, but simulated

LAG: 0 mo (AMJ)

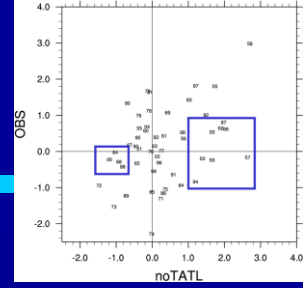
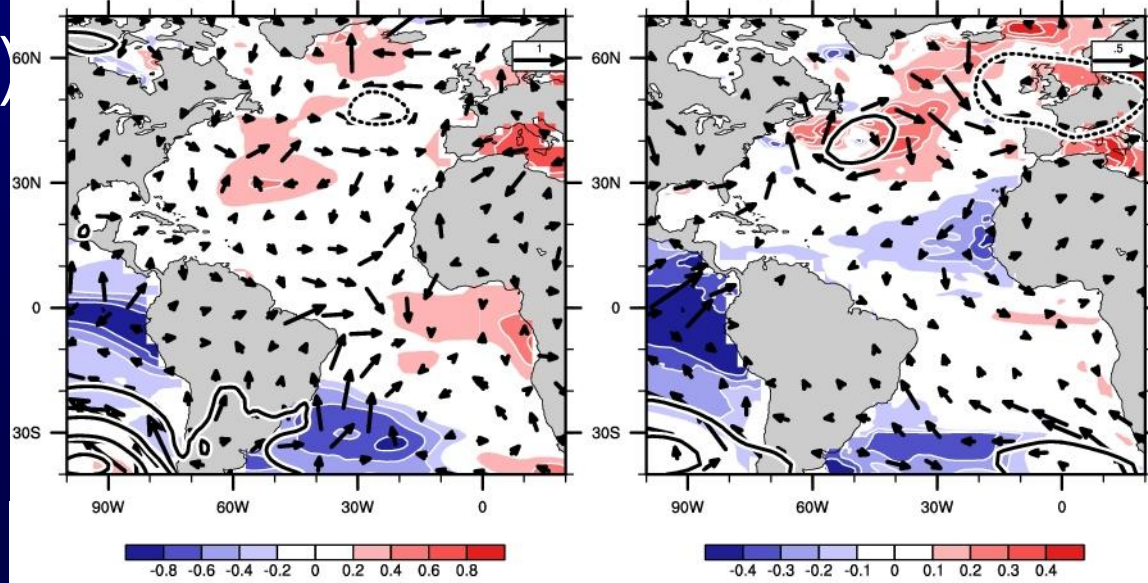
OBS

noTATL

Positive(6)



Negative(7)

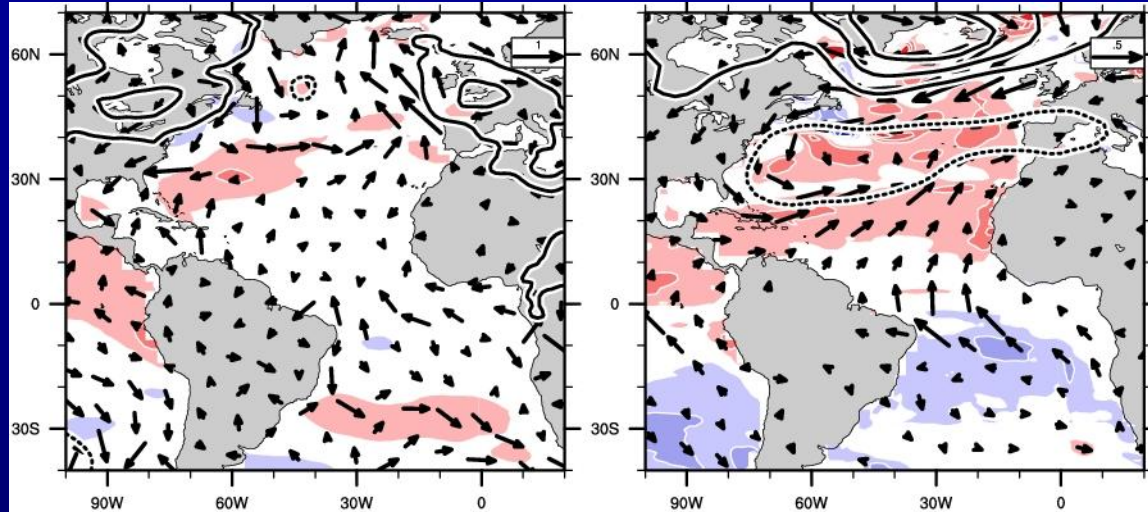


# Dipole: not observed, but simulated

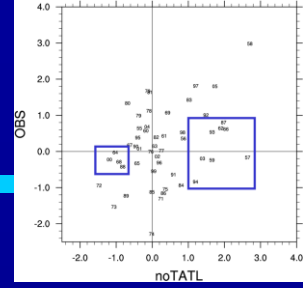
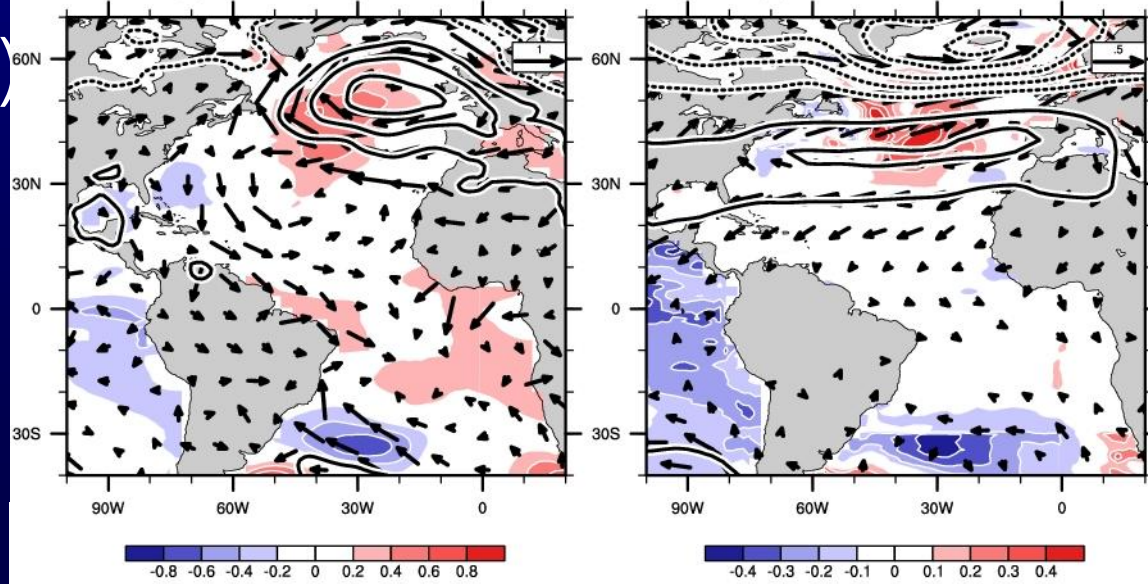
LAG: -4 mo (DJF) OBS

noTATL

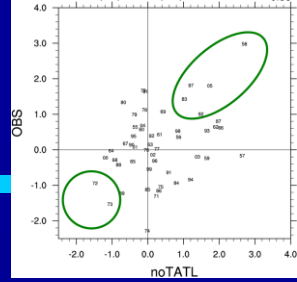
Positive(6)



Negative(7)



# Dipole: Observed AND simulated



Positive(4)

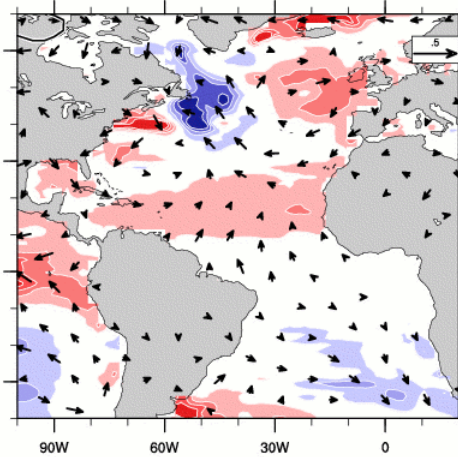
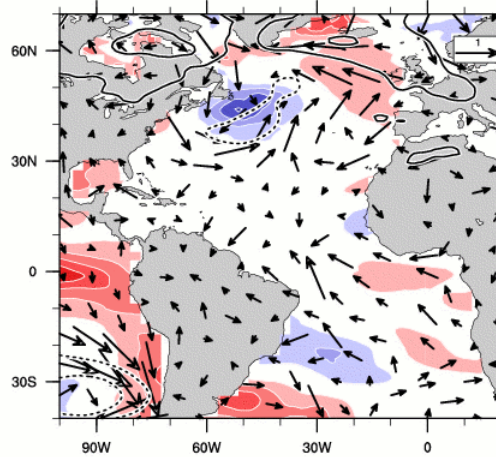
Composite DMI (AMJ) BOTH: -12 month LAG

OBS

noTATL

Positive (4)

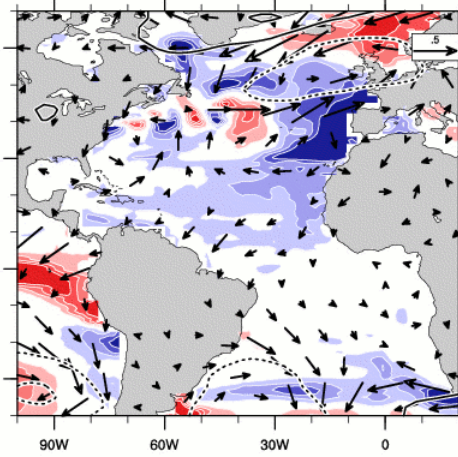
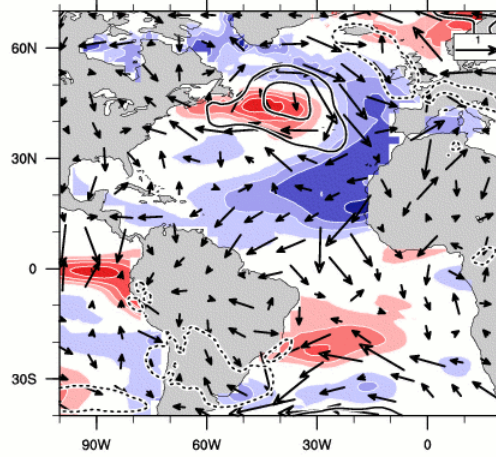
Positive (4)



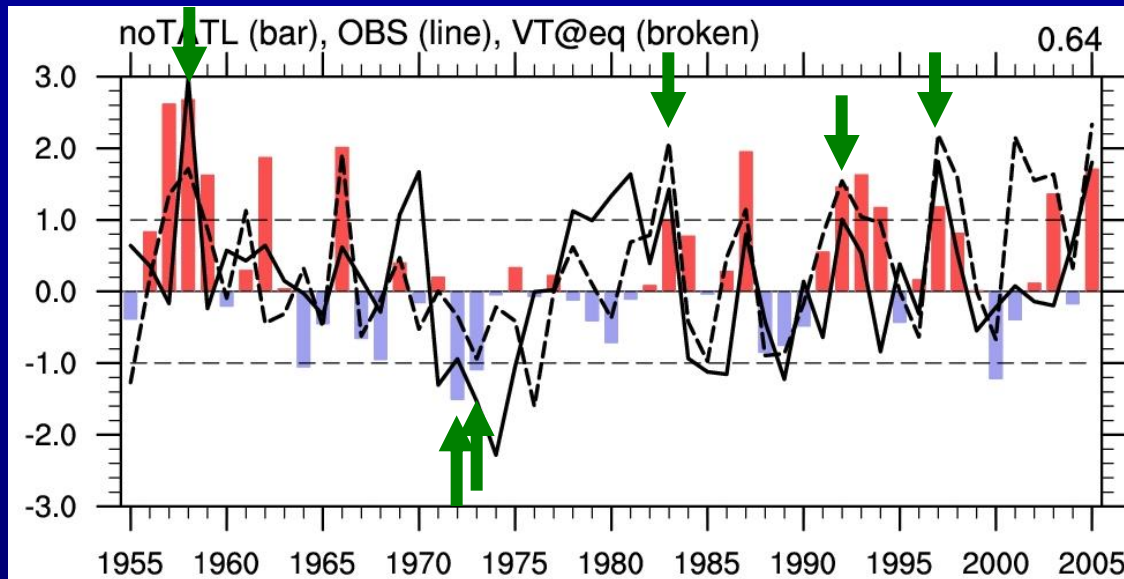
Negative(2)

Negative (2)

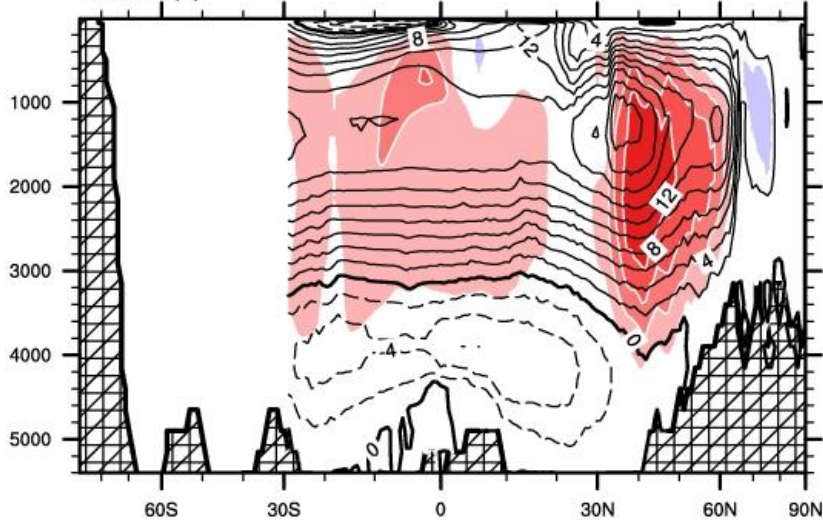
Negative (2)



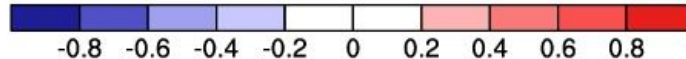
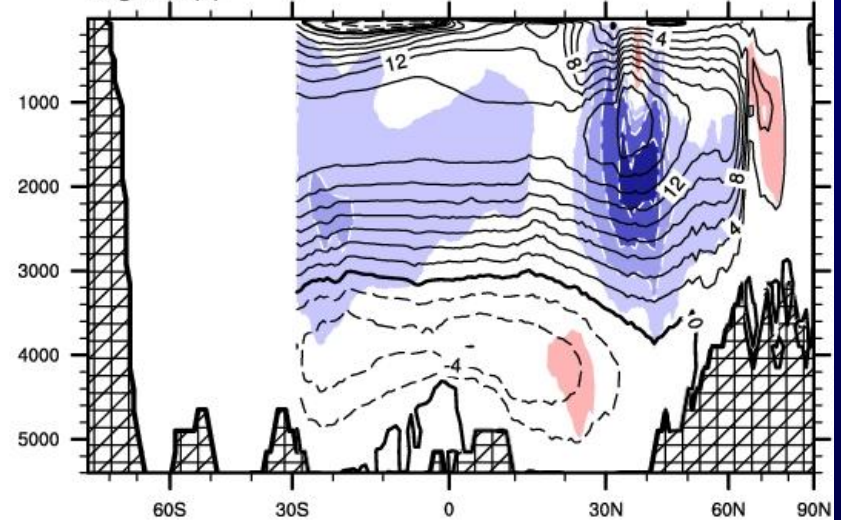
# Dipole mode and AMOC



Positive (4)



Negative (2)



# Summary

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- Multi-year predictability of tropical ATL SST dipole mode and associated shift of ITCZ is demonstrated.
- WES feedback appears to maintain interseasonal memory, but source of predictability has to be elaborated.
- ENSO, NAO, AMOC can trigger ATL dipole.

# Predicting Typhoon potential?

