Potential Sources of Oceanic Predictability

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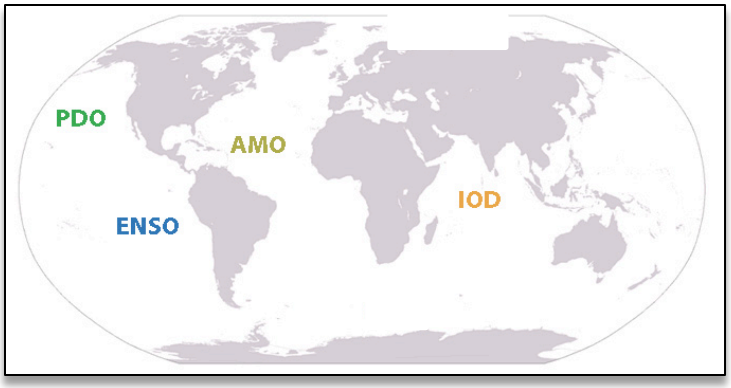
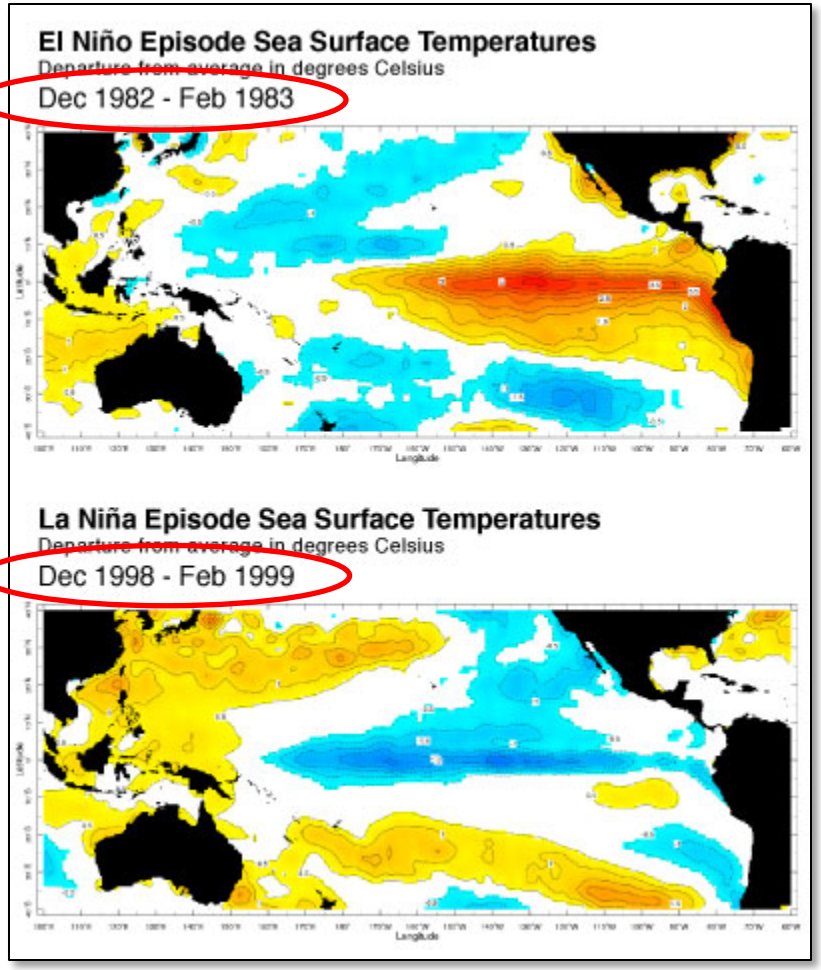
Oceanic variability on different time-scales

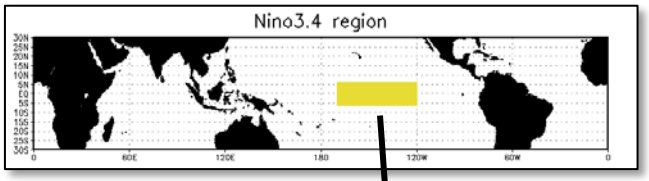
- Tidal
- Weekly
  - Mesoscale eddies
  - Tropical instability waves
- Seasonal-to-interannual
  - El Niño–Southern Oscillation (ENSO)
  - Indian Ocean Dipole (IOD)
- Decadal
  - Pacific Decadal Oscillation (PDO)/Inderdecadal Pacific Oscillation (IPO)
  - Atlantic Multi-decadal Oscillation (AMO)
- Centennial
  - Thermohaline
  - Trends due changes in external forcings

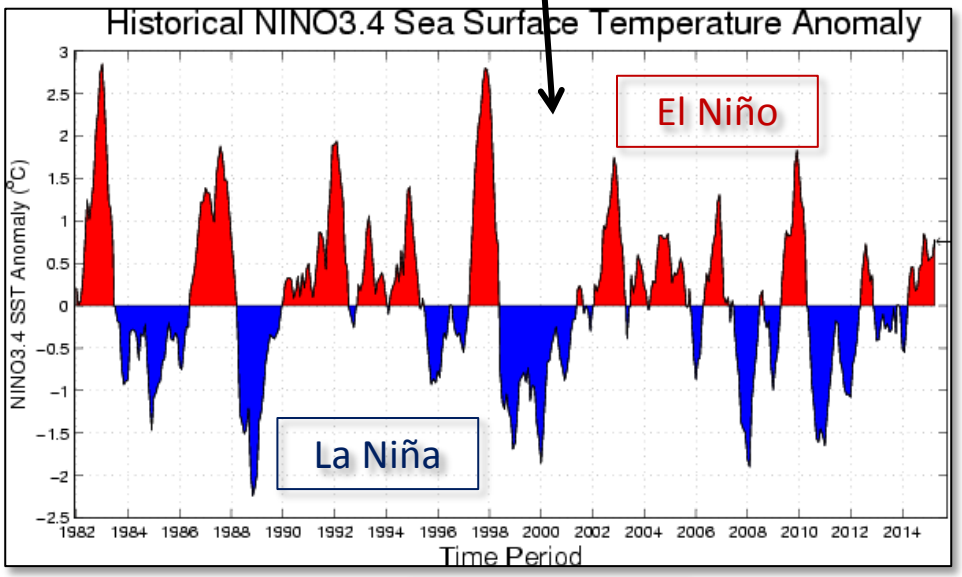


Seasonal-to-Interannual - ENSO



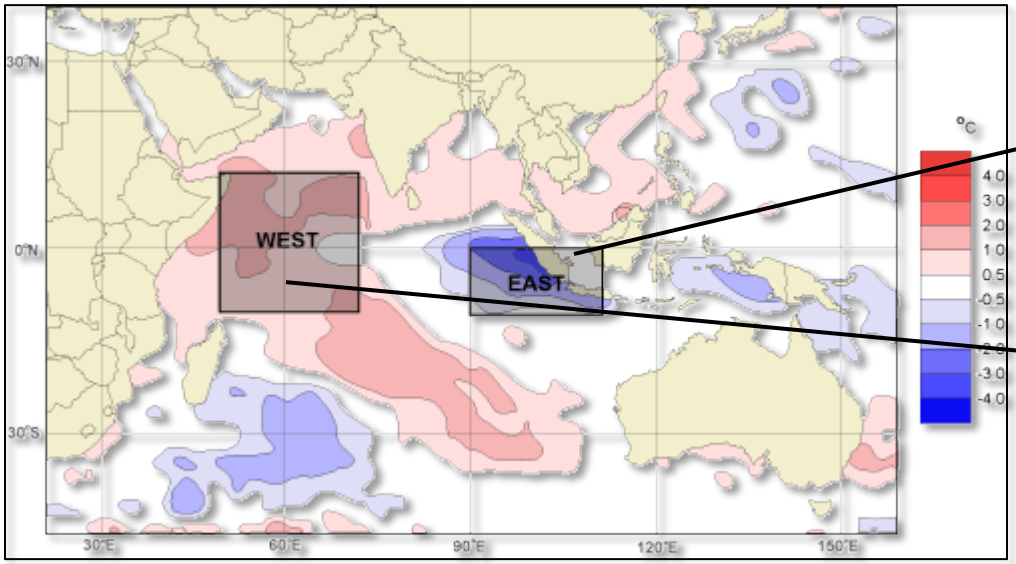
Sea Surface Temperature Anomaly



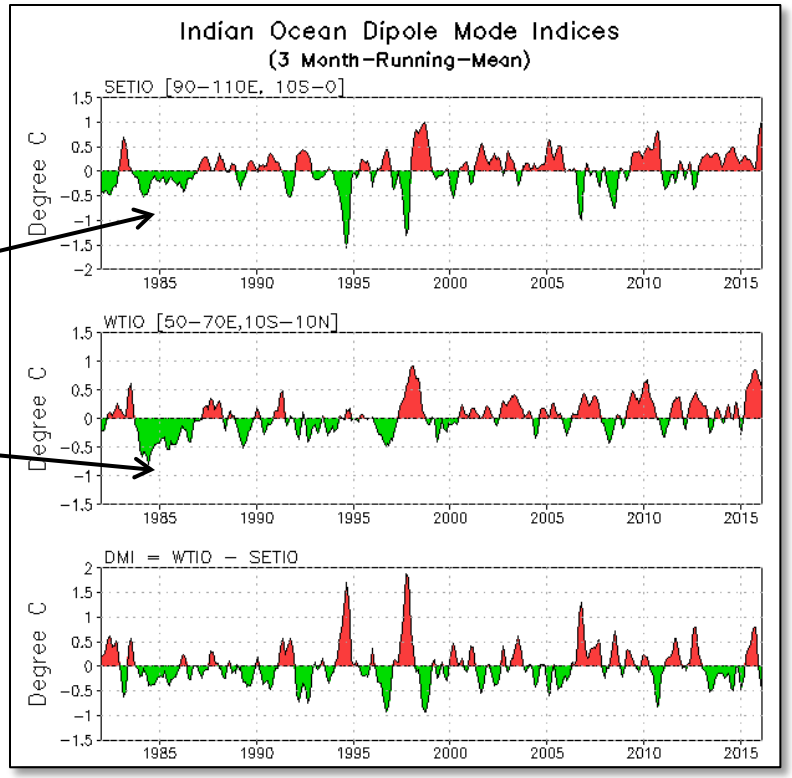


ENSO Index

Seasonal-to-Interannual - IOD

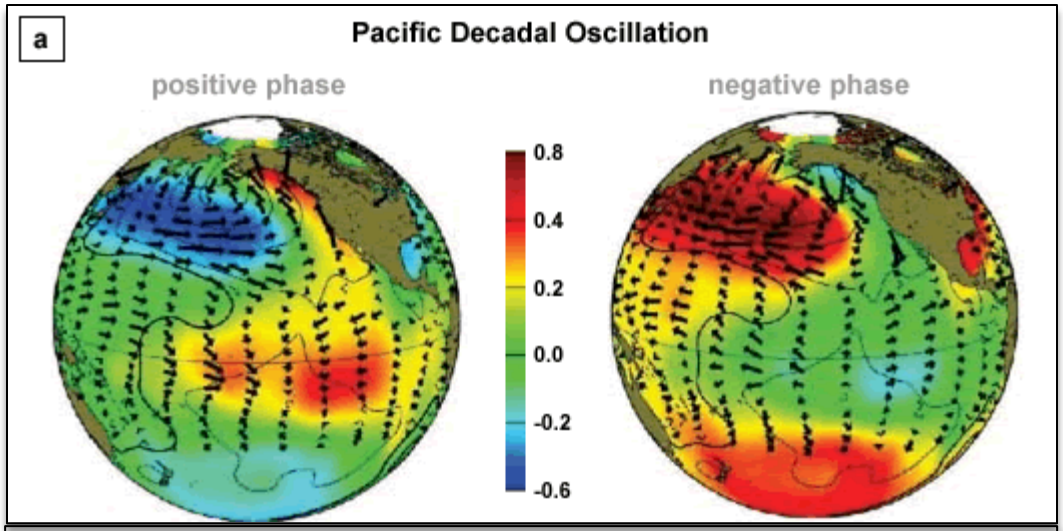


Sea Surface Temperature Anomaly
November 1997

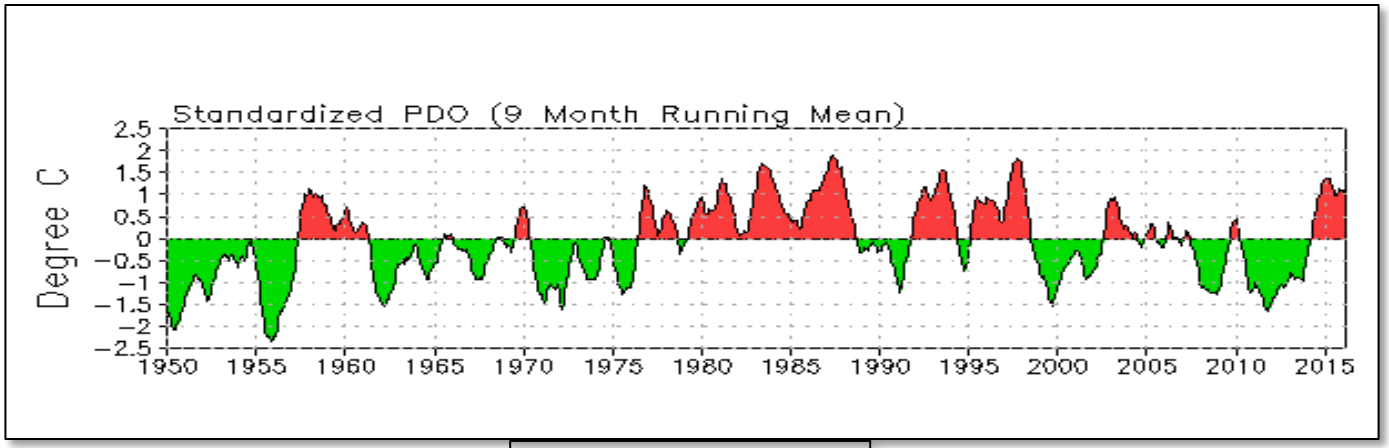


IOD Indices

Decadal - PDO



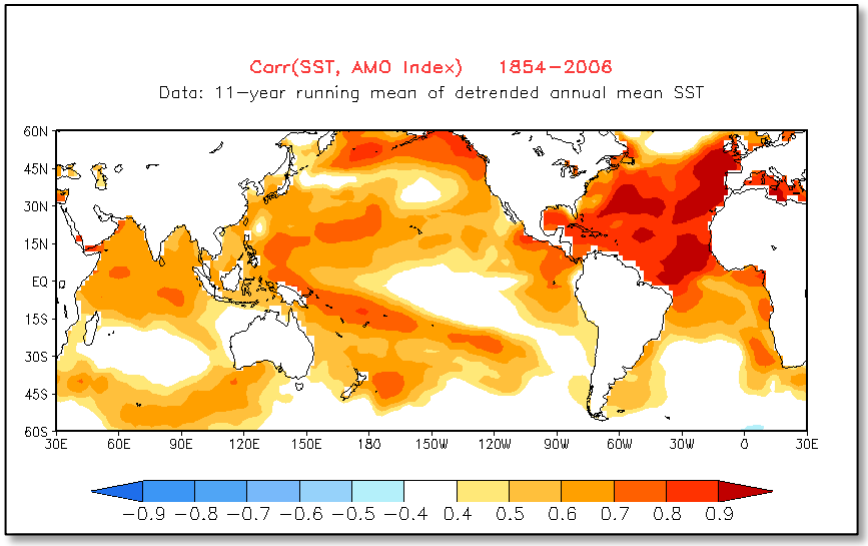
Sea Surface Temperature Anomaly (shading)



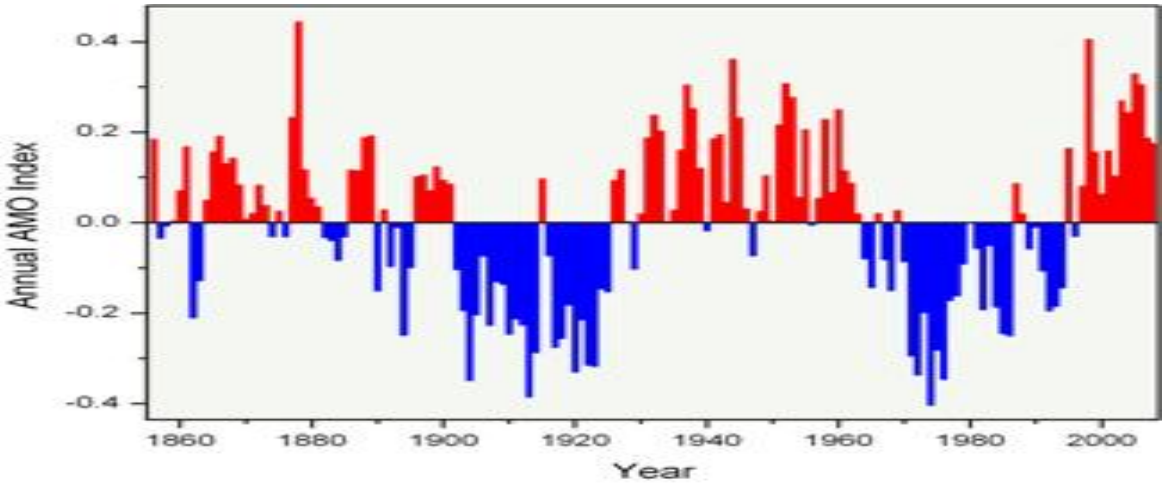
PDO Index

Decadal - AMO

Sea Surface Temperature Anomaly



AMO Index



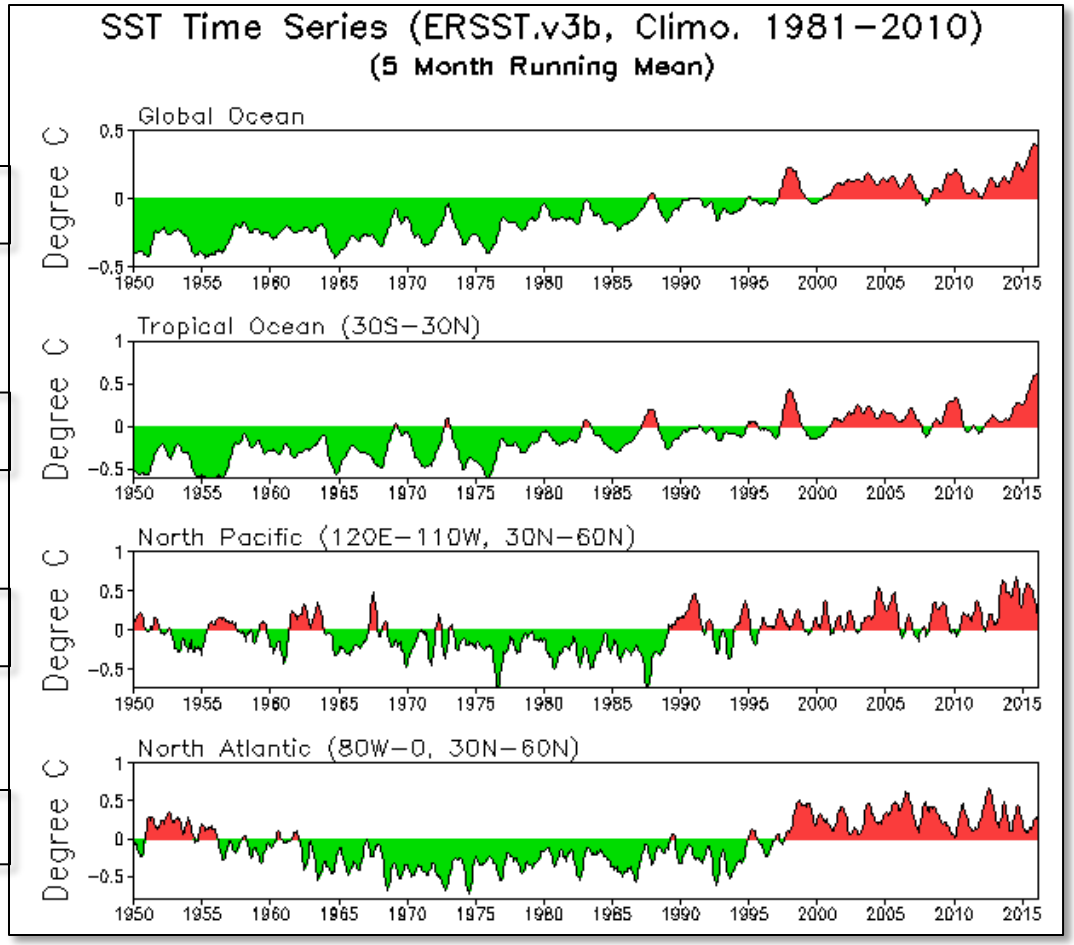
Centennial

Global

Tropics

N. Pacific

N. Atlantic



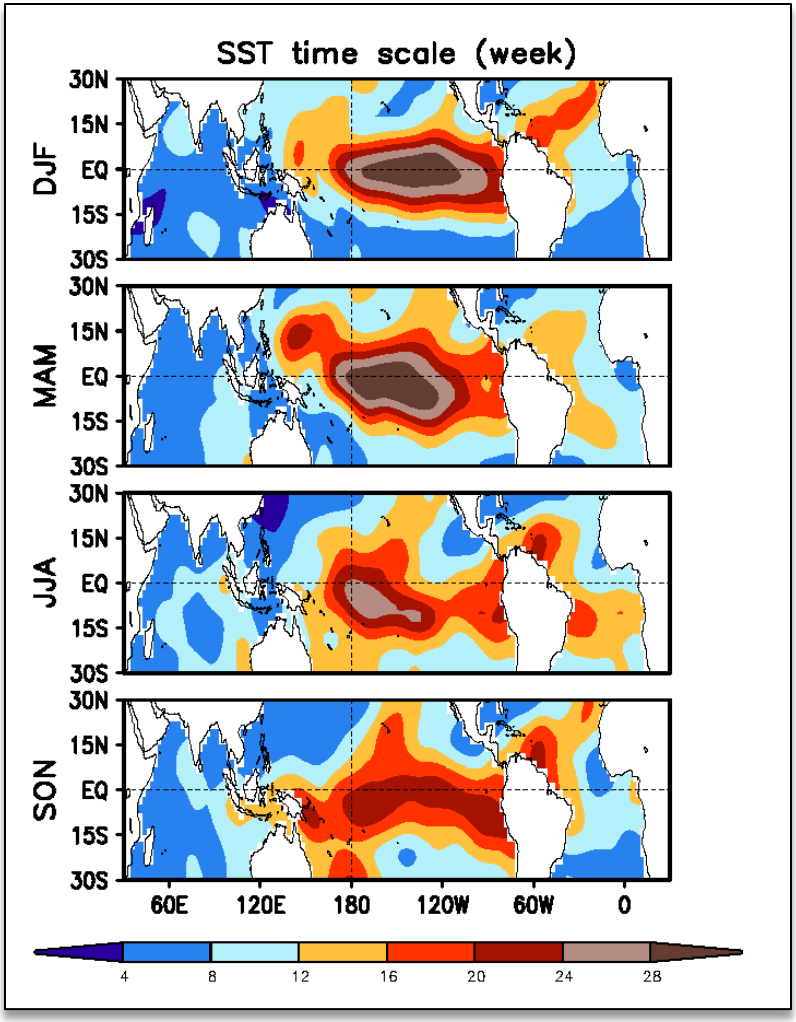
Sea Surface Temperature
(basin averages)

Predictability

- Predictability: From the knowledge of the current state of the ocean, our ability to anticipate its future evolution → Prediction skill

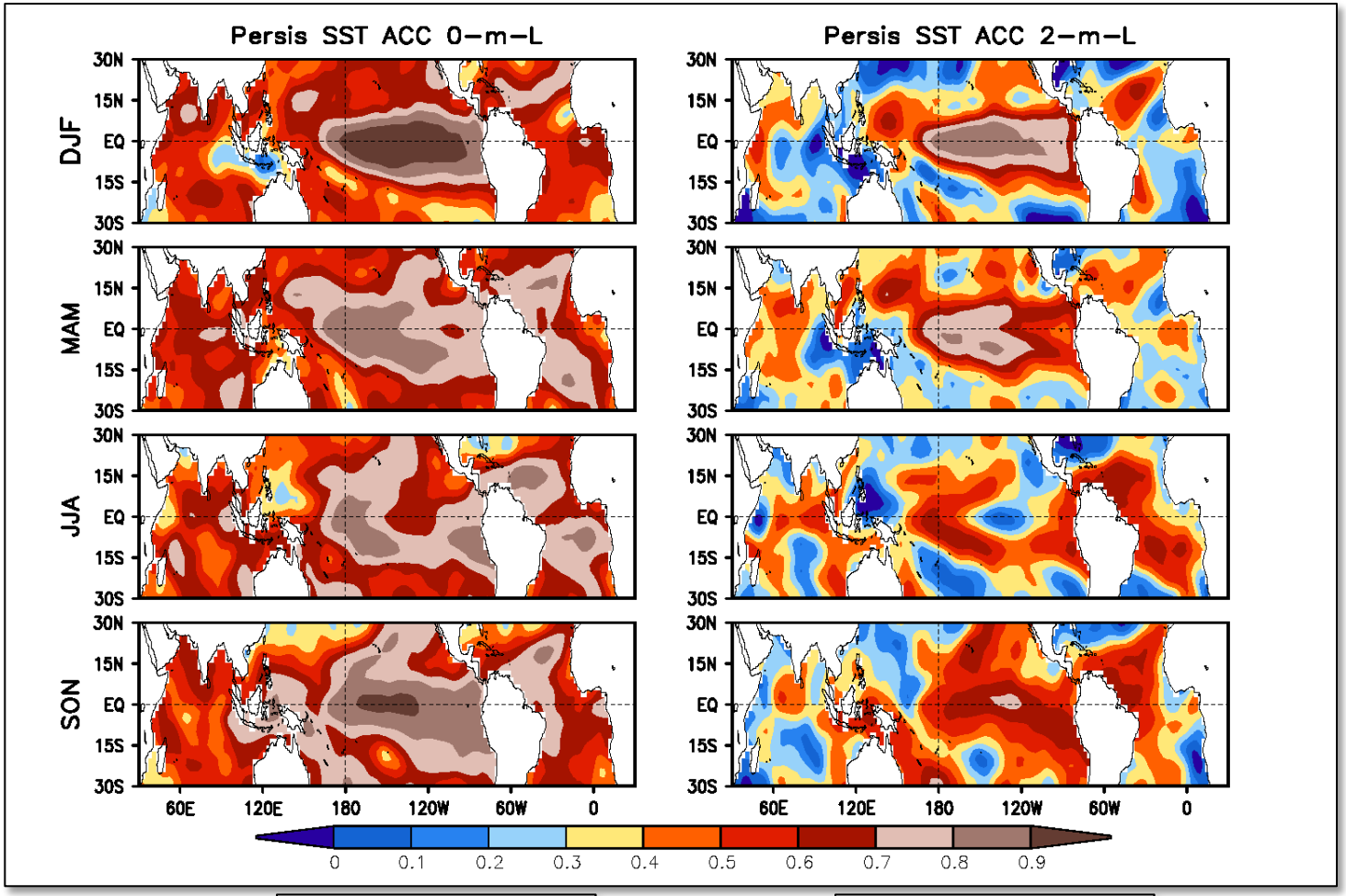
- Sources of predictability
  - Persistence of anomalies
  - Horizontal propagation of anomalies (Ocean dynamics: e.g., propagation of oceanic waves; advection;…)
  - Coupled air-sea interactions
  - Oceanic teleconnections (via atmospheric bridge)

Persistence time-scale



Time-scale in weeks when autocorrelation drops to 0.5

Prediction skill due to persistence

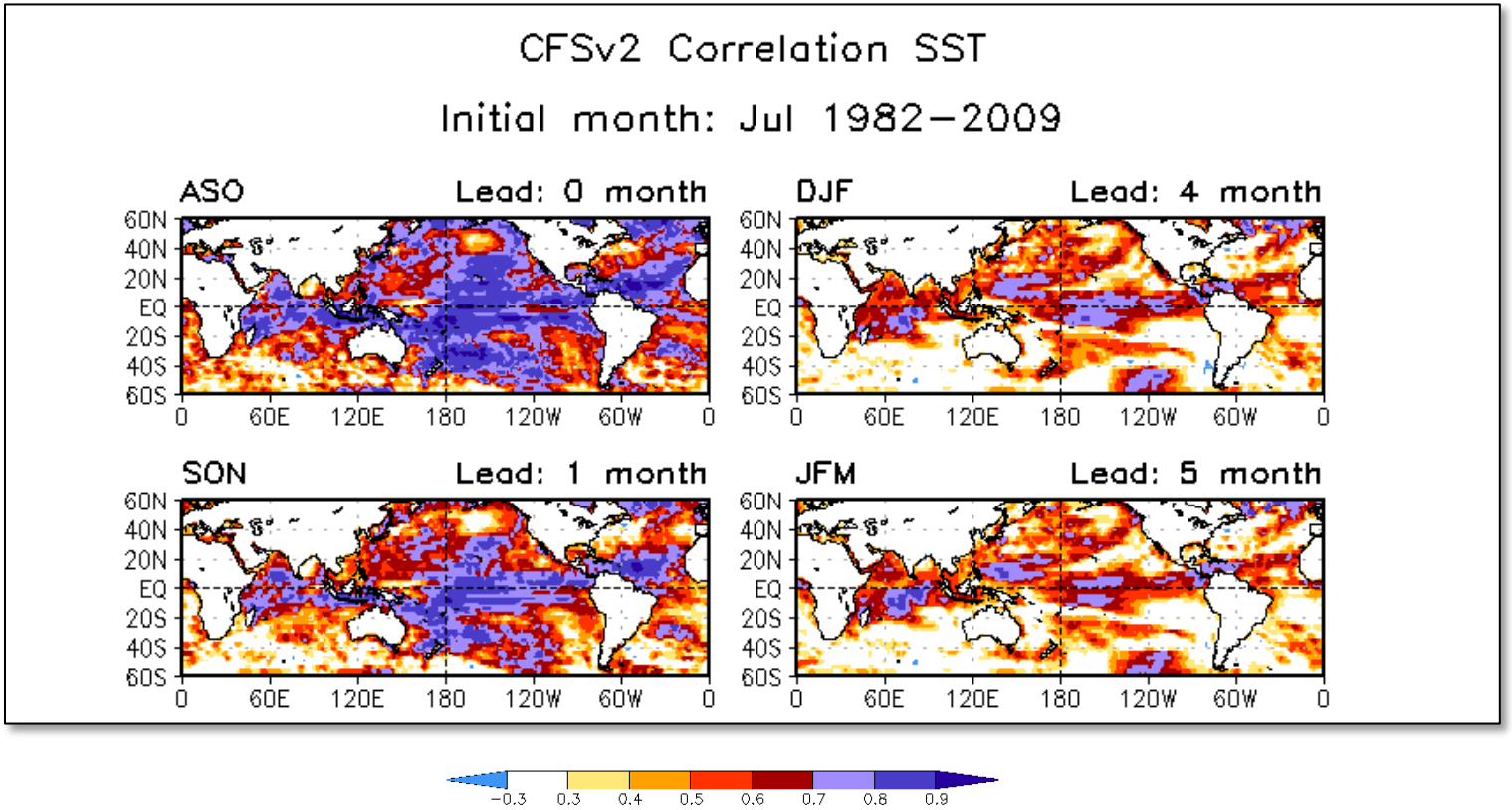


0-month lead

2-month lead

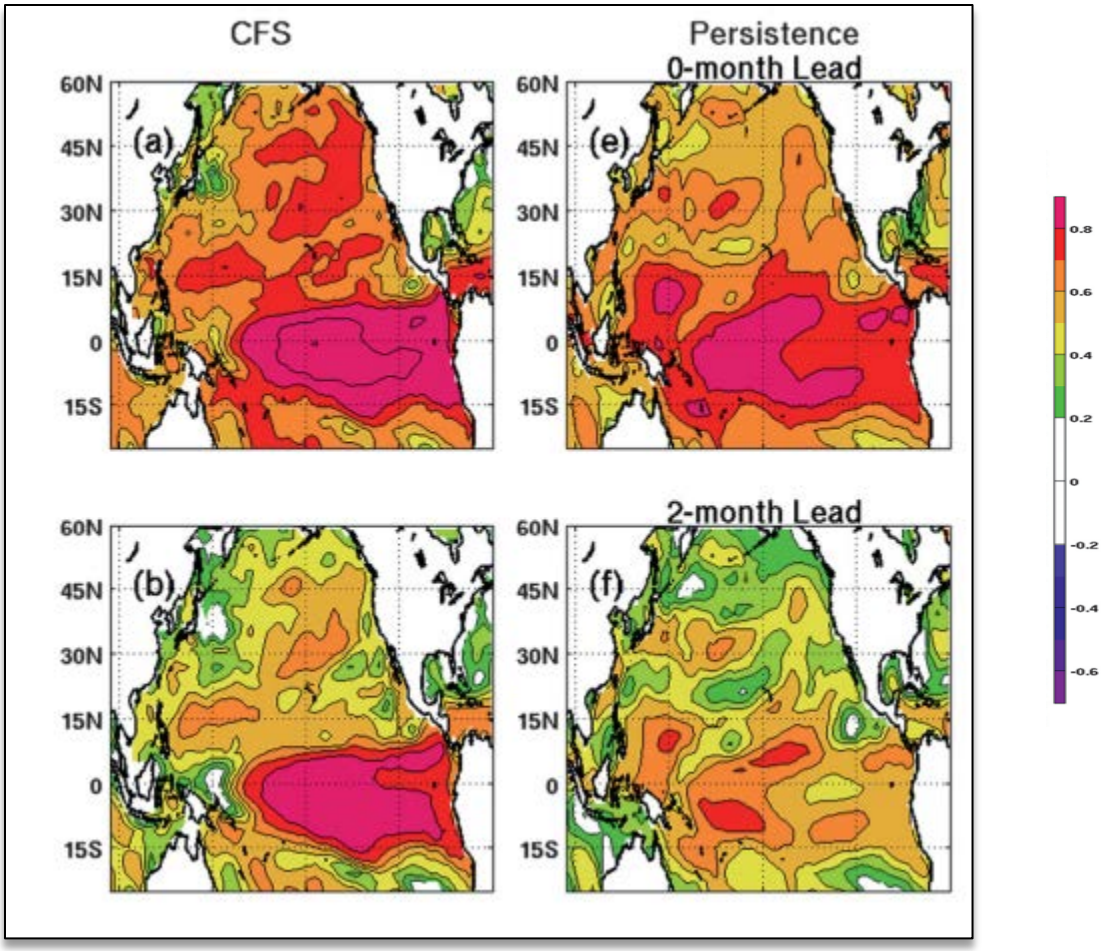
Skill in predicting monthly mean SSTs based on persistence of initial anomalies

Prediction skill using initialized dynamical models
Seasonal



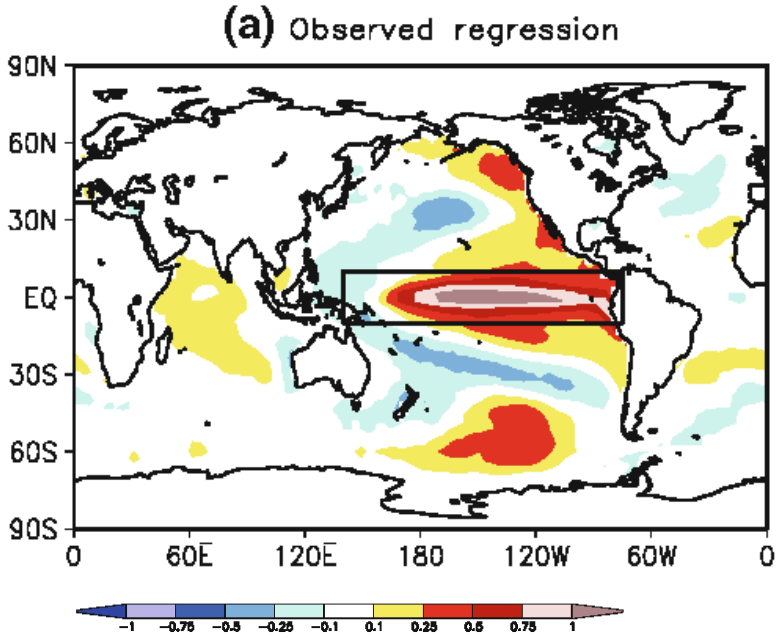
Skill in predicting seasonal mean SSTs
Source: Persistence + Ocean Dynamics + Coupled interactions

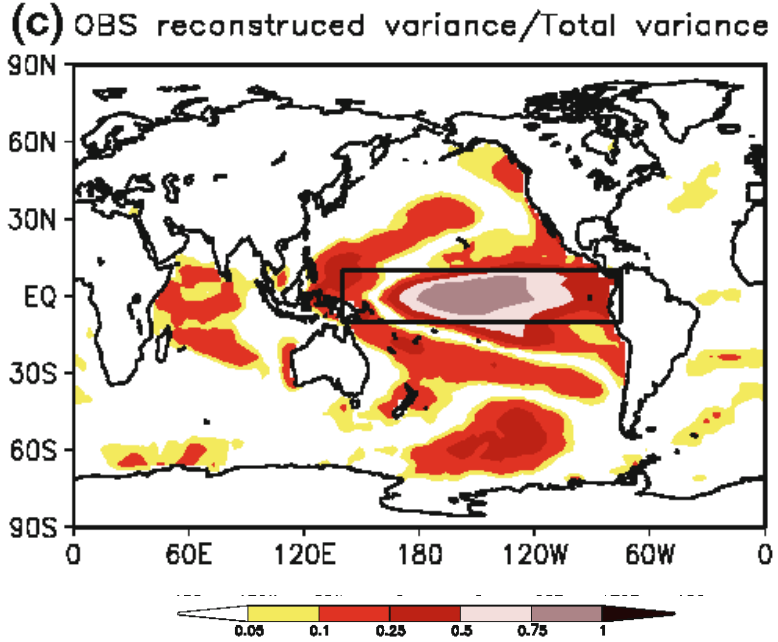
Prediction skill using initialized dynamical models
Seasonal



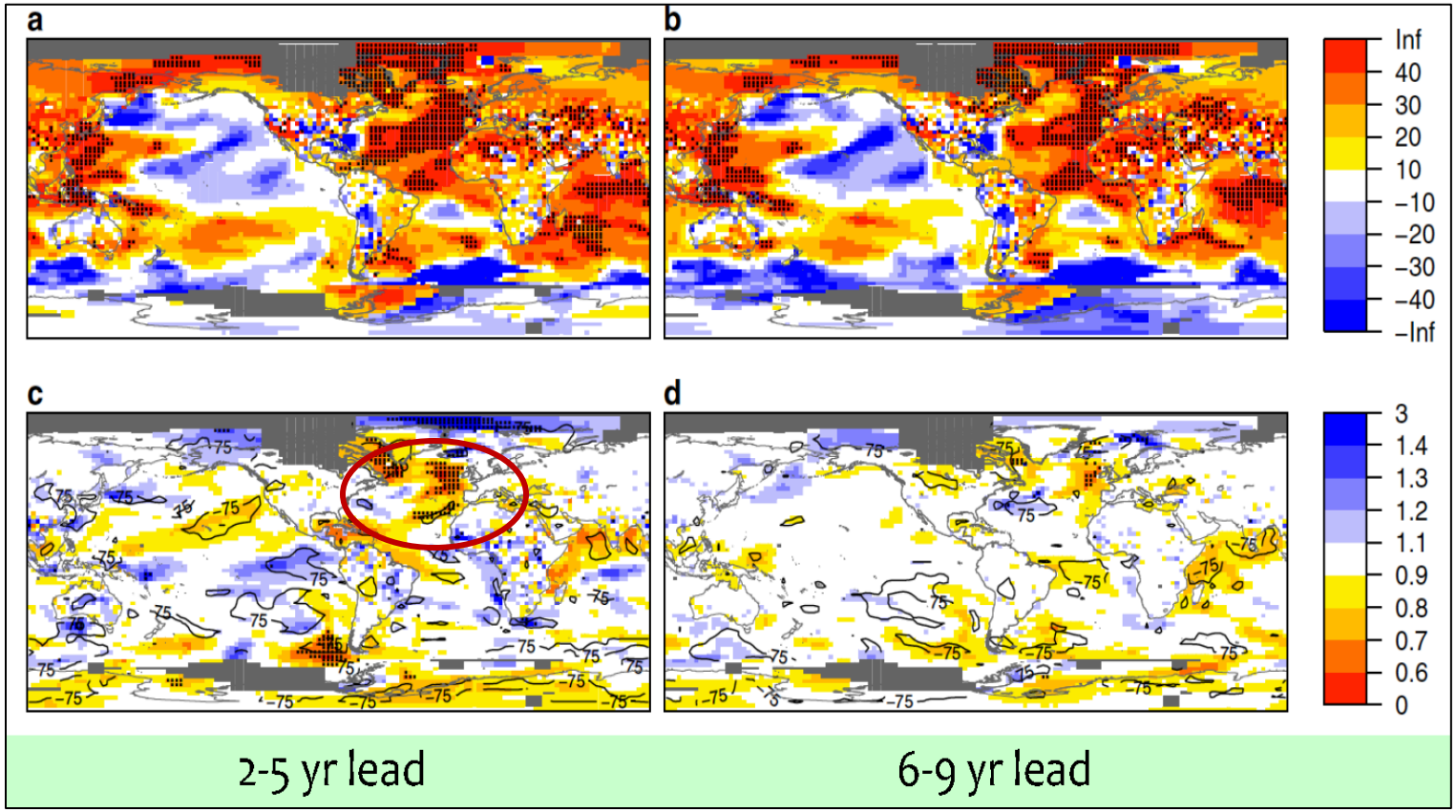
Gain in skill beyond persistence

Predictability due to oceanic teleconnections (mediated via atmospheric bridge)





Prediction skill using initialized dynamical models
Decadal



Skill

Additional skill due to ocean initialization

Doblas-Reyes et al. (2013, Nature Comm.)

Summary

- Oceanic variability exists on various time-scales

- There are various sources of oceanic predictability (persistence, ocean dynamics, couple air-sea interaction etc.) that allow us to anticipate the future evolution of the current state of ocean anomalies

- There is demonstrable skill in prediction oceanic anomalies on various time-scales, however, skill has regional variations