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Seasonal to Decadal Prediction at MRI

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Seasonal and Decadal Prediction Systems

Seasonal Prediction System (JMA/MRI-CGCM3)

- JMA operational seasonal forecast system
- developed at MRI and JMA/CPD (Climate Prediction Division)
- AGCM (based on operational model) + OGCM (MRI.COM)
- atmosphere initial condition: JRA25 (and JRA55)
- ocean full fields assimilated by MRI ocean assimilation (MOVE)
- CHFP experiment
- sensitivity experiments (e.g., 2006 El Nino, 2010 hot summer)

Decadal Prediction System (MRI-CGCM3)

- CGCM for CMIP5 developed at MRI
- modified JMA AGCM + OGCM (MRI.COM)
- ocean anomaly fields assimilated in a CGCM
- decadal prediction in every 5 years (9 members)

Seasonal and Decadal Prediction Systems

Seasonal Prediction

JMA/MRI-CGCM3

- AGCM(JMA AGCM) : TL95L40
- OGCM(MRI.COM2): 1x(1-0.3)L50
  sea ice climatology
- Initialization
  Atmos.:JRA25
  Ocean: MOVE/MRI.COM-G
  T, S&SSH (sea ice climatology)

JMA/MRI-CGCM5

- AGCM(JMA AGCM) : TL159L60
- OGCM(MRI.COM3): 1x(0.5-0.3)L53
  sea ice model
- Initialization
  Atmos.:JRA55
  Ocean: MOVE/MRI.COM-G
  T, S & SSH (sea ice model)

Decadal Prediction

Current JMA Operational System
CHFP experiment

CMIP5

MRI-CGCM3

- AGCM(modified JMA AGCM) :
  TL159L48 (model top: 0.01hPa)
- OGCM(MRI.COM3): 1x0.5L51
  sea ice model
- Initialization
  CGCM: ocean T & S anomalies

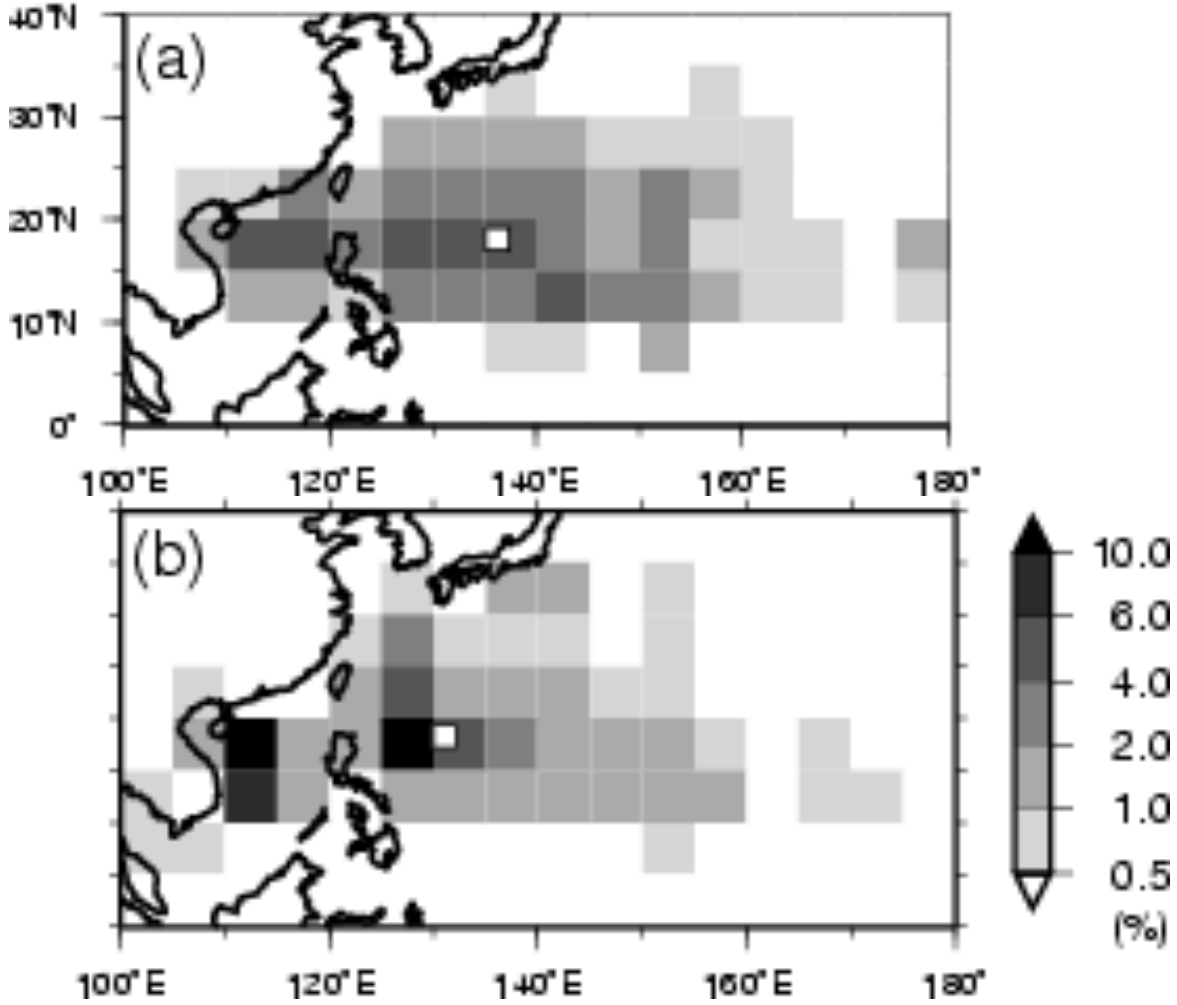
2014: Next JMA Operational System

Typhoon predictability

Geographical distribution of the probability density of the location of typhoon formation

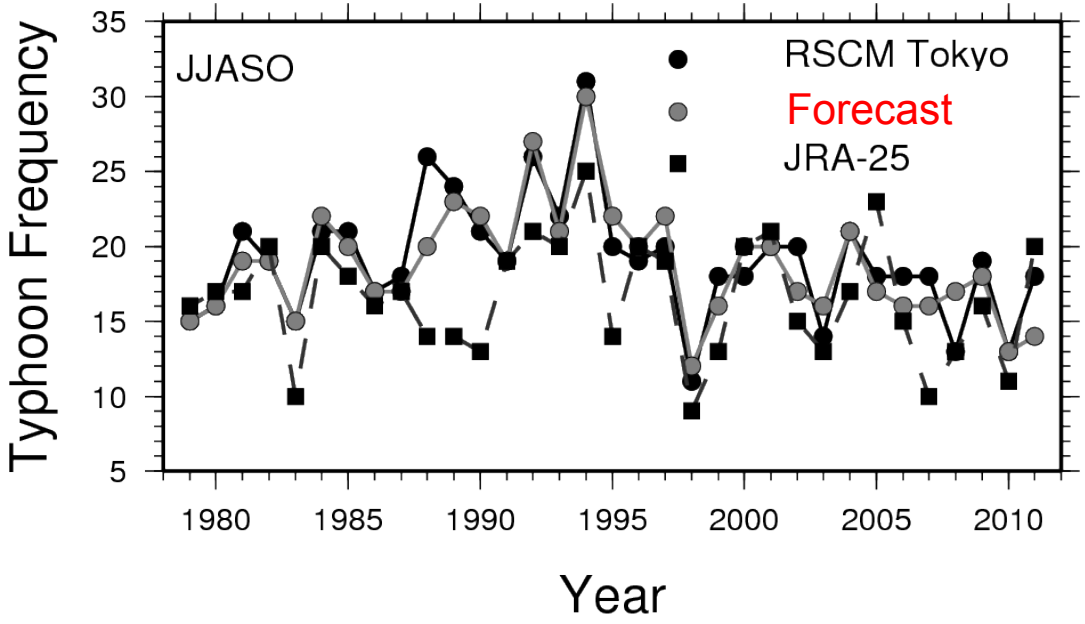
Obs.

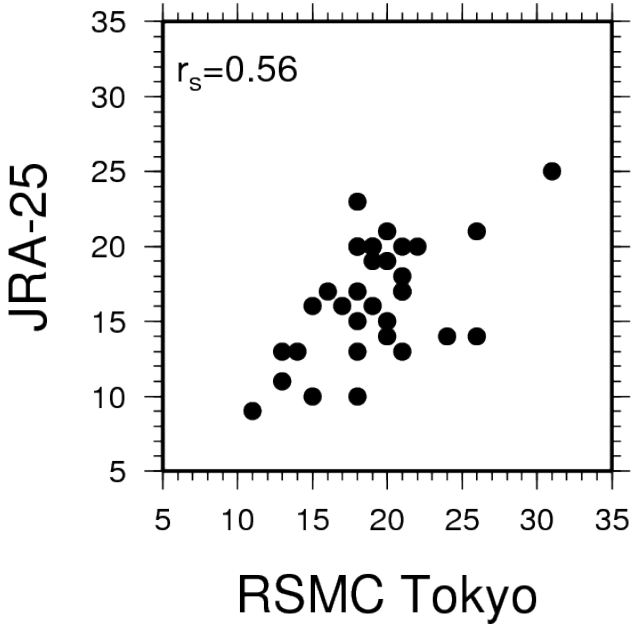
Forecast



Takaya et al. 2010

Typhoon predictability



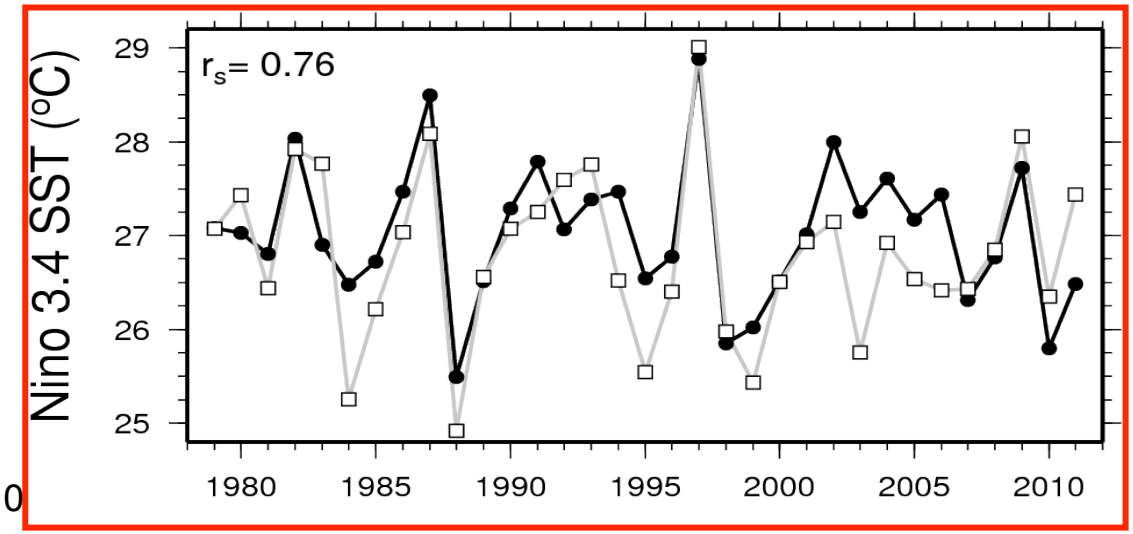


Region : 0-40N, 100E-180

Initial date: 1st May

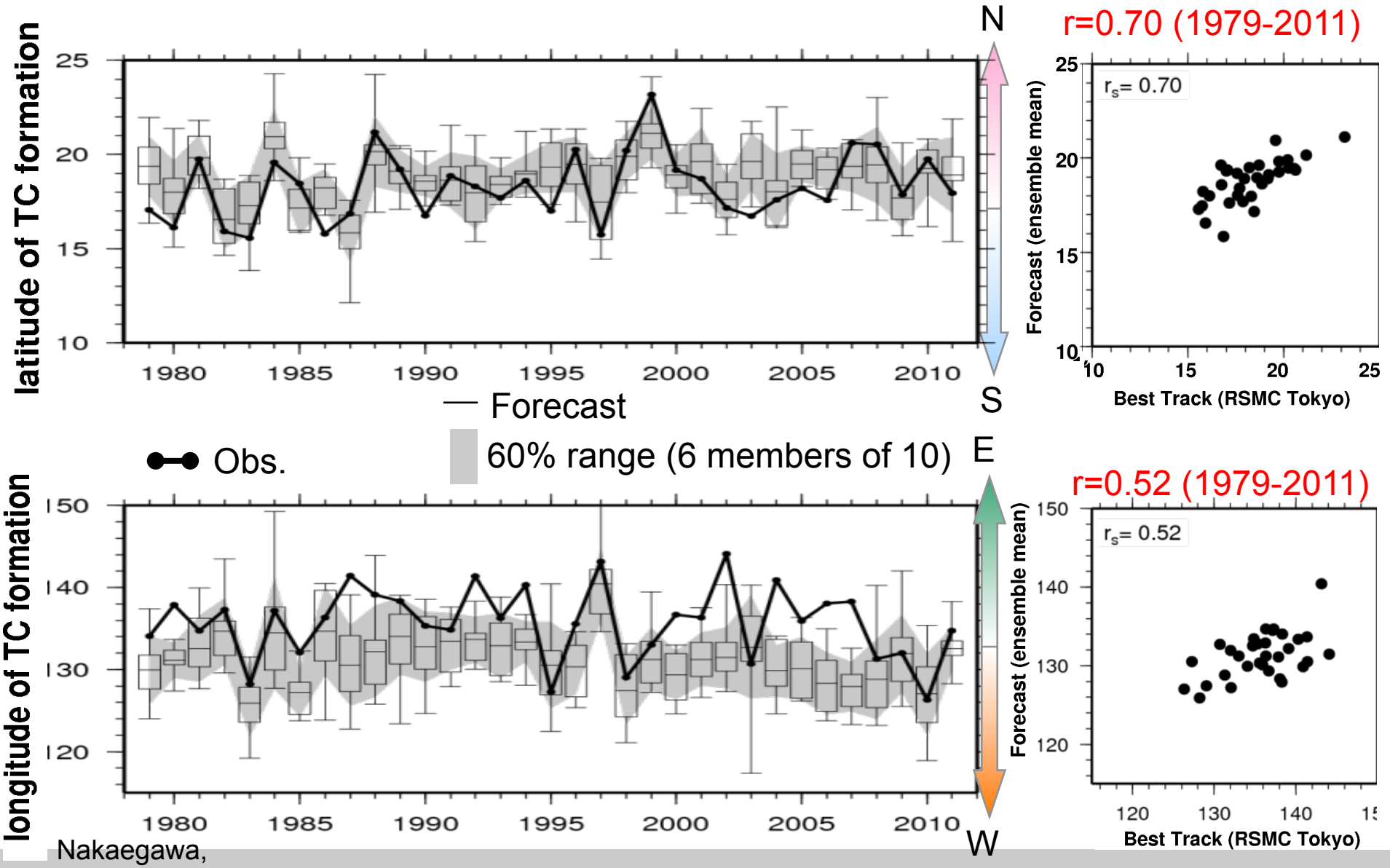
Period : Jun.-Oct.

Correlation : 0.56 (1979-2011)



T. Nakaegawa, updated from Takaya et al. 2010

Typhoon predictability



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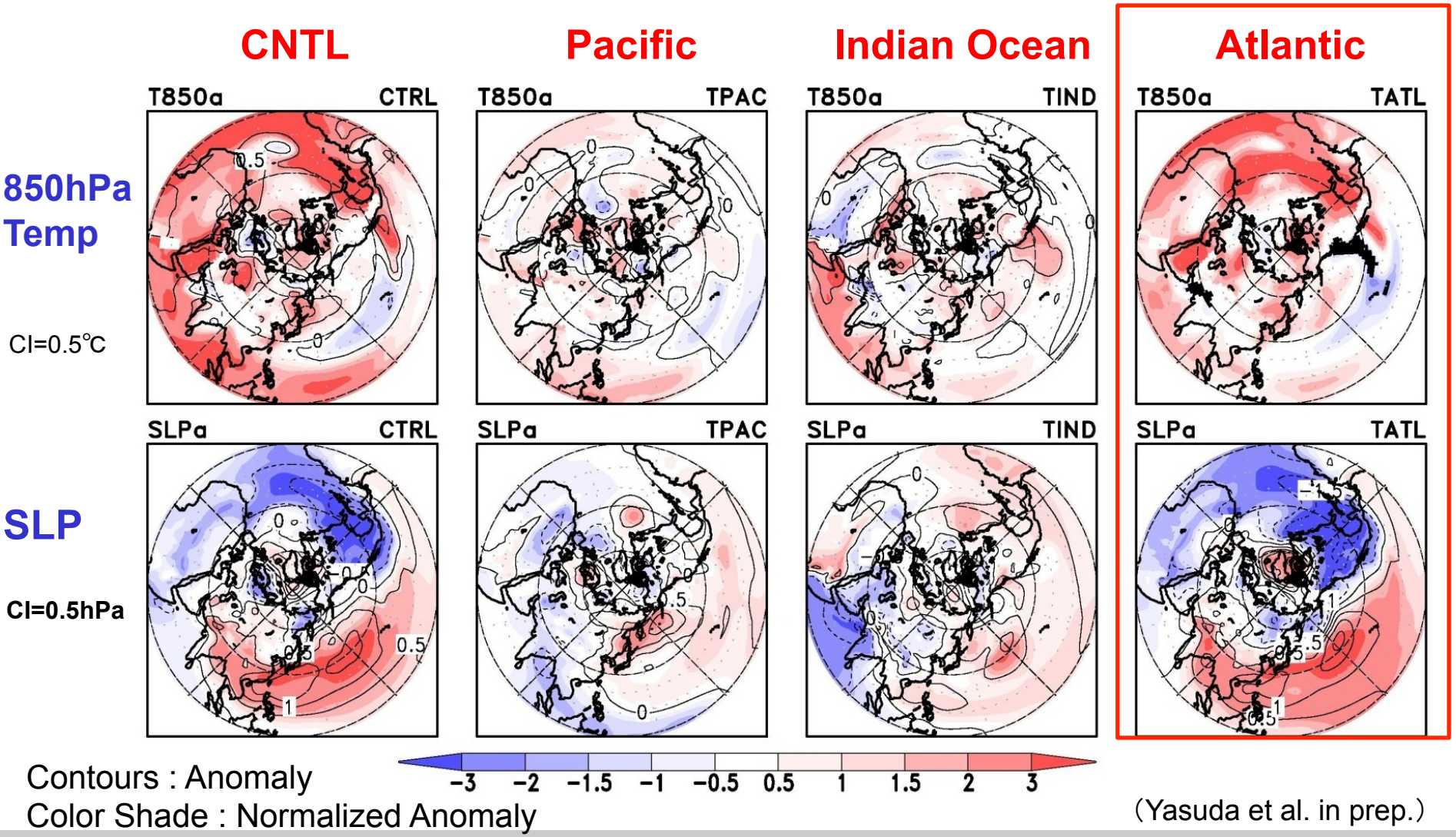
Seasonal Forecast for 2010 hot summer

Research on impact from SST anomaly over each ocean

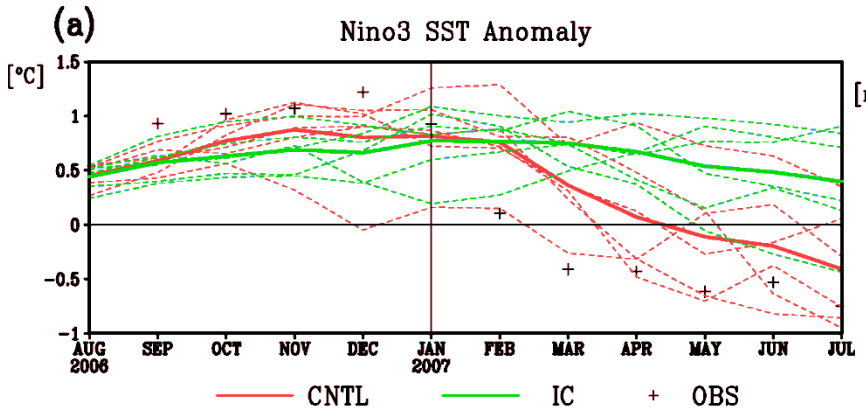


Contours : Anomaly
Color Shade : Normalized Anomaly

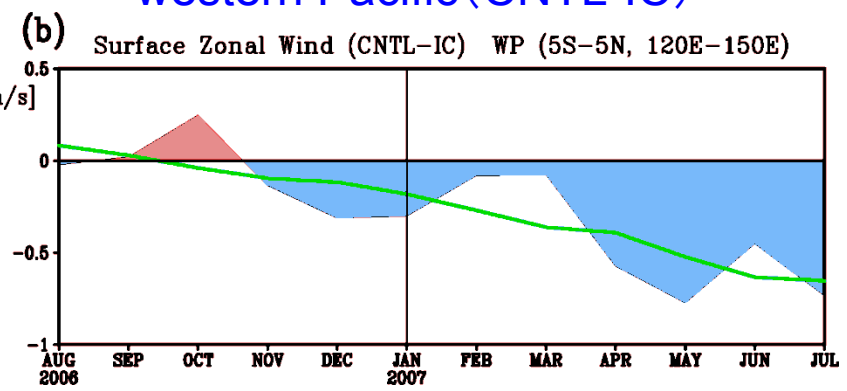
(Yasuda et al. in prep.)

Impact of Indian Ocean on a rapid termination of 2006/07 El Niño

El Niño Index



Easterly wind over the western Pacific（CNTL-IC）



- CGCM experiments indicate that Indian Ocean contributed to a rapid termination of the El Niño.
- This supports the hypothesis that the interaction between the Pacific and Indian Ocean is important.

Yamanaka et al. (2009)

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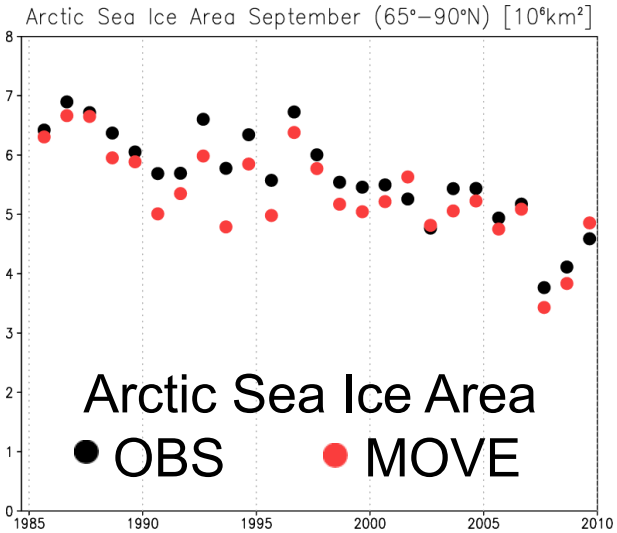
2014: Next JMA Operational System

Next JMA Operational Seasonal Prediction System

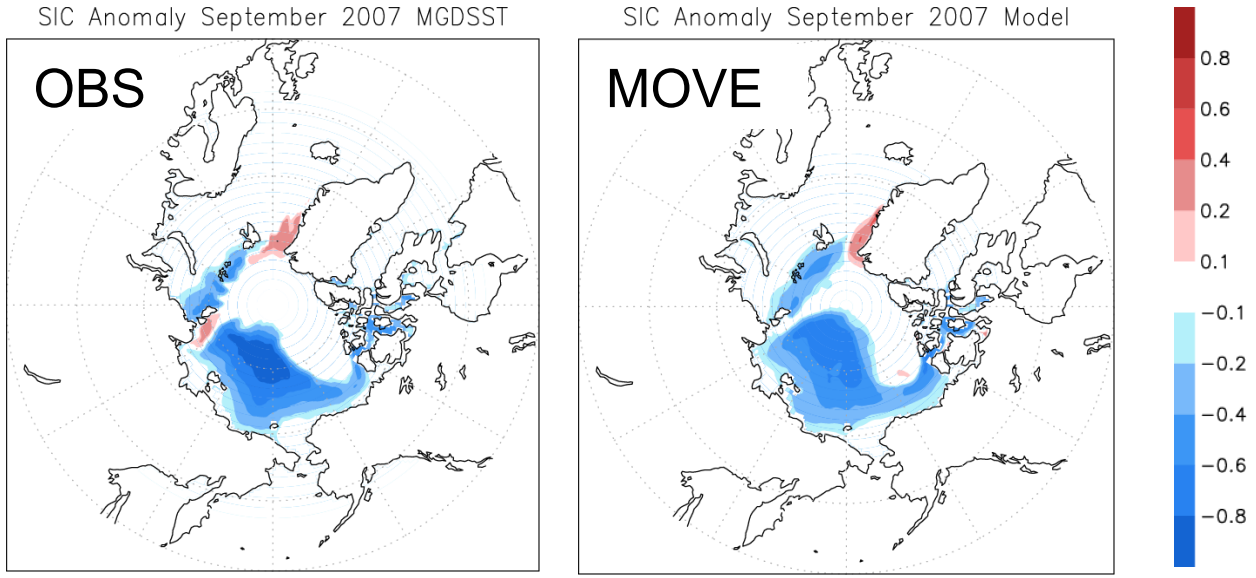
(Toyoda et al., 2011)

Sea ice in Ocean Data Assimilation System



JMA/MRI Ocean Data Assimilation System (MOVE/MRI.COM) is applied to polar regions. Seasonal and inter-annual variability of arctic sea ice is reproduced well.

Sea ice concentration anomaly in Sep. 2007



Toyoda et al. 2012

Decadal prediction by MRI-CGCM3

MRI-CGCM3 for CMIP5 (Yukimoto et al. 2011)

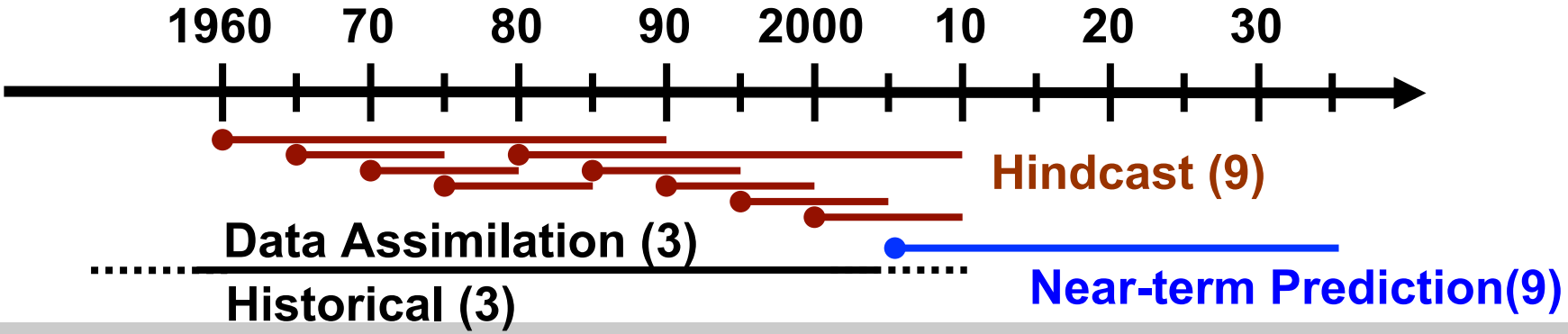
- AGCM: modified JMA AGCM
  cumulus convection, cloud, etc
  Resolution: TL159L48 (Model top: 0.01hPa)
- OGCM: MRI.COM3 (Tsujino et al. 2010)
  Resolution: 1 x 0.5 L51

Decadal Experiments (1960-, every 5 years)

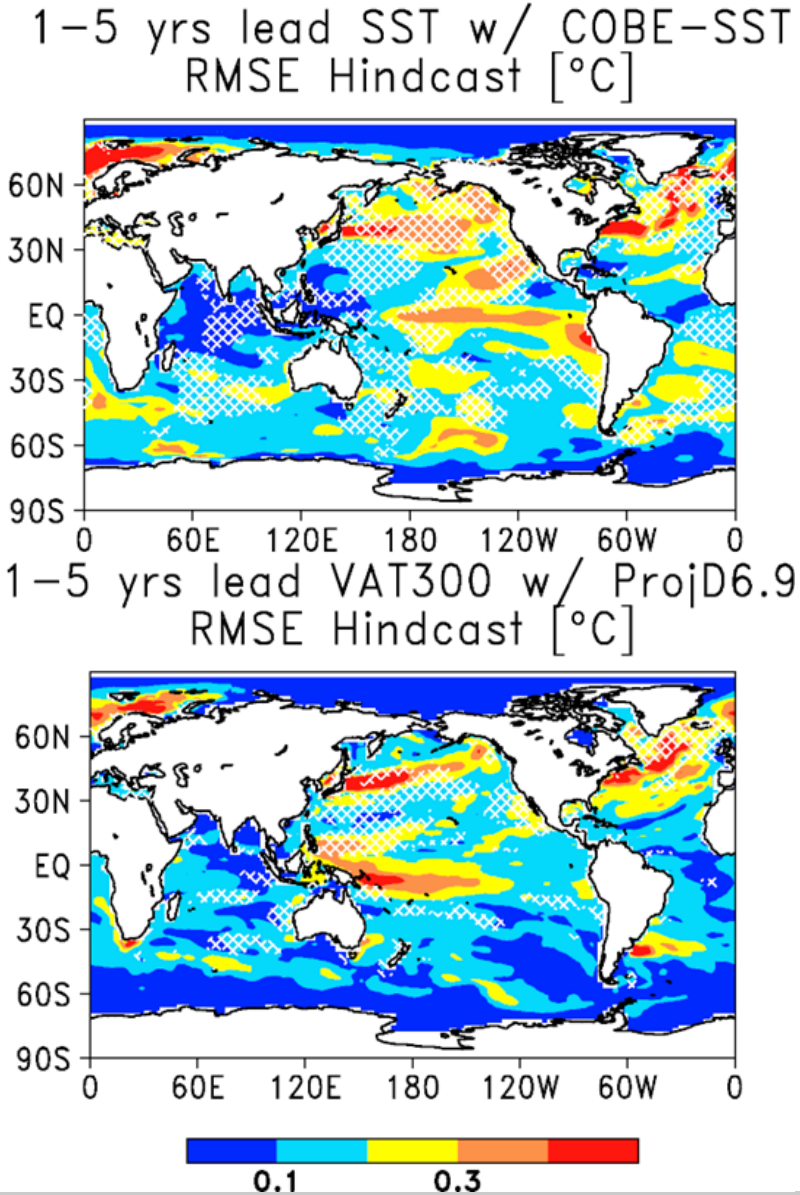
- 9 ensemble members: 3 (perturbation) x 3 (1st Jul., Oct. and Jan.)

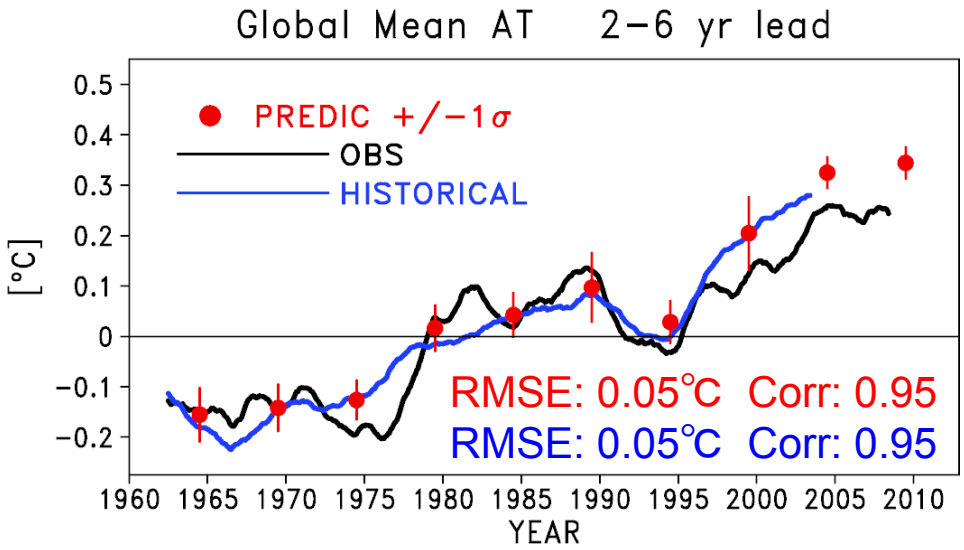
Initial data

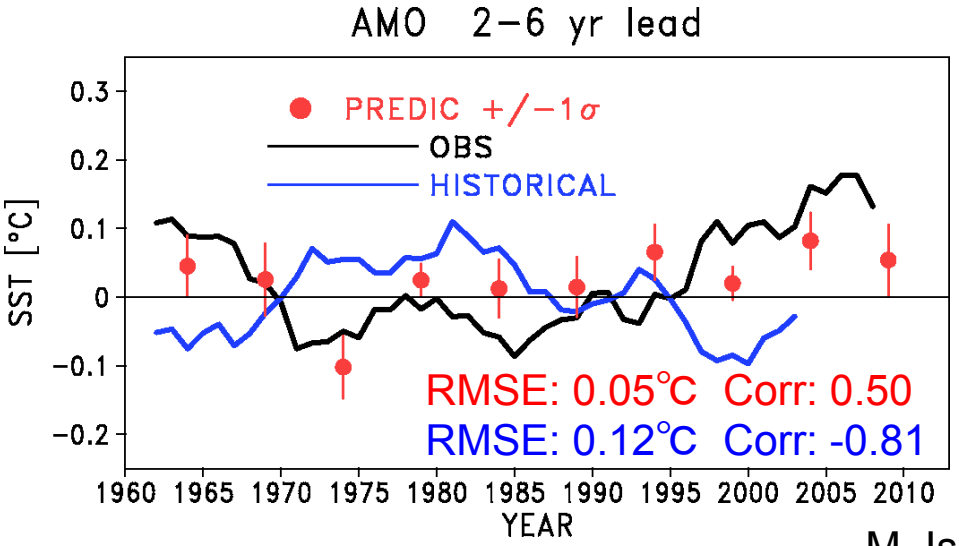
- Ocean part of the CGCM is initialized with monthly T & S anomalies.
- Sea ice is not assimilated.



Decadal prediction by MRI-CGCM3



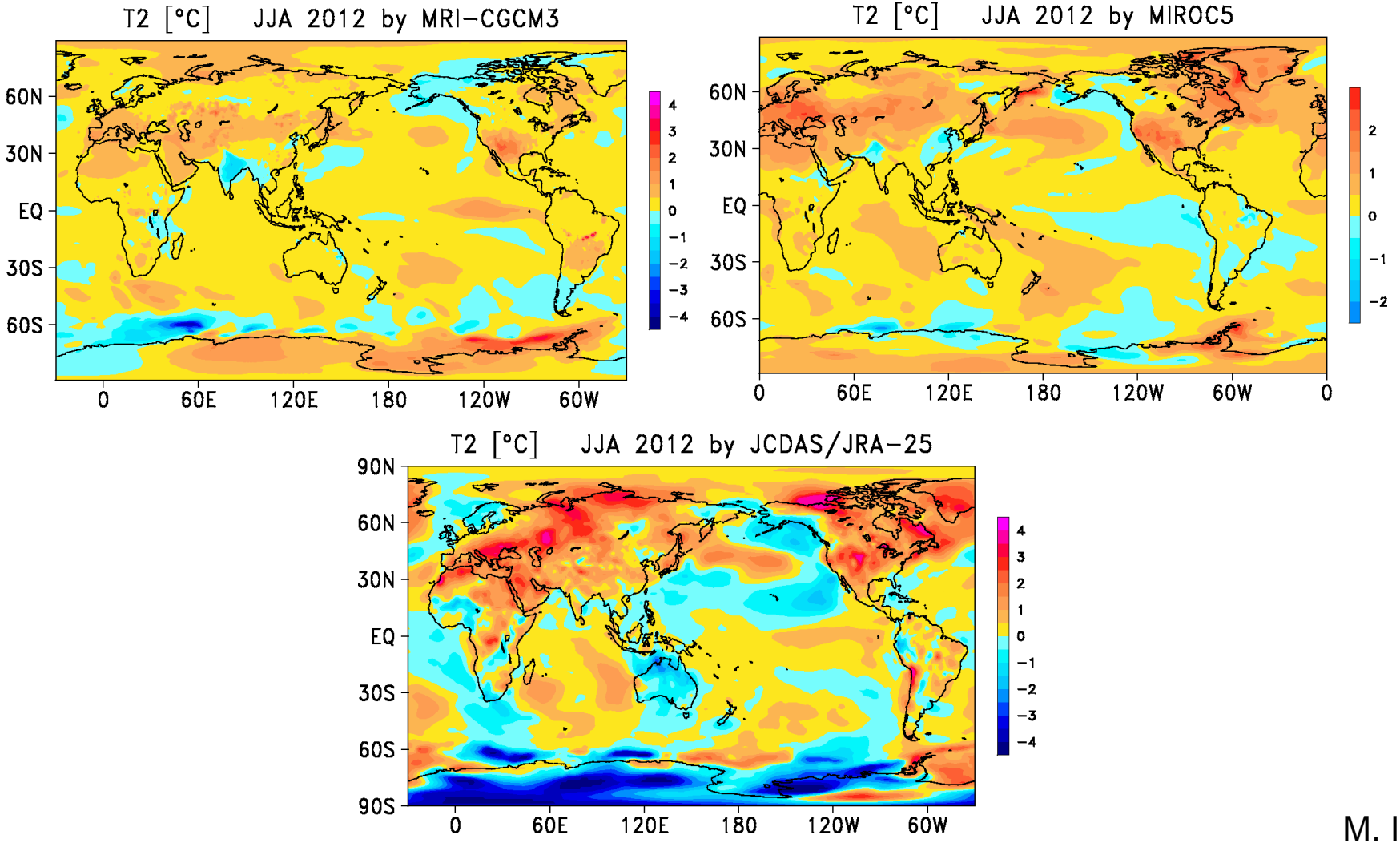




M. Ishii

Seasonal prediction by MRI-CGCM3

Prediction of SAT for JJA 2012 (Initial:JAN2011)



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2014: Next JMA Operational System

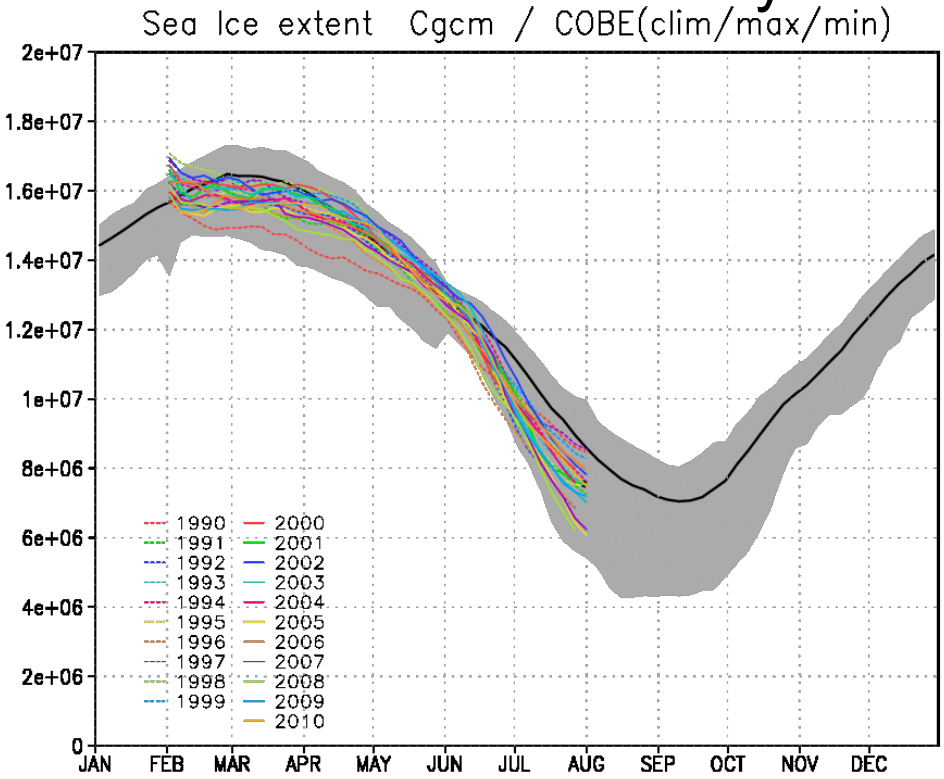
Next JMA Operational Seasonal Prediction System

(Toyoda et al., 2011)

Seasonal prediction (test)

Sea ice extent

Initial: 1st February



Initial: 1st October