The development of APCC seasonal prediction system using NCAR CCSM3

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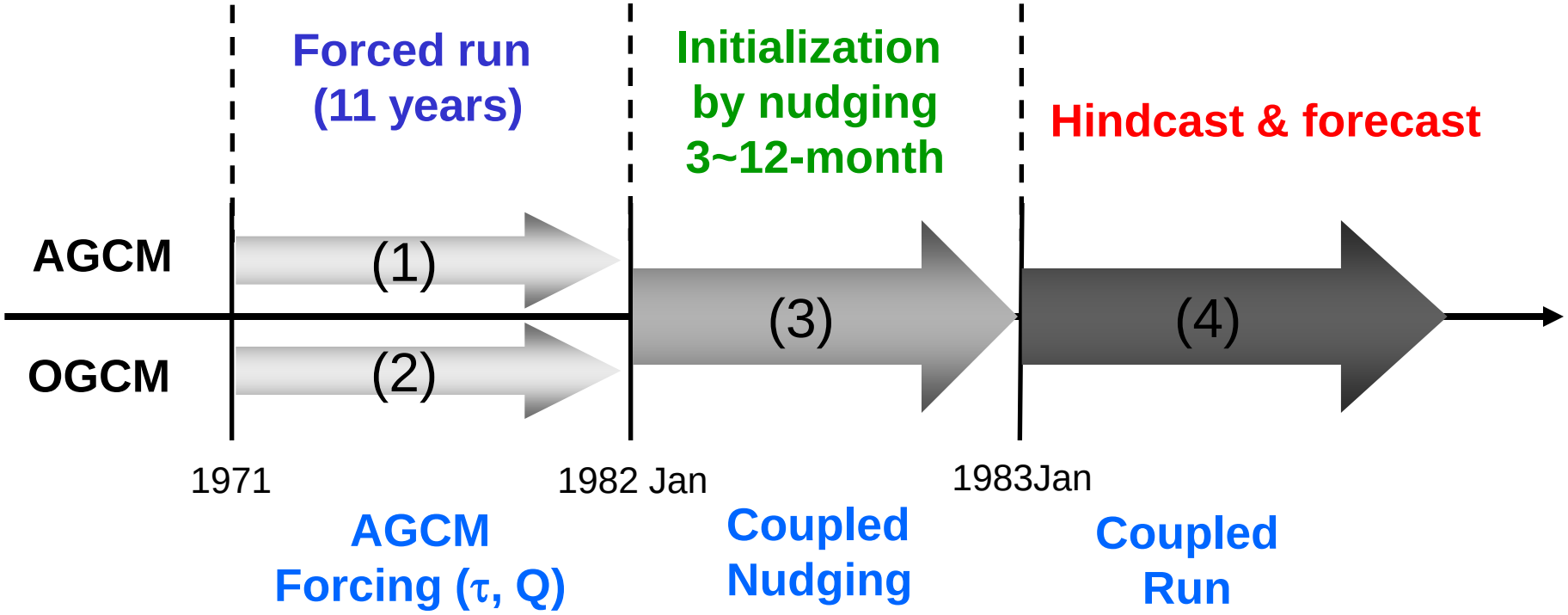
Importing NCAR's CCSM3

- **NCAR's CCSM3**
  - Coupled global climate prediction model
  - Atmos., ocean, land, and sea-ice connected by a flux coupler
  - Resolution : AGCM **(T85L26)** = 256 Lon X 128 Lat X 26 Level
    OGCM **(gx1v3L40)** = 320 Lon X 384 Lat X 40 Level
- **Ported and tested at KMA Cray X1E**
- **Free run (Control run) was simulated for 25 years**
- **Retrospective Forecast (Hindcast)**
  - 5-ensemble member
  - Atmosphere I.C. = Nov. 1st, Nov. 3rd, Nov. 5th, Nov. 7th, and Nov 9th
  - Ocean I.C. = Nov. 1st
  - Hindcast Period = 1982~2007 (26 Years)

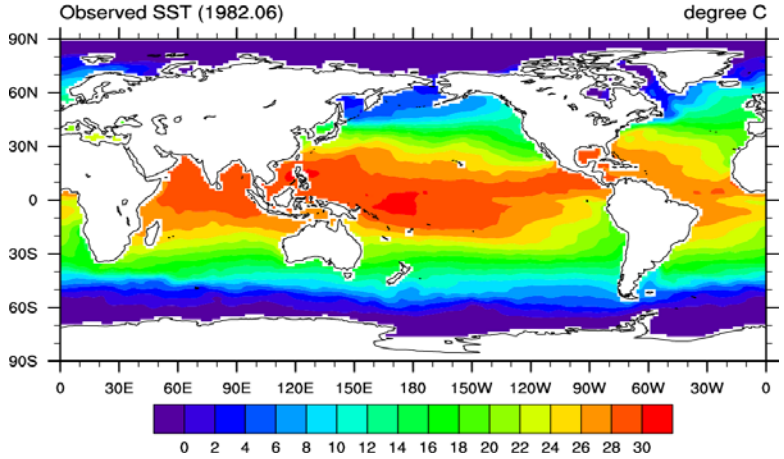
Framework of Initialization & Forecast

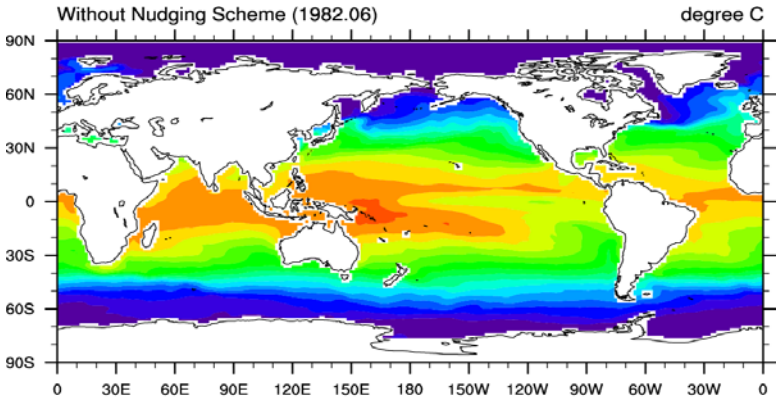


(1) generate 2-hourly forcing (t, Q) for OGCM using AGCM.
Then, observed SST is required for AGCM.
(2) forced run of OGCM using AGCM forcing
(3) generate initial data for forecast using OBS by nudging (CGCM)
(4) run forecast from the initial data (CGCM)

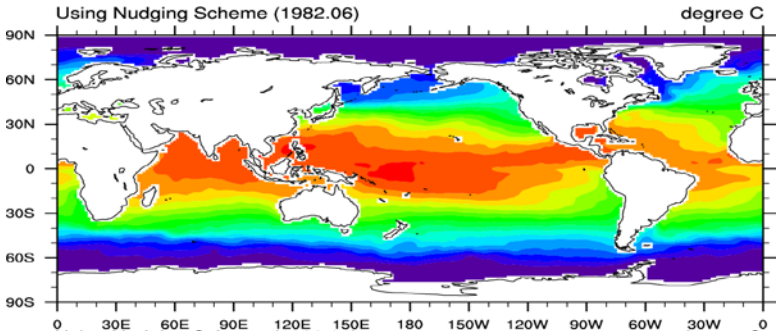
Performance of SST Nudging for CCSM3

OISST (June 1982)

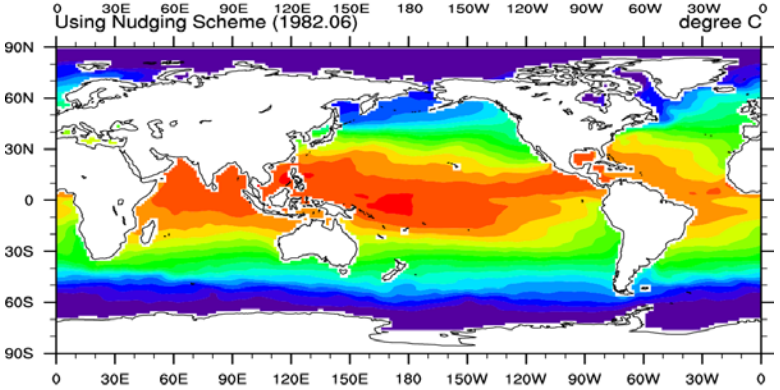




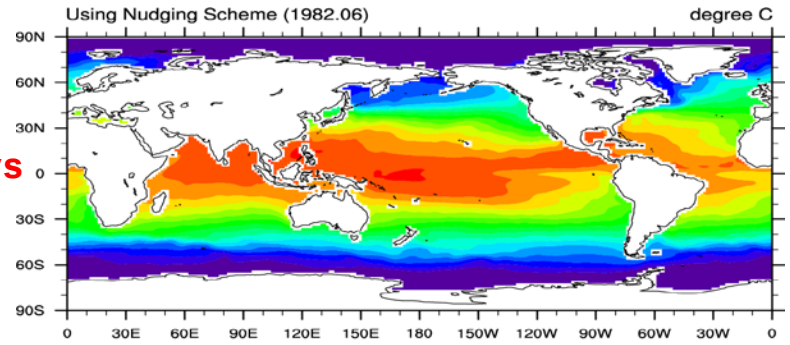
1 day



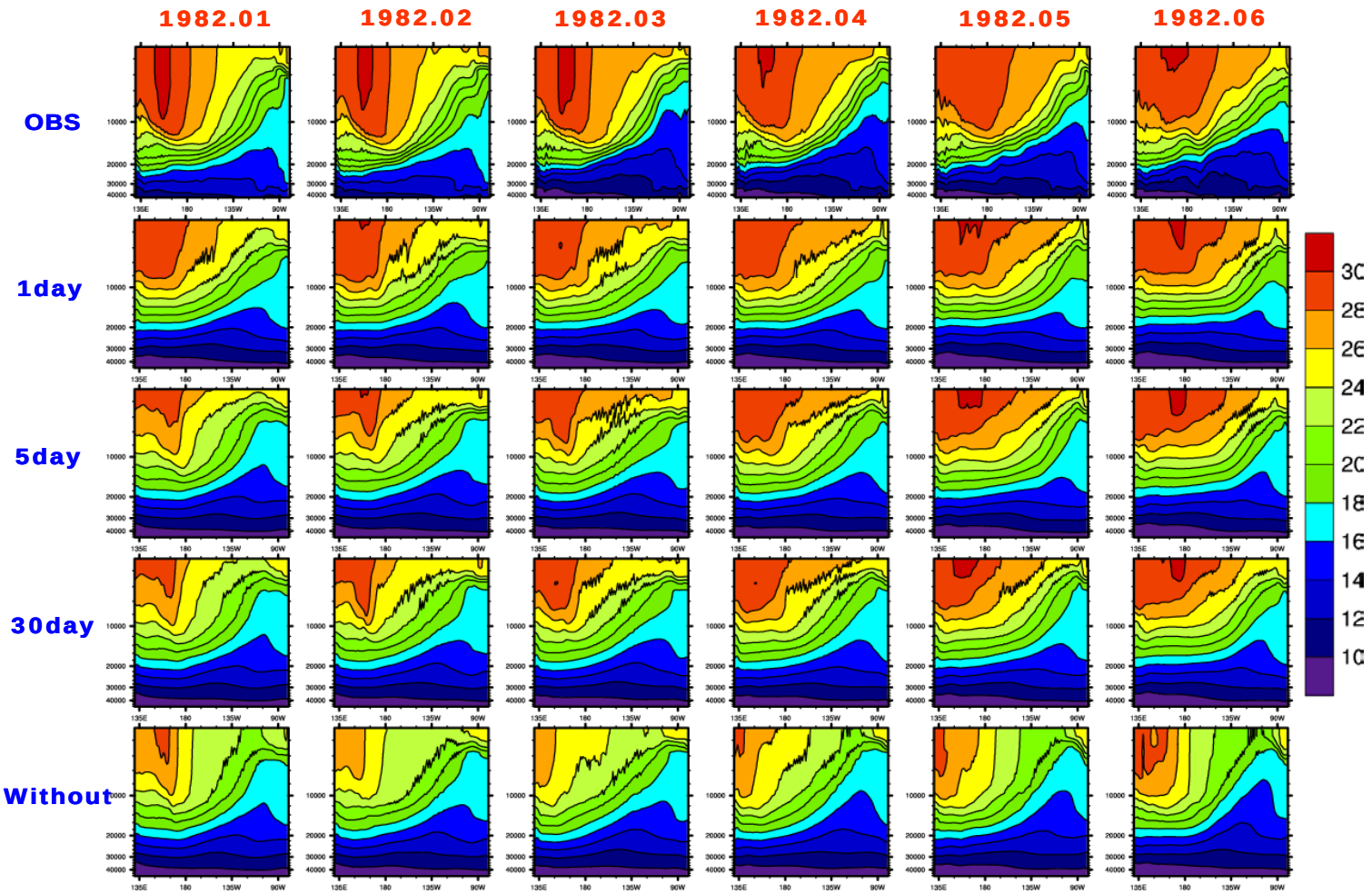
5 days



30 days

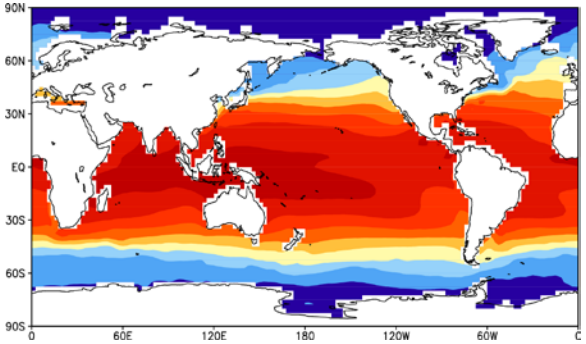


Sensitivity Test for various Nudging Coefficients

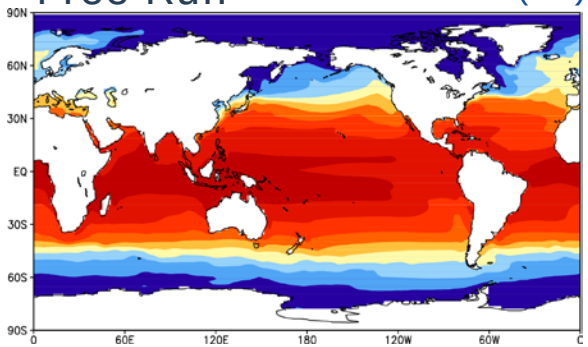


Climatology of Simulated SST for DJF (82-07)

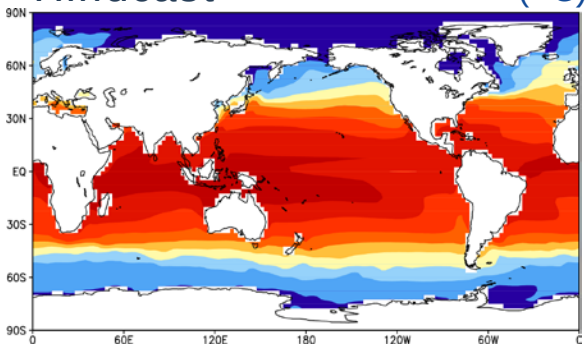
OISST (°C)



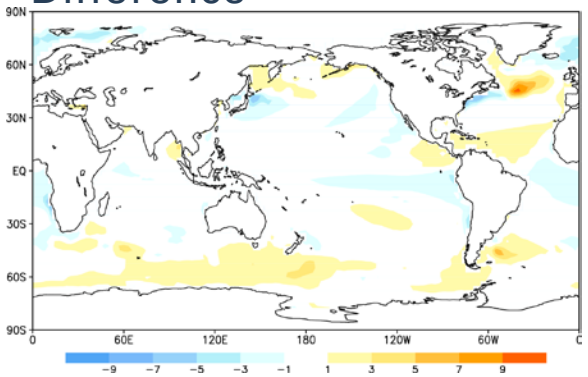
Free Run (°C)



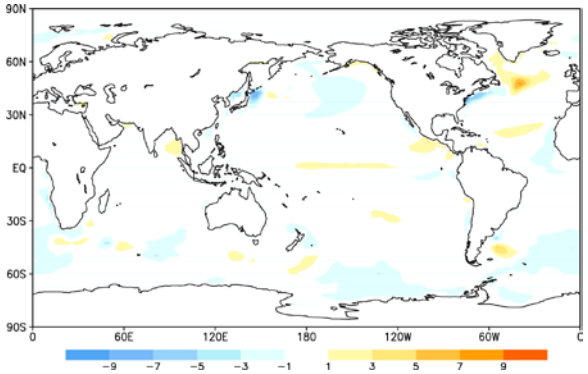
Hindcast (°C)



Difference (°C)

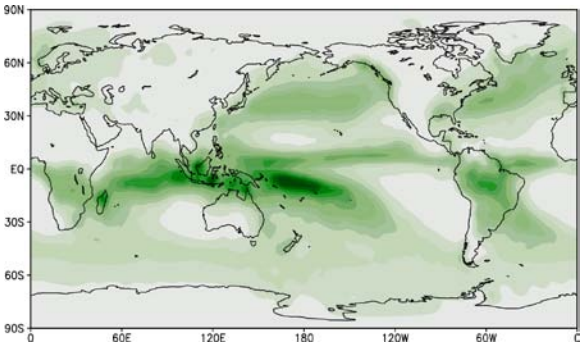


Difference (°C)

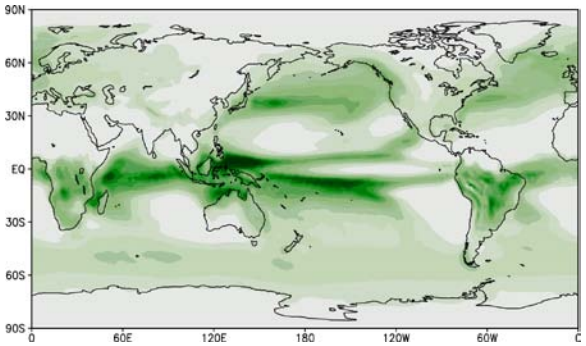


Climatology for Simulated Prec. for DJF (82-07)

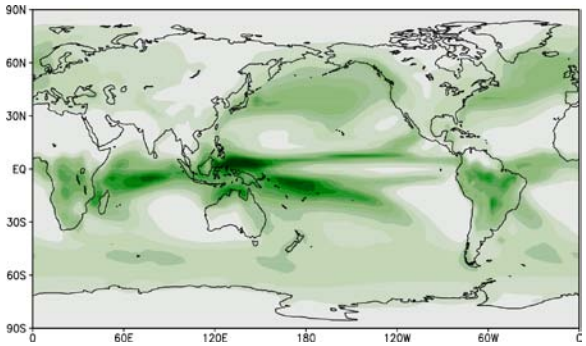
CMAP (mm/day)



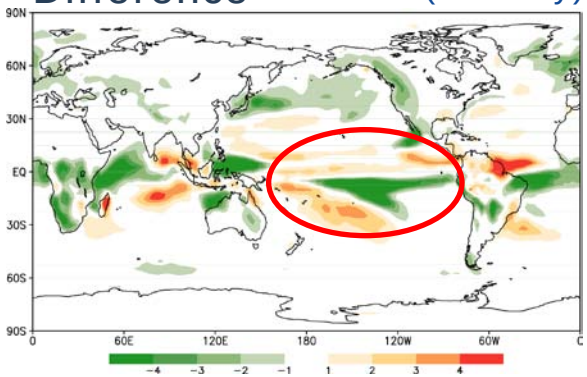
Free Run (mm/day)



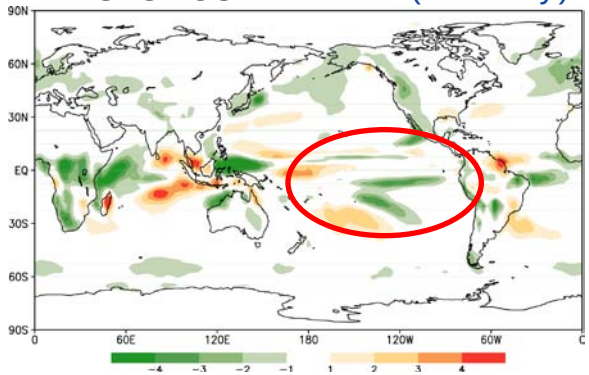
Hindcast (mm/day)



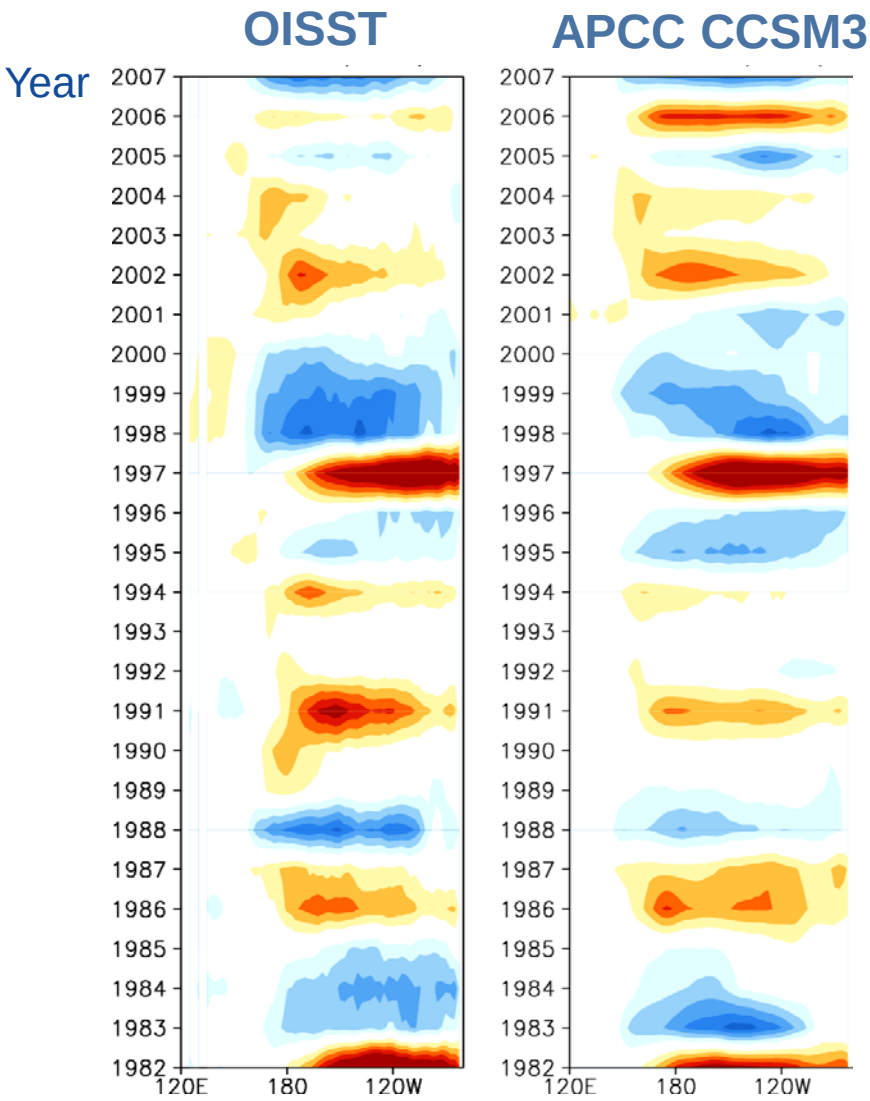
Difference (mm/day)



Difference (mm/day)

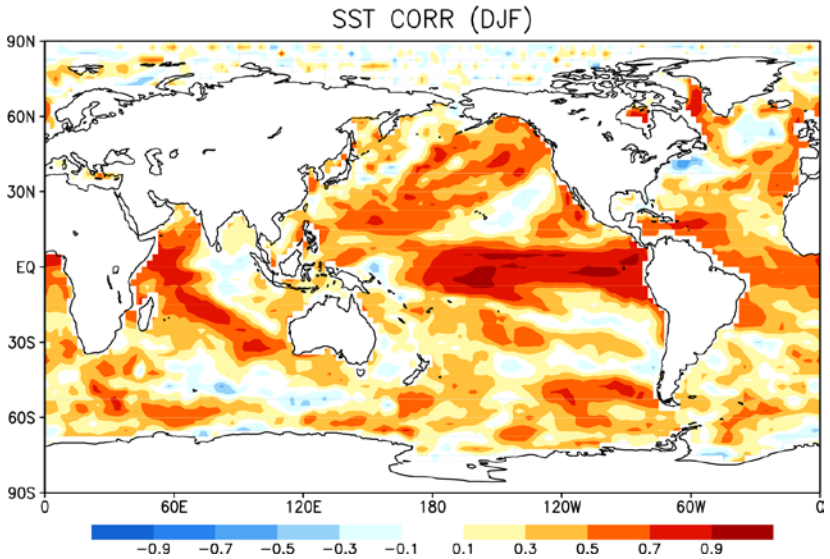


Seasonal Prediction System using CCSM3

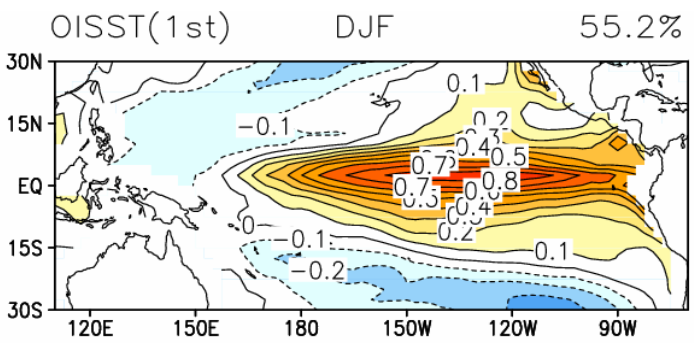


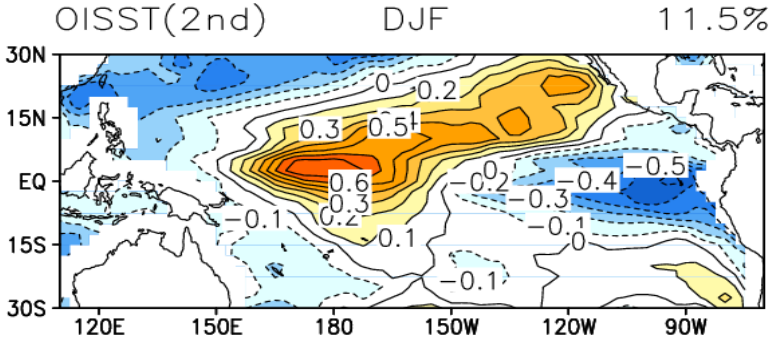
- Preliminary results indicates successfully prediction for El Nino and La Nina event
- Preliminary results indicates significant predictability for the phase of DJF ENSO event with 2-4 months lead

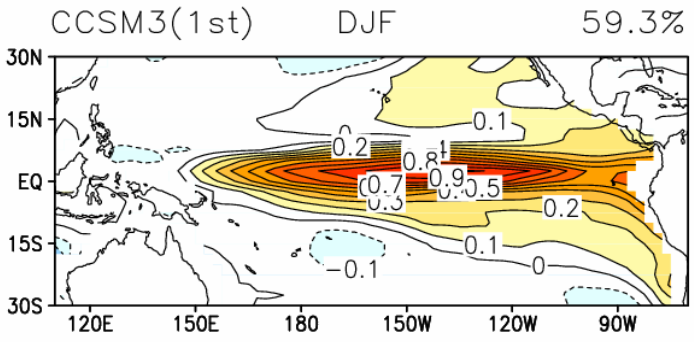
Contour : 95% significant level

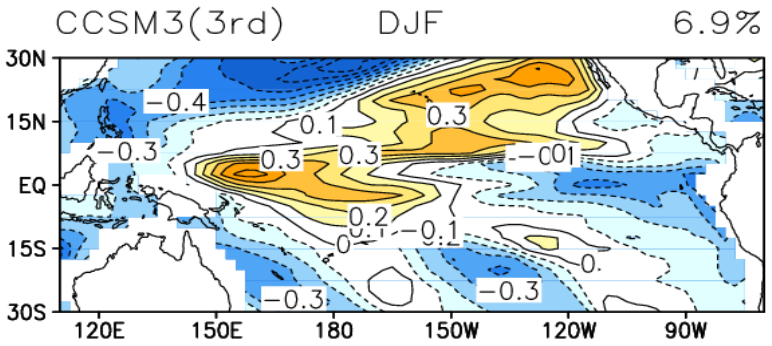


Seasonal Prediction System using CCSM3







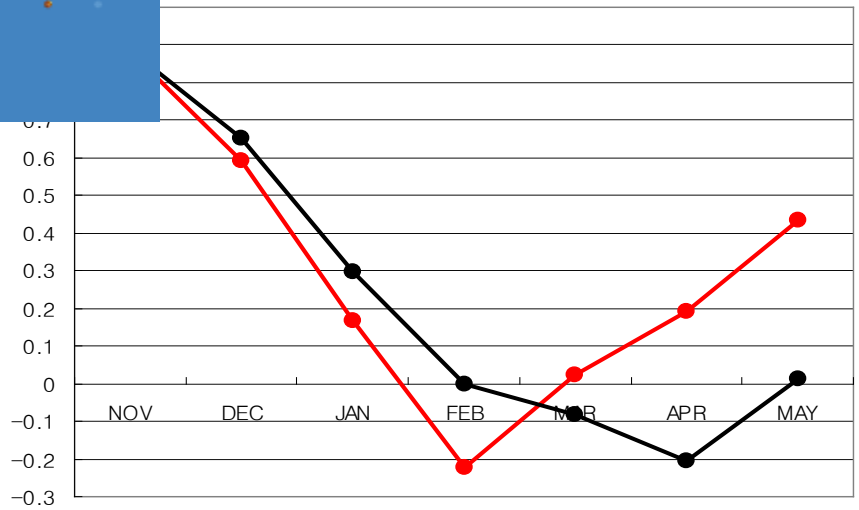


Corr. Between PC time Series : 0.93

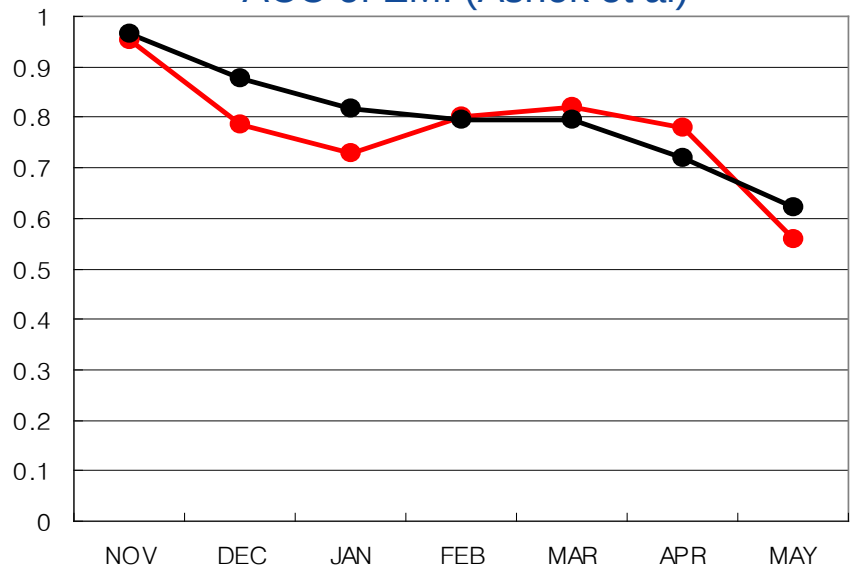
Corr. Between PC time Series : 0.83

- Successful prediction of the boreal winter ENSO and ENSO Modoki evolution, including their phase

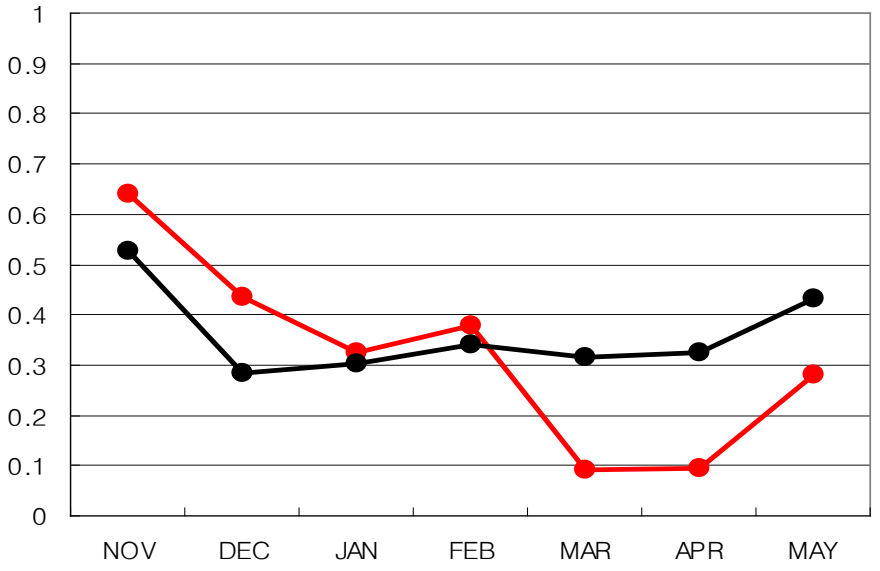
ACC of IOD indices (Saji et al)



ACC of EMI (Ashok et al)

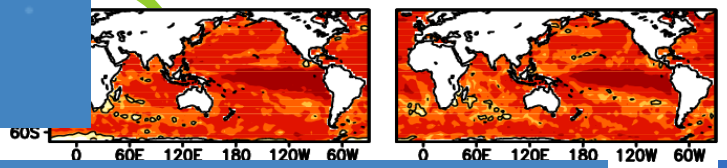


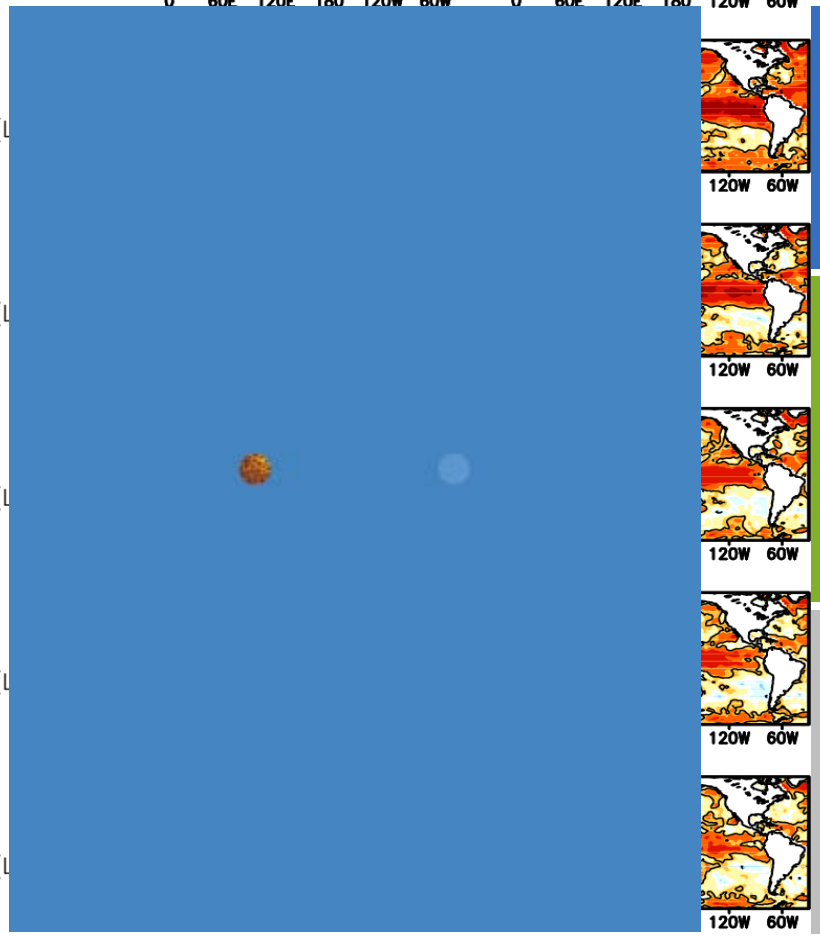
ACC of SDI



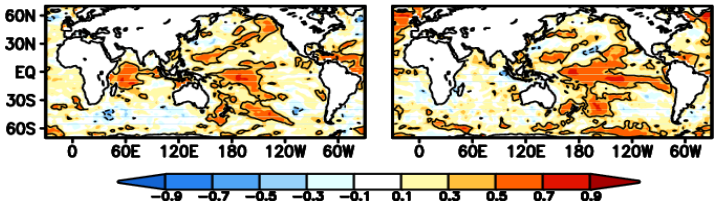
CCSM3

Persistence

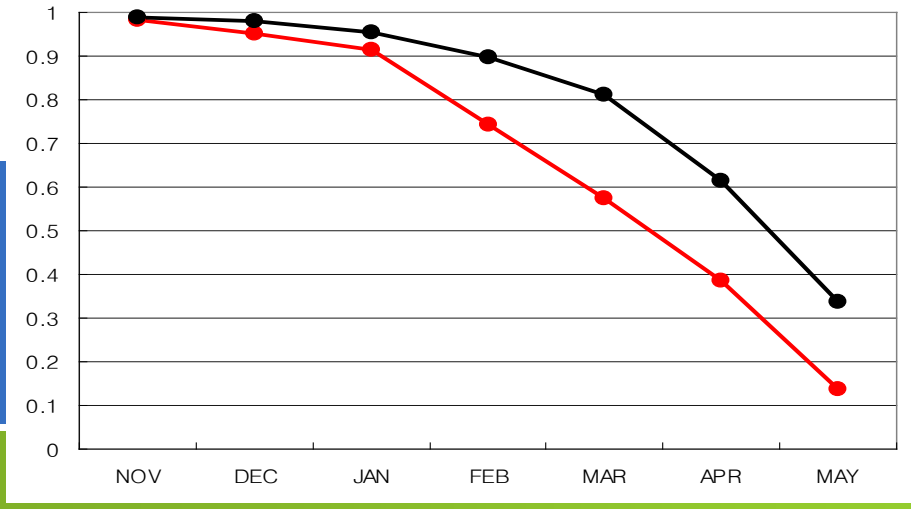




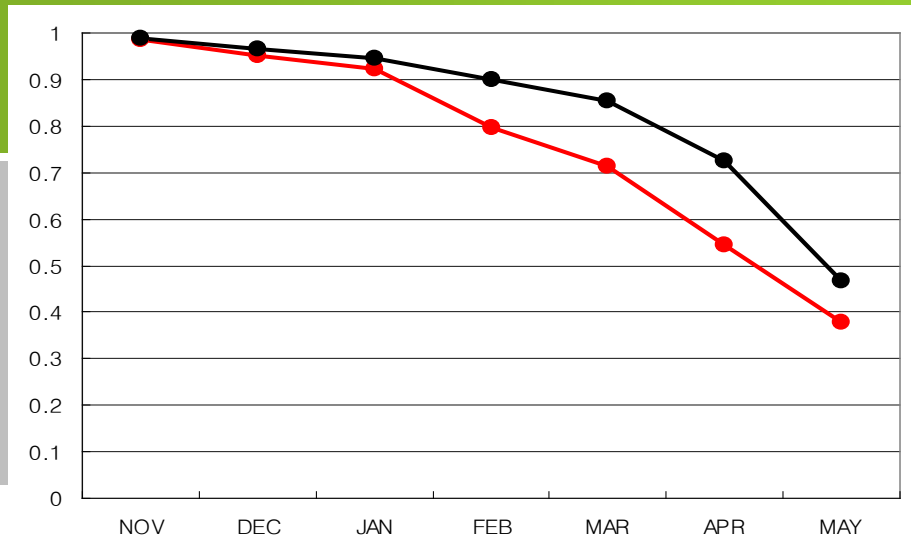
MAY
(Lead6)



ACC of Nino 3 indices



ACC of Nino 3.4 indices



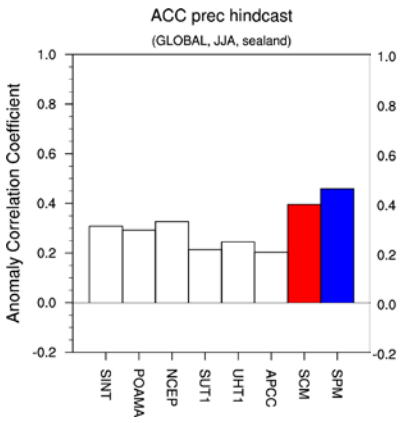
CCSM3 Persistence

Summary and Conclusion

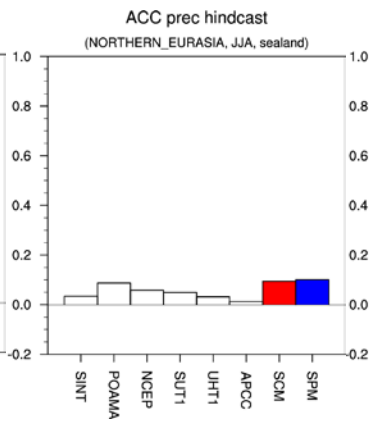
- An initialization scheme for hindcast and forecasts was developed using simple coupled SST nudging method.
- Retrospective 6month forecasts (Hindcasts) for DJFMAM with Nov. IC are completed for 21years(1982-2007). Although there is still some model bias, results show a reasonable climatology.
- A good correlation between observation and hindcasts.
- Particularly, APCC CCSM3 successfully predicted for El Nino/La Nina.
- Further study is needed in terms of teleconnection and monsoon predictability.

Hindcast Verification for JJA forecast (Prec)

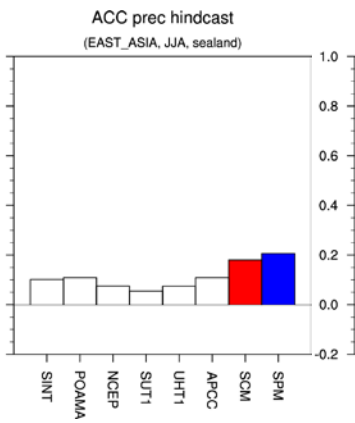
Globe



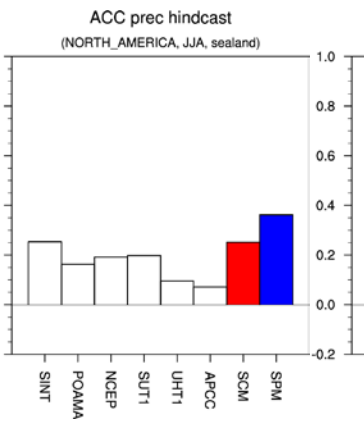
Northern Eurasia



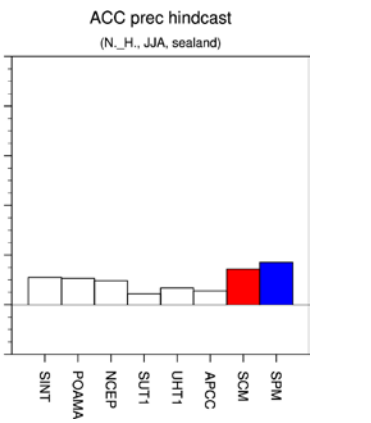
East Asia



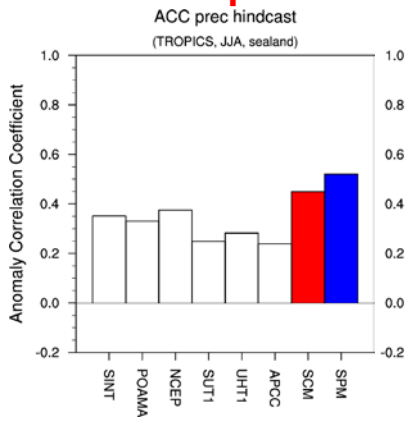
North America



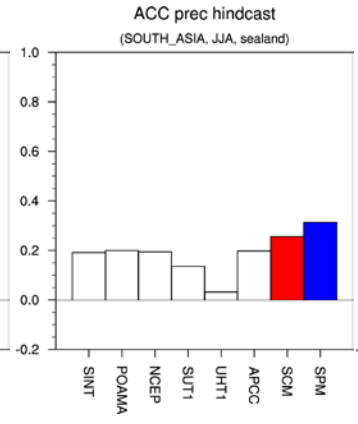
Northern H.



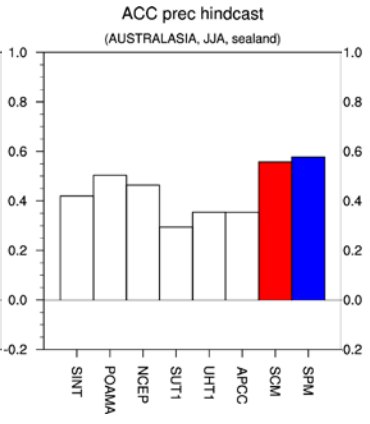
Tropics



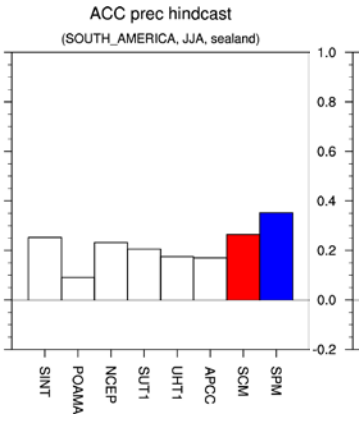
South Asia



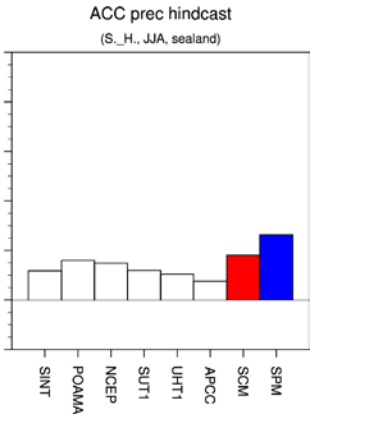
Australasia



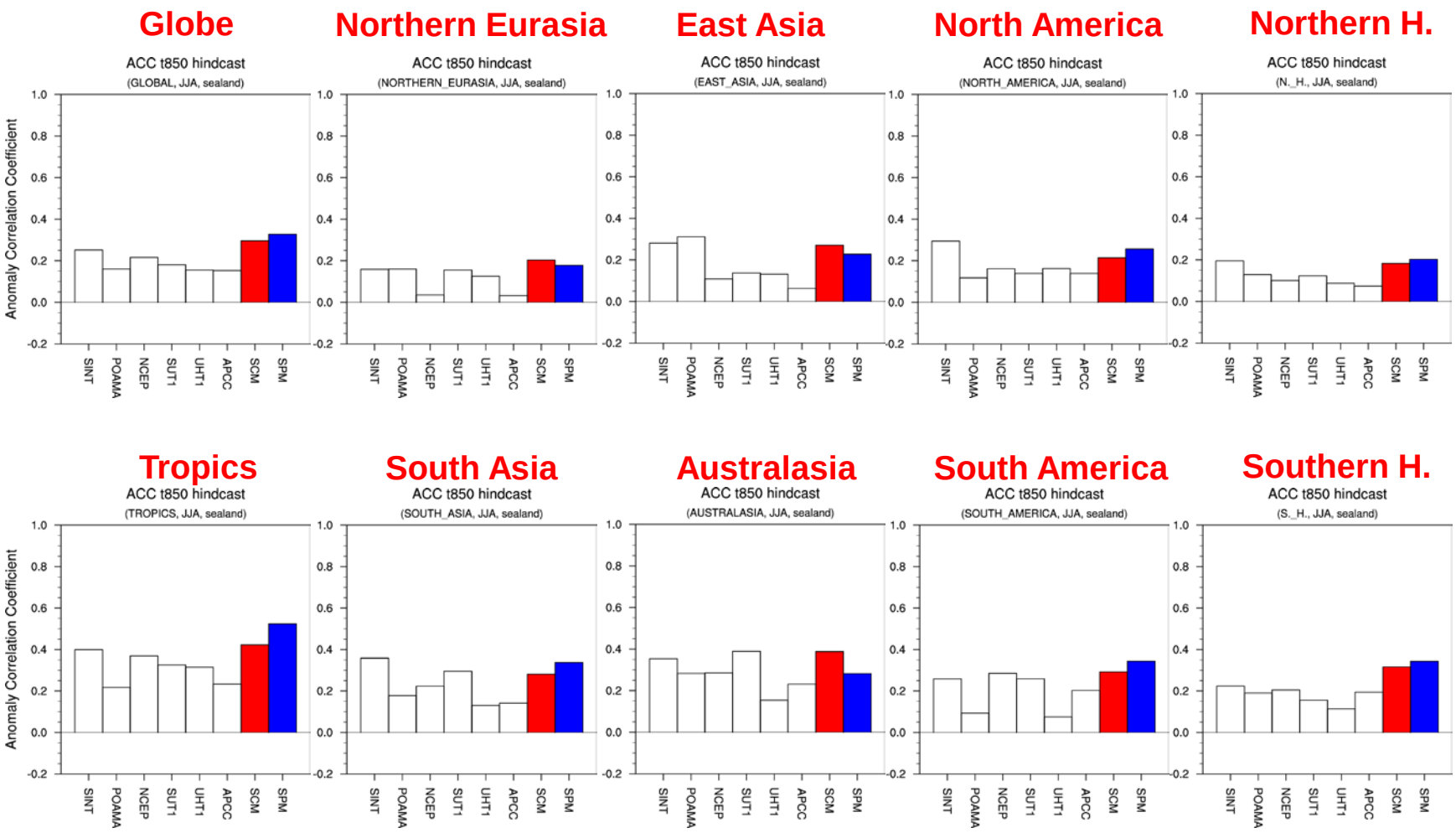
South America



Southern H.



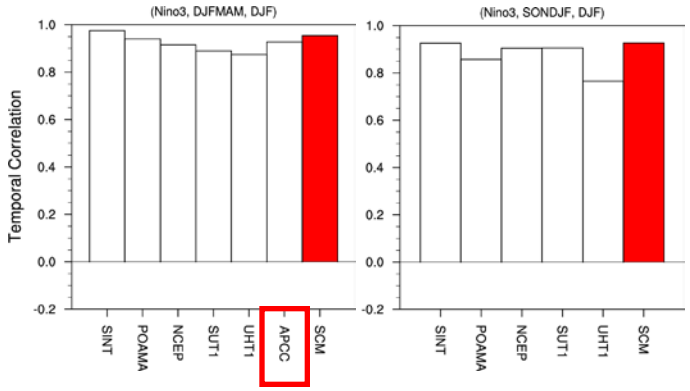
Hindcast Verification for JJA forecast (T850)



Verification : APCC Experimental ENSO prediction

Target : DJF

1-3 month Lead

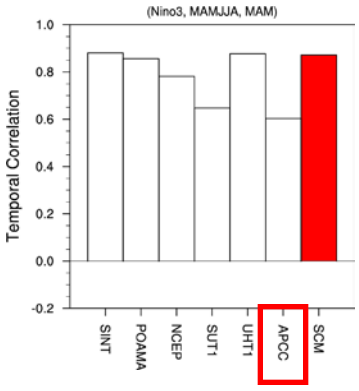


4-6 month Lead

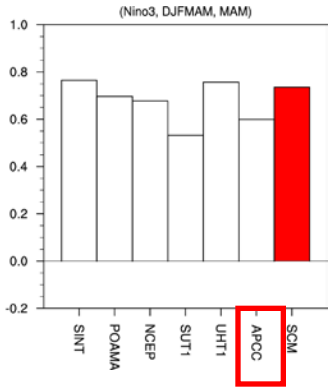
Nino 3

Target : MAM

1-3 month Lead

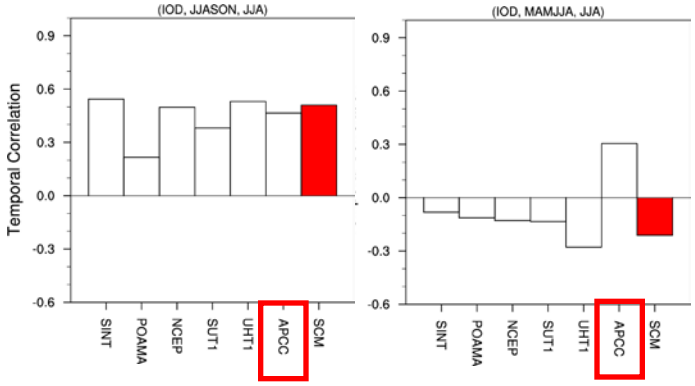


4-6 month Lead



Target : JJA

1-3 month Lead

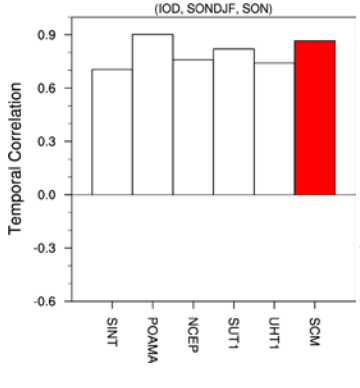


4-6 month Lead

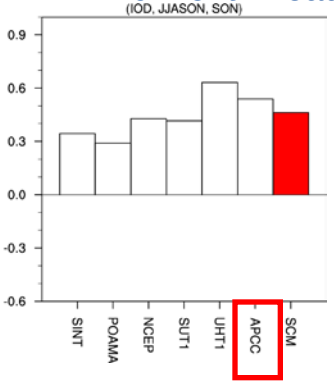
IOD

Target : SON

1-3 month Lead

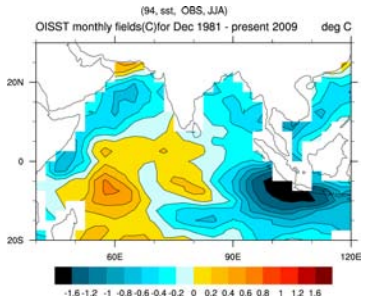


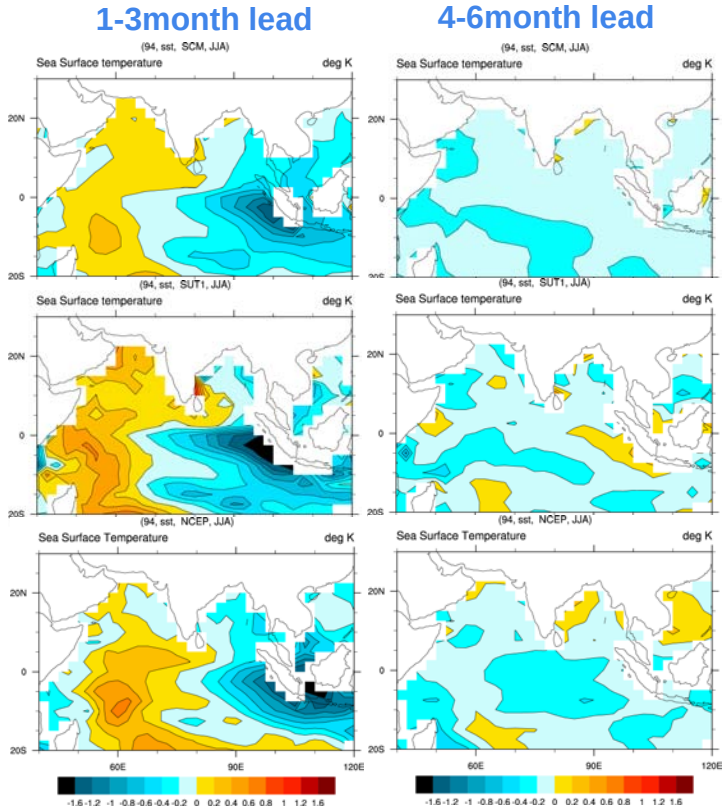
4-6 month Lead

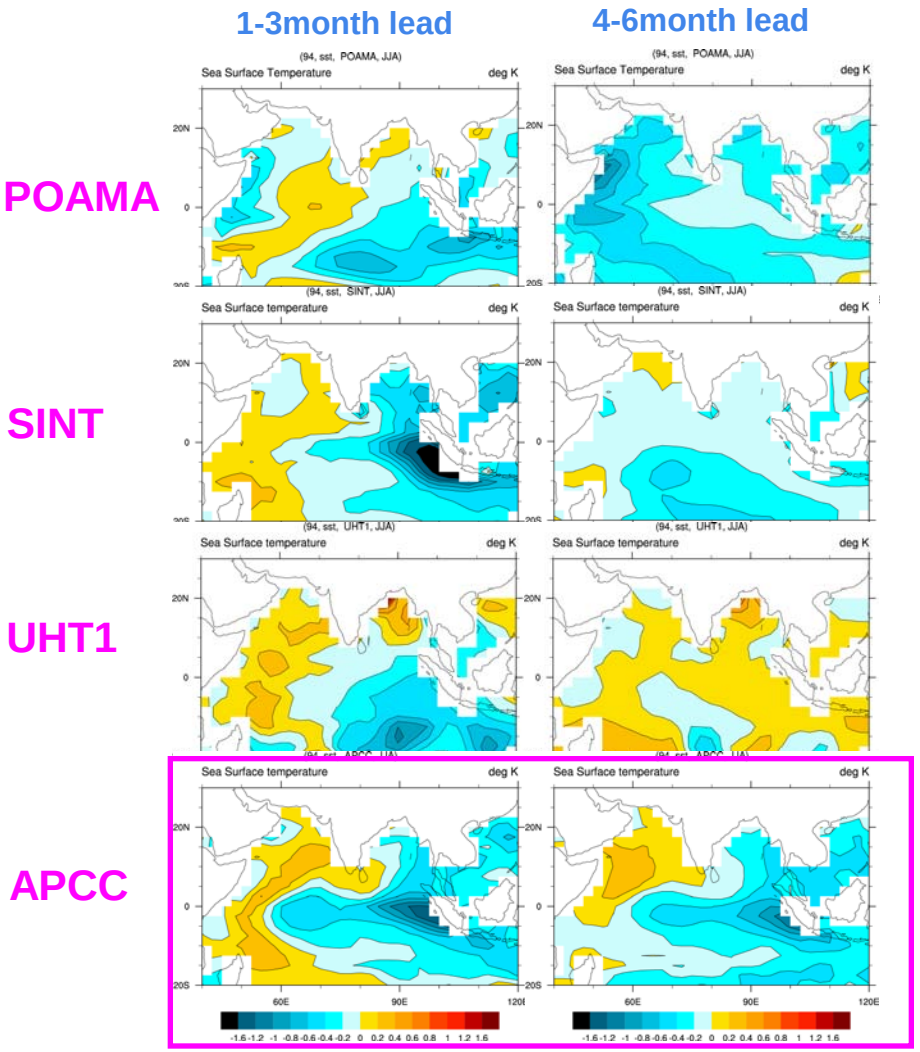


Verification : APCC Experimental ENSO prediction

Observation (1994 JJA)







Thank You !