

The APCC climate prediction activities: New Developments

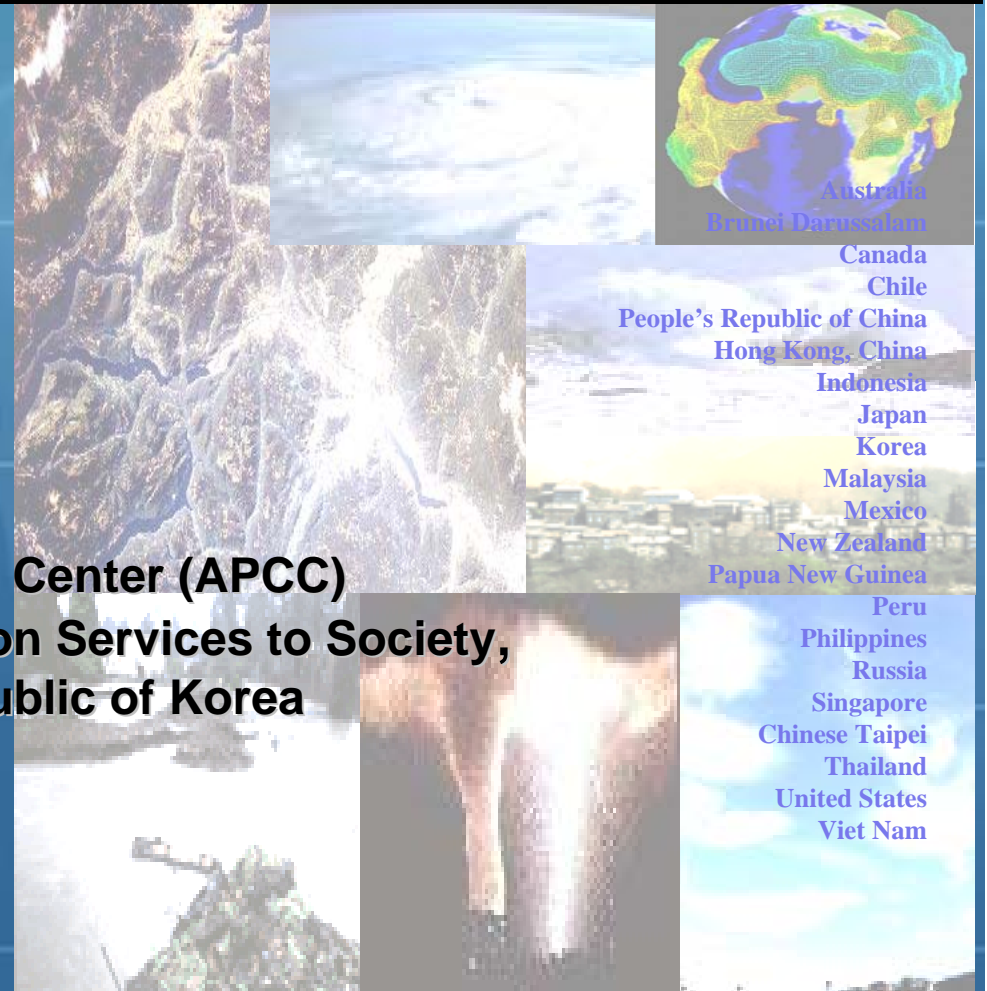
Asia

Pacific
Economic Cooperation

Climate

Center

**APEC Climate Center (APCC)
for Climate Information Services to Society,
Busan, Republic of Korea**





2008 projects

Operations

- Operationalization of monthly 3-month forecast since January, with upgraded hindcast verification.
- Downscaled forecast provision at 60 Korean stations to KMA with due hindcast verification
- New monitoring products

Development

- 6-month MME seasonal prediction
- In-house development of coupled prediction system
- Probabilistic downscaling



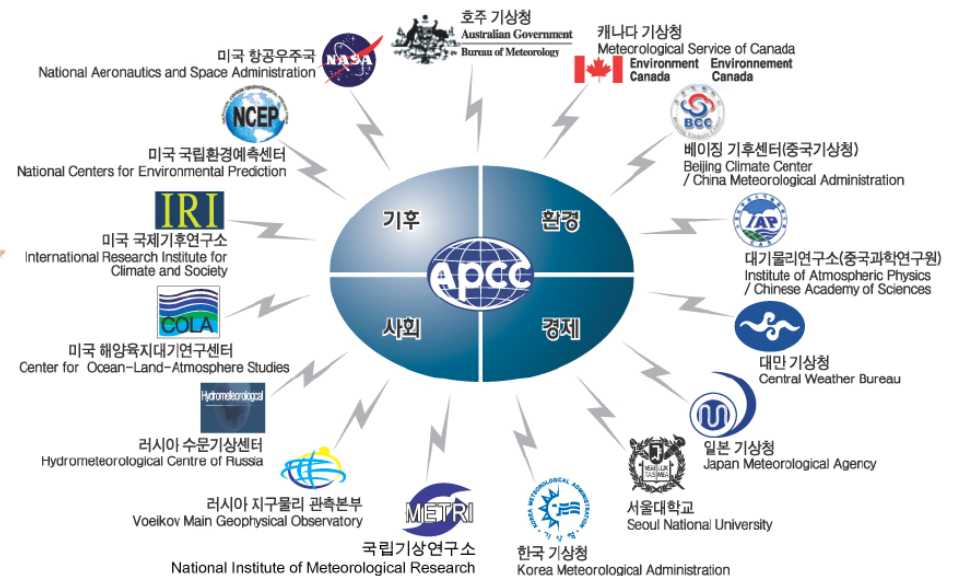
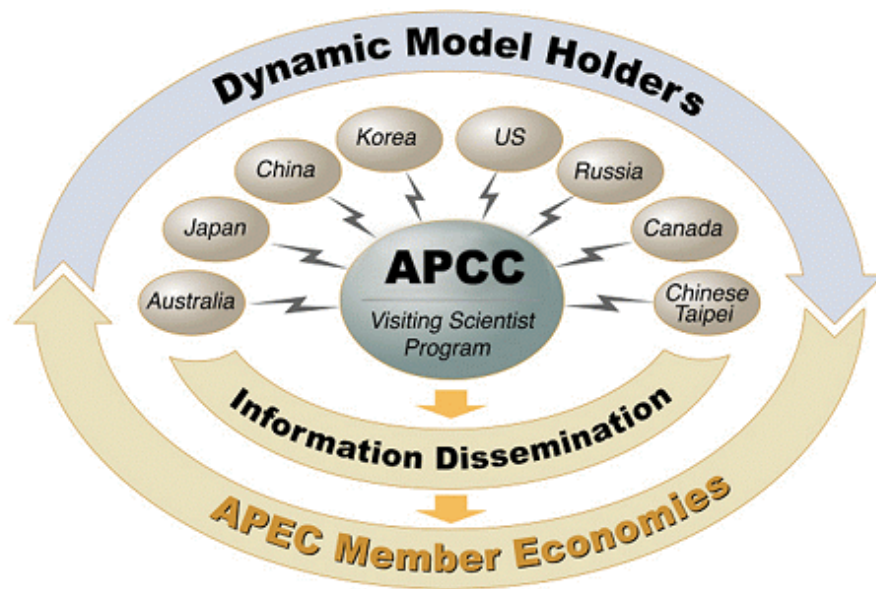
Operational Products

Enhancement of MME forecast for APCC economies → 12 times/yr

※ Operation schedule

10 ~ 15	16 ~ 18	19 ~ 23
Data acquisition & analysis	production of MME forecast	MME forecast outlook & climate highlights services

※ Multi-institutional cooperation and sharing of high-cost data





Models

Name/Economy	Start Year/Month	End Year/Month	Variables	Model Designation	SST Specification (Hindcast/Forecast)	Ensemble (H/F)	Focal Point/E-Mail
BCC China	1983/Jan.	2008/Present	PREC,T850,Z500	NCC-CGCM T63L16	Predicted SST/	8/8	Peiqun Zhang zhangpq@cma.gov.cn
COLA U.S.A.	1981/Dec.	2002/Dec.	T2M, PREC, MSLP, T850, U850, V850, U200, V200, Z500, OLR	COLA AGCM v2.2.6 T63L18	OISSTv2/ IRI SST Forecast	10/10	Daniel Paolino paolino@cola.iges.org
CWB Chinese Taipei	1979/Jan.	2003/Dec.	T2M, PREC, MSLP, T850, U850, V850, U200, V200, Z500	CWB T42L18	OISSTv2/ IRI SST Forecast	5/10	Jyh-Wen Hwu jwhwu@rdc.cwb.gov.tw
GCPS Republic of Korea	1979/Jan.	2008/Present	T2M, PREC, MSLP, T850, U850, V850, U200, V200, Z500	GCPS T63L21	KMA/SNU SST Forecast/ KMA/SNU SST Forecast	4/4	Jeong-Seok Lee jslee@kma.go.kr
GDAPS Republic of Korea	1979/Jan.	2008/Present	T2M, PREC, MSLP, T850, U850, V850, U200, V200, Z500	GDAPS T106L21	OISSTv2/OISSTv2	1/20	Won-Tae Yun ytyun@kma.go.kr
HMC Russia	1979/Mar.	2003/Dec.	T2M, PREC, MSLP, T850, Z500	SL-AV 1.125 x 1.406, L28	Persistent SST/ Persistent SST	10/10	Dmitry Kiktev kiktev@mecon.ru
IAP	1979/Jan.	2004/Jan.	T2M, PREC, MSLP, T850, U850, V850, U200, V200, Z500, OLR	IAP9L-AGCM 5.0 x 4.0, L9	Observed SST/ IAP-TOGA SST Forecast	7/7	Huijun Wang Wanghj@mail.iap.ac.cn
IRI	1979/Jan.	2005/Dec.	T2M, SST, PREC, MSLP, T850, U850, V850, U200, V200, Z500, OLR	ECHAM4.5 T42L19	Observed SST/ Forecasted SST	24/24	David G. Dewitt daved@iri.columbia.edu
JMA	1979/Jan.	2006/Dec.	T2M,SST,PREC,MSLP,OLR,T850, Z500,U850,V850,U200,V200	GSM TL95, L40	Persistent SST/ Persistent SST	51/51	Kiyotoshi Takahashi Kiyotoshi.takahashi-a@met.kishou.go.jp
METRI	1979/Jan.	2008/Present	PREC, MSLP, T850, U850, V850, U200, V200, Z500	METRI AGCM 5.0 x 4.0, L17	Persistent OISST/ Persistent OISST	10/10	Won-Tae Kwon wontk@metri.re.kr
MGO Russia((((1979/Jan.	2004/Dec.	T2M, SST, PREC, MSLP, T850, U850, V850, Z500, OLR	MGOAM2 T42L14	Observed SST/ Persistent SST	6/10	Vadim Matyugin matyugin@main.mgo.rssi.ru
MSC Canada	1969/Jan.	2003/Dec.	T2M, PREC, MSLP, T850, U850, V850, U200, V200, Z500	RPN GEM 1.875 x 1.875, L50	Persistent ERA40-SST/ Persistent CMC SST	10/10	Normand Gagnon Normand.gagnon@ec.gc.ca
NASA U.S.A..	1993/Feb.	2007/Sep.	T2M, SST, PREC, MSLP, T850, U850, V850, U200, V200, Z500, OLR	NASA-GSFC 2.5x2.0, L34	Predicted SST/ Predicted SST	6/18	Myong-In Lee milee@gamo.gsfc.nasa.gov
NCEP U.S.A..	1981/Dec.	2003/Feb.	T2M, SST, PREC, MSLP, T850, U850, V850, U200, V200, Z500, OLR	NCEP CFS T62L64	Predicted SST/ Predicted SST	15/15	Jae-Kyung E. Schemm Jae.Schemm@noaa.gov
POAMA Australia	1981/Dec.	2003/Feb.	T2M, SST, PREC, MSLP, T850, U850, V850, U200, V200, Z500, OLR	POAMA 1.5 T47L17	Predicted SST/ Predicted SST	15/15	Oscar Alves o.alves@bom.gov.au





High Performance Computing System

Korea Meteorological Administration (Cray X1E)



Scale	Total number of cabinets	8	Server for computing
	Number of nodes	256	
	Processor	188 MSPs	
	Memory capacity	3.84 Tbytes	
Performance of single CPU		18.08 Gflops	
Theoretical performance	System node	51.2 Gflops	
	Computation node	2.4 Gflops	
Effective performance		2.1 Gflops	

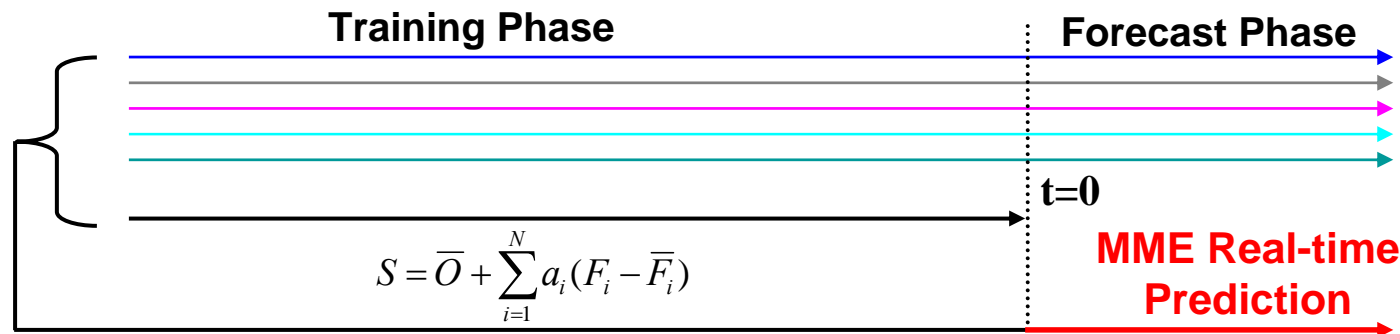
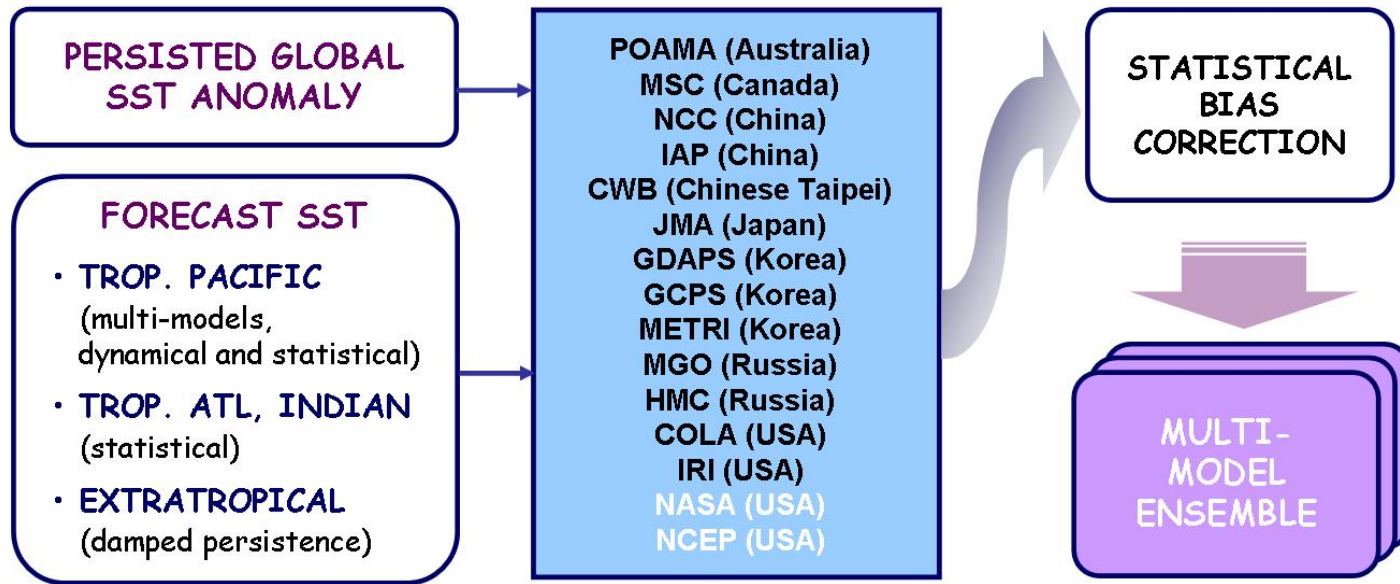
Korea Institution of Science & Technology Information (IBM)



- IBM System p5 595 server
- Storage System : IBM 366 TB DS4700
- Shared storage : 460 TB
- Speed : 37 TF
- Memory : 1024 GB memory per 1 node



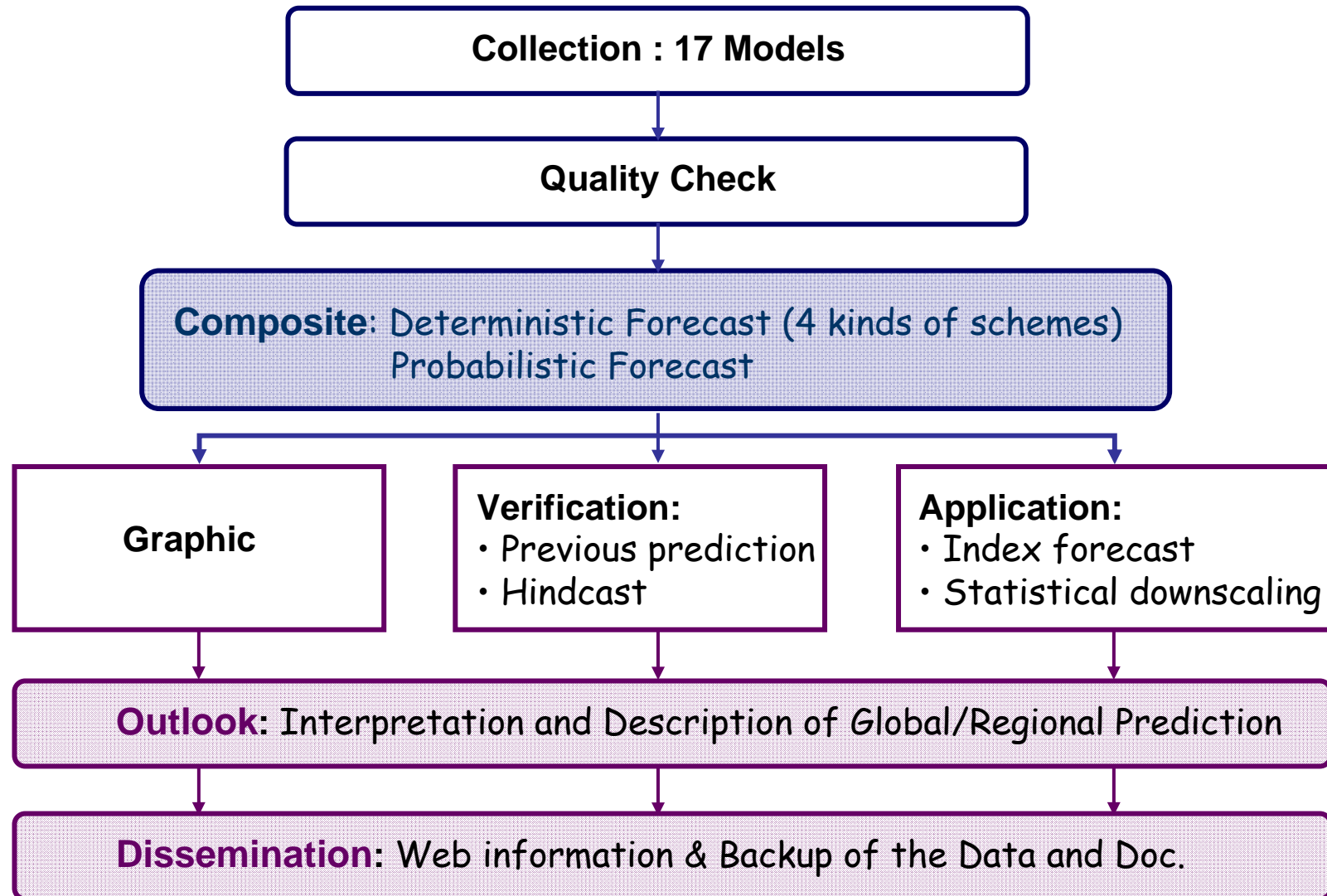
APCC Dynamical Climate Forecast System (Tier2)



The weights are computed at each grid point by minimizing the function: $G = \sum_{t=0}^{train} (S_t - O_t)^2$



Procedure of MME Seasonal Prediction System





Deterministic MME Schemes

SCM

Simple Composite Method :

Simple composite of individual forecast with equal weighting

$$P = \frac{1}{M} \sum_i F_i'$$

SPPM

Stepwise Pattern Projection Method :

Simple composite of individual forecasts, after correction by SPPM (improved version of CPPM)

$$P = \frac{1}{M} \sum_i \hat{F}_i'$$

MRG

Multiple Regression Method:

Optimally weighted composite of individual forecasts. The weighting coefficient is obtained by SVD based regression

$$P = \sum_i a_i F_i'$$

SSE

Synthetic Multi-Model Super Ensemble Method:

Weighted combination of statistically corrected multi model output

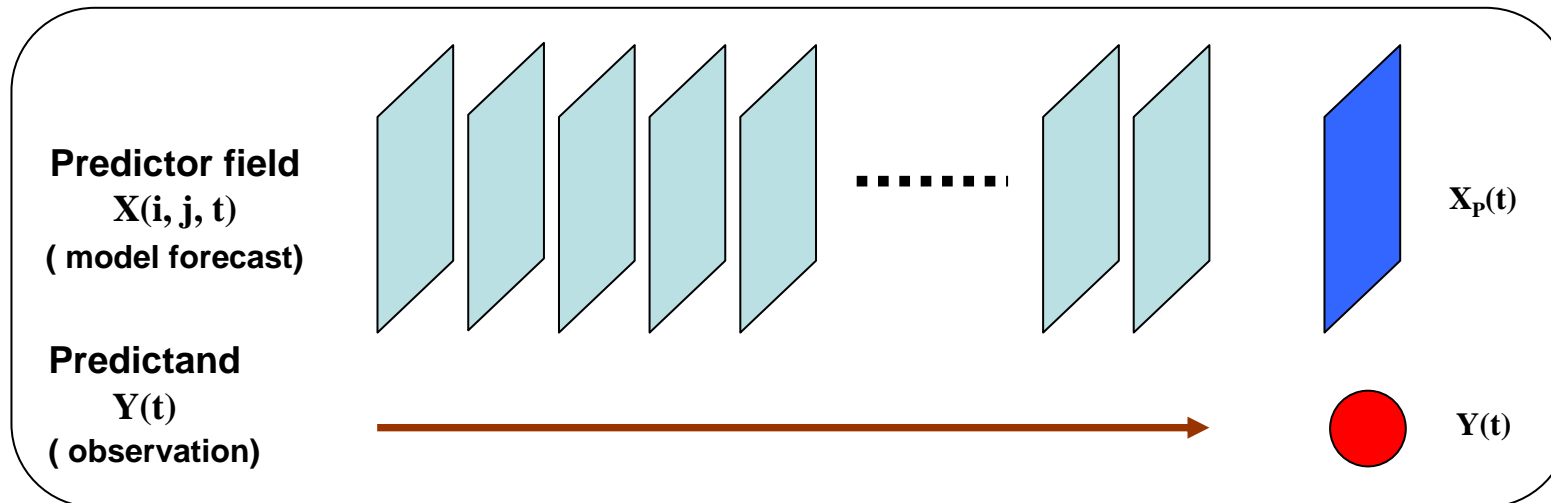
$$P = \frac{1}{M} \sum_i \alpha_i \hat{F}_i'$$



Couple Pattern Projection Method

- Forecast procedure – Pointwise regression method

$$Y(t) = \alpha X_p(t) + \beta$$



Coupled pattern projection coefficient

$$X_p(t) = \sum_{i,j} \text{COR}(i,j) \cdot X(i,j,t) \quad \text{COR}(i,j) = \frac{\frac{1}{N} \sum (Y(t) - Y_m) \cdot (X(i,j,t) - X_m(i,j))}{\sigma_X(i,j) \cdot \sigma_Y}$$

Calculate regression coefficient α , β in training period, forecast a regional climate from projection coefficient of the coupled pattern onto forecast field.



Implemented MME-S in APCC

- SPPM and MME-S was tested on prediction of 850 hPa temperature precipitation using **APCC hindcast data** for the period 1983-2003 and **operational forecast data for 2006 and 2007.**
- SPPM code was transferred to APCC and is now part of the **Automated Forecast System.**

MME-S Procedure

STEP 1: Applying statistical correction using SPPM to individual models

- (1) Prior prediction selection
- (2) Second Step: Pattern Projection
- (3) Optimal choice of prediction

STEP 2: Simple multi-model composite using available predictions

Advantage to using SPPM2

(1) Computational Estimates (per 1 model, 1 variable, 22 years)

CPPM- OLD version : 72
hours

CPPM – New version : 12-15
hours

SPPM v2 : 5 hours
(suggestion: If you use 8 cpu
simultaneously, it takes 10
hours for all models'
hindcast and forecast and
two variables)

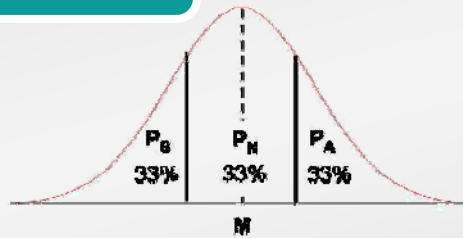
(2) Improved skill, especially for precipitation



Probabilistic MME Scheme

Defining terciles

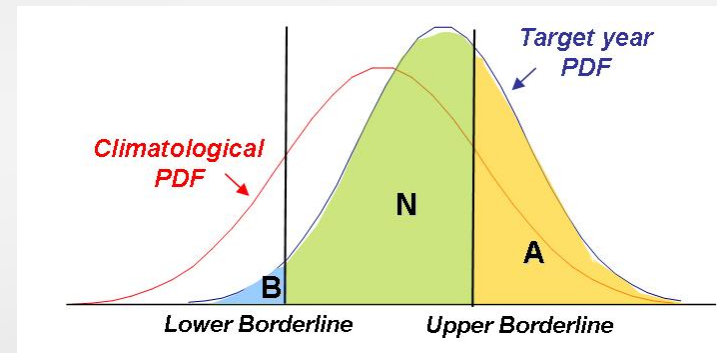
Normal fitting method



- For the middle/upper tercile boundary :
mean plus 0.43 times the standard deviation
→ $\mu + 0.43\sigma$
- For the lower/middle tercile boundary :
mean minus 0.43 times the standard deviation
→ $\mu - 0.43\sigma$

Forecast probability

- A** Probability of Above-normal
- N** Probability of Near-normal
- B** Probability of Below-normal





Monthly 3-Month Forecasts Operationalized

- 4-deterministic and one probabilistic MME forecasts carried out each month. Best deterministic forecast for that month selected on hindcast verification.
- Forecast outlooks sent out by 25th of each month to 21 NMHSs and to larger climate prediction community.
- Review of outlook by Working Group and SAC members prior to public release

The APEC CLIMATE CENTER
Climate Outlook for August-October, 2008

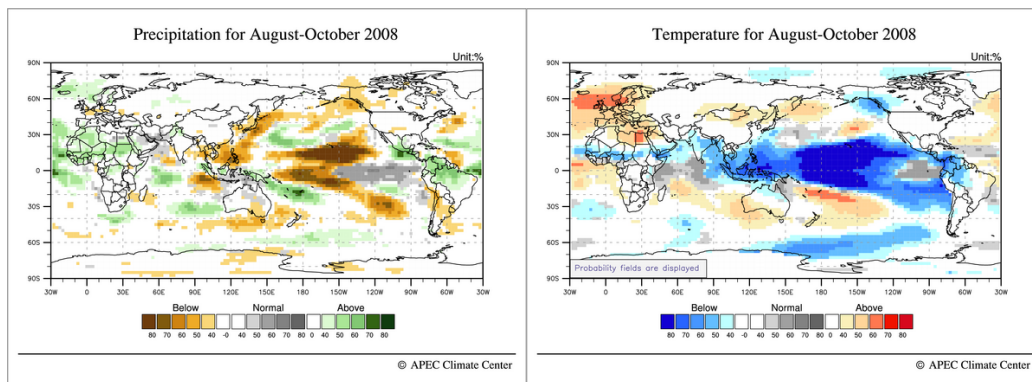
BUSAN, 23 July 2008 - Synthesis of the latest computer model forecasts for August to October, 2008 at the APEC Climate Center (APCC), located in Busan, Korea, predicts warmer than normal temperatures in Western Europe, Mediterranean, parts of middle East, Mongolia and the East Asian region covering China, Korea and Japanese archipelago. Many parts of Asia may experience near normal to drier-than normal conditions. The current conditions in the tropical Indian Ocean are indicative of a positive IOD event.

Current Climate Conditions

During the past May-to-July period (based on data up to July 18, 2008), it has been drier than normal in the southeastern as well as western part of US, while a larger region covering northeastern Brazil and the equatorial Atlantic has seen surplus rainfall. It has been warm and dry in the Middle East, midlatitude Central Asia and northeast Asia. Most part of the continental Australia also experienced deficiency in rainfall in the past three months or longer. On the other hand, it has been wetter than normal in the Philippines, the southern Polynesian Islands and also northern part of India. Current cooler than normal Sea Surface Temperature over equatorial eastern Indian Ocean and alongshore surface wind easterly anomalies off Sumatra persisted, indicative of a positive Indian Ocean Dipole (IOD) event.

Forecast

The APCC forecasts for ASO, 2008 indicate that a broad region covering from north Australia, through most of the Maritime Continent and Indochina, till India is expected to see anomalously cool conditions. On the other hand, southeast Australian continent to New Zealand may experience slightly warmer and dry than normal conditions; the expected rainfall conditions are in agreement with the positive IOD-like conditions that currently prevail, indicating a possibility of continuation of the event.





Upgrading of the SVS

- APCC pursues the WMO-prescribed SVS measures.
- We are upgrading our efforts of verification. We have upgraded our verification almost to level 3 suggested by WMO.

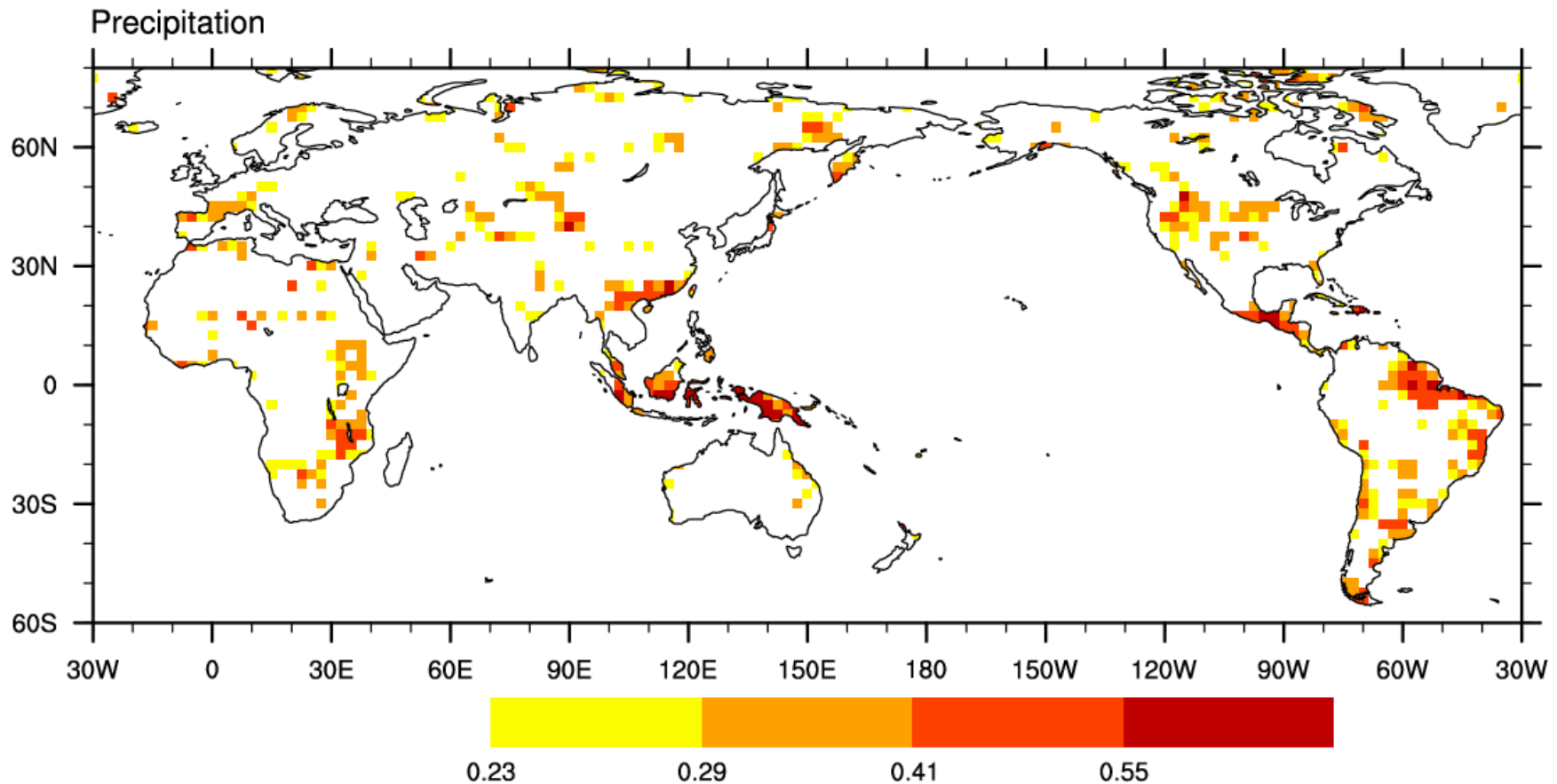
Level 1	Parameters	Verification Regions	Deterministic Forecasts	Probabilistic Forecasts
	T2m anomaly Precipitation anomaly	Tropics Northern Extra-Tropics Southern Extra-Tropics	MSSS (bulk number)	ROC curves, ROC areas Reliability diagrams Frequency histograms
	Niño3.4 Index	N/A	MSSS (bulk number)	ROC curves, ROC areas Reliability diagrams Frequency histograms
Level 2	Parameters	Verification Regions	Deterministic Forecasts	Probabilistic Forecasts
	T2m anomaly, SST anomaly Precipitation anomaly	grid point verification on a 2.5° by 2.5° grid	MSSS and its three term decomposition at each grid point	ROC areas at each grid point
Level 3	Parameters	Verification Regions	Deterministic Forecasts	Probabilistic Forecasts
	T2m anomaly, SST anomaly Precipitation anomaly	grid point verification on a 2.5° by 2.5° grid	3 by 3 contingency tables at each grid point	ROC reliability tables at each grid point

[Main Link](#)



Upgrading of the SVS

Gerrity Skill Score (SCM, prec)

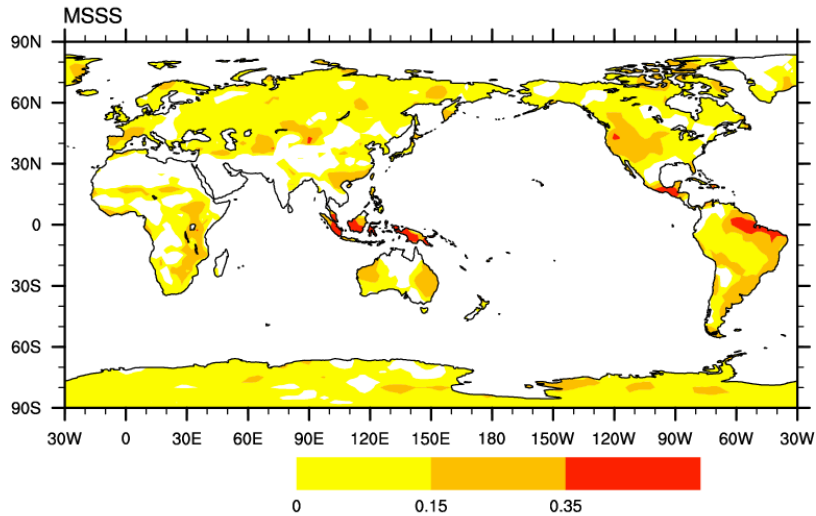


- Fig.: One of the level3 scores, based on 3X3 deterministic contingency tables
- A new extreme event index has also been designed based on Gerrity Score.

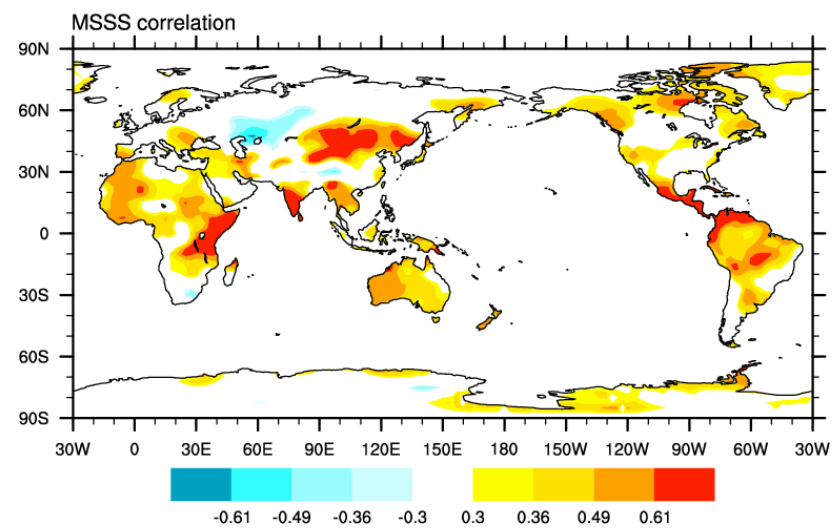
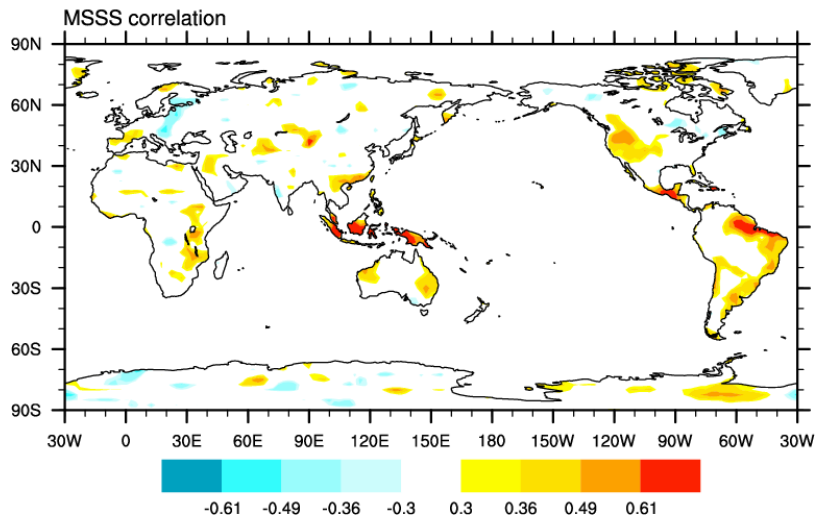
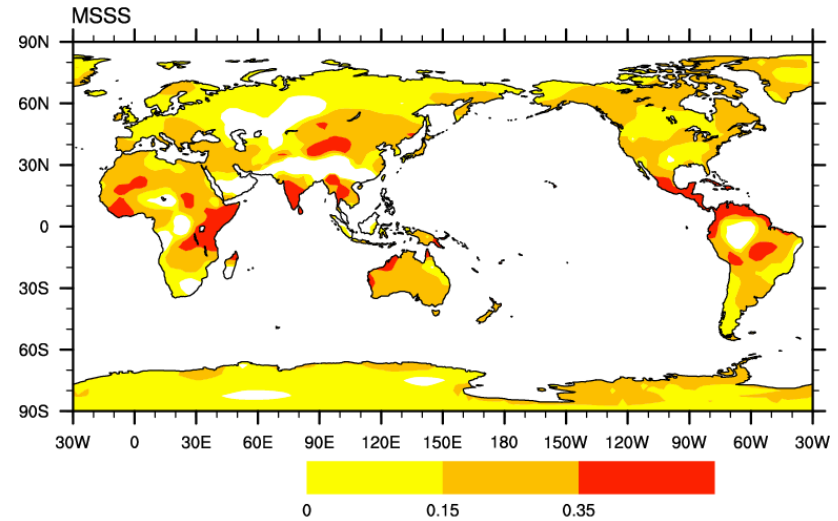


Some verification statistics

MME, prec, 1983-2003, JJA



MME, t850, 1983-2003, JJA

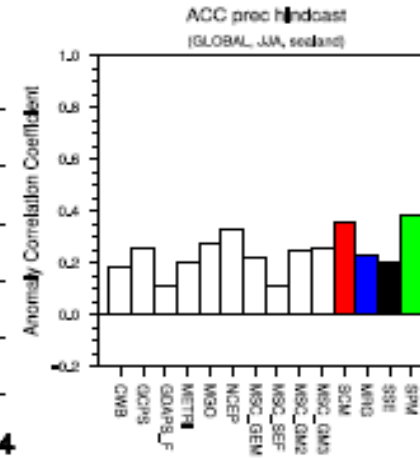
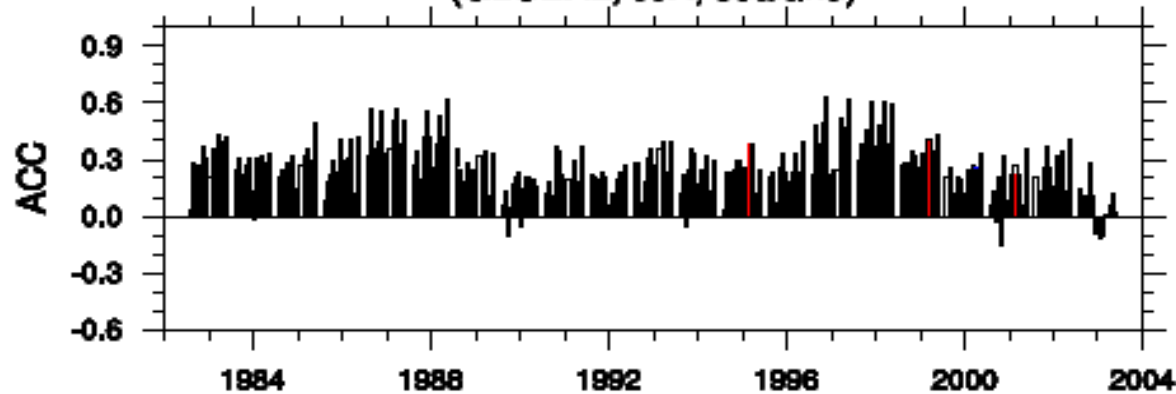




Some verification statistics

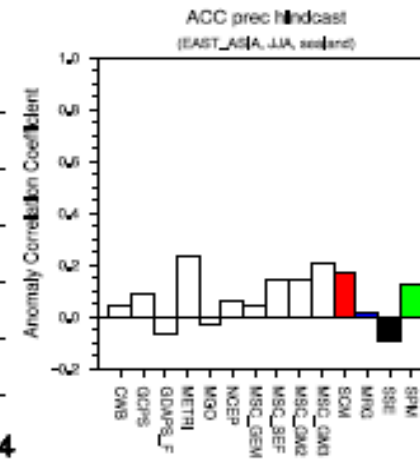
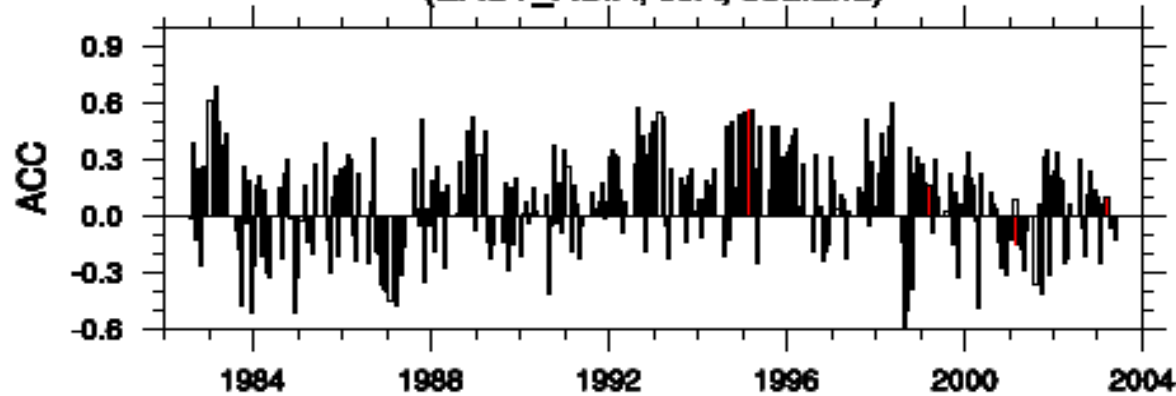
ACC prec hindcast

(GLOBAL, JJA, sealand)



ACC prec hindcast

(EAST_ASIA, JJA, sealand)

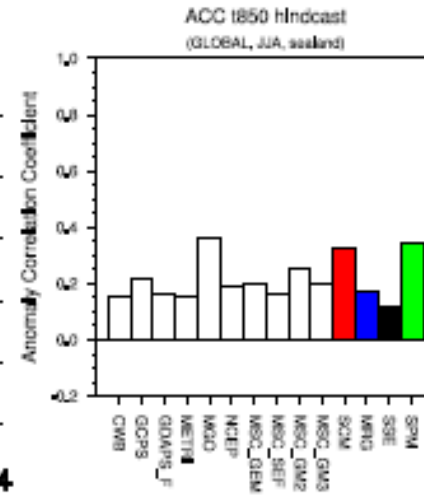
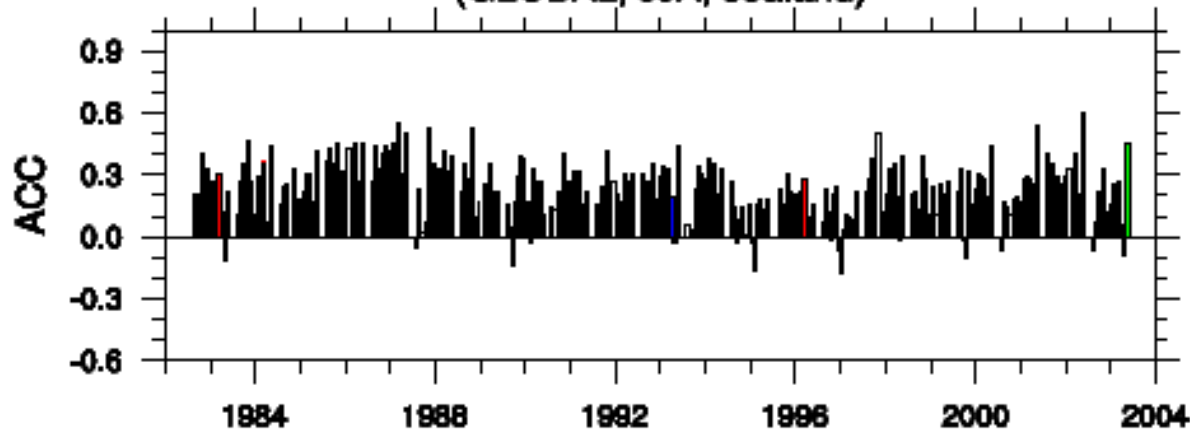




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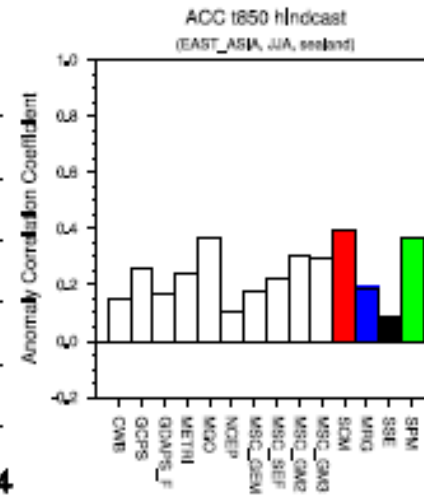
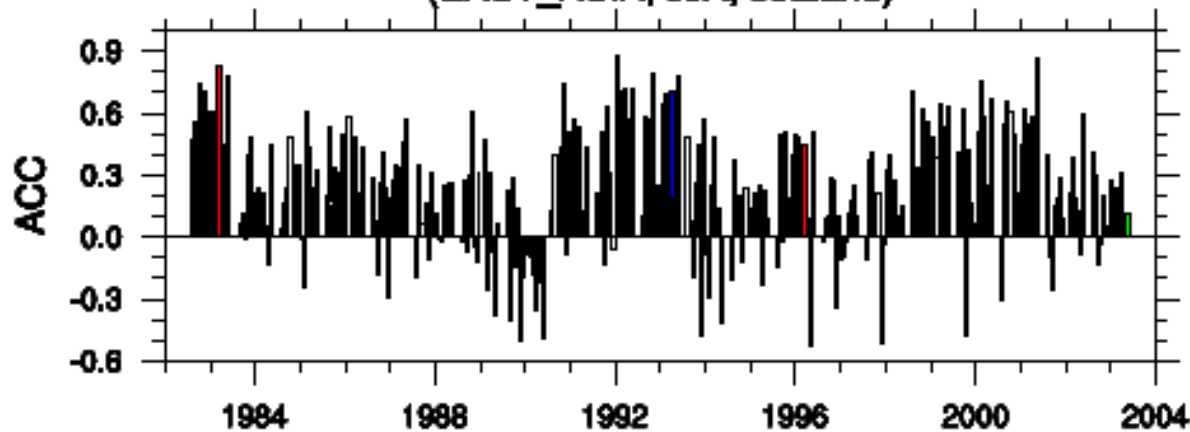
ACC t850 hindcast

(GLOBAL, JJA, sealand)



ACC t850 hindcast

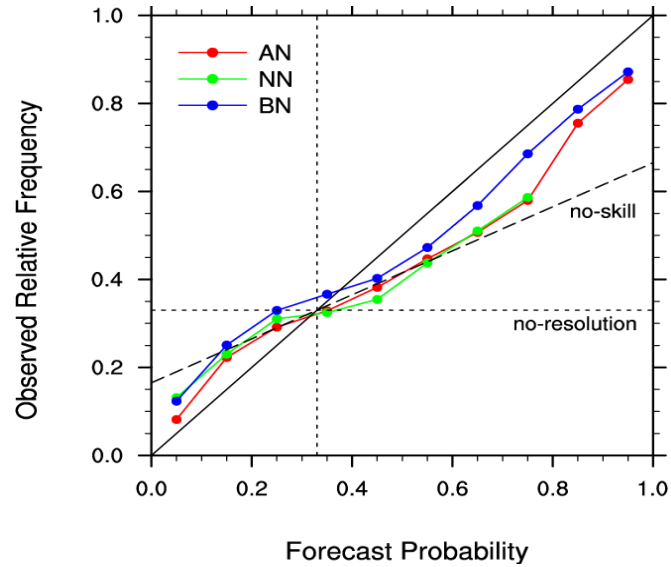
(EAST_ASIA, JJA, sealand)



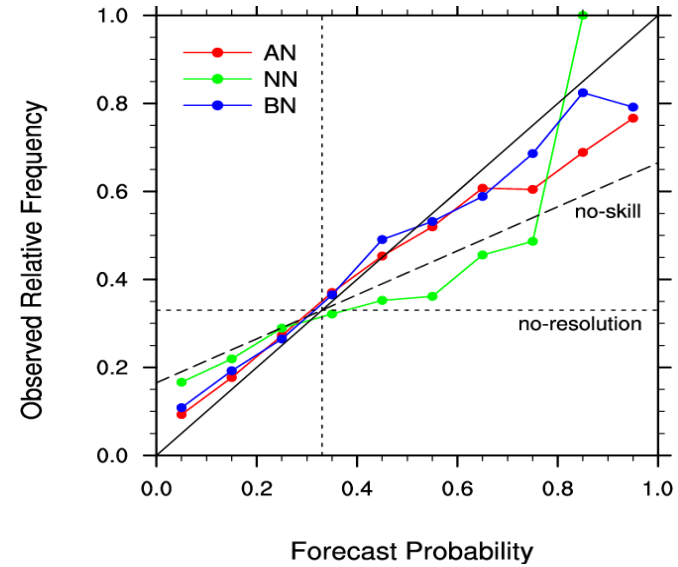


Some verification statistics

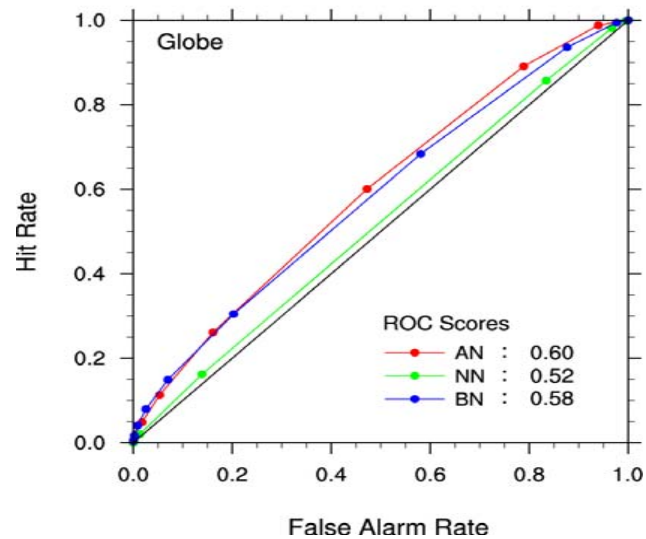
Reliability Diagram, PREC, JJA (1983~2003)



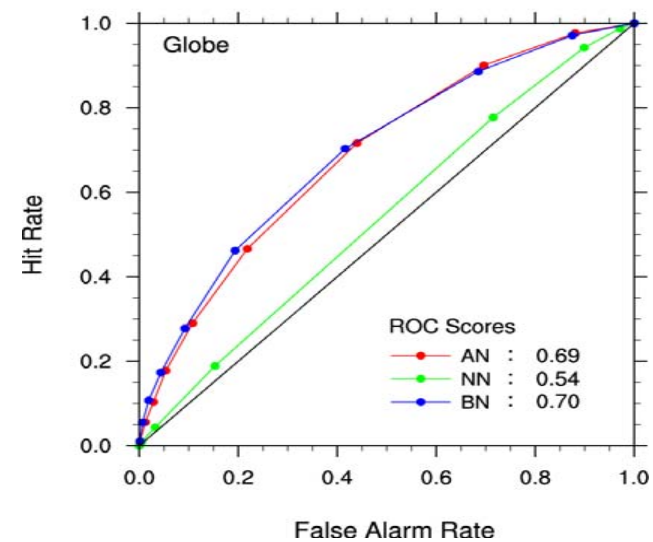
Reliability Diagram, T850, JJA (1983~2003)



ROC Curve, PREC, JJA (1983~2003)



ROC Curve, T850, JJA (1983~2003)



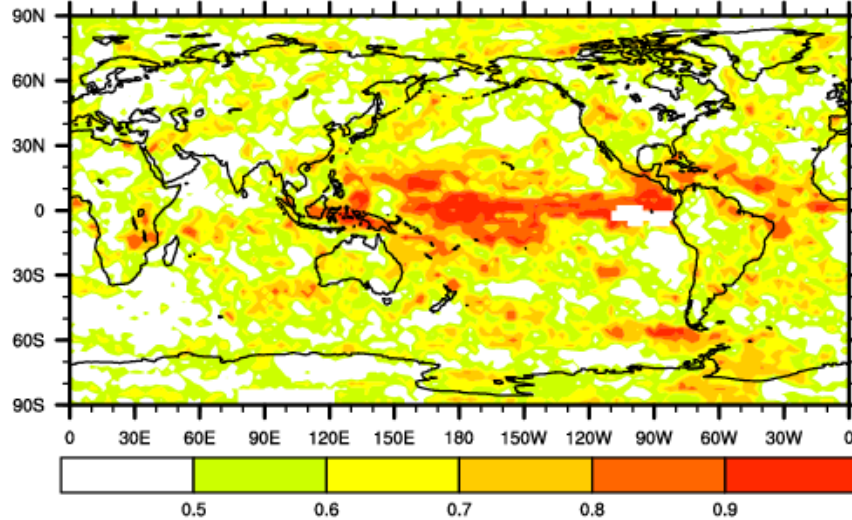


Some verification statistics

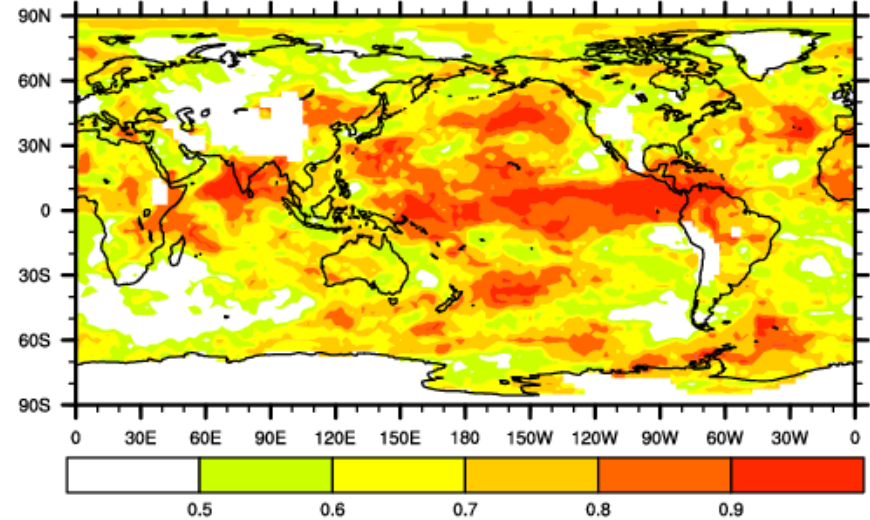
ROC Score : PREC, JJA (1983-2003)

ROC Score : T850, JJA (1983-2003)

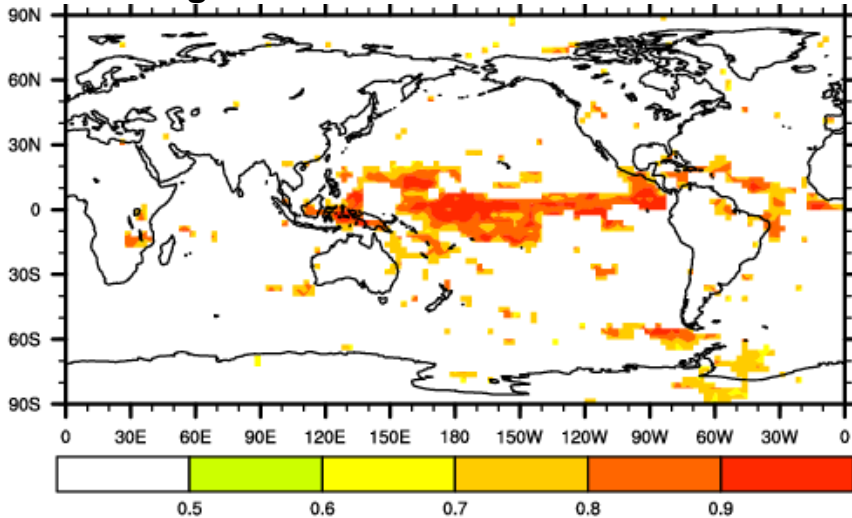
Above-Normal



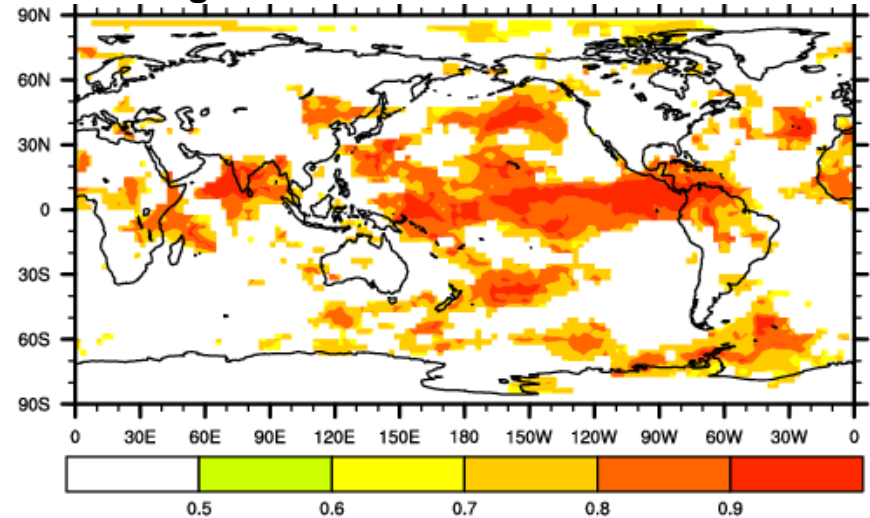
Above-Normal



10% Significance

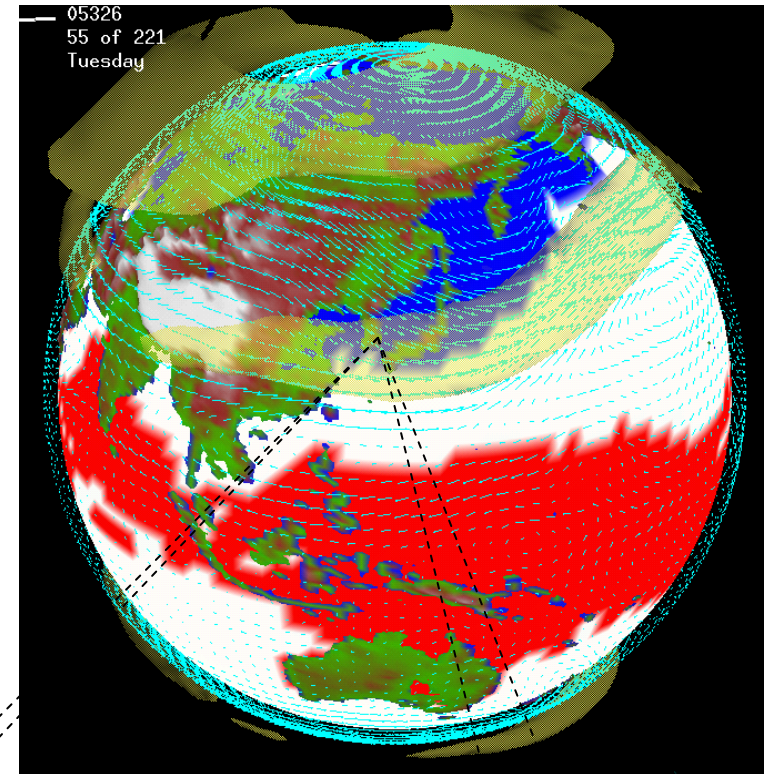
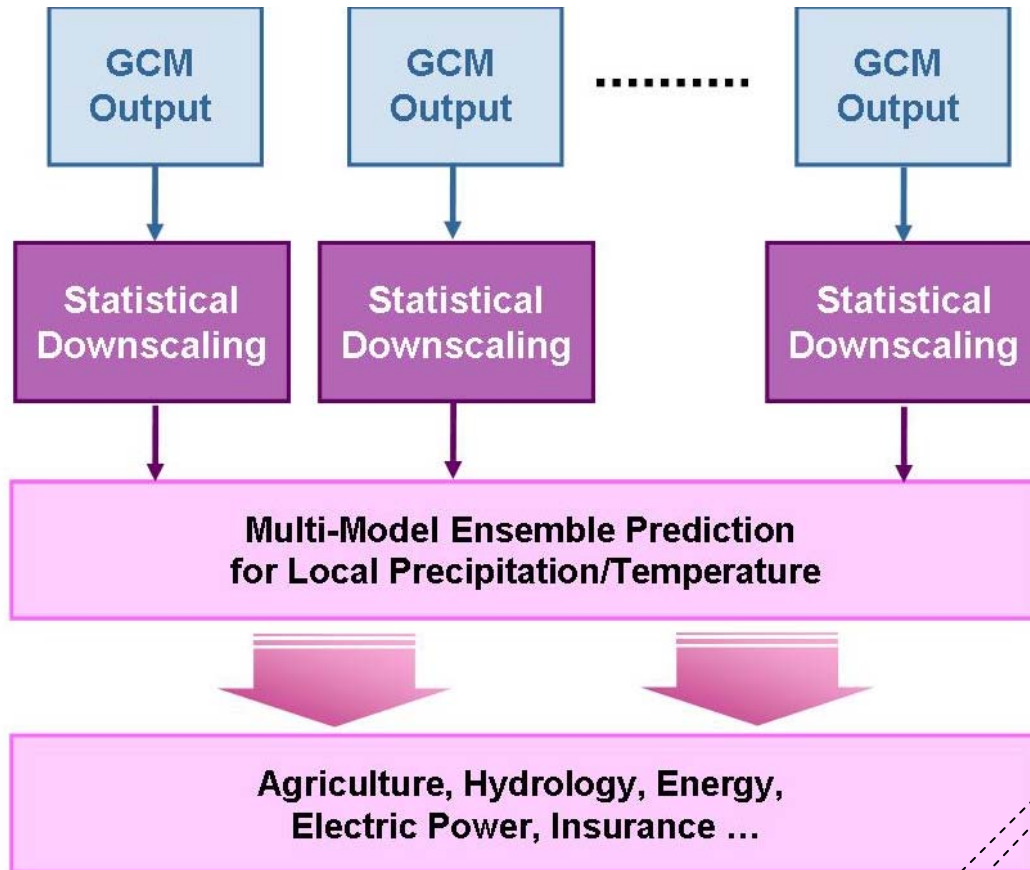


10% Significance





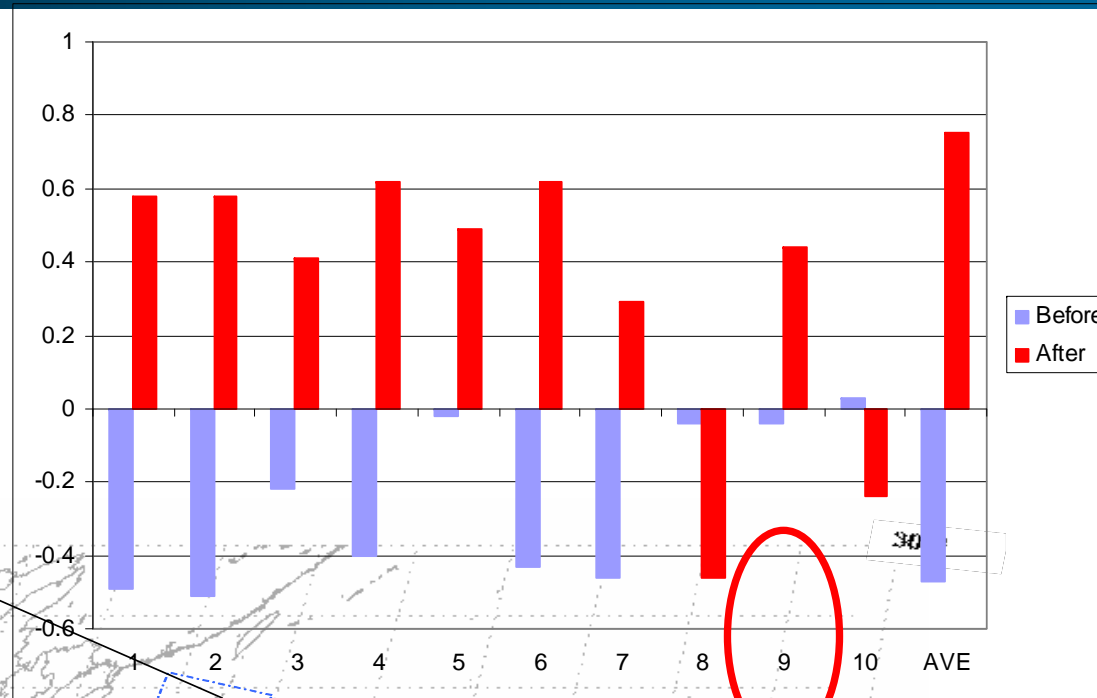
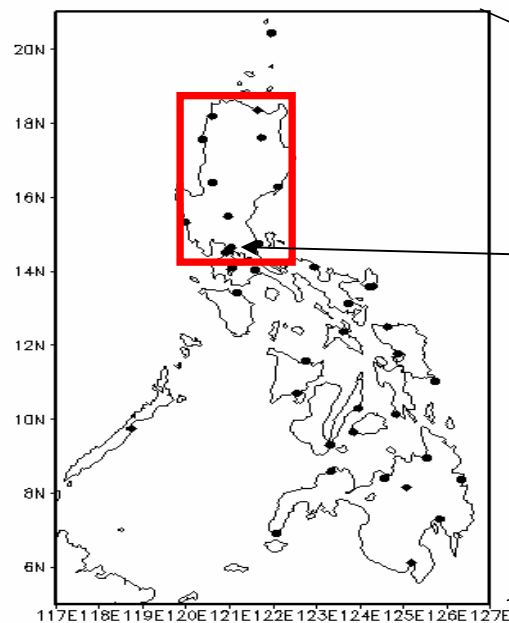
Downscaled forecast provision





Statistical Downscaling

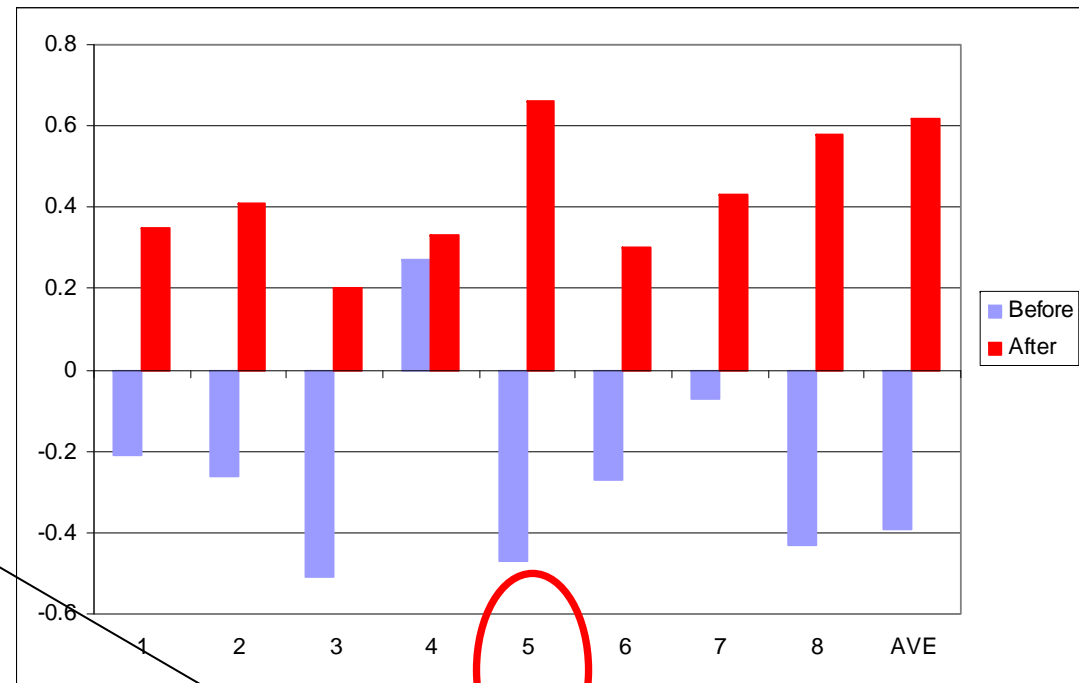
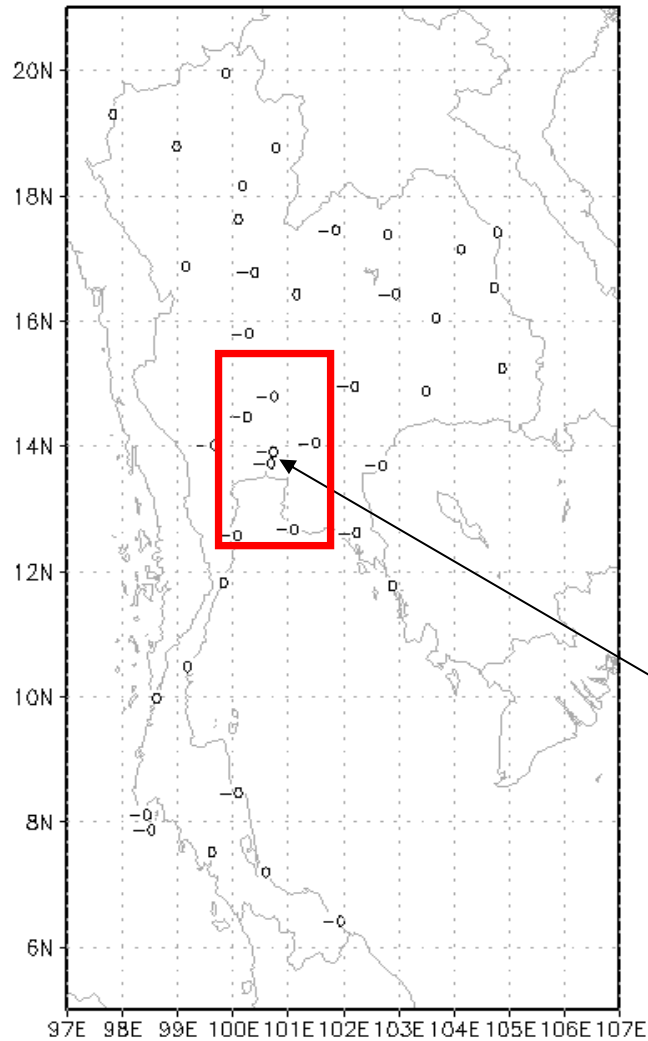
Northern Philippine



Manila



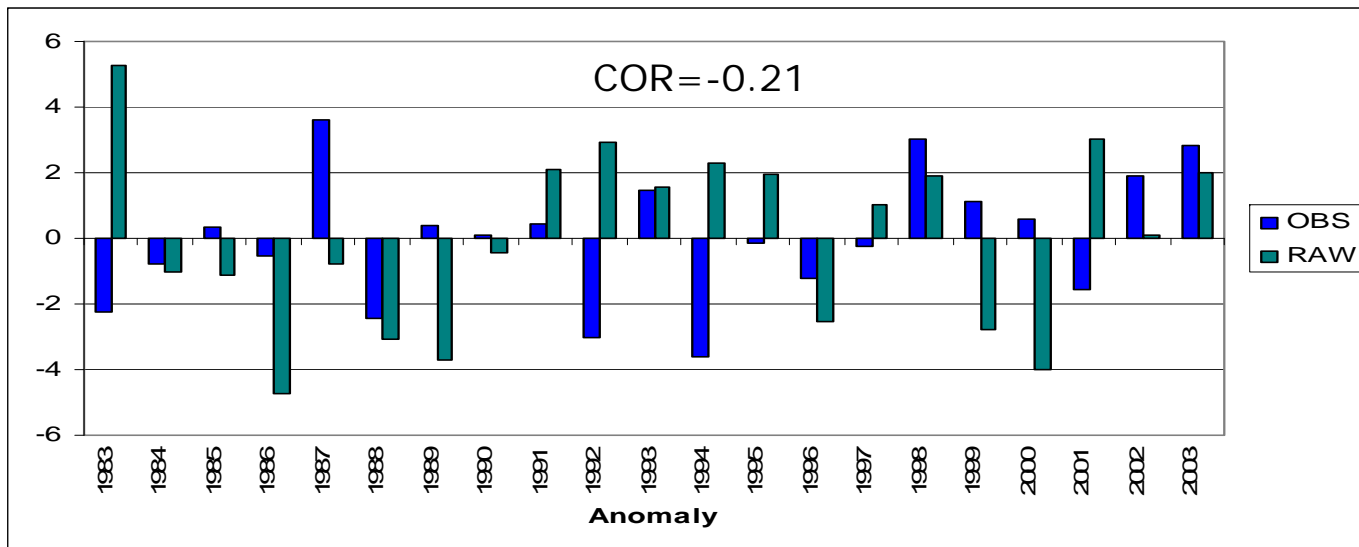
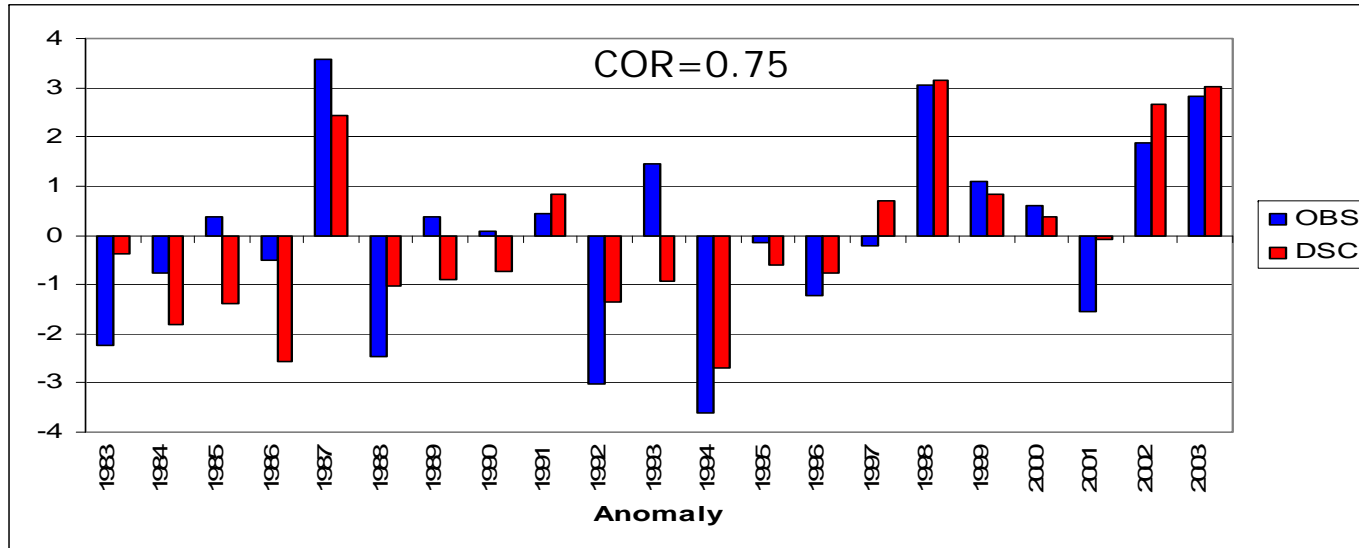
Statistical Downscaling : Precipitation



Bangkok



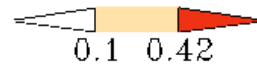
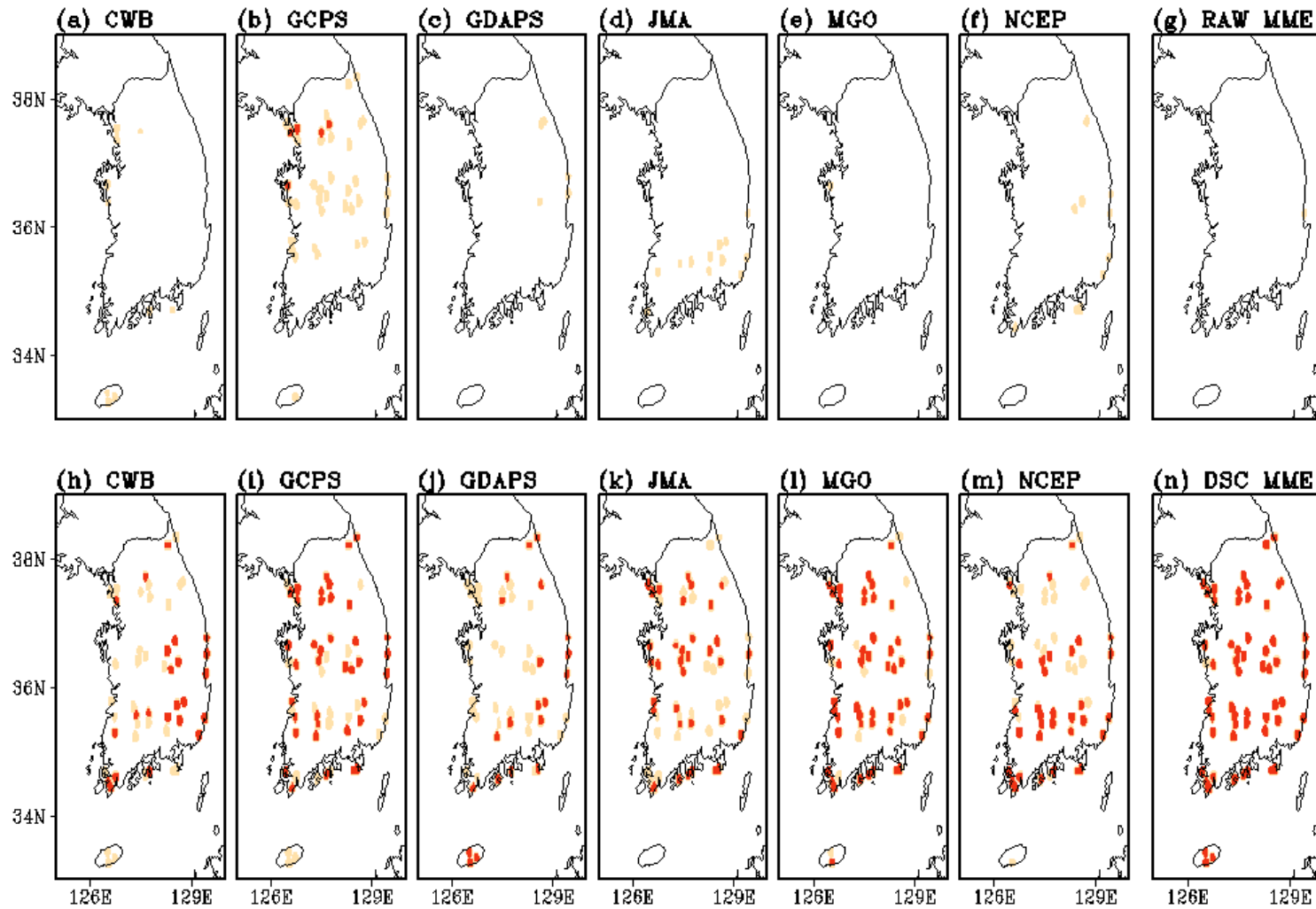
MME: Area-averaged JJA rainfall anomaly for Korea





MME: Verification skills for Korea

Precipitation



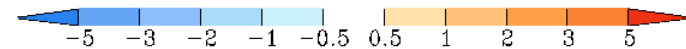
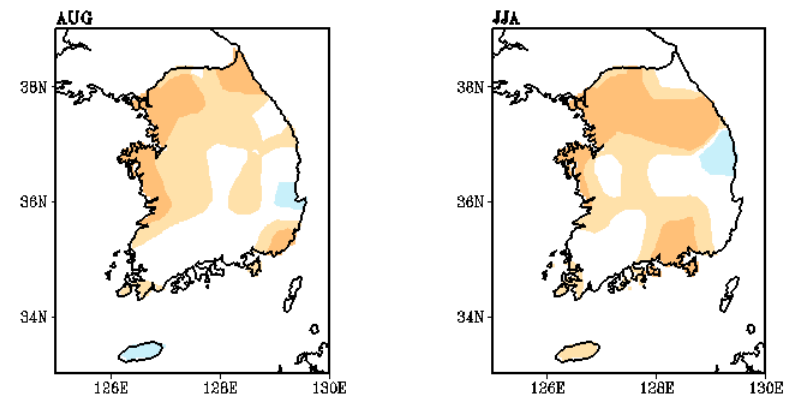
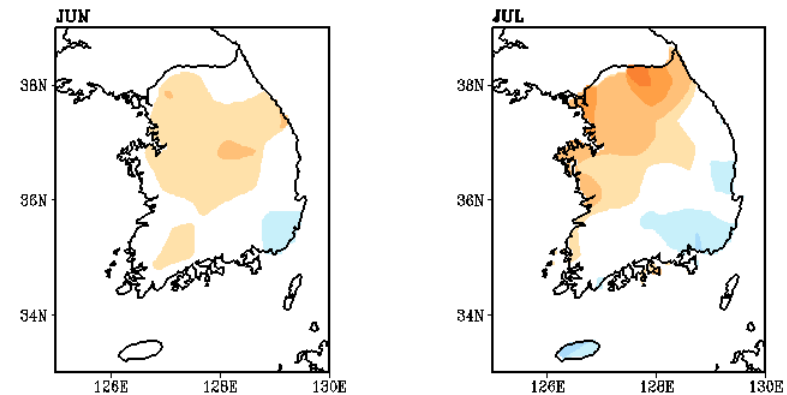
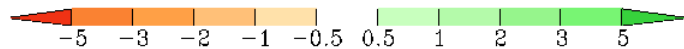
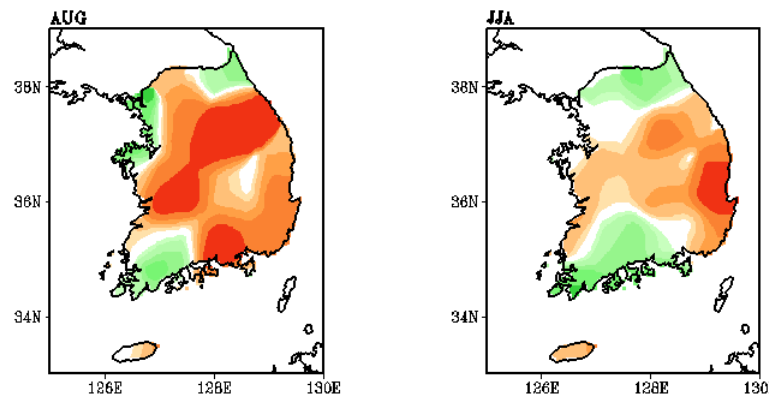
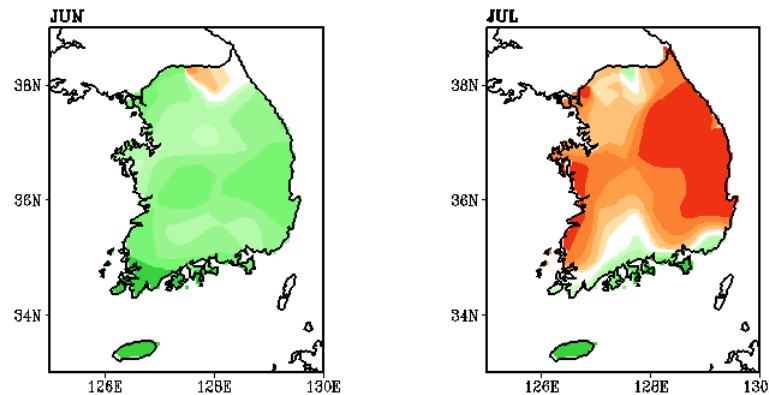


Real Time Downscaling Forecast for Korea

2008JJA

PREC

T2m





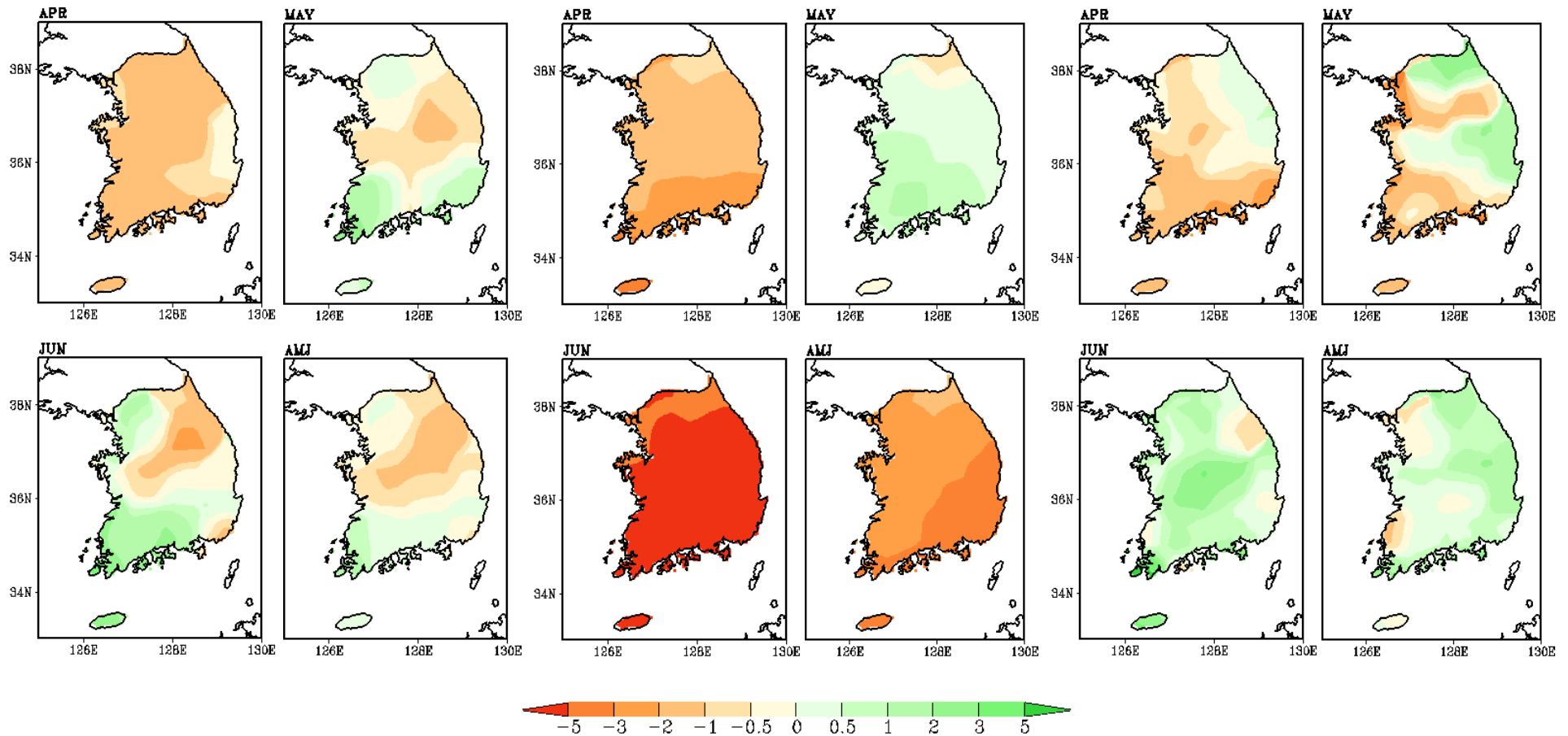
Forecast Verification

Precipitation anomaly for AMJ 2008

Stational observation

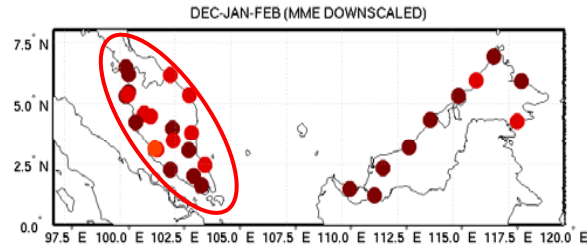
MME prediction

Downscaling prediction

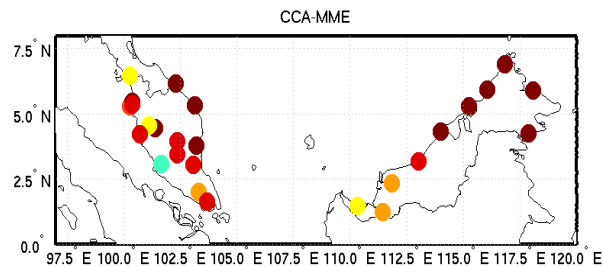




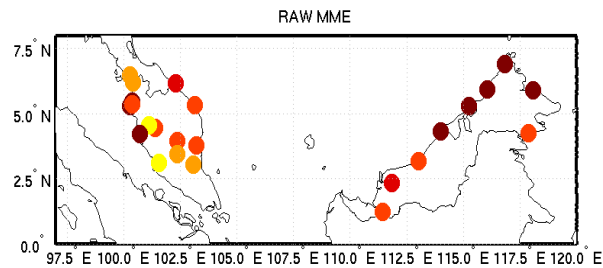
Spatial Distribution of Skills (DJF) over Malaysia



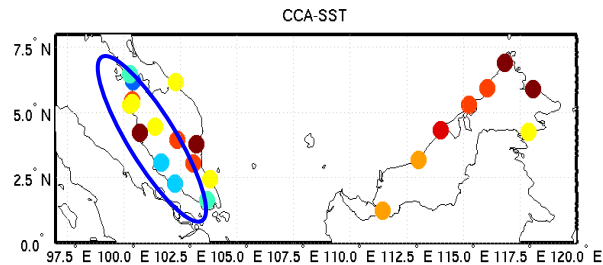
Downscaled APCC-MME



Downscaled CCA-MME



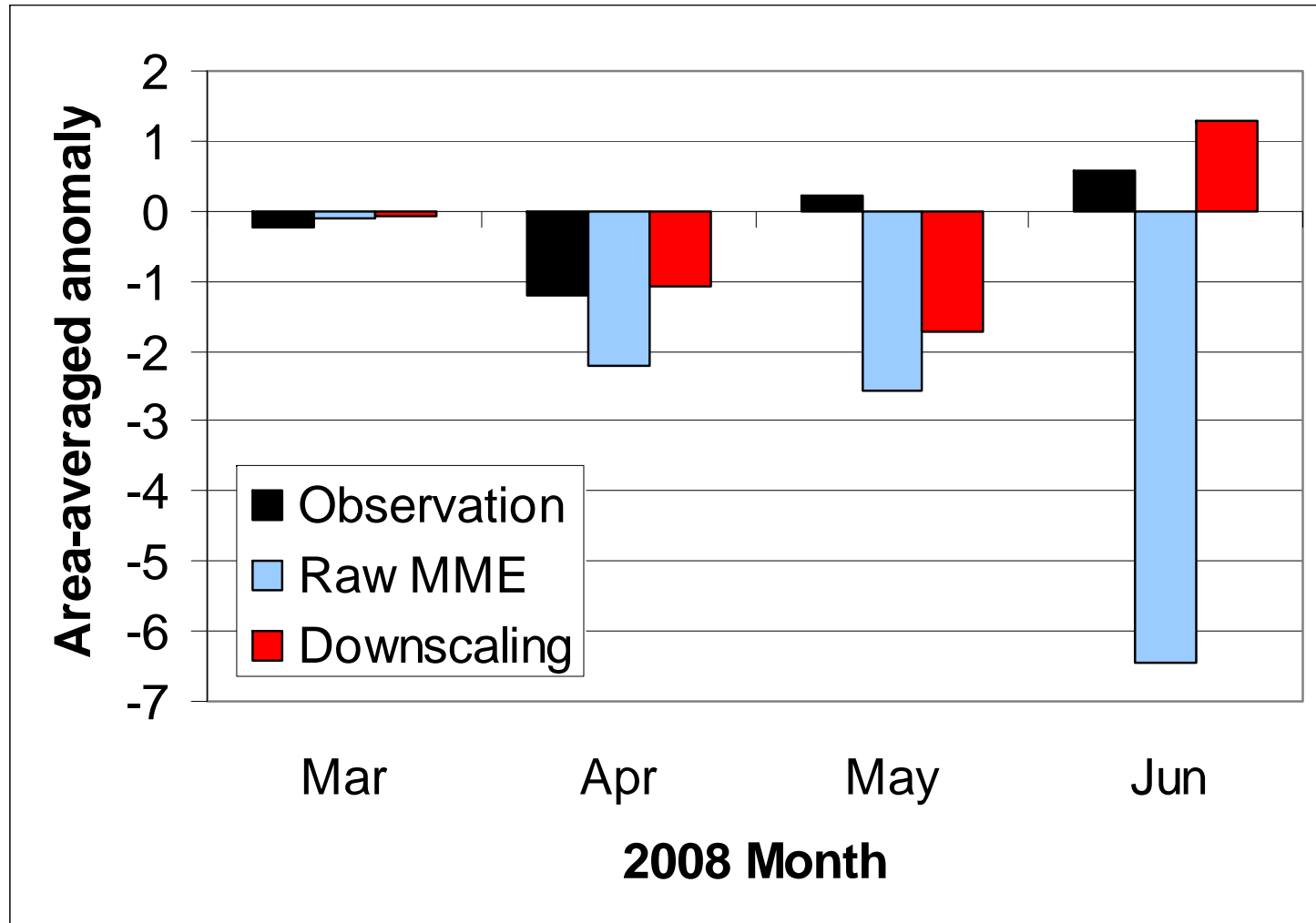
RAW MME



CCA-SST (pure statistical model)



Forecast Verification for Korea





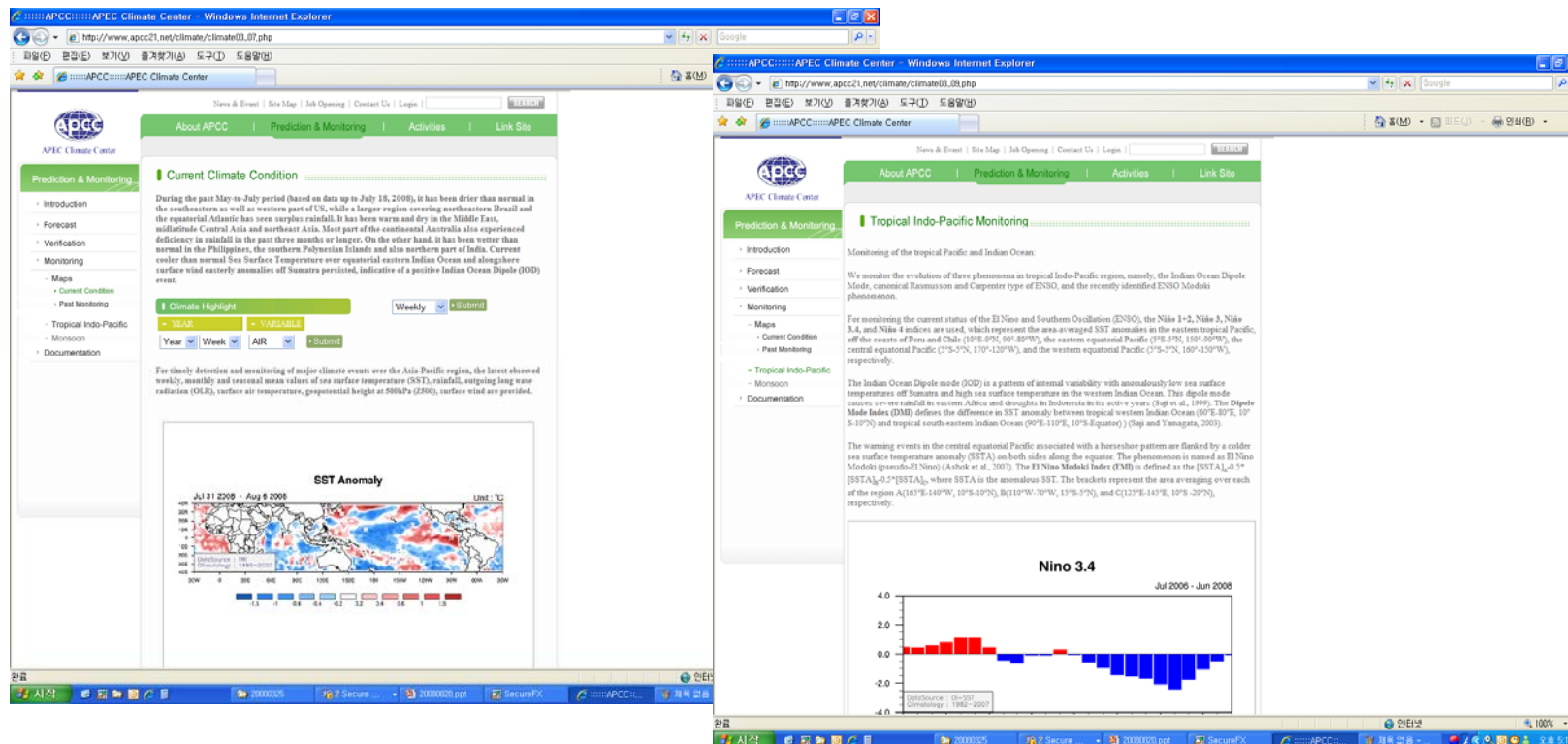
APCC Climate Monitoring Products

- Provided since summer 2008
- Weekly / monthly / seasonal SST, temperature, OLR, rainfall, geopotential height at 500hPa, surface wind anomalies

http://www.apcc21.net/climate/climate03_07.php

- Current (monthly) indices for tropical Indo-Pacific monitoring

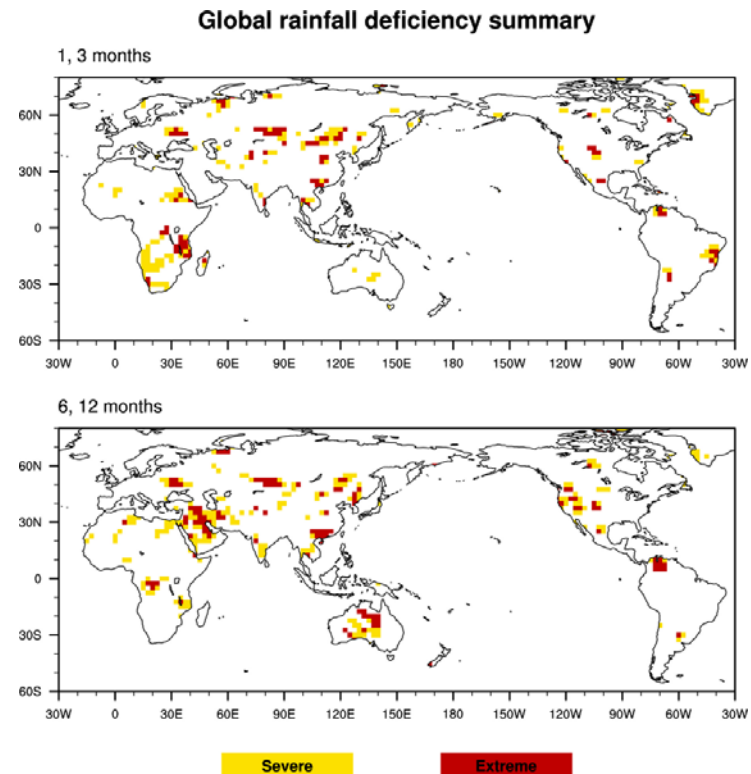
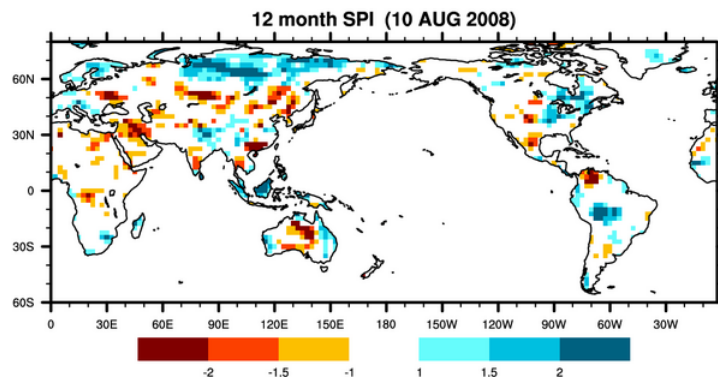
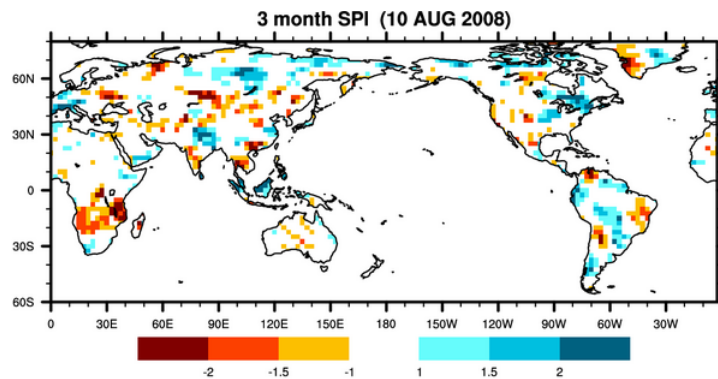
http://www.apcc21.net/climate/climate03_09.php





Experimental Global Drought Monitoring

- Experimental drought monitoring system set up using Standardized Precipitation Index (SPI; McKee et al. 1993)
- SPI is calculated for multiple time scales: 1, 3, 6, 12 months
- Summary maps of rainfall deficiency on the short term (1 to 3 months) and intermediate term (6 to 12 months) are also provided.
- Datasets: Japanese 25-year ReAnalysis and Japan Meteorological Agency Climate Data Assimilation System





Standardized Precipitation Index (SPI)

- Precipitation is quantified by transforming its distribution (usually fitted to a Gamma) into a standardized normal distribution on an equal probability basis

Gamma function

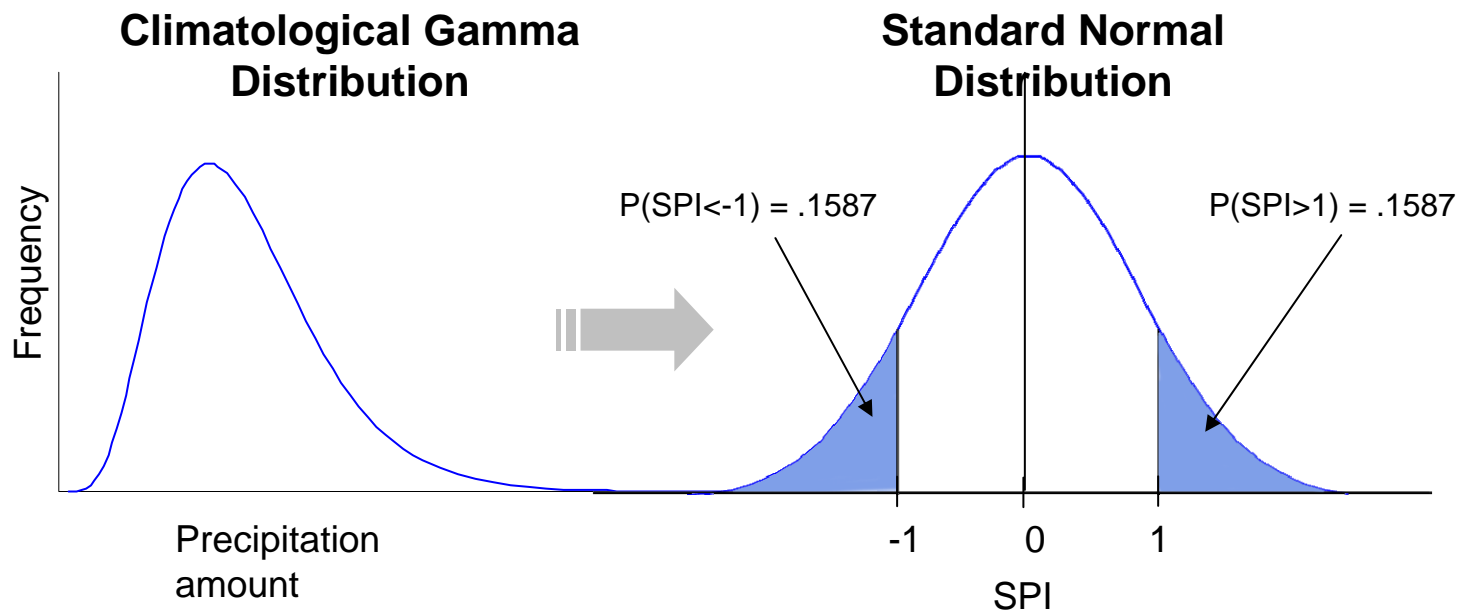
$$G(x) = \frac{1}{\Gamma(\hat{\alpha})} \int_0^x t^{\hat{\alpha}-1} e^{-t} dt$$

Cumulative probability

$$H(x) = q + 1(1 - q)G(x)$$

Standard normal random variable

$$Z = \pm \left[t - \frac{c_0 + c_1 t + c_2 t^2}{1 + d_0 t + d_1 t^2 + d_2 t^3} \right]$$

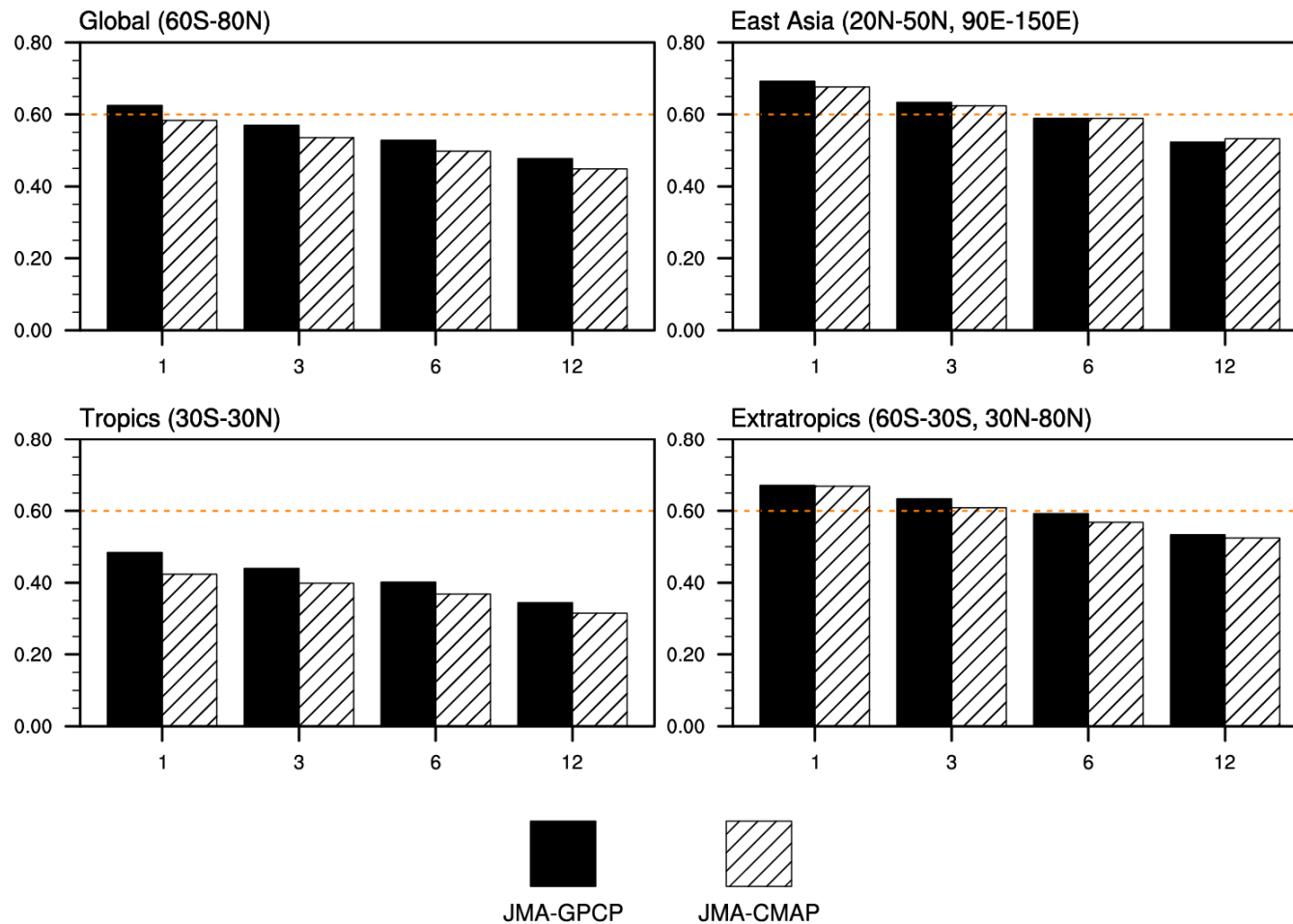




Quality Check of JRA-25/JCDAS

- Result is encouraging, especially for the Asia Pacific region.

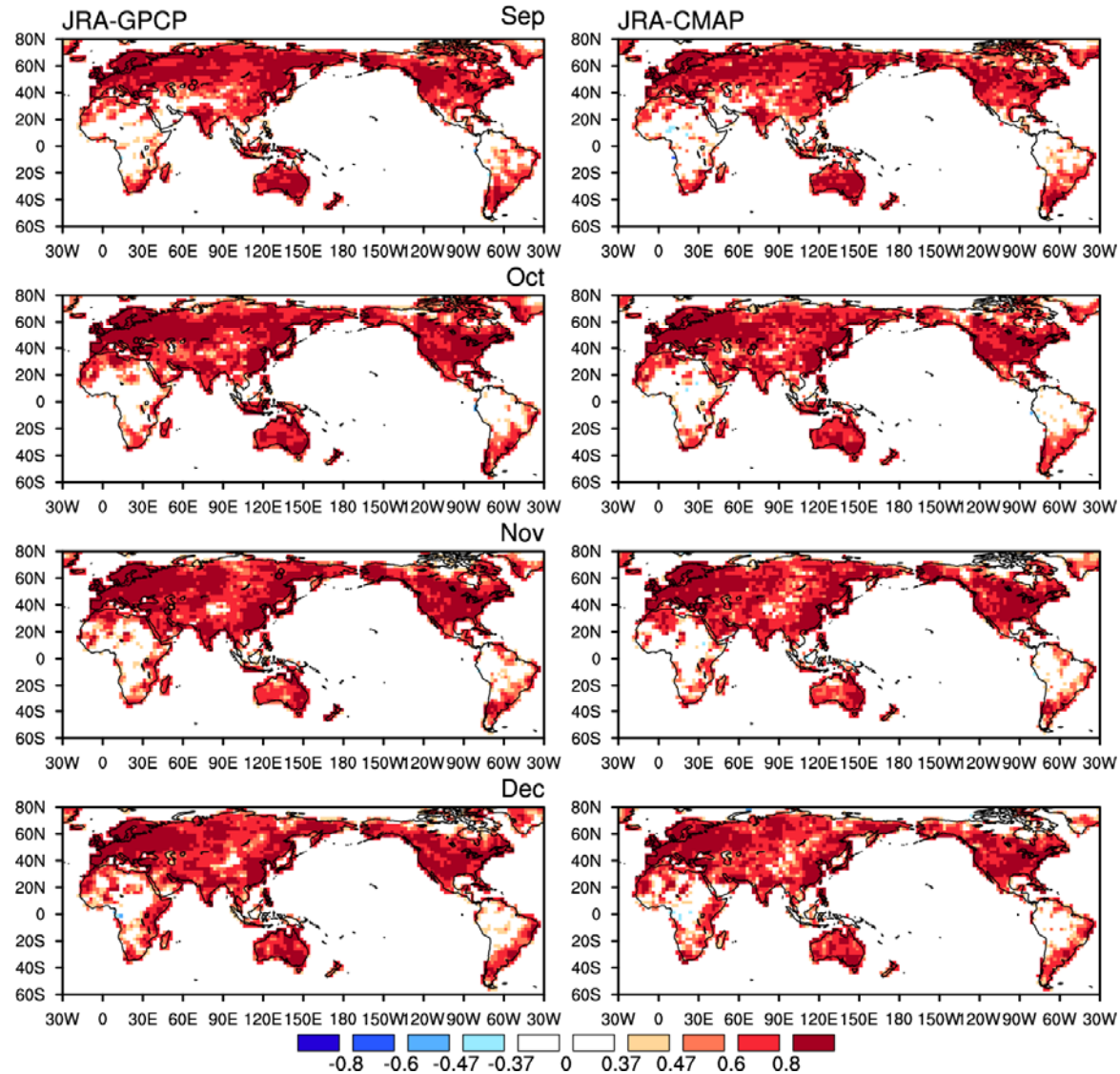
Pattern correlation (Land only) of SPI





Quality Check of JRA-25/JCDAS

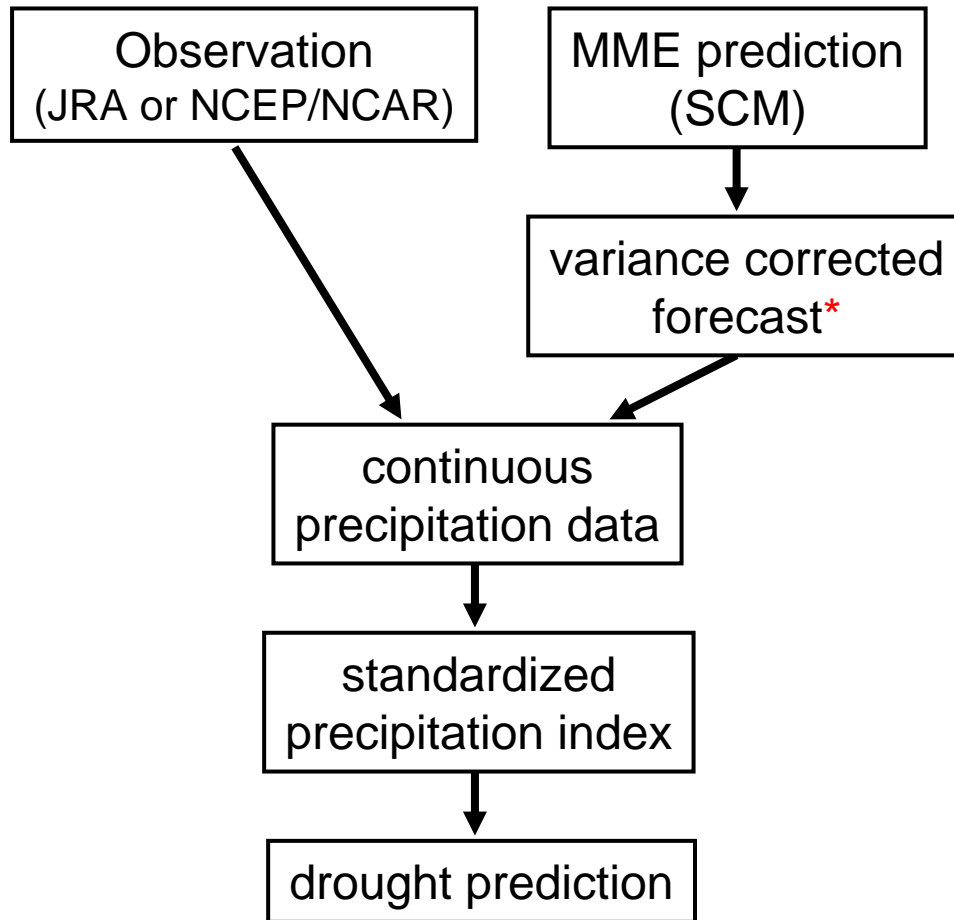
Temporal Correlation of Precipitation



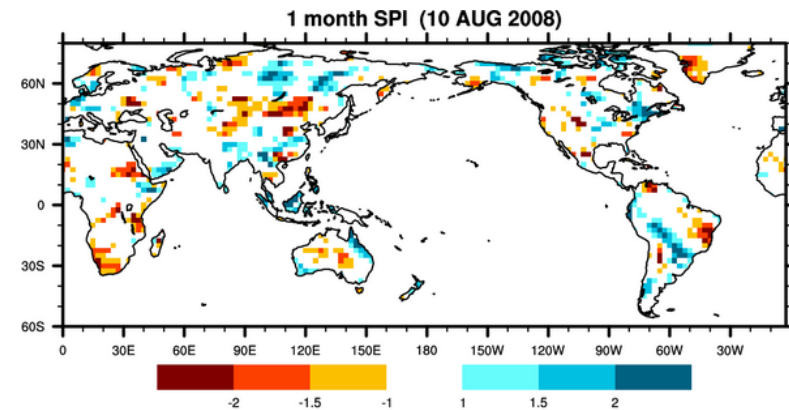
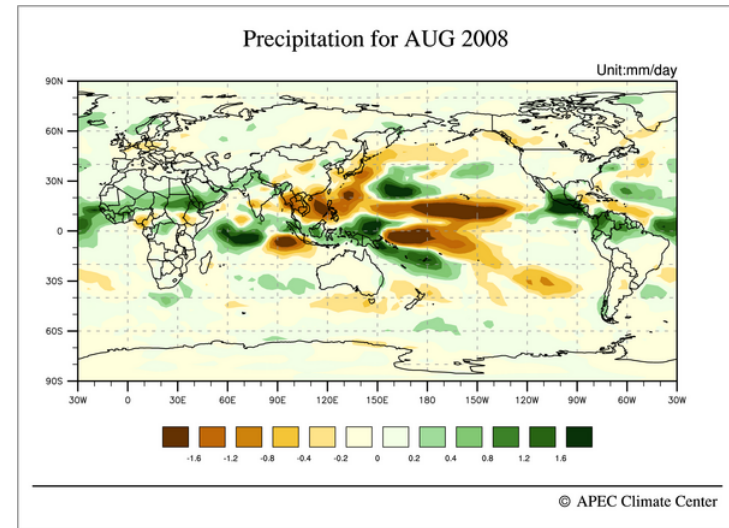


Development of drought prediction system

drought prediction system



(*MME variance is smaller than observation)

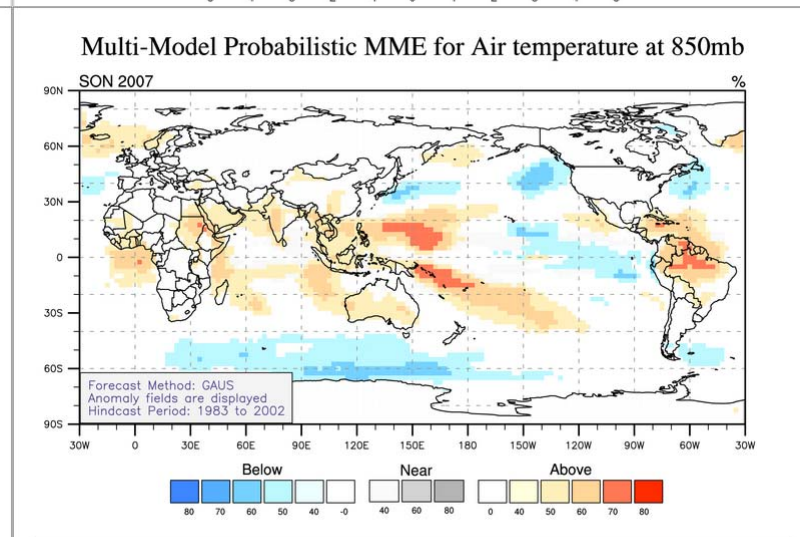
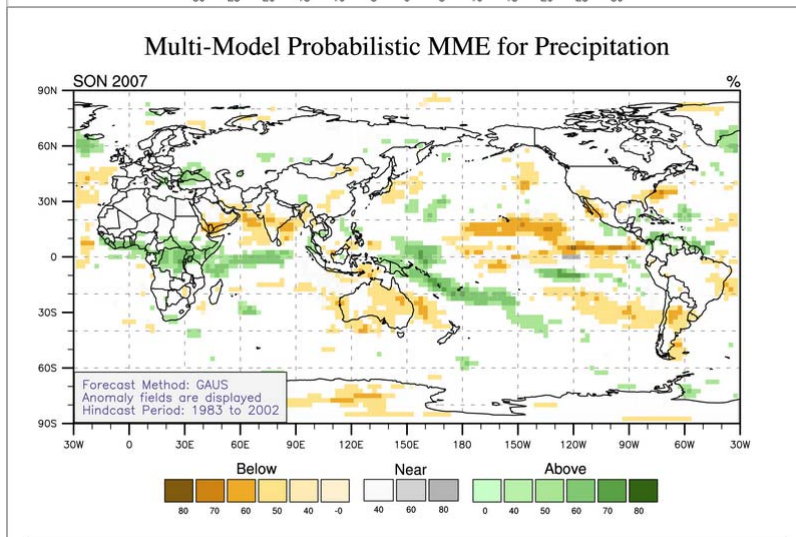
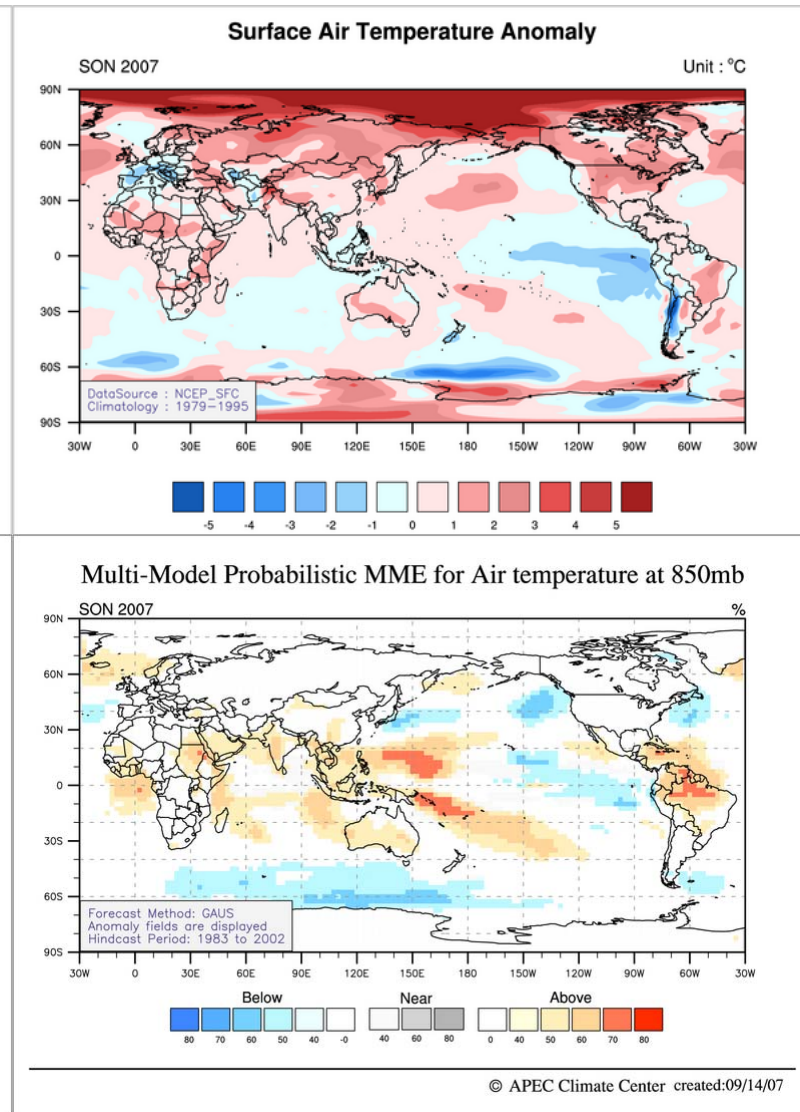
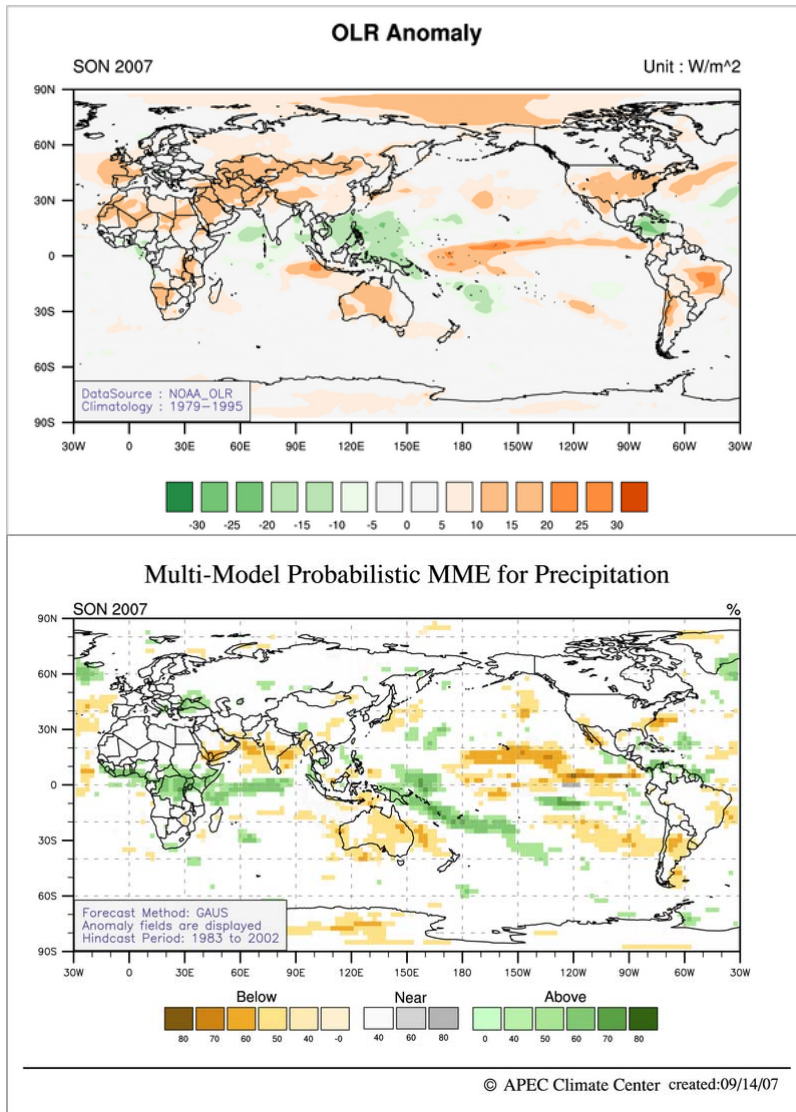




Performance in 3-Month MME Forecast

SON 2007

“Weak La Niña-like tropical Pacific conditions”

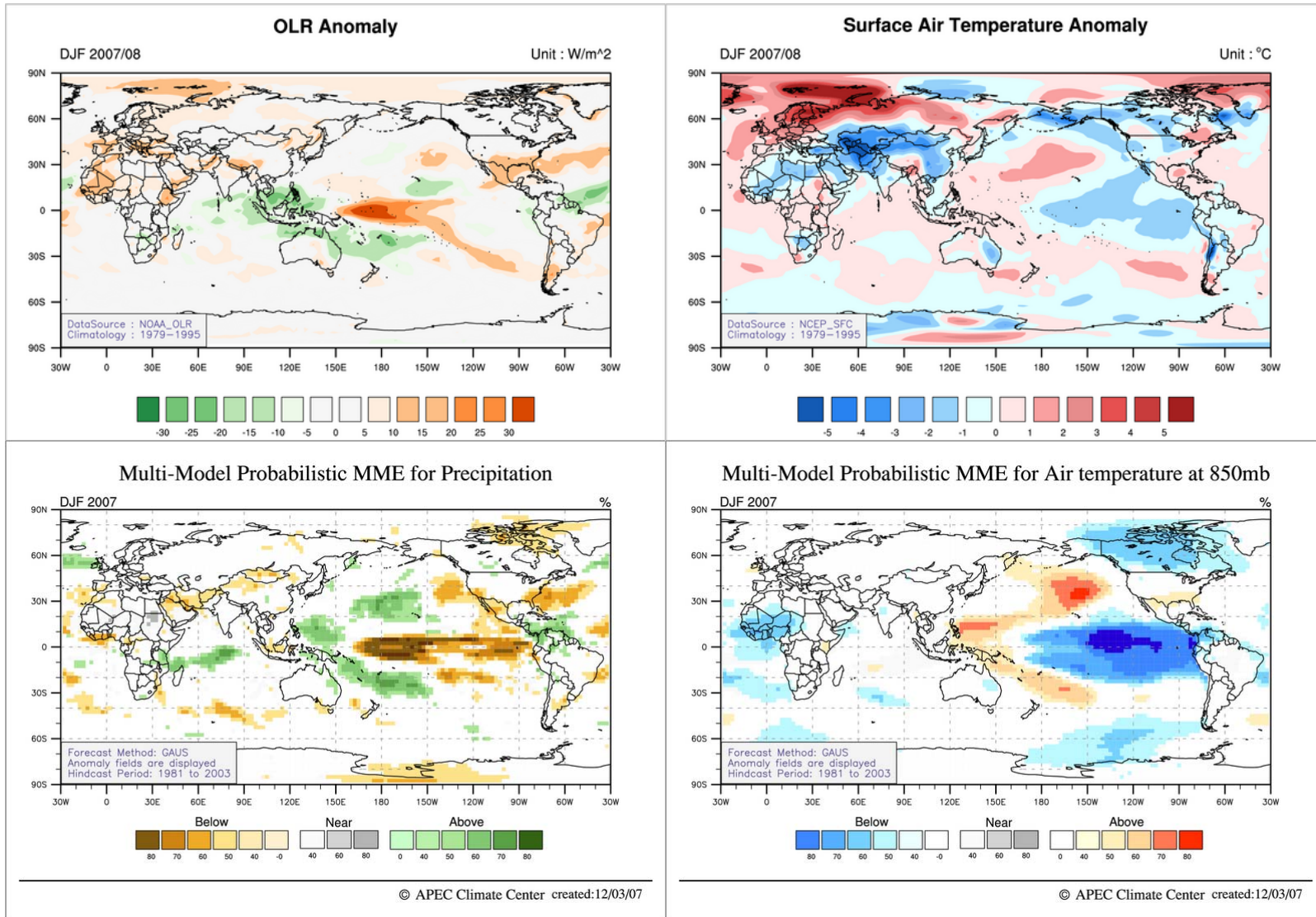




Performance in 3-Month MME Forecast

DJF 2007/08

“Cold winter in the northern portion of North America”

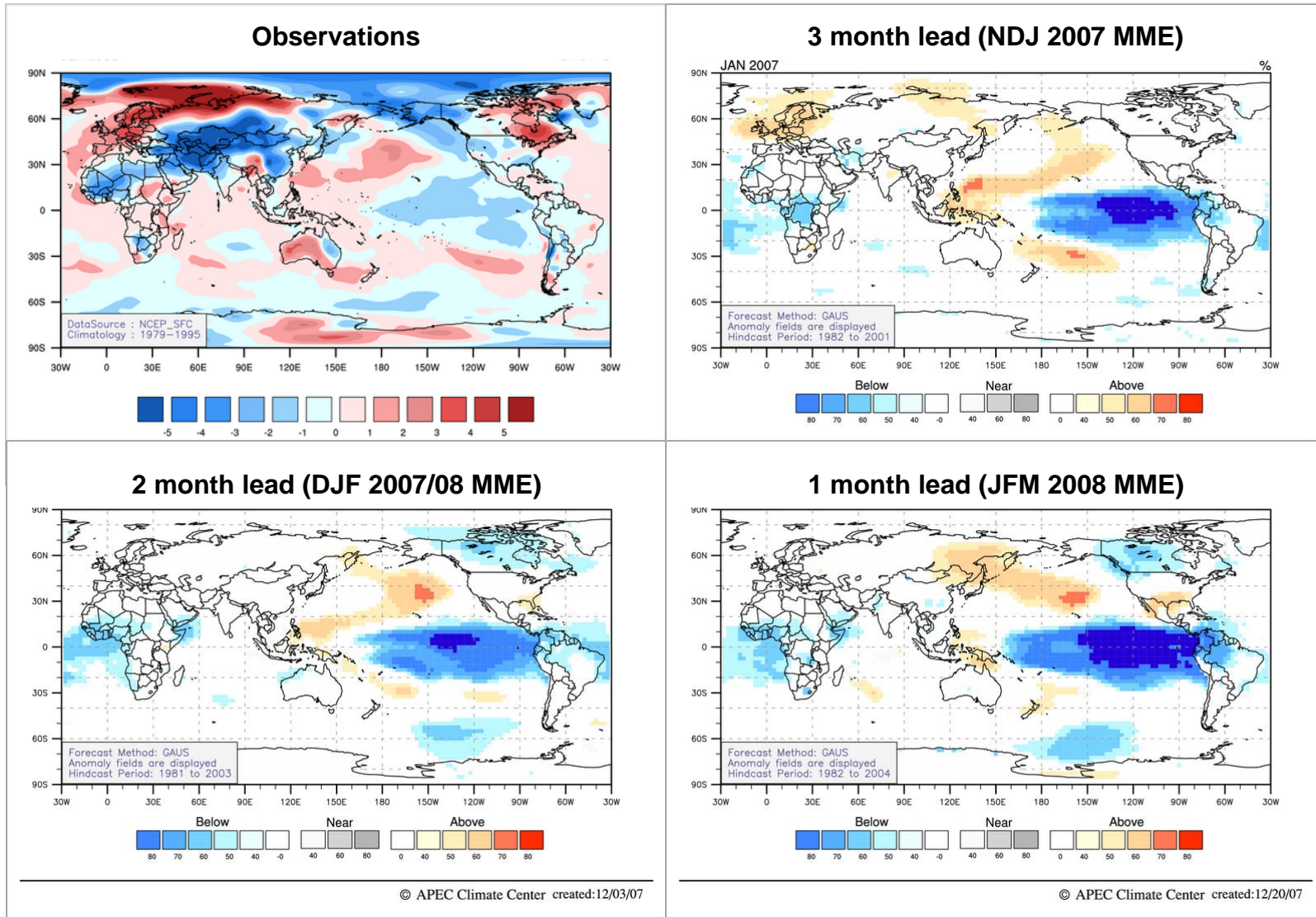




Performance in 3-Month MME Forecast

Jan 2008

Severe snow storms hit the Middle East, central and eastern China

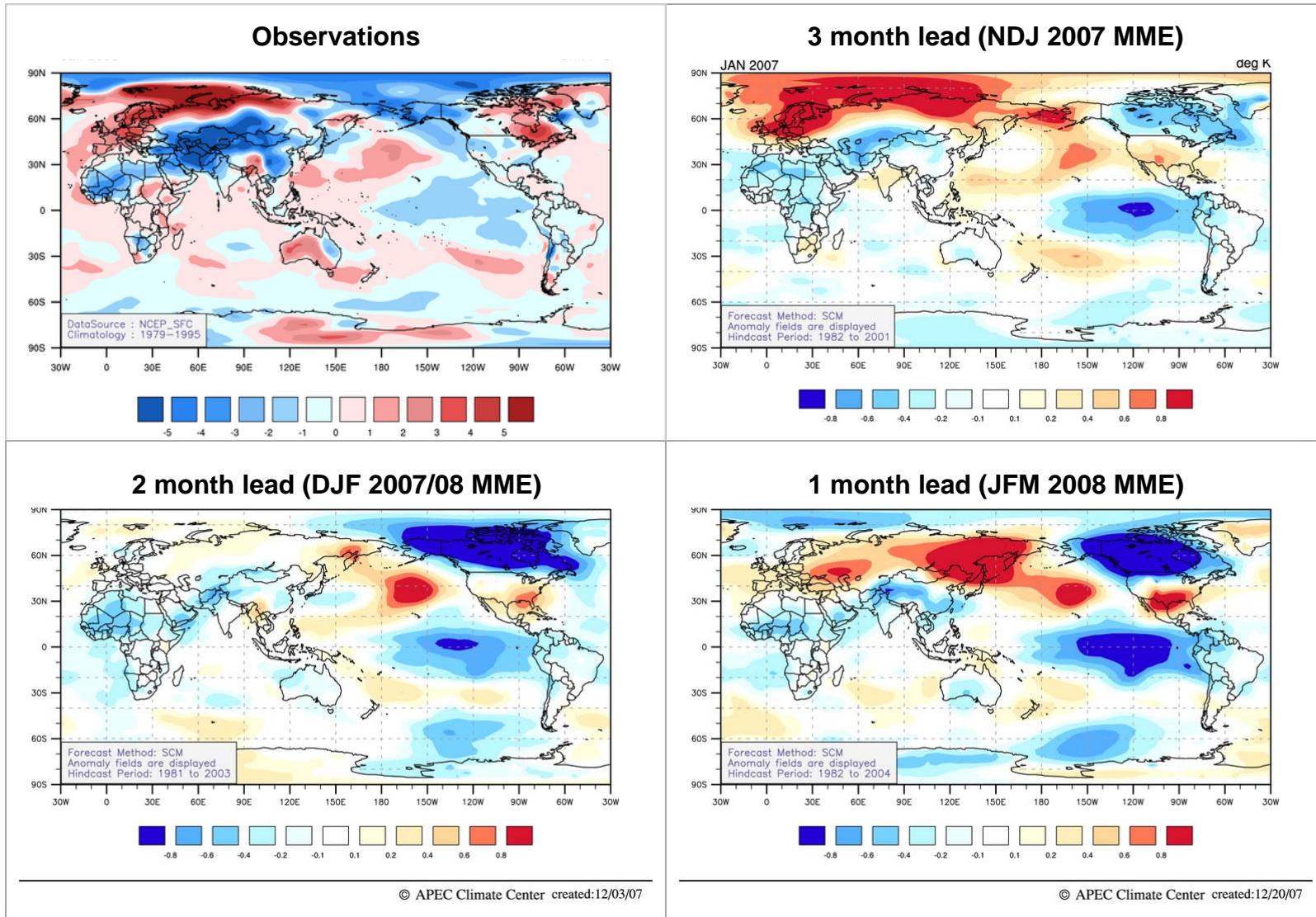




Performance in 3-Month MME Forecast

Jan 2008

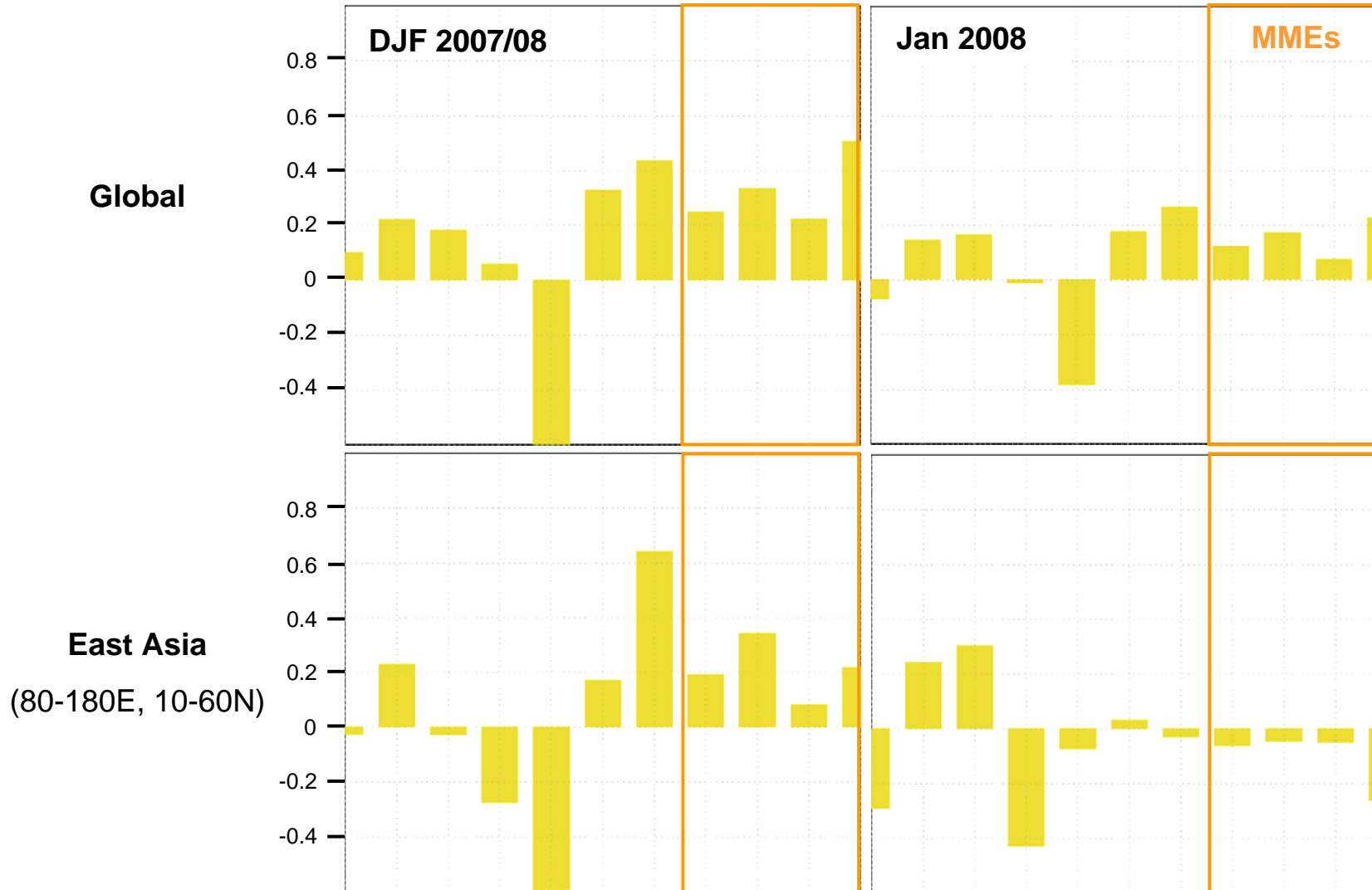
Severe snow storms hit the Middle East, central and eastern China





Performance in 3-Month MME Forecast

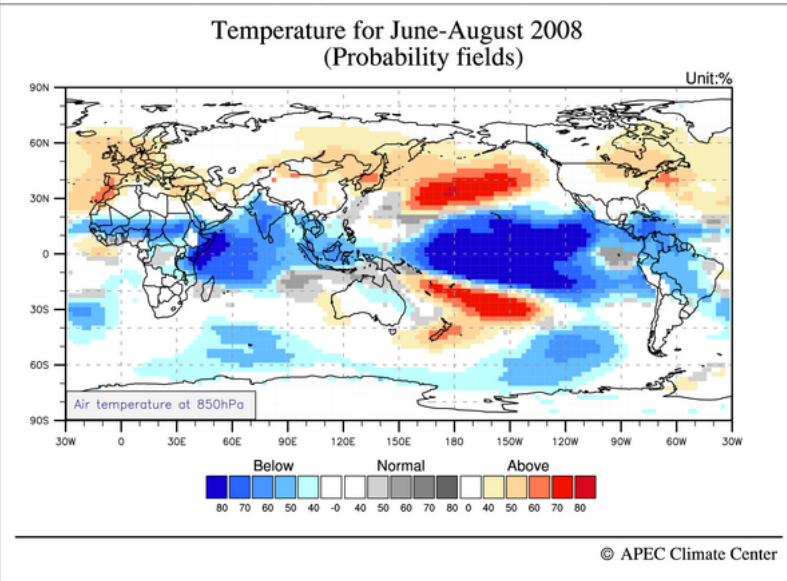
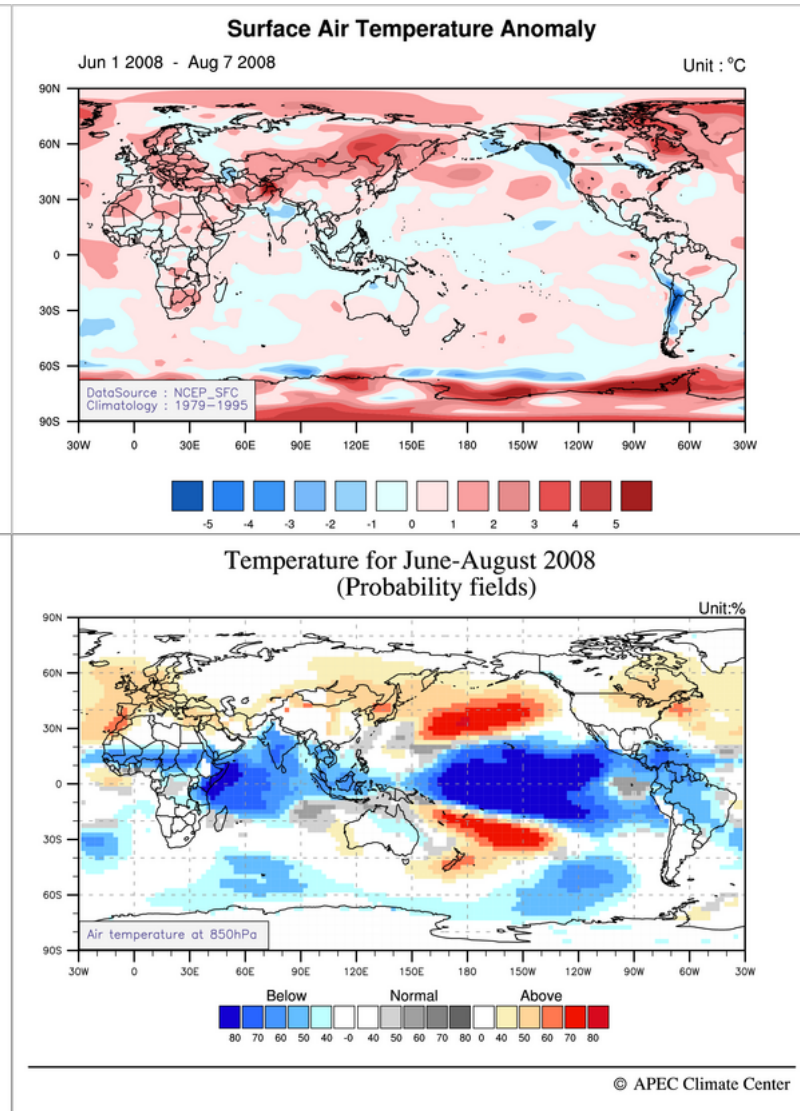
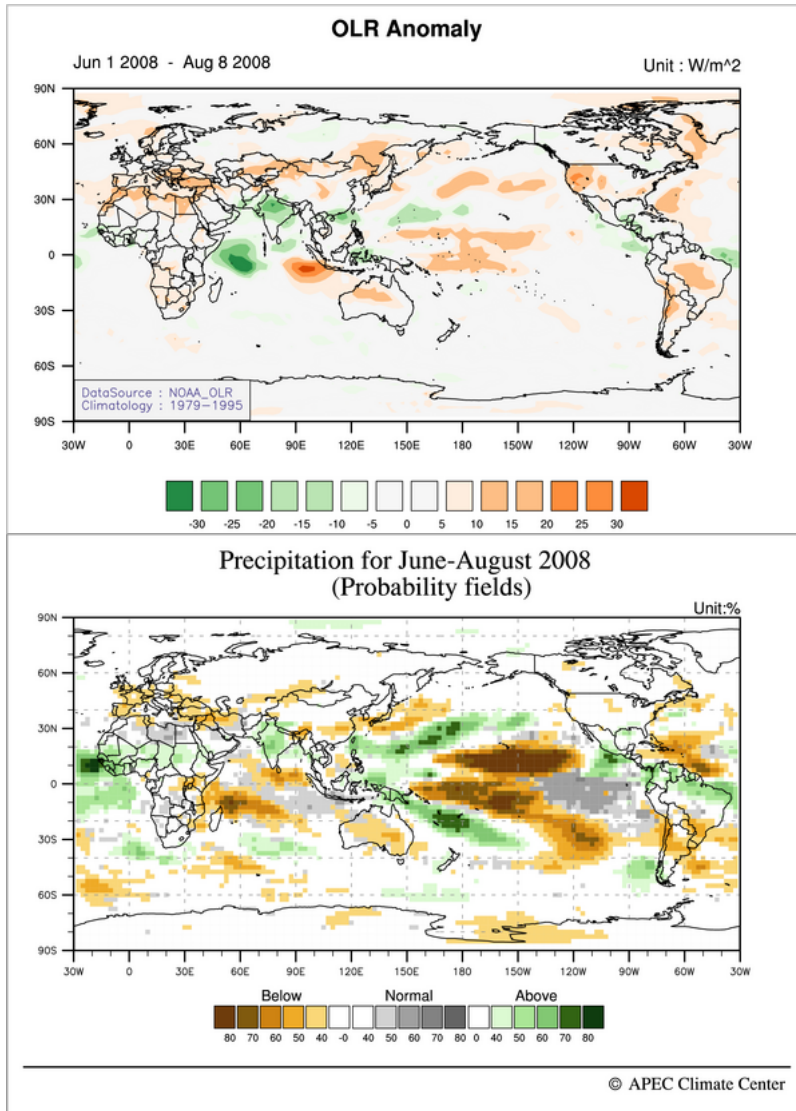
Anomaly Pattern Correlation for DJF 2007/08 T850 Forecast





Performance in 2008

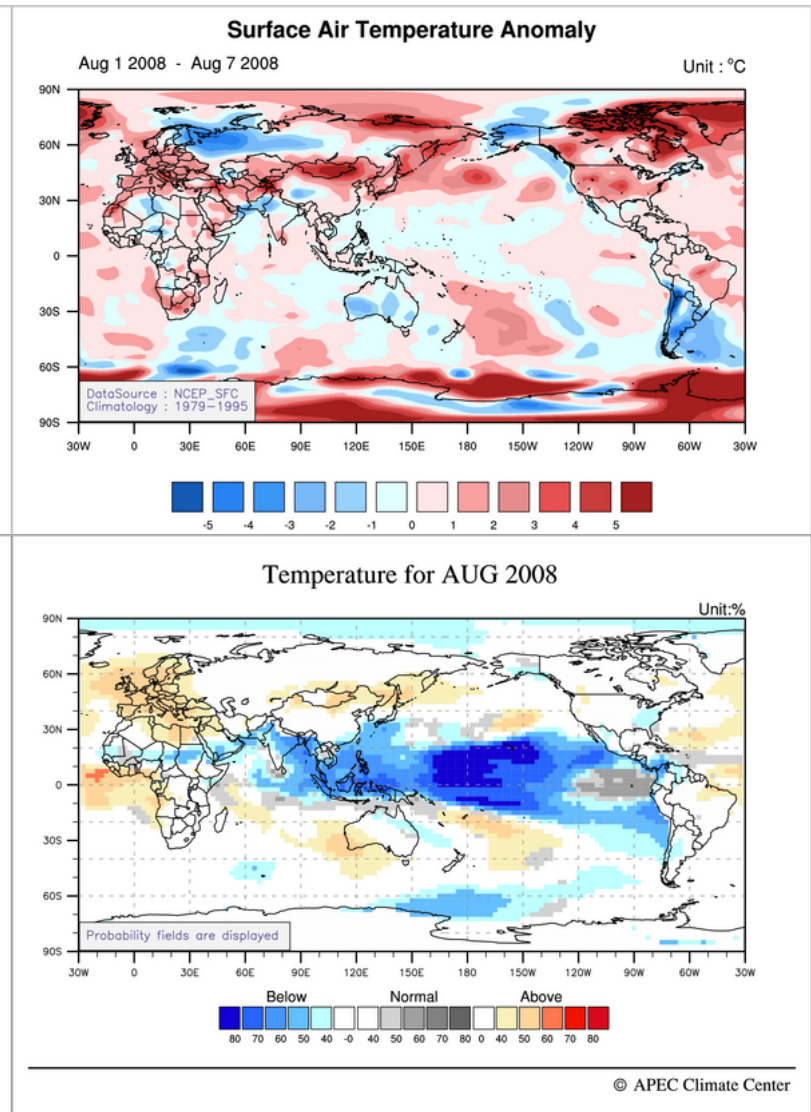
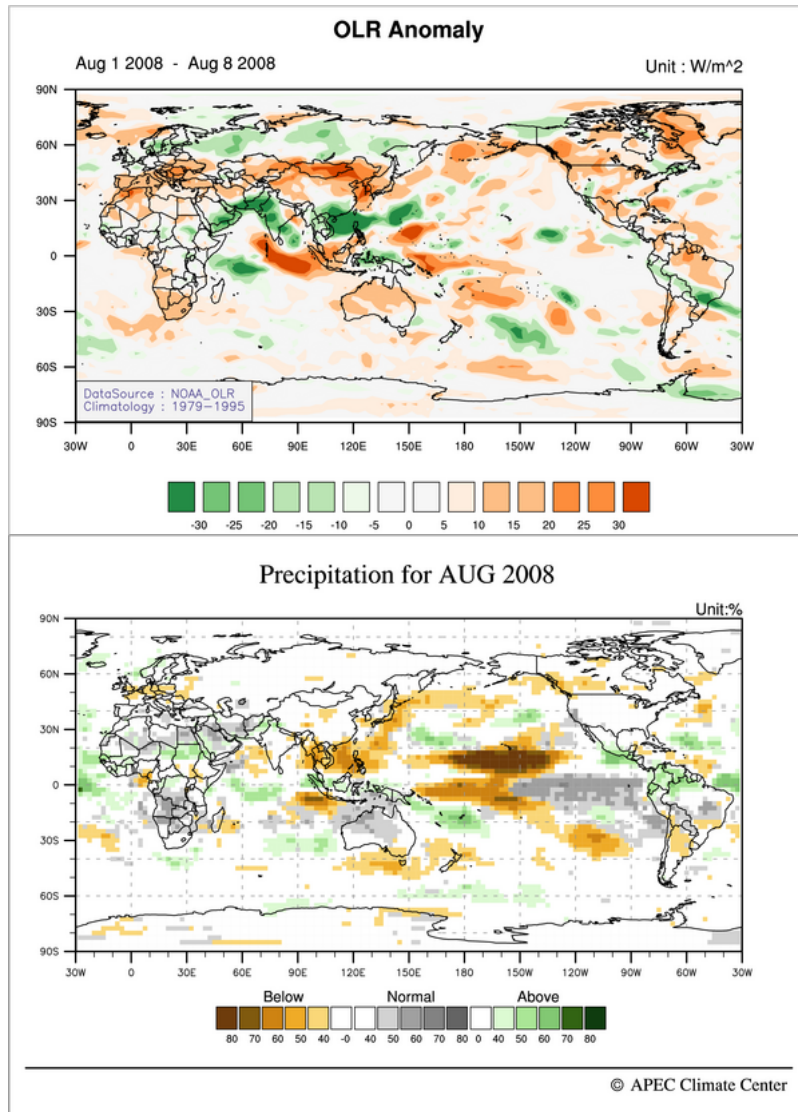
JJA 2008





Performance in 2008

Aug 2008



Experimental 6-Month 1-Tier MME Prediction

Objective

- To provide a longer and more reliable forecast

Status

- **First forecast for MAMJJA**
 - Three models were available (FRCGC, UH and NCEP)
 - Development of the relevant additional software unique 6-month prediction (especially deterministic)
 - **Second forecast for JJASON**
 - Five models were available (FRCGC, UH, NCEP, **SNU** and **POAMA**)
 - Development of probabilistic prediction system for 6-month
 - Development of hindcast verification for deterministic and probabilistic
- Started, Hindcast packages completed in August

Experimental 6-Month 1-Tier MME Prediction

• Participating Models

- FRCGC/Japan, SNU/Korea, UH/USA, NCEP/USA, and BMRC/Australia

Institute	AGCM	Resolution	OGCM	Resolution	Ensemble Member	Reference
FRCGC	ECHAM4	T106 L19	OPA 8.2	2° cos(lat)x2° lon L31	9	Luo <i>et al.</i> (2005)
SNU	SNU	T42 L21	MOM2.2	1/3° lat x 1° lon L32	6	Kug <i>et al.</i> (2005)
UH	ECHAM4	T31 L19	UH Ocean	1° lat x 2° lon L2	10	Fu and Wang (2001)
NCEP	GFS	T62 L64	MOM3	1/3° lat x 1° lon L40	15	Saha <i>et al.</i> (2005)
BMRC	The Bureau of Meteorology unified climate/NWP model (BAM) version 3.0d	T47 L17	ACOM2 Ocean Model based on GFDL MOM2	72 x 144 grid points for the physics grid	Daily Ensemble Generation	Colman <i>et al.</i> (2002)

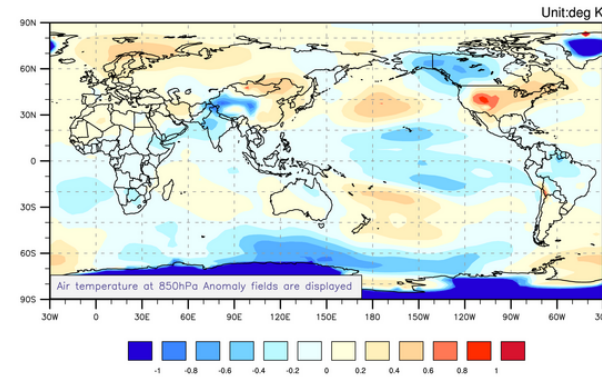
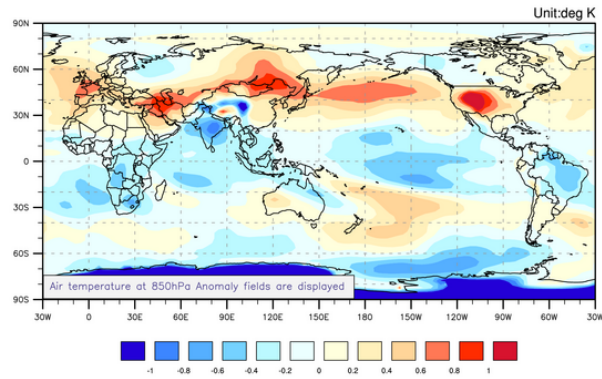
FRCGC, SNU, and UH : 10 Variables (tsfc, prcp, mslp, ts2m, t850, z500, u200, v200, u850, v850)
 NCEP, BMRC: 11 variables (olr, prec, slp, sst, t2m, t850, u200, u850, v200, v850, z500)

Recent Forecasts : 2008JJASON

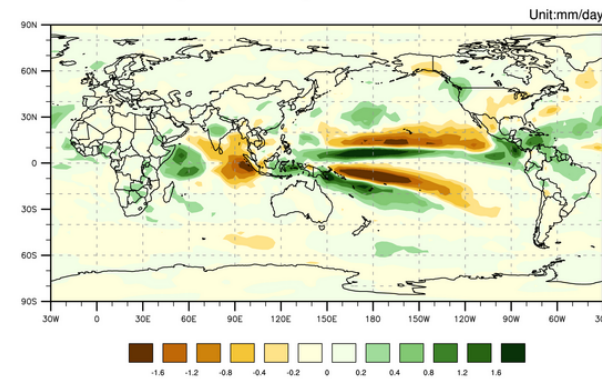
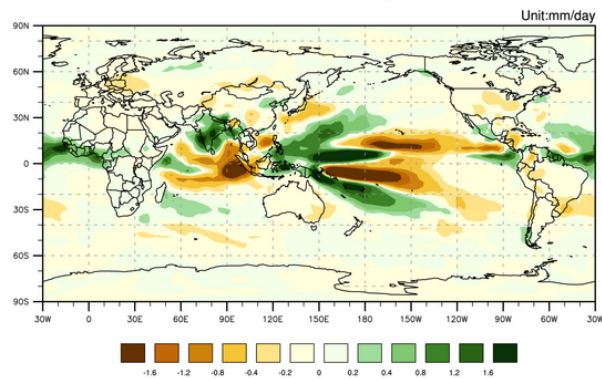
2008JJA

2008SON

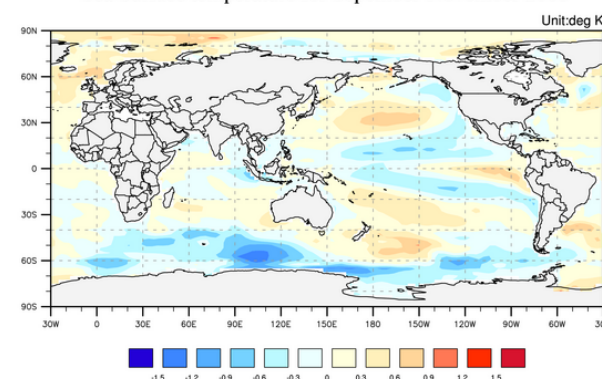
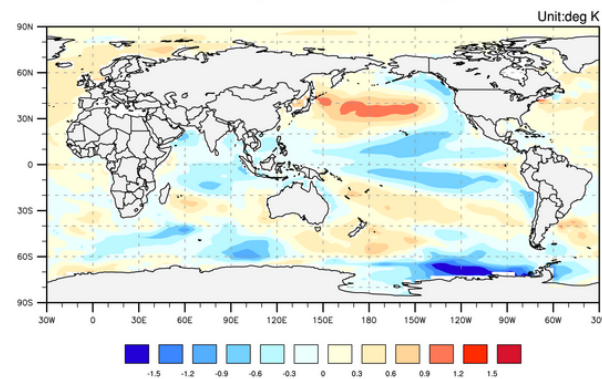
T850



PREC



SST

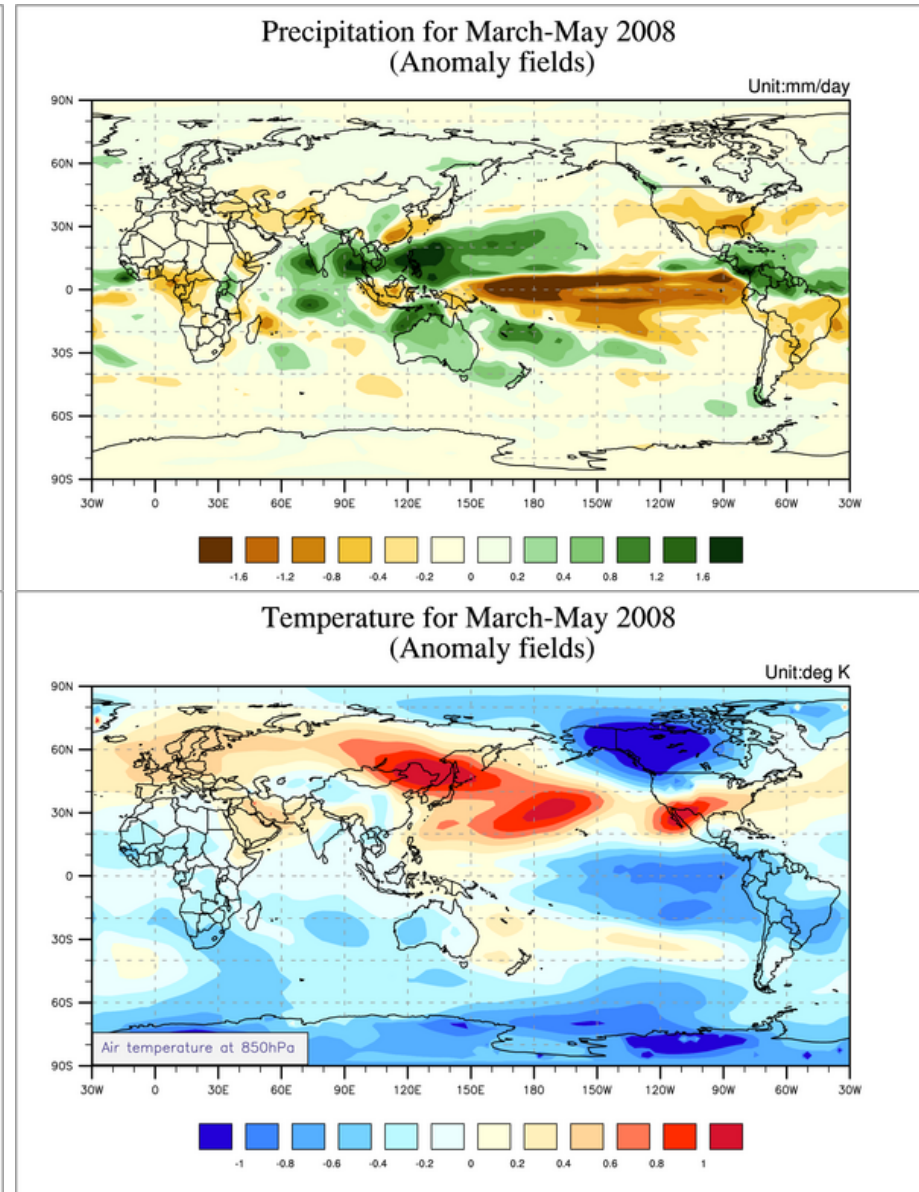
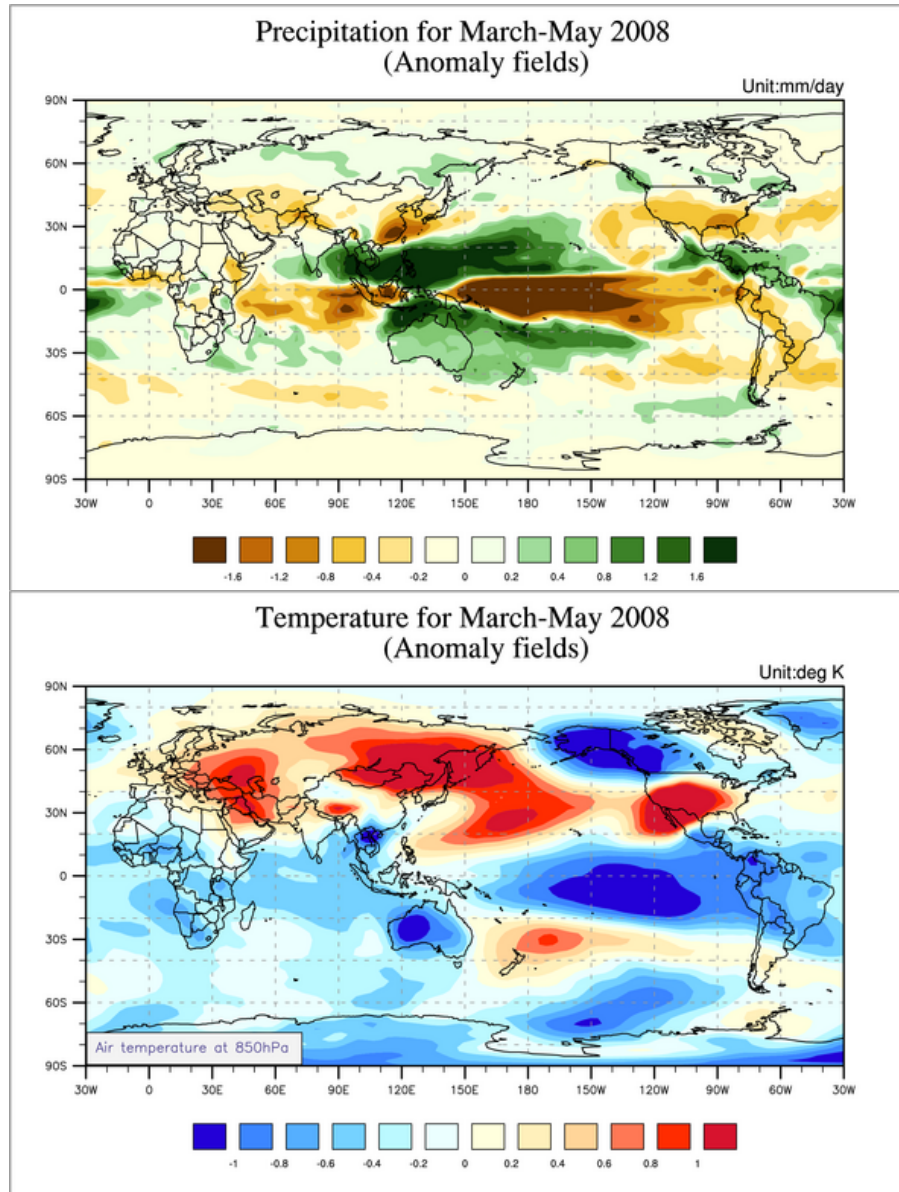




Predictions for MAM

(left) from 6 month 1-tier MME

(right) APCC operational MME





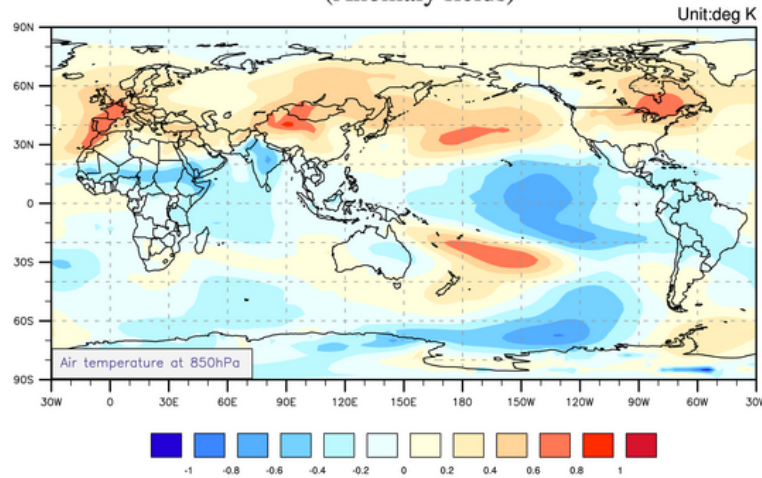
Comparison : Deterministic MME for 2008JJA

APCC Operational MME

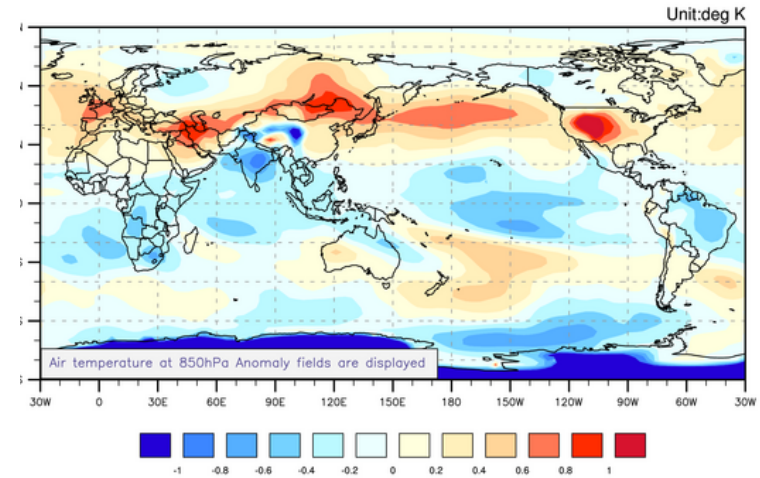
6-Month 1-Tier MME

T850

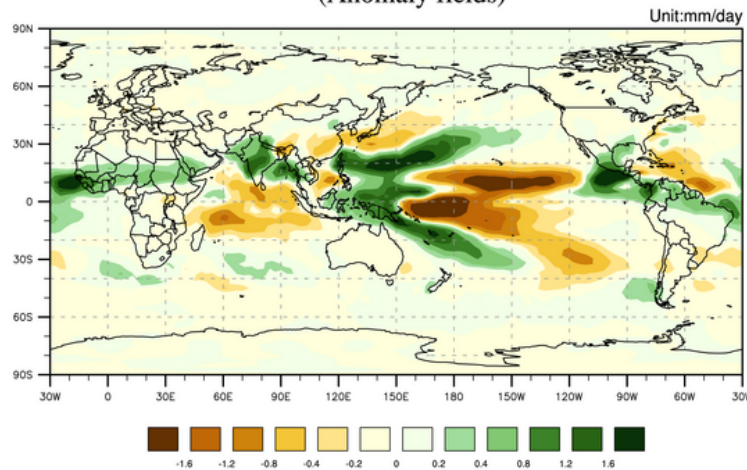
Temperature for June-August 2008
(Anomaly fields)



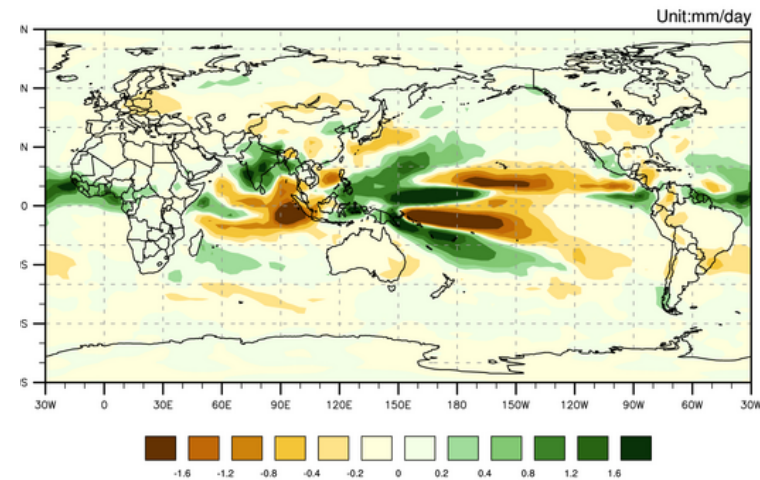
Temperature for June-August 2008



Precipitation for June-August 2008
(Anomaly fields)



Precipitation for June-August 2008



PREC





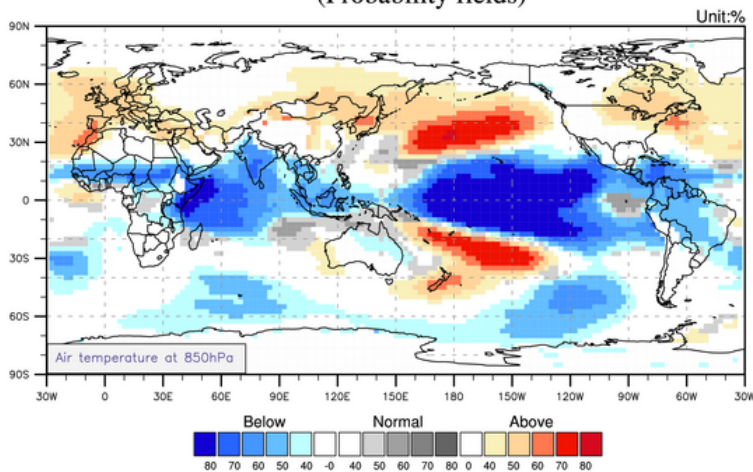
Comparison : Probabilistic MME for 2008JJA

APCC Operational MME

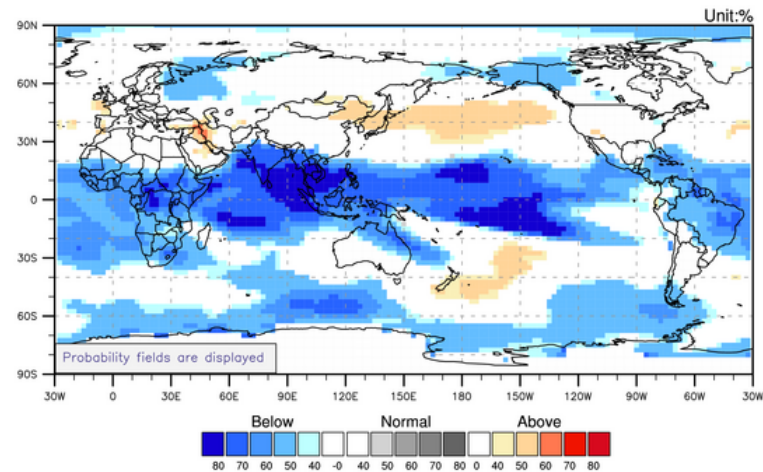
6-Month 1-Tier MME

T850

Temperature for June-August 2008
(Probability fields)

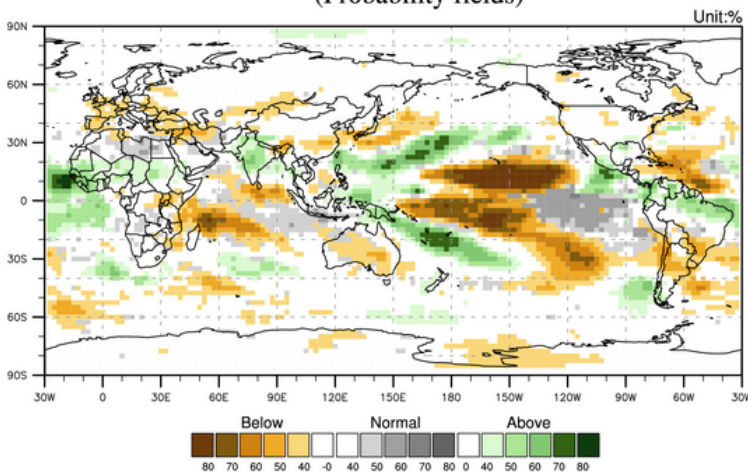


Temperature for June-August 2008

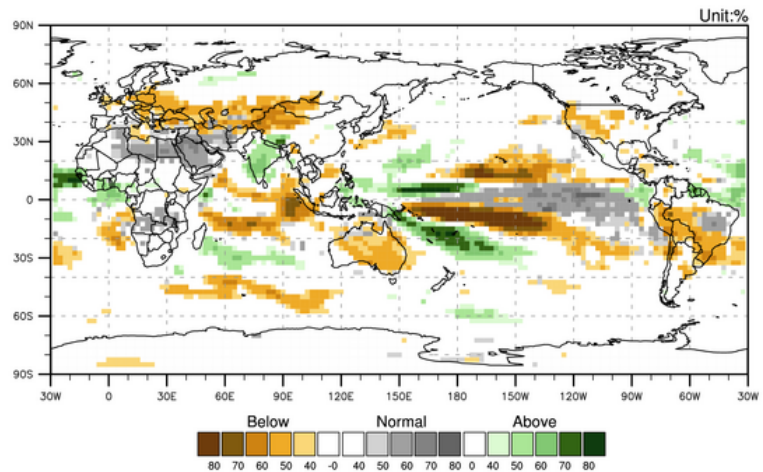


PREC

Precipitation for June-August 2008
(Probability fields)



Precipitation for June-August 2008

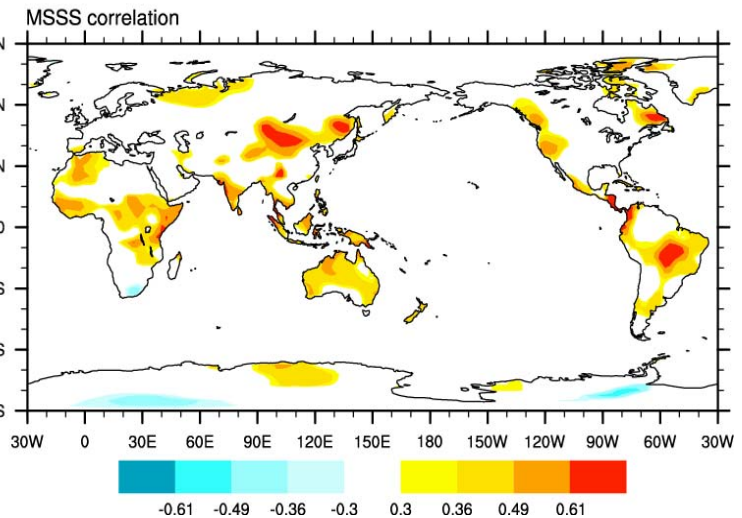
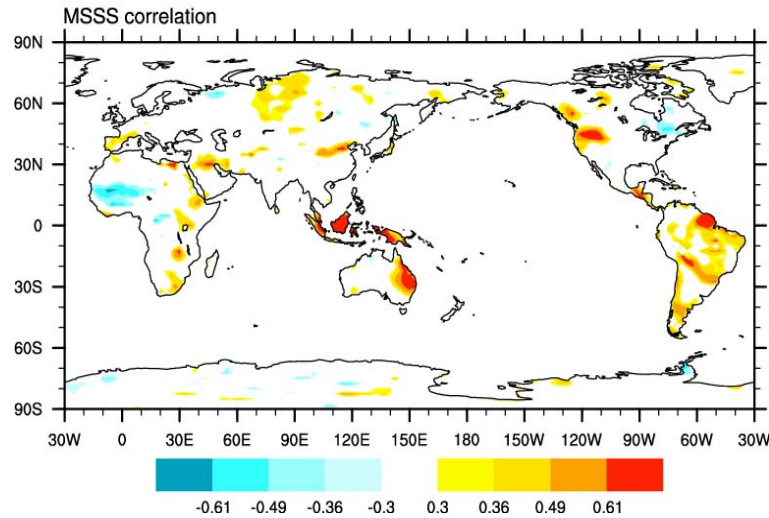




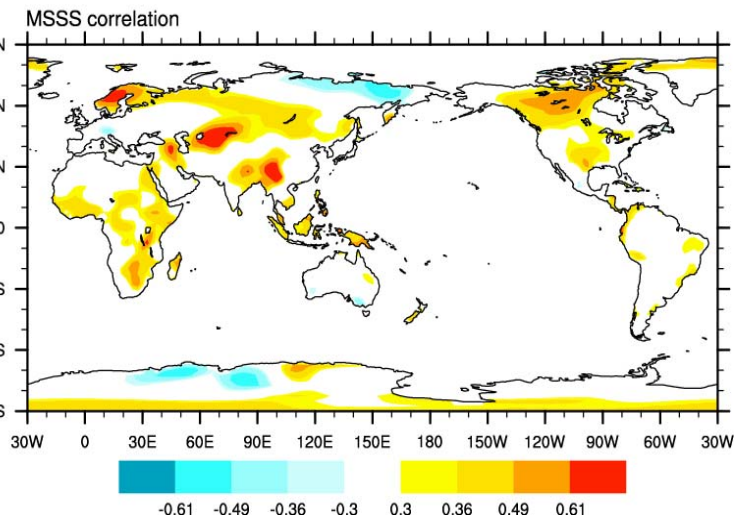
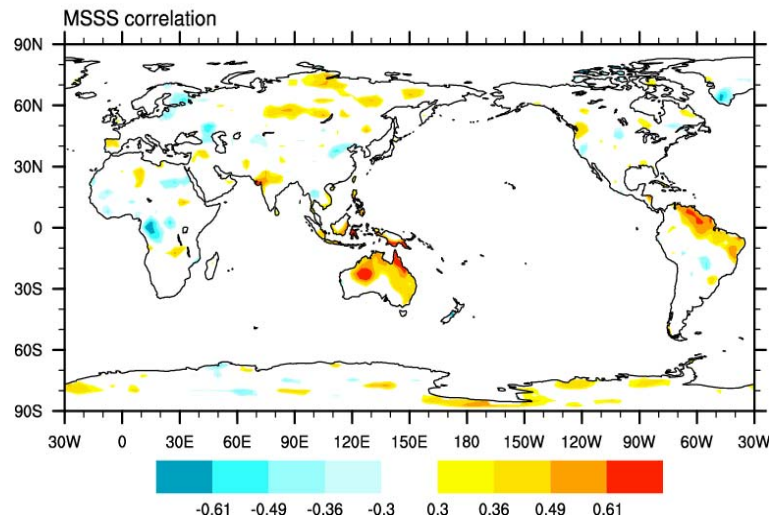
Verification : Deterministic Hindcast Forecast

T850, 1983-2003

JJASON



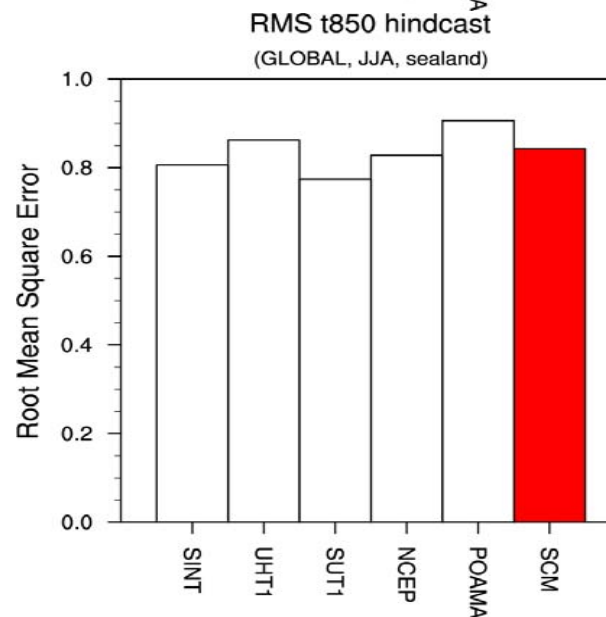
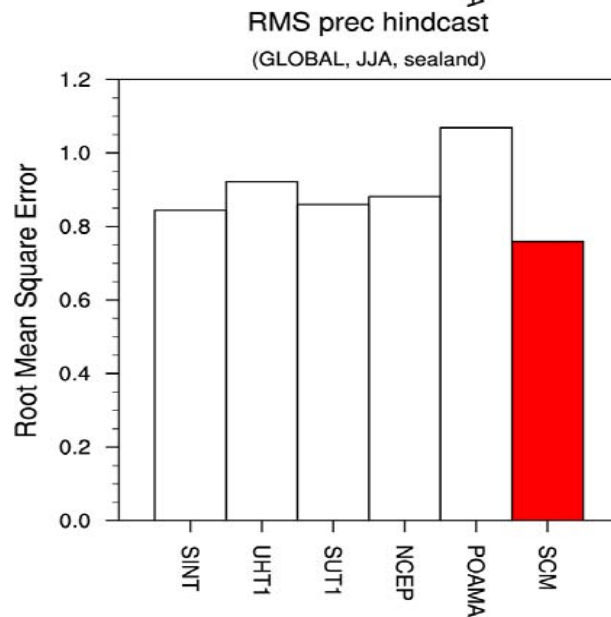
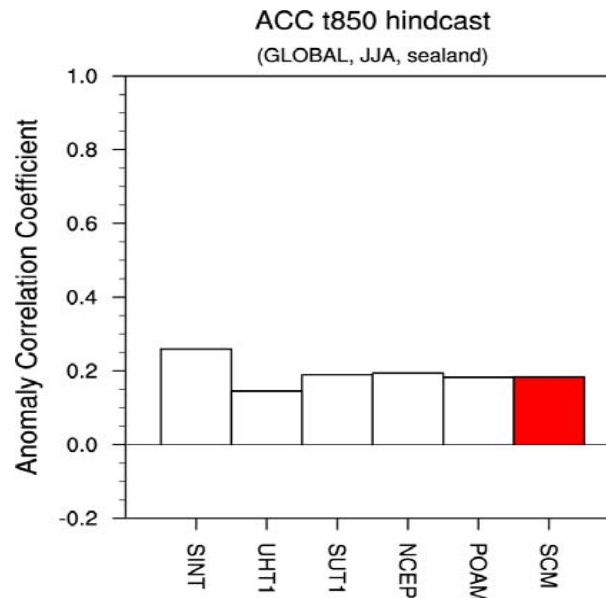
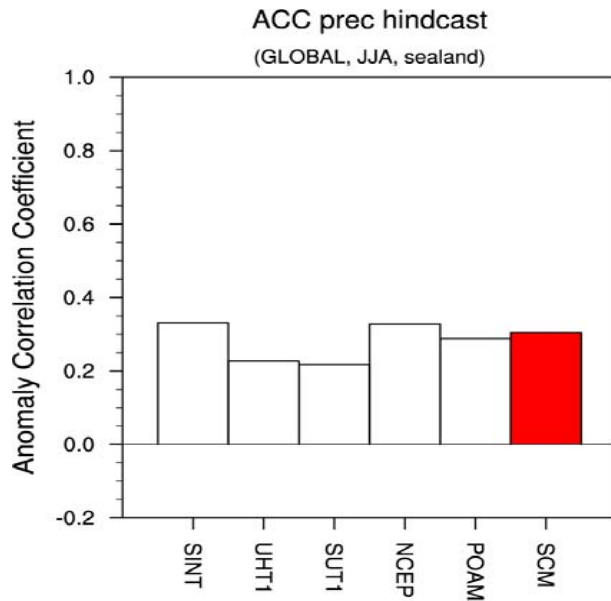
JJASON





Verification : Deterministic Hindcast Forecast

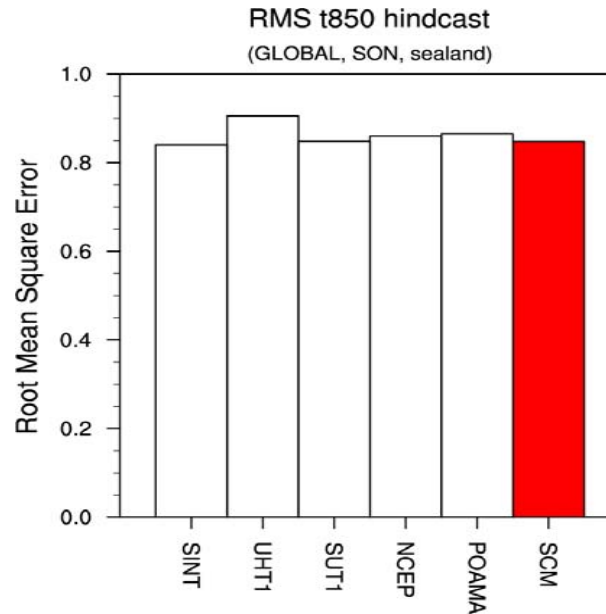
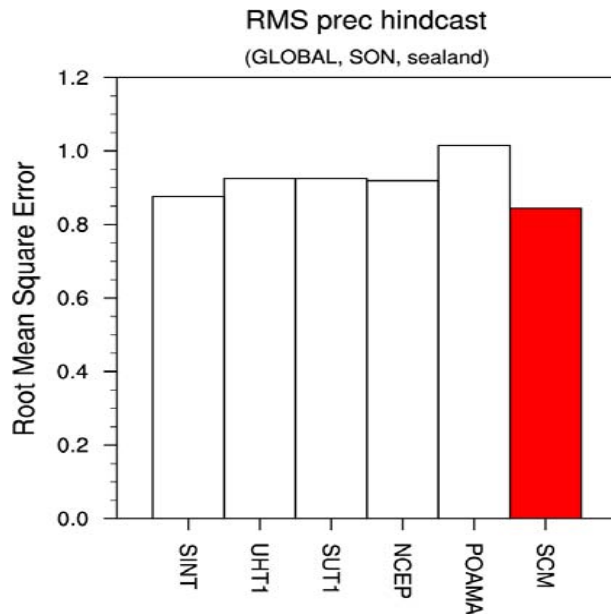
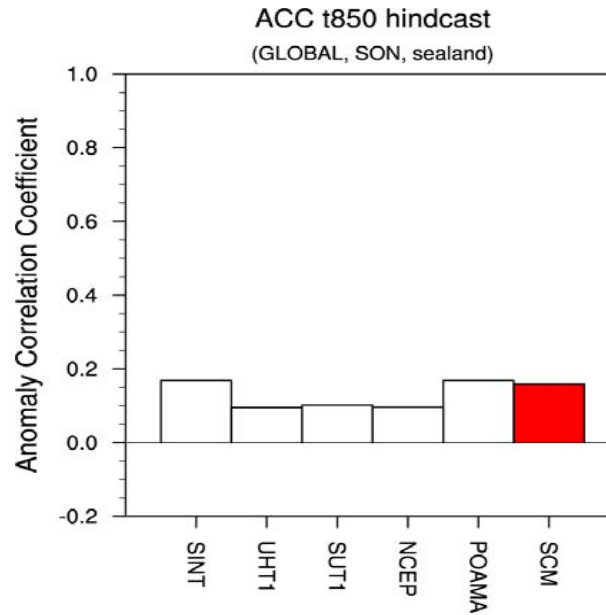
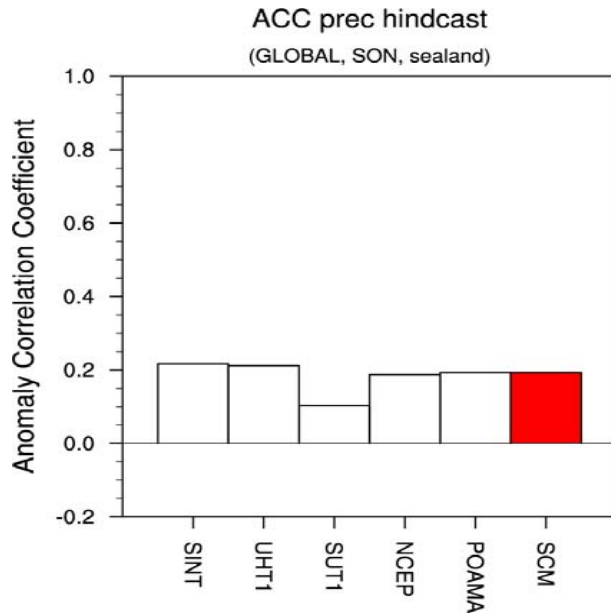
JJASON





Verification : Deterministic Hindcast Forecast

JJASON



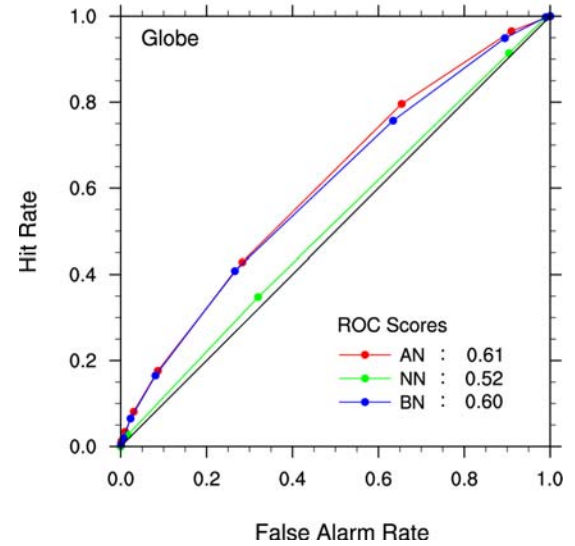
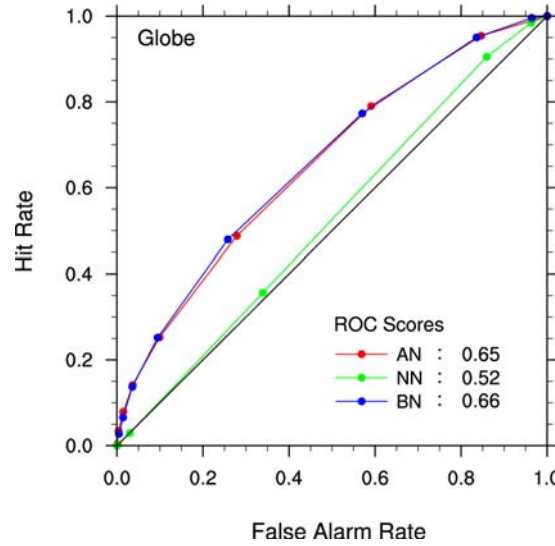
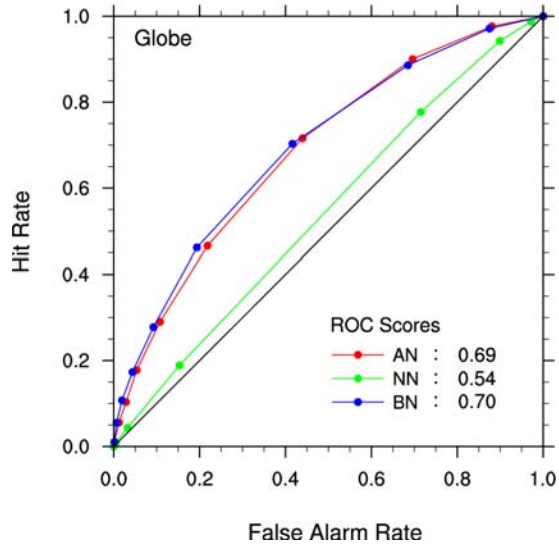


Verification : Probabilistic Hindcast Forecast

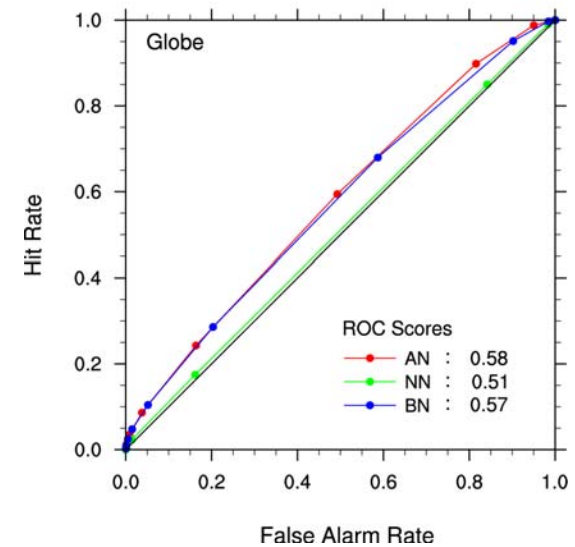
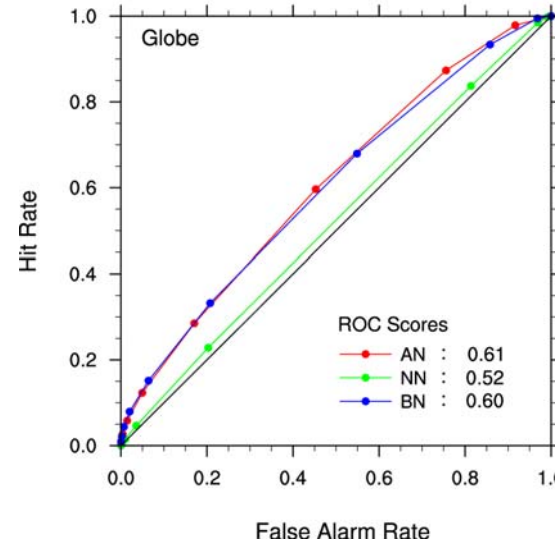
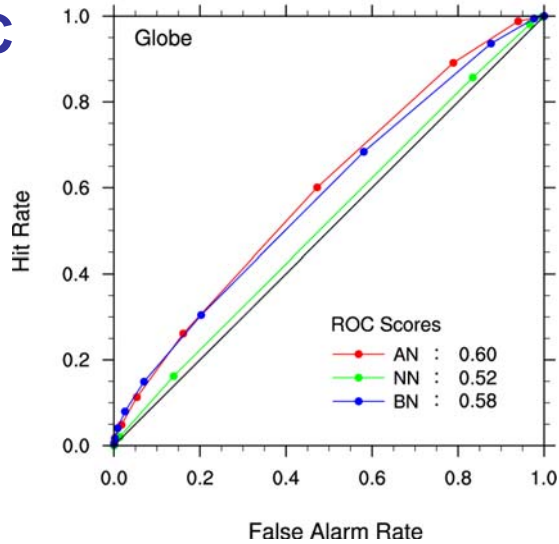
APCC Operational MME (JJA)

(JJA) 6-Month 1-Tier MME (SON)

T850



PREC



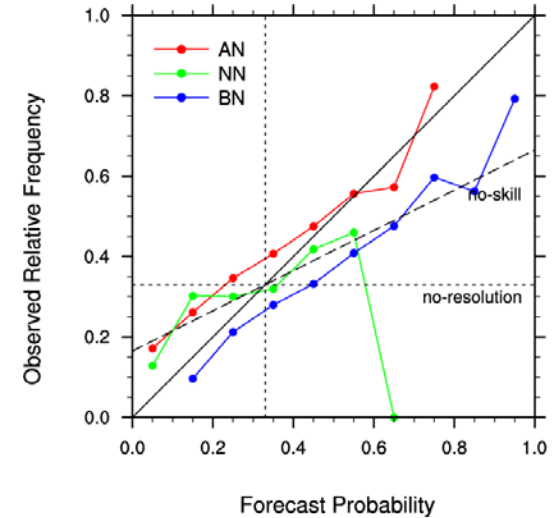
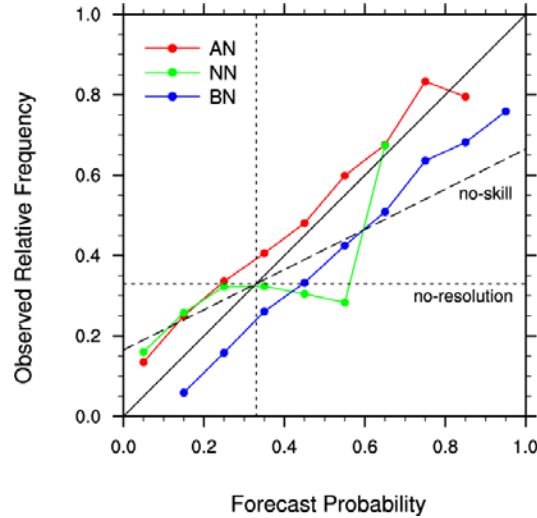
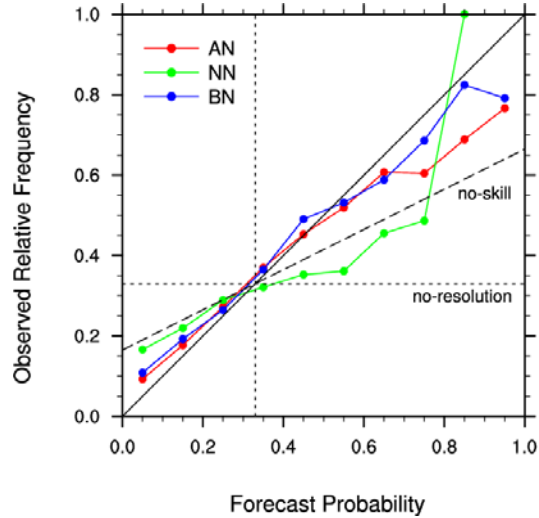


Verification : Probabilistic Hindcast Forecast

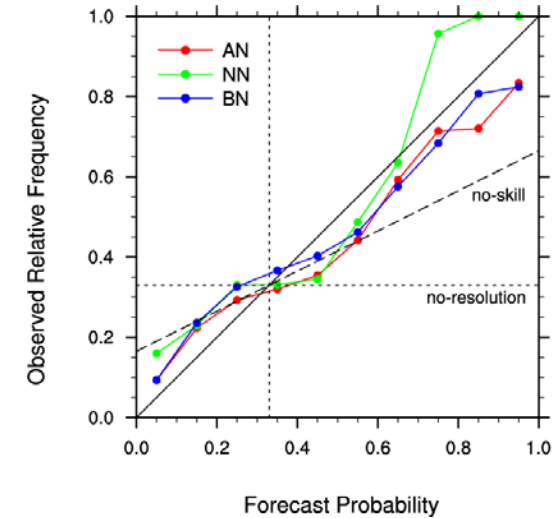
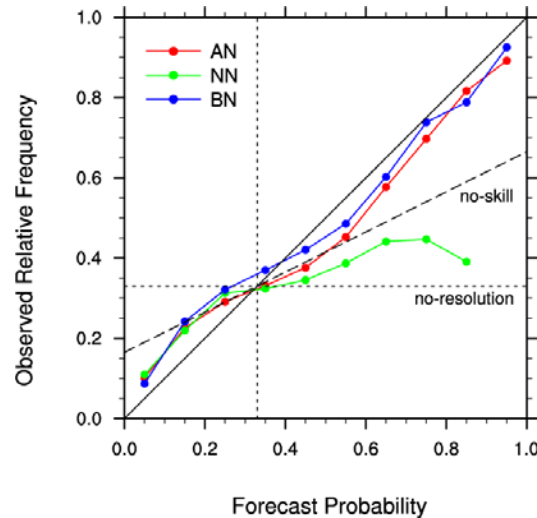
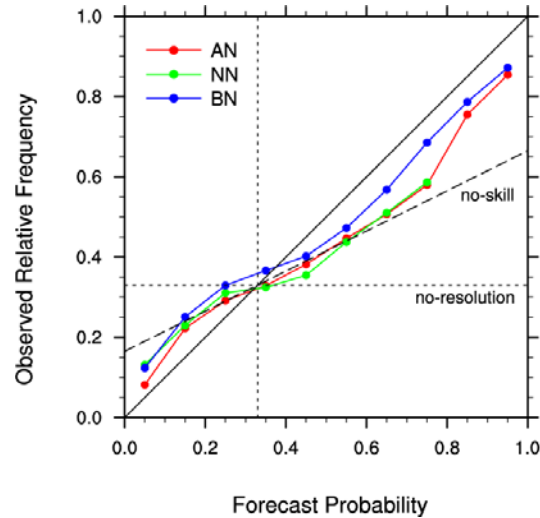
APCC Operational MME (JJA)

(JJA) 6-Month 1-Tier MME (SON)

T850



PREC





Development of an in-house coupled prediction system

- *To develop an in-house coupled climate prediction system suitable for 12-month climate prediction by 2010*

2008 Plans

Phase 1

- Porting the CCSM3 (T85L26) to KMA/KISTI computer.
- Development of an initialization package by APCC.
- Simple coupled SST nudging.
- NCEP/CDC OISST (Reynolds, 1992).

Phase 2

- Coupled climate run and validation.
- Retrospective 6-month forecast with November 1 initial conditions.
- 20 years and 10 ensembles.

Phase 3

- 6-month forecast with November, 2008 initial conditions.
- 10 ensembles.



In-House Coupled Model (CCSM3)

- **Overview**

- Coupled model forecasts are superior to the stand-alone AGCM forecasts on seasonal scale, particularly in the monsoon region.
- It is expected that APCC operational MME prediction can be improved through using 1-tier model predictions.

- **Goals/Objectives**

- **To develop an in-house coupled model based on NCAR's CCSM3** that would be capable of joining 12-month lead time climate prediction

- **NCAR's CCSM3 (T85L26, gx1v3L40)**

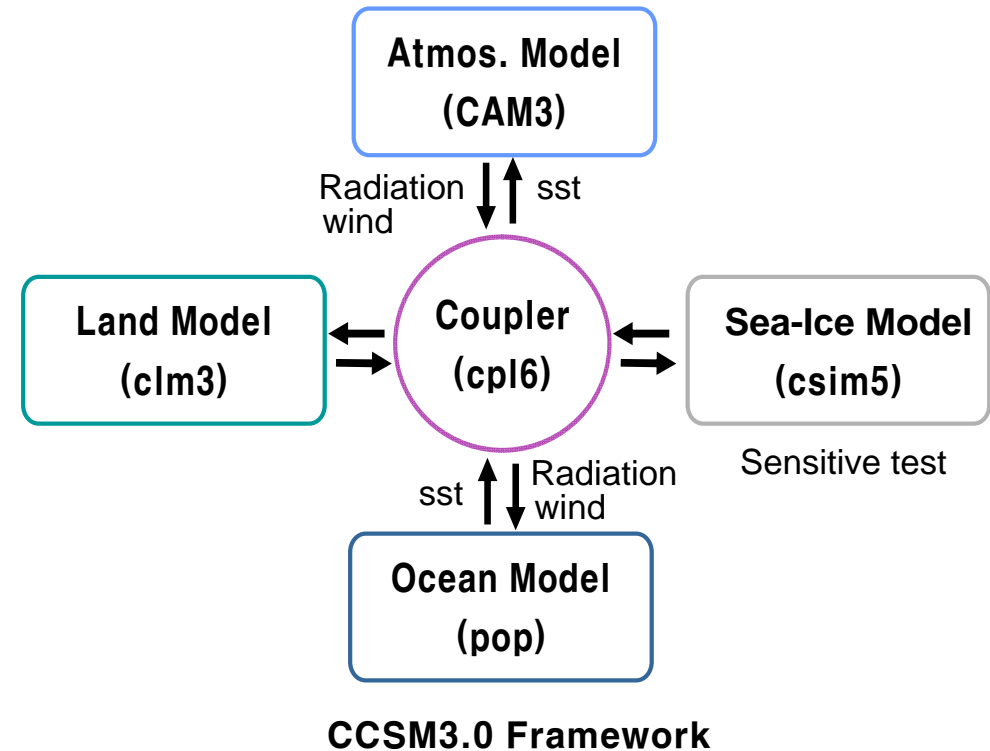
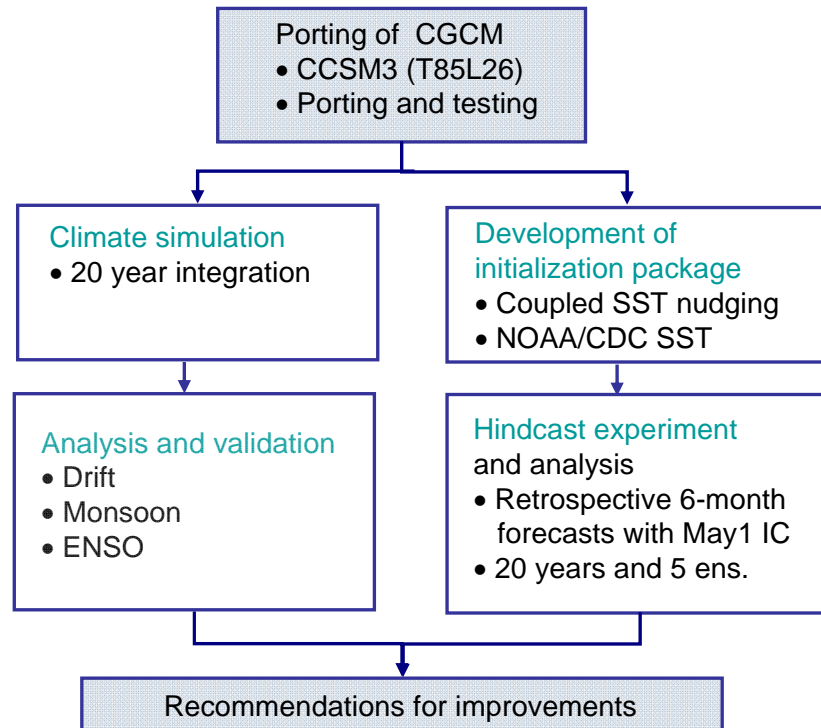
- **Coupled global climate prediction model**
- Atmos., ocean, land, and sea-ice connected by a flux coupler
- Resolution : AGCM = 256 Lon X 128 Lat X 26 Level
OGCM = 320 Lon X 384 Lat X 40 Level
- Simulation Time : approx. 1year / 1day (64 CPUs)





In-House Coupled Model (CCSM3)

- Import of an ocean-atmosphere CGCM & climate simulation
- Development of initialization scheme & hindcast experiment

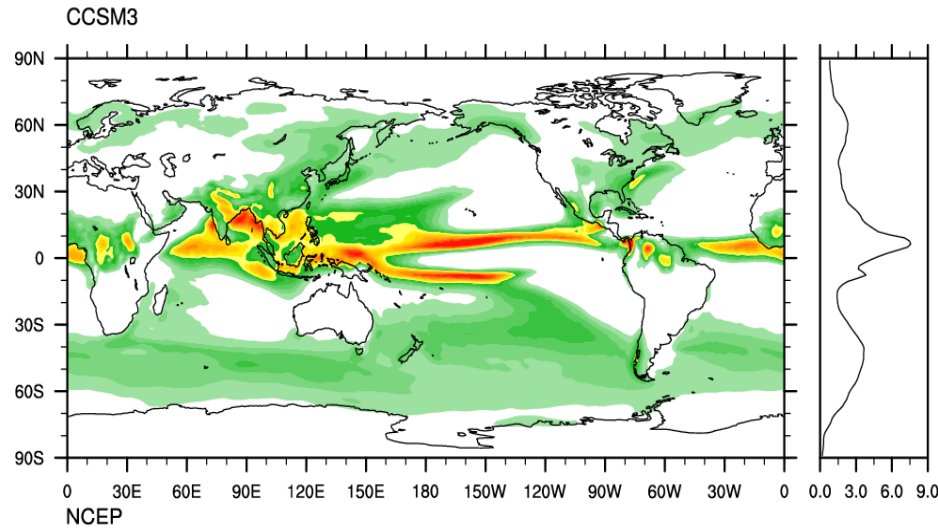




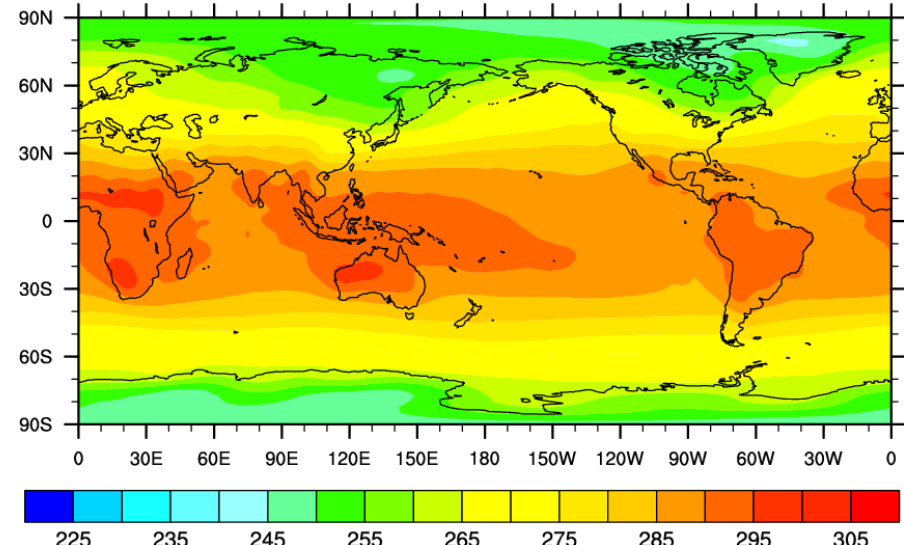
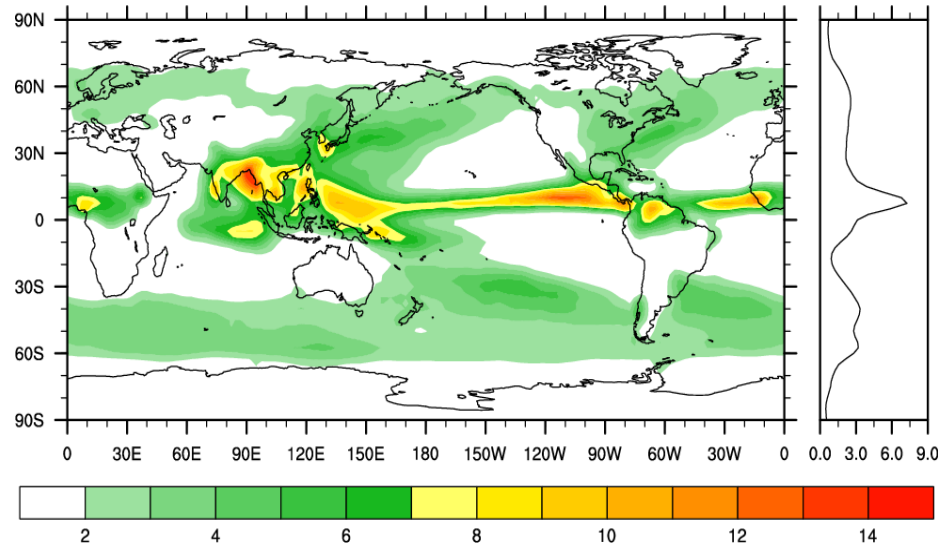
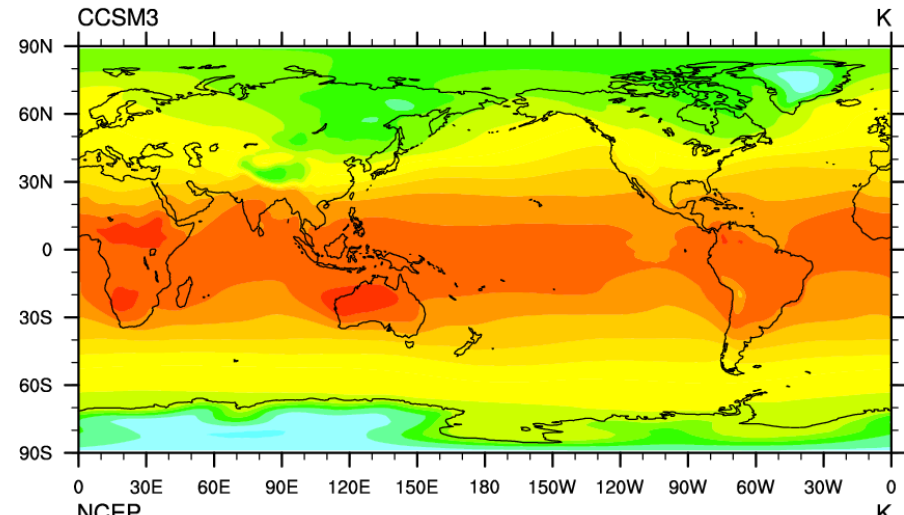
In-House Coupled Model (CCSM3)

Performance for CCSM3 Free-run

Total Precipitation (JJA)



Temperature at 850 hPa (DJF)





Development of initialization scheme for CGCM

Background

- APCC is trying to predict 6~12-month forecast using in-house CGCM
- Initialization scheme is important for the seasonal forecasting in order to provide skillful forecast
- Nudging method shows successful prediction of the ENSO events (Luo et al. 2005)

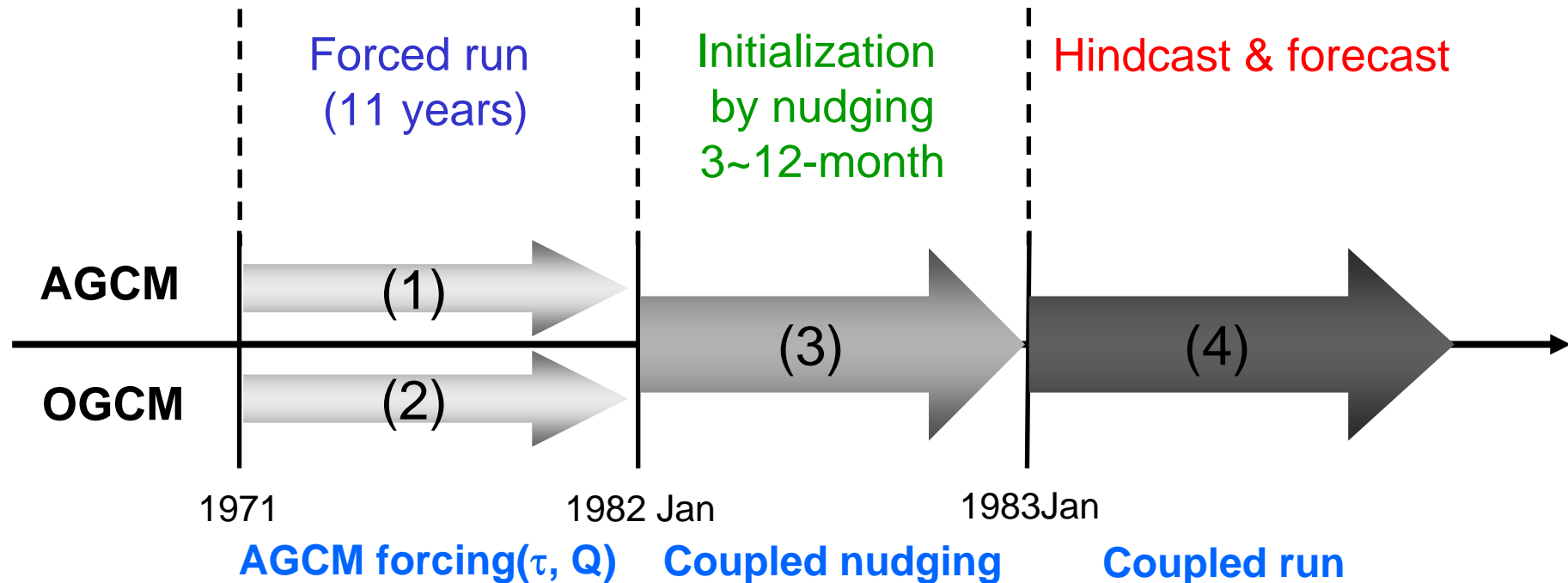
Goal

- development of initialization scheme based on nudging for CCSM3
- hindcast experiment using the initialization scheme
- sensitivity of the predictions to factors such as initial condition, boundary condition





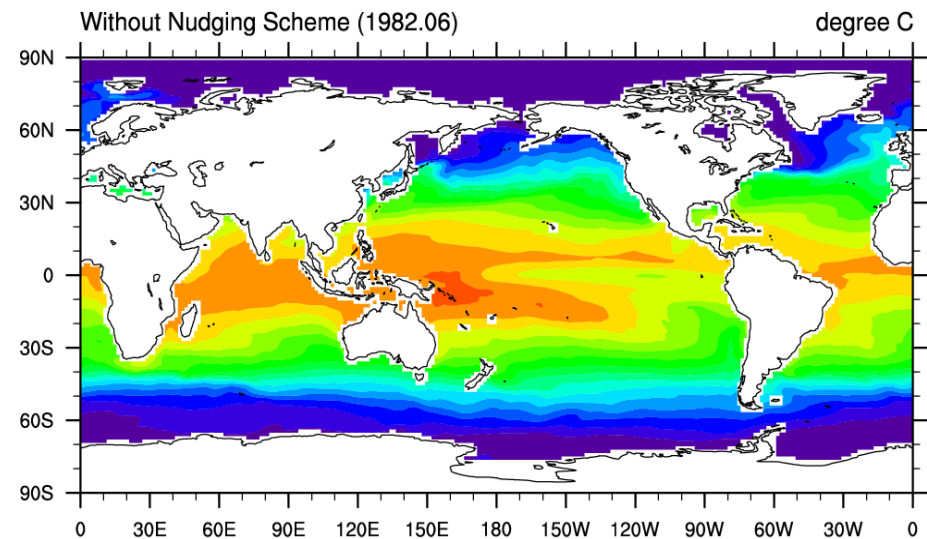
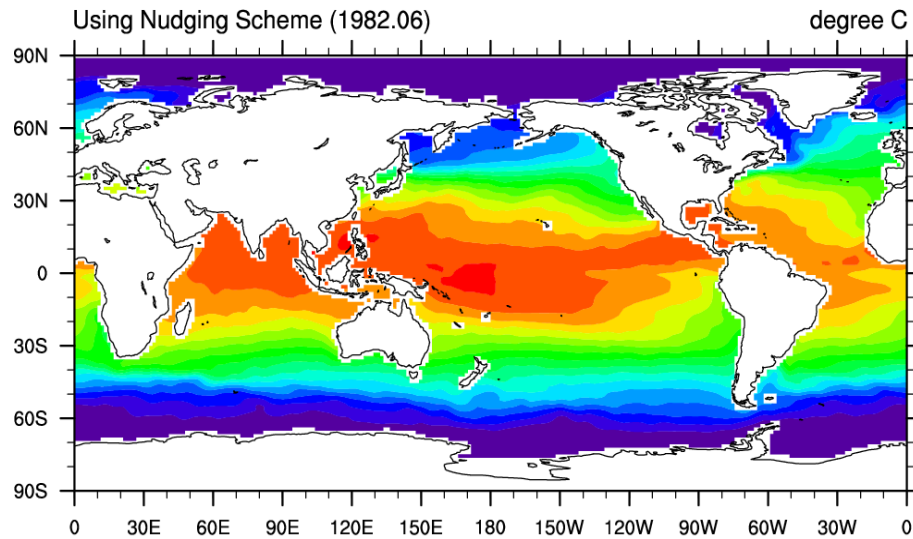
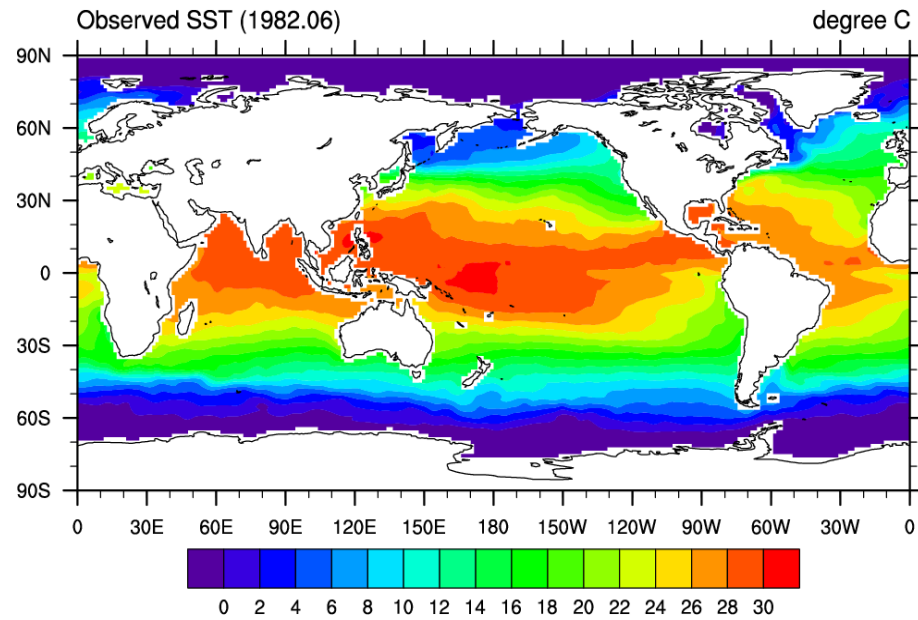
Framework of Initialization & Forecast



- (1) generate 2-hourly forcing (τ, 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)



Nudging Performance for CCSM3





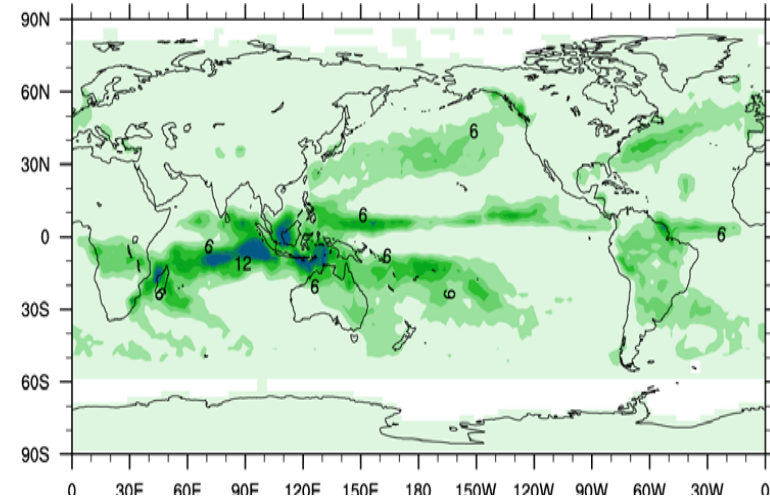
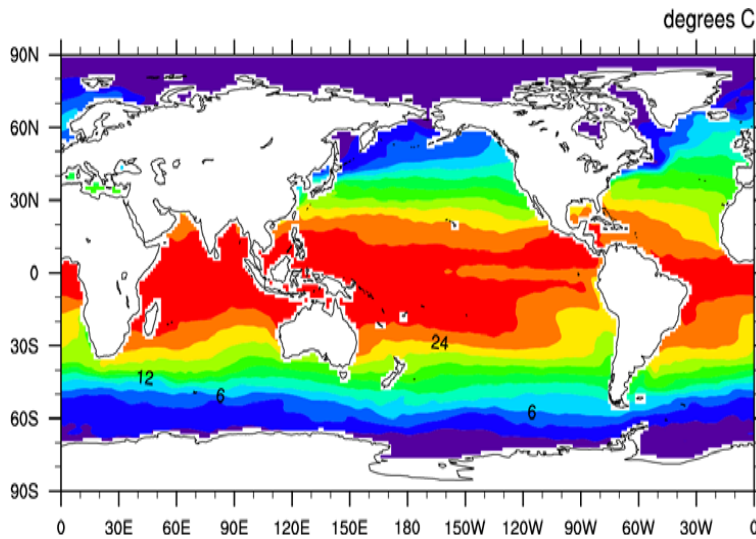
Preliminary results for Hindcast (1983 DJF)

I.C. : Nov 1st, 1983

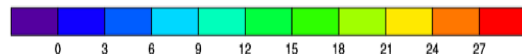
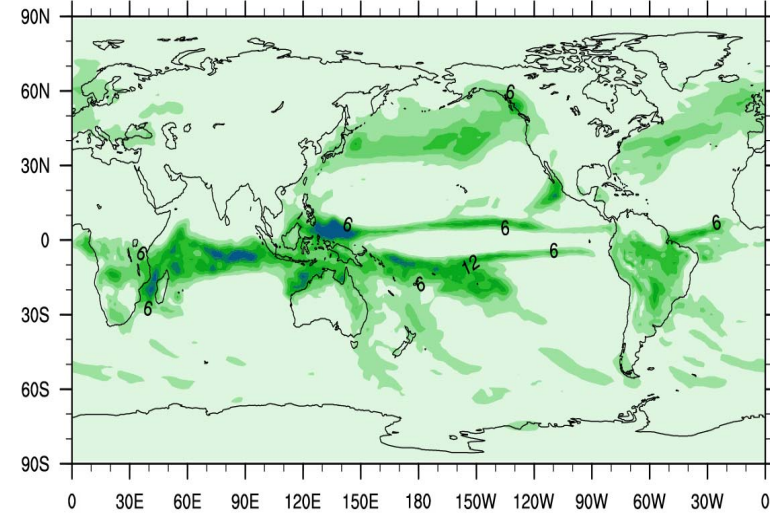
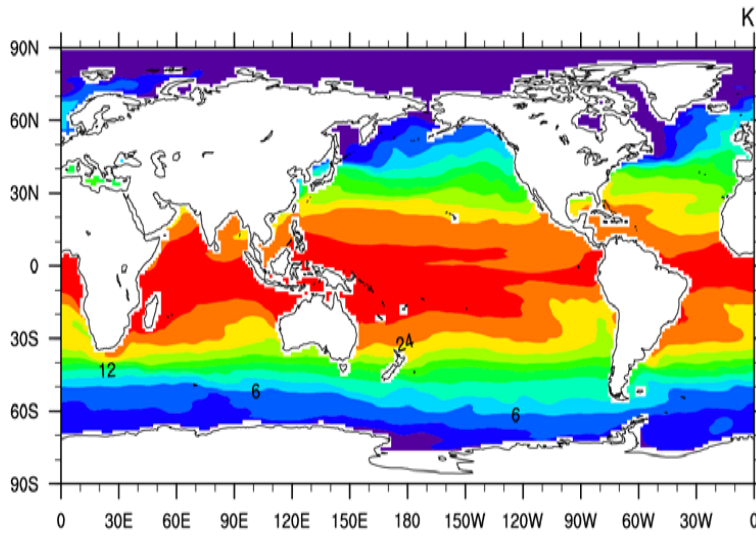
SST

Precipitation

Observation



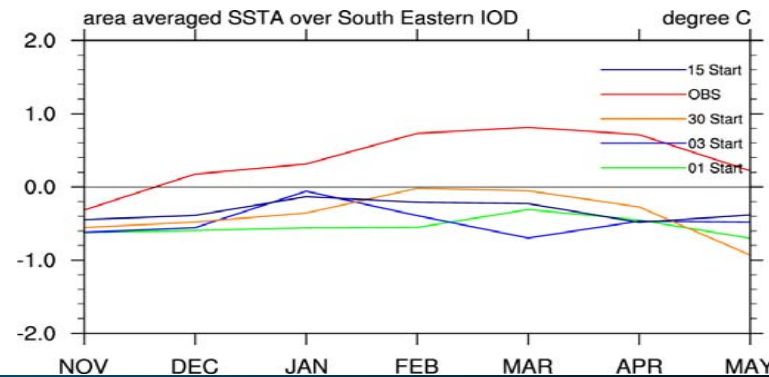
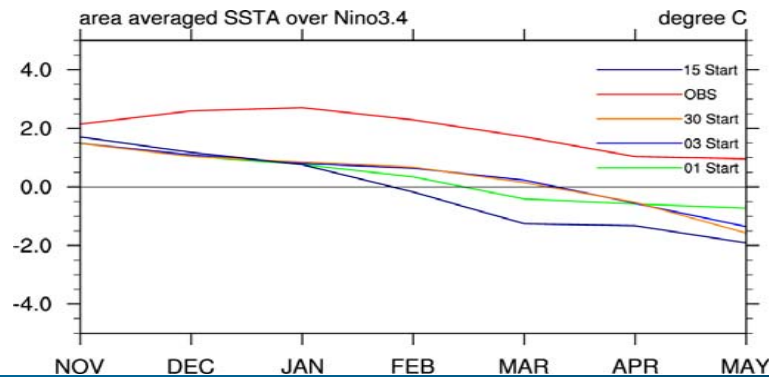
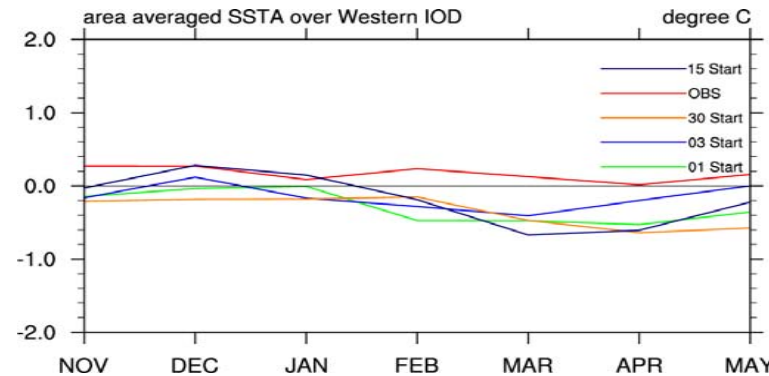
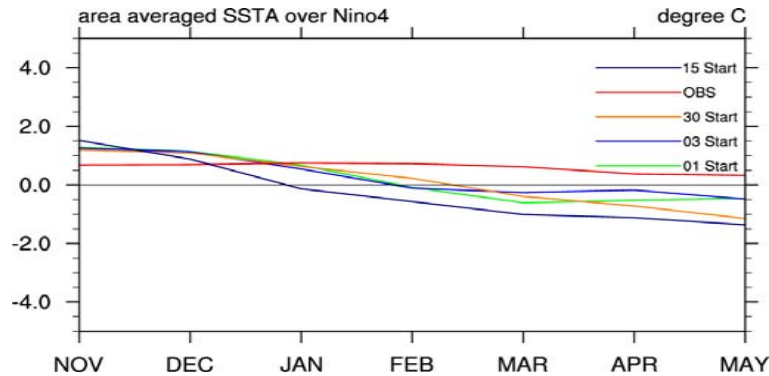
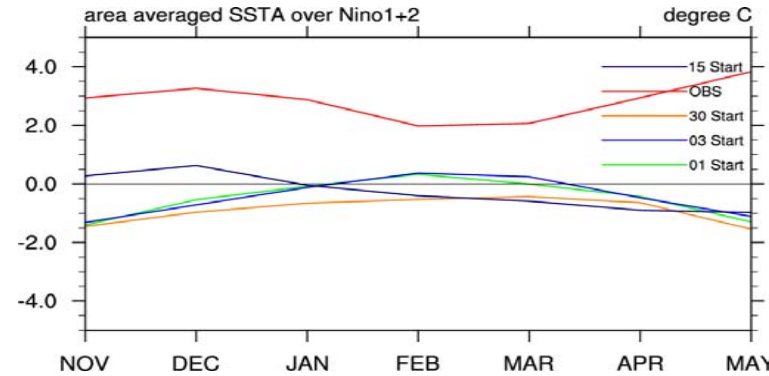
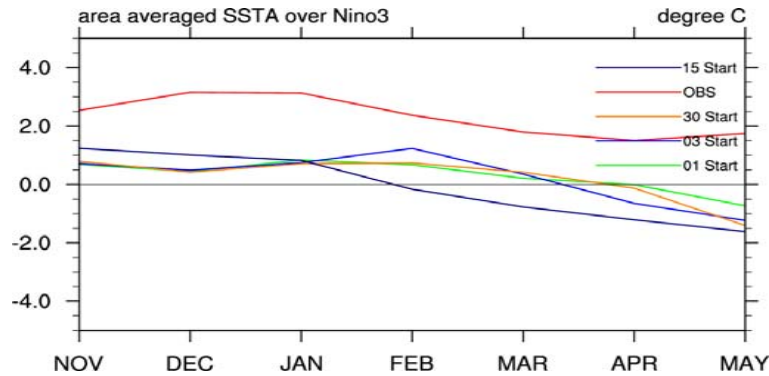
CCSM3





Preliminary results for Hindcast

Time series of hindcast SSTA from Nov 1982 to May 1983
Climatology : 20 years mean of free run

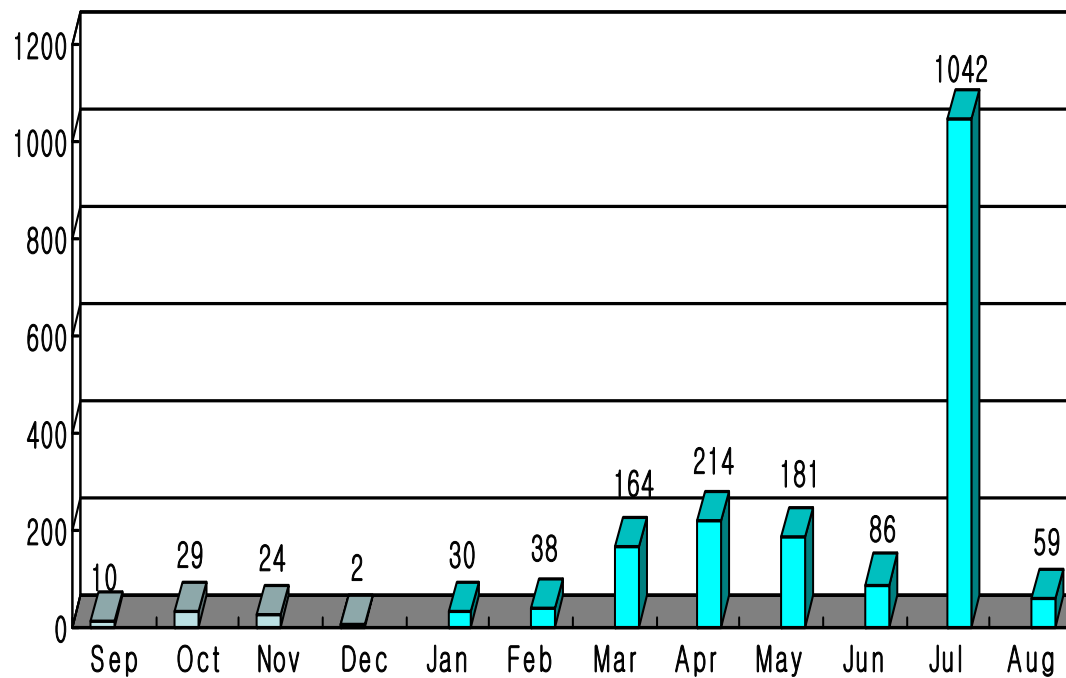




Visitor of ADSS website

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2007									10	29	24	2	65
2008	30	38	164	214	181	86	1042	59					1814

Visitor of ADSS



Count of 2007 Count of 2008

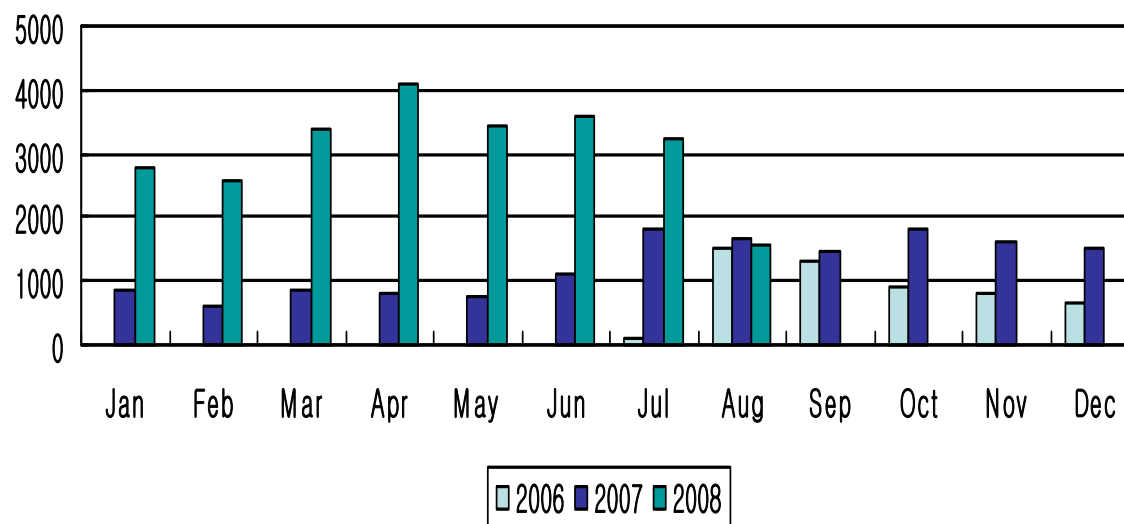
	Inside (staff)	Outside	Total
2007	58	7	65
2008	272	1542	1814
Total	330	1549	1879



Visitor of APCC website

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2006							87	1510	1320	925	824	637	5303
2007	843	616	849	815	751	1116	1843	1644	1461	1831	1602	1499	14870
2008	2785	2567	3409	4104	3450	3605	3234	1555					24709

Visitor of APCC website



	Inside (staff)	Outside	Total
2006	1445	3858	5303
2007	2570	12300	14870
2008	1544	23165	24709
Total	5559	39323	44882





Plans for 2009

- *Development of ISV prediction*
- *6-month operational prediction since next summer*
- *Designing of the ENSO/ENSO Modoki/IOD indices for 1-tier MME system to facilitate the prediction of these events.*
- *Experimental 6-month downscaling*
- *Further development of in-house coupled model*
- *Drought prediction*
- *other applications (?)*





Plans for 2009

- *Development of extreme event prediction*
- *6-month operational prediction since next summer*
- *6-month downscaling*
- *Further development of in-house coupled model*





Center in Busan APEC Climate Center in Busan APEC Climate Center in Busan APEC Climate Center in Busan APEC Climate Center in Busan APEC Climate Center in Busan APEC Climate Center in Busan APEC Climate Center in Busan APEC Climate Center in Busan APEC Climate Center in Busan

아경투시도

Thanks for the attention



APCC New Building (To be completed in Dec. 2008)

주경투시도