Asia-Pacific
Economic Cooperation

REPORT
on
APEC CLIMATE SYMPOSIUM

Lima, Peru
19 to 21 August 2008

APEC Industrial Science and Technology Working Group

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REPORT

ON

APEC CLIMATE SYMPOSIUM

(Lima, Peru, 19 to 21 August 2008)

I. ORGANIZATION OF THE SESSION

1. The APEC Climate Symposium was held in the National Museum, Lima, Peru from 19 to 21 August 2008.

2. The Session was attended by 38 international participants from 31 National Meteorological and Hydrological Services (NMHSs) or Institutes. 34 of them are from Member economies, namely: Australia, Canada, Chile, China, Chinese Taipei, Indonesia, Japan, Malaysia, New Zealand, Peru, Republic of Korea, Russia, Singapore, Thailand, the Socialist Republic of Viet Nam, and the United States of America (USA). Apart from these participants, 72 local participants from Peru had attended the symposium.

3. Representatives from the APEC secretariat and World Meteorological Organization (WMO) also attended the session. The list of participants is given in Appendix I.

Opening of the Session (agenda item 1)

4. The opening ceremony was declared open by Dr. Antonio Brack, Minister of the Ministry of Environment, at 08:55 hrs on Tuesday, 19 August 2008 in the Museo de la Nación (National Museum), Lima, Peru.

5. The following statements were delivered at the opening ceremony:
    - Opening remarks by Dr. W.J. Lee, Executive Director, APCC
    - Congratulatory message from Mr. Peter Chen, WMO representative and Chief of Data Processing and Forecasting Systems, Weather and Disaster Risk Reduction Services Department, WMO
    - Congratulatory message from Prof. In-Sik Kang (SNU, Korea), Co-Chair of APCC'
    - Congratulatory message from Maj. Gen. P.A.F. (Ret.) Wilar Gamarra Molina,

Executive President, SENAMHI, Peru

- Congratulatory message from Dr. Antonio Brack, Minister of the Ministry of Environment, Peru, and declaration of the opening of the symposium

The above-mentioned statements are given in Appendix II.

II SCIENTIFIC PRESENTATIONS

6. After the inaugural session, the sessions were kick-started with a key note address on "Seasonal Forecasting in the Provision of Meteorological Services", delivered by Mr. Peter Chen of WMO. The Session was informed of the WMO programme of activities on and the infrastructure that has been established for long-range forecasting, and important issues and considerations that climate forecasting centers should address for the benefit of the community. The session noted that the concept of regionalized demonstration project for severe weather forecasting can be applied to the application of seasonal forecasting. The key note talk was followed by three sessions dedicated to various issues of seasonal prediction.

7. The first session on "Issues and challenges in Regional climate prediction, with special attention to America" was chaired by Prof. A.D. Moura of INMET, Brazil. 7 talks were delivered in this session. Dr. T. Ambrizzi opened the session by talking on the fidelity of the southern hemisphere teleconnection simulations, and indicated that the relevant atmospheric dynamics at large scales can be qualitatively interpreted through the linear wave theory during austral winter. Prof. A. Moura presented a seminar on the dynamical multi-ensemble seasonal climate forecast over Northeast Brazil, its applications, and methods to benefit from these through interactions with a wider community of stakeholders. Prof. C.-P. Chang of NPS, USA, talked about abnormal late season cold surges during Asian winter monsoon 2005. Eng. Carmen Reyes, SENAMHI, PERU has presented a paper on Seasonal Climate Prediction in Perú using the CCM3, and also their efforts to downscale these predictions dynamically using a regional model, as well as some statistical techniques. The next talk by Mr. Swarinoto of BMG, Indonesia brought out the importance of mitigation and adaptation programs in Indonesia to offset the negative impacts of climate change. Dr. J. Carrasco of National Weather Service, Chile, talked about the regional 3-month climate predictions, based on regional models and the CPT tools, being pursued at their

institute. Dr. A. S. Mascarenhas of CIIFEN, Ecuador, described the regional effort between, and National Meteorological Services from Venezuela, Colombia, Ecuador, Peru, Bolivia and Chile and the Scientific Modeling Center of Zulia University to improve the Seasonal Prediction capabilities, statistical and dynamical downscaling that has been conducted to generate seasonal and sub seasonal forecast at National and regional level. Their unique efforts in applying the downscaled information to assess the agricultural risk management in the Andean countries were also discussed.

8. The second session on "Applications of Seasonal prediction," comprising of 6 talks, was chaired by Dr. S. Mason of IRI, USA. Dr. J. Renwick of NIWA, New Zealand, opened the session by presenting updates on the application of climate prediction in New Zealand. He reviewed the work in the new EcoClimate consortium, and touched on new developments in regional seasonal forecasting and climate change scenario development. Dr. O. Alvez of BOM, Australia, discussed about a range of experimental products that have been developed, ranging from forecasting regional rainfall for agriculture to forecasting Great Barrier Reef coral bleaching, based on the real time climate forecasts using the POAMA system. He also mentioned about the significantly-improved SSTs and in predicted regional rainfall in Australia, as compared to the earlier model. Mr. K. Takahashi of JMA has presented the recent developments on the seasonal prediction front of JMA, such as early warning prediction of extreme events, and JMA's foray into providing statistically downscaled forecast model outputs for the first time for a region outside Japan. Dr. S. Mason from IRI, USA, presented a very informative talk on some of the information products being developed by the IRI specifically for the International Federation of Red Cross and Red Crescent Societies (IFRC). These products involve the use of weather and climate information on a wide range of timescales. The work highlighted the importance of an integrated climate information service. Dr. L. Chen of BCC/CMA, China talked about the efforts of statistical downscaling of the boreal winter hindcasts of CGCM/BCC using BP-CCA method, and emphasized the advantage of the downscaling technique. In the last presentation of the session, Dr. John Low of MSD/NEA, Singapore, described the ongoing efforts and activities on short-term climate prediction in Singapore and in South East Asia; the main efforts are focused on statistical downscaling using SCOPIC (Seasonal Climate Outlooks for Pacific Island Countries) and CPT (Climate Prediction Tool).

9. The last session of the day was dedicated to the theme "Frontline technologies in seasonal climate prediction". Chaired by Prof. Bin Wang of IPRC/UH, it attracted 6 talks. The first talk by Prof. M. Kimoto of CCSR, Tokyo University, was the status of development of SPAM, a system for prediction

and assimilation by the climate model MIROC, for seasonal to decadal prediction. Prof. Bin Wang, the next speaker, talked about the recent advances and Prospectus of Seasonal Prediction, along with an Assessment of the APCC/CliPAS 14-Model Ensemble Retrospective Seasonal Prediction for the period 1980–2004. His results indicate that the MME method is demonstrated to be a useful and practical approach for reducing errors and quantifying forecast uncertainty due to model formulation. The MME prediction skill is substantially better than the averaged skill of all individual models. He presented the recent progress, and remaining challenges, in prediction of the equatorial Indo-Pacific SSTA, land rainfall in monsoon region etc. In the next talk by Prof. In-Sik Kang of SNU, Korea, importance and recent issues of initialization process in coupled ocean-atmosphere prediction system for seasonal prediction were discussed, with comparative examples of the performances of different methods such as 4DVAR, Ensemble Kalman Filter. In addition, Prof. Kang evaluated various ensemble generation methods and showed their implementation results in coupled GCM. Prof. Cheng-Ta Chen of NTNU, Chinese Taipei, using the DEMETER data archives, comprising of seven coupled model data, discussed his studies which investigate whether the relative rarity of a seasonal event would affect forecast skill systematically. Dr. Emilia K. Jin of COLA, USA, elucidated their developmental efforts in constructing the initial conditions for the 3 main components of CCSM3 - atmosphere, land surface, and ocean - that are based on data assimilation in all three domains. By conducting parallel forecast experiments with the ocean-land-atmosphere initialization, the predictability of the ocean-only and ocean-land-atmosphere initialization systems on forecast skill has been examined. In the last talk of the day, Dr. M.I. Lee of GMAO/NGSFC, USA, described the Goddard Earth Observing System, Version 5 (GEOS-5) the latest version of the data assimilation system, and its research applications such as assessing the impacts of air-sea coupling on the tropical MJO prediction, and assessing the tropical influence on the extra-tropical weather extremes by applying the “replay” technique to the incremental analysis update (IAU) method.

III. REVIEW OF THE 2007-08 CLIMATE AND SEASONAL FORECASTS

10. This review was held as a part of the first session of the working group (see section IV for details). The session noted that 2007 SON-2008 August witnessed several important climate events such as a La Niña accompanied by a weak IOD. The boreal winter (DJF) witnessed the very unusual cold conditions in tropical China, including a strong snowfall during January. The other anomalous features included the persistently cold conditions in Northern North America, cold and wet signals in Eastern Australia etc. The La Nina conditions have been weakening since spring, 2008, and since June the Indian Ocean is

witnessing a positive IOD-like signal again. The current summer signals indicate a dry and warm East Asia, near-normal Indian monsoon, anomalously hot Europe, and also parts of northern North America, tropical Africa, and drought in West and East Australia, (which may be associated with the ongoing IOD conditions in the Indian Ocean).

11. The Committee took note with appreciation the review of the 2007-08 Climate diagnostics (Appendix III) and performances of seasonal prediction based on the multi-model ensemble system provided by the APEC Climate Center (Appendix IV).

IV. WORKING GROUP MEETING

12. Following the scientific seminars, Working Group Meeting was convened on the morning of 20 August 2008 to review progress of work during the intersession, to identify priorities for cooperation and to recommend points to the Session for consideration

13. The major outcomes of the Working Group Meeting was reported to the plenary session as given below

ADOPTION OF THE WG AGENDA

i. The Group adopted the agenda, as shown in Appendix V.
ii. Major General W. Gamarra M. of SENAMHI, Peru served as the Chair of the Group.

OPERATION OF CLIMATE INFORMATION SERVICE BASED ON MULTI-MODEL ENSEMBLE SEASONAL PREDICTION SYSTEM (AGENDA 3)

- The session, chaired by Mr. K. Takahashi of CPD/JMA Japan, and rapporteured by Dr. J.-Y. Lee of IPRC/UH, USA, began with three seminars on the state of art in the prediction systems of CMC, NCEP and JMA. Later, Dr. S. Mason of IRI presented a new verification skill score for beginning of the session was devoted to review the climate conditions during 2007-2008, and

performance of the MME system (see section II above). The members were requested to provide, as per the individual convenience,

- Newer coupled modeling forecasts data to support the APCC coupled MME prediction
- Increased length of hindcast data
- High resolution temporal and spatial forecast data for extreme event prediction
- Training activities on climate prediction and applications.

14. The Session took note of the report of APCC on the recent operational efforts including the monthly 3-month MME forecasts and their downscaling for Korea, developmental activities on coupled 6-month MME prediction, development of an in-house coupled model system, drought prediction etc., and future plans.

CAPACITY BULDING IN PRODUCING AND USING RELIABLE CLIMATE PREDICTIONS (AGENDA 4)

15. Dr. J.-K. Schemm of CPC/NCEP/NWS/NOAA, USA, chaired the session while Dr. Emilia K. Jin of COLA/GMU, USA rapporteured for this session. The participants from Thailand, Vietnam and Chile presented reports on recent capacity building activities taking place in their economies. All the three are involved in producing dynamically downscaled forecasts to meet demands for regional level forecasts.

16. The prototype of climate information tool kit being developed at APCC for a better climate information exchange was exhibited, and its potential use in improving the climate prediction efforts in many climate centers was appreciated. The regional capacity building efforts in climate prediction was discussed, and the issues such as the need for better technology, data, and trained human resources were discussed.

V. INTERNATIONAL COOPERATION

17. This was the first of the two scheduled SAC sessions. Following the lunch break the session started at 1:30 pm and was chaired by Prof. Kimoto of CCSR, Japan, while Dr. Emilia K. Jin of COLA/GMU, USA, and Mr. Boonlert Archevarahuprok rapportuered for this session. Prof. Tercio Ambrizzi of Univ. Sao Paolo discussed the ongoing efforts of EUROBRISA to improve seasonal forecasts over

Brazil and suggested possible collaboration with APCC. Dr. Affonso Mascarenhas introduced the research and development activities at CIIFEN, Ecuador. He also elaborated on 3 areas of mutual interest where APCC and CIIFEN may cooperate in the near future; the potential topics of collaboration are: (i) coupled regional models (ii) multi-model multi-ensemble technology and (iii) establishment of Andean GRID infrastructure. Prof. Bin Wang of University of Hawaii presented two talks, one on the CliPAS multimodel system and the other on APCCs possible role in the Asian Monsoon Year (AMY) experiments.

18. Following the talks, Prof. Kimoto chaired the discussion session in which various issues related to APCC's MME production were discussed. APCC mission relative to IRI and WMO GPCs were also commented upon by members.

VI. PROGRAMME FOR 2009 AND BEYOND

19. The theme comprised of parallel SAC and WG meetings. The WG session took note of the reports of the parallel sessions of the Working Group Meeting (Appendix VI).

Decisions of Working Group

20. The group appointed Mr Wilar Gamarra Molina (Peru) as Chair of the Working Group.

21. Re-establish the Working Group to be responsible for the planning and promotion of cooperation among the Working Group Members in the areas as presented in terms of reference (Appendix VII);

22. To organize a Symposium and Working Group Meeting in 2009. The NWS of USA was the only institution that offered to host the 2009 meeting. However, other sites such as Singapore and Busan, Korea, were suggested in view of tight travel budget. Finally, in the plenary session on the next day when the working group summary was being compiled, Singapore was recommended, subject to factors such as the approval of its Government, particularly owing to advantage of the available infrastructure associated with the APEC SOM in the case of Singapore, and the suggestion was approved.

23. Encourage participation of Committee Members to share coupled prediction and longer hind cast data;

24. Recognize the opportunity offered by the APCC for open DAP data server for CHFP project in coordination with WGSIP/WCRP/WMO (Appendix VIII);

25. Recognize the importance of the exchange of additional data for diagnosis and prediction of extreme climate events;

26. Took note of suggestions to APCC from Vietnam and Thailand delegates to play a lead role in enhancement of downscaling capabilities for the region in reference to CIIFEN activities over South America;

27. Encourage active collaboration with IRI and other related institutions to facilitate MME based applications;

28. There was general support for the overall thrust of the APCC for the future, including developments in intra-seasonal prediction, and towards decadal and longer climate-change-related projections. The in-house model development activity, along with the development of the intraseasonal prediction, may be carried out with active support from CliPAS and other relevant institutes.

29. One recommendation was a closer collaboration between the Working Group members and coordination through CliPAS.

30. One suggestion was that the APCC might get useful information from the success of CPTEC that has coordinated among South American institutions. It was also noted that external help is available from the IRI, and possible collaboration with WMO for training could be considered.

31. Applications were recognised as a very exciting and important field. Since there is presently a gap between actual applications and current seasonal forecast information, the APCC should work to reformat its seasonal forecast product to be more understandable and useful for non-expert users.

32. Capacity building: APCC is not only to focus on MME, but should also deal with a host of evolving issues related to its general mission. As a part of the APCC Data Service System (ADSS) , data exchanger (DEX) and utilization system (tentatively named as Climate Information Tool Kit - CLIK) is underway. Effective management of data is important, and cooperation with WMO on the WMO Information System should be considered.

Recommendations of Science Advisory Committee

33. Due to the limited time available for discussion, SAC could only carry out a limited review. However, a number of recommendations were provided for improving the efficiency, transparency, and productivity of APCC thereby the contribution toward regional prosperity. The recommendations are presented in the Appendix IX. Continuation of efforts toward utilization of MME, along with development of an interface to applications, is the highlight of the recommendations.

VII. SUPPORT REQUIRED FOR THE WORKING GROUP ACTIVITIES

APEC Climate Symposium

34. The Session expressed its gratitude to the APEC economies for supporting the ongoing symposium and its support for the next APEC Climate Symposium.

APN/ GEF/ KOICA training program

35. The Session expressed its gratitude to the APN and KOICA for providing necessary support to train seasonal forecasters in Asia Pacific regions. The Session recommended APCC continue to explore further opportunity to expand similar training events through the APN and KOICA, GEF and other international funding agencies

Science foundations and in-kind contributions

36. The Session expressed its gratitude to the Government of the Chinese Taipei, Korea (Rep. of), and United States for proving financial or in-kind support to carry out visiting program among scientists in

Asia-Pacific region. The Session recommend that such opportunity be further extended through the financial support of national Science Foundations and/or voluntary support of institutes in the region.

37. The Committee expressed its gratitude to relevant Government offices for the facilities, support, and supplies.

VIII. COORDINATION WITH OTHER INTERNATIONAL ACTIVITIES

38. The session was informed by the APCC:

(i) that the APCC was an invited participant in "The Fourth Session of the Forum on Regional Climate Monitoring, Assessment and Prediction for Asia (FOCRAII)", sponsored by CMA and WMO and held in Beijing during 9-11 April, 2008.

(ii) that it Will Participate as training faculty in the WMO Training Workshop on Monsoon that will be held during the WMO Fourth International Workshop on Monsoons (IWM-IV) during 20-25 October, 2008.

(iii) About the forthcoming World Climate Conference-3 on "Climate predictions and information for decision making" to be held from 31 August to 4 September 2009 in Geneva under the auspices of WMO in cooperation with other UN agencies, national governments and private sector. APCC as well as several speakers have emphasized the importance of the participation in this meeting for the climate prediction community.

39. The session took note of the activities of the RCOFs under WMO's CLIPS programme in conjunction with regional climate information and prediction services.

IX. DATE AND PLACE OF THE SYMPOSIUM, WORKING GROUP MEETING, AND SCIENCE ADVISORY COMMITTEE METTING

40. The session appreciated the offer of NWS of USA to host the 2009 meeting. However, in view of tight travel budget, other choices such as Singapore and Busan, Korea, were suggested. Singapore was

finally recommended as the potential next venue, as it will be hosting the next APEC leaders and associated senior officers meetings subject to factors such as the approval of its Government. Further, APCC as well as Dr. John Low, the WG member from Singapore, were advised to approach the Government of Singapore for their acceptance. The venue and exact date of the Symposium will be announced by APCC in due time after due process.

41. The meetings of working group and science advisory committee would be arranged by the APCC in consultation with the chairs and co-chairs of the working group, science advisory committee and the host country as an integral part of the Symposium.

X. ADOPTION OF THE REPORT

42. The Committee adopted the report of the session at 19:30 hours, 21 August 2008.

XI. CLOSURE OF THE SESSION

43. The participants of the Symposium, representatives of APEC secretariat, WMO, and APCC expressed their thanks and appreciation to the Government of Peru for the successful hosting of the Symposium. They also expressed gratitude to Major General Wilar Gamarra, Director General of the SENAMHI of PERU, and his staff for the warm hospitality and excellent arrangements made and also for organizing the guided tour of the SENAMHI, Peru.

44. The Session was closed at 20:00 hours, 21 August 2008.

APPENDIX I

List of Participants

INTERNATIONAL PARTICIPANTS

No.	Title	Name	Affiliation/Country/ E-mail
1	Dr.	Alves, Oscar	Bureau of Meteorology / Australia o.alves@bom.gov.au
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SENAMHI PARTICIPANTS

No.	Title	Name	Institution
1	Eng.	ACUÑA, DELIA	SENAMHI
2	Eng.	ALARCON, CONSTANTINO	SENAMHI
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5	Eng.	CANALES, JULIO	SENAMHI
6	Colonel	CASTILLO, HILDEBRANDO	SENAMHI
7	Eng.	CHIRA, JORGE	SENAMHI
8	Eng.	CONCEPCION, ERIC	SENAMHI
9	Eng.	DIAZ, AMELIA	SENAMHI
10	Colonel	GARCIA, MARCIAL	SENAMHI
11	Eng.	GARCIA, TERESA	SENAMHI
12	Eng.	ITA, NICEFORO	SENAMHI
13	Eng.	JAIMES, ENA	SENAMHI
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15	Eng.	LOAYZA, RAQUEL	SENAMHI
16	Eng.	MENIS, LOURDES	SENAMHI
17	Eng.	ORIA, CLARA	SENAMHI
18	Commander	PORTILLA, SERGIO	SENAMHI
19	Eng.	PULACHE, WILMER	SENAMHI
20	Eng.	ROSAS, GABRIELA	SENAMHI
21	Eng.	ROSAS, RICARDO	SENAMHI
22	Eng.	ROSAS, VICTOR	SENAMHI
23	Eng.	VARA, MIGUEL	SENAMHI

OTHER LOCAL PARTICIPANTS (Non-SENAMHI)

No.	Title	Name	Institution
1	Dr.	HERRERA, CARLOS	Centro Internacional de la Papa
2	Dr.	MELLADO, AUGUSTO	Comisión de Ciencia y Tecnología
3	Ms.	AVELLANEDA,CLAUDIA	Comisión Nacional del Ambiente
4	Mr.	BERNALES, MANUEL	Comisión Nacional del Ambiente
5	Mr.	CERVANTES, CESAR	Comisión Nacional del Ambiente
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7	Admiral	CACHO, MAURO	Dirección de Hidrografía y Navegación
8	1st. Lieutenant	OTINIANO, JORGE	Dirección de Hidrografía y Navegación
9	1st. Lieutenant	SABLICH, RODOLFO	Dirección de Hidrografía y Navegación
10	Colonel	SOTOMAYOR, LUIS	Dirección de Meteorología FAP
11	Colonel	CAMPOS, RAFAEL	Instituto de Defensa Civil
12	General	PALOMINO, LUIS	Instituto de Defensa Civil
13	Eng.	PAGADOR, CARLOS	Instituto de Recursos Naturales
14	Admiral	SOLDI, HECTOR	Instituto del Mar del Perú
15	Dr.	TAM, JORGE	Instituto del Mar del Perú
16	Dr.	SILVA, YAMINA	Instituto Geofísico del Perú
17	Eng.	SANCHEZ, ODOM	Instituto Geofísico del Perú
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26	Mrs.	MIYAN COLOMA, MARIA	Ministerio de Educación
27	Mr.	DELGADO, EMILIO	Ministerio de Educación
28	Ms.	GARCIA BELAUNDE, SOL MARIANA	Ministerio de Educación
29	Ms.	REYES, JUDITH	Ministerio de Educación
30	Ms.	REYMER, ANGELA	Ministerio de Educación
31	Mr.	CARDENAS, RAFAEL	Ministerio de Energía y Minas
32	Ms.	ESPINOZA, MARGOT	Ministerio de Energía y Minas
33	Ms.	IBARRA, GIANINA	Ministerio de Energía y Minas

34	Mr.	CISNEROS, PABLO	Ministerio de Relaciones Exteriores
35	Ambassador	KOSTRISKY, SERGIO	Ministerio de Relaciones Exteriores
36	Ms.	MANDALENGOITIA, LAURA	Ministerio de Relaciones Exteriores
37	Ms.	CHINEN, PAOLA	Ministerio de Salud
38	Mr.	RONCAL, SEGUNDO	Ministerio de Salud
39	Doctor	BRACK, ANTONIO	Ministerio del Ambiente
40	Engineer	VEREAU, CARMEN	Ministerio del Ambiente
41	Mr.	PARDON, MAURICIO	ORG SAUD
42	Major	ESCOBAR, DAVID	SIAP MICROS
43	Eng.	EUSTAQUIO, CARMEN	TELEMATICA
44	Dr.	BAIGORRIA, GUILLERMO	Universidad de Florida
45	Dr.	ROMERO, CONSUELO	Universidad de Florida
46	Mrs.	GALARZA, ELSA	Universidad del Pacifico
47	Eng.	CHAVARRI, EDUARDO	Universidad Nacional La Molina
48	Mr.	VEREAU, ROGER	VAISALA

APPENDIX II

Congratulatory Addresses

OPENING REMARKS

Woo – Jin Lee

Executive Director, APEC Climate Center

(LIMA, PERU, 19 to 21 August 2008)

Honourable Dr. Antonio Brack, Minister of Ministry of Environment,
Distinguished Guests,
Ladies and Gentlemen,

As an organizer of the Symposium in coordination with APEC secretariat and local host, it is an honour and indeed a privilege for me to extend a warm welcome to the distinguished delegates from the various countries on the occasion of our opening ceremony.

I wish to take this opportunity to express my deep appreciation to the Government of Peru for hosting this important event. Let me also thank Major General Wilar Gamarra Molina, Executive President of National Meteorology and Hydrology Service of Perú, and his staff, for the excellent arrangements made to ensure the success of the Symposium. On behalf of APEC Climate Center, I should like to express a word of gratitude to APEC economies for the generous support through the APEC project or through their governments.

This Symposium provides a unique opportunity for deliberations on the challenges the extreme climate events pose for the climate prediction community, and for identifying appropriate strategies for ensuring the enhancement of seasonal forecasting capability and application for the benefit of society in support of sustainable development under rapid climate change. The Symposium, therefore, provides a forum for policy makers, researchers, and forecasters to exchange views and experiences on challenges facing their climate information services.

Fortunately, most Member economies have recognized the important role of APEC Climate network in contributing towards improving forecast skill in seasonal time-scale and longer, through the

sharing of climate model outputs. As you are aware the regional cooperation on the exchange of know-how and data information is important to strengthen the resilience of societies and national economies to climate related disasters, thus contributing to the protection of life and property and sustainable development of nations. I earnestly desire, in this respect, that the Symposium provides insight and wisdom ***to strengthen further the cooperation with regional and nongovernmental organizations and international programmes, and also*** *to* strengthen further bilateral and multilateral cooperation within the context of these regional initiatives.

In closing, I wish all of your every success in your deliberations in the Symposium, and pleasant stay in Lima throughout this week.

Thank you.

———

"Climate Prediction and Application – Tackling Regional Needs"
APEC Climate Symposium
Lima, Peru
19 August 2008

Opening address by Mr. Peter Chen

World Meteorological Organization

Good Morning Distinguished Guests, Colleagues, Ladies and Gentlemen, Friends.

I am honoured and very pleased to join you at this important 3rd Annual Asia Pacific Climate Symposium. I feel privileged to address you, and to participate with you today, on behalf of the World Meteorological Organization "WMO". I would like to congratulate the APCC in organizing such a rich programme of speakers and topic areas, and I wish you a very successful week of this symposium and meetings.

Strategies for building and maintaining scientific and technical capabilities for seasonal forecasting should have these goals:

- to meet the needs of users,
- to benefit economies, and
- to assure public safety and security and disaster risk reduction for nations

ALL require effective organization, and strong leadership, and active cooperation.

As well, I believe in today's context, we also need effective partnerships among members and organizations, to pool our resources and expertise, and to share in the scientific and technical advances. We need to direct resources on activities that contribute the most, that "make a difference" to Society.
I believe the APCC framework and activities, including this third in a series of Asia Pacific Climate Symposia continue to be very successful this context.

From the point of view of delivering weather and climate forecasting services, including to sustain and to continuously improve these services, the strategy should include:

- building capacity among service providers,
- educating users, and
- educating the public, including for example teachers and children.

Also, I believe the strategy would be best *coordinated globally*, and *implemented in a regionalized approach* – if possible, with regional structures that recognize existing communities that already work effectively together in Meteorology, or if they share common societal and economic interests, or if they experience similar consequences of high impact weather and climatic phenomena. With such an approach, the capacities are strengthened where the needs are greatest, and the quality and consistency of forecasting guidance and products are enhanced in a sustainable way throughout a collaborating region.

While weather and climate forecasting science and technology are continuously evolving, and evolving rapidly with more and more useful and reliable "products", the human element needs to continue to be part of both the forecasting and service delivery process. Forecasting will continue to require a combined objective and subjective mix as well as understanding and providing services that meet the needs of society (mitigating disaster risk). By "objective" I mean, establishing and using a sound scientific foundation for the forecasting process, including dynamical (NWP) and statistical methods to generate predictions. By "subjective" I mean forecasting and providing climate services based on human expertise and strength of experience to synthesize all available information, knowledge and experience.

Forecasters and users alike should extract and benefit from the maximum forecast information through this objective-subjective mix, through well designed forecast products, which are maintained and assessed, and improved through quality assurance, and continuous improvement cycles, and using proven best practices.

Together, we must work hard to meet the weather and climate information needs of society in the context of climate variability and change, maximizing the use of existing technologies, focused and tailored to different societal needs, as well as to *accelerate and broaden* the transfer of technologies to benefit as broad a range of users as possible. Forecasting capacity in National Meteorological and Hydrological Services of developing countries and economies, and populations that are under greatest risks stand to benefit the most from effective partnerships.

To close, I would like to congratulate APCC as leaders in scientific and technical developments for climate prediction. I am confident that APCC will significantly contribute to regional adaptation to climate variability and change.

Thank you.

(Delivered 09:00, Lima, Peru, 19 August 2008.)

Congratulatory Address by Maj. Gen. Wilar Gamarra Molina, Executive President, SENAMHI, Peru

Honorable Minister Antonio Brack, Minister of the Environment, Dr. Woo Jin Lee, Executive Director of APCC, Mr. Peter Chen, Representative of WMO, Prof. In-Sik Kang, distinguished international and national authorities, scientists, ladies and gentlemen:

It is an honor to address you today, here at the National Museum of Peru; that congregates a selected group of members from the scientific community of the Asia-Pacific Member Economies, whose common denominator is their participation in the Asia-Pacific Climate Center, contributing with their work and knowledge to the understanding of the different atmospheric and ocean variables that determine the climate characteristics of the Asia-Pacific region; as well as the phenomena and meteorological events occurring in it and that cause a considerable impact on society and its economical activities.

The APEC Climate Center (APCC) was created in 1998, ten years ago, at the proposal of the Korea Meteorological Administration, as the Asia-Pacific Climate Network, within the core of the Asia-Pacific Economies Cooperation - APEC. Since then it has evolved until it has reached its current level as a climate center, with its operational headquarters in Busan, Korea.

The mission of the APCC is to enhance the socio-economic well-being of the Member Economies, by using up-to-date scientific knowledge and by applying innovative climate prediction techniques.

For this purpose, APCC has developed a real-time climate prediction system, applying prediction models from the member economies in an ensemble multimodel state-of-the-art atmospheric simulation system. The APCC also acts as a center for climate data with open access to member economies and it helps them building capacities in the production and use of reliable predictions.

One of APCC's most important functions is to develop improved methods of utilizing socio-economic innovation to mitigate and adapt to climate fluctuations and climate change and to be a guide to member economies for an optimum use of climate prediction information.

The scale in which weather and climate phenomena develop, encompassing continents and even the entire planet, has shown that the international exchange of climate information is essential for minimizing natural disasters and their negative economic impacts. Among scientists and policy makers a consensus was reached that actions need to be taken to develop climate early warning systems and climate information networks at a regional scale to improve the monitoring and prediction of climate variations.

Starting from 2006, and in order to have a space to exchange knowledge and experiences, and to disseminate to society the results of its work, APCC organizes annual Symposiums, like the one that gathers us today. For the first time it is hosted outside Busan, for which we feel twice as honored and we are committed to make our best efforts to achieve a top quality event, as you all deserve.

The scientists and members who have met in this venue are leaders in their corresponding research fields. The topics that they will address are the latest results in research on matters related to atmospheric modeling, generation of climate scenarios and other tools that can be applied to short, medium and long-term forecasts and climate prediction.

The development of these research papers and their application in the generation of forecasts and studies is of paramount importance to decision makers, when it concerns the adoption of strategic measures for prevention, mitigation and protection purposes, which can be planned at a large scale and long-term. For this, the prediction information has to be highly reliable, since any error could imply a very high cost in both social and economical terms.

The challenge posed to us is huge, because after all, what we are trying to establish here are scenarios of future climate events and their impact on our geographical configuration.

Peru is a country that is highly vulnerable to the effects of hydro-meteorological events such as El Niño and La Niña, frosts, flooding, droughts, etc, as well as it is particularly vulnerable to climate change-related long term events, being one of the most conspicuous signals, the increase in the average air temperature, that is causing an increasing retreat of our tropical glacial surface, a main source of water supply for the rivers in our coastal region, considering that the rainy season only lasts four months and that 15 million people depend on it for their own needs as well as for energy production.

This is why our authorities and population should know well ahead and as accurately as possible, what these climate scenarios will be, in a way that they will be able to take appropriate measures of adaptation to this future reality in a planned and controlled way.

The concern of the Peruvian Government on these issues has resulted in the establishment of the Ministry of Environment, in May of this year. One of its terms of reference is precisely to face the threats posed by climate change and to establish the corresponding mitigation and adaptation measures that should turn these threats into opportunities and insure the sustainability of the well-being and progress of the Peruvian people.

Today, we are honored to have among us Dr. Antonio Brack Egg, Minister of Environment of Peru, who is a well-known and prestigious scientist with an outstanding background, specialized in ecological matters and who shares with us, the concern for having a better knowledge of climate change and its impacts. For this reason, and for his characteristic willingness to participate, he is attending this event and will be in charge of the opening address.

Also, we are honored to have with us distinguished institutional directors, scientists and engineers involved in the matters we are just about to discuss. We deeply appreciate their presence and participation in this event. Since the expectations for this event have exceeded the capacity of this auditorium, we have installed a teleconference system that will transmit, in real time, the conferences to the auditorium at SENAMHI's headquarters.

This is also a good opportunity to express my special appreciation to our sponsors, that are supporting in different ways the realization of this event, helping us in providing you our best possible attention to your needs, and giving you some examples of our culture, like the bags, which depict the face of a god of the Chavin culture, and other details.

To our guests, please be cordially welcome to Peru and to the APCC Symposium. I hope that from this exchange of ideas and discussion some valuable conclusions and learnings will be obtained. I am convinced that for us, this is a golden opportunity to improve our capacities and to learn from you, for which I sincerely thank you. On our part, we will do our best to accomplish a successful event, and we

will do everything possible for you to enjoy your stay in Peru, the friendly country that receives you with open arms and hope that you will return home taking with you the best remembrances.

Thank you very much.

Congratulatory Address by Dr. Antonio Brack, Minister of Environment, Government of Peru

OPENING SPEECH

Ladies and Gentlemen,

Have a warm welcome to our country and to this APEC meeting. I hope you have had the chance to enjoy our excellent food and to get to know what our city and country have to offer.

Our planet Earth is currently facing severe environmental problems, in particular, those related to Climate Change issues, situation that imposes huge challenges to the entire human race in order to control its causes and for developing countries to adapt

It is known that the cost of the great development and wellbeing achieved by developed countries is Climate Change. Of course this is not the sole cause, yet, developed countries are still responsible of the main part of greenhouse emissions to the atmosphere.

Nevertheless, developing countries have also the chance to contribute in a substantial manner to the environmental balance of the planet. This balance can be achieved through the provision of environmental services rendered by the tropical forests as carbon stocks and the capacity to develop forest plantations to store exceeding carbon dioxide in the atmosphere.

Peru is aware that its contribution could be important. My country is the fourth extension of tropical forests and the ninth in forest tenures at world level. We possess near 65 million hectares of woods, 55 millions of which have been destined to conservation in the form of natural protected areas, indigenous property, and forests for permanent production subject to sustainable forestry management. There are also near 10 million hectares for reforestation.

This important forest patrimony and the recent decision of the Peruvian government to create the Ministry of the Environment, which will have a specialized department for Climate Change in charge of the

coordination of global initiatives and the establishment of national policies, are a clear demonstration of our commitment to mitigation and adaptation to Climate Change.

Among the APEC countries we believe Climate Change allows for a wide range of cooperation. Peru offers the capacities of its National Meteorological Service – SENAMHI - and of the Ministry itself; and, as another evidence of its commitment to the global goods, this time at the international level, is pleased to announce its partnership with the Japanese government under the so called “Cool Earth Program”.

Let me encourage countries here to develop similar and even more comprehensive cooperation initiatives and hope to you all, a fruitful work.

On behalf of the Government of Peru, I hereby declare inaugurated the 30th Meeting on Climate Change.

Thank you.

Appendix III

(THIS DOCUMENT WAS EARLIER SUBMITTED TO THE WG AS WG DOCUMENTS 3.2)

APEC CLIMATE CENTER

4th Working Group Meeting/
Science Advisory Committee
Meeting

CLIMATE PREDICTION AND APPLICATION – TACKLING REGIONAL NEEDS

LIMA Republic of Peru 19-21 AUGUST 2008

APCC/WG/Doc. 3.2(1)

(22.VII.2008)

Item: 3.2

ENGLISH ONLY

REVIEW OF CLIMATE CONDITION OVER ASIA-PACIFIC REGION DURING 2007-2008

(Submitted by APEC Climate Center)

Summary and Purpose of Document

This document lists the important climate conditions in Asia-Pacific since the boreal summer of 2007.

ACTIONS CARRIED OUT

The data-providing WG participants were invited to peruse the issues, before reading the next document on the performance of the APCC MME system, and also add any other relevant information.

- References: APCC forecasts and other products (see http://www.apcc21.net)

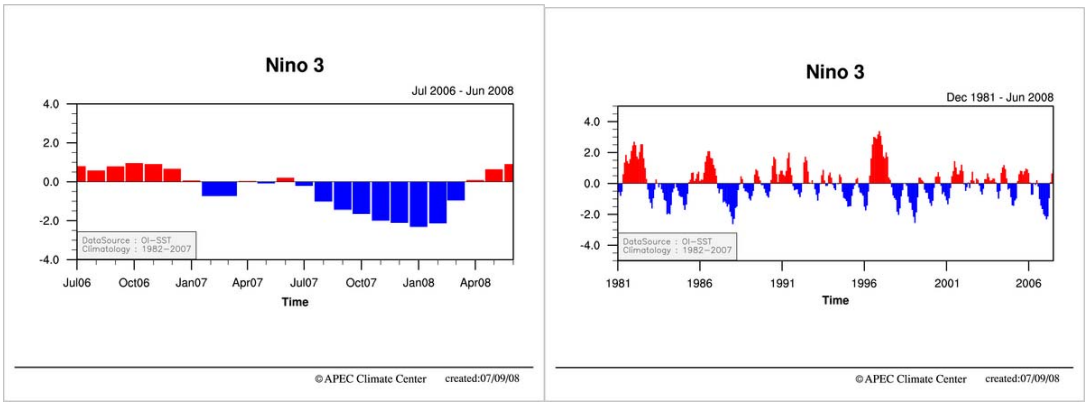
3.2 REVIEW OF CLIMATE OVER THE ASIAN PACIFIC REGION IN 2007-2008

Monitoring of the tropical Pacific and Indian Ocean

Condition over the tropical Pacific:

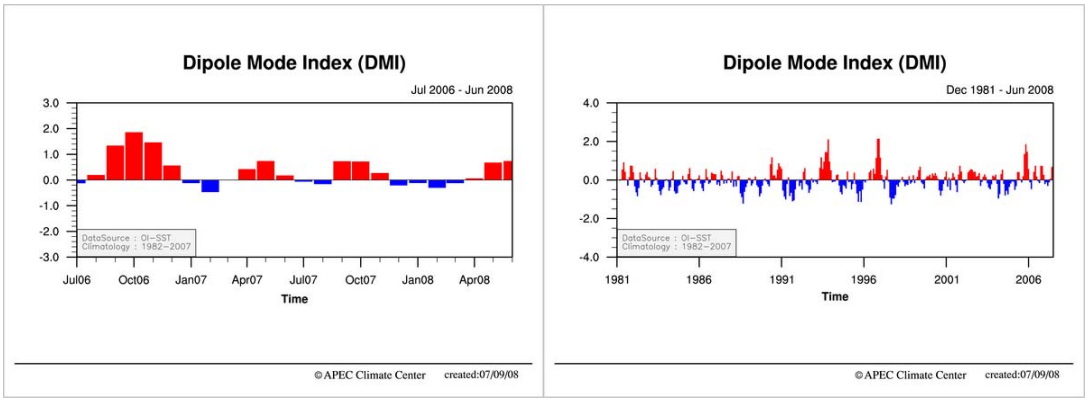
In boreal summer 2007, anomalously cold sea surface temperature (SST) began to develop over the equatorial eastern Pacific and expanded westward as the season progressed. Since August 2007, the Southern Oscillation Index (SOI) has also become positive, and the Nino 3 index negative, accompanied with suppressed convection over the eastern to central equatorial Pacific. This indicated the development of the La Nina event beginning from the late boreal summer in 2007.

The intensity of the 2007/2008 La Nina episode lies in the middle-range of those observed in the historical record. After its peak in February, the La Nina event has gradually subsided. Eastern equatorial SST anomalies have their sign reversed and became slightly positive since April 2008, while the SOI lied within the neutral range since May. However, despite the warming tendency over the eastern Pacific, cold SST anomaly persisted through June over the equatorial central Pacific.



Condition over the tropical Indian Ocean:

The 2007 boreal fall saw the rare combination of a La Nina event and a positive Indian Ocean Dipole (IOD) event, the latter of which is characterized by anomalously warm (cold) SST over the equatorial western Indian Ocean (eastern Indian Ocean off Sumatra). The 2007 IOD event is however of moderate strength. In June 2008, cooler than normal SST over equatorial eastern Indian Ocean and surface wind conditions off the coast of Sumatra suggest a possibility of the return of a positive IOD in 2008.



Monitoring of climate condition over the Asian Pacific region

Asia:

During the northern summer of 2007, hot and dry conditions in general prevailed over Eurasia and central to north eastern part of Asia. Such conditions persisted over the northern central Asia until the end of the following fall season. In particular, severe rainfall deficiency was found over north western part of China, Mongolia and central Asia during SON. Suppressed rainfall was also found in the same SON period over the south eastern part of China. In the Arctic region, temperature was unusually high, with anomalously warm condition peaking in around September to October in 2007.

Enhanced precipitation was found in the western Pacific region over and near the Philippines since the SON season. A wetter than normal condition persisted until late boreal spring in 2008, although occasionally disrupted by the intraseasonal oscillation. The rainfall surplus in that region is consistent with the 2007/2008 La Nina episode.

In the DJF season, unseasonably cold conditions were observed in a wide region covering the Middle East, central Asia and southern China. On the other hand, the northern rim of Eurasia saw warmer than normal condition. Suppressed rainfall condition continued in DJF over central to north eastern Asia.

Since February, less than normal rainfall was also seen over the Middle East. Dry condition in the region continued and became especially prominent in the 2008 MAM season. Suppressed rainfall was seen over the south eastern coastal China and neighbouring regions. On the other hand, it was wetter than normal over the southern part of the Indian subcontinent, Sri Lanka and western Indochina in MAM. The mid-to-high latitude Eurasia stretching from East Asia to Eastern Europe experienced a warmer than normal boreal spring. During early boreal summer from late May to June 2008, heavy monsoon rainfall was observed over southern China and northern Indian subcontinent.

Australasia:

Starting from the 2007 SON season till May to June 2008, it has been wetter than normal over part of the southern Polynesian islands, consistent with the presence of La Nina condition over the tropical Pacific. The eastern maritime continent also saw enhanced rainfall during the SON period.

Over the Australian continent, the eastern to north eastern part benefited from this La Nina event with surplus rainfall during the monsoon season from December to March. The southern, central and western part of the continent, however, have seen suppressed rainfall and warmer than normal condition during much of the period from the 2007 austral winter to fall in 2008. Northern Australia saw unseasonably cold JJA season in 2007. Extremely hot condition was observed in March in southern Australia.
.

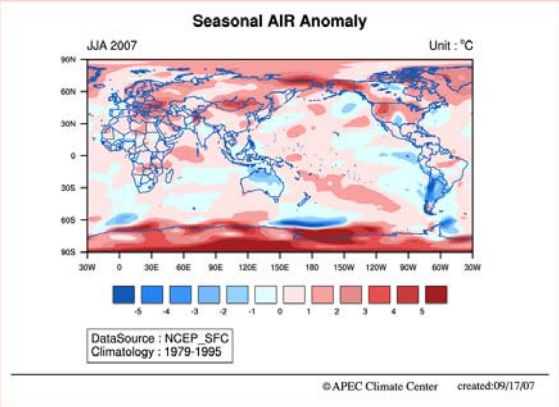
Americas:

During the 2007 JJA season, it was hot and dry over the western as well as south eastern parts of U.S. A severe heat wave occurred across much of the central, southeast, and eastern parts of the Southern U.S., throughout much of August 2007. On the other hand, the southern part of South America experienced an unseasonably cold winter in the same period.

Hot and dry condition persisted over most part of the U.S in the SON season. It was also warmer than normal for the more northern part of North America. There was enhanced precipitation over the Bahamas, Caribbean Sea and nearby regions.

Starting from the 2007/2008 DJF season, cooling was observed over the northern part of North America. Warm and dry conditions prevailed in the south eastern U.S. and part of Mexico. A cooler than normal condition was found over the west coast of equatorial South America. Deficit in rainfall over the southern U.S./Mexican region continued in later part of the season and early boreal spring. At the same time, above normal rainfall was observed in the equatorial Americas.

In the 2008 MAM period, colder than normal temperature was found over the central-northern part of North America. Wet condition prevailed over north eastern South America and the equatorial Atlantic. It remained warm and dry in the south eastern U.S. The western part of U.S. as well as the south eastern part of South America also saw suppressed rainfall.


Seasonal AIR Anomaly
JJA 2007
Unit : ℃
DataSource : NCEP_SFC
Climatology : 1979-1995
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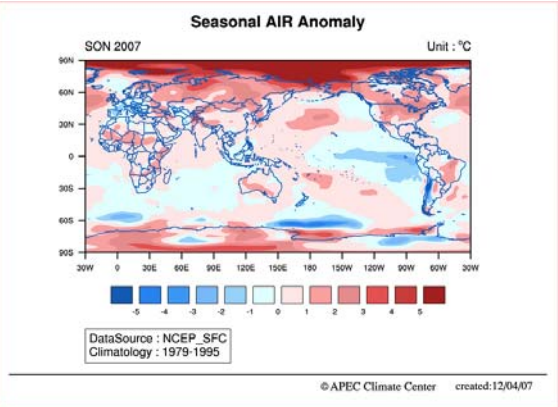
created:09/17/07


Seasonal AIR Anomaly
SON 2007
Unit : ℃
DataSource : NCEP_SFC
Climatology : 1979-1995
©APEC Climate Center
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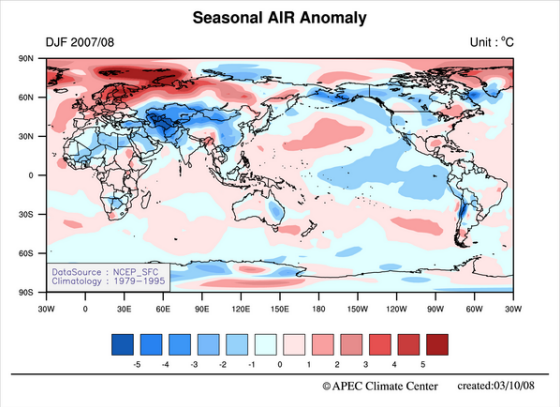
Seasonal AIR Anomaly
DJF 2007/08
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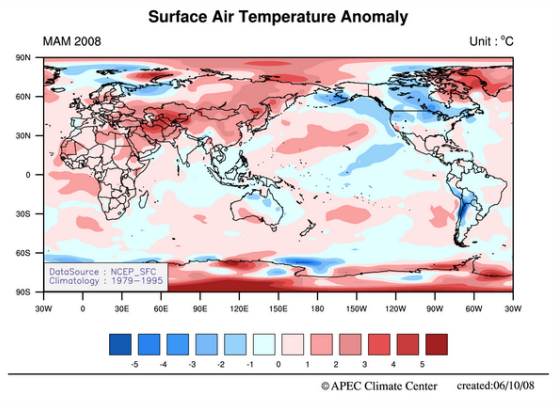
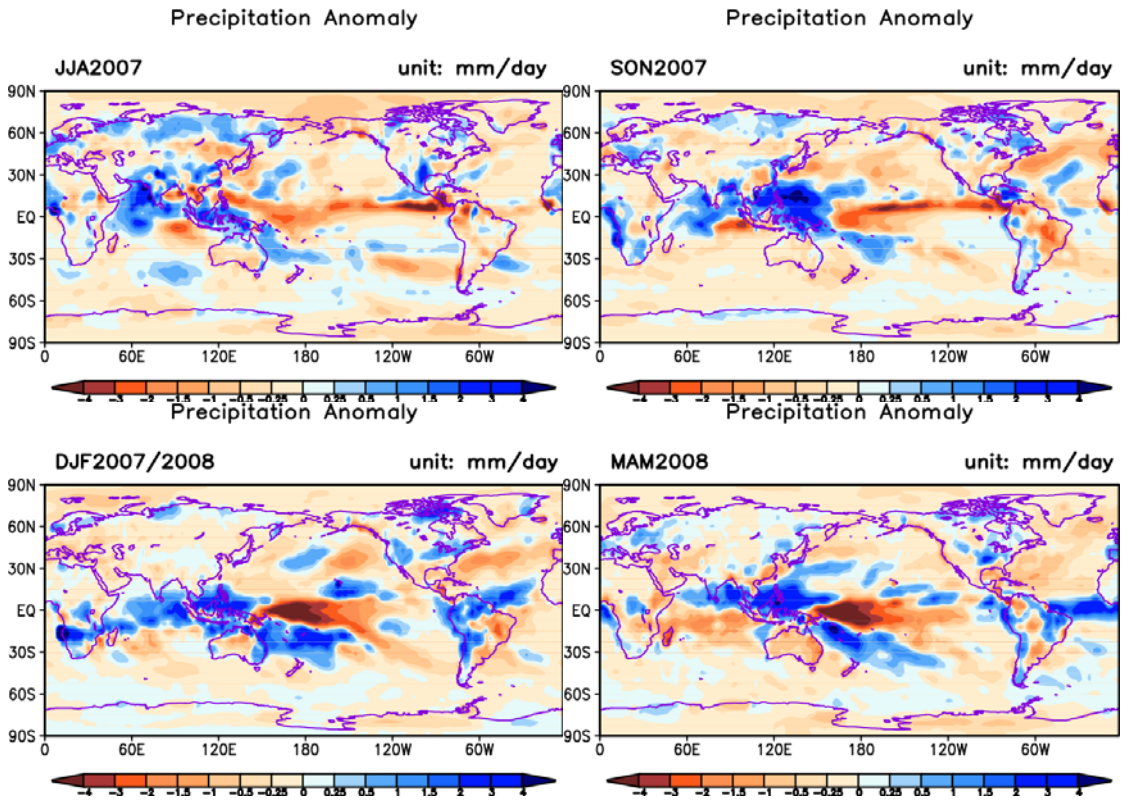
Climatology : 1979-1995
©APEC Climate Center
created:03/10/08


Surface Air Temperature Anomaly
MAM 2008
Unit : ℃
DataSource : NCEP_SFC
Climatology : 1979-1995
©APEC Climate Center
created:06/10/08


Precipitation Anomaly
JJA2007
unit: mm/day
Precipitation Anomaly
SON2007
unit: mm/day
Precipitation Anomaly
DJF2007/2008
unit: mm/day
MAM2008
unit: mm/day

Appendix IV

(THIS DOCUMENT WAS EARLIER SUBMITTED TO THE WG AS WG DOCUMENT 3.3)

APEC CLIMATE CENTER

4th Working Group Meeting/
Science Advisory Committee
Meeting

CLIMATE PREDICTION AND APPLICATION – TACKLING REGIONAL NEEDS

LIMA Republic of Peru 19-21 AUGUST 2008

APCC/WG/Doc. 3.3(1)

(22.VII.2008)

Item: 3.3

ENGLISH ONLY

PERFORMANCE OF MME SEASONAL PREDICTION AT APCC DURING 2008
(Submitted by APEC Climate Center)

Summary and Purpose of Document

This document discusses some outputs from the APCC's MME forecasts since 2007 SON.

ACTIONS CARRIED OUT

The WG participants were invited to peruse the document and give their feedback, along with suggestions if any, on the performance of the MME system since 2007. General comments from the other WG members are appreciated.

- References: APCC forecasts and other products (see http://www.apcc21.net)

3.3 PERFORMANCE OF MME SEASONAL PREDICTION AT APCC DURING 2008

3.3.1 Forecast Verification

The results of forecast verification against observation are shown here from 2007SON to 2008MAM, which are the seasons after last APCC Symposium. Pattern anomaly correlation coefficients (ACC) are used here to evaluate MME prediction performance in global, East Asia and Australia, as samples of the performance (performance for the other regions can be assessed from our webpage). The forecasts from four deterministic MME Schemes are evaluated.

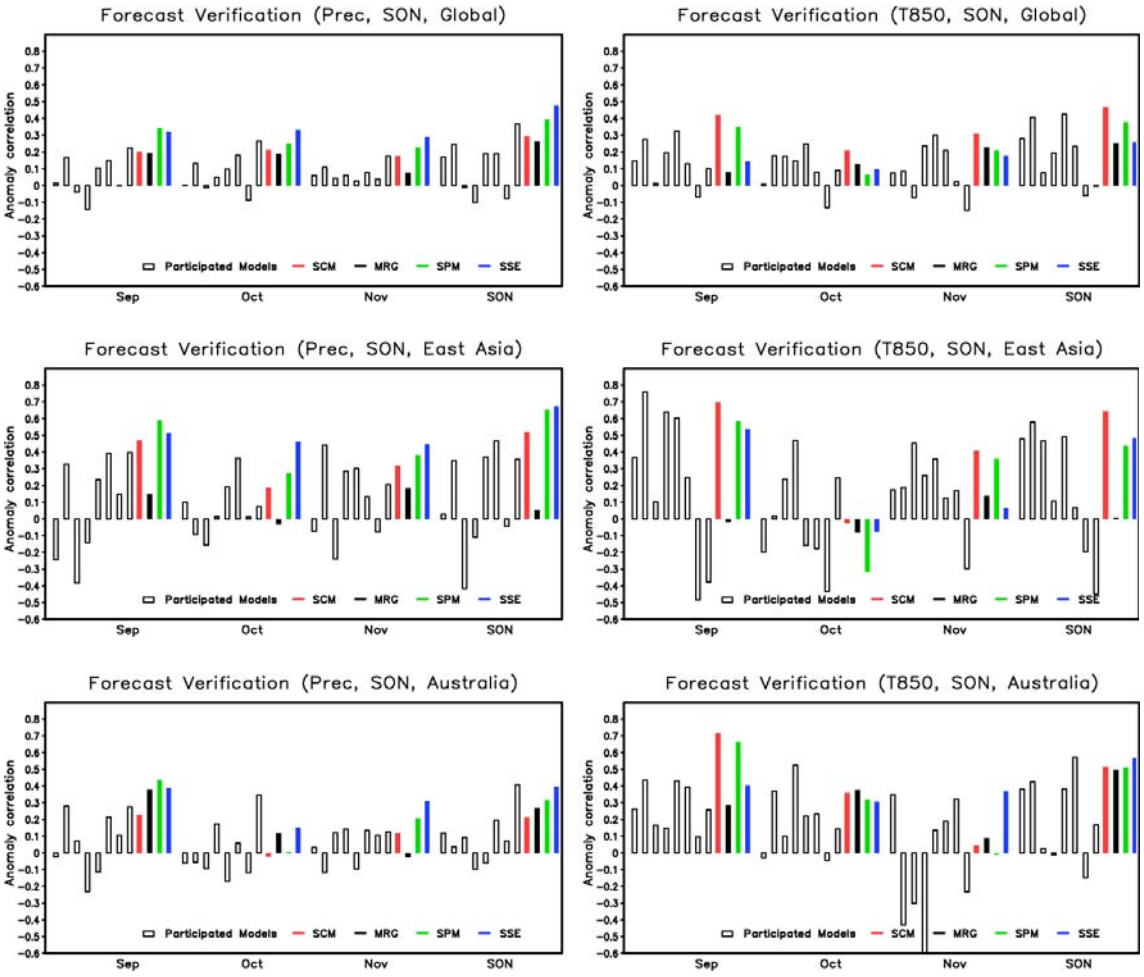
In 2007SON, MME forecasts for both precipitation and T850 generally show stable forecast skills except MRG scheme in East Asia. The forecast skill of SSE scheme is superior to that of other MME schemes for precipitation, while SCM scheme is better than others for temperature.

In 2007DJF, MME forecasts for precipitation demonstrate quite good prediction skills over global or in Australia. It is interesting that the forecast skills for precipitation by these MME schemes are superior to that for temperature.

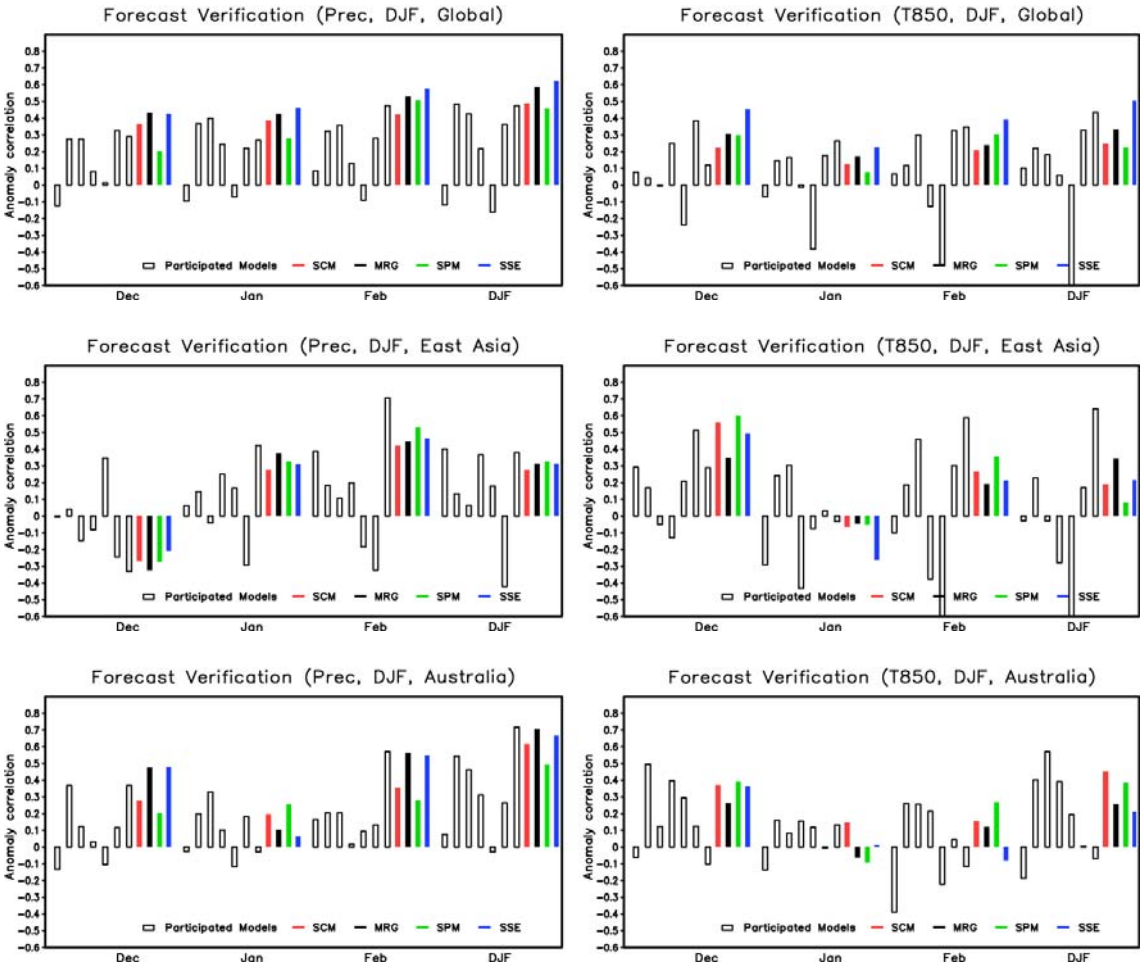
In 2008MAM, MME schemes show very good forecast skills for both precipitation and temperature over global and in East Asia. In Australia, the MME schemes still show high forecast skills for precipitation, however, they show lower forecast skill for temperature.

In general, MME schemes have generated skilful forecasts for precipitation from 2007DJF to 2008MAM, and skilful forecasts for temperature from 2008JFM to 2008MAM.

a. 2007 SON


Forecast Verification (Prec, SON, Global)
Forecast Verification (T850, SON, Global)
Forecast Verification (Prec, SON, East Asia)
Forecast Verification (T850, SON, East Asia)
Forecast Verification (Prec, SON, Australia)
Forecast Verification (T850, SON, Australia)
Anomaly correlation
Participated Models
SCM
MRG
SPM
SSE
Sep
Oct
Nov
SON

b. 2007 DJF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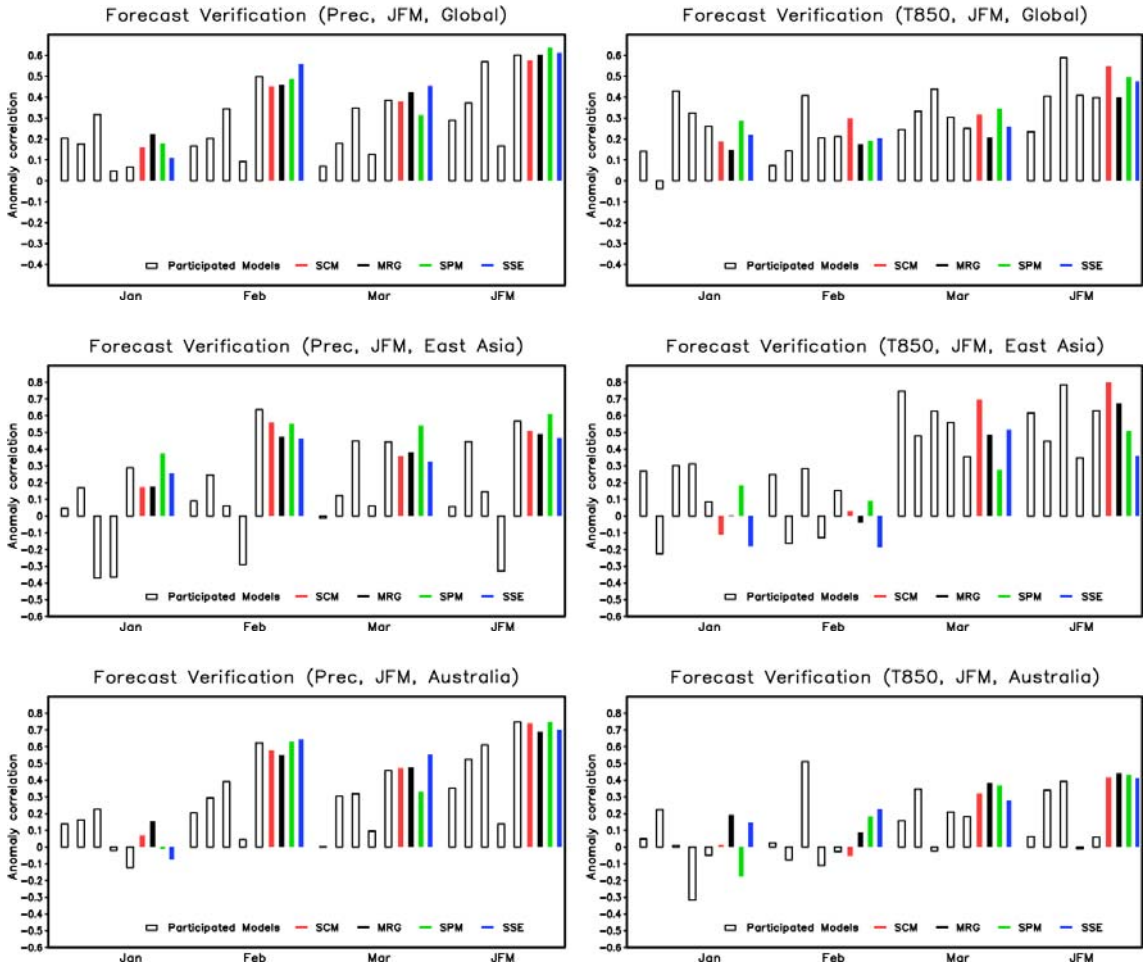
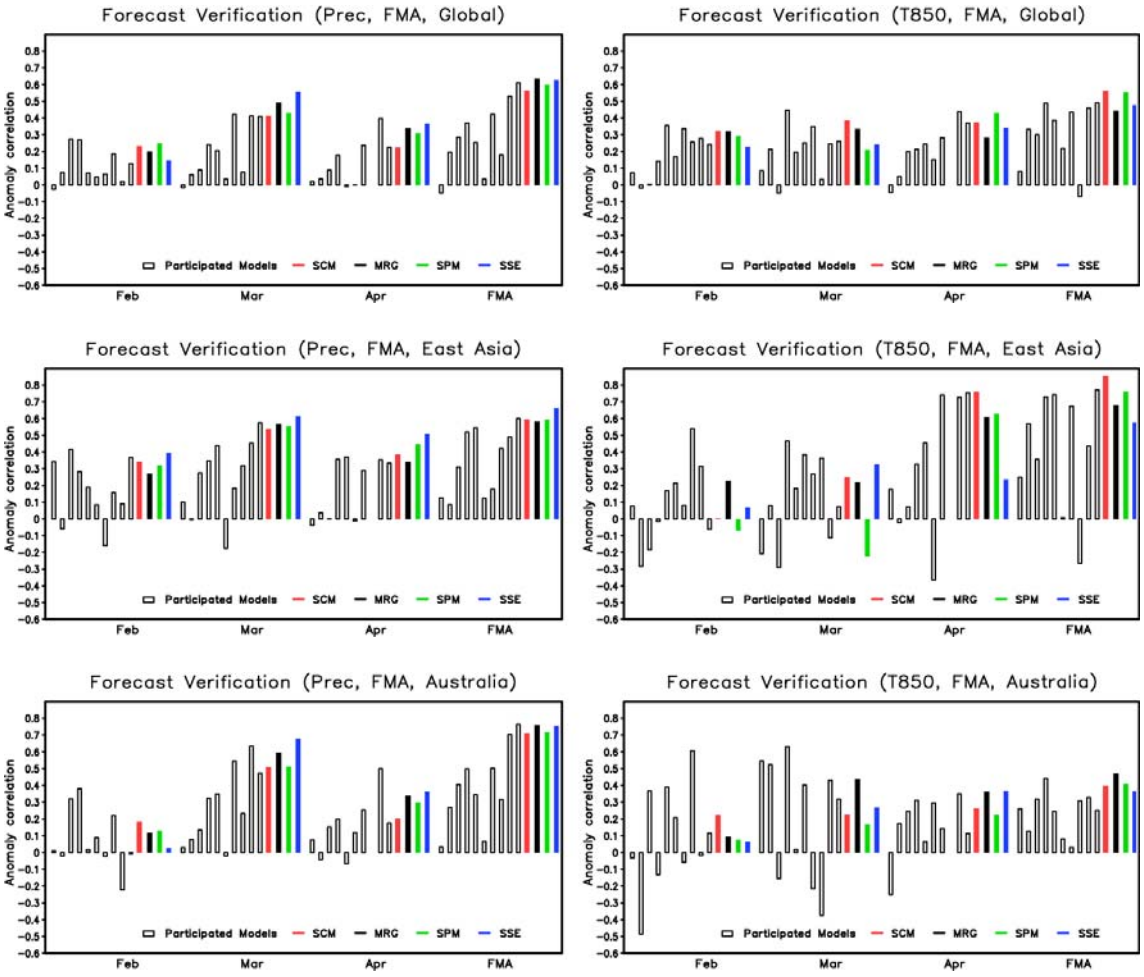
Forecast Verification (T850, DJF, Global)
Forecast Verification (Prec, DJF, East Asia)
Forecast Verification (T850, DJF, East Asia)
Forecast Verification (Prec, DJF, Australia)
Forecast Verification (T850, DJF, Australia)
Anomaly correlation
Participated Models
SCM
MRG
SPM
SSE
Dec
Jan
Feb
DJF

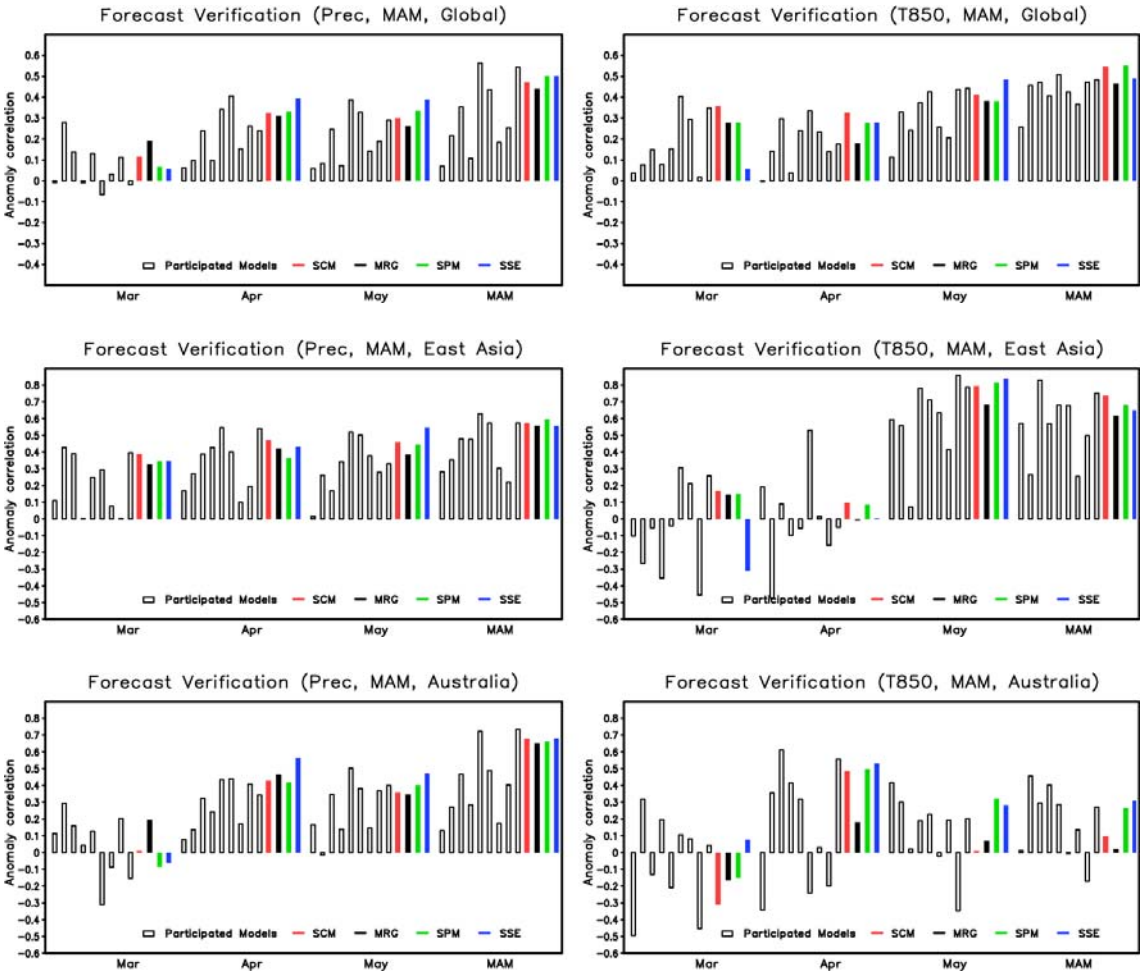
c. 2008 JFM


Forecast Verification (Prec, JFM, Global)
Forecast Verification (T850, JFM, Global)
Forecast Verification (Prec, JFM, East Asia)
Forecast Verification (T850, JFM, East Asia)
Forecast Verification (Prec, JFM, Australia)
Forecast Verification (T850, JFM, Australia)
Anomaly correlation
Participated Models
SCM
MRG
SPM
SSE
Jan
Feb
Mar
JFM

d. 2008 FMA


Forecast Verification (Prec, FMA, Global)
Forecast Verification (T850, FMA, Global)
Forecast Verification (Prec, FMA, East Asia)
Forecast Verification (T850, FMA, East Asia)
Forecast Verification (Prec, FMA, Australia)
Forecast Verification (T850, FMA, Australia)
Anomaly correlation
Participated Models
SCM
MRG
SPM
SSE
Feb
Mar
Apr
FMA

e. 2008 MAM


Forecast Verification (Prec, MAM, Global)
Forecast Verification (T850, MAM, Global)
Forecast Verification (Prec, MAM, East Asia)
Forecast Verification (T850, MAM, East Asia)
Forecast Verification (Prec, MAM, Australia)
Forecast Verification (T850, MAM, Australia)
Anomaly correlation
Participated Models
SCM
MRG
SPM
SSE
Mar
Apr
May
MAM

3.3.2 Hindcast Verification

In order to evaluate deterministic MME hindcast, three skill scores are used in this section.

A detailed description of mean squared skill score (MSSS) is provided by WMO (2002), so only a brief description is presented here. Let x_{ij} and f_{ij} (i=1,…,n) denote time series of observations and continuous deterministic forecasts respectively for a grid point or station j over the period of verification (POV). Then, their averages for the POV, $\bar{x}_j$ and $\bar{f}_j$ and their sample variances s_{xj}^2 and s_{fj}^2 are given by:

$$\bar{x}_j = \frac{1}{n}\sum_{i=1}^{n} x_{ij},\ \bar{f}_j = \frac{1}{n}\sum_{i=1}^{n} f_{ij}$$

$$s_{xj}^2 = \frac{1}{n-1}\sum_{i=1}^{n}\left(x_{ij}-\bar{x}_j\right)^2,\ s_{fj}^2 = \frac{1}{n-1}\sum_{i=1}^{n}\left(f_{ij}-\bar{f}_j\right)^2$$

The mean squared error of the forecasts is:

$$MSE_j = \frac{1}{n}\sum_{i=1}^{n}\left(f_{ij}-x_{ij}\right)^2$$

For the case of cross-validated (see section 3.4) POV climatology forecasts where forecast/observation pairs are reasonably temporally independent of each other (so that only one year at a time is withheld), the mean squared error of 'climatology' forecasts (Murphy, 1988) is:

$$MSE_{cj} = \frac{n-1}{n} s_{xj}^2$$

The *Mean Squared Skill Score* (MSSS) for j is defined as one minus the ratio of the squared error of the forecasts to the squared error for forecasts of 'climatology':

$$MSSS_j = 1 - \frac{MSE_j}{MSE_{cj}}$$

For the three domains described in Sec. 3.1.1 it is recommended that an overall MSSS be provided. This is computed as:

$$MSSS = 1 - \frac{\sum_j w_j MSE_j}{\sum_j w_j MSE_{cj}}$$

Where, w_j is unity for verifications at stations and is equal to $\cos(\theta_j)$, where θ_j is the latitude at grid point j on latitude-longitude grids.

For either $MSSS_j$ or MSSS a corresponding *Root Mean Squared Skill Score* (RMSSS) can be obtained easily from

$$RMSSS = 1 - \left(1 - MSSS\right)^{1/2}$$

MSSSj for forecasts fully cross-validated (with one year at a time withheld) can be expanded (Murphy, 1988) as

$$MSSS_j = \left\{ 2\frac{s_{fj}}{s_{xj}} r_{fxj} - \left(\frac{s_{fj}}{s_{xj}}\right)^2 - \left(\frac{\left[\bar{f}_j - \bar{x}_j\right]}{s_{xj}}\right)^2 + \frac{2n-1}{(n-1)^2} \right\} \Bigg/ \left\{ 1 + \frac{2n-1}{(n-1)^2} \right\}$$

Where, r_{fxj} is the product moment correlation of the forecasts and observations at point or station j.

$$r_{fxj} = \frac{\frac{1}{n}\sum_{i=1}^{n}\left(f_{ij} - \bar{f}_j\right)\left(x_{ij} - \bar{x}_j\right)}{s_{fj}\, s_{xj}}$$

The first three terms of the decomposition of $MSSS_j$ are related to phase errors (through the correlation), amplitude errors (through the ratio of the forecast to observed variances) and overall bias error, respectively, of the forecasts. These terms provide the opportunity for those wishing to use the forecasts for input into regional and local forecasts to adjust or weight the forecasts as they deem appropriate. The last term takes into account the fact that the 'climatology' forecasts are cross-validated as well.

A recommended skill score for categorical deterministic forecasts is the *Gerrity Skill Score*, GSS. If x_i and f_i now denote an observation and corresponding forecast of category i (i = 1,…,3), let n_{ij} be the count of those instances with forecast category i and observed category j. The full contingency table is defined as the nine n_{ij}. Graphically the nine cell counts are usually arranged with the forecasts defining the table rows and the observations the table columns:

Table 1: General three by three contingency table.

		Observations			
		Below Normal	Near Normal	Above Normal	
Forecasts	Below Normal	n_{11}	n_{12}	n_{13}	$n_{1\bullet}$
	Near Normal	n_{21}	n_{22}	n_{23}	$n_{2\bullet}$
	Above Normal	n_{31}	n_{32}	n_{33}	$n_{3\bullet}$
		$n_{\bullet 1}$	$n_{\bullet 2}$	$n_{\bullet 3}$	T

In Table 1, $n_{i\bullet}$ and $n_{\bullet i}$ represents the sum of the rows and columns respectively; T is the total number of cases. Generally about at least 90 forecast/observation pairs are required to properly estimate a three by three contingency table. Thus it is recommended that the provided tables be aggregated by users over windows of target periods, like several adjacent months or overlapping three-month periods, or over verification points. In the case of the latter the weights W_i should be used in summing n_{ij} over different points i (see discussion on Table 4). W_i is defined as:

$W_i = 1$ when verification is done at stations or at single grid points within a 10 degree box.

$W_i = \cos(\theta_i)$ at grid point i, when verification is done on a grid.

$\theta_i =$ the latitude at grid point i.

On a 2.5 degree latitude-longitude grid the minimally acceptable sample is easily attained even with a record as short as n = 10 by aggregating over all grid points with a 10 degree box. Or alternatively in this case, an adequate sample can be achieved by aggregation over three adjacent months or overlapping three-month periods and within a 5 degree box. Regardless, scores derived from any contingency table should be accompanied by error bars, confidence intervals or level of significance.

Contingency tables such as the one in Table 3 are mandatory for level 3 verification in the core SVS.

The *relative sample frequencies* p_{ij} are defined as the ratios of the cell counts to the total number of forecast/observation pairs N (n is reserved to denote the length of the POV):

$$p_{ij} = n_{ij} / N$$

The sample probability distributions of forecasts and observations respectively then become

$$p(f_i) = \sum_{j=1}^{3} p_{ij} = \hat{p}_i ; i = 1, ..., 3$$

$$p(x_i) = \sum_{j=1}^{3} p_{ji} = p_i ; i = 1, ..., 3$$

A recommended skill score for the three by three table which has many desirable properties and is easy to compute is the *Gerrity Skill Score*, GSS. The definition of the score uses a scoring matrix s_{ij} (i = 1,…,3), which is a tabulation of the reward or penalty every forecast/observation outcome represented by the contingency table will be accorded:

$$GSS = \sum_{i=1}^{3} \sum_{j=1}^{3} p_{ij} s_{ij}$$

The scoring matrix is given by

$$s_{ii} = \frac{1}{2}\left(\sum_{r=1}^{i-1} a_r^{-1} + \sum_{r=i}^{2} a_r \right)$$

$$s_{ij} = \frac{1}{2}\left[\sum_{r=1}^{i-1} a_r^{-1} - (j-1) + \sum_{r=j}^{2} a_r \right]; 1 \le i < 3, i < j \le 3$$

Where,

$$a_i = \frac{1 - \sum_{r=1}^{i} p_r}{\sum_{r=1}^{i} p_r}$$

Note that GSS is computed using the sample probabilities, not those on which the original categorizations were based (i.e. 0.33, 0.33, 0.33).
The spatial distribution of scores of MSSS, correlation and GSS for both precipitation and 850 hPa temperature (T850) are shown in the below, which includes the seasons of FMA, MAM, AMJ, MJJ, JJA and JAS.

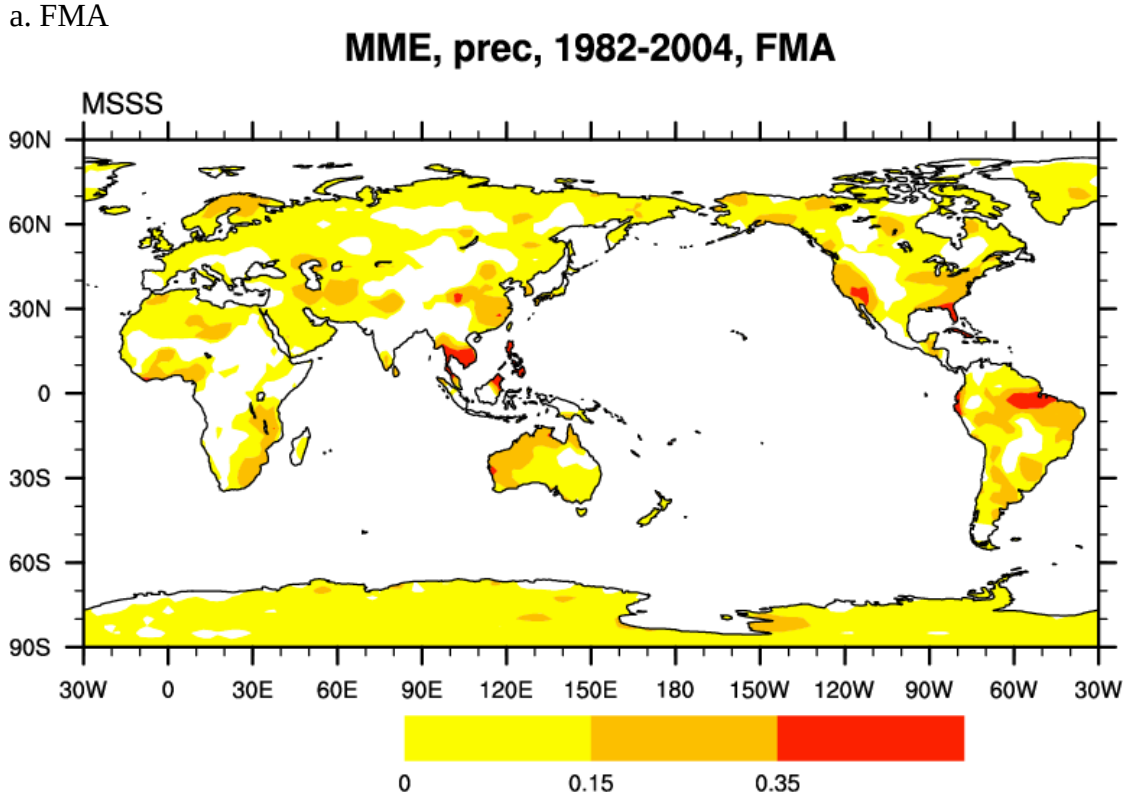
In boreal spring, it is found that MME prediction for T850 show pretty well performance in the tropical regions. It also has quite good skills in most of the northern America continent, Siberia region, the southern Africa continent, Western Europe and Middle East regions. However, MME prediction for precipitation have only marginally skills in some of the equatorial area, such as Indochina peninsula, northern Borneo Island, the Philippines, northwestern part of Australia, northern Brazil, Mexico and western coast of the US, western equatorial Africa, and part of the middle east area.

In boreal summer, MME predict T850 well in Mongolia, northeastern China, total India peninsula, Indochina peninsula, eastern part of Maritime Continent, western part of Australia, equatorial America and northern part of Southern America, western and eastern regions of Canada, eastern tropical Africa and northwestern Africa. But MME predictions for precipitation have only marginal skills in Maritime Continent and northeastern Brazil.

It is noticed that the skill scores of temperature prediction are, in general, better than that of precipitation in both boreal spring and summer season.

It is also found that the prediction skill for temperature is better in boreal summer than that in boreal spring; and the prediction skill for precipitation is better in boreal spring than in boreal summer.

a. FMA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MSSS
90N
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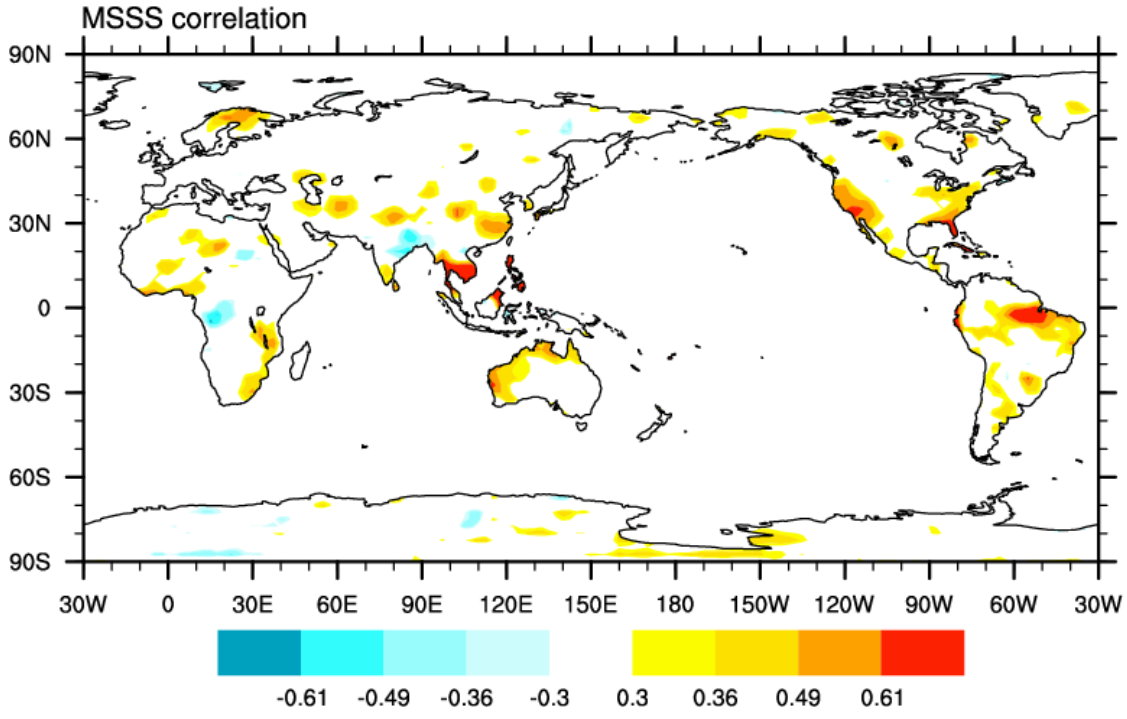
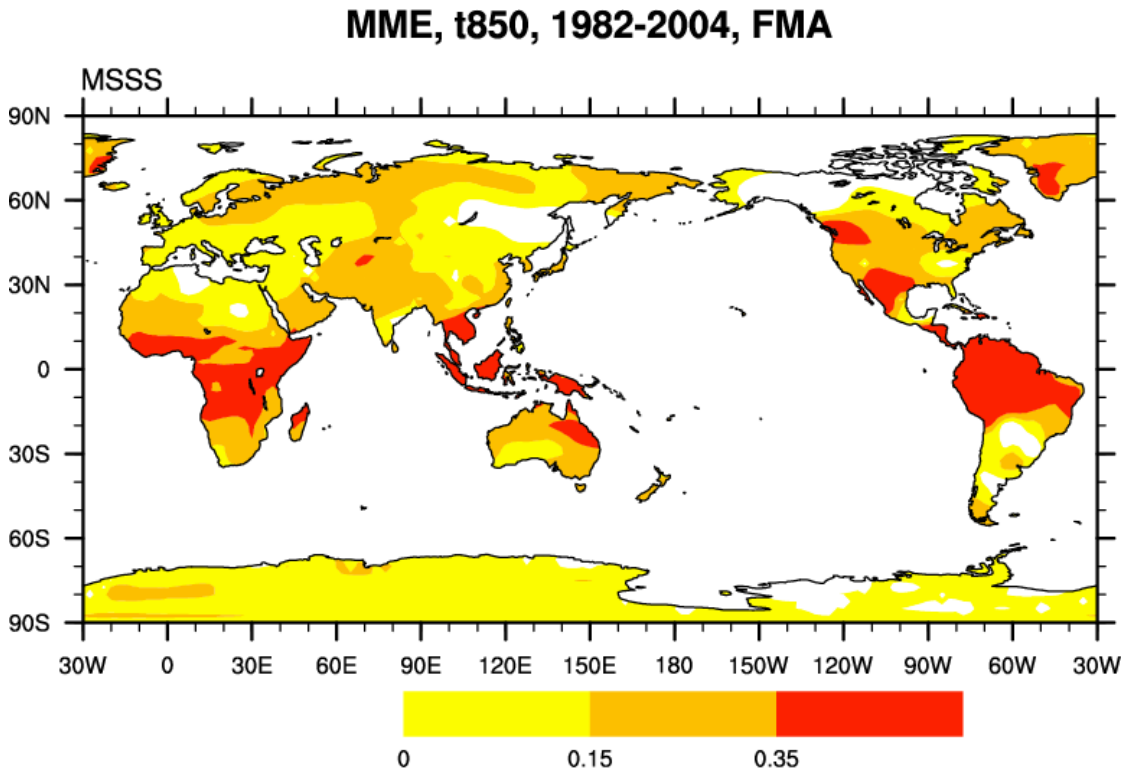
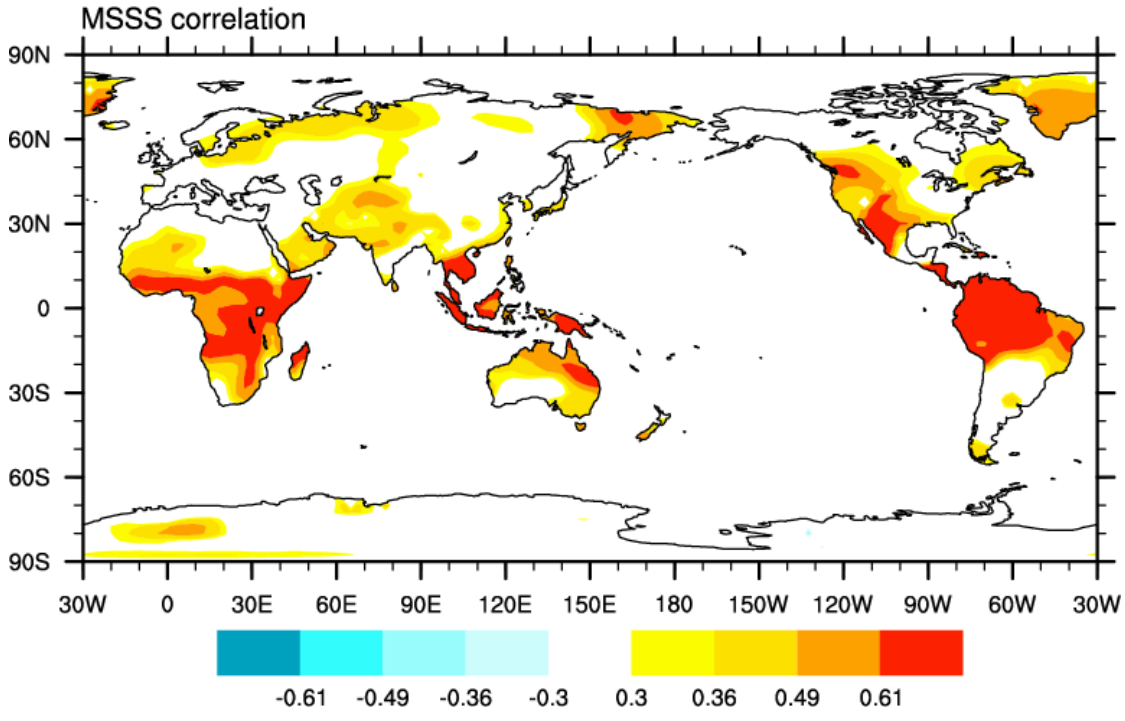
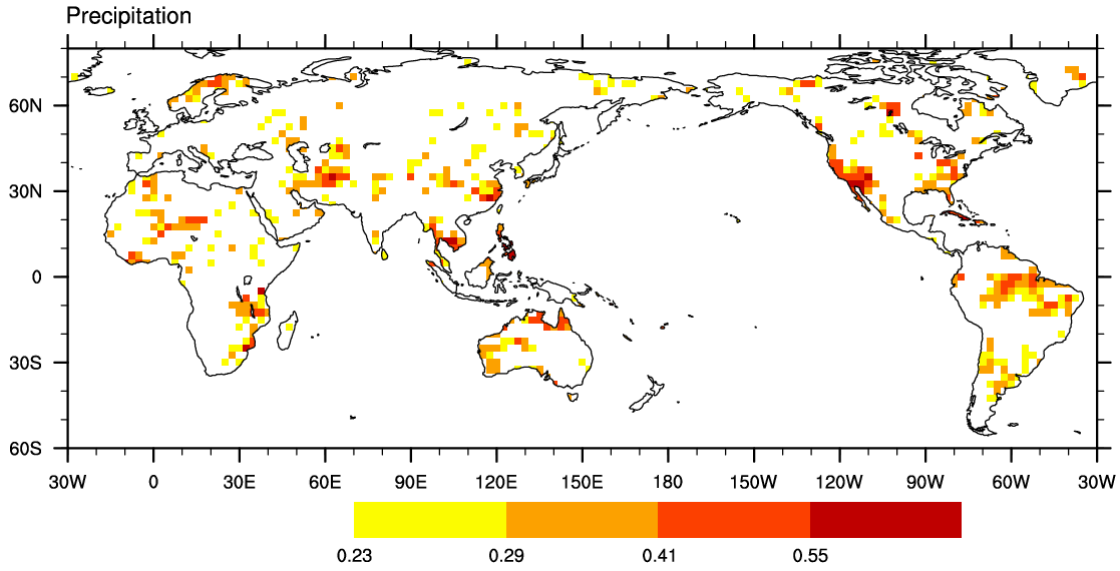
30S
60S
90S
30W 0 30E 60E 90E 120E 150E 180 150W 120W 90W 60W 30W
0 0.15 0.35

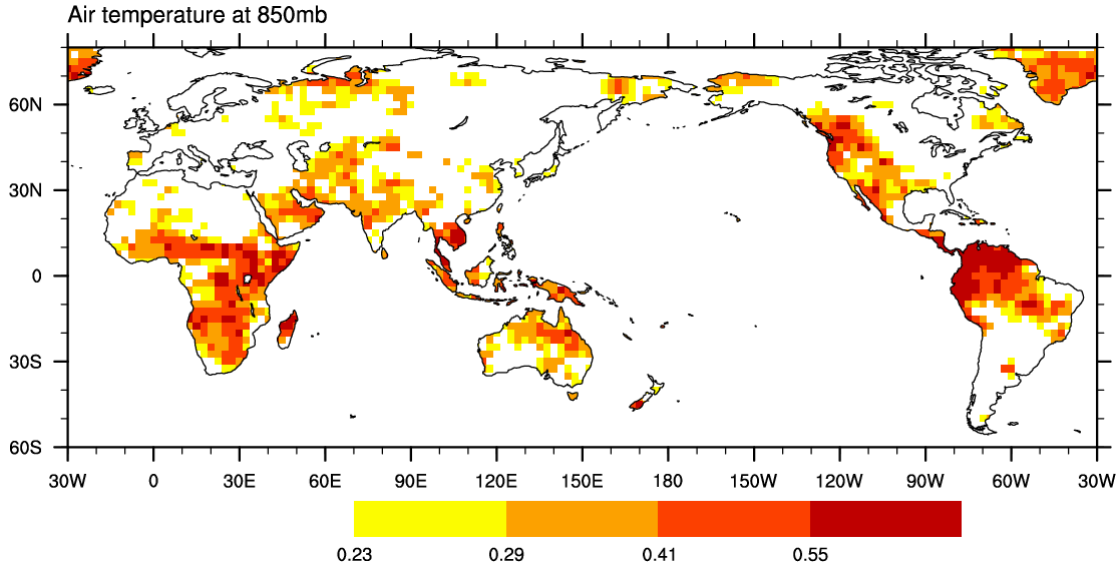

MSSS correlation
90N
60N
30N
0
30S
60S
90S
30W 0 30E 60E 90E 120E 150E 180 150W 120W 90W 60W 30W
-0.61 -0.49 -0.36 -0.3 0.3 0.36 0.49 0.61


MME, t850, 1982-2004, FMA
MSSS
90N
60N
30N
0
30S
60S
90S
30W 0 30E 60E 90E 120E 150E 180 150W 120W 90W 60W 30W
0 0.15 0.35

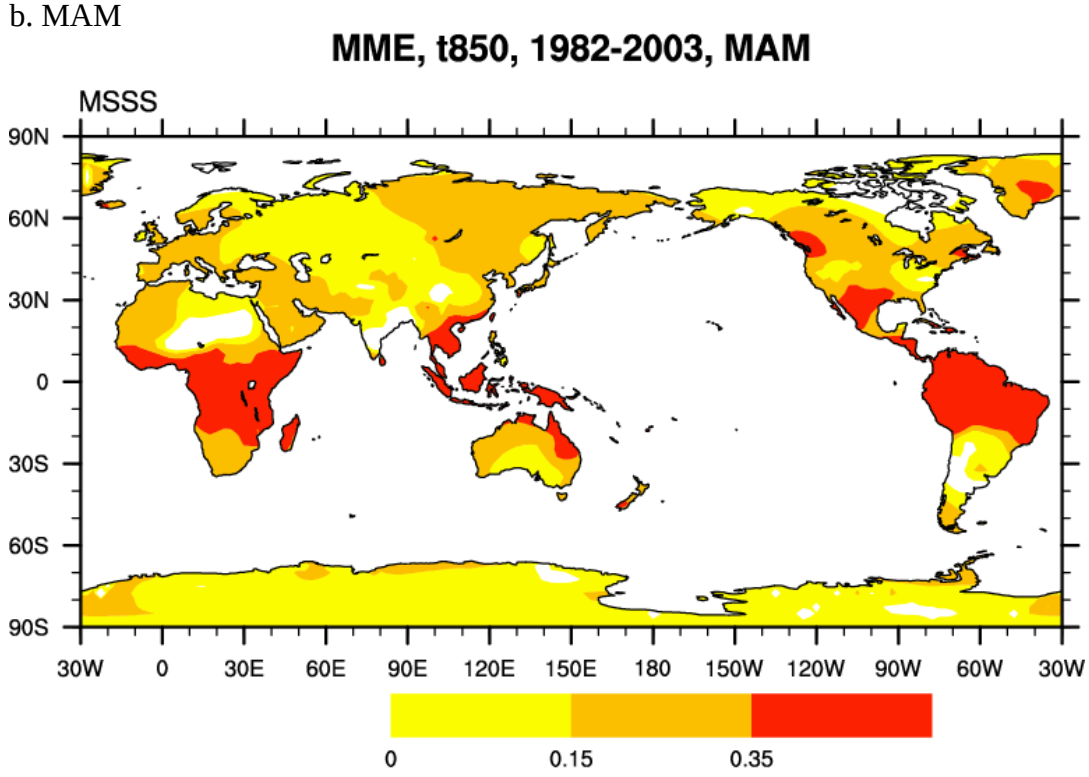

MSSS correlation
90N
60N
30N
0
30S
60S
90S
30W 0 30E 60E 90E 120E 150E 180 150W 120W 90W 60W 30W
-0.61 -0.49 -0.36 -0.3 0.3 0.36 0.49 0.61

Gerrity Skill Score





b. MAM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MSSS
90N
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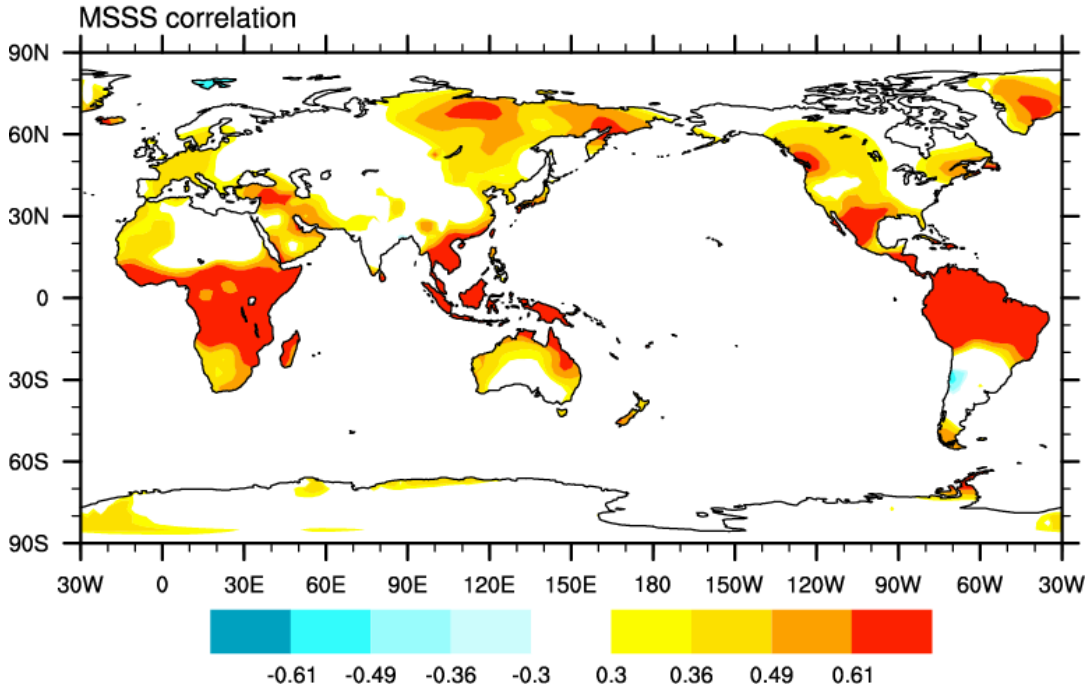
0
30S
60S
90S
30W 0 30E 60E 90E 120E 150E 180 150W 120W 90W 60W 30W
0 0.15 0.35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90N
60N
30N
0
30S
60S
90S
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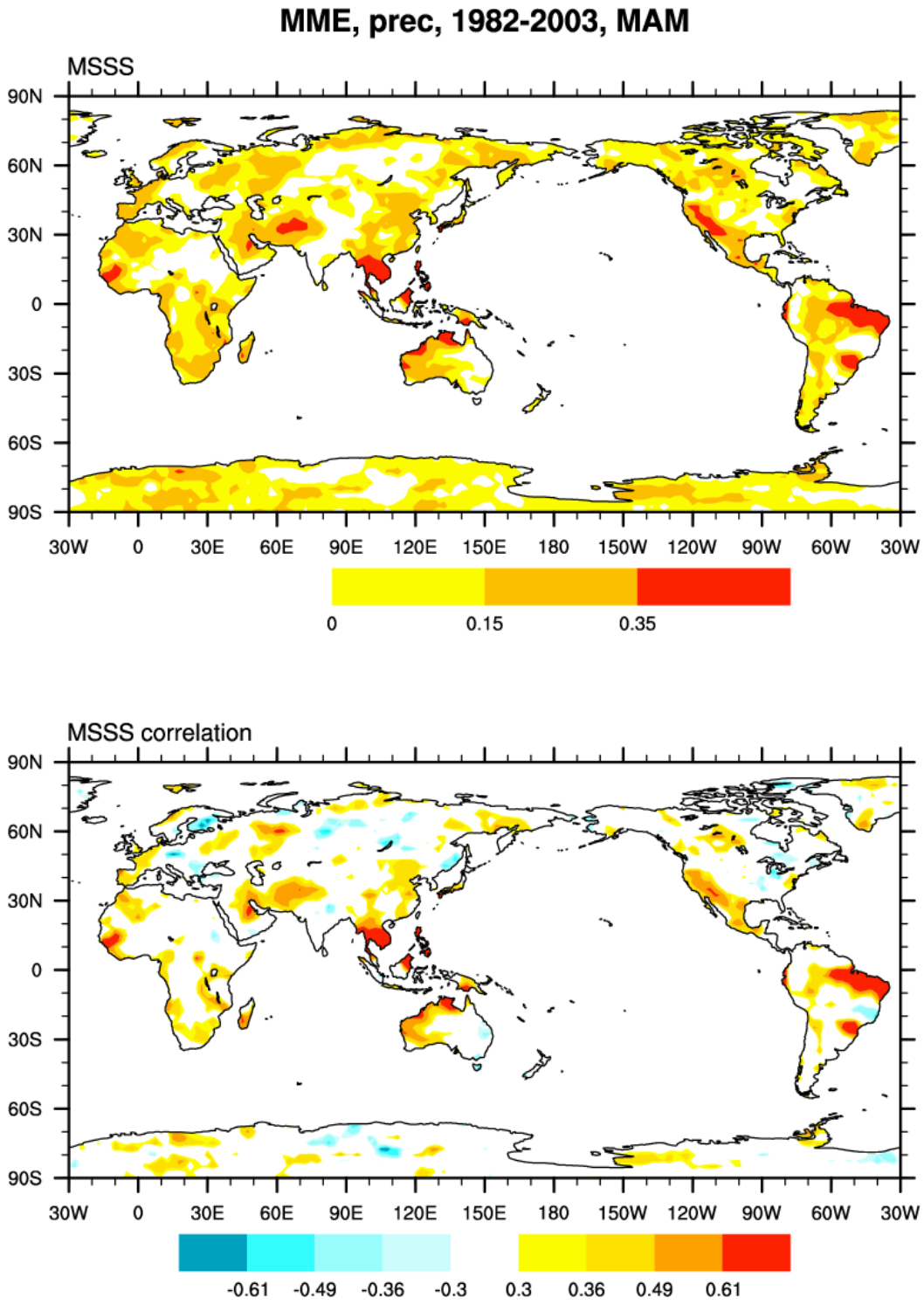
-0.61 -0.49 -0.36 -0.3 0.3 0.36 0.49 0.61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MSSS
90N
60N
30N
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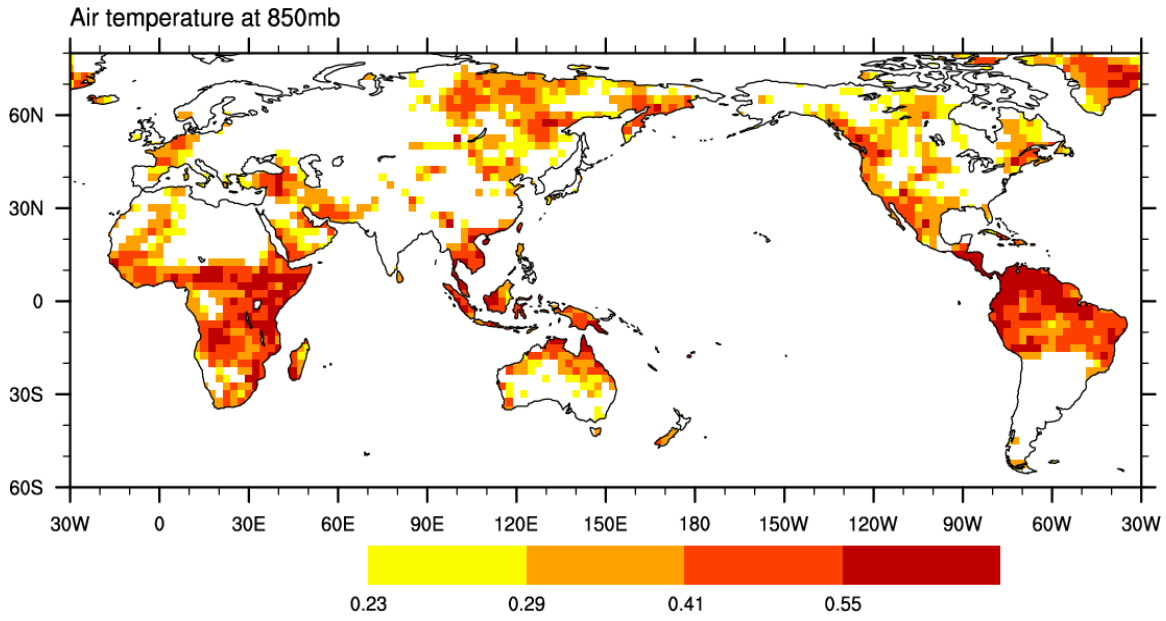
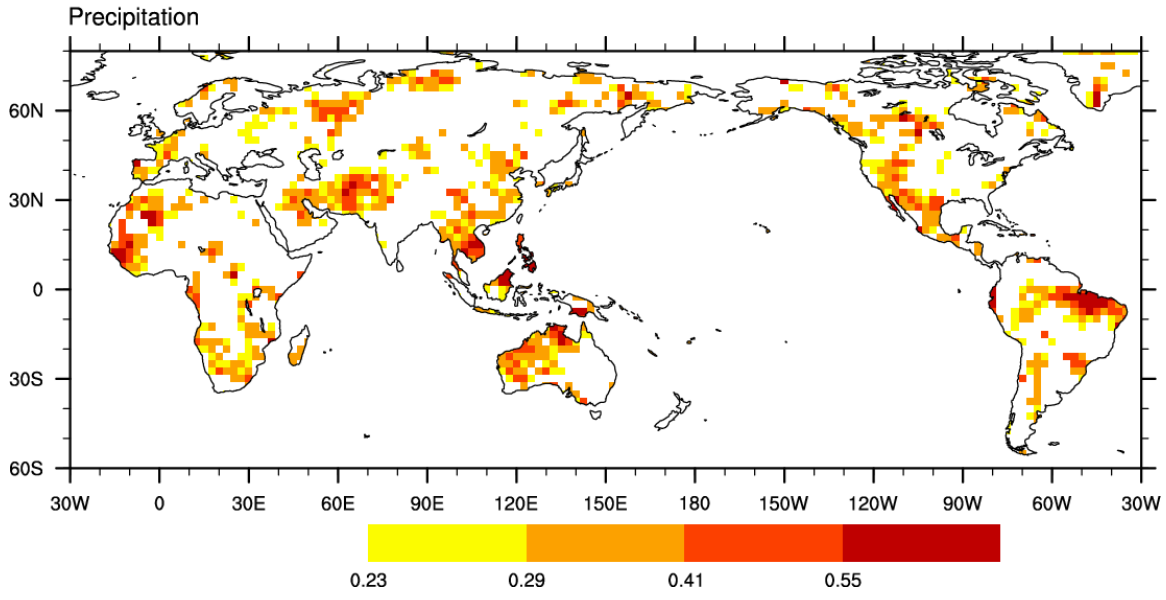
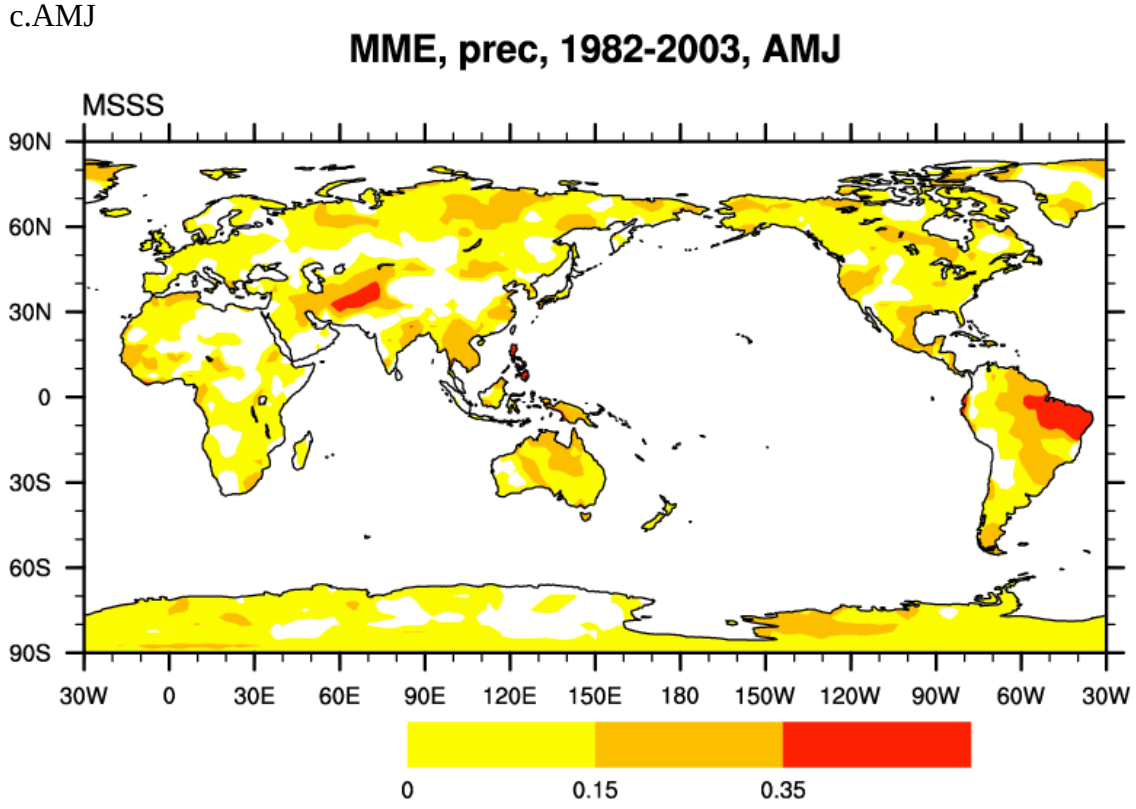
30S
60S
90S
30W 0 30E 60E 90E 120E 150E 180 150W 120W 90W 60W 30W
0 0.15 0.35
MSSS correlation
90N
60N
30N
0
30S
60S
90S
30W 0 30E 60E 90E 120E 150E 180 150W 120W 90W 60W 30W
-0.61 -0.49 -0.36 -0.3 0.3 0.36 0.49 0.61

Gerrity Skill Score





c.AMJ


MME, prec, 1982-2003, AMJ
MSSS
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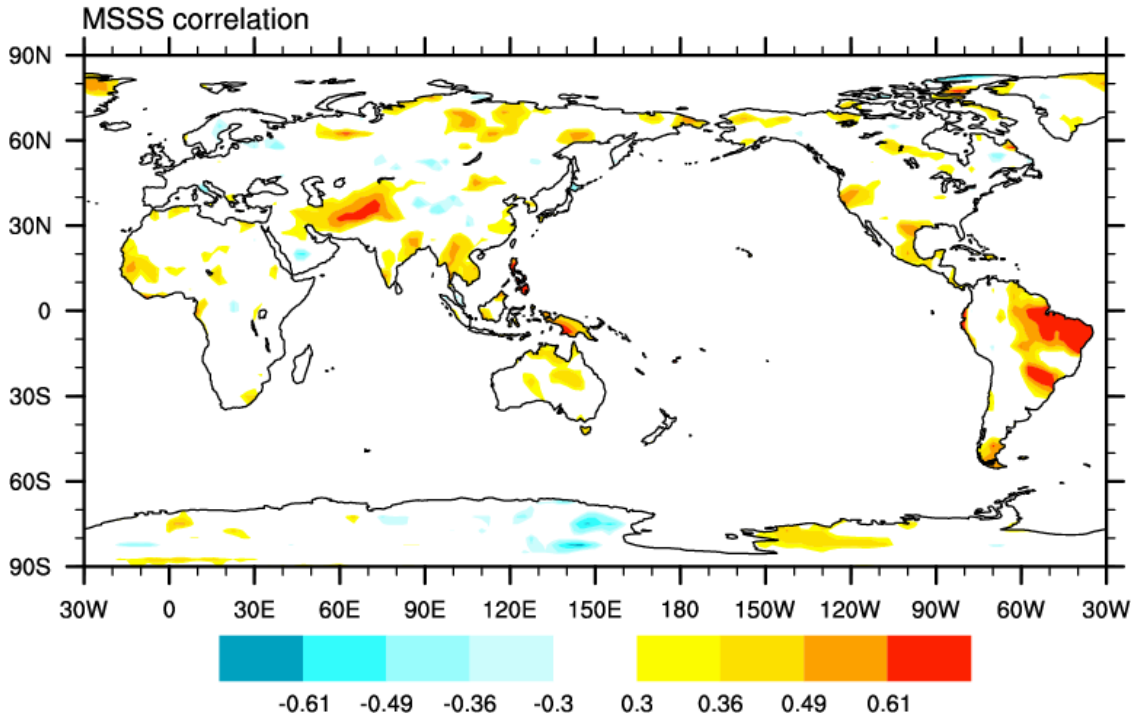
30S
60S
90S
30W 0 30E 60E 90E 120E 150E 180 150W 120W 90W 60W 30W
0 0.15 0.35


MSSS correlation
90N
60N
30N
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30S
60S
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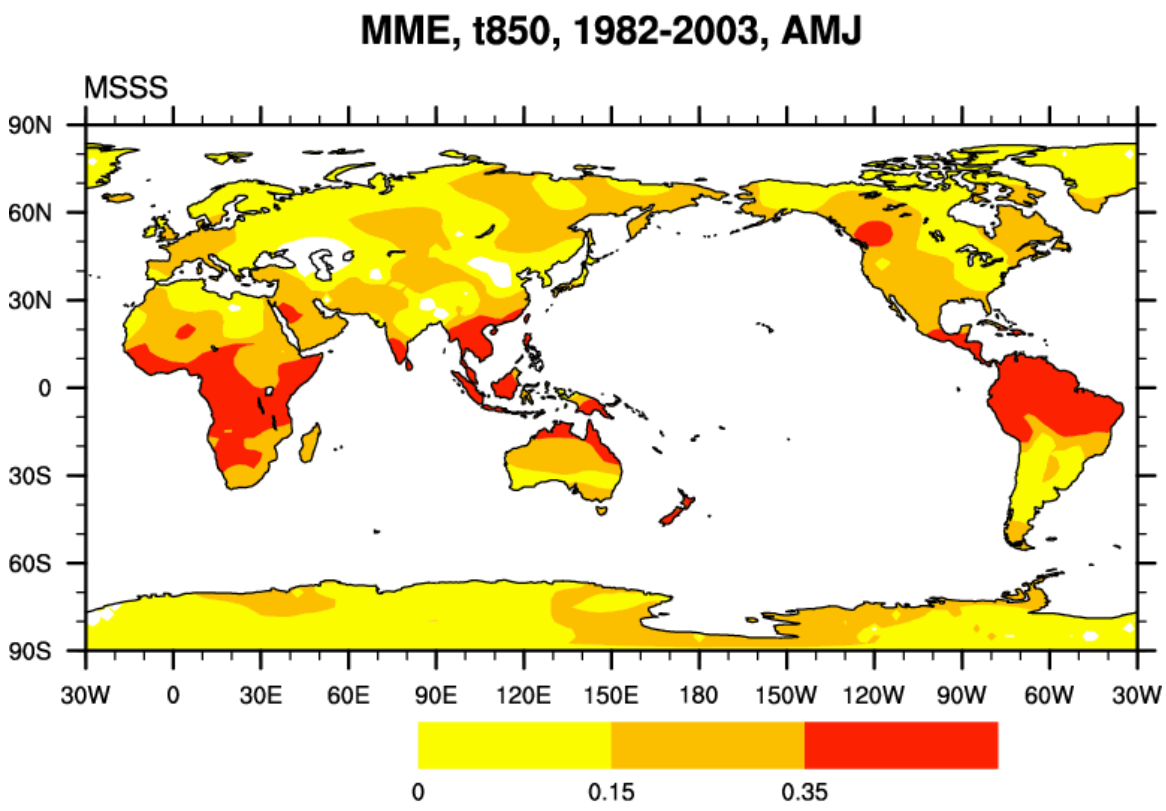
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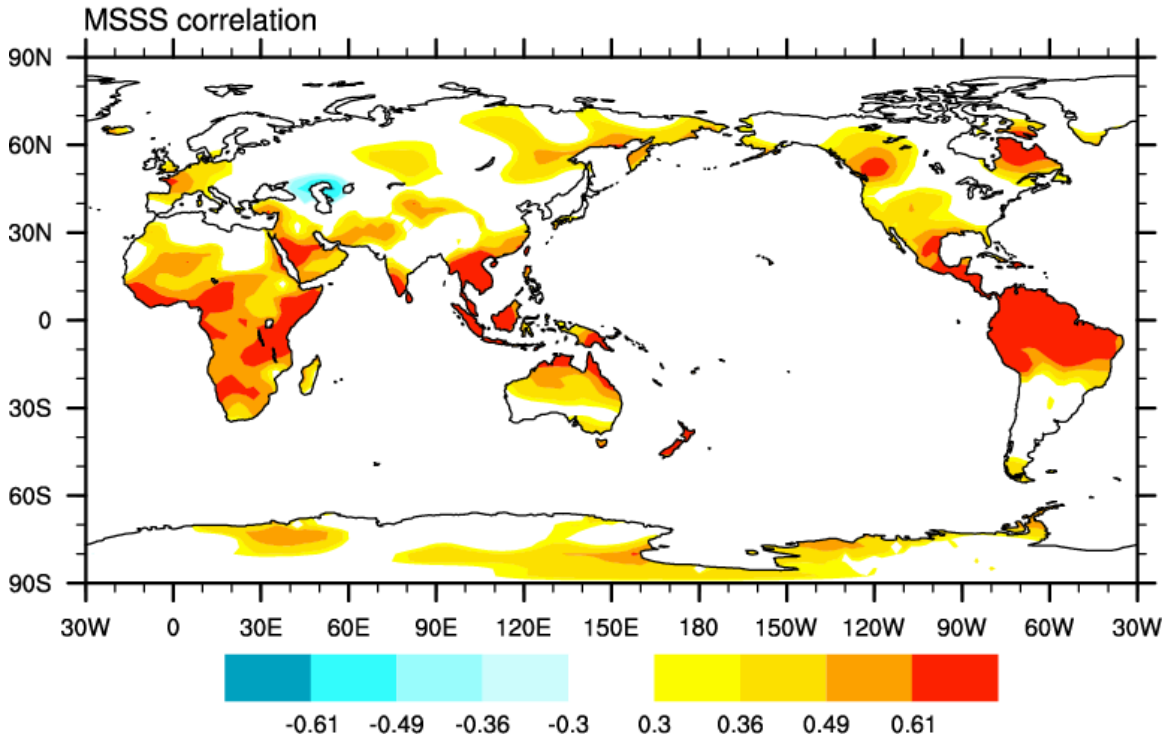
30S
60S
90S
30W 0 30E 60E 90E 120E 150E 180 150W 120W 90W 60W 30W
0 0.15 0.35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30S
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90S
30W 0 30E 60E 90E 120E 150E 180 150W 120W 90W 60W 30W
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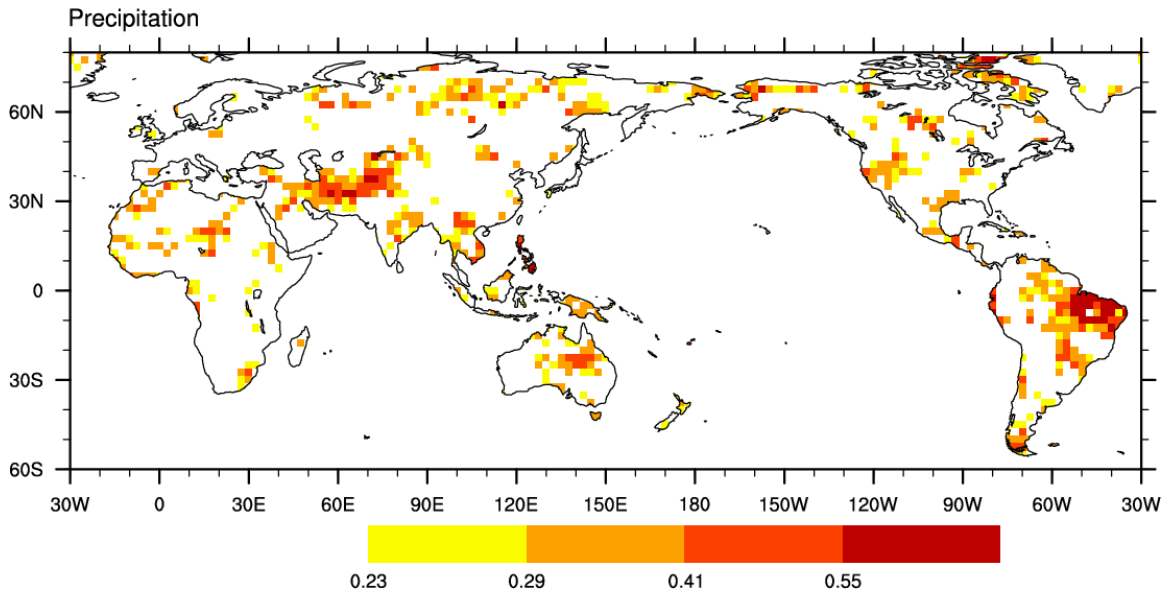
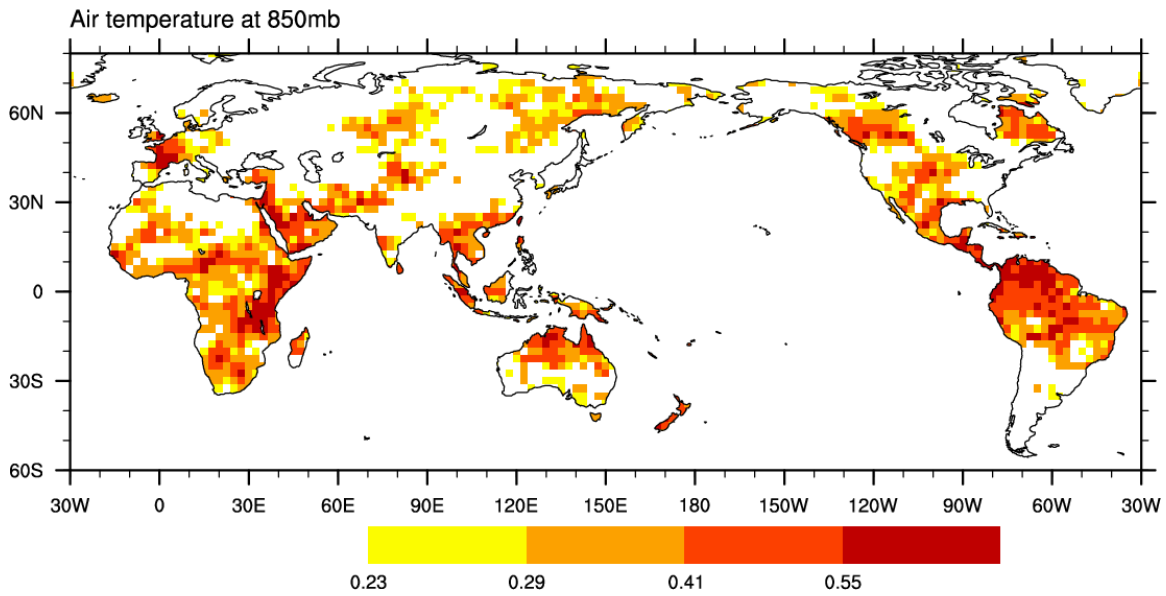
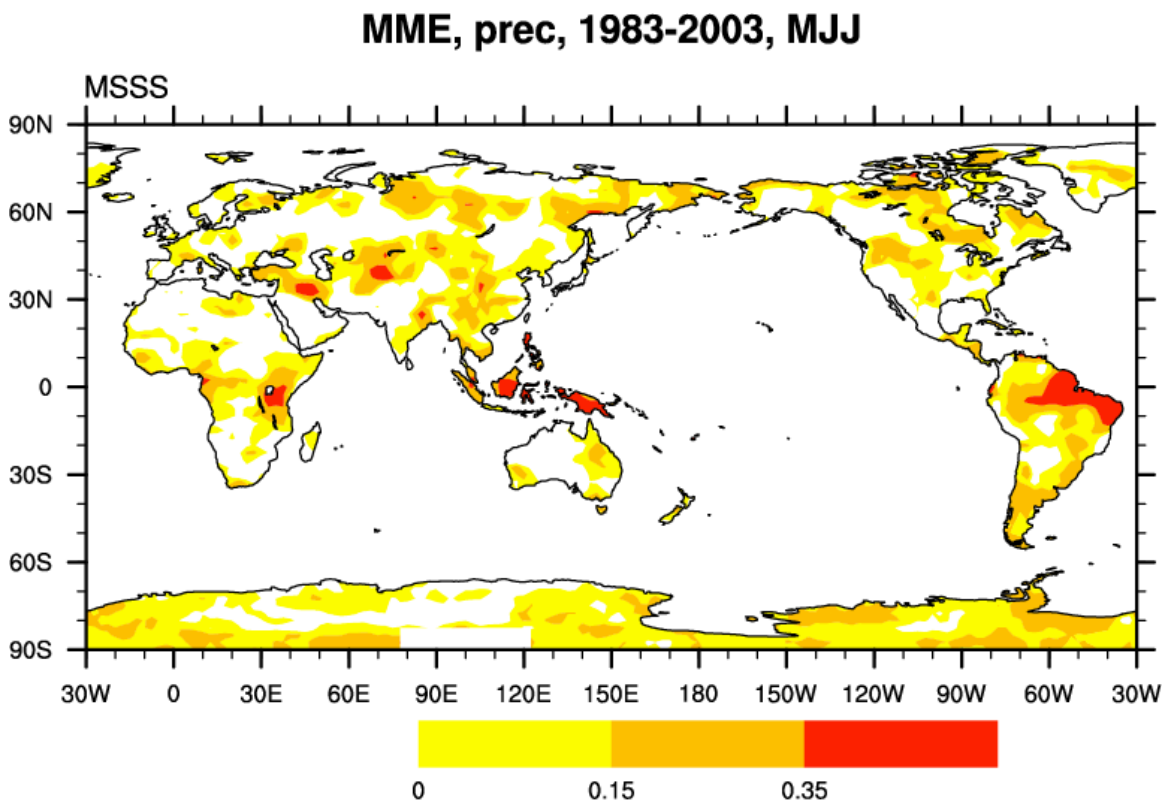
Gerrity Skill Score





d. MJJ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30S
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0.15
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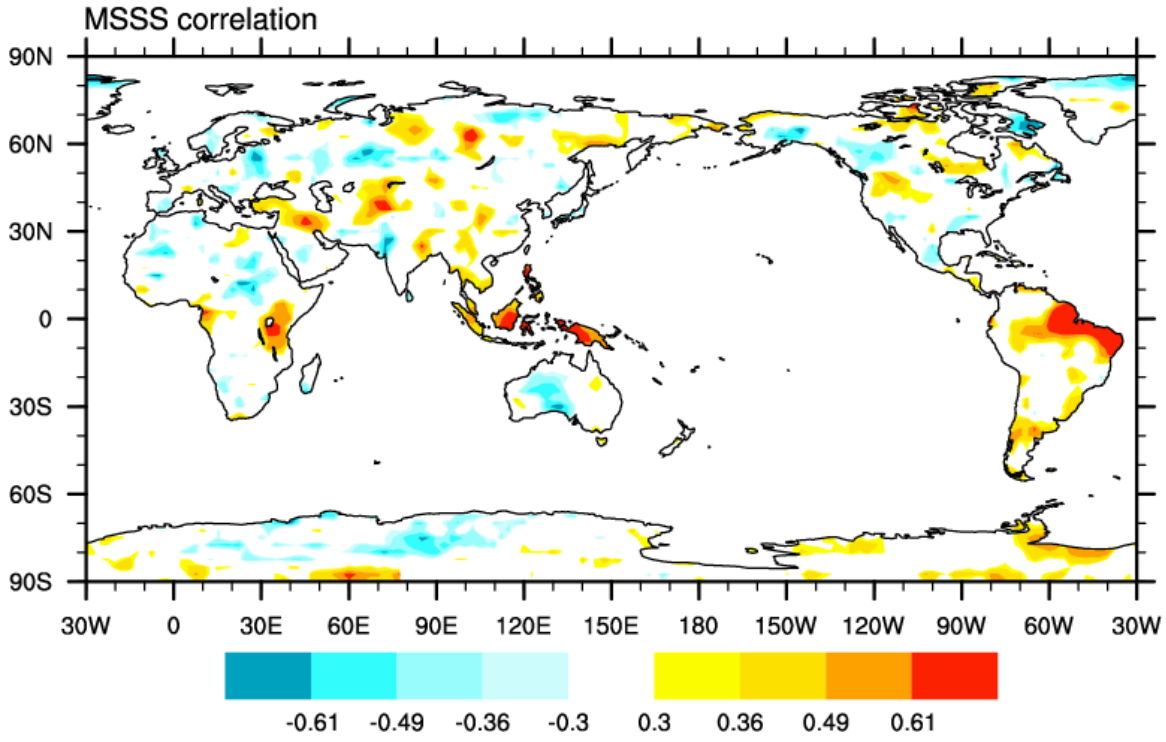
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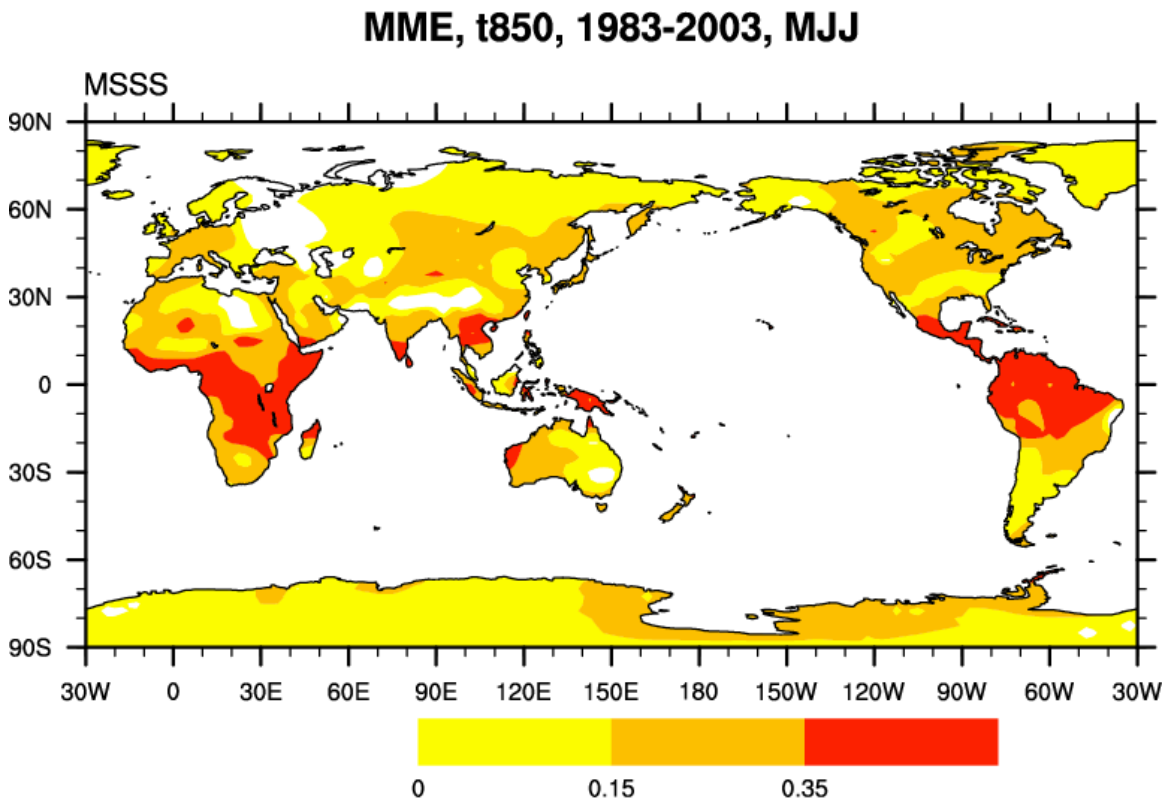
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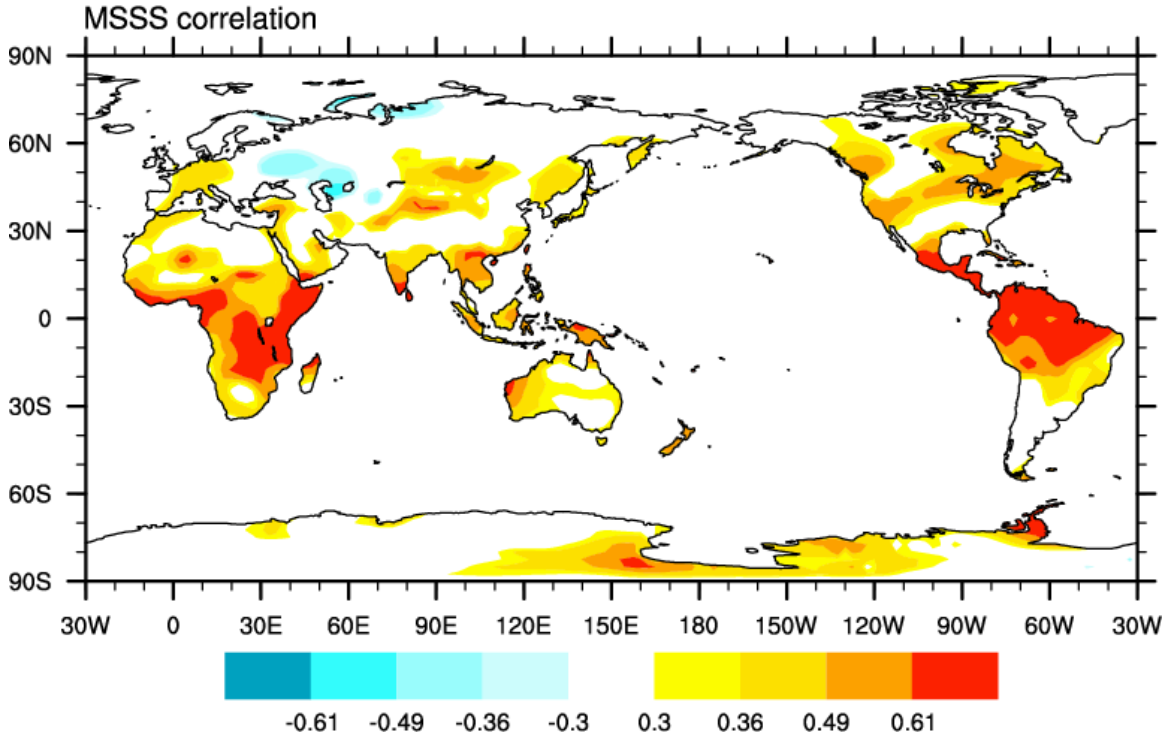
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150W
120W
90W
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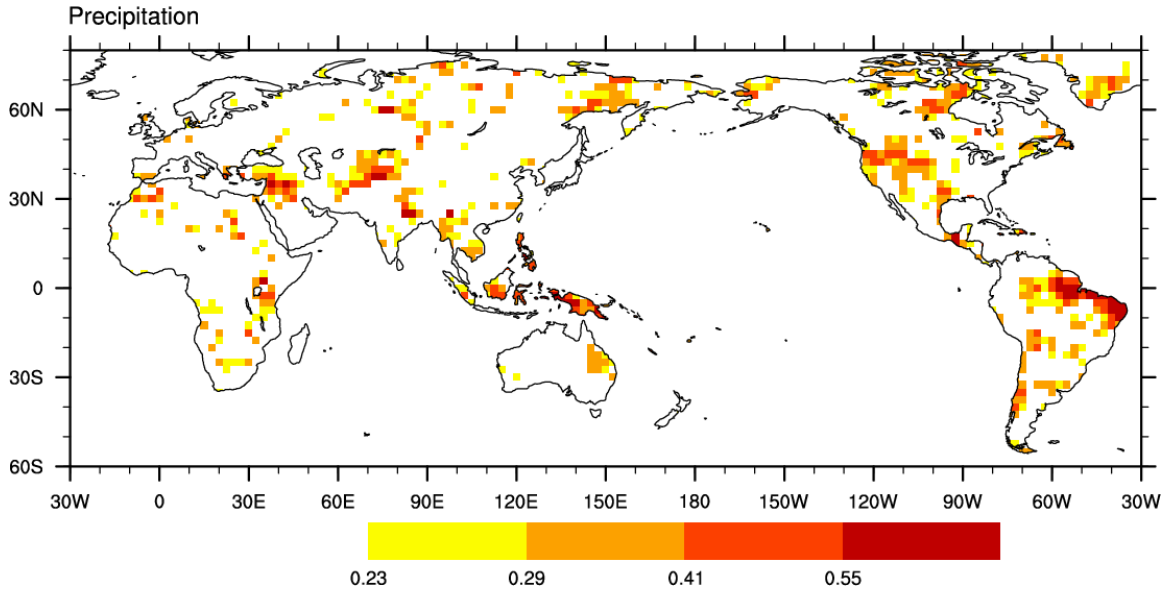
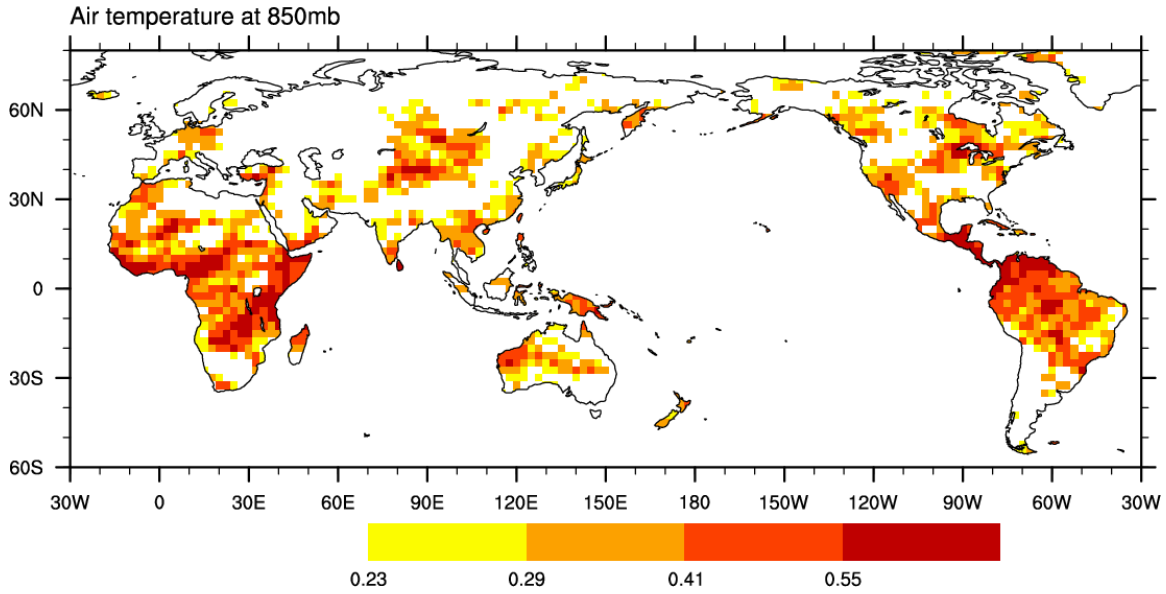
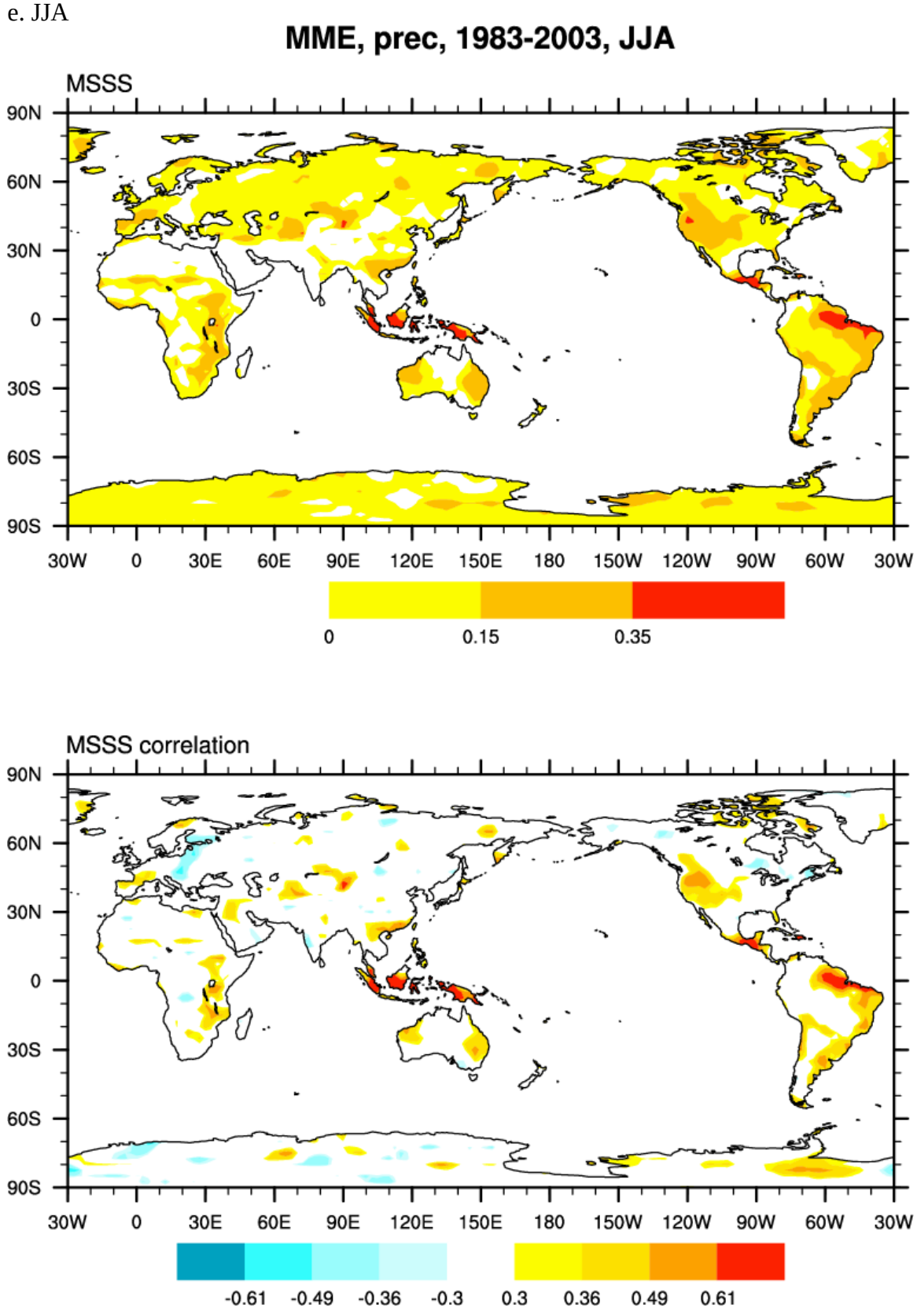
-0.36
-0.3
0.3
0.36
0.49
0.61

Gerrity Skill Score





e. JJA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30W 0 30E 60E 90E 120E 150E 180 150W 120W 90W 60W 30W
0 0.15 0.35
MSSS correlation
90N
60N
30N
0
30S
60S
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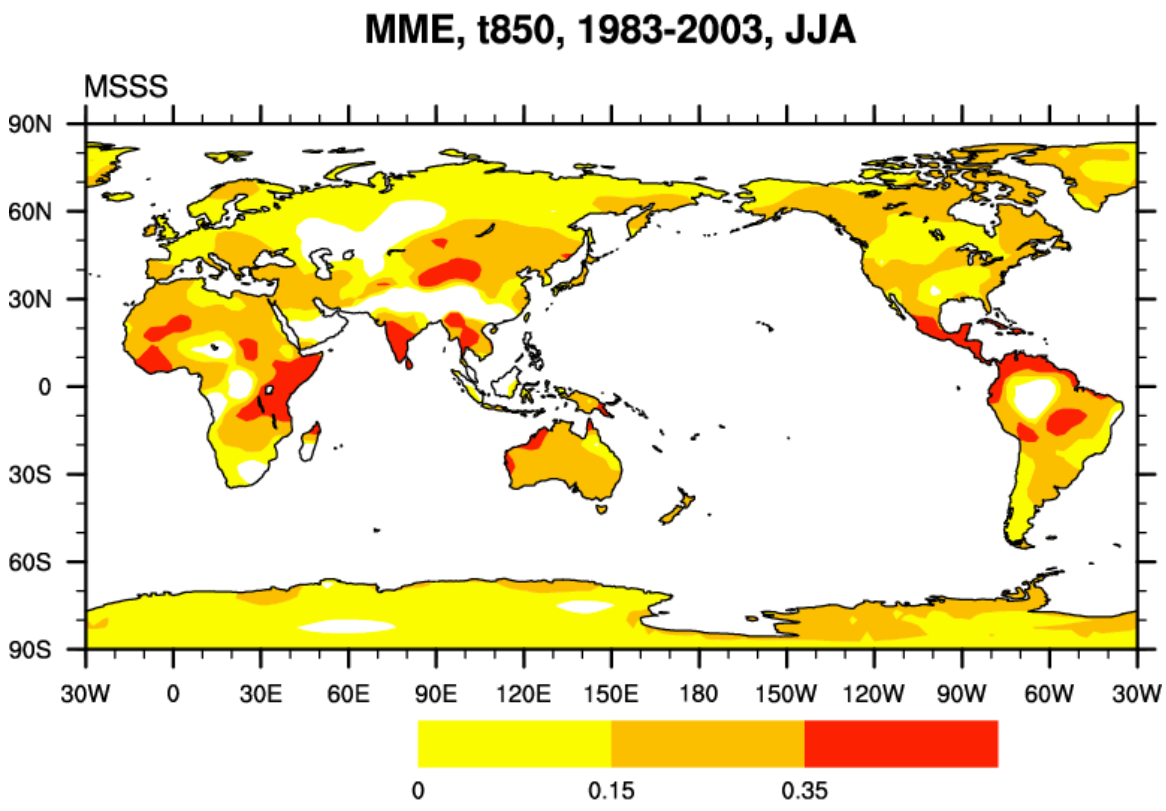
-0.61 -0.49 -0.36 -0.3 0.3 0.36 0.49 0.61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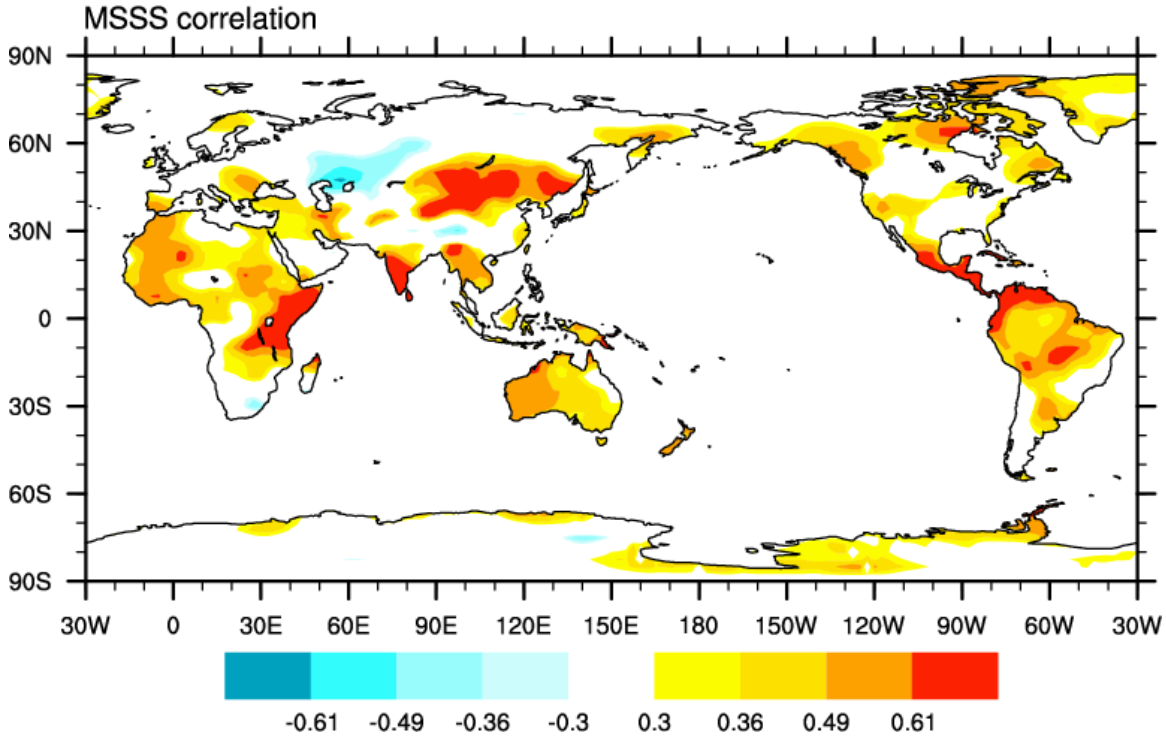
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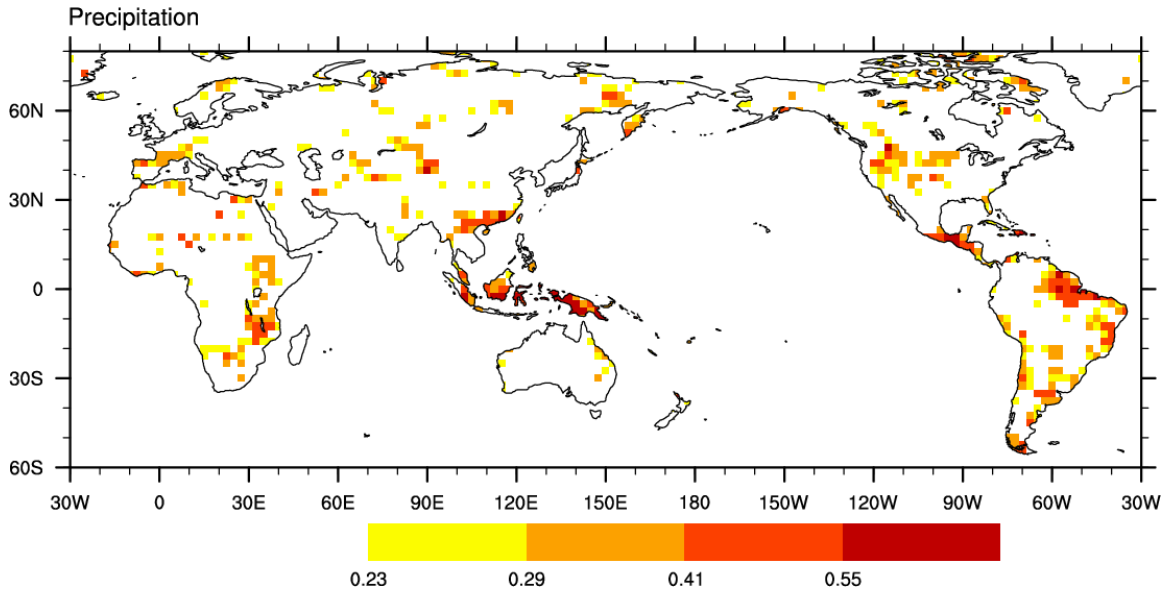
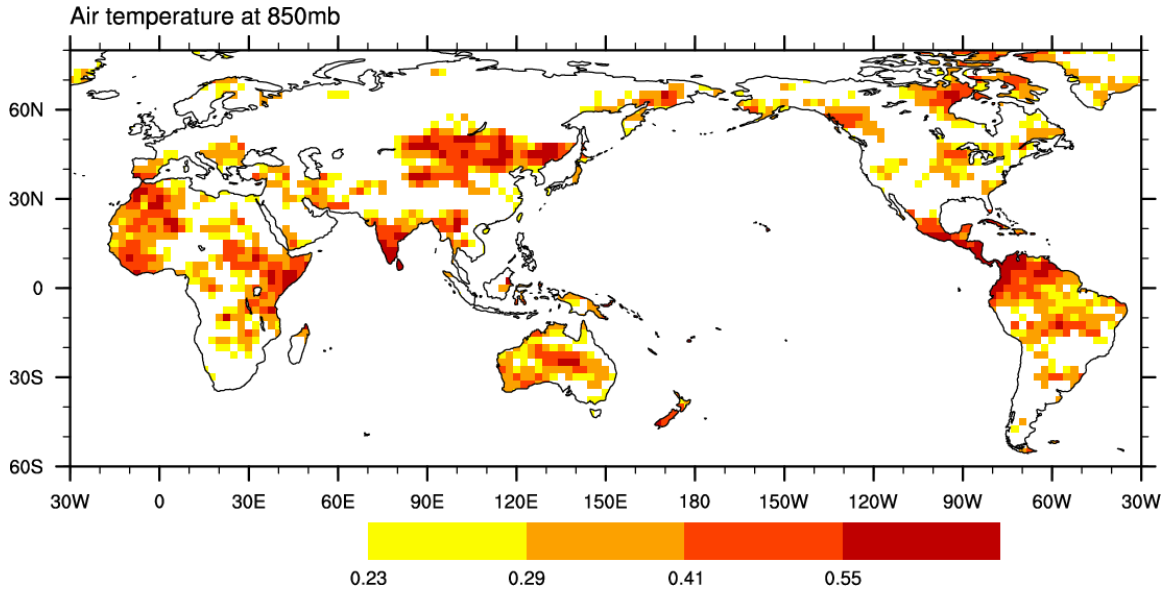
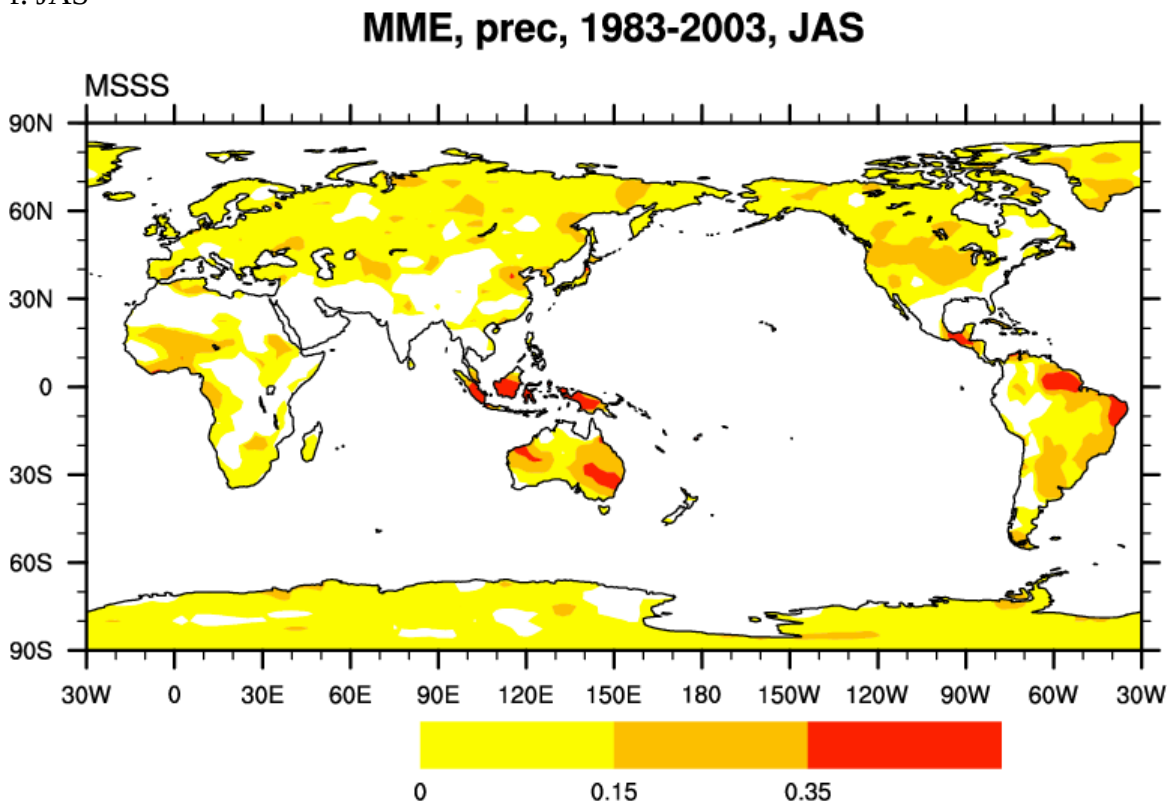
Gerrity Skill Score





f. JAS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MSSS
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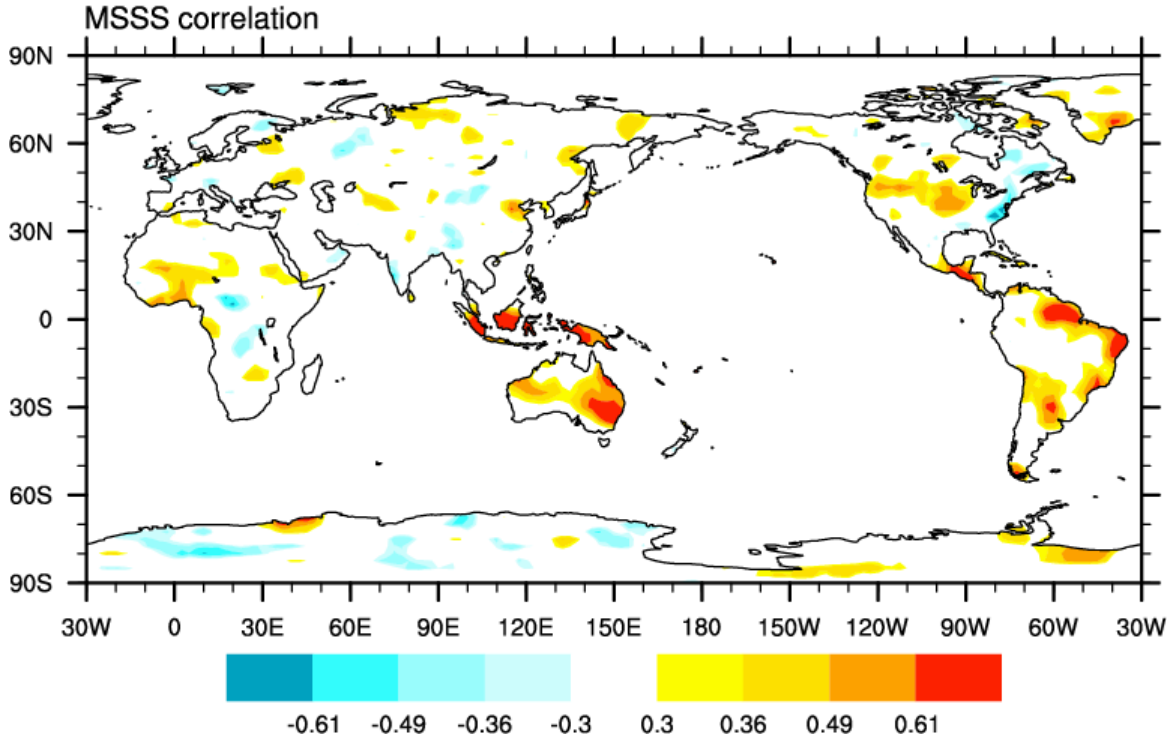
30S
60S
90S
30W 0 30E 60E 90E 120E 150E 180 150W 120W 90W 60W 30W
0 0.15 0.35


MSSS correlation
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30S
60S
90S
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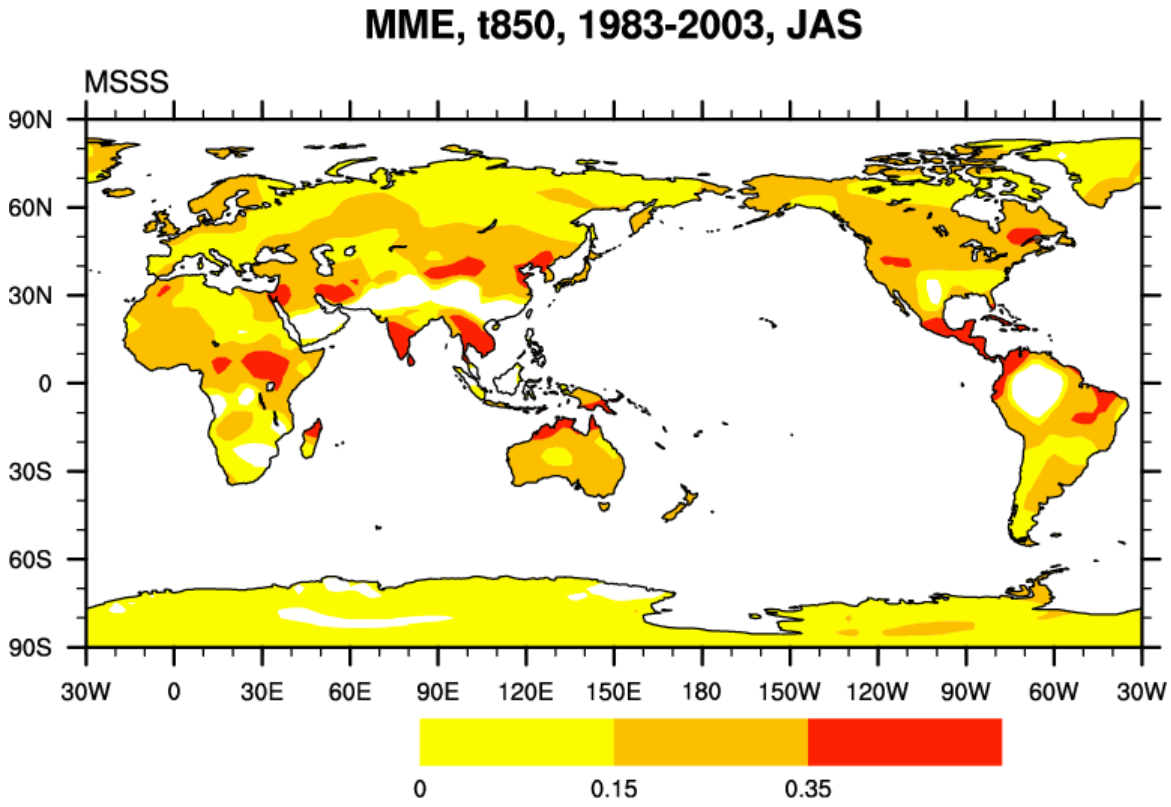
MME, t850, 1983-2003, JAS
MSSS
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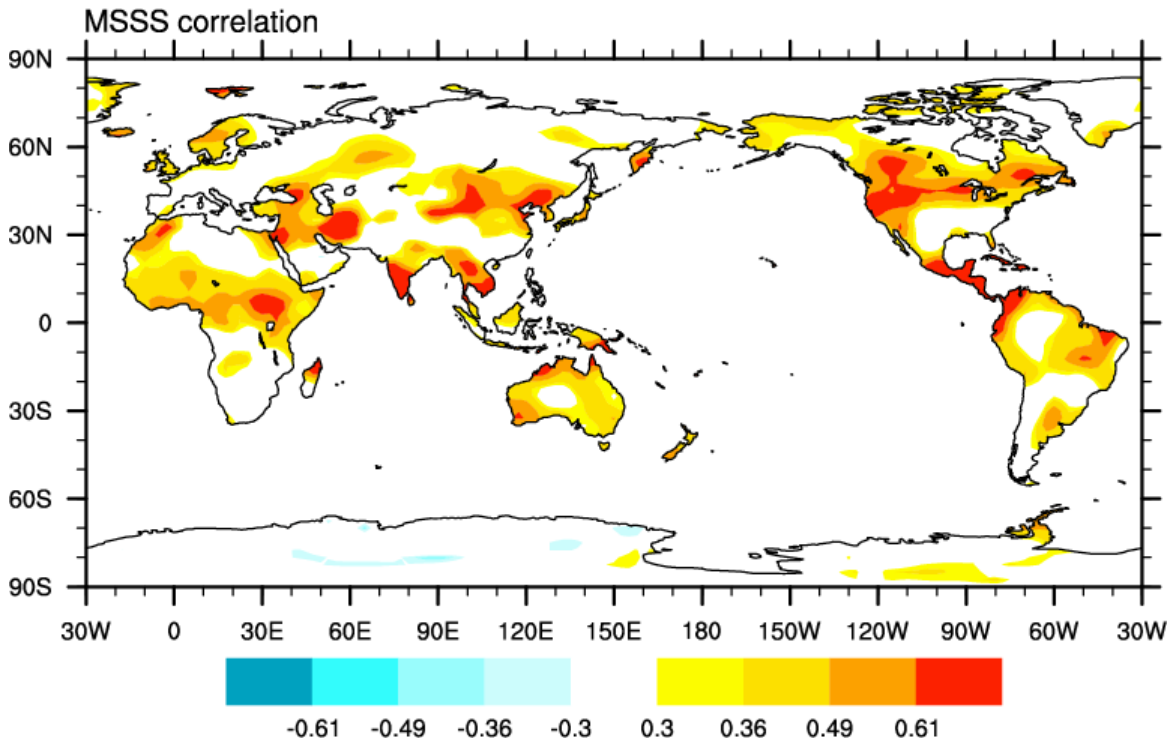
MSSS correlation
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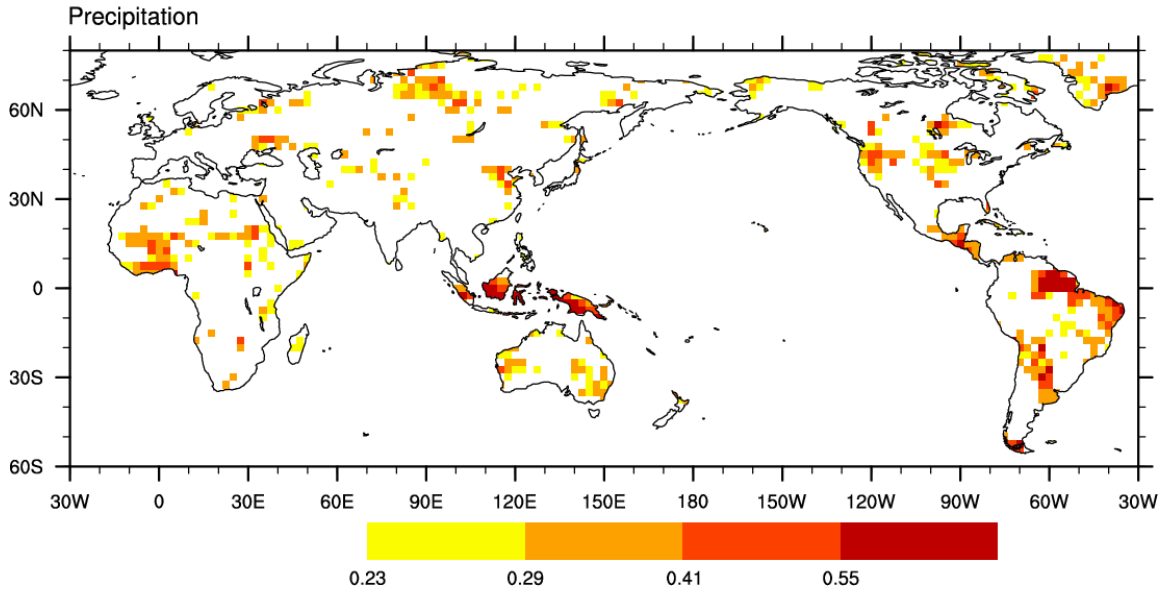
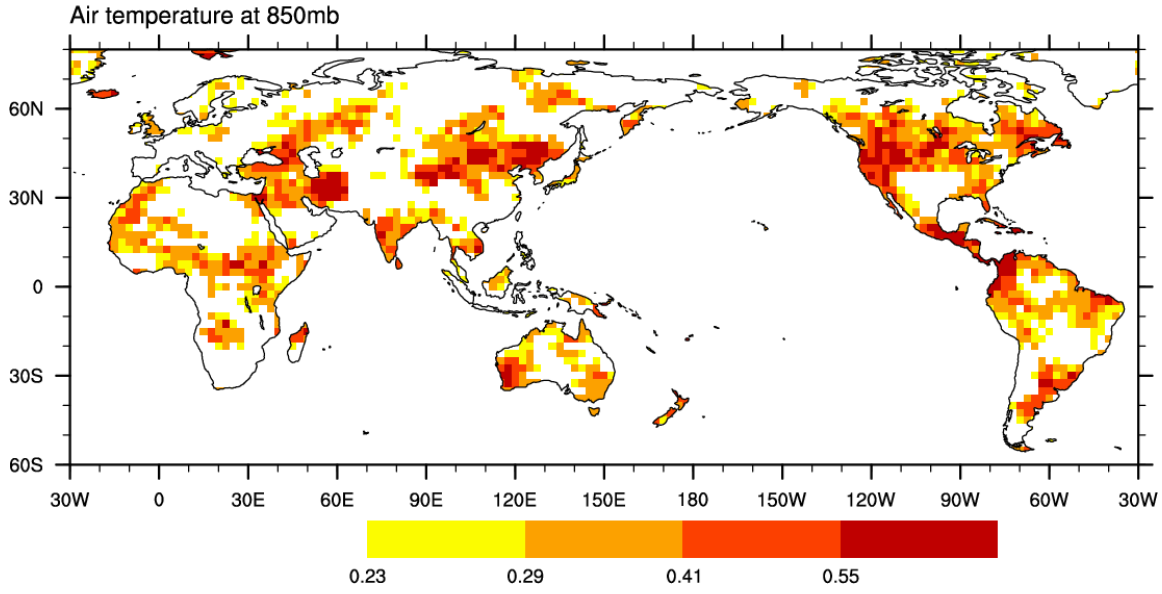
Gerrity Skill Score





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APPENDIX V

APEC Climate Symposium, 2008

The Agenda for the Working Group discussions and deliberations

1. OPENING OF THE SESSION

2. ORGANIZATION OF THE SESSION

- Adoption of the agenda
- Wo rking arrangements

3. OPERATION OF CLIMATE INFORMATION SERVICE BASED ON MULTI-MODEL ENSEMBLE SEASONAL PREDICTION SYSTEM

- Working group activities during 2008 (Ref. WG Doc. 3.1 (1)).
- Review of climate condition over Asia-Pacific region during 2008 (Ref. WG Doc. 3.2(1)).
- Performance of MME seasonal prediction at APCC during 2008 (Ref. WG Doc. 3.3(1)).
- Model data issues (Ref. WG Doc.3 4(1), WG Doc. 3.4add1).
  - *Coupled MME data issues: request for longer forecasts and more number of ensembles.*
  - *daily data*
  - *hindcast length*
- Questionnaire on the climate information service (Ref. WG Doc. 3.5(1)).

4. CAPACITY BUILDING IN PRODUCING AND USING RELIABLE CLIMATE PREDICTIONS

- Working group activities during 2008 (Ref. WG Doc. 4.1(1)).
- Current training activities and proposal for improvement (Ref. WG Doc.4.2(1)).
- Capacity building for climate information exchange (Ref. WG Doc. 4.3(1)).

5. FUTURE ACTIVITIES TO IMPROVE CLIMATE INFORMATION SERVICE FOR APEC ECONOMIES

- Coordination with other activities of the APEC/WMO programme (Ref. WG Doc. 5.1(1), WG5.1(2), and WG_inf_5.1.3).
  - *World modelling summit*
  - *IPCC*
  - *WWW/WCP/WCRP*
  - *APEC/ ESCAP*
- Programs for 2009 and beyond (Ref. WG Doc. 5.2(1)).
- Support required for the working group program (Ref. WG Doc.5.3(1)).

Date and place for the 5th Symposium and working group meeting (Ref. WG Doc. 5.4(1)).

APPENDIX VI

Summary of Session IV-a, the WG session on Future Activities to Improve Climate Information Services for APEC Economies
16:15-18:00, Wednesday 20 August 2008

APCC Annual Symposium and Working Group Meeting 2008, Lima, Peru, 19-21 August 2008

Summary of Working Group sessions

James Renwick, Myong-In Lee, Emilia Jin, Wilar Gamarra, June-Yi Lee and Juan Fontecilla

Session I, Working Group session on Advances on long-range climate prediction

9:20-10:45, Wednesday 20 August 2008

The session opened with six short talks about current advances of long-range prediction in individual working group institutions:

The new ensemble prediction system at CMC was reported by Dr. F. S. Fontecilla, CMC of Canada, while an *Update on the NCEP Climate Forecast System (CFS) development activities* was given by Dr. J.-K. E. Schemm, NCEP of USA with focus on the advanced land model and improved initial condition through implement CFS reanalysis, and *Recent development of JMA seasonal prediction system* was given by Mr. K. Takahashi, JMA of Japan.

Dr. Simon Mason, IRI of USA emphasized the importance on the way to present forecast verification information to user communities in his talk entitled *Presenting forecast verification information to user communities*, and *Some intraseasonal forecasting activity at Environment Canada* was given by Dr. Hai Lin, Environment Canada.

Followed by individual working group activities, Dr. K. Ashok, APCC summarized the APCC climate prediction activities in 2008 which is highlighted by the operationalization of monthly 3-month forecast and statistical downscaling for 60 Korean stations. He also shows the recent development on 6-month MME seasonal prediction and in-house development of coupled prediction system.

The Working Group (WG) then had an open discussion session on:

1) The performance of MME seasonal prediction at APCC

2) Forecast and hindcast data issues

1) Followed by Dr. Ashok's talk on the performance of APCC seasonal prediction, several questions were raised associated with the future improvement of MME.

In addition to the existing report of MME verification/performance skills in the website and WG documentation, an extensive oral presentation about the latest MME skills by APCC was recommended for a more intensive discussion on improvement of APCC MME. The importance of evaluating the real forecast skill which is generally lower than hindcast skill was emphasized by Dr. Simon Mason of IRI,

and it was hoped that the direction of further model development cloud be suggested by APCC by evaluating common problems of the participating model predictions. Another suggestion was that scope of MME should be rethought in many ways in APCC. In particular, the best composite of MME and downscaling should be explored.

There was a discussion around the APCC's development of an operational coupled GCM for carrying out tier-1 coupled hindcasts and forecasts, for inclusion in the multi-model ensemble (MME). The consensus was that it would be advantageous if the APCC could carry out model development and implementation in collaboration with other operational agencies, both in terms of mutual support and in terms of efficient use of resources.

2) APCC plan to develop systems for intra-seasonal prediction, and on extreme events. This would require modelling groups to provide high spatial resolution and high time frequency forecast outputs. The WG identified that some institutions may not be able or prepared to provide those data sets, at least in the short-term future. Since the upgrade (change) of forecast model version is expected, it was felt that APCC would make good use of whatever model outputs could be provided, and that this would be an evolving situation. One recommendation in this area was a closer collaboration between the Working Group members and coordination through CliPAS.

Session II, Working Group session on Regional prediction activities and capacity building

14:15-15:45, Wednesday 20 August 2008

The session opened with four short talks about Working Group activities during 2008:

Medium-range weather forecast in Vietnam and its perspectives was given by Dr. N. D. Quang, Viet Nam NCHMF of Viet Nam. In particular, he proposed the necessity of group activity on seasonal prediction among Southeast Asian countries and the possible role of APCC on it.

Applicatoin of ECPC G-RSM for monthly to seasonal prediction in Thailand was given by Mr. Boonlert Archevarahuprok, TMD of Thailand. Third talk was given by Dr. Myrna Araneda Fuentes, National Weather Service of Chile entitled *Improving the capacity building for numerical modelling in the Chilean National Weather Service*.

Finally, *Climate information tool kit (CLIK): Facilitating effective exchange and utilization of climate information* was given by Dr. N. H. Saji, APCC to summarize the activity of APCC about capacity building for climate information exchange.

The Working Group (WG) then had an open discussion session on:

1) Current training activity and proposal for improvement

2) Capacity building for climate information exchange and some ideas for using CLIK/DEX

1) Applications were recognised as a very exiting and important field. Since there is presently a gap between actual applications and current seasonal forecast information, we should work to reformat our seasonal forecast products to be more understandable and useful for non-expert users.

2) There was general discussion around capacity-building. Several WG members discussed the possibility/intention of APCC supporting and/or coordinating training course on regional prediction activities among Southeast Asian countries (and held in-country). It was noted that a training workshop on downscaling will be held at APCC, starting in late September. One suggestion was that the APCC might gain useful information from CPTEC (Brazil) that has successfully coordinated such courses among South American institutions. It was also noted that external help is available from the IRI, and WMO resources for training can be considered.

Further, the WG noted that APCC is focused not only on MME, but is also beginning to deal with a host of evolving issues related to its general mission, around access to data, and systems related to climate prediction. For example, as part of the APCC Data Service System (ADSS), the development of the data exchanger (DEX) and climate data utilization system (CLIK) is underway. Effective management of data was considered by the WG to be very important, and cooperation with WMO and the WMO information system should be considered. Moreover, the development of smart feedback mechanism for reverse cascade is recommended.

One suggestion was that application experts will be needed at APCC to look for more application targets. how MME can be useful among ensemble spread of uncertainties.

Session IV-a, Working Group session on Future Activities to Improve Climate Information Services for APEC Economies

16:15-18:00, Wednesday 20 August 2008

The session opened with two talks:

1) *Implications of climate change scenarios in Peru* was given by Dr. Luis Metzger, SENAMHI. In his presentation, Luis showed that the signal of climate change is quite evident and nation-wide for the last 40 years in Peru, as apparent in Andean glacial retreat as well as in ground-based observations of surface temperature and precipitation. His group has also developed projections of regional climate change by using global and regionally-nested dynamical models forced by future greenhouse gas emissions scenarios (SRES scenarios). Projections were consistent with the observational findings. The speaker also described future programs of SENAMHI in the area of long-term climate change for establishing international research collaborations. The Regional Andean Project of Adaptation that deals with the future changes of glacial water variability is one example.

2) The second talk was given by Dr. Ahmad Jamaluddin of Malaysia, entitled *Early notifications of extreme weather events: Building the adaptive capacity*. He first discussed the weather and climate in Malaysia and recent observed changes, where the region is becoming more vulnerable to the extreme weather events such as flooding and haze. He introduced their on-going efforts to set up early-warning systems for extreme weather and an implementation plan for risk management system development.

The Working Group (WG) then had an open discussion session on:

1) potential possibilities for coordination with other international programs/meetings/activities,

2) seeking the next meeting place and hosting institute, and

3) suggestions on and approval of the revised terms of reference (TOR) for the WG, followed by

1) The WG discussed coordination with existing international research program and activities. One of the ideas recommended was to explore the possibility of linking to one or more of the WMO's existing research programs. The representative from WMO (Mr. Peter Chen) suggested there is great potential in this area. The WMO's CBS could be one possibility, and the Commission for Climatology (CCl).Dr.Renwick noted there is a CCl Expert Team on Seasonal Forecasting meeting in September, and he would describe APCC activities at that meeting. The APCC can also join the activities of the World Climate Conference-3, which will be focusing on the issue of decision-making and adaptation to future climate change.

A general point discussed was that APCC should aim to communicate with existing programs and to contribute where possible to the international community effort through conferences and research programs. As the IPCC process is in a lull between assessment reports, there was no discussion of interactions with IPCC, but APCC is well-placed to contribute in several ways to the IPCC process, once the AR5 is under way.

There was general support for the overall thrust of the APCC for the future, including developments in intra-seasonal prediction, and towards decadal and longer projections.

2) The NOAA/NCEP Climate Prediction Center has volunteered to host the next APCC meeting in 2009. Jae Schemm and her institute have proposed to organize the APCC symposium and the WG meeting in Monterey, California (USA), in conjunction with the 34th Climate Diagnostics and Prediction Workshop (CDPW). The CDPW will be held between 26 and 30 October 2009. The Department of Meteorology at the Naval Postgraduate School was proposed as the local host. Dr. Schemm stated that the scope of the APCC meeting is well aligned with the primary focus of the CDPW, which is around climate predictability beyond two weeks. The CDPW meeting will be specifically focusing next year on the impact of global climate signals upon the western United States, so it would be a great opportunity for APCC to introduce their pan-Pacific prediction activities to the US research community. It was also mentioned that the CDPW meeting usually attracts about 150 participants, being a high-profile range of researchers active in the field of climate variability and prediction, and runs for 4.5 days. The proposal is for a one day joint session in the CDPW, and two-day separate sessions for the WG and SAC meeting. The issue of travel support to the participants was raised (CPC is not allowed to support the travel expenses for the individual participants).

3) The WG considered the revised Terms of Reference (TOR) for the WG. The changes essentially formalise some practises that are already in place, and introduce a little more structure to WG activities. These include keeping an up-to-date list of contact points from each of the APEC economies, and setting up chair and vice-chair positions with responsibilities for the periods between WG meetings.

The WG endorsed the revised TOR. The chair and vice-chair positions are set up to be aligned with the hosts for the forthcoming two WG meetings. No chair has yet been nominated for the 2009 meeting, butDr.Schemm will make enquiries.

APPENDIX VII

TERMS OF REFERENCE OF THE WORKING GROUP

In order to coordinate efforts on the implementation of various activities and to better support the socio-economic development process in the APEC Area, the Working Group has been established with the following Terms of Reference and operational modalities.

Terms of Reference

As the main liaison with home institutions, the Member Working Group will:

- facilitate the exchange of regional climate information, particularly climate prediction, among APEC member economies;
- facilitate individual efforts in operational centers and research institutions within the framework of APEC;
- improve multi-model ensemble (MME) and develop new applications through the close cooperation with the Science team of APEC Climate Center (APCC).

The chairperson of the Working Group will:

- To chair the Working Group Meeting and facilitate arrangements through the meeting in consultation with local host and APCC;
- To coordinate activities of Working Group during the intersession period..

The vice-chairperson of the Working Group will:

- To support chair to lead the working group meeting and to facilitate the arrangements through the meeting in consultation with local host and APCC;
- To support chair to coordinate activities of working group during the intersession period;
- To represent the working group in the absence of chair.

Membership

The Working Group will consist of the members in Table VII.1 with:

- The permanent representative of the most recent APEC WG meeting (in the present case, Mr Wilar Gamarra, Peru) as Chairman
- The permanent representative from the NMHS which organized the next meeting would be the vice-chair

The APEC secretariat, WMO, and other interested institutions take part in the Working Group. The membership of the working group should be update as appropriate, ensuring that the respective members are acting as a focal point representing their NMHS or Institute for the cooperative tasks as described in terms of reference .

For the effective arrangement of the Working Group Meetings, the chair will be elected from the representatives of hosting institute, and vice-chair from the hosting institute in the following year, respectively. Their terms will automatically terminate just before the following Working Group Meeting .

Operation modalities

In view of the limited financial resources, the Working Group is expected to communicate through email and other means which require no financial resources. However, the Working Group could meet once a year with the financial support from APEC projects and other voluntary supports.

Reporting requirements

The Chairperson of the Working Group prepare, in consultation with APEC Climate Center, a report for submission to the annual Working Group Meeting, that includes activities during the intersession and recommendations related to priority research activities to be undertaken in the coming years.

Table VII.1 **Current membership of Working Group**

No	Member Economy	Organization	Nominee
1	**Australia**	POAMA	Dr.Brad Murphy
2	**Brunei**	BMS	-
3	**Canada**	MSC	Dr.Hai Lin
4	**Chile**	DMC	Mrs. Paola Uribe Raibaudi
5	**China**	IAP	Dr. Lin Zhaohui
6	**China**	NCC	Dr. Zhang Peiqun
7	**Chinese Taipei**	CWB	Dr. Jyh Wen Hwu
8	**Hong Kong**	HKO	Dr. Lee Tsz-Cheung
9	**Indonesia**	BMG	Mr. Antoyo Setyadipratikto
10	**Japan**	JMA	Dr. Kiyotoshi Takahashi
11	**Korea**	KMA GDAPS/GCPS	Mr. Jeong-Seog Lee
12	**Korea**	METRI	Dr.Hyun-Suk Kang
13	**Malaysia**	MMD	Mr. Kwan Kok Foo
14	**Mexico**	SMN	Ms. Adelina Albanil
15	**New Zealnad**	NIWA	Dr. James Renwick
16	**Papua New Guinea**	NWS	Mr. Samuel Maiha
17	**Peru**	SENAMHI	Ms. Amelia Diaz
18	**Philipppines**	PAGASA	Ms.Flaviana Hilario
19	**Russia**	HMC	Dr. Dmitry Kiktev
20	**Russia**	MGO	Dr. Vadim Matyugin
21	**Singapore**	NEA	Mr. Chien Wan Tham
22	**Thailand**	TMD	Mr. Boonlert Archevarahuprok
23	**USA**	COLA	Dr. Dan Paolino
24	**USA**	IRI	Dr. David G. DeWitt
25	**USA**	NASA	Dr. Myong-In Lee
26	**USA**	NCEP	Dr. Jae-Kyung E. Schemm
27	**Vietnam**	Vietnam HMS	Mr. Nguyen Huu Chinh

APPENDIX VIII

HOSTING A PART OF DATA SERVER FOR CHFP

Data Sharing

Since the CHFP is designed to conduct research to improve seasonal prediction science, the current practice for data sharing among participating institutions through APCC could be extended to the scientists associated with the climate research under WCRP projects. Estimated resources required to host CHFP monthly atmospheric data would be 36 GB for consideration of 2.5 degree grids, 10 variables at 17 levels from 18 models, each having 20 ensembles, during past 25 years.

First Phase

The first phase of implementation for CHFP, targeted for early 2009, simply covers the existing historical forecast data at APCC openDAP server.

Second Phase

The second phase may be launched after assessment of the 1st phase. Depending on the participating institutions' contributions, the served dataset may be extended to accommodate requirements of CHFP in terms of models, variables, temporal and special resolutions.

APPENDIX IX

SAC RECOMMENDATIONS

1. APCC should provide comments against last years recommendations

2. APCC make more use of SAC

3. Chair(s) and APCC director jointly develop agenda before hand.

4. APCC presents more on scientific background and operational products, verification and skill.

5. Director considers how to more formally recognize in-kind contribution from member economies, and strive for increased Korean government funding.

6. SAC members to help identify potential projects for future collaboration.

7. Director to clarify purpose of in-house coupled model development and long term strategy. However, the use of coupled model (from a different organization) should not divert from the main purpose which is MME. With present resources model development should not be a core activity.

8. The MME aspect should be the primary focus and this should include:
- Evaluation and intercomparison of component models (e.g. CliPAS)
- Develop more products and how to interface with users

9. The interface to applications must be given more priority, particularly in the SE Asia region. Director to develop a plan, for feedback from SAC and WG

APPENDIX X

List of Acronyms

No.	Acronym	Institute
1	APCC	APEC Climate center
2	APEC	Asian Pacific Economic Cooperation
3	APN	Asia-Pacific Network
4	BCC	Beijing Climate Center
5	BMG	Meteorological and Geophysical Agency
6	CCM3	NCAR Community Climate Model
7	CCSR	Center for Climate System Research
8	CIIFEN	Centro Internacional para la Investigación del Fenómeno el Nino (Ecuador)
9	CliPAS	Climate Prediction and its Application to Society
10	CMA	China Meteorology Agency
11	GEF	Global Environment Facility
12	GMAO	Global Modeling and Assimilation Office
13	GPC	Global Producing Centre
14	INMET	Instituto Nacional de Meteorología
15	IPRC	International Pacific Research Center
16	IRI	International Research Institute
17	JMA	Japan Meteorological Agency
18	KOICA	Korea International Cooperation Agency
19	MME	Multi-model ensemble
20	NGSFC	National Aeronautics and Space Administration's Goddard Space Flight Centre
21	NIWA	National Institute of Water & Atmospheric Research
22	NMHS	The Meeting of National Meteorological and Hydrological Service
23	NPS	Naval Postgraduate School
24	NTNU	National Taiwan Normal University
25	NWS	National Weather Service
26	SENAMHI	Servicio Nacional de Meteorología e Hidrología (National Meteorology and Hydrology Service)
27	UH	Univ. of Hawaii
28	WCRP	World Climate Research Programme
29	WGSIP	Working Group on Seasonal to Interannual Prediction
30	WMO	World Meteorological Organization