Progress Report – APEC Climate Center for Climate Information Services (IST 01/2008)

Purpose: Information
Submitted by: Korea

35th Industrial Science and Technology Working Group Meeting
Ha Noi, Viet Nam
8-9 September 2008
Summary of Progress Report for

APEC Project IST 01/2008 - APEC Climate Center for Climate Information Services

The project has led to significant progress in the exchange of climate information among APEC member economies. Due to efforts made during the last symposium supported by APEC, we have succeeded in increasing the frequency and quality of climate prediction and information provision to member economies. The ongoing project will further enhance the new phase of regional cooperation on global climate prediction and analysis, and also introduce to the participants the state of art technology that has been developed in 2008 to further regional climate prediction.
# Progress Report on APEC Projects

<table>
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<tr>
<th>[√] Operational Account</th>
<th>[ ] TILF Special Account</th>
<th>[ ] APEC Support Fund</th>
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<tr>
<td>Project number: IST 01/2008</td>
<td>Date received by Secretariat:</td>
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<tr>
<td>Name of Committee/Working Group: Industrial Science and Technology Working Group (ISTWG)</td>
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<td>Title of Project: APEC Climate Center for Climate Information Services</td>
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<td>Proposing APEC Economy: Republic of Korea</td>
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<td>Co-sponsoring APEC Economy (ies): Australia; Hong Kong, China; Japan; Peru; Philippines; Chinese Taipei; Thailand; Canada; Chile; China; Indonesia; Malaysia; Singapore; New Zealand; Russia; Vietnam</td>
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<td>Project Overseer: Name, Title and Organization (M/F)</td>
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<tr>
<td>Dr. Woo-Jin Lee, Executive Director, APEC Climate Center</td>
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<tr>
<td>Financial Information</td>
<td>Total cost of proposal (US$): $166,000</td>
<td>Amount being sought from APEC Central Fund (US$): $79,000</td>
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<td>Project start date: March 2008</td>
<td>Project end date: February 2009</td>
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**Brief description of Project: its purpose and the principal activities (including when and where):**

APEC Climate Center (APCC), which embarked on its full operation since November 2005, has ushered in the new phase of the regional cooperation on global climate prediction and analysis, and now provides optimized climate prediction information to 21 APEC members, including those members which have no capability to produce the high-cost climate information.

This project is to provide more effective, accurate and timely climate information so that member economies can protect their people more efficiently from extreme climate events. This project will also build on the capacities of Meteorological Services in member economies. To further facilitate the data exchange and regional cooperation for the development of early warning system of high impact climate, this project organized the **APCC Scientific Symposium on 19-21 August 2008 in Lima, Peru.**

Signature of Project Overseer: [Signature]

(Separate written confirmation acceptable for email submission) Date 26. Aug. 2008

Signature of Committee Chair/WG Lead Shepherd: (Not applicable to Progress Report and Evaluation Report)

(Separate written confirmation acceptable for email submission) Date:
Progress Report on APEC Projects

<table>
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<th>Status/Progress and Problems</th>
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**Current status of project:** On schedule (Yes/No)  Within budget (Yes/No)

**Objectives**
How do results of the project thus far (if any) compare with its expected results? Include your results thus far (if any) relative to quantitative measures you proposed in paragraph 1 (and 25) of the project design proposal.

- The APEC Climate Symposium was successfully held jointly with APCC Member Working Group (WG), and APCC Science Advisory Committee (SAC) Meeting from 19-21 August 2008.
- The symposium was a part of the APEC Senior Officials Meetings (SOM III) taking place in Lima, Peru 12-23 August 2008.
- Forty presentations and 20 working documents were reviewed and discussed during the symposium period.
- Sixteen out of 21 APEC economies participated in the 3-day symposium. The total participants were 38 out of whom 34 were from APEC economies.
- The participants reviewed state of the art of technologies and infrastructure to deal with climate related disaster and discuss more effective ways for exchanging climate data and information in order to reduce negative economic impacts due to extreme climate events.

**Linkages, Methodology, Budget**
Describe any problems which have arisen and how they were resolved, including changes in schedule or revised dates, budget changes, changes in participation, or additions or deletions of activities.

N. A.

**Gender Considerations**
Provide a brief description of the impact of the project on women to date.
Provide details to show how women have been consulted on the delivery of the project.
What kind of sex-disaggregated data has been collected and used for the project?

Seven women staffs participate in data processing, data exchange, and administration at APCC, and also involved in the preparation for the symposium. Six women representatives from China, Chile, Mexico, Peru and USA were nominated by the head of their services and organization to participate in the forthcoming APEC Climate symposium.

**Progress since last report**:

1. The APEC Climate Symposium was successfully held jointly with APCC Member Working Group (WG), and APCC Science Advisory Committee (SAC) Meeting from 19-21 August 2008 at Lima, Peru.

2. Disseminated 7 seasonal forecasts and climate information reports to APEC economies since January 2008 through various media such as internet, direct emailing etc, and also provides monthly climate monitoring. It is noted that the seasonal forecast service require significant human and computing resources that are not covered by this project.

3. Digital service of climate information initiated since January of 2007. The digital climate data is available freely to National Meteorological Services and registered users in near real time.

4. Hosted visit of Mr. Erik Swenson, a graduate student from George Mason University, USA. He
was supported partially by the US National Science Foundation and the APEC Climate Center. During his visit from 23 June 2008 to 8 August 2008 Mr. Swenson examined the utility of APEC Climate Center products in simulating important teleconnection patterns over North America.

5. Hosted visit of Prof. Vinayachandran from Indian Institute of Science, India. He was supported in part by the Brain Pool Korea Program and by APCC. During his visit from 1 December 2007 to 31 August 2008, Prof. Vinayachandran examined the role of intraseasonal weather disturbances on the ocean.

6. Facilitated and supported visit of prominent scientists in the APEC region to attend the Asia Oceanic Geophysical Symposium that was held in Busan, Korea from June 16-20, 2008. APCC supported scientists involved Dr. Harry Hendon of Australia and Dr. Duane Waliser of USA.

7. APCC organised training program on climate prediction and regional application for 14 operational forecasters or researchers from APEC economies that will start in this fall for 4-7 weeks.

**Held seminars and lectures as follows:**

(i) Held a session in AOGS “on Variability and Predictability of the Multi-scale Asia-Pacific Climate System”


**Notes:**

- All Committee and Working Group projects, irrespective of their source of funding, should be reported to BMC.
- Please mark “N.A.” if any item is not applicable.
- Name of Project should be identical with the name stated in the project proposal.
PROJECT INFORMATION

Project number: IST 01/2008

Title of Project:
APEC Climate Center for Climate Information Services

Name of Committee/Working Group:
Industrial Science and Technology Working Group (ISTWG)

Proposing APEC Economy:
Republic of Korea

Co-sponsoring APEC Economy (ies):
Australia; Hong Kong, China; Japan; Peru; Philippines; Chinese Taipei; Thailand; Canada; Chile; China; Indonesia; Malaysia; Singapore; New Zealand; Russia; Viet Nam

Project Overseer:
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This document contains the major progress at APEC Climate Center for climate information services to society during 2008 from the viewpoint of follow-up actions on the 4th APEC Science and Technology Ministers’ Meeting in sequence of four key policy issues, i.e., human capacity building, international science and technology networks, connecting research and innovation, and strengthening technological cooperation and encouraging best practice in strategic planning.

ANNEX I. Review of Climate conditions over Asia-Pacific region during 2007-2008
ANNEX II. Performance of seasonal forecasts during 2008
ANNEX III. Draft summary of APEC Climate Symposium (19-21 August 2008, Lima, Peru)
Reference Meeting summary of 4th APEC Science and Technology Ministers’ Meeting

1. Climate information service through international science and technology networks

Summary for follow-up actions on the 4th APEC Science and Technology Ministers’ Meeting

APEC Climate Center has been successful in establishing, maintaining and continuously improving an international science and technology network for the purpose of reducing/mitigating adverse consequences from high impact climate and weather events. The project organized annual symposiums with APEC funding, to further strengthen the network, to share knowledge and expertise with stakeholders in the APEC region, and to facilitate the data exchange and regional cooperation for the benefit of regional prosperity through the provision of climate information service and technology transfer. The following characteristic of successful Science and Technology networks are identified in the APEC project conducted by APEC Climate Center, i.e., (1) cooperative research activities drive the improvement of the quality of
climate information, (2) the cooperation through multi-model ensemble forecast and annual symposium enhance skill and knowledge on the current climate and its future evolution, (3) the APEC Climate project has a clear goal of regional prosperity through climate prediction and monitoring service, (4) the climate information is of vital importance to all the member economies in adaptation to climate change at hand and in the future, and (5) the application of ensemble forecasts require active involvement of every model provider and user.

Infrastructure and operational service:

Based on the recognition of the importance of the work of APEC Climate Network at the 4th APEC Science and Technology Ministers’ Meeting, APEC Climate Center (APCC) was formally established and started operations in November 2005. Since then it has been providing operational 3-month lead dynamical seasonal predictions through the multi-model ensemble (MME) technique, and since 2008, operational rolling monthly 3-month forecasts every month.

MME predictions are facilitated through multi-institutional co-operation within the APEC region. Eighteen dynamical seasonal forecasts are made available to the APCC from 15 National Hydrometeorological Centers/Research Institutes of eight APEC member economies. Currently APCC operates the world’s largest and most extensive operational MME dynamical seasonal prediction system. Organizations and institutes participating in the joint real-time MME operational forecasts are NASA, NCEP, IRI and COLA of USA, HMC and MGO of Russia, KMA, METRI and SNU of Korea, Japan Meteorological Agency, CWB of Chinese Taipei, IAP and BCC of China, Canadian Meteorological Center and the Australian Bureau of Meteorology. The basic functions of APCC are illustrated in Fig. 1.
Performance of seasonal forecasts in 2008:

Eight rolling monthly 3-month forecasts and climate information reports were disseminated to APEC economies, including those members who have no capability to produce the high-cost climate information, since January 2008 through various media such as internet, direct emailing etc, and weekly to monthly and sub-monthly climate monitoring are also disseminated through the APCC website. It is noted that the seasonal forecast service require significant human and computing resources that are supported by the Korean Government. The contents and their performance are presented in ANNEX I and ANNEX II of this report.

In addition, digital service of climate information has been initiated since January of 2007. The digital climate data is available freely to National Meteorological Services and registered users in near real time. Starting 2008, APCC has initiated two prototype technologies to illustrate possible solutions, and to encourage discussion and close cooperation among member economies to facilitate further the application of the climate information produced at APCC (Fig. 2).

The ongoing Climate Information Tool Kit (CLIK), planned to be released in early 2009 to participating NMHSs, is a technology that aids users in customizing climate predictions to their specific needs and regions of interest. Designed as a web application, CLIK embeds technologies that allow users to download climate data from providers such as APCC with an easy-to-use interface. The climate prediction data thus acquired can be used create customized Multi Model Ensemble forecasts and downscaled products for the region of interest.

The Data EXchange Services (DEX) is another technology under active development. This technology will aid expert users in retrieving, managing and redistributing climate information from APCC using a simple command line interface. Further it will aid users in adjusting the data to their needs by providing tools for regrinding, slicing and reformatting the raw data. DEX is thereby hoped to alleviate the burden of climate information management for people that require climate information to make management decisions and to manipulate data for basic and applied research.

Fig. 2. Conceptual configuration of data service tools for user oriented support. AFS: Automated Forecast System; CMS: Climate Monitoring System; DFS: Downscale Forecast Tool
Sharing knowledge and expertise

The APEC Climate Symposium, supported by APEC project entitled “APEC Climate Center for Climate Information Services to Society (2007/BMC2/019-27, IST 01/2008)” under ISTWG, was successfully held jointly with APCC Member Working Group (WG) from 19-21 August 2008 at Lima, Peru. Sixteen out of 21 APEC economies participated in the 3-day symposium. The total participants were 38 out of whom 34 were from APEC economies.

Forty presentations and 20 working documents were reviewed and discussed during the symposium period. The participants reviewed state of the art of technologies and infrastructure to deal with climate related disaster and discuss more effective ways for exchanging climate data and information in order to reduce negative economic impacts due to extreme climate events. The Symposium helps facilitate the data exchange and regional cooperation for the development of early warning system of high impact climate in the APEC regions. The major outcome of the Symposium is summarized in ANNEX III.

2. Capacity building

Summary for follow-up actions on the 4th APEC Science and Technology Ministers’ Meeting

The APEC Climate Center recognizes the regional needs for technical transfer on climate applications and downscaling techniques. APCC products are available particularly for those who have no capability to produce the high-cost climate information. APCC promotes technology transfer between economies through bilateral agreements, visiting programs, and various training events.

Training:

Starting the third week of September 2008, APCC is organising two training programs on climate prediction and regional applications for 14 operational forecasters/researchers from APEC economies. These trainings will last for 4-7 weeks.

Technology transfer

APCC promotes technology transfer between economies through bilateral agreements. A few Scientists from Malaysia, Peru, Philippines, Thailand, Taiwan, and Viet Nam, visited APCC in the past to train in technologies relevant for adapting to regional climate issues such as regional downscaling. APCC has improved the technology further now, and will strive to disseminate this information for societal benefits in terms of application to agriculture, water management etc.
Visiting programs
APCC hosted a visit of Mr. Erik Swenson, a graduate student from George Mason University, USA. He was supported partially by the US National Science Foundation and the APEC Climate Center. During his visit from 23 June 2008 to 8 August 2008 Mr. Swenson examined the utility of APEC Climate Center products in simulating important teleconnection patterns over North America. APCC also hosted visit of Prof. Vinayachandran from Indian Institute of Science, India. He was supported in part by the Brain Pool Korea Program and by APCC. During his visit from 1 December 2007 to 31 August 2008, Prof. Vinayachandran examined the role of intraseasonal weather disturbances on the ocean.

Other programs
APCC facilitated and supported visit of prominent scientists in the APEC region to attend the Asia Oceanic Geophysical Symposium that was held in Busan, Korea from June 16-20, 2008. APCC supported scientists involved Dr. Harry Hendon of Australia and Dr. Duane Waliser of USA. More than 10 seminars on climate prediction and variability issues were presented at APCC by prominent visiting scientists. More details are available from:


Fig. 3. Facilities available at APEC Climate Center for cooperative research, training, and outreach programs.
3. Research and innovation and technical cooperation

Summary for follow-up actions on the 4th APEC Science and Technology Ministers’ Meeting

The research outcomes from in-house or international cooperation are systematically transferred into operation to enhance the quality of climate information service for the APEC region. The quality of forecast products at APEC Climate Center are regularly monitored in terms of standard metrics of World Meteorological Organization.

In-house research:

APCC research and development activities in 2008 focus on enhancing the capability of seasonal prediction and improvement of climate information content. Other in-house projects include automation of MME prediction procedure and GCM studies. Highlights of major activities in 2008 are as follows:

(1) Automatic system for monthly 3-month rolling forecasts and monitoring- An automatic forecasting system has been constructed and used in operations since the beginning of 2008.

(2) Statistical downscaling- Downscaling of monthly deterministic MME forecasts for 60 stations is being carried out operationally and provided to KMA every month, along with the APCC’s MME, to facilitate a more exhaustive and spatially-improved forecast database.

(3) Ground work for development of 6-9 month forecasts - Since February 2008, APCC has initiated an experimental 6-month MME prediction to be issued four times a year, involving 5 coupled models. APCC is also developing an in-house coupled prediction system based on CCSM3 (T85L26, GX1V3), including a coupled SST nudging scheme.

(4) Improvement of climate information service- Monitoring of intraseasonal activity is being carried out, along with development of a drought prediction system and MME-based proxy climate indices for deriving better phenomenon-specific prediction.

Technical cooperation:

The Climate Prediction and Its Application for Society (CliPAS) project is an essential international research component of APCC. Its mission is to better understand climate predictability and to advance forecasting methodology for seasonal prediction, as well as to promote application of climate information for the benefit of the APEC region. The CliPAS international project was initiated in recognition of the need for a multi-institutional research project on a core set of scientific problems on MME prediction to improve the APCC prediction system. The
 CliPAS consortium consists of twelve institutions from USA, Korea, Japan, Australia and China. Prominent scientific achievements include the assessment of the current status of seventeen climate prediction models and improved MME schemes. The specific goals of CliPAS research are devoted to improving APCC operational multi-model ensemble (MME) prediction system through developing and implementing innovative MME schemes and developing a state-of-the-art multi-model coupled prediction system.

The primary activities in 2008 are to facilitate establishment of APCC one-tier seasonal prediction system and development of the capability for intraseasonal prediction. Major tasks include:

(1) Providing 6-month lead one-tier MME predictions from non operational centers in February, May, August, and November of 2008;

(2) intercomparison of coupled prediction experiments using NCAR Community Climate System Model (CCSM3); and

(3) developing a coordinated hindcast experiment for determining predictability of intraseasonal variation (ISV) in the current climate models.

4. Sustainable development under climate change

Summary for follow-up actions on the 4th APEC Science and Technology Ministers’ Meeting

The climate monitoring and seasonal forecast products provided by APEC Climate Center have broad implication on adaptability on extreme climate events that currently occur on seasonal and sub-seasonal time scales. The same technology can be extended to address the issues of long-term climate change induced by greenhouse gas emission.

Toward Climate change:

There is now a consensus among scientists and policy makers on anthropogenic climate change. While it may not be possible to avert future climate change, efforts can be made to prepare societies and economies to adapt to changes in weather and climate patterns in the future. Better seasonal forecasting and monitoring of extreme event will play an ever more important role in a changing climate. In particular there is a great threat in the possibility of increased frequency of extreme climate and weather events.

The climate information service based on the seasonal prediction and climate monitoring gives useful guidance for the warning on the occurrence of extreme
climate events in the future. In addition several programs are underway to tackle the issue of regional climate change including (1) extension of the lead-time of seasonal forecast from 3 months to 6/12 months, (2) improved climate monitoring services tailored to regional and societal needs such as monsoon circulation and drought indices, etc., and (3) development of a multi-model ensemble system capable of predicting droughts in advance of 6-months.

Together with the proposed 6-12 months lead prediction system, these products help the national and local agencies to plan in advance to mitigate the adverse impacts of extreme events. APCC is also working with the NMHS/institutes in Indonesia, Malaysia, Philippines, and Viet Nam to develop infrastructure for adapting to climate change by utilizing the aforementioned products.

The APCC products and technology help enhancing/building national capacities of sustainability through provision of state-of-art climate forecasting and monitoring tools, and also through transfer of downscaling technology at no extra cost. This reduces the costs of development and infrastructure in many developing nations of the region while providing them sustainable climate information products.

<table>
<thead>
<tr>
<th>12-month Tier-1 MME System</th>
<th>Extreme Climate Prediction</th>
<th>Statistical Downscaling</th>
<th>Climate Information and Early Warning System</th>
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<tr>
<td>~2010</td>
<td>T159 AGCM</td>
<td>Downscaling for key APEC region</td>
<td>+ Comprehensive climate datasets; hindcast data; WCRP TFSP data; typhoon simulation from NASA</td>
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<tr>
<td>In-house coupled models</td>
<td>ISO, extreme event forecast</td>
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<td>+ Climate-environmental monitoring by satellite data</td>
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<td>Atmospheric-ocean-land data assimilation</td>
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<td>6-month MME forecast</td>
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</table>

| ~2012                       | 30-km high-resolution     | Early warning system for ENSO, IOD, floods, droughts, etc. |
| 12-month MME forecast       | Coupled system             |                                                        |
| Extreme climate prediction  |                            |                                                        |

| ~ 2025                     | 1 year to decadal climate projection for ENSO, droughts, energy, water resources, etc. |
| Decadal Projection          | Regional climate forecast with downscaling and high-resolution model |
| Climate Application         | Tropical cyclone activity, ISO, extreme climate events, climate adaptation |
| Climate Monitoring          | IPCC, WMO climate change program |

Fig. 4. Long-term goal of APEC Climate Center toward regional adaptation on climate change
ANNEX I.

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

This report documents the important climate conditions in Asia-Pacific since the boreal summer of 2007, analyzed by APEC Climate Center. More products can be found at http://www.apcc21.net

1. 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.

2. 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 northeastern part of Asia. Such conditions persisted over the northern central Asia till the end of the following fall season. In particular, severe rainfall deficiency was found over northwestern part of China, Mongolia and central Asia during SON. Suppressed rainfall was also found in the same SON period over the southeastern 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. Wetter than normal condition persisted till 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 northeastern 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 southeastern coastal China and neighboring 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 northeastern 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 southeastern 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 southeastern U.S. and part of Mexico. 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 northeastern South America and the equatorial Atlantic. It remained warm and dry in the southeastern U.S. The western part of U.S. as well as the southeastern part of South America also saw suppressed rainfall.
This document reports the overall performance of seasonal forecasts since Fall 2007 that was provided to APEC economies on monthly basis by APEC Climate Center. More products can be found at http://www.apcc21.net

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
b. 2007 DJF
d. 2008 FMA
e. 2008 MAM
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 \( f_{ij} \) \((i=1,\ldots,n)\) 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 \( s_{x_j}^2 \) and \( s_{f_j}^2 \) are given by:

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

\[
s_{x_j}^2 = \frac{1}{n-1} \sum_{i=1}^{n} (x_{ij} - \bar{x}_j)^2, \quad s_{f_j}^2 = \frac{1}{n-1} \sum_{i=1}^{n} (f_{ij} - \bar{f}_j)^2
\]

The mean squared error of the forecasts is:

\[
MSE_j = \frac{1}{n} \sum_{i=1}^{n} (f_{ij} - x_{ij})^2
\]

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:

\[
MSE_{cj} = \frac{n-1}{n} s_{x_j}^2
\]

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:
\[ MSSS = 1 - \frac{\sum_j w_j \text{MSE}_j}{\sum_j w_j \text{MSE}_{cj}} \]

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

For either \( \text{MSSS}_j \) or \( \text{MSSS} \) a corresponding Root Mean Squared Skill Score (RMSSS) can be obtained easily from

\[ \text{RMSSS} = 1 - \left(1 - \text{MSSS}\right)^{1/2} \]

\( \text{MSSS}_j \) for forecasts fully cross-validated (with one year at a time withheld) can be expanded (Murphy, 1988) as

\[
\text{MSSS}_j = \left\{ \frac{2 S_{fj}}{S_{xj}} r_{fsj} - \left( \frac{S_{fj}}{S_{xj}} \right)^2 - \left( \frac{\bar{f}_j - \bar{x}_j}{S_{xj}} \right)^2 + \frac{2n-1}{(n-1)^2} \right\} \div \left\{ 1 + \frac{2n-1}{(n-1)^2} \right\}
\]

where \( r_{fsj} \) is the product moment correlation of the forecasts and observations at point or station \( j \).

\[
r_{fsj} = \frac{1}{n} \sum_{i=1}^{n} \left( f_{ij} - \bar{f}_j \right) \left( x_{ij} - \bar{x}_j \right)
\]

\[
S_{fj} S_{xj}
\]

The first three terms of the decomposition of \( \text{MSSS}_j \) 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 \( i \) (\( i = 1, \ldots, 3 \)), let \( n_i \) 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.

<table>
<thead>
<tr>
<th>Forecasts</th>
<th>Observation s</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Below Normal</td>
</tr>
<tr>
<td>Below Normal</td>
<td>n_{11}</td>
</tr>
<tr>
<td>Near Normal</td>
<td>n_{21}</td>
</tr>
<tr>
<td>Above Normal</td>
<td>n_{31}</td>
</tr>
<tr>
<td></td>
<td>n_•1</td>
</tr>
</tbody>
</table>

In Table 1, n_•i and n_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:

\[ W_i = \begin{cases} 
1 & \text{when verification is done at stations or at single grid points within a 10 degree box.} \\
\cos(\theta_i) & \text{at grid point } i, \text{ when verification is done on a grid.} 
\end{cases} \]

\[ \theta_i = \text{the latitude at grid point } i. \]

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):

\[
p_{ij} = \frac{n_{ij}}{N}
\]

The sample probability distributions of forecasts and observations respectively then become

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

\[
p(x_i) = \sum_{j=1}^{3} p_{ji} = p_i ; i = 1, \ldots, 3
\]

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 \( s_{ij} \) (\( i = 1, \ldots, 3 \)), which is a tabulation of the reward or penalty every forecast/observation outcome represented by the contingency table will be accorded:

\[
\text{GSS} = \sum_{i=1}^{3} \sum_{j=1}^{3} p_{ij} s_{ij}
\]

The scoring matrix is given by

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

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

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.
MME, prec, 1982-2004, FMA

MSSS

MSSS correlation

-0.61 -0.49 -0.36 -0.3 0.3 0.36 0.49 0.61
Gerrity Skill Score
b. MAM
Gerrity Skill Score
MME, prec, 1982-2003, AMJ

MSSS

MSSS correlation

32
Gerrity Skill Score
d. MJJ

MME, prec, 1983-2003, MJJ

MSSS correlation

35
Gerrity Skill Score

Precipitation

Air temperature at 850mb
MME, prec, 1983-2003, JJA

MSSS correlation

-0.61 -0.49 -0.36 -0.3 0.3 0.36 0.49 0.61
Gerrity Skill Score
MME, prec, 1983-2003, JAS

MSSS

MSSS correlation
Gerrity Skill Score
ANNEX III.

APEC CLIMATE SYMPOSIUM
Lima, Peru, 19 to 21 August 2008

This document contains the draft summary of the APEC Climate Symposium under the APEC project “APEC Climate Center for Climate Information Services to Society (2007/BMC2/019-27, IST 01/2008)”

DRAFT REPORT

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 participants from 31 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).

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

4. The opening ceremony was declared open by Dr. Antonio Brack, Minister of the Ministry of Environment, at 0950 hrs on Tuesday, 19 August 2008 in the Museo de la Nacion (National Museum), Lima, Peru.

5. The following statements were delivered at the opening ceremony:
   - The welcome and opening address by Dr. W.J. Lee, Executive Director, APCC
• Congratulatory message from Mr. Peter Chen, WMO representative and The Chief of Data Processing and Forecasting Systems Weather and Disaster Risk Reduction Services, 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.

II SCIENTIFIC PRESENTATIONS

6. After the inaugural session, the sessions were kick-started with a keynote address on “Seasonal Forecasting in the Provision of Meteorological Services”, delivered by Mr. Peter Chen of WMO. The Session was informed of the WMO policies on the long-range infrastructure, important issues that climate forecasting centers should address for the benefit of the community. The keynote 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 NWS Chile talked about the regional 3-month climate predictions, based on regional models and the CPT tools, being pursued at their institute.

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 focussed 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 TNNU, 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 about 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 and performances of seasonal prediction based on the multi-model ensemble system provided by the APEC Climate Center.
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.

ii. Major General W. M. Gamarra of SENAMHI, Peru served as the Chair of the Group.

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

14. The session, chaired by Mr. K. Takahashi of CPD/JMA Japan, and rapportuered 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, and training activities on climate prediction and applications.

15. 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 BUILDING IN PRODUCING AND USING RELIABLE CLIMATE PREDICTIONS

16. Dr. J.-K. Schemm of CPC/NCEP/NWS/NOAA, USA, chaired the session while Dr. Emilia K. Jin of COLA/GMU, USA, rapportuered 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.

17. 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

18. Following the lunch break the session restarted 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, Equador. He also elaborated on 3 areas of mutual interest where APCC and CIIFEN may cooperate in the near future. 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.

19. 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

20. 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.
Decisions of Working Group

21. The group appointed Mr Wilar Gamarra Molina (Peru) as Chair of the Working Group, and recommend that Singapore be the next venue, since it will be next APEC’s host;

22. 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;


24. Encourage participation of Committee Members to share coupled prediction and longer hindcast data;

25. Recognize the opportunity offered by the APCC for openDAP data server for CHFP project in coordination with WGSIP/WCRP/WMO;

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

27. 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;

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

29. 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.

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

31. 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 WMO resources for training can be considered.

32. Applications were recognized as a very exciting 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 product to be more understandable and useful for non-expert users.

33. Capacity building: APCC is not to only 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 (CLIK) is underway. Effective management of data is important, and cooperation with WMO and the WMO information system should be considered.

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 the Government office facilities and
supplies.

VIII. COORDINATION WITH OTHER INTERNATIONAL ACTIVITIES

38. The session was informed by the APCC that the:

(a) 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.

(b) Participating 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.

(c) To participate actively in 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.

39. The session took note of the activities of the RCOF under CLIPS program of WMO in conjunction with regional climate service

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

40. The Session noted a few offers and recommendations to host the Symposium of 2009. Among the proposed venues are Monterey U.S.A., Busan Korea, and Singapore. However, it recommended that Singapore be the next venue, subject to factors such as the approval of its Government, as it will be hosting the next APEC leaders and associated senior officers meetings. The venue and exact date of the Symposium will be announced by APCC in consultation with local host and the executive council of APCC.

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.
XI. ADOPTION OF THE REPORT

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

XII. 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

<table>
<thead>
<tr>
<th>Title</th>
<th>Name</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr.</td>
<td>Alves, Oscar</td>
<td>Bureau of Meteorology / Australia</td>
</tr>
<tr>
<td>Ms</td>
<td>Araneda, Myrna</td>
<td>Dirección Meteorológica de Chile / Chile</td>
</tr>
<tr>
<td>Prof</td>
<td>Ambrizzi, Terzio</td>
<td>Department of Atmospheric Sciences / Brazil</td>
</tr>
<tr>
<td>Mr.</td>
<td>Archevarahuproek, Boonlert</td>
<td>Thai Meteorological Department / Thailand</td>
</tr>
<tr>
<td>Dr.</td>
<td>Behera, Swadhin K.</td>
<td>Japan Agency for Marine-Earth Science and Technology / Japan</td>
</tr>
<tr>
<td>Dr.</td>
<td>Carrasco, Jorge</td>
<td>Dirección Meteorológica de Chile / Chile</td>
</tr>
<tr>
<td>Prof</td>
<td>Chang, C.P</td>
<td>Naval Postgraduate School / USA</td>
</tr>
<tr>
<td>Prof</td>
<td>Chen, Cheng-Ta</td>
<td>National Taiwan Normal University / Chinese Taipei</td>
</tr>
<tr>
<td>Mr.</td>
<td>Chen, Peter</td>
<td>World Meteorological Organization / Switzerland</td>
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<tr>
<td>Dr.</td>
<td>Fontecilla, Juan Sebastian</td>
<td>Canadian Meteorological Centre / Canada</td>
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<tr>
<td>Dr.</td>
<td>Hameed, Saji N.</td>
<td>APEC Climate Center / Korea</td>
</tr>
<tr>
<td>Mr.</td>
<td>Jamaluddin, Ahmad Fairudz</td>
<td>Malaysian Meteorological Department / Malaysia</td>
</tr>
<tr>
<td>Dr.</td>
<td>Jin, Emilia K.</td>
<td>George Mason Univ. / USA</td>
</tr>
<tr>
<td>Prof</td>
<td>Kang, In-Sik</td>
<td>Seoul National Univ. / Korea</td>
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<tr>
<td>Dr.</td>
<td>Karumuri, Ashok</td>
<td>APEC Climate Center / Korea</td>
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<tr>
<td>Dr.</td>
<td>Kattsov, Vladimir</td>
<td>Voeikov Main Geophysical Observatory / Russia</td>
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<tr>
<td>Dr.</td>
<td>Kimoto, Masahide</td>
<td>Univ. of Tokyo / Japan</td>
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<tr>
<td>Dr.</td>
<td>Lagos, Pablo</td>
<td>SENAMHI / Peru</td>
</tr>
<tr>
<td>Dr.</td>
<td>Lee, Myong-In</td>
<td>NASA / USA</td>
</tr>
<tr>
<td>Dr.</td>
<td>Lee, Byong-Lyol</td>
<td>Korea Meteorological Agency / Korea</td>
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<tr>
<td>Dr.</td>
<td>Lee, June-Yi</td>
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<tr>
<td>Dr.</td>
<td>Lee, Woo-Jin</td>
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<tr>
<td>Ms</td>
<td>Lijuan, Chen</td>
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<tr>
<td>Dr.</td>
<td>Lin, Hai</td>
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<tr>
<td>Mr.</td>
<td>Low, John</td>
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<tr>
<td>Dr.</td>
<td>Mascaranes, Affonso</td>
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</tr>
<tr>
<td>Dr.</td>
<td>Mason, Simon</td>
<td>International Research Institute, Columbia Univ. / USA</td>
</tr>
<tr>
<td>Eng.</td>
<td>Metzger, Louis</td>
<td>SENAMHI / Peru</td>
</tr>
<tr>
<td>Mr.</td>
<td>Molina, Wilar Gamarra</td>
<td>SENAMHI / Peru</td>
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<tr>
<td>Dr.</td>
<td>Moura, Antonio Divino</td>
<td>Instituto Nacional de Meteorologia / Brazil</td>
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<tr>
<td>Dr.</td>
<td>Nguyen, Dang Quang</td>
<td>National Hydro-Meteorological Service of Vietnam / Viet Nam</td>
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<tr>
<td>Mr.</td>
<td>Park, Yung-Suh</td>
<td>APEC secretariat / Singapore</td>
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<td>Dr.</td>
<td>Renwick, James</td>
<td>National Institute of Water &amp; Atmospheric Research / New Zealand</td>
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<tr>
<td>Eng.</td>
<td>Reyes, Carmen</td>
<td>SENAMHI / Peru</td>
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<tr>
<td>Dr.</td>
<td>Schemm, Jae-Kyung E.</td>
<td>National Centers for Environmental Prediction / National</td>
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<td>Name</td>
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<tr>
<td>Mr Swarinoto, Yunus S.</td>
<td>Indonesia Meteorological and Geophysical Agency / Indonesia</td>
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<tr>
<td>Mr Takahashi, Kiyotoshi</td>
<td>Japan Meteorological Agency / Japan</td>
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</tr>
<tr>
<td>Prof Wang, Bin</td>
<td>International Pacific Research Center, Univ.of Hawaii/ USA</td>
<td></td>
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APPENDIX II. List of acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>APCC</td>
<td>APEC Climate center</td>
</tr>
<tr>
<td>APEC</td>
<td>Asian Pacific Economic Cooperation</td>
</tr>
<tr>
<td>APN</td>
<td>Asia-Pacific Network</td>
</tr>
<tr>
<td>BCC</td>
<td>Beijing Climate Center</td>
</tr>
<tr>
<td>BMG</td>
<td>Badan Meteorologi dan Geofisika</td>
</tr>
<tr>
<td>CCM3</td>
<td>NCAR Community Climate Model</td>
</tr>
<tr>
<td>CCSR</td>
<td>Center for Climate System Research</td>
</tr>
<tr>
<td>CIIFEN</td>
<td>Centro Internacional para la Investigación del Fenómeno el Nino (Ecuador)</td>
</tr>
<tr>
<td>CliPAS</td>
<td>Climate Prediction and its Application to Society</td>
</tr>
<tr>
<td>CMA</td>
<td>China Meteorology Agency</td>
</tr>
<tr>
<td>GEF</td>
<td>Global Environment Facility</td>
</tr>
<tr>
<td>GMAO</td>
<td>Global Modeling and Assimilation Office</td>
</tr>
<tr>
<td>GPC</td>
<td>Global Producing Centre</td>
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<tr>
<td>INMET</td>
<td>Instituto Nacional de Meteorologia</td>
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<td>IPRC</td>
<td>International Pacific Research Center</td>
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<tr>
<td>IRI</td>
<td>International Research Institute</td>
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<td>JMA</td>
<td>Japan Meteorological Agency</td>
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<tr>
<td>KOICA</td>
<td>Korea International Cooperation Agency</td>
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<tr>
<td>MME</td>
<td>multi-model ensemble</td>
</tr>
<tr>
<td>NGSFC</td>
<td>National Aeronautics and Space Administration's Goddard Space Flight Centre</td>
</tr>
<tr>
<td>NIWA</td>
<td>National Institute of Water &amp; Atmospheric Research</td>
</tr>
<tr>
<td>NMHS</td>
<td>The Meeting of National Meteorological and Hydrological Service</td>
</tr>
<tr>
<td>NPS</td>
<td>Naval Postgraduate School</td>
</tr>
<tr>
<td>NTNU</td>
<td>National Taiwan Normal University</td>
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<tr>
<td>NWS</td>
<td>National Weather Service</td>
</tr>
<tr>
<td>SENAMH</td>
<td>Servicio Nacional de Meteorologia e Hidrologia (National Meteorological and Hydrological Service)</td>
</tr>
<tr>
<td>UH</td>
<td>Univ. of Hawaii</td>
</tr>
<tr>
<td>WCRP</td>
<td>World Climate Research Programme</td>
</tr>
<tr>
<td>WGSIP</td>
<td>Working Group on Seasonal to Interannual Prediction</td>
</tr>
<tr>
<td>WMO</td>
<td>World Meteorological Organization</td>
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