APEC CLIMATE CENTER

TENTATIVE PLAN FOR ASIA PACIFIC DATA EXCHANGE PORTAL
(Submitted by APEC Climate Center)

Summary and Purpose of Document

This document introduces APCC's activity and plan for a regional data server associated with CHEP experiment.

ACTION PROPOSED

For the perusal of the WG participants

Asia Pacific Data Exchange Portal

Current status and plans for contributing to CHFP experiments

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1. Preamble

APEC Climate Center

The Asia Pacific Economic Cooperation (APEC) Climate Center (APCC) aims at realizing the APEC vision of regional prosperity through the enhancement of economic opportunities, the reduction of economic loss, and the protection of life and property by responding effectively to natural disasters and mitigating economic losses in the case of extreme climate events. APCC aims to enhance the socio-economic well-being of the APEC member economies by utilizing up to date scientific knowledge and applying innovative climate prediction techniques. The mission statement of APCC describes the following major functionalities:

- Facilitating the share of high-cost climate data and information to minimize economic and human losses due to natural disasters
- Capacity building in climate prediction and sustainable social and economic applications of climate information
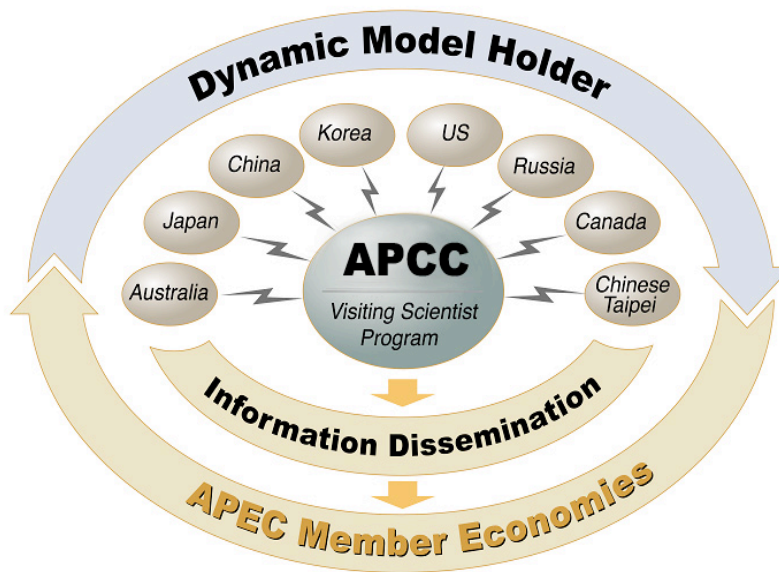
The recurring keyword in the mission and vision statements is "exchange" or sharing data between two or more partners to maximize the utility of climate information for societal benefit. To facilitate the mission goals, APCC has built up an international network of climate prediction providers (Fig. 1) and operates a Multi Model Ensemble (MME) prediction system, output from which is shared with the model providers and the National Meteorological and Hydrological Services (NMHS) in the APEC economies. Since its inauguration in November 2005, APCC has been providing operational 3-month lead dynamical seasonal predictions through the MME technique. MME predictions are facilitated through multi-institutional co-operation within the APEC region. 15 Tier-2 and two Tier-1 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.

As a by-product of these operations, APCC also holds an extensive collection of seasonal dynamical climate prediction data (hindcasts and forecasts) and supporting observational data which are undoubtedly of great value for not only the operational communities, but also for climate research communities in the APEC region and elsewhere. Thanks to a resolution by the APCC Working Group during the APEC Climate Symposium in 2006, a majority of this collection is now open to the research and operational communities for purposes of non-commercial research and operations.

Climate-system Historical Forecast Project (CHFP)

The CHFP is a new experimental framework proposed by the Task Force for Seasonal Prediction (TSFP) of the World Climate Research Program (WCRP). The TFSP proposed the CHFP as a multi-model and multi-institutional experimental framework for sub-seasonal to decadal complete physical climate system prediction.   This experimental framework is based on advances in climate research during the past decade, which have lead to the understanding that modeling and predicting a given climate anomaly over any region is incomplete without a proper treatment of the effects of SST, sea ice, snow cover, soil wetness, vegetation, stratospheric processes, and atmospheric composition (carbon dioxide, ozone, etc.).

The core experiment is an 'Interactive Atmosphere-Ocean-Land-Ice Prediction Experiment'

emphasizing the use of comprehensive coupled general circulation models, which includes realistic interactions among the component models. The experiment is to perform seven-month lead ensemble (10-members) predictions of the total climate system. If possible longer leads and larger ensembles are encouraged. The initialization strategy is to use the best available observations of all the components of the climate system.

While the emphasis in on comprehensive coupled general circulation models, uncoupled component, intermediate, simplified and statistical models are encouraged to participate where appropriate. The fundamental experimental design is to mimic real prediction in the sense that no "future" information can be used after the forecast is initialized. For example, the PROVOST or DSP experiments would be excluded because they use observed SST as the simulation evolves, whereas the SMIP/HFP experiment could be included as subset since no future information is used as the forecast evolves[1].

The component models should be interactive, but this is left open to accomplish a wider participation, e.g. for groups without sea-ice or vegetation model. The only requirement is that no "future" information is used once the prediction is initialized. This requirement necessarily includes any tuning or training either the component models or the development of statistical prediction schemes.

Thus, the component models are:
- Ocean – Open but interactive (e.g., slab mixed layer or GCM)
- Atmosphere – Open but interactive (most likely a GCM)
- Land – Open but interactive (e.g. SSiB, Mosaic, BATS, CLM, Bucket)
- Ice – Open but interactive (e.g., thermodynamic or dynamic)

The results of these experiments provide a framework for future experiments, specifically these prediction results will:

(i)   Provide a baseline assessment of our seasonal prediction capabilities using the best available models of the climate system and data for initialisation.
(ii)   Provide a framework for assessing of current and planned observing systems, and a test bed for integrating process studies and field campaigns into model improvements
(iii)   Provide an experimental framework for focused research on how various components of the climate system interact and affect one another
(iv)   Provide a test bed for evaluating IPCC class models in seasonal prediction mode

2. Overview and Introduction

In the Working Group meeting held at Barcelona, Spain in 2007, the WGSIP requested APCC to be one of the distributed data centers for the CHFP data. Currently, though APCC provides its own collection of digital data from the MME based operations through an openDAP server to registered customers (http://cis.apcc21.net), the enhanced demands from the user communities and WCRP called for the enhancement and rethinking of the current data provison services. To this end, APCC has started work on the development of Asia Pacific Data Exchange Portal (ADEPT), a system that will facilitate the exchange, discovery and utilization of diverse climate prediction data sets

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[1]   The SMIP/HFP experiment is viewed as a subset of the experiments proposed here since they do not necessarily include feedbacks from land surface or sea ice processes or the initialization of these components of the climate system.

Objectives

The objective of the Data Portal is to facilitate and promote the exchange and dissemination of climate prediction data resulting from operational centers and from co-ordinated intercomparison experiments. The portal will provide seamless access to collections and inventories of prediction data and will allow for the discovery, evaluation (through visualisation and metadata review) and access to data via web services. The system architecture will use modern and standards oriented Web-oriented information technologies to access the information available in its repositories.

3. Current status

Hardware

APCC has purchased a cluster of 4 servers to operate ADEPT. At the current configuration, the system can accommodate upto 10 TerraBytes of data. The data are shared among 4 servers via GFS file system. All servers operate using Linux OS and are under HA (high availability) configuration, so any server can takes other's service when one of them fails.

Data Servers (software)

The following software components have been tested and installed

1. OpenDAP server – this server allows for data to be sliced according (http://opendap.org/)
2. GFDNavi server – data visualisation, hyperslicing, aggregration (http://www.gfd-dennou.org/arch/davis/gfdnavi/index.en.htm)
3. DEX   server -   allows for command line based data retrieval, slicing and reformatting for expert users (developed at APCC)

Application Tools

1. CLIK – Climate Information Tool Kit : enables users to do web-based online climate predictability experiments and downscaling (prototype at http://clik.apcc21.net)

4. Future plans

Operation of the data center will start in late February 2009 with basic functionalities for user registration, data discovery and data downloading and improved functionality will be added through the rest of 2009 according to the following time line. Currently part of the APCC data collection fulfils the minimum requirements as stipulated by the CHFP protocol and we plan to serve these immediately as a contribution to the experiment.

1st Phase (Jan-Mar) - Operation of version 0.5 of services portal

1. Servers - Thredds, GFDNavi, DEX

2. Type-1 data – Atmospheric Model Predictions
- Hindcast of   8 Atmospheric Model Predictions initialized every month from 1979 to 2003
- Realtime Forecasts of same models from 2005 to present
- Variables (Montly 6-month lead Atmospheric model output for following 8 variables)

- Level variables: Temperature at 850hPa, zonal and meridional winds at 200 and 850hPa, Geopotential height at 500hPa
- Surface variables – Total precipitation, Mean sea level pressure

3. Type-2 data – Coupled Ocean-Atmosphere Model Predictions
- Hindcast of 6 Coupled Model Predictions initialized each February, May, August and November of each year from 1983 to 2002
- Realtime Forecasts of same models from 2008 to present
- Variables (Montly 6-month lead Atmospheric model output for following 8 variables)
- Level variables: Temperature at 850hPa, zonal and meridional winds at 200 and 850hPa, Geopotential height at 500hPa
- Surface variables – Total precipitation, Mean sea level pressure

4. Requests to contribute to APCC CHFP server sent to model providers in Asia Pacific region

2nd Phase (Apr-Jun)   - Operation of version 0.6

1. New server - wDEX server (web version of DEX)
2. Application tools – CLIK
2. Data – addition of additional years for the above models as stipulated by CHFP framework

3rd Phase (Jul-Sep) - Addition of external CHFP data starts

4th Phase (Oct-Dec) - Service of external CHFP data