Report for 40th Session of

ESCAP/WMO Typhoon Committee

21 to 26 November 2007

Meteorological Services Division
National Environment Agency
Singapore

I. Overview of Meteorological and Hydrological Conditions

Singapore did not experience any direct impact of tropical cyclone during November 2006 to October 2007.

However, the Northeast Monsoon Season of 2006/2007 was relatively severe with wet condition persisting through December 2006 to January 2007. The early part of the season was particularly wet with the highest monthly rainfall of 1180 mm recorded for December 2006. The month became the wettest December in 138 years, since records started in 1869.

The intense rainfall associated with the Northeast Monsoon surge occurring between 17 and 19 December caused floodwaters to rise to waist levels in some parts in of Singapore at one point – a sight not seen since last flooding on 2 December 1978. Damage to property as well as the disruption to traffic flow and business was reported due to the flooding.

II. Meteorology

1. Progress in Member's Regional Cooperation and Selected Strategic Plan Goals and Objectives:

a. Hardware and/or Software Progress.
Nil

b. Implications to Operational Progress
Nil

c. Interaction with users, other Members, and/or other components

The International Research Institute for Climate and Society (established through a cooperative agreement between Columbia University and the National Oceanic and Atmospheric Administration of the United States of America - NOAA) and the ASEAN Specialized Meteorological Centre (ASMC) conducted a joint training workshop on the ASEAN Seasonal-Interannual Climate Prediction and its Applications in Singapore on 21-30 May 2007.

The workshop provided participants with an overview of seasonal forecasting methods, with a focus on statistical downscaling. The central theme was the tailoring of forecast and other climate information for risk management applications, for which practical statistical approaches were introduced.

The workshop was hosted by ASEAN Specialized Meteorological Centre (ASMC) which is co-located in Meteorological Services Division (MSD) of the National Environment Agency (NEA). It was held at NEA, Environment Building, Singapore. This workshop was a collaborative activity under the Memorandum of Understanding between NOAA and NEA-MSD for Technical Cooperation in Meteorology and Climate.

This 2007 workshop is a follow up of the 2006 activities. In Nov 2006, a team of scientists from five ASEAN countries (Indonesia, the Philippines, Singapore,

Thailand, and Vietnam) were invited by International Research Institute (IRI) for a one month working visit in IRI. The attachment to IRI involved the study of the correlations of various large-scale global circulation data and SSTs with the local rain fall gauges data, brought by the participants. The result of the attachment is the selection of an IRI-developed statistical tool, Climate Prediction Tool, and the use of appropriate data sets, namely the global climate model, ECHAM, and tropical SSTs, for the 2007 workshop.

The model outputs are currently being used in MSD in addition to other tools.

d. Training progress

With the establishment of the Tsunami Early Warning System, MSD has in the past year been very active in staff training in both professional and administrative fields. The following lists the participations in regional training programs.

- Three meteorological officers are currently attending the "Applied Meteorology Course for Forecasters" at Nanjing University of Information Science & Technology (NUIST), China from May 2007 – January 2008.
- One meteorological officer participated in the Typhoon Committee Roving Seminar held in Manila, Philippines on 3–8 Sept 2007.
- One meteorological officer participated in the "3rd Session of the Forum on Regional Climate Monitoring Assessment & Prediction for Asia" on 3–7 April 2007 in Beijing Climate Centre, Beijing, China.
- One meteorological officer attended the "WMO Regional Seminar on Enhancing Service Delivery" in Kuala Lumpur, Malaysia on 1- 6 April 2007.
- One meteorological officer attended the "Training Course on Severe Convective Storm Nowcasting in Beijing, China on 31 March–13 April 2007.
- One meteorological officer attended the WMO International Training Workshop on Tropical Cyclone Disaster Reduction on 25 March-1 April 2007 in Guangzhou, China.
- The ASEAN Specialised Meteorological Centre (ASMC) in collaboration with NOAA-IRI organized a "Workshop on ASEAN Seasonal-Interannual Climate Forecasting and its Applications in Singapore on 21–31 May 2007. The Workshop was attended by officers from the ASEAN Member countries (Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam). Climate experts from USA, Australia, Indonesia and Singapore were invited as lecturers at the Workshop.

A number of the above were Typhoon Committee sponsored training programs. MSD would like to express her gratitude to the host countries for providing the opportunities.

e. Research Progress

f. Other Cooperative/ Strategic Plan Progress.

2. Progress in Member's Important, High-Priority Goals and Objectives (towards the goals and objectives of the Typhoon Committee).

a. Hardware and/or Software Progress

Development of National Tsunami Early Warning System

The development of Singapore's national Tsunami Early Warning System comprises the enhancement of the seismic and tidal monitoring systems, development of tsunami modelling capability as well as a national tsunami response plan. The objective of the system is to enable Singapore to better assess potential impacts of tsunamis on the country, enhance its national preparedness and contribute to regional and international efforts to monitor and mitigate potential disasters. The upgrade of the seismic and tidal gauge systems and the development of the tsunami modeling capability are in progress and is expected to be completed as planned in Aug 2008. A national tsunami task force led by MSD has been formed to coordinate the efforts of the various response agencies to deal with a tsunami incident. A preliminary response plan has been formulated to guide agencies in the event of a tsunami incident.

Migration of the Main Computing System

The mainframe computer is the core data processing system in MSD and handles the processing of weather data generated locally as well as those received from weather stations around the world. These data are used for performing weather analysis and forecast and for the generation of specialized products and services customized to meet the specific requirements of MSD main user groups. The current mainframe computer system which was installed in 1994, is in the process of being replaced with an open system based on a J2EE 3-tier (web, application and database) architecture, which will facilitate further development and integration of various computing resources in MSD. The migration process which has taken about a year and a half is close to completion and is expected to be rolled out to users by Nov 2007. The new system will present users with a more user-friendly web portal interface as well as support the provision of web services to users.

Revamp of Weather Information Dissemination System

MSD is currently in the process of upgrading its integrated weather information dissemination system, which provides weather information to the public through various communication channels (such as interactive voice, fax, pager and SMS). With the increasing popularity of mobile phones, the system has been enhanced to enable the dissemination of a large volume of SMS to users in a very short period of time. This system is currently used for automatically disseminating SMS alerts of earthquakes/tremors and heavy rain incidents to public agencies as well as lightning risk warnings to subscribers.

b. Implications to Operational Progress
(including exchange of in situ and remotely sensed data and uses; development of guidance and data requirements; improved use of consensus/ensemble model guidance; exchange of information with other Members via the internet; validation and verification activities; exchange/provision of information among Members; use of these exchanged data/information for improved forecasts; establishment of networks; expansion of the area coverage of forecasts and warnings; improvement of accuracy of forecasts/warnings; development of related tools and techniques; and improvement of timeliness of forecasts/warnings dissemination).

c. Interaction with users, other Members, and/or other components (including

improvement of meteorological products to meet users' requirements and expectation; enhancement of community participation; linkage with other components (hydrology and DPP); use of integrated meteorological products and services in capacity building and sustainability decisions; and development of regional requirements; new dissemination methods).

d. Training Progress
(As in 1d)

e. Research Progress

The Research and Development Section of MSD has developed the Systematic Objective Area Prediction (SOAP) system which uses WRF as the underlying mesoscale prediction model. The system is developed in Linux with open-source tools and shell scripting. SOAP is on operational trial and is evaluated daily with the images from of the precipitation radar.

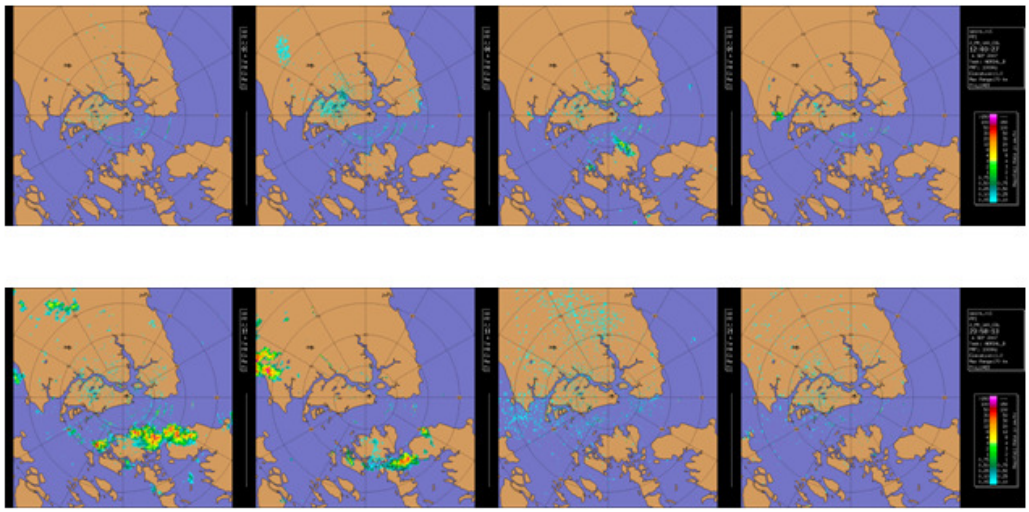

Figure 1 Radar Images of rainfall over Singapore on the 6 Sep 2007

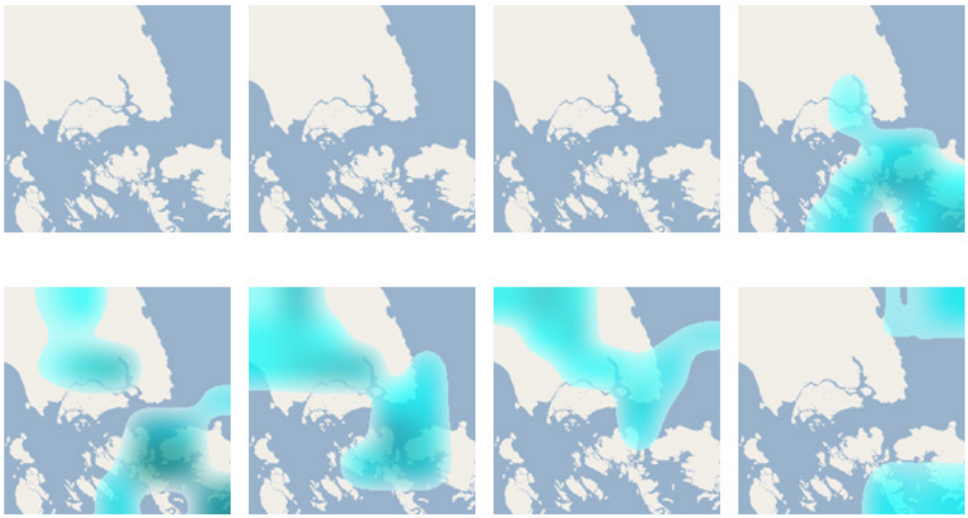

Figure 2 SOAP prediction for the same day, issued a day earlier on the 5th Sep 3pm.

f. Other Cooperative/Strategic Plan Progress.
Nil

3. Opportunities for Further Enhancement of Regional Cooperation
Nil.

III. Hydrology

(Hydrology matters are handled the Public Utilities Board (PUB) in Singapore. The activities will not reported here)

IV. Disaster Prevention and Preparedness (DPP)

1. Progress in Member's Regional Cooperation and Selected Strategic Plan Goals and Objectives:

a. Hardware and/or Software Progress

(See item II 2a)

b. Implications to Operational Progress

c. Interaction with users, other Members, and/or other components.

d. Training Progress
In view of an increased expectation from the public and media on early warnings and alerts on severe weather conditions, NEA had organized a 2-day Intensive Level Media Management Training Seminar to equip staff with media handling skills. More than 10 NEA senior staff members including those from MSD attended the seminar. Some specific skills and difficulties related to the recent Severe Monsoon Season were discussed.

e. Research Progress.

f. Other Cooperative/ Strategic Plan Progress.

2. Progress in Member's Important, High-Priority Goals and Objectives (towards the goals and objectives of the Typhoon Committee).

a. Hardware and/or Software Progress

b. Implications to Operational Progress

c. Interaction with users, other Members, and/or other components

Singapore is located close to the equator (1.5 N) and normally not affected by tropical cyclone directly. However, historical record shows that tropical cyclone "Vamei" came as close as 50 km from Singapore on 27 December 2001. The event did not cause significant damage to Singapore due to its rapid weakening on approaching land.

Under the backdrop of climate change, a multi-agency task force called Extreme Weather Group (EWG) was formed. The EWG was tasked to study the how best the impact of similar events in the future could be mitigated. The study has concluded and has provided recommendations for various agencies. A follow-up more-detailed investigation –Climate Change Vulnerability Study which is a joint effort between NEA and National University of Singapore has also been initiated. The ongoing study is looking into impacts of possible sea-level rise and extreme weather conditions.

e. Research Progress.

f. Other Cooperative/ Strategic Plan Progress.

3. Opportunities for Further Enhancement of Regional Cooperation
Nil

V. Typhoon that Impacted TC Members

Nil

VI. Resource Mobilization Activities

1. Capacity building on Climate Prediction in ASEAN:

(a) The ASEAN Specialized Meteorological Centre (ASMC) and US National Oceanic and Atmospheric Administration (NOAA) have collaborated to develop Seasonal-Inter-annual (S-I) prediction capacity of ASEAN member countries. The project is aimed to enhance the technical capacity of ASEAN in making and tailoring seasonal climate forecasts for risk management in important sectors such as agriculture, water resources and public health. The active participation in the project various workshops and training by the ASEAN countries underlies the importance of technical expertise in this area, which is vital in mitigating impacts of extreme climate such as droughts and floods. The project is funded by NOAA and coordinated by the ASEAN Specialized Meteorological Centre (ASMC).

As part of this collaborative effort, the International Research Institute for Climate and Society (IRI) (established through a cooperative agreement between Columbia University and the National Oceanic and Atmospheric Administration of the United States of America - NOAA) and the ASEAN Specialized Meteorological Centre (ASMC) conducted a joint training workshop on the ASEAN Seasonal-Inter-annual Climate Prediction and its Applications in Singapore on 21-30 May 2007.