MEMBER REPORT

ESCAP/WMO Typhoon Committee
8th Integrated Workshop/2nd TRCG Forum

Singapore

Macao, China
2 - 6 December 2013

CONTENTS

I. Overview of tropical cyclones which have affected/impacted Member's area in 2013

1. Meteorological Assessment (highlighting forecasting issues/impacts)

   Singapore is not directly affected by the presence of tropical cyclones in the region, the only exception being Tropical Cyclone "Vamei", which passed within 65 km from Singapore in 2001. However, tropical cyclones which move across the South China Sea may exert some indirect influence on the weather in Singapore. These effects may be in the form of extended rain bands from the cyclones, increased instability leading to enhanced convective activity, and the strengthening and convergence of southwesterly winds resulting in line squalls affecting Singapore, bringing heavy rain and strong surface wind gusts.

   The weather in Singapore is largely dominated by monsoons throughout the year. The Northeast Monsoon typically lasts from December to March, bringing with it the traditional wet season during the 1st half of the Monsoon season from December to January. The second half or dry phase of the Northeast Monsoon typically affects Singapore around February and March. The Southwest Monsoon typically lasts from June to September. Separating the 2 distinct monsoon seasons are the Inter-Monsoon periods from April to May and October to November.

   During the 2013 Pacific Typhoon season, there were a number of occasions in which tropical storms indirectly affected the weather in Singapore.

   Tropical Storm Yagi developed in the Philippine Sea on 8 June 2013. This tropical storm influenced the wind field over southern ASEAN region, resulting in scattered thunderstorms over Singapore on 2 days. In August 2013, Tropical Storms Jebi and Mangkhut and Typhoon Utor induced south-westerly and westerly winds in the region, resulting in the passage of squall lines or "Sumatra" squalls over Singapore on 9 days. In September 2013, Typhoon Wutip also resulted in the passage "Sumatra" squalls over Singapore on 4 days. Similarly, in October 2013, Typhoon Nari brought unstable weather conditions over Singapore and the vicinity as it tracked over the South China Sea. These situations resulted in moderate to heavy rainfall over Singapore and the immediate vicinity.

2. Hydrological Assessment (highlighting water-related issues/impact)

   It is a challenging task to manage water for both water resource and flood control as these two functions have conflicting interest. Keeping high storage water level is optimal for water resource which may result in increasing the risk of flooding. Accurate, reliable and timely weather forecast will be a good decision support tool to help manage the water resource more efficiently.

3. Socio-Economic Assessment (highlighting socio-economic and DRR issues/impacts)
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4. Regional Cooperation Assessment (highlighting regional cooperation successes and challenges)
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II. Summary of progress in Key Result Areas

TC Members' Report
Summary of Progress in KRAs

Title of item 1: Heavy Rain and Strong Winds Advisory and Warnings

To help alleviate the impact of storms such as squalls, or tropical cyclones, the Meteorological Service Singapore (MSS) provides heavy rain and strong winds advisory and warnings to various government agencies to enhance preparedness for expected heavy rain and/or strong wind events.

The warnings are also made available to members of the public via the media, internet as well as via smart phone applications.

Identified opportunities/challenges, if any, for further development or collaboration:

Nil

Summary Table of relevant KRAs and components (please tick boxes, can be more than one, as appropriate):

KRA =	1	2	3	4	5	6	7
Meteorology	✓	✓		✓			
Hydrology							
DRR							
Training and research							
Resource mobilization or regional collaboration							

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TC Members' Report
Summary of Progress in KRAs

Title of item 2: Hydrological Achievements and Results

Over the past decades, Singapore has been improving the drainage infrastructure. The flood-prone areas have been reduced from 3200 ha in the 1970s to about 37 ha today.

Singapore continuously reviews and upgrades her drainage infrastructure to ensure an effective drainage network for flood alleviation and prevention.

Identified opportunities/challenges, if any, for further development or collaboration:

Nil

Summary Table of relevant KRAs and components (please tick boxes, can be more than one, as appropriate):

KRA =	1	2	3	4	5	6	7
Meteorology							
Hydrology	✓						
DRR							
Training and research							
Resource mobilization or regional collaboration							

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Summary of Progress in KRAs

Title of item 3: Participations in Training Workshops, Conferences and Meetings

Singapore participated in several meteorological training workshops/conferences/meetings during the year. Our officers have found the training workshops/meetings educational and beneficial in their course of work. The list of relevant workshops/conferences attended in 2013 are as follows:

- WMO Regional Training Seminar for National Trainers of RA II and RA V, 26 Feb - 7 Mar 2013, Bogor, Indonesia
- 3rd MSC Mekong & 9th TWG Mekong Meetings, 31 Mar - 1 Apr 2013, Siem Reap, Cambodia
- International Training Course on Aeronautical Meteorology Services, 9 - 19 Apr 2013, Beijing, China
- Workshop on Sub-Committee on Space Technology and Applications Cooperative Project, 25 - 26 Apr 2013, Bangkok, Thailand
- RA V Workshop on WMO Information System (WIS)/Table Driven Codes Form, 7 - 17 May 2013, Melbourne, Australia
- International Training Course on Nowcasting, 15 - 23 May 2013, Beijing, China
- 35th Meeting of the SCMG, 2 - 4 Jul 2013, Manado, Indonesia
- Seminar on "Social and Economic Benefits and Delivery of Meteorological and Hydrological Services, 21 - 25 Oct 2013, Bandar Seri Begawan, Brunei Darussalam
- 5th International Workshop on Monsoons (IWM-V), 28 Oct – 1 Nov 2013, Macao, China

Identified opportunities/challenges, if any, for further development or collaboration:

Nil

Summary Table of relevant KRAs and components (please tick boxes, can be more than one, as appropriate):

KRA =	1	2	3	4	5	6	7
Meteorology							
Hydrology							
DRR							
Training and research			✓				
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TC Members' Report
Summary of Progress in KRAs

Title of item 4: New Lightning Detection Network

In December 2010, MSS embarked on a project to install a new Lightning Detection Network (LDN) to detect lightning activities over Singapore and the surrounding region. The LDN was commissioned in March 2013.

The LDN comprises four of Vaisala TLS200 lightning detection sensors located around Singapore. The sensors are able to detect both cloud-to-cloud and cloud-to-ground lightning strokes, which are collectively known as Total Lightning.

Cloud discharges and cloud-to-ground (CG) flashes both emit radio frequency pulses over a wide range of frequencies. Cloud-to-ground lightning emits the highest amplitude pulses in the LF to VLF range as a large amount of current travels over a long distance during a cloud-to-ground stroke. For the detection of cloud-to-ground lightning, the time-of-arrival method is combined with magnetic direction finding. The time-of-arrival method is based on measuring the time difference between the electromagnetic pulse detections by the different sensors. Magnetic direction finding is used to determine the direction of the lightning stroke based on magnetic field detection.

The LDN has a location accuracy of about 100 to 200 metres for cloud-to-ground lightning strokes and about 1 to 2 kilometres for cloud-to-cloud lightning strokes when all 4 sensors are in operation. The detection efficiency of the LDN is estimated to be greater than 90% for both cloud-to-ground and cloud-to-cloud lightning. The location accuracy and detection efficiency will be reduced when lightning occurs beyond the range of the LDN or when not all lightning detection sensors are in operation.

Identified opportunities/challenges, if any, for further development or collaboration: **Nil**

Summary Table of relevant KRAs and components (please tick boxes, can be more than one, as appropriate):

KRA =	1	2	3	4	5	6	7
Meteorology		✓		✓		✓	
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DRR							
Training and research							
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TC Members' Report
Summary of Progress in KRAs

Title of item 5: New Lightning Information Service

MSS launched a new free Lightning Information Service (LIS) in October 2013. This is a service provided charge-free to the public, giving them real-time detected lightning information available via smartphone application, the MSS website and the weather information hotline.

The smart phone lightning application, Lightning@SG, can be downloaded from the App Store or Play Store for iPhone and Android phone users respectively. Users will be able to customise up to three locations of interest and receive push alerts when lightning is detected within a pre-defined distance of either 6km or 8km from their location of interest. In addition, they are able to choose the type of lightning (cloud-to-cloud and/ or cloud-to-ground) and thundery showers forecast for which to receive a push alert. These would be particularly useful for those who are outdoors.

The lightning information service will also be available on the MSS website at http://online.weather.gov.sg/lightning/ which has similar functions as the Lightning@SG application. The website can also be accessed via a link from the NEA website at http://app2.nea.gov.sg/weather-climate/specialised-services/lightning. The website will display a scrolling ticker message when lightning is detected in the selected watch areas. The public can also call the MSS weather information hotline at 6542 7788 for real-time lightning information.

To further educate the public on the potential lightning risk, MSS will be distributing educational material on lightning safety precautions to schools, community centres and facilities providing outdoor services.

Identified opportunities/challenges, if any, for further development or collaboration:
Nil

Summary Table of relevant KRAs and components (please tick boxes, can be more than one, as appropriate):

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Meteorology		✓		✓		✓	
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Training and research							
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Title of item 6: MJO Task Force and Global Atmospheric System Studies (GASS) MJO Meeting

Singapore's Centre for Climate Research Singapore (CCRS), a department under Meteorological Service Singapore (MSS), hosted the MJO Task Force and Global Atmospheric System Studies (GASS) MJO Meeting on 3-5 June 2013. The meeting brought together modelers who contributed output to the model intercomparison project organised by the MJO Task Force and GASS panel to study in detail the behaviour of weather and climate modeling systems during the MJO.

The meeting was attended by 34 participants and comprised researchers from local and overseas research institutes as well as MSS and CCRS staff.

During the meeting, project leads presented the latest analysis of the different modelling components and gained feedback from meeting participants. The meeting provided an opportunity for MJO experts to learn about the modeling project and identify further research to be undertaken. MSS participants also had the chance to network with MJO experts and identify areas for collaboration.

Identified opportunities/challenges, if any, for further development or collaboration:

Nil

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Meteorology							
Hydrology							
DRR							
Training and research						✓	
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Title of item 7: Inaugural ASEAN Climate Outlook Forum

In a new initiative to improve understanding of climate variability and change relevant to Southeast Asia, and to develop a consensus-based seasonal climate outlook for the region, Singapore hosted the first ASEAN Climate Outlook Forum (ASEAN-COF) from 3 to 5 December 2013 at the Centre for Climate for Research (CCRS). The establishment of ASEAN-COF was endorsed in July 2013 by the ASEAN Sub-Committee on Meteorology and Geophysics (SCMG), comprising the National Meteorological Services (NMS) of ASEAN member countries.

A total of about 40 experts from the NMS of ASEAN member countries, international experts from China, Japan, South Korea, USA and Europe as well as representatives from the World Meteorological Organisation (WMO), participated in the three-day event. The meeting was supported by WMO under a project funded by the United States Agency for International Development (USAID).

The inaugural ASEAN-COF saw a fruitful exchange of ideas and plans discussed to improve long-range forecasts for the region. In particular, the participants reached a consensus on the regional climate outlook for the current Northeast Monsoon season from December to February. For southern Southeast Asia, normal to above normal rainfall is expected, while normal to below normal rainfall is expected for northern Southeast Asia during the season. There was also agreement that more scientific research was needed to improve understanding of the predictability of rainfall in the region as well as the key drivers of the region's climate, such as the El Nino and La Nina phenomena.

Identified opportunities/challenges, if any, for further development or collaboration:

Nil

Summary Table of relevant KRAs and components (please tick boxes, can be more than one, as appropriate):

KRA =	1	2	3	4	5	6	7
Meteorology							
Hydrology							
DRR							
Training and research						✓	
Resource mobilization or regional collaboration							

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