

MEMBER REPORT

ESCAP/WMO Typhoon Committee
44th Session

6 – 11 February 2012
Hangzhou, China

by
Meteorological Service Singapore

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I. Overview of tropical cyclones which have affected/impacted Member's area in 2011

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 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.

The 2010/2011 Northeast Monsoon season onset in December 2010. During a typical Northeast Monsoon, Singapore may be affected by 2-5 surge episodes of prolonged widespread rain, induced by the strengthening of northeasterly winds over the South China Sea. The first surge of the season took place in the 3rd week of December 2010, followed by two surges in January 2011. The surge in the 30-31 January 2011 brought widespread moderate to heavy rain that led to flooding over several parts of Singapore. The amount of rainfall recorded for January 2011 (513.2 mm) is 110% above the long-term average. The long-term average for January is 244.0 mm. The dry phase of the Northeast Monsoon (February to March) was significantly drier than normal. Our climate station recorded 23 mm of rain compared to the long-term average of 161.7 mm for the February.

The Southwest Monsoon season commenced in June 2011 and lasted till September 2011. With the exception of June 2011, the other months in the season registered below normal rainfall. In June 2011, the total rainfall recorded for the month was 213mm or 30% above the long-term average of 161.7 mm. The heavy showers were mainly induced by strong convective heating of land areas, as well as strong convergence of winds which brought unstable weather conditions to Singapore and the surrounding region. In particular, the heavy showers on 5 June 2011 lead to flash floods in several parts of Singapore.

The active Pacific Typhoon season also saw a few storms indirectly affecting the weather in Singapore. In July 2011, Tropical Storm Nock-Ten induced unstable weather conditions over Singapore and the vicinity as it made land fall over southern China. Similarly, Tropical Storm Haitang in September 2011 also resulted in the passage of a line squall over Singapore. The Sumatra squall was induced by the prevailing southwesterly winds when Haitang approached the Indochina peninsular. Both situations resulted in 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 DPP 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 (For achievements/results which apply to more than one Key Result Area, please describe them under the most applicable Key Result Area. Then, at the end of the description, place in parentheses () the other applicable Key Result Areas)

1. Progress on Key Result Area 1: Reduced Loss of Life from Typhoon-related Disasters. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2011 Typhoon Committee Annual Operating Plan goals)

a. Meteorological Achievements/Results

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 warning to various government agencies for enhancing preparedness for expected heavy rain and strong winds. The warnings are also issued to the public via the media. In view of several heavy rain incidents which have led to some flooding in 2011, MSS together with the Public Utilities Board (Singapore's National Water Agency) launched a Heavy Rain and Rising Water Level Alert SMS System to alert/warn the public on heavy rainfall that is forecast and/or whenever water levels in canals rise above 70% and 90% of threshold levels and recede below 50%.

b. Hydrological Achievements/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 56ha today. Singapore continuously reviews and upgrades her drainage infrastructure to ensure an effective drainage network for flood alleviation and prevention.

c. Disaster Prevention and Preparedness Achievements/Results

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d. Regional Cooperation Achievements/Results

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e. Identified Opportunities/Challenges for Future Achievements/Results

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2. Progress on Key Result Area 2: Minimized Typhoon-related Social and Economic Impacts. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)

a. Meteorological Achievements/Results

As in KRA 1(a) and KRA 6 (a)

b. Hydrological Achievements/Results

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c. Disaster Prevention and Preparedness Achievements/Results

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d. Research, Training, and Other Achievements/Results

Singapore's Civil Defense Academy provides disaster rescue and mitigation courses to the international community.

e. Regional Cooperation Achievements/Results

Singapore's Civil Defense Force provides water rescue and evacuation operations in the event of floods, resulting from typhoons and sustained rainfall and alerts the general public through the Public Warning System on the dangers of an impending flood. In addition, Singapore's Civil Defense Academy conducts disaster rescue and mitigation courses to the international community.

Under the ambit of the United Nations Environment Programme/Office for the Coordination of Humanitarian Affairs (UNEP/OCHA) Joint Environment Unit (JEU), Singapore provides international assistance for Hazardous Materials emergencies (HazMat) that may arise from typhoon-related incidents.

f. Identified Opportunities/Challenges for Future Achievements/Results

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3. Progress on Key Result Area 3: Enhanced Beneficial Typhoon-related Effects for the Betterment of Quality of life. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)

a. Meteorological Achievements/Results

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b. Hydrological Achievements/Results

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c. Disaster Prevention and Preparedness Achievements/Results

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d. Research, Training, and Other Achievements/Results

(i) Singapore participated in several meteorological training workshops/conferences/meetings during the year including those sponsored/organized by the Typhoon Committee. Singapore would like to express her sincere thanks and appreciation to the Typhoon Committee for the opportunity to participate in the workshops. Our officers have found the training workshops/meetings educational and beneficial in their course of work. The list of relevant workshops/conferences attended in 2011 are as follows:

- APEC Typhoon Symposium (APTS), 11 – 13 Apr 2011, Taiwan
- WMO RAV Training Course on Satellite Applications for Meteorology and Climatology, 19 – 17 Oct 2011, Bogor, Indonesia
- Typhoon Committee Roving Seminar, 20-23 Sep 2011, Petaling Jaya, Malaysia
- WMO CLIPS Training Workshop on Operational Climate Prediction for Southeast Asia, 27 Sep – 7 Oct 2011, Citeko, Bogor, Indonesia
- WMO/WWRP Monsoon Heavy Rainfall Workshop, 12-14 Oct 2011, Beijing, China
- Training Workshop on Mesoscale NWP – Phase II, 16 – 29 Nov 2011, Petaling Jaya, Malaysia

(ii) There are on-going efforts to improve the short to medium-range forecasts through the use of NWP models such as the Weather and Research Forecasting (WRF) model. A 2-way nested regional run is currently being used to produce high resolution forecasts over Singapore. Some of the development work in WRF is done jointly with the local universities to improve the forecasts through the use of statistics and weather case studies. There are plans to introduce data assimilation of satellite/radar observations as well as nudging methods to improve the predictions.

e. Regional Cooperation Achievements/Results

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f. Identified Opportunities/Challenges for Future Achievements/Results

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4. Progress on Key Result Area 4: Improved Typhoon-related Disaster Risk Management in Various Sectors. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)

a. Meteorological Achievements/Results

As in KRA 1(a) and KRA 6(a)

b. Hydrological Achievements/Results

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- c. Disaster Prevention and Preparedness Achievements/Results
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 - d. Research, Training, and Other Achievements/Results
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 - e. Regional Cooperation Achievements/Results
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 - f. Identified Opportunities/Challenges for Future Achievements/Results
 - As in KRA 2(e)
5. Progress on Key Result Area 5: Strengthened Resilience of Communities to Typhoon-related Disasters. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2008 Typhoon Committee Annual Operating Plan goals)
- a. Meteorological Achievements/Results
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 - b. Hydrological Achievements/Results
 -
 - c. Disaster Prevention and Preparedness Achievements/Results
 -
 - d. Research, Training and Other Achievements/Results
 -
 - e. Regional Cooperation Achievements/Results
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 - f. Identified Opportunities/Challenges for Future Achievements/Results
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6. Progress on Key Result Area 6: Improved Capacity to Generate and Provide Accurate, Timely, and understandable Information on Typhoon-related Threats. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2011 Typhoon Committee Annual Operating Plan goals)
- a. Meteorological Achievements/Results

(i) Developing climate science capabilities to support national climate resilience efforts

The Climate Science Department (CSD) in MSS is working to address the growing concern of climate change and its impact on Singapore and the region. The focus areas of the department include climate modelling and prediction, climatology and climate studies, and weather and environmental prediction. Under the area of climate modelling and prediction, the ongoing activities include the production of monthly climate forecasts over Singapore and the region using the US International Research Institute (IRI) for Climate and Society's Climate Prediction Toolkit (CPT) and developing long-term climate assessments using the UK Hadley Centre's PRECIS climate modelling system.

MSS aims to strengthen its capabilities in climate modelling and research to produce climate predictions and assessments to assist government agencies and policymakers in the formulation of climate change mitigation and adaptation strategies. One of the areas of concern is the potential changes in Singapore's long term rainfall patterns which could have critical impacts on water resource and flood management.

In May 2011, MSS established a research partnership with the UK Met Office under a Memorandum of Understanding (MOU), for multi-year collaboration in regional climate modeling and research. MSS organized two regional climate modeling workshops in May and September 2011 to foster climate research links with ASEAN Met Services.

MSS has also established the Centre for Climate Research Singapore (CCRS) to undertake research and modeling studies to better understand the climate and weather of Singapore and the wider Southeast Asia region.

(ii) Implementation of On-Line Weather Monitoring Network

In September 2011, MSS completed the installation of the Online Weather Monitoring Network of Automated Weather Stations (OWNet). The OWNet consists of 64 automated weather stations that transmit data in real-time to a Central Processing System for processing and display. All the stations in the network have rain gauges while some stations are equipped with wind, temperature, pressure and other weather sensors. The data from the OWNet is provided to government agencies via a web-based interface. The public will be provided with access through the Internet in the first half of 2012. The data from the network is used to support operational forecasting, weather assessments (of heavy rain and strong wind events) as well as for the purpose of flood and other monitoring and research purposes.

(iii) Quantitative Precipitation Estimation

Although the network of rain gauges over Singapore is relatively comprehensive, there are still locations which are not covered by rain gauges. In order to capitalize on the advantages of the weather radar in terms of its spatial coverage, the rainfall data from the On-Line Weather Monitoring Network has been integrated into the weather radar system to generate products showing accumulated rainfall amounts. These products are being evaluated over a period to ensure that they provide representative indications of radar-derived rainfall estimations.

(iv) Testing of Quantitative Precipitation Forecast Tools

The new Weather Radar system is installed with Nowcasting software applications to utilize radar data to perform tracking of thunderstorm cells and estimations of probabilities of rainfall exceeding pre-defined thresholds. Heavy rain events in Singapore are often associated with monsoon surges, squalls and localized convective thunderstorms. Given the short-lived nature and generally low predictability of such systems, especially the localized convective systems, further evaluations are being done to determine the effectiveness of these applications.

(v) Satellite Reception System

MSS commissioned a new 2.4m X/L-band satellite reception system in May 2011 to receive data from the NOAA and EOS Terra and Aqua satellites. The new satellite reception system is designed to be able to receive from the new FY3 and NPP (NASA-NOAA).

- b. Hydrological Achievements/Results
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 - c. Disaster Prevention and Preparedness Achievements/Results
 - As in KRA 1(c)
 - d. Research, Training, and Other Achievements/Results
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 - e. Regional Cooperation Achievements/Results
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 - f. Identified Opportunities/Challenges for Future Achievements/Results
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7. Progress on Key Result Area 7: Enhanced Typhoon Committee's Effectiveness and International Collaboration. (List progress on the Strategic Goals and Associated Activities in the Strategic Plan and progress on the 2011 Typhoon Committee Annual Operating Plan goals)
- a. Meteorological Achievements/Results
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 - b. Hydrological Achievements/Results
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- c. Disaster Prevention and Preparedness Achievements/Results
As in KRA 2(e)
- d. Research, Training, and Other Achievements/Results
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- e. Regional Cooperation Achievements/Results
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- f. Identified Opportunities/Challenges for Future Achievements/Results
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8 Resource Mobilization Activities

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9. Update of Members' Working Groups representatives

1. Working Group on Meteorology

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5. Resource Mobilization Group

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