

# **MEMBER REPORT**

## **(SINGAPORE)**

ESCAP/WMO Typhoon Committee  
15<sup>th</sup> Integrated Workshop  
1-2 December 2020

# CONTENTS

## **I. OVERVIEW OF TROPICAL CYCLONES WHICH HAVE AFFECTED/IMPACTED MEMBER'S AREA SINCE THE LAST COMMITTEE SESSION**

	<i>Page</i>
1. Meteorological Assessment (highlighting forecasting issues/impacts)	1
2. Hydrological Assessment (highlighting water-related issues/impacts)	3
3. Socio-Economic Assessment (highlighting socio-economic and DRR issues/impacts)	3
4. Regional Cooperation Assessment (highlighting regional cooperation success and challenges)	3

## **II. SUMMARY OF PROGRESS IN PRIORITIES SUPPORTING KEY RESULT AREAS**

1. ASEAN Climate Outlook Forum (ASEANCOF) and Southeast Asia Regional Climate Centre Network (SEA RCC-NETWORK)	4
2. Capability-Building Programme in Subseasonal-to-Seasonal Predictions for Southeast Asia (S2S-SEA) and Subseasonal-to-Seasonal Southeast Asia Pilot Project (S2S-SEA Pilot Project)	7
3. Collaborations with the National Water Agency to Manage and Maintain Adequate Water Supply	9
4. Hydrological Achievements and Results	10
5. Participations in Training Workshops, Conferences and Meetings	11

## **I. OVERVIEW OF TROPICAL CYCLONES WHICH HAVE AFFECTED/IMPACTED MEMBER'S AREA SINCE THE LAST COMMITTEE SESSION**

### **1. Meteorological Assessment (highlighting forecasting issues/impacts)**

Tropical Storms that develop over the Indian Ocean or western Pacific Ocean can at times influence the winds over the surround regions of Singapore. Depending on positions of the tropical storms as they track over large bodies of water of the South China Sea and the western Pacific Ocean, the tropical storms can induce and affect the weather in Singapore. The weather impact can also be from extensions of the tropical storm's rain bands over the southern South China Sea close to the Equator. The presence of these tropical storms can either bring fair and dry weather or heavy thundery showers to the island state. For the latter, lines of thunderstorm or squalls accompanied by occasional strong gusty winds are often induced under the influence of the storm, resulting in widespread heavy rainfall over Singapore and the surrounding vicinity.

During the 2020 Pacific Typhoon season, there were a few occasions during which tropical storms had an indirect influence on the weather in Singapore. The development of low pressure systems had also contributed to convergence of winds in the region which in turn resulted in increased rainfall.

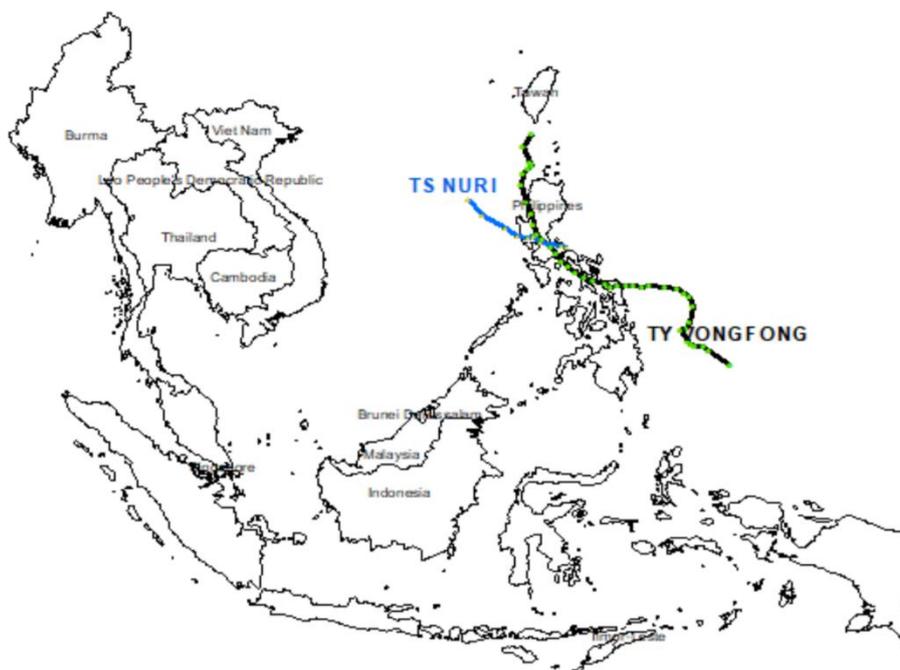
In May 2020, Typhoon Vongfong (Ambo), formed on 8 May 2020 east of Mindanao, the Philippines, attained a maximum wind speed of 150 km/h on 13 May 2020 and eventually made landfall in Visayas and Luzon on 14 May 2020. On a few days during the period, the presence of Typhoon Vongfong indirectly led to the development of Sumatra squalls which brought widespread thundery showers and gusty winds to Singapore between the pre-dawn hours and morning.

On 10 June 2020, Tropical Storm Nuri (Butchoy) developed to the east of Samar, Visayas, the Philippines. It tracked towards the northwest and reached a peak intensity of 75 km/h before making landfall in Yanjiang, China on 14 June 2020. On 13 June 2020, widespread moderate to heavy thundery showers fell over Singapore between the predawn hours and morning, due to the convergence of winds over the region under the indirect influence of Tropical Storm Nuri. There were also thundery showers on several nights due to large-scale convergence of winds in the surrounding region. With a monthly total rainfall of 233.8 mm recorded at the climate station, June 2020 was the wettest June for Singapore in the last 10 years, exceeding the 213 mm recorded in June 2011.

### RAINFALL ANOMALY 1 - 30 JUNE 2020



**Figure 1:** Rainfall anomaly for June 2020. (Source: Meteorological Service Singapore)



**Figure 2:** Storm tracks of Typhoon Vongfong (8-18 May 2020) and Tropical Storm Nuri (10-14 Jun 2020). (Source: ASEAN Specialised Meteorological Centre Bulletin Issue No.6)

- 2. Hydrological Assessment (highlighting water-related issues/impacts)**  
Nil.
- 3. Socio-Economic Assessment (highlighting socio-economic and DRR issues/impacts)**  
Nil.
- 4. Regional Cooperation Assessment (highlighting regional cooperation success and challenges)**  
Nil.

## **II. SUMMARY OF PROGRESS IN PRIORITIES SUPPORTING KEY RESULT AREAS**

### **1. ASEAN Climate Outlook Forum (ASEANCOF) and Southeast Asia Regional Climate Centre Network (SEA RCC-NETWORK)**

#### **1.1 ASEANCOF**

##### Background

The ASEAN Climate Outlook Forum (ASEANCOF) was established in 2013, following the support at the 35th Meeting of the ASEAN Sub-Committee on Meteorology and Geophysics (ASCMG, July 2013). ASEANCOF provides collaboratively developed and consensus-based seasonal climate outlooks and related information on a regional scale, including risk assessment of heightened tropical cyclone activities and the associated atmospheric circulation anomalies. These activities support decision-making to manage climate-related risks and support sustainable development. The hosting of ASEANCOF sessions is rotated among ASEAN Member States and supported by the ASEAN Specialised Meteorological Centre (ASMC), hosted by the Meteorological Service Singapore (MSS).

##### Recent Developments

The latest physical meeting, ASEANCOF-13, was held in Bangkok, Thailand, from 18-21 November 2019, hosted by the Thai Meteorological Department (TMD) in collaboration with the ASEAN Specialised Meteorological Centre (ASMC). The event was co-sponsored by the ASEAN Science, Technology and Innovation Fund (ASTIF), the Thai government, the DeRisk Project, and the World Meteorological Organization (WMO). Apart from the customary process of issuing regional consensus outlooks for temperature and rainfall for the upcoming boreal winter monsoon season (December 2019 – February 2020), a 2-day pre-Climate Outlook Forum training, hosted by representative from the UK Met Office was held. The training was interactive and served as a refresher course on seasonal prediction. It had set a good foundation for the transition towards more objective outlooks from ASEANCOF, in line with guidance from WMO. During discussions with co-host DeRisk Project (<https://deriskseasia.org>), participants shared their experience and best practices on the delivery of seasonal products in Southeast Asia.

The most recent ASEANCOF-14 meeting was conducted via email correspondence and an online meeting and was coordinated by ASMC for the June-August (JJA) summer monsoon season of 2020. The Consensus Outlook from ASEANCOF-14 for the region was published in late May 2020 (<http://asmc.asean.org/events-fourteenth-session-of-the-asean-climate-outlook-forum-aseancof-14>).

Since ASEANCOF-13, ASMC has been working with experts on the operationalization of objective seasonal outlooks and tailored products for ASEANCOF. These include the use of a regionally accepted climate dataset to monitor and verify the seasonal outlook, to enable the RCCs and NMHSs to select the most appropriate ensemble for the seasonal products, and among others, to develop tailored seasonal outlook products relevant for the region. In ASEANCOF-14, a gridded format was implemented for the outlooks for ease of verification, with the initial outlook based on the multi-model ensemble from the WMO Lead Centre for Long Range Forecasting.

The upcoming ASEANCOF-15 is planned to be hosted by the ASMC online in November 2020 over a few days to provide more interaction and discussion between NMHSs, GPC, RCC, and other experts. The training for developing objective seasonal outlooks which have been part of the ASEANCOF would be postponed until the next physical meeting. Detailed meeting reports are available at [http://asmc.asean.org/asmc\\_asean\\_conf\\_about](http://asmc.asean.org/asmc_asean_conf_about).

## 1.2 SEA RCC-Network

### Background

The Southeast Asia Regional Climate Centre Network (SEA RCC-Network) is an operational platform for delivery of climate services. The Network complements the ASEANCOF, which is primarily a platform for sharing best practices and improving the process of consensus-building for climate outlooks. An RCC-Network for the region was first proposed at the WMO RA V 16th Session (Jakarta, May 2014), and covers ten Southeast Asian countries in two WMO Regional Associations (RA), RA II and RA V. The SEA RCC-Network entered the demonstration phase in November 2017.

As a group of centres (nodes), the SEA RCC-Network collectively fulfils the four mandatory functions of an RCC, namely long-range forecasting led by Singapore (MSS), climate monitoring led by the Philippines (PAGASA), operational data services led by Indonesia (BMKG), and training led by all three partners. Singapore is the current coordinator of the Network. Within the monitoring and long-range forecasting functions, assessments of tropical cyclone activities are included as deliverables by either the lead node or a contributing consortium member.

### Recent Developments

Following the start of the demonstration phase for the SEA RCC-Network, the 3 nodes have since provided pilot products for long-range forecast, climate data services, and monitoring through their respective portals. These sites can be accessed from the SEA RCC-Network webpage ([www.mss-int.sg/sea-rcc-network](http://www.mss-int.sg/sea-rcc-network)). Since the demonstration phase, monthly climatologies for TC tracks and a two week outlook by PAGASA are available on the website (<https://www.mss-int.sg/sea-rcc-network/long-range->

[forecasting/tropical-cyclone/fortnightly-outlook](#)). The climatology will be expanded to cover all of Southeast Asia in the near future. The SEA RCC-Network has a Climate Watch System which currently focuses on the 1-month SPI, and this is soon to be expanded to other variables, including heightened risk of TC development.

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

The inclusion of objective seasonal outlooks in ASEANCOF is an opportunity to improve the seasonal forecasts, including additional tailored products for the region. This requires cooperation from all NMHSs in the region as well as the necessary training. Due to the global COVID-19 pandemic, the implementation of objective seasonal outlooks has been put on hold due to travel restrictions currently in place,

***Priority Areas Addressed:***

Improved capacity to generate and provide accurate, timely and understandable information on typhoon-related threats.

***Contact Information:***

Member: Singapore  
Name: Thea Turkington  
Telephone: +65 6488 1850  
Email: [thea\\_turkington@nea.gov.sg](mailto:thea_turkington@nea.gov.sg)

## **2. Capability-Building Programme in Subseasonal-to-Seasonal Predictions for Southeast Asia (S2S-SEA) and Subseasonal-to-Seasonal Southeast Asia Pilot Project (S2S-SEA Pilot Project)**

### **2.1 S2S-SEA**

MSS, as host of the ASEAN Specialised Meteorological Centre (ASMC), conducts a Capability-Building Programme in Subseasonal-to-Seasonal Predictions for Southeast Asia (S2S-SEA). S2S-SEA is a multi-year series of workshops to equip the NMHSs with the knowledge and skills to deliver S2S predictions to end-users. S2S predictions typically span timescales of 2 weeks to 2 months and has the potential to provide warnings for extreme rainfall events, caused by tropical storms or otherwise, but requires further studies.

The first two workshops, held in March 2017 and August 2018, focused on building the technical capability of the NMHSs in S2S predictions. For the third workshop in July 2019 (<http://asmc.asean.org/publication-asmc-bulletin-issue-4-sep-2019>), ASMC collaborated with ESCAP and RIMES to shift the focus to development of prediction products with involvement from end-user agencies and the disaster risk reduction community. The fourth workshop, also focused on engaging with end users, is expected to take place during the end of the S2S-SEA Pilot Project.

### **2.2 S2S-SEA Pilot Project**

To tighten and continue the collaboration with end-user agencies towards product development, the S2S-SEA has embarked on a Pilot Project involving NMHSs, and national and regional users in the disaster risk reduction sector, with support from ESCAP and RIMES. Details on the planned Pilot Project are described in this primer co-authored with ESCAP (<https://www.unescap.org/resources/applying-subseasonal-seasonal-predictions-improve-disaster-risk-reduction-south-east-asia>).

Since February 2020, ASMC has been providing fortnightly subseasonal outlooks to the (AHA Centre). The Department of Meteorology and Hydrology, Myanmar (DMH) and relevant end users in Myanmar joined the project in July 2020. The ASMC had also approached PAGASA to join the project, however there have been delays due to the COVID situation.

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

Extreme rainfall anomalies from typhoon-related activities are often more predictable within a one or two-week lead time, based on preliminary assessments (PAGASA and others). With the advent of DMH joining the pilot project, there is opportunity to explore whether rainfall or atmospheric circulation anomalies at longer leads times

can provide useful information of heightened risk of rainfall extremes arising from TCs.

With the current travel restrictions, it is difficult to have physical meetings for more focused interactions with NMHSs and end users. While the project is proceeding via online communication, a physical meeting would likely progress the project faster.

***Priority Areas Addressed:***

Strengthen typhoon-related disaster risk reduction activities in various sectors, including increased community-based resiliency with better response, communication, and information sharing capability.

Improved capacity to generate and provide accurate, timely and understandable information on typhoon-related threats.

***Contact Information:***

Member: Singapore  
Name: Thea Turkington  
Telephone: +65 6488 1850  
Email: [thea\\_turkington@nea.gov.sg](mailto:thea_turkington@nea.gov.sg)

### **3. Collaborations with the National Water Agency to Manage and Maintain Adequate Water Supply**

The National Water Agency of Singapore manages the water supply, water catchment and used water in Singapore. Intense thunderstorms, prolonged rainfall and dry spell events can have an impact on the water levels in the water catchment areas. Therefore, it is crucial for the National Water Agency to receive reliable and as accurate as possible extended- and long-range forecasts on the timescale of weeks to months ahead so as to make informed decisions to manage the level of water in the reservoirs. Rainfall patterns on this timescale are influenced by planetary- and synoptic-scale climate drivers and processes, including tropical cyclones that change the atmospheric circulation patterns over Singapore and the nearby region.

MSS provides a 7-Day quantitative precipitation forecast to the National Water Agency. It is an outlook of the total rainfall amount expected for critical water catchment areas for the next several days. This enables the National Water Agency to better manage manpower for heavy rainfall events, and to maintain an adequate water supply for the nation. MSS has also been providing a 3-month probabilistic rainfall outlook to the Agency and are exploring ways to improve these services, including providing quantitative estimates of rainfall and its linkages to reservoir water levels and streamflow.

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

Nil.

#### ***Priority Areas Addressed:***

Minimize and mitigate the potential negative impact of heavy rainfall and extended dry period events.

#### ***Contact Information:***

Member: Singapore  
Name: Cheong Wee Kiong  
Telephone: +65 6545 7196  
Email: [cheong\\_wee\\_kiong@nea.gov.sg](mailto:cheong_wee_kiong@nea.gov.sg)

#### 4. Hydrological Achievements and Results

Over the past decades, Singapore has been improving the drainage infrastructure. The flood-prone areas have been reduced from 3200 hectares in the 1970s to about 28.1 hectares today. Singapore continuously reviews and upgrades drainage infrastructure to ensure an effective drainage network for flood alleviation and prevention.



**Figure 3:** Flood prone areas (blue polygon) in Singapore in 2020 (Source: Public Utilities Board (PUB), Singapore)

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

Nil.

#### **Priority Areas Addressed:**

The rain band associated with typhoons occasionally induce intense thunderstorms over Singapore. The constant effort to review and upgrade the drainage infrastructure can help to minimize the impact of flash floods on business and everyday life.

#### **Contact Information:**

Member: Singapore  
 Name: Cheong Wee Kiong  
 Telephone: +65 6545 7196  
 Email: [cheong\\_wee\\_kiong@nea.gov.sg](mailto:cheong_wee_kiong@nea.gov.sg)

## 5. Participations in Training Workshops, Conferences and Meetings

Singapore participates in several meteorological training workshops, conferences and meetings each year. Our officers found the training workshops/meeting educational and beneficial in their course of work. The list of relevant workshops, conferences and meetings attended in 2019/2020 are as follows:

Workshop/Conference/Meeting	Date	Location
● ESCAP/WMO Typhoon Committee Roving Seminar	11-13 Nov 2019	Beijing, China
● International Training Course on ‘Fengyun Satellite Products and Application’	11-17 Nov 2019	Haikou, China
● Technical Meeting on Regional Weather Radar Network for Southeast Asia	13-15 Nov 2019	Tokyo, Japan
● Implementation Coordination Meeting of SEA RCC-Network	15-16 Nov 2019	Bangkok, Thailand
● 13 <sup>th</sup> ASEAN Climate Outlook Forum (ASEANCOF-13)	18-21 Nov 2019	Bangkok, Thailand
● 10 <sup>th</sup> Asia-Oceania Meteorological Satellite Users’ Conference	2-7 Dec 2019	Melbourne, Australia
● Training Course on the Basic Principles of Satellite Remote-Sensing	22 Jun 2020 – 3 Jul 2020	Webinar online
● AOGS-EGU Joint Conference on New Dimensions for Natural Hazards in Asia	21-23 Sep 2020	Webinar online
● IOTIC – ICT/IOTWMS Pre-IOWave20 Webinar on Standard Operating Procedures (SOPs) for Tsunami Early Warning and Emergency Response	28-30 Sep 2020	Webinar online
● UK Met Office User Workshop on Atmosphere and Land Modelling and Related Discussion	9-12 Nov 2020	Webinar online

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

The training workshops, conferences and meetings provided opportunities for officers to expand their knowledge and develop projects within the Service to better improve our services to users.

### ***Priority Areas Addressed:***

Attending meetings and workshops can help to ensure that Singapore together with other Members are working towards improving international and regional collaboration.

**Contact Information:**

Member: Singapore  
Name: Patricia Ee  
Telephone: +65 6542 2863  
Email: [patricia\\_ee@nea.gov.sg](mailto:patricia_ee@nea.gov.sg)