

MEMBER REPORT

(SINGAPORE)

ESCAP/WMO Typhoon Committee
16th Integrated Workshop
(Video conferencing)
2-3 December 2021

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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 in the Indian Ocean, western Pacific Ocean or South China Sea may influence the weather patterns in Singapore and the surrounding region. Depending on the position and strength of the tropical storms, they may induce or enhance convective weather activities over Singapore and the surrounding areas. One type of weather system which is observed to be somewhat influenced by tropical cyclone activity is the Sumatra squall. Sumatra squalls are lines of thunderstorms which form over Sumatra or the Strait of Malacca and bring widespread thundery showers with occasional gusty winds to Singapore as they propagate eastward towards the South China Sea. On other occasions, the presence of tropical storms may also bring dry air masses from the Indian Ocean or the Java Sea and suppress the development of rain clouds, leading to fair and warm weather conditions over Singapore.

During the 2021 Pacific Typhoon season, there were a few occasions during which tropical storms resulted in the convergence of prevailing winds around the surrounding region of Singapore.

In Sep 2021, Tropical Storm Dianmu developed over the South China Sea, west of the Philippines on 22 September 2021. The tropical storm tracked westward and affected Viet Nam, Laos, and Thailand between 23 – 24 September 2021. During this period, Singapore experienced two consecutive spells of Sumatra squalls on 21 and 22 September, as prevailing winds converged around the surrounding region of Singapore under the influence of the tropical storm. The Sumatra squalls developed over the Strait of Malacca before moving eastward and affected Singapore in the early hours on 21 September, and in the pre-dawn hours on 22 September. The squalls were however not well-organised and did not result in significant heavy rain or strong winds in Singapore.

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. Enhancement of Weather Observation Network

There has been continuous improvement in Singapore's weather surveillance network, particularly over Singapore Changi International Airport with the replacement and upgrade of the Automated Weather Observing System (AWOS). The airport wind shear alert and monitoring system was also enhanced with the implementation and integration of the Low-Level Windshear Alert System (LLWAS), X-band Doppler weather radar and two wind lidars.

For upper air observation, Meteorological Service Singapore (MSS) replaced the Vaisala upper air sounding system with the Meisei RD18-MGPS2 sounding system and the IMS-11 radiosondes. A separate GRAW sounding system using the DFM-09 and DFM-17 radiosondes, is also in place as backup and is periodically used to perform dual soundings alongside the main system.

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

Nil.

Priority Areas Addressed:

Integrated

- Enhance activities to develop impact-based forecasts and risk-based warning.

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

2.1 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 MSS, as host of the ASEAN Specialised Meteorological Centre (ASMC).

Recent Developments

Since 2020, ASEANCOF has been held virtually due to travel restrictions. ASEANCOF-15 was held online between 23 and 27 November 2020. As November sessions are typically physical meetings over multiple days, the ASEANCOF online format was expanded to cover three half days to allow more time for interactions between NMHSs, GPC, RCC, and other experts. On the final day, end users from the Disaster Risk Reduction (DRR) community were invited to participate and share their perspectives on climate services.

The most recent ASEANCOF-16 meeting was conducted online for the June-August (JJA) summer monsoon season of 2021. After the success of the online ASEANCOF-15 session, the May 2021 session was expanded to cover two half days, the first covered a sharing session on downscaling and calibration techniques for seasonal outlooks, while the second covered the consensus discussion. Typically, the May ASEANCOF sessions only covers the consensus discussion. The Consensus Outlook from ASEANCOF-16 for the region was published in late May 2021 (<http://asmc.asean.org/events-sixteenth-session-of-the-asean-climate-outlook-forum-aseancof-16/>).

The ASEANCOF Working Group (AWG) was also established in 2021. The goal of AWG to guide and support the long-term development of ASEANCOF under ASMC coordination, in particular the implementation of objective outlooks as per WMO guidelines. The steps towards objective outlooks include the use of a regionally accepted climate dataset to monitor and verify the seasonal outlook, to shift from the current subjective consensus process to one where the RCCs and NMHSs select the most appropriate ensemble for the seasonal products, to provide regional calibration and bias correction, and develop tailored seasonal outlook products relevant for the region.

The next session, ASEANCOF-17, will be held at the end of November 2021, in a similar format to ASEANCOF-15, with the same theme of Disaster Risk Reduction. While it was initially planned to continue with training for developing objective seasonal outlooks, this has been postponed until the next physical meeting.

Detailed meeting reports are available at the ASMC portal at http://asmc.asean.org/asmc_asean_conf_about/.

2.2 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 recently updated main page of the SEA RCC-Network (<https://www.mss-int.sg/sea-rcc-network/>). Since the demonstration phase, monthly climatologies for TC tracks and a two-week outlook are included on the website (<https://www.mss-int.sg/sea-rcc-network/long-range-forecasting/tropical-cyclone/fortnightly-outlook>) provided by PAGASA (the climatology will be expanded to cover all of Southeast Asia in the future). The SEA RCC-Network has also implemented a Climate Watch System. This Climate Watch initially focused on the 1-month SPI, but is expected to be expanded to other variables, including heightened risk of TC development, in the future.

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

The incorporation of objective seasonal outlooks in ASEANCOF provides the opportunity to improve the seasonal outlooks, including additional tailored products for the region. However,

this shift requires all NMHSs in the region to be involved in the process, which in turn requires training. As suitable online training is not available, the implementation of objective seasonal outlooks is expected to be delayed until travel restrictions are eased.

Priority Areas Addressed:

Integrated

- Enhance collaborative activities with other regional/international frameworks/organizations, including TC and PTC cooperation mechanism.

Meteorology

- Enhance the capacity to monitor and forecast typhoon activities particularly in genesis, intensity, and structure change.
- Promote communication among typhoon operational forecast and research communities in Typhoon Committee region.

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3. 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)

3.1 S2S-SEA

MSS, as host of the 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. The 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 other weather systems, although further studies are required.

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.

3.2 S2S-SEA Pilot Project

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 project can be found in the write up in the 3rd WMO Projects Newsletter ([WMO Projects Newsletter 03 | World Meteorological Organization](#)). The S2S-SEA Pilot Project is conducted under the S2S Real-Time Pilot initiative ([S2S Real-Time Pilot Initiative \(dtbs.RealtimePilot\) - XWiki \(s2sprediction.net\)](#)), the latter of which was initially scheduled to end in November 2021. However, due to projects under this initiative facing delays due to the COVID pandemic, access to real-time products for the projects has been extended for another year.

As part of the S2S-SEA Pilot Project, ASMC has been providing fortnightly subseasonal outlooks to the AHA Centre (regional level partner) since February 2020. At the national level, there were challenges in implementing the project due to the COVID situation. The Department of Meteorology and Hydrology, Myanmar (DMH) joined the project in July 2020, with several online meetings and discussions over case studies. The pilot project is expected to extend into early 2022.

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

Extreme rainfall anomalies from typhoon related activities are typically predictable within a one or two-week lead time based on preliminary assessment (PAGASA and others). Based on the case studies with DMH, rainfall and atmospheric circulation anomalies have not

shown much improvement of heightened risk of rainfall extremes arising from TCs. However, additional calibration/statistical techniques may still help (not included as part of this pilot).

With the current travel restrictions, it is difficult to have physical meetings for more focused interactions with NMHSs and end users. This is particularly challenging at the national level where multiple parties are involved. However, there have still been valuable lessons learnt at both the national and regional levels.

Priority Areas Addressed:

Integrated

- Enhance activities to develop impact-based forecasts and risk-based warning.

Meteorology

- Enhance the capacity to monitor and forecast typhoon activities particularly in genesis, intensity, and structure change.
- Promote communication among typhoon operational forecast and research communities in Typhoon Committee region.

DRR

- Enhance Members' disaster reduction techniques and management strategies.

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4. 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 heavy rain and dry spell events can have an impact on the water levels in the water catchment areas. The National Water Agency requires accurate and reliable forecast across different time scales for water reservoir and flood management.

MSS provides a 7-Day daily rainfall forecast to the National Water Agency. The quantitative rainfall forecast product enables the National Water Agency to plan, prepare and allocate necessary resources for flood management in the event of heavy rain events. In addition, MSS also provides a 3-month probabilistic rainfall outlook to the Agency for longer-term water resource management.

MSS works closely with the National Water Agency in several research and development projects, including the development of nowcasting system, installation of a new weather radar in Singapore, and the use of high-resolution weather models for heavy rain prediction.

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

Nil.

Priority Areas Addressed:

Integrated

- Enhance activities to develop impact-based forecasts and risk-based warning.

Meteorology

- Enhance and provide typhoon forecast guidance based on NWP including ensembles and weather radar related products, such as QPE/QPF.

Hydrology

- Enhance capacity in impact-based and community-based operational flood forecasting and early warning, including methodology research, hydrological modelling, and operation system development.

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5. Hydrological Achievements and Results

Singapore has been improving the drainage infrastructure over the past decades. The flood-prone areas have been reduced from 3200 hectares in the 1970s to about 28.0 hectares today. Singapore continuously reviews and upgrades drainage infrastructure to ensure an effective drainage network for flood alleviation and prevention.

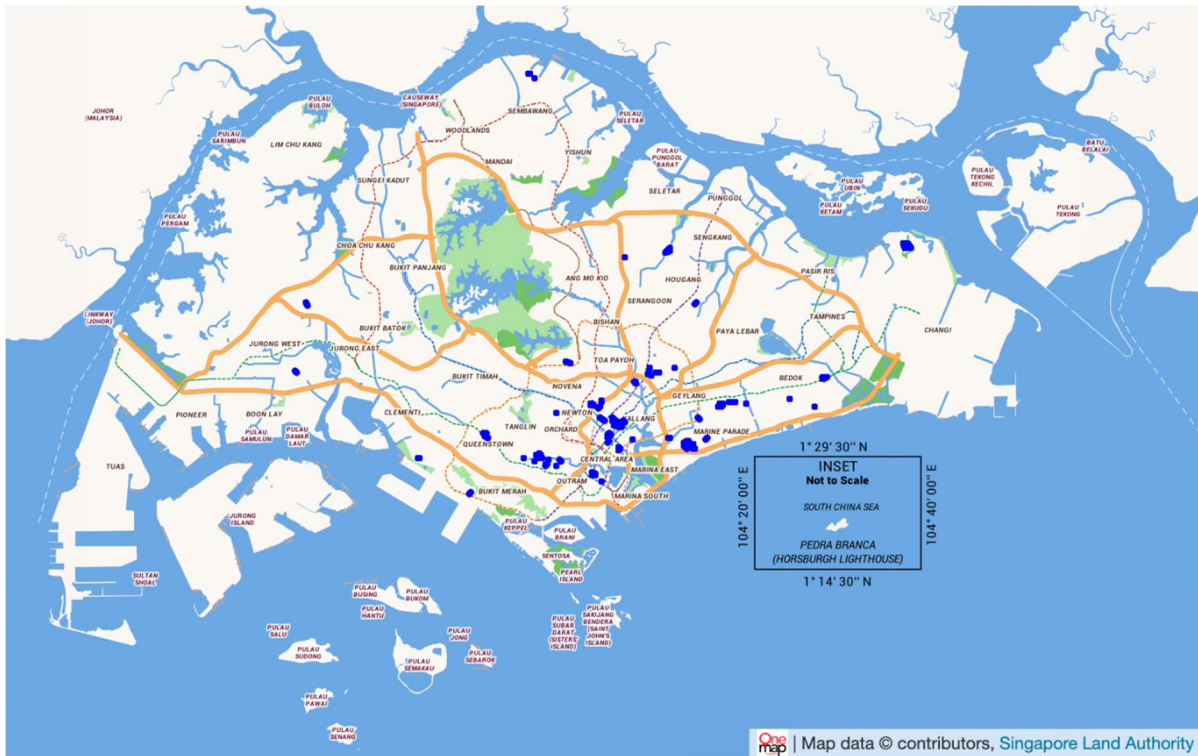


Figure 1: Flood prone areas (blue polygon) in Singapore in 2021
(Source: Public Utilities Board (PUB), Singapore)

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

Nil.

Priority Areas Addressed:

Hydrology

- Enhance capacity in flood risk (hazard, inundation) information, mapping, and its application.

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6. Participations in Training Workshops, Conferences and Meetings

Singapore participates in several meteorological training workshops, conferences, and meetings each year to ensure our meteorologists are up-to-date with the latest scientific developments. The list of relevant workshops, conferences and meetings attended in 2020/2021 are as follows:

Workshop/Conference/Meeting	Date	Location
• WMO Training Course on Impact-based Forecast	7-9 Dec 2020	Web conference
• Asia/Pacific Meteorology/Air Traffic Management Webinar and 10 th Meeting of the ICAO Asia/Pacific Meteorological Requirements Working Group	24-28 May 2021	Web conference
• ASEAN Strategic Policy Dialogue on Disaster Management	24-26 Aug 2021	Web conference
• The 2021 Common Alerting Protocol (CAP) Implementation Workshop	13-15 Oct 2021	Web conference
• 10 th Meeting of Typhoon Committee Working Group on Hydrology	22 Oct 2021	Web conference

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 to better improve our services to users.

Priority Areas Addressed:

Integrated

- Enhance activities to develop impact-based forecasts and risk-based warning.
- Enhance collaborative activities with other regional/international frameworks/organizations, including TC and PTC cooperation mechanism.

Meteorology

- Enhance the capacity to monitor and forecast typhoon activities particularly in genesis, intensity, and structure change.

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