

MEMBER REPORT (Singapore)

ESCAP/WMO Typhoon Committee
12th Integrated Workshop
Jeju, Republic of Korea
30 October – 3 November 2017

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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 that develop over the Indian or western Pacific Oceans or the South China Sea can at times have an indirect influence on the weather in Singapore. The presence of these tropical storms could either bring fair and dry weather conditions or heavy thundery showers to the Island State, depending on the location of the storm as it tracks over the large water bodies and/or an extension of the tropical storm's rain bands over the southern South China Sea close to the Equator. This would induce lines of thunderstorms or squalls accompanied by occasional strong gusty winds resulting in widespread heavy rainfall over Singapore and the surrounding vicinity.

During the 2017 Pacific Typhoon season, there were a few occasions in which tropical storms had an indirect influence on the weather in Singapore. For example, Tropical Storm Merbok developed over South China Sea, west of the Philippines on 9 June 2017. It tracked towards the north-northwest while intensifying, and reached peak intensity of 102 km/h on 12 June 2017. On 10 June 2017, a line of thunderstorms developed west of Singapore, and as it moved eastward, the squall brought heavy thundery showers over many areas of Singapore in the night. Singapore recorded a daily total rainfall of 238.2mm of rain that day. Similarly, a tropical depression which formed over the western Pacific Ocean, east-northeast of Luzon, the Philippines on 20 August 2017 intensified into a typhoon (Typhoon Hato) on 23 August 2017.

As Typhoon Hato tracked to the northwest towards Hong Kong, the extension of its rain bands and convergence of winds over Singapore and the surrounding vicinity brought thundery showers mostly over sea areas west of Singapore that day. While thundery showers fell over Singapore in the predawn hours, the showers were not widespread or heavy.

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

Water resource and flood control are functions that are of conflicting interests. Maintaining a high storage of water level is optimal for water resource but this increases the risk of flooding. Hence reliable and timely weather forecasts are good decision support tools for the efficient management of water resources.

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 Observing Network

- **Identified opportunities/challenges, if any, for further development or collaboration**
- **Priority Areas Addressed**

Meteorological Service Singapore (MSS) operates a comprehensive weather observation system which comprises a network of manned and automatic weather stations, an upper air observatory, a lightning detection network, weather radars, a wind profiler, a wind and aerosol LIDARs and various weather and environmental satellite reception and processing systems.

MSS' observation network is continually being enhanced to support operational needs as well as the requirements of other government agencies. During the period of review, an additional 30 rainfall stations were installed across the island to better support Singapore's Water Agency in the monitoring of flash floods.

In late 2016, MSS operationalised a new C-band dual-polarization weather radar to complement the existing S-band weather radar (installed in 2010) to support weather surveillance and the issuance of short term forecasts and warnings.

MSS makes available its non-conventional data (e.g., weather radar, automated weather sensor data etc) to Members and the general public on its website.

The enhanced and improved weather observation network has helped improve our capacity to provide reliable and timely weather forecast and services and information of heavy rainfall events.

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2. ASEAN Climate Outlook Forum (ASEANCOF)

The ASEAN Climate Outlook Forum (ASEANCOF) was established in 2013, following the strong support at the 35th Meeting of the ASEAN Sub-Committee on Meteorology and Geophysics (ASCMG) held in Manado, Indonesia (2-4 July 2013) for the proposal for a Regional Climate Outlook Forum (RCOF) in Southeast Asia. The national representatives present at the meeting also supported the offer by Singapore to host the first meeting at the Meteorological Service Singapore's (MSS') Centre for Climate Research Singapore (MSS-CCRS). The RCOF concept was initiated by the WMO/Climate Information and Prediction Services (WMO/CLIPS) project, in collaboration with NMHSs, regional/international climate centres among many other partners. ASEANCOF aims to provide 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. ASEANCOF sessions are coordinated by the local hosts and MSS, as host of the ASEAN Specialised Meteorological Centre (ASMC).

Recent ASEANCOF Sessions

The Seventh ASEANCOF (ASEANCOF-7) was hosted by the Philippines Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA). It was conducted in November 2016 in Manila ahead of the December-February (DJF) boreal winter monsoon season of 2016-17.

The meeting was attended by representatives from the ASEAN NMHSs, the WMO's Global Producing Centres of Long-Range Forecasts (GPCs), end-user communities, as well as experts from WMO Lead Centre for Long Range Forecast Multi-Model Ensemble (WMO LC-LRFMME) and the APEC Climate Centre (APCC). A 3-day training workshop for ASEANCOF-7 was conducted before the main Forum with a theme on extreme weather and climate events on the subseasonal-to-seasonal (S2S) timescale, which includes topics on tropical cyclone.

The most recent ASEANCOF-8 meeting was conducted via email correspondence and online meeting, and was coordinated by ASMC for the June-August (JJA) summer monsoon season of 2017. The Consensus Outlook from ASEANCOF-8 for the region was published in early June 2017. The next ASEANCOF-9 is planned to be hosted by the National Center for Hydro-meteorological Forecasting, Vietnam in November 2017.

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

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

Although ASEANCOF is focused on seasonal predictions, other related initiatives in the region, in particular the proposed WMO RA V Southeast Asia Regional Climate Centre Network (SEA RCC-Network), can serve as complementary platforms to deliver both seasonal (long-range) and sub-seasonal (shorter range) outlooks for risk of tropical cyclones. The SEA RCC-Network will have monitoring and outlook products related to tropical cyclones contributed by its Climate Monitoring Node led by PAGASA and its Long-Range Forecast (LRF) Node led by MSS with contributions from PAGASA as a consortium member of the LRF Node.

Priority Areas Addressed:

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

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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.

Since December 2016, MSS has been providing a 7-Day quantitative precipitation forecast to the National Water Agency. This service provides an outlook of the total rainfall amount expected for critical water catchment areas for the next few days. This enables the National Water Agency in their manpower management to prepare for heavy rainfall events, and to maintain adequate water supply for the nation. MSS has also been providing 3-month probabilistic rainfall outlook to the Agency and are exploring ways to improve these services.

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.

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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 30 hectares 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

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.

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5. Participation in Training Workshops, Conferences and Meetings

Singapore participates in several meteorological training workshops, conferences and meetings each year, and each time, officers found the training workshops/meetings educational and beneficial in their course of work. The list of relevant workshops conferences and meetings attended in 2016/2017 are as follows:

- ESCAP/WMO Typhoon Committee 11th Integrated Workshop, "Improving Typhoon Impact-based Forecasting and Warning", 24 – 27 Oct 2016, Cebu, Philippines
- Tokyo Climate Training Seminar on Primary Modes of Global Climate Variability & Regional Climate, 14 - 18 Nov 2016, Tokyo, Japan
- Roving Seminar 2016, 15 – 17 Nov 2016, Ha Noi, Vietnam
- 49th Session of the Typhoon Committee, 21 – 24 Feb 2017, Yokohama, Japan
15th Meeting of Meteorological Information Exchange Working Group and the 7th Meeting of Meteorological Services Working Group, 20 - 24 Mar 2017, Bangkok, Thailand
- 39th ASEAN Sub-Committee on Meteorology and Geophysics (ASEAN-SCMG), 3 - 5 May 2017, Manila, Philippines
- Urban Meteorology, Environment and Climate Services, 28 Aug – 8 Sep 2017, Johor, Malaysia

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

The workshops provided opportunities for officers to expand their knowledge and develop projects within the Service to better improve our services to users. For example, the Tokyo Climate Training Seminar on Primary Modes of Global Climate Variability and Regional Climate led to fruitful discussions during monthly seasonal prediction forums within MSS.

Priority Areas Addressed:

Attending meetings and workshops can help to ensure that Singapore is working towards the same targets as the other nations to improve international and regional collaboration.

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