**MEMBER REPORT**

**(Singapore)**

ESCAP/WMO Typhoon Committee

­11th Integrated Workshop

24 – 28 October 2016

Cebu, Philippines

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	1. **Overview of tropical cyclones which have affected/impacted Member’s area in 2016**
10. Meteorological Assessment (highlighting forecasting issues/impacts)

Singapore does not experience the direct influence or effects of tropical cyclones in the western Pacific Ocean or the South China Sea. However, these cyclones can at times have an indirect effect or influence on the weather in Singapore depending on the position of the cyclone as it tracks over the South China Sea. Such effects could take the form of an extension of the cyclone’s rain bands over the southern South China Sea area including Singapore. This would bring lines of thunderstorms or squalls accompanied by occasional strong gusty winds resulting in heavy rainfall over Singapore and the surrounding vicinity.

During the 2016 Pacific Typhoon season, there were a few occasions in which tropical cyclones had an indirect influence on the weather in Singapore.

For example, Typhoon Nepartak developed over the Western Pacific Ocean, south of Guam on 3 July 2016. It tracked northwest and intensified into a super typhoon on reached peak intensity on 6 July 2016, east of the Philippines. On 6 July 2016, a squall line developed west of Singapore and moved eastwards bringing 65.8mm of rain and wind gusts of 55knots to Singapore.

Similarly, on 29 July 2016, Typhoon Nida formed as a tropical depression over the Western Pacific Ocean east-southeast of Manila. On 3 August 2016 after Typhoon Nida made landfall over the southern coast of China, the passage of a squall line over Singapore brought 17.1mm of rain and wind gusts of 46 knots to parts of the island resulting in a few trees being uprooted and damage to a few structures.

1. 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.

1. Socio-Economic Assessment (highlighting socio-economic and DRR issues/impacts)

- Nil

1. Regional Cooperation Assessment (highlighting regional cooperation successes and challenges)

- Nil

* 1. **Summary of progress in Key Result Areas**

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| **Title of item 1: Heavy Rain and Strong Winds Advisory and Warnings** |
| To help alleviate the impact of heavy thundery showers from line squalls, that develop due to the indirect effect of tropical cyclones in the Northwest Pacific and the South China Sea, the Meteorological Service Singapore (MSS) issues heavy rain and strong winds advisories/warnings to relevant government agencies and the public to enhance their preparedness in expectation of the heavy rain/strong wind events. MSS offers a free SMS subscription service which the public can subscribe to so as to receive the heavy rain warnings via short message service (SMS). Mobile phone users can also receive push notifications of heavy rain warnings through the new ‘Weather@SG’ application (see item 2). MSS also makes available the warnings on the MSS website at <http://www.weather.gov.sg/warning-heavy-rain/>, and via print and broadcast media platforms.  |
| 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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| **Title of item 2: New Mobile Weather App ‘Weather@SG’** |
| MSS launched its free weather mobile application ‘Weather@SG’ in March 2016, giving users a convenient means to check Singapore’s official weather forecasts and observations wherever they are. The ‘Weather@SG’ mobile application can be downloaded from both the Apple App Store and the Android Play Store.The ‘Weather@SG’ mobile application provides users with access to the latest national forecasts, observations as well as warnings and advisories. Through the ‘Weather@SG’ application, mobile phone users can receive push notifications of heavy rain warnings and other hazards such as earthquakes in the region and tropical storm information. The weather mobile application has features to detect a user’s location and automatically display the 2-hour Nowcast and the current weather conditions such as temperature, rain amount and wind information. In addition, graphical temperature and rainfall trends for the past 12 hours are available. Users will also be able to view the rain areas over the island and up to 240km away.   |
| 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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| **Title of item 3: Enhancement of Observation Network** |
| MSS operates an observation network of real-time weather monitoring systems which comprises 60 Automatic Weather Stations, a lightning detection network, weather radar, wind profiler and various weather and environmental satellite reception and processing systems.  During the period of review, MSS has continued to enhance its observation network. In addition to the existing 60 Automatic Weather Stations, 15 rainfall stations were installed. Over the next year, another 15 rainfall stations will be added. The expansion in the network is intended to strengthen flood monitoring and management.   A satellite reception system has been implemented to receive data from the Himawari Cloud service and generate operational products to support both weather and haze monitoring.A wind LIDAR and aerosol LIDAR were installed in 2016. The wind LIDAR provides measurements of the vertical wind profile and complements the existing wind profiler radar.  The aerosol LIDAR provides an indication of the distribution of particulate matter in the atmosphere. The systems will help enhance the real-time monitoring of weather and haze.   |
| 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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| **Title of item 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 31 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 |

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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| **Title of item 5: Workshop on the Extension of the Rainfall Estimation for Monitoring of High Risk Fire Areas in Southeast Asia** |
| MSS organised a 3-day workshop on the Extension of the Rainfall Estimation for Monitoring of High Risk Fire Areas in Southeast Asia in Singapore from 28 to 30 March 2016. The workshop was attended by participants from the ASEAN NMHSs. Trainers from the Japan Meteorological Agency (JMA) and from the Japan Aerospace Exploration Agency (JAXA).The objective of the training workshop was to advance the use of meteorological satellite data in the ASEAN NMHSs, particularly for the monitoring of weather and environmental hazards relevant to the region. The scope of the workshop included (i) Utilisation of satellite data for rainfall, weather hazard and disaster monitoring (ii) Understanding the principles and applications of satellite rainfall estimation products, and (iii) Practical sessions on Himawari-8 satellite data utilisation for operational weather forecast and monitoring.The workshop provided an opportune platform to engage and interact directly with the Experts from JMA and JAXA on satellite meteorology. In addition, the sharing of experiences by ASEAN NMHS members provided mutually beneficial exchanges which helped JMA and JAXA have a better understanding of the needs and capabilities in satellite meteorology of the respective member countries.**In addition, the workshop helped to build capability among the ASEAN NMHS members through the understanding and use of enhanced satellite applications/products. The training helped ASEAN NMHS members learn to use the latest Himawari-8 satellite to better monitor and forecast weather and related environmental hazards to support safe and efficient operations, and to be better prepared to remain responsive, and conduct environmental disaster risk management and mitigation measures which are crucial to building a resilient ASEAN Socio-Cultural Community.** |
| 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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| **Title of item 6: ASEAN Climate Outlook Forum (ASEANCOF)** |
| **Background**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 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. **Recent ASEANCOF Sessions**The Fifth ASEANCOF (ASEANCOF-5) was hosted by Meteorological Service Singapore’s Centre for Climate Research Singapore (CCRS) and was conducted in November 2015 ahead of the December-February (DJF) boreal winter monsoon season of 2015-16. It was attended by representatives from the ASEAN NMHSs, the WMO’s Global Producing Centres of Long-Range Forecasts (GPCs), and the end-user communities, in particular from National Disaster Risk Management Agencies (NDRMAs) in Southeast Asia, the ASEAN Coordinating Centre for Humanitarian Assistance on disaster management (AHA Centre), as well as the Global Water Partnership Southeast Asia (GWP-SEA). Also present were experts from WMO Lead Centre for Long Range Forecast Multi-Model Ensemble (WMO LC-LRFMME), APEC Climate Centre (APCC), and the International Research Institute for Climate and Society (IRI).The recent ASEANCOF-6 meeting was via email correspondence, and was coordinated by the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) with assistance from the ASEAN Specialised Meteorological Centre (ASMC)[[1]](#footnote-1) for the June-August (JJA) summer monsoon season of 2016. The Consensus Outlook from ASEANCOF-6 for the region was published in early June 2016. The next ASEANCOF-7 will be coordinated by PAGASA and will be held in Manila in November 2016. A 3-day training workshop for ASEANCOF-7 will be 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. Detailed meeting reports are available at: <http://asmc.asean.org/asmc_asean_conf_about/> |
| 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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| --- | --- | --- | --- | --- | --- | --- | --- |
| KRA = | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Meteorology |  |  |  |  |  |  |  |
| Hydrology |  |  |  |  |  |  |  |
| DRR |  |  |  |  |  |  |  |
| Training and research |  |  |  |  |  | ✓ |  |
| Resource mobilization or regional collaboration |  |  |  |  |  |  |  |

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| **Title of item 7: Participations in Training Workshops, Conferences and Meetings** |
| MSS 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 2016 are as follows:* Initial Planning Meeting on Establishment of Flash Flood Guidance System for SE Asia-Oceania Region, 2 - 4 Feb 2016, Jakarta, Indonesia
* First Session of the EC Working Group on WMO Strategic and Operational Planning, 16 - 19 Feb 2016, Geneva, Switzerland
* 14th Meeting of Meteorological Information Exchange Working Group and the 6th Meeting of Meteorological Services Working Group, 7 - 11 Mar 2016, Bangkok, Thailand
* 12th Session of Forum on Regional Climate Monitoring-Assessment-Prediction for Asia (FOCRAII), 7 - 9 Apr 2016, Guangzhou, China
* WMO World Weather Research Programme and CAeM Aviation Research Demonstration Project Training Works, 20 - 25 Jul 2016, Hong Kong, China
* 38th ASEAN Sub-Committee on Meteorology And Geophysics (ASEAN-SCMG), 29 - 31 Aug 2016, Yangon, Myanmar
 |
| 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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| --- | --- | --- | --- | --- | --- | --- | --- |
| KRA = | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Meteorology |  |  |  |  |  |  |  |
| Hydrology |  |  |  |  |  |  |  |
| DRR |  |  |  |  |  |  |  |
| Training and research |  |  | ✓ |  |  |  |  |
| Resource mobilization or regional collaboration |  |  |  |  |  |  |  |

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===== End =====

1. The ASEAN Specialised Meteorological Centre (ASMC) is hosted by the Meteorological Service Singapore. [↑](#footnote-ref-1)