MEMBER REPORT
Singapore

ESCAP/WMO Typhoon Committee
20th Integrated Workshop/High-Level Forum
Macao, China
2 – 5 December 2025

CONTENTS

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. A 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 2025 Pacific Typhoon season, there were few occasions during which tropical storms resulted in the convergence of prevailing winds around the surrounding region of Singapore.

In early June 2025, tropical depression developed over the South China Sea, west of Philippines on 9 June 2025. The storm tracked westward, intensified and was later upgraded to Tropical Storm WUTIP on 11 June 2025. Viet Nam, southern China including Hainan, Hong Kong and Macau were affected between 10 and 15 June 2025. During this period, Singapore experienced Sumatra squalls on both 8 and 10 June 2025, likely associated with the intensification of Tropical Storm WUTIP. Strong winds were recorded on both days and heavy rain on 8 June 2025.

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

Nil.

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

Nil.

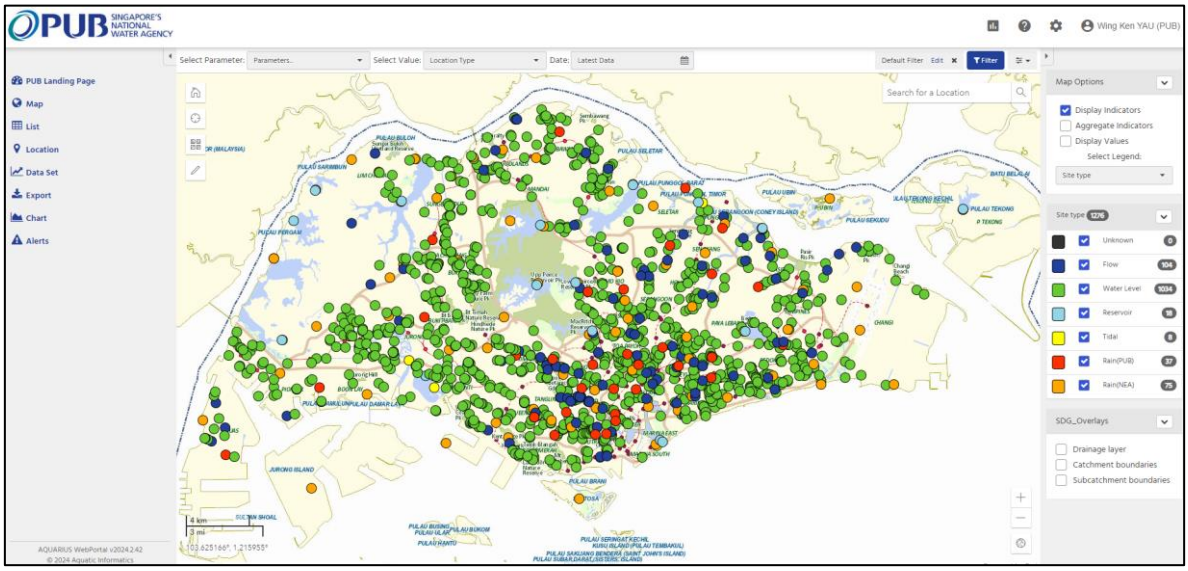
4. Regional Cooperation (highlighting regional cooperation and related activities)

Nil.

II. Summary of Progress in Priorities supporting Key Result Areas

1. Smart Drainage Grid System for Sensor Data Management and Analytics

Main text:
With large scale implementation of hydrometric and hydrometeorological data collection since 2010, huge amounts of data were collected over the years and Public Utilities Board (PUB), Singapore's national water agency developed the Smart Drainage Grid (SDG) system to achieve two main objectives. Firstly, to integrate all sensor data collected in a single database and employ tools for metadata management and data error detection to ensure data quality. Secondly, to harness the vast amount of data collected and to correlate data from disparate sensor networks to generate data-driven insights for strategic drainage planning and maintenance to minimise flood risk.



Map view of SDG showing more than 1000 sensors integrated in the system

The advanced analytics capabilities of the SDG system are exemplified by its automated extraction of rainfall runoff events. By associating catchments to each level and flow sensor, the system computes catchment-based rainfall time series based on rainfall observations. Discrete rainfall runoff events extracted from this data source, alongside comprehensive event analytics (including rainfall and hydraulic characteristics) are stored in an 'Event Database' and are accessible for analysis.

Since being implemented in 2019, the system has helped PUB to ensure sensor data quality by automatically identifying data quality issues that are further investigated and followed up with sensor vendors. SDG also provides drainage performance insights for drainage upgrading prioritisation, as well as alerts on anomalous drainage behaviour (that could be due to localised issues such as siltation and blockage) for investigation and pre-emptive maintenance of drainage infrastructure to be carried out as needed.

Identified opportunities/challenges, if any, for further development or collaboration:
PUB is on the lookout for new algorithms or approaches for detection of anomalous drainage behaviour.

Priority Areas Addressed:

Hydrology

- Improve typhoon-related flood (including riverine flood, flash flood, urban flood, and coastal flood) monitoring, data collection and archiving, quality control, transmission, processing, and sharing framework.
- Increase capacity in utilization of advanced science and technology for typhoon-related flood forecasting, early warning, and management.

Key Pillars of UN's Early Warnings for All (EW4All) Initiative Addressed:

Key Pillars of EW4All	Please ✓ the related pillar(s)
Disaster risk knowledge and management	
Detection, observation, monitoring, analysis, and forecasting	✓
Warning dissemination and communication	
Preparedness and response capabilities	

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2. Efforts to Strengthen Flood Resilience Among Communities

Main text:

a. ‘Get Flood-Wise in a F.L.A.S.H.’ Flood Resilience Campaign

PUB, Singapore’s national water agency, launched a flood resilience campaign, ‘*Get Flood-Wise in a F.L.A.S.H*’ in Nov 2024 (https://www.pub.gov.sg/Public/KeyInitiatives/Get-Flood-Wise), to encourage the public to be flood ready, amidst increasingly erratic weather and more intense storms triggered by climate change. Singapore is vulnerable to flood risks due to our topography and rapid urbanization. Sudden and intense heavy storms can temporarily overwhelm our canals and drains and cause flooding.

Through the campaign film and a series of visuals, the public – from motorists to business owners – can learn to be prepared and protect themselves from floods, in the event of extreme weather, by following the simple F.L.A.S.H tips.

F.L.A.S.H tips in PUB’s ‘Get Flood-Wise in a F.L.A.S.H’ flood resilience campaign

b. Community Table-top Exercise on Climate Threats

Complementing the ‘Get Flood-Wise in a F.L.A.S.H.’ Flood Resilience Campaign, PUB organised a community table-top exercise on climate threats (https://www.pub.gov.sg/Public/KeyInitiatives/Get-Flood-Wise/Community-TTX-on-Climate-Threats) in Nov 2024, bringing together over 50 Grassroots Leaders, residents, youths and business representatives to dive into discussions on flood preparedness. Participants discussed a mock extreme flooding scenario set in 2040 on severe torrential rain causing widespread disruption in Singapore, affecting transport, local businesses, hawker centres and essential services such as clinics.

Together, they brainstormed and shared insightful ideas on how the community and businesses can be more prepared in the face of such extreme flooding events. During the exercise, PUB also showcased the flood protection devices that PUB loans out to homeowners and business owners in flood-prone areas, such as inflatable flood bags and portable flood barriers.

c. Expansion of Flash Flood Alerts

PUB and Land Transport Authority (LTA) have collaborated and launched flash flood alerts for motorists on the Electronic Road Pricing (ERP) on-board units (OBUs) starting 1 July 2025. Motorists receive alerts about flash floods when approaching or travelling along affected roads within 3km radius to allow them to take alternate routes and avoid the area where possible.

PUB also collaborates with various partners such as ride hailing companies and vehicle management platforms to share flood safety tips with their drivers and users. PUB has worked with Grab (a superapp providing ride hailing, food delivery and digital payment solutions) to push out flood alerts to their drivers and food delivery riders via the Grab mobile application. This helps to alert the driver-partners to flash flood locations and route them away from these areas.

In addition, members of the public are encouraged to stay updated on flood risks and occurrences of flash floods through PUB's Telegram channel (t.me/pubfloodalerts) and the myENV mobile application.

Identified opportunities/challenges, if any, for further development or collaboration:
Managing flood risk is a collective effort and PUB is working towards strengthening community flood resilience through 3As: creating Awareness, fostering Acceptance and motivating Action among the community.

PUB proactively plans for media publicity (news features, social posts, interviews etc.) to raise awareness in PUB's efforts in flood management and to socialise the public to increasing flash flood risk due to climate change. In addition, PUB carries out engagement with premise owners at flood prone areas before the onset of monsoon season to equip them with flood protection devices and share with them on how to stay prepared for flood. Building on the 3As framework, PUB is enhancing its outreach initiatives to engage broader community segments and strengthen community flood resilience.

Priority Areas Addressed:
DRR
- Enhance Members' disaster risk reduction techniques and management strategies.
- Share experience/knowhow of DRR activities including legal and policy framework, community-based DRR activities, methodology to collect disaster-related information.

Key Pillars of UN's Early Warnings for All (EW4All) Initiative Addressed:

Key Pillars of EW4All	Please ✓ the related pillar(s)
Disaster risk knowledge and management	✓
Detection, observation, monitoring, analysis, and forecasting	
Warning dissemination and communication	✓
Preparedness and response capabilities	✓

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3. Data-Driven Probabilistic Thunderstorm Forecast Guidance for Singapore

Main text:
Thunderstorms are high-impact events that can cause significant disruptions to people's lives and economic activity in Singapore. Yet, despite significant advances in weather prediction over the past decade, it remains a challenge to forecast thunderstorms accurately. This project aims at providing probabilistic guidance for forecasters by linking thunderstorm activity in and around Singapore with antecedent large-scale regional weather patterns.

This was achieved by first clustering large-scale regional weather patterns over the past 20 years by means of a self-organizing map (SOM), with each cluster corresponding to a regional weather regime (Figure 1). The hourly frequency of thunderstorm occurrence at locations of interest over the next 24 hours was then derived from Singapore's historical weather radar data for each regional weather regime (Figure 2). The operational use of this model would involve feeding operational NWP analyses into the SOM to determine the current weather regime and the associated next-day hourly thunderstorm forecast probabilities.

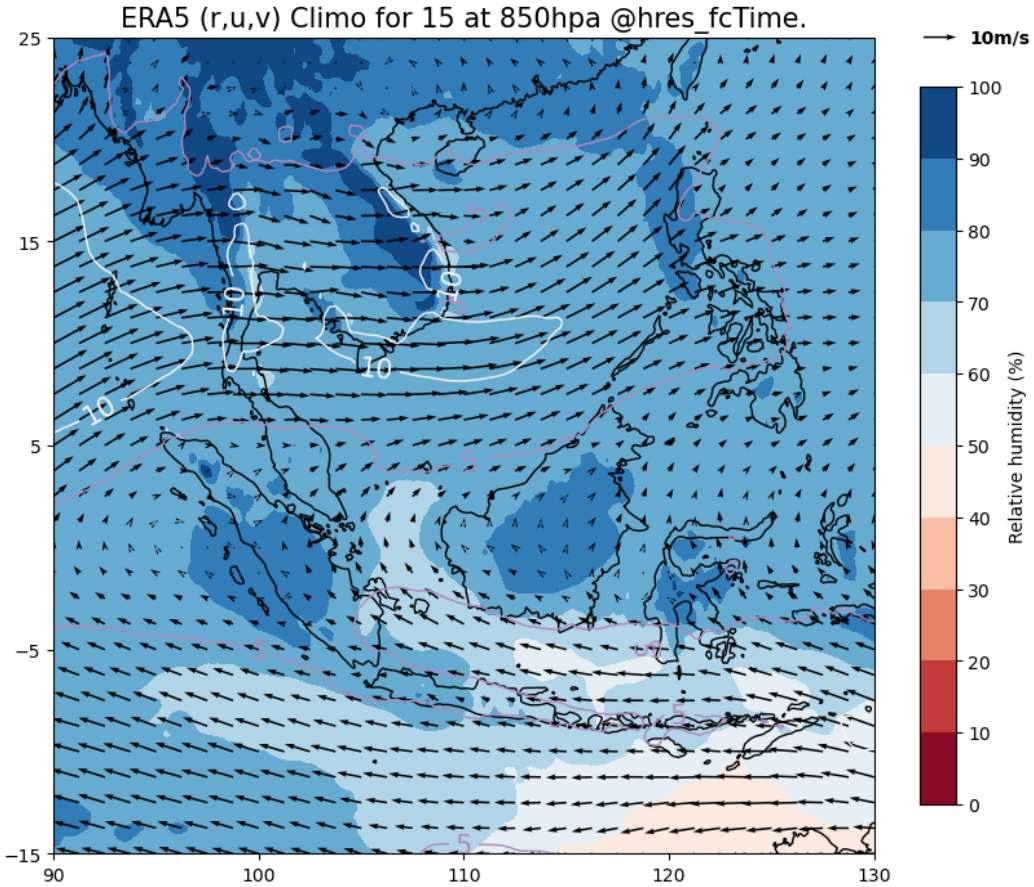

Figure 1: A large-scale regional weather pattern from ECMWF's ERA5 reanalysis dataset.

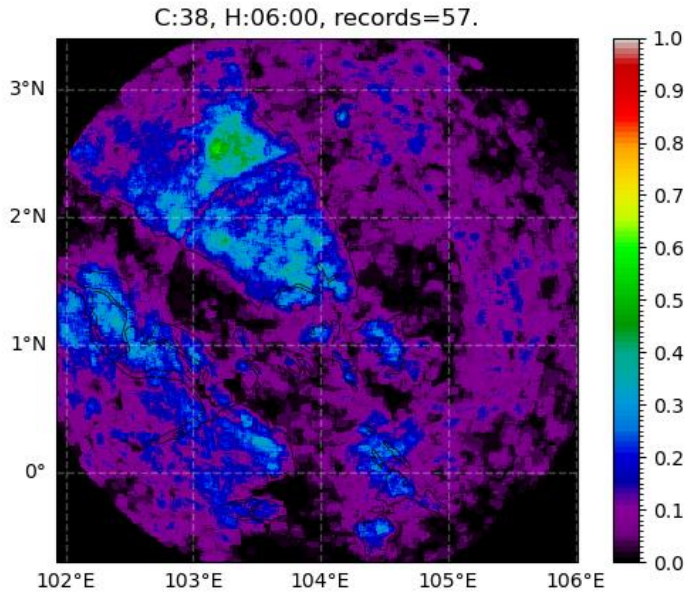

Figure 2: Frequency of thunderstorm occurrence in a particular hour associated with a particular regional weather regime.

An evaluation of the hourly probabilistic thunderstorm forecasts derived from this model has been performed for a one-year period ending May 2025. The reliability diagram (Figure 3) shows that the model is skillful up to forecast probabilities of 50%.

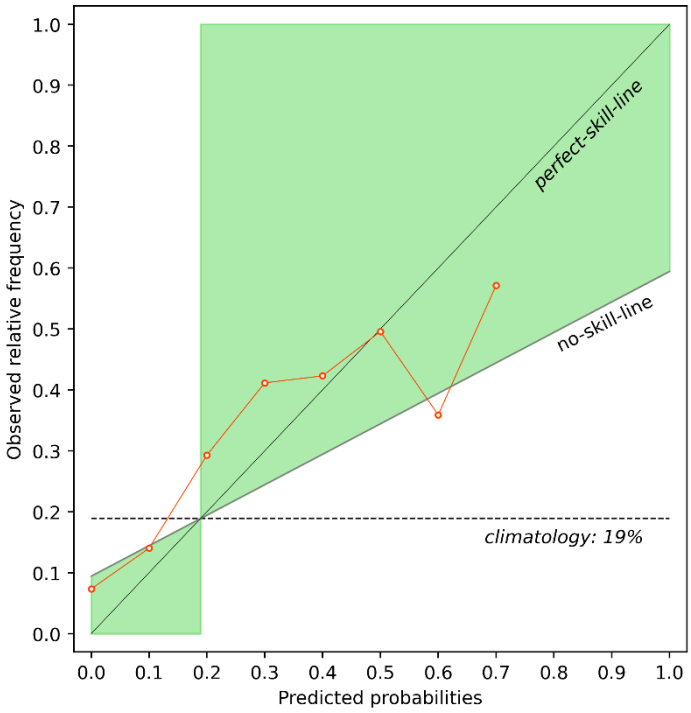

Figure 3: Reliability diagram for probabilistic thunderstorm forecasts contingent on ECMWF operational analyses.

Identified opportunities/challenges, if any, for further development or collaboration:
This data-driven approach to probabilistic thunderstorm forecasting offers much-needed additional guidance to forecasters at much lower computational costs compared to NWP-based ensemble

prediction systems, which tend to underestimate forecast uncertainty for precipitation-related variables. Forecasters could, for example, leverage this model to issue more granular and reliable thunderstorm forecasts for Singapore.

Priority Areas Addressed:

Meteorology

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

Key Pillars of UN's Early Warnings for All (EW4All) Initiative Addressed:

Key Pillars of EW4All	Please ✓ the related pillar(s)
Disaster risk knowledge and management	
Detection, observation, monitoring, analysis, and forecasting	✓
Warning dissemination and communication	
Preparedness and response capabilities	

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

Main text:

a. ASEANCOF-24 Meeting, 22 – 25 April 2025

Meteorological Service Singapore (MSS), as host of the ASEAN Specialised Meteorological Centre (ASMC) has been supporting the ASEAN Climate Outlook Forum (ASEANCOF) since its establishment in 2013. The most recent ASEANCOF (ASEANCOF-24) meeting was organised by the Ministry of Water Resources and Meteorology, Cambodia (MOWRAM), with support from RIMES, MSS/ASMC, and WMO. A two-day training workshop occurred prior to the COF proper, with training by the UK Met Office, ASMC, and University of Southern Queensland (22 – 23 April). During the COF proper, participants from the NMHSs of ASEAN Member States created a consensus forecast for the boreal summer monsoon 2025 in the ASEAN region. The consensus for the June-July-August (JJA) 2025 outlook was achieved through a hybrid session, which included presentations from NMHSs, questionnaires, and discussions regarding the current climate conditions and predictions for Southeast Asia. During JJA 2025, tropical cyclone (TC) frequency is predicted to be near average around the Philippine Sea and the South China Sea and above average over the Bay of Bengal. The consensus outlook can be found at: https://asmc.asean.org/events-twenty-fourth-session-of-the-asean-climate-outlook-forum-aseancof-24/.

b. SEA RCC-Network

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. Following the start of the demonstration phase for the SEA RCC-Network, monthly climatology for TC tracks and a two-week outlook are updated regularly on a weekly basis on the website (https://www.mss-int.sg/sea-rcc-network/long-range-forecasting/tropical-cyclone/fortnightly-outlook) provided by PAGASA.

The expansion of the TC track climatology to cover all Southeast Asia will be done when the TC climatology period is updated. The SEA RCC-Network has also implemented a Climate Watch System. This Climate Watch initially focuses on the 1-month SPI, but is expected to be expanded to other variables, including heightened risk of TC development, in the future. An expansion on the SEA-RCC Long-range Forecasting (LRF) model output to the subseasonal timescale for extreme rainfall outlook in the next few weeks compliments the TC outlook.

c. ASMC Fortnightly discussion

ASMC organises online fortnightly discussion meeting with ASEAN NMHSs officers for discussion on the climate and weather system in the past two weeks as well as the outlook for the next two weeks. During which, the NMHSs officers share on the impact of recent TC on their region and the TC outlook for the next two weeks.

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

Regional forum and training on seasonal, sub-seasonal and fortnightly outlook provides the opportunity for NMHSs in the ASEAN region to improve the seasonal rainfall and TC outlooks, including additional tailored products for the region.

Priority Areas Addressed:

Integrated

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

Meteorology

- Develop and enhance typhoon analysis and forecast techniques from nowcast to medium-range, and seasonal to long-range prediction.

Key Pillars of UN's Early Warnings for All (EW4All) Initiative Addressed:

Key Pillars of EW4All	Please ✓ the related pillar(s)
Disaster risk knowledge and management	
Detection, observation, monitoring, analysis, and forecasting	✓
Warning dissemination and communication	
Preparedness and response capabilities	

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5. Enhanced Rainfall Nowcasting for Singapore

Main text:

The Centre for Climate Research Singapore (CCRS), the research arm of MSS, is consistently enhancing our nowcasting capabilities through in-house development and collaborations with local and international partners. These developments will further drive improvements in rainfall nowcasts which will benefit our stakeholders and the public.

Enhancing radar data quality and signal processing through international collaboration

Our collaboration with the Australian Bureau of Meteorology has yielded significant advances, with the implementation of the Bureau's advanced radar processing software in CCRS' real-time operational nowcasting system. The partnership has brought sophisticated components into CCRS' operations to improve MSS' radar data and products (see Figure 1 for example). Complex radar data processing does not slow down the timeline to deliver nowcasts. Through extensive efforts in optimising the system workflow, CCRS has both introduced complex radar data processing algorithms and reduced nowcast delivery time—from 15 minutes to ~4 minutes (excluding radar scanning time) —enabling faster responses to Singapore's rapidly changing weather conditions.

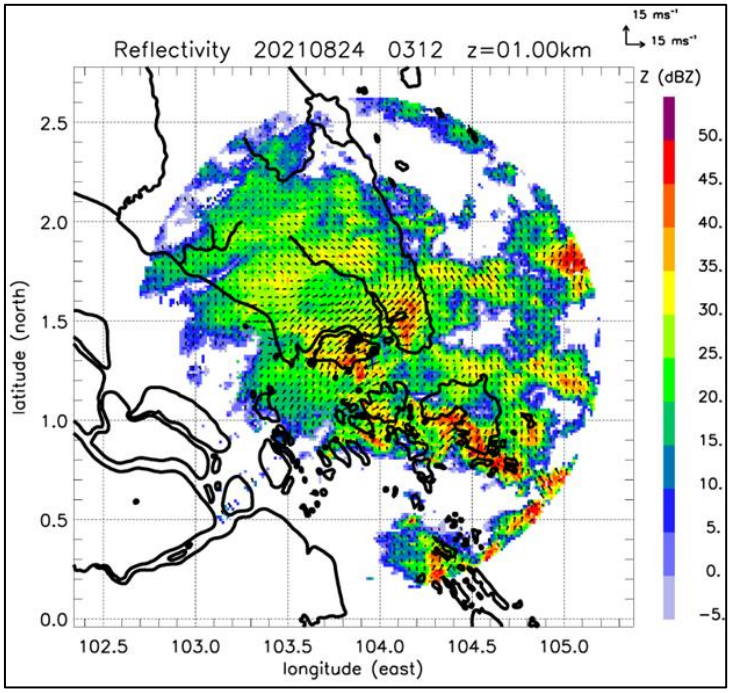

Figure 1: Example of a 2D wind and reflectivity slice taken from the processed 3D data

Applying artificial intelligence / machine learning to improve rainfall nowcasting

Building on the foundation of better radar QC and signal processing, artificial intelligence / machine learning (AI/ML) is further applied in rainfall nowcasting. We completed the Initial Operational Capability (IOC) project with Public Utilities Board (PUB), Singapore's National Water Agency. The project included rigorous testing and operational validation of the nowcasts from our enhanced AI-based nowcast model 'RainNet'. CCRS is now distributing real-time nowcasts to PUB as part of the information used in its flood management operations. Compared to traditional nowcasting methods, RainNet has demonstrated superior performance, achieving an 80% probability of detection (POD) with a relatively low false alarm rate (see Figure 2). This achievement led to RainNet replacing our previous extrapolation-based approach for real-time nowcast, marking a significant upgrade in our operational capabilities.

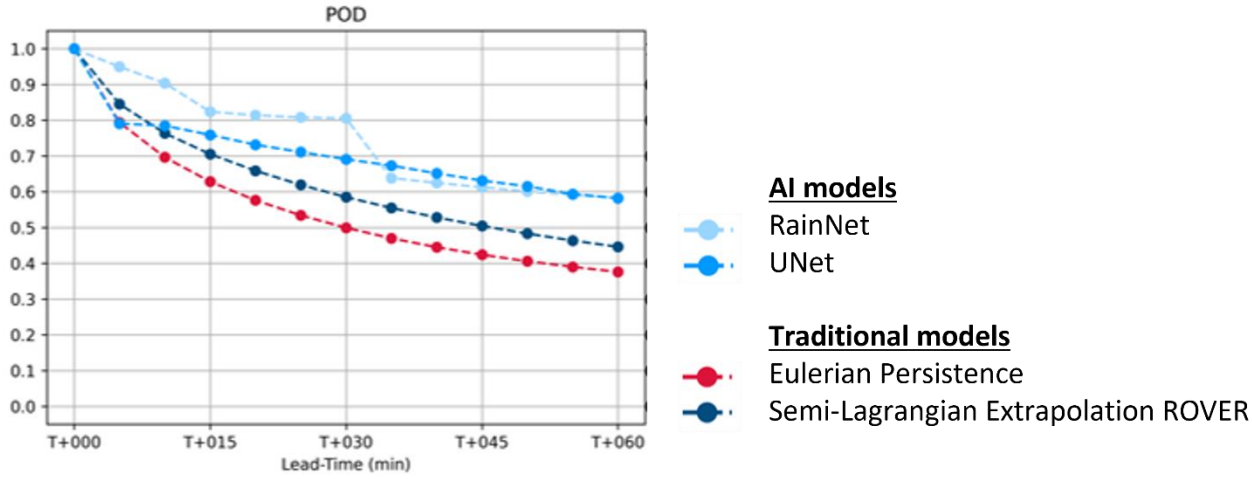

Figure 2: After analysing about 1300 rain events, CCRS' enhanced AI-based nowcast model 'RainNet' was found to achieve an 80% probability of detection (POD) for nowcasts with lead time of 30 minutes, generally higher than traditional models and another AI model 'UNet'. Improvements were also observed in other parameters, e.g. False Alarm Rate (FAR).

Continuous R&D excellence for more robust nowcasting capabilities

CCRS is collaborating with the National University of Singapore on using generative AI to develop Physics-Informed Machine Learning (PIML) for rainfall nowcasting, through the development of a probabilistic nowcasting model, the Singapore Generative Model of Radar (SGMR). SGMR development allows us not only to perform more efficient ML training with large volumes of radar images, but also incorporate additional meteorological information into the model, such as surface wind conditions, diurnal cycles, seasonality, 3D wind, and 3D reflectivity. Such information is important for capturing storm initiation, intensification and decay, thereby potentially improving nowcasting rainfall and intensity at longer lead-time.

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

MSS' focus remains on further enhancing rainfall nowcasting with AI/ML techniques and capabilities, particularly in predicting heavy rainfall events and reducing false alarms in our probabilistic models.

Priority Areas Addressed:

Meteorology

- Develop and enhance typhoon analysis and forecast techniques from nowcast to medium-range, and seasonal to long-range prediction.

Hydrology

- Strengthen capacity in effective flood forecasting and impact-based early warning, including hazard mapping and anticipated risk based on methodological and hydrological modelling, and operation system development.

Key Pillars of UN's Early Warnings for All (EW4All) Initiative Addressed:

Key Pillars of EW4All	Please ✓ the related pillar(s)
Disaster risk knowledge and management	
Detection, observation, monitoring, analysis, and forecasting	✓
Warning dissemination and communication	
Preparedness and response capabilities	

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6. Operationalization of Ensemble Prediction System SINGV-EPS

Main text:

SINGV-EPS is a convective-permitting ensemble prediction system over the Western Maritime Continent (Figure 1). An early version of SINGV-EPS used in research was developed under the collaborative SINGV project between the CCRS and the UK Met Office (UKMO). It was a downscaler of the global ensemble and results were provided to forecasters when available.

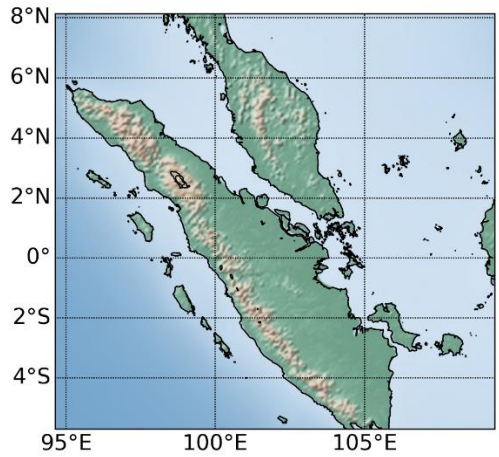

Figure 1. SINGV domain

Significant efforts have been made in CCRS to further develop its ensemble system to address uncertainty in weather forecasts in deep tropics. In February 2025, CCRS formally operationalized SINGV-EPS vn6.2. The latest system features (i) an advanced model science configuration which is consistent with the SINGV deterministic model (SINGV-DA), (ii) a centering of the ensemble on the data assimilation analysis from SINGV-DA, (iii) an adaptive selection of the ensemble members from the global ensemble, and (iv) an inflation of the ensemble perturbations from the global ensemble.

The performance of the 4.5km resolution, 12-member SINGV-EPS vn6.2 has been evaluated against the driving ECMWF Ensemble Prediction System (ECMWF-ENS) to ensure that SINGV-EPS adds value with respect to the global ensemble. Trials were run for four months (Dec 2023, Mar, Jun and Sep 2024). Using the Continuous Ranked Probability Score (CRPS), forecasts were evaluated against observations for variables in both the surface (AWS and SYNOP) and upper atmosphere (radiosonde).

The performance of the SINGV_EPS for surface variables can be summarized as:

i. SINGV-EPS vn6.2 performs significantly better than ECMWF-ENS for 2m temperature
ii. SINGV-EPS vn6.2 is comparable to ECMWF-ENS for precipitation
iii. When compared to SYNOP, SINGV-EPS vn6.2 performs significantly better than ECMWF-ENS for 10m wind direction and wind speed, however, the opposite is observed when compared to AWS

For the upper atmosphere variables, SINGV-EPS vn6.2 performs significantly better than ECMWF-ENS at the lower troposphere (850-1000hPa) (Figure 2).

Article reported in the Momentum Users Newsletters No. 30 (March 2025):
https://info.metoffice.gov.uk/cr/AQi1wgUQzpqNBxiiufTVASHdvdEypgvVMd-TiTj0d2DefkwiNFpWp-LZa5R8fDxj

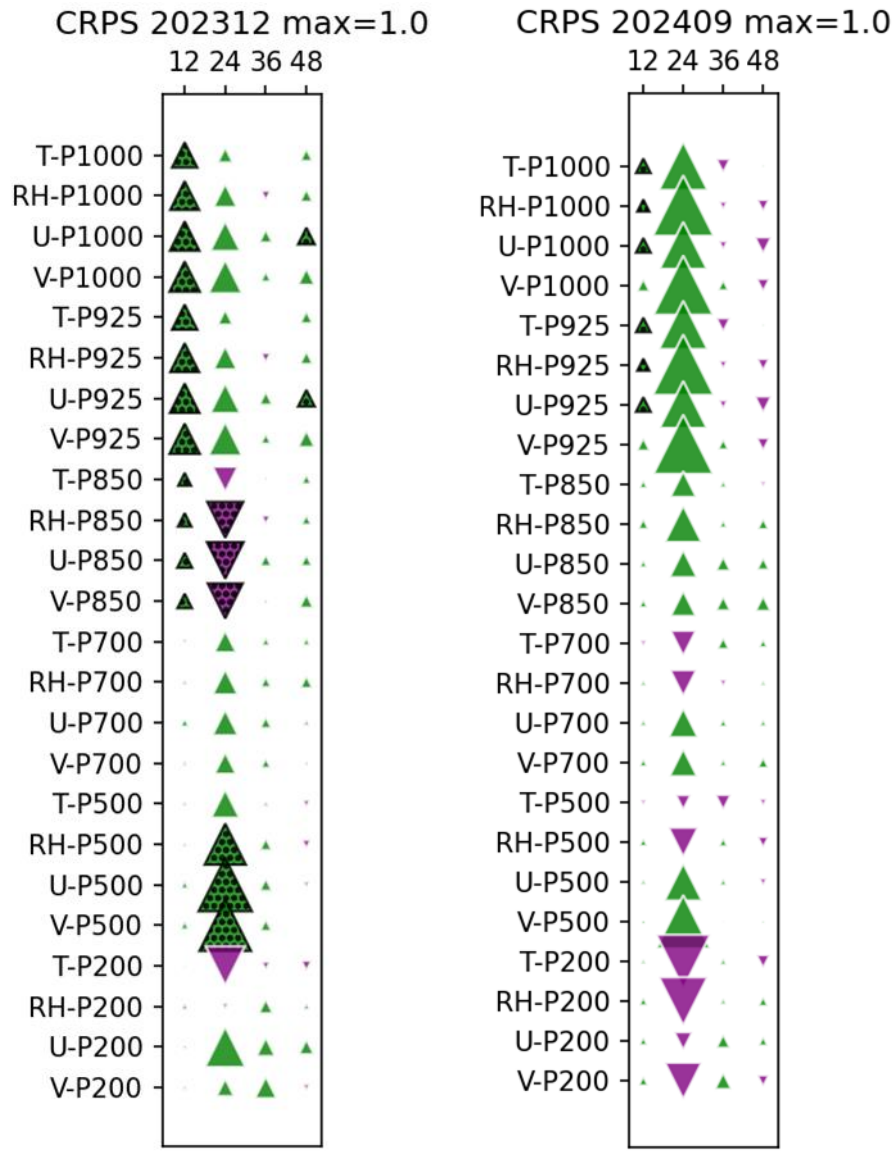

Figure 2. Hinton diagram comparing the forecast skill of the 12-member ensemble in SINGV-EPS version 6.2 and the 51-member ensemble in ECMWF-ENS, tracked over December 2023 and September 2024, measured by the Continuous Ranked Probability Score (CRPS). Green triangles indicate better skill by SINGV-EPS while purple triangles indicate better skill by ECMWF-ENS. Black edges and dots within triangles denote statistically significant results at 95% confidence intervals. The forecasts for different variables are compared at 12-hourly intervals up to 48 hours in advance.

Identified opportunities/challenges, if any, for further development or collaboration:
Moving forward, plans for further development of SINGV-EPS include increasing the number of ensemble members and produce more tailored products to support the downstream applications of SINGV-EPS. Further R&D will also be pursued in the development of MSS next generation (SINGV_NG) system.

Priority Areas Addressed:

Meteorology

- Develop and enhance typhoon analysis and forecast techniques from nowcast to medium-range, and seasonal to long-range prediction.
- Enhance and provide typhoon forecast guidance based on NWP including ensembles, weather radar and satellite related products, such as QPE/QPF.

Key Pillars of UN's Early Warnings for All (EW4All) Initiative Addressed:

Key Pillars of EW4All	Please ✓ the related pillar(s)
Disaster risk knowledge and management	
Detection, observation, monitoring, analysis, and forecasting	✓
Warning dissemination and communication	
Preparedness and response capabilities	

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7. Participation in the Development of RDCA Satellite Products

Main text:

Convective weather within Asia-Pacific is a significant aviation hazard that can produce dangerous, rapid changes in wind directions, updrafts, lightning, icing and turbulence. Recent turbulence-related incidences in the region have put increasing urgency on aviation meteorologists to provide accurate nowcasts of convective weather for pilots to improve situational awareness.

The Rapidly Developing Cumulus Area (RDCA) product is one component of the Himawari satellite-based Convective Cloud Information (CCI) product developed by the Japan Meteorological Agency (JMA) to enhance aviation safety. RDC clouds pose a hazard to aircraft as they can develop rapidly into thunderstorms. MSS has been utilising the RDCA product through the JMA-hosted SIGMET coordination portal. JMA has also shared the algorithm with MSS in a collaborative effort to enhance aviation safety.

Originally packaged for the SEA region, MSS has expanded the coverage to the Asia-Pacific (90E to 190E, 50S to 50N) through horizontal segment stitching (from segments 1 to 10), with parallel processing to minimise production latency. Presently, the RDCA product is generated every 10 minutes upon reception of Himawari Standard Data (HSD) via HCloud.

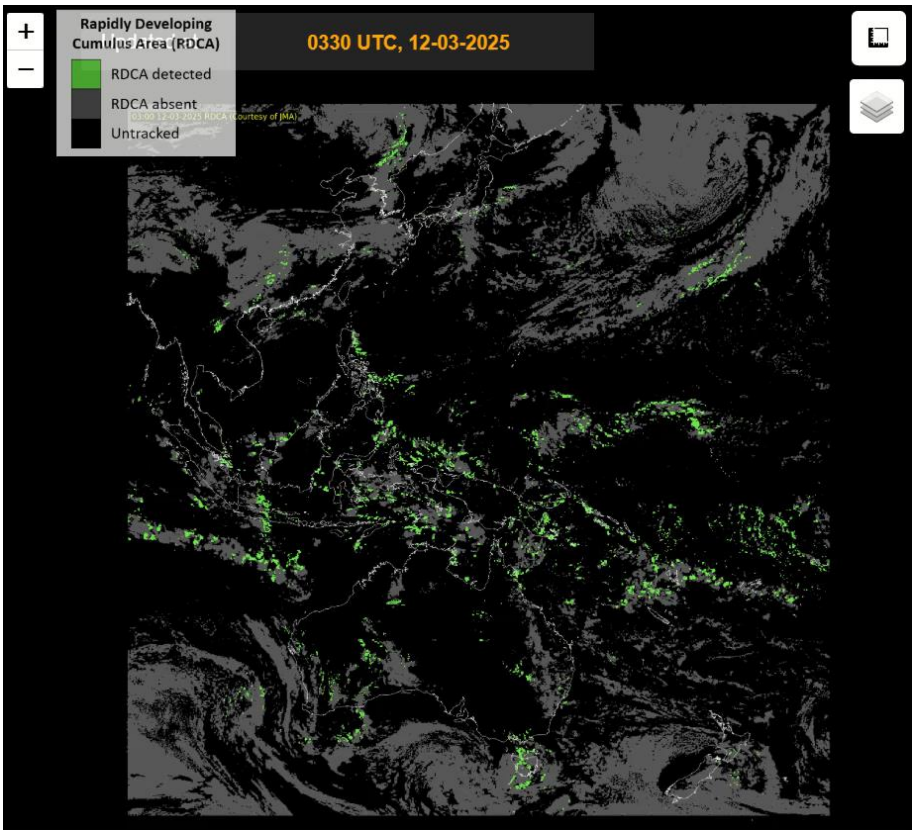

Figure 1. RDCA detection over the expanded Asia-Pacific domain.

To factor in possible rapid and dangerous changes in cloud-top heights, MSS applies optical flow tracking on cloud-top height data to calculate cloud-top height changes (differenced Cloud-Top Height, or dCTH). The dCTH and RDCA information are then composited into a raster-based nowcast product for MSS's aviation partners.

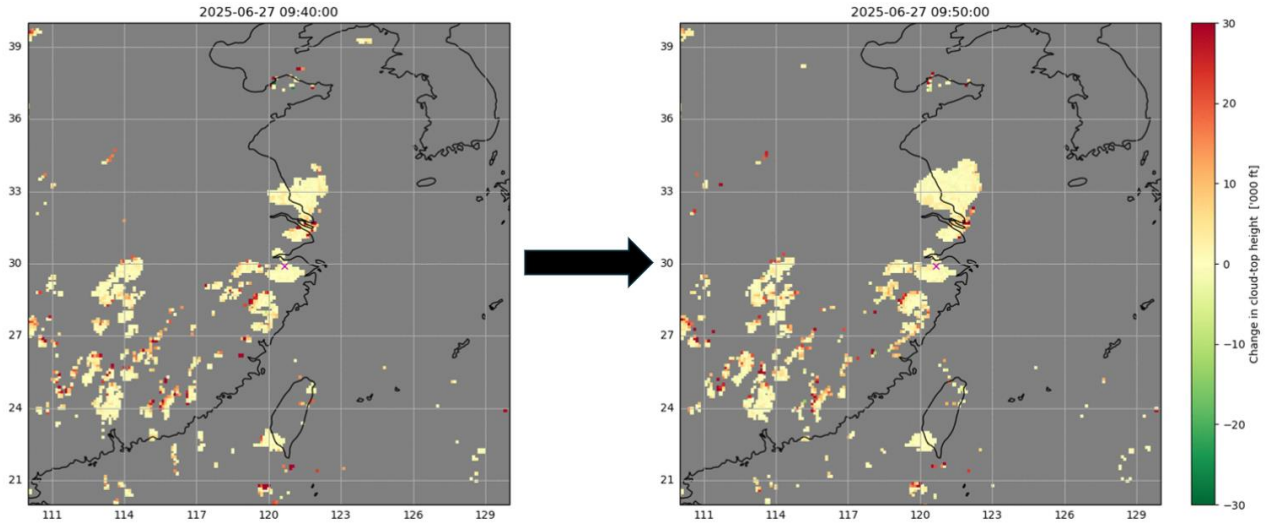

Figure 2. The dCTH-RDCA product (zoomed in to an area with convective activity).

Identified opportunities/challenges, if any, for further development or collaboration:
The RDCA algorithm was developed using data from around Japan. MSS aims to finetune the algorithm for Southeast Asia using global lightning data.

Priority Areas Addressed:
Integrated

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

Meteorology

- Enhance the capacity to monitor and forecast typhoon activities particularly in genesis, intensity and structure change
- Develop and enhance typhoon analysis and forecast techniques from nowcast to medium-range, and seasonal to long-range prediction.
- Enhance and provide typhoon forecast guidance based on NWP including ensembles, weather radar and satellite related products, such as QPE/QPF.
- Promote communication among typhoon operational forecast and research communities in Typhoon Committee region
- Enhance training activities with TRCG, WGH, and WGDRR in accordance with Typhoon Committee forecast competency, knowledge sharing, and exchange of latest development and new techniques

Key Pillars of UN's Early Warnings for All (EW4All) Initiative Addressed:

Key Pillars of EW4All	Please ✓ the related pillar(s)
Disaster risk knowledge and management	
Detection, observation, monitoring, analysis, and forecasting	✓
Warning dissemination and communication	

Preparedness and response capabilities	

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Appendix I - Priority Areas of Working Groups for the Strategic Plan 2022-2026

WG	Priorities
Integrated	1. Strengthen the cooperation between TRCG, WGM, WGH, and WGDRR to develop impact-based forecasts, decision-support and risk-based warning.
	2. Strengthen cross-cutting activities among working groups in the Committee.
	3. Enhance collaborative activities with other regional/international frameworks/organizations, including technical cooperation between TC/AP-TCRC and TC/PTC cooperation mechanism.
Meteorology	4. Enhance the capacity to monitor and forecast typhoon activities particularly in genesis, intensity and structure change.
	5. Develop and enhance typhoon analysis and forecast techniques from nowcast to medium-range, and seasonal to long-range prediction.
	6. Enhance and provide typhoon forecast guidance based on NWP including ensembles, weather radar and satellite related products, such as QPE/QPF.
	7. Promote communication among typhoon operational forecast and research communities in Typhoon Committee region.
	8. Enhance training activities with TRCG, WGH, and WGDRR in accordance with Typhoon Committee forecast competency, knowledge sharing, and exchange of latest development and new techniques.
	9. Enhance RSMC capacity to provide regional guidance including storm surge, in response to Member's needs.
Hydrology	10. Improve typhoon-related flood (including riverine flood, flash flood, urban flood, and coastal flood) monitoring, data collection and archiving, quality control, transmission, processing, and sharing framework.
	11. Enhance capacity in typhoon-related flood risk management (including land-use management, dam operation, etc.) and integrated water resources management and flood-water utilization.
	12. Strengthen capacity in effective flood forecasting and impact-based early warning, including hazard mapping and anticipated risk based on methodological and hydrological modelling, and operation system development.
	13. Develop capacity in projecting the impacts of climate change, urbanization and other human activities on typhoon-related flood disaster vulnerability and water resource availability.
	14. Increase capacity in utilization of advanced science and technology for typhoon-related flood forecasting, early warning, and management.
DRR	15. Provide reliable statistics of mortality and direct disaster economic loss caused by typhoon-related disasters for monitoring the targets of the Typhoon Committee.
	16. Enhance Members' disaster risk reduction techniques and management strategies.
	17. Evaluate socio-economic benefits of disaster risk reduction for typhoon-related disasters.
	18. Promote international cooperation of DRR implementation project.
	19. Share experience/knowhow of DRR activities including legal and policy framework, community-based DRR activities, methodology to collect disaster-related information.