MEMBER REPORT
Macao, China

ESCAP/WMO Typhoon Committee
20th Integrated Workshop
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)

As of 21st November, 14 tropical cyclones affected Macao, China in 2025, which makes 2025 the most active typhoon season for Macao on record. Tropical cyclones that affected the territory includes: Typhoon Wutip (2501), Nameless TD in June, Typhoon Danas (2504), Typhoon Wipha (2506), Severe Typhoon Podul (2511), Nameless TD in August, Severe Typhoon Kajiki (2513), Tropical Storm Nongfa (2514), Severe Tropical Storm Tapah (2516), Severe Tropical Storm Mitag (2517), Super Typhoon Ragasa (2518), Typhoon Matmo (2521), Severe Tropical Storm Fengshen (2524), and Super Typhoon Fung-wong (2526). Their tracks and the highest issued Tropical Cyclone Signals in Macao are shown in Fig. 1 and Table 1 respectively. Their meteorological influences on Macao are described below in details.

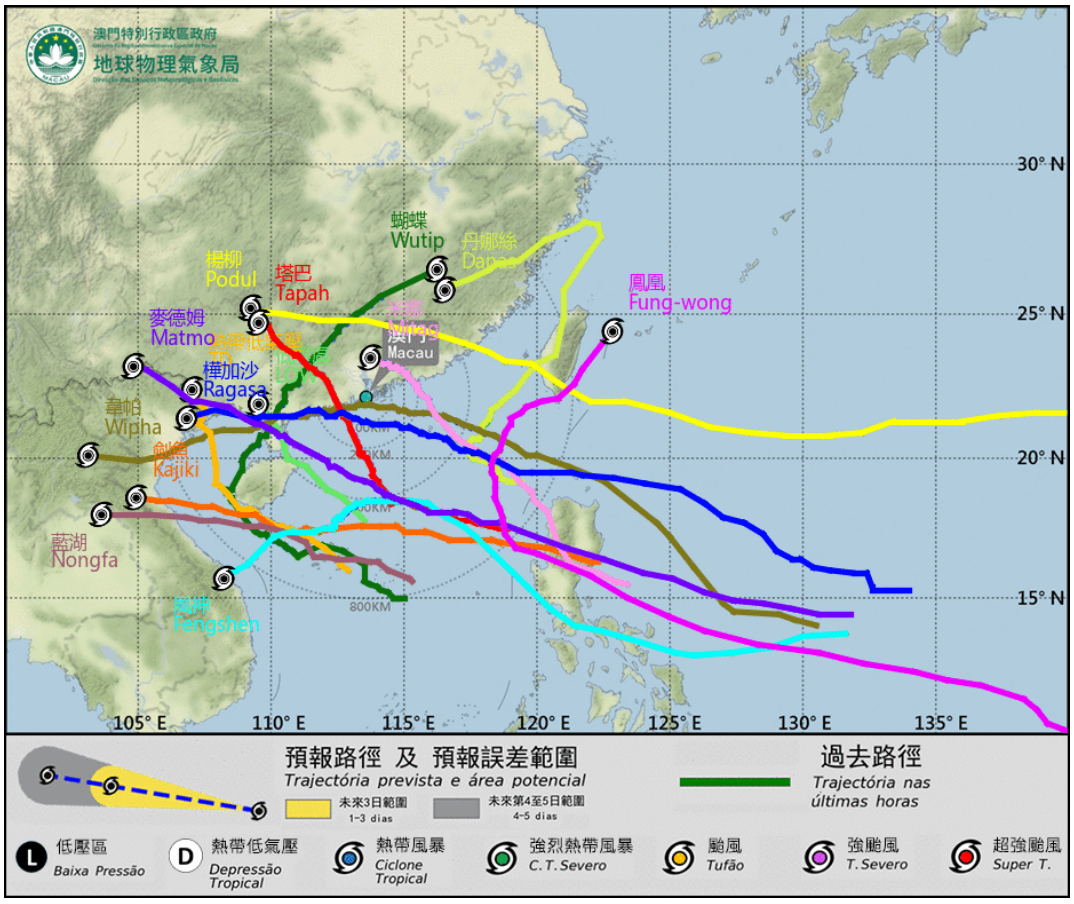

Figure 1 *Tracks of tropical cyclones affecting Macao, China in 2025.*

Typhoon Wutip (2501)

Wutip formed over the central part of South China Sea on 10th June. On the next day, Wutip intensified into a tropical storm and moved in a generally westward direction towards the western coast of Hainan Island. On 14th June, while traversing the Beibu Gulf, it strengthened into a typhoon, then made a second landfall in western Guangdong Province. It came closest to Macao in the early morning on 15th June, about 240 km to the northwest of the territory. Subsequently Wutip moved further inland and gradually weakened into a low-pressure system later that day.

During the period of Wutip's influence, due to the combined effects of a high-pressure ridge and southwesterly airflow, Tropical Cyclone Signal No.3 was issued on two separate occasions.

Under the influence of Wutip, winds in Macao reached up to 55.1 km/h with maximum gust of 65.5 km/h.

Nameless TD in June

A low-pressure system over the South China Sea intensified into a tropical depression on 25th June and moved in a generally northwestward direction. It made landfall in Hainan Island on the following day, then made a second landfall in Leizhou Peninsula, subsequently moving into inland area and weakened into a low-pressure area on the evening of 26th June. Due to its weak intensity and relatively far distance, it did not significantly impact the territory.

Typhoon Danas (2504)

Danas formed over the northeastern part of South China Sea on 4th July. On the next day, Danas initially moved northwest slowly, then turned to move northeast toward Taiwan. Under favourable atmospheric and oceanic conditions, Danas intensified into a tropical storm early that day and further intensified into a severe tropical storm by the evening. It came closest to Macao on the afternoon of 5th July, about 440 km to the east-southeast of the territory. It reached its peak intensity on the following day as a typhoon before it made its first landfall over Taiwan. On 6th July, Danas entered the East China Sea and weakened into a tropical storm, then made a sharp turn to move southwest. It made landfall again over the coast of Zhanjiang on the evening of 8th July and finally dissipated on the following day.

Since Danas was relatively distant from Macao, under the influence of the subtropical high and its outer subsiding air, the weather in Macao continued to be very hot during the period.

Typhoon Wipha (2506)

Wipha formed over the ocean east of the Philippines on 16th July, moving northwest toward the Luzon Strait. It intensified into a tropical storm on 18th July. Wipha entered South China Sea on the following day, moved steadily west-northwest towards the coast of Guangdong. It further intensified into a typhoon on 20th July, making landfalls over Taishan and Yangjiang cities in the afternoon. It came closest to Macao between 1 and 2 p.m. that day, about 30 km to the south-southwest of the territory, with maximum wind of 140 km/h near its centre. It then moved along the Guangdong coast, further weakening into a tropical storm on 21st July. Upon entering the Beibu Gulf, Wipha briefly re-intensified into a severe tropical storm, finally dissipated on 23rd July as it moved further inland of Vietnam.

Wipha was the first tropical cyclone necessitating the issuance of the Tropical Cyclone Signal No. 10 in 2025. Under the influence of Wipha, winds in Macao reached up to 119.2 km/h with maximum gust of 153.0 km/h. Furthermore, over 100 mm of rainfall was recorded during the passage of Wipha. Although storm surge from Wipha did not coincide with the astronomical high tide, low-lying areas experienced minor flooding due to heavy rainfall.

Severe Typhoon Podul (2511)

Podul formed over the ocean east of the Philippines in early August, moving northwest and gradually intensifying into a tropical storm. On 10th August, Podul strengthened into a severe tropical storm and moved westward towards the seas east of Taiwan, rapidly intensified as it approached Taiwan in the following days. Podul made landfall in Taiwan on 13th August as a severe typhoon but started weakening afterwards. Podul made landfall again in Fujian Province on the following day, rapidly weakened further. On 15th August, it has dissipated as it moved deeper into mainland China.

Under the influence of Podul's outer circulation, Macao experienced frequent heavy showers and thunderstorms on 14th August. The Black Rainstorm Warning was issued at 14:02 as rain intensified. During the rainstorm warning period, Ká-Hó weather station recorded a maximum hourly rainfall of 110.0 mm. Due to persistent rainfall, flooding occurred across multiple areas in Macao, with particularly severe flooding in low-lying areas. The water level monitoring station at Caminho das Hortas recorded a peak flood level of 0.92 metres.

Nameless TD in August

A monsoon depression over the South China Sea intensified into a tropical depression on 16th August, moved north-northwest towards Hainan Island. It passed near Hainan Island and made landfall in Vietnam on 19th August, subsequently moving into inland and weakened into a low-pressure area. Although the tropical depression was relatively weak and remained far from Macao, under the combined influence of the high-pressure ridge and the tropical depression, maximum sustained wind speed at cross-sea bridges reached Force 6 during the passage of the tropical depression.

Severe Typhoon Kajiki (2513)

Kajiki formed over the ocean east of the Philippines on 22nd August. It moved westward, crossing the Philippines and entered the northern part of South China Sea on the following day, meanwhile it intensified into a tropical storm. It intensified rapidly under favourable atmospheric and ocean conditions, reaching the intensity of a severe typhoon on 24th August. Kajiki made landfall over Vietnam on the evening of 25th August, gradually weakened overland. Winds at cross-sea bridges reached Force 6 temporarily during the passage of severe typhoon Kajiki.

Tropical Storm Nongfa (2514)

Nongfa formed over the central part of South China Sea on 28th August, moved northwest across the South China Sea. It intensified into a tropical storm on 30th August, before making landfall over the central coast of Vietnam. Nongfa dissipated next morning as it moved further inland. Winds at cross-sea bridges reached Force 6 temporarily during the passage of Nongfa.

Severe Tropical Storm Tapah (2516)

Tapah formed over the central part of South China Sea on the evening of 5th September. It intensified into a tropical storm and moved west-northwest on the following day. On 7th September Tapah made a sharp turn, moved north to northwest towards the coast of Guangdong and intensified into a severe tropical storm. It made landfall on the coast of Taishan city next morning, after which it gradually weakened and finally dissipated on 9th September as it continued to move inland. It came closest to Macao on the morning of 9th September, about 110 km to the west-southwest of the territory, with maximum wind of 110 km/h near its centre.

Under the influence of Tapah, winds in Macao reached up to 77.0 km/h with maximum gust of 102.2 km/h, necessitating the issuance of the Tropical Cyclone Signal No. 8. Furthermore, Tapah induced a storm surge in Macao, leading to the issuance of yellow storm surge warning. Minor flooding occurred in low-lying areas, with water levels reaching approximately 0.10m high.

Severe Tropical Storm Mitag (2517)

Mitag formed over the ocean east of the Philippines on 16th September, it moved northwest, crossing the Philippines and entered the northern part of South China Sea on the following day. It intensified into a tropical storm on 18th September and continued moving northwest towards the coastal area of eastern Guangdong. On 19th September it intensified into a severe tropical storm and made landfall over Shanwei City in the afternoon. It continued to move inland, eventually dissipated overland on the following day. It came closest to Macao on the morning of 20th September, about 140 km to the north-northeast of the territory. Winds at cross-sea bridges reached Force 5 to 6 during the passage of Mitag.

Super Typhoon Ragasa (2518)

Ragasa formed over the ocean east of the Philippines on 18th September, moving in a generally northwest direction. It rapidly intensified into a tropical storm on the same day. Benefited from warm ocean temperatures and sustained conducive conditions, Ragasa intensified rapidly, reaching super

typhoon status on 21st September. Steered by a subtropical high, it moved steadily northwest across the Luzon Strait and entered the South China Sea, without crossing major landmass. It developed a broad, well-structured circulation with a double eyewall structure. It came closest to Macao on the morning of 24th September, about 90 km to the south-southwest of the territory, with maximum wind of 185 km/h near its centre. Ragasa then made landfall in Yangjiang City, Guangdong in the afternoon as a severe typhoon, then moved along the coastal area of western Guangdong, gradually weakened and dissipated on 25th September.

Ragasa was the most intense tropical cyclone to affect Macao in 2025. Under the influence of Ragasa, winds in Macao reached up to 130.3 km/h with maximum gust of 164.2 km/h, necessitating the issuance of the Tropical Cyclone Signal No. 10 for the second time this year. It was the first time when Signal No. 10 was issued twice in a single year since official record started in 1968. Furthermore, Ragasa induced a severe storm surge in Macao, leading to the issuance of Red Storm Surge Warning. Flooding was widespread over the territory, particularly evident in low-lying areas near the Inner Harbour, with water levels reaching approximately 1.51 metres high.

Typhoon Matmo (2521)

Matmo formed over the ocean east of the Philippines on 1st October. On the next day, Matmo intensified into a tropical storm and moved steadily west-northwest towards Northern Luzon. It entered South China Sea on 3rd October and intensified into a Typhoon in the following day. It came closest to Macao on the morning of 5th October, about 290 km to the south-southwest of the territory, with maximum wind of 145 km/h near its centre. Matmo made landfall over the coast of Zhanjiang in the afternoon. It entered the Gulf of Beibu in that evening and finally dissipated near the border of China and Vietnam in the early morning on 7th October.

Under the influence of the extensive circulation and strong gust associated with outer rainbands of Matmo, winds in Macao reached up to 88.2 km/h with maximum gust of 130.7 km/h, necessitating the issuance of the Tropical Cyclone Signal No. 8 for the fourth time this year, tying with 1993, 2008 and 2022 as the record for the most No. 8 Signals issued in a single year. Furthermore, since the timing of the highest storm surge induced by Matmo did not coincide with the astronomical high tide, low-lying areas experienced minor flooding on the morning of 5th October.

Severe Tropical Storm Fengshen (2524)

Fengshen formed over northern Luzon on 17th October. It intensified into a tropical storm on the next day, moving westward towards the Philippines. After crossing Luzon Island, it turned to move northwest, approaching the northern part of the South China Sea on 19th October. As a surge of northeast monsoon arrived at the coast of South China in the following day, Fengshen gradually slowed down and shifted to move westward. It came closest to Macao at midnight on 21st October, about 410 km to the south of the territory, before turning southwest and gradually moving away from Macao while weakening. It eventually dissipated over the central coast of Vietnam on 23rd October.

Under the influence of the northeast monsoon, the Strong Monsoon Signal was issued at midnight on 20th October, then replaced by Tropical Cyclone Signal No. 3 on the evening of the following day as Fengshen edged closer to the city. As Fengshen started to move away from the territory, the Tropical Cyclone Signal was once again replaced by Strong Monsoon Signal on the afternoon of 21st October. Under the combined influence of Fengshen and the northeast monsoon, winds in Macao reached up to 49.0 km/h with maximum gust of 65.5 km/h.

Super Typhoon Fung-wong (2526)

Fung-wong formed over western Pacific Ocean on 3rd November. It intensified into a tropical storm on 6th November, moving north-westward towards the Philippines and gradually intensifying into a Super Typhoon. After crossing Luzon Island and moving into the South China Sea, it turned to move northward and gradually weakened into a Severe Tropical Storm. It then turned to move northeastward on 12th November towards the southern part of Taiwan region. It eventually dissipated over the western Pacific Ocean on 13th November.

Since Fung-wong maintained a distance of more than 550 km away from Macao, Macao was not affected by Fung-wong, and was predominantly affected by the northeast monsoon during the period. The highest Tropical Cyclone Signal issued was Signal No.1.

Start Date	End Date	Name	The Highest Signal
11 Jun, 2025	15 Jun, 2025	Wutip	No. 3
25 Jun, 2025	26 Jun, 2025	TD	No. 1
04 Jul, 2025	06 Jul, 2025	Danas	No. 1
19 Jul, 2025	21 Jul, 2025	Wipha	No. 10
13 Aug, 2025	14 Aug, 2025	Podul	No. 1
16 Aug, 2025	17 Aug, 2025	TD	No. 3
23 Aug, 2025	24 Aug, 2025	Kajiki	No. 1
28 Aug, 2025	29 Aug, 2025	Nongfa	No. 1
06 Sep, 2025	08 Sep, 2025	Tapah	No. 8
18 Sep, 2025	20 Sep, 2025	Mitag	No. 3
22 Sep, 2025	25 Sep, 2025	Ragasa	No. 10
03 Oct, 2025	05 Oct, 2025	Matmo	No. 8
20 Oct, 2025	21 Oct, 2025	Fengshen	No. 3
10 Nov, 2025	11 Nov, 2025	Fung-wong	No. 1

Table 1 *The Tropical Cyclone Signals issued by Macao Meteorological and Geophysical Bureau during the tropical cyclones affected period.*

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

Nil.

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

Macao was hit by 14 tropical cyclones in 2025. Two of them resulted in the issue of up to Tropical Cyclone Signal No.8 (“Tapah” and “Matmo”), and two resulted in the issue of Tropical Cyclone Sgnal No.10 (“Wipha” and “Ragasa”), the others only resulted in the issue of up to Tropical Cyclone Signal No.3 and No.1, which caused minor damages in Macao.

No injuries were reported in tropical cyclone “Tapah” and “Matmo”. No incidents were reported for “Tapah” and 5 incidents were reported for “Matmo”. (Refer to the following tables for more details)

Typhoon “Wipha” prompted the hoisting of Typhoon Signal No.10 and a yellow storm surge warning was issued, it means that the water level in the low lying area in Macao is expected to be 1.0 to 1.5 meters above road level. However, a minor damages caused by “Wipha”, 121 incidents were reported and 2 people injured during “Wipha”. (refer to the following tables for more details)

Super Typhoon “Ragasa” brought prolonged severe weather and storm surges with flooding comparable to Typhoons “Hato” and “Mangkhut”. A Typhoon signal No.10 and a fourth level (red) storm surge warning had been issued. This meant that the water level in the low-lying areas of Macao was expected to be 1.5 to 2.5 meters above the road level. The highest sustained wind speed in the centre reached 220 km/h, resulting in 201 reported incidents and no people injured. (refer to Table 2 for more details).

Tropical cyclones “Wipha”and “Ragasa” are the fifth and sixth typhoon signal No.10 issued in 9 years in Macao, following “Hato” in 2017, “Mangkhut” in 2018, “Haikos” in 2020 and “Saola” in 2023. Compared with 1968 to 2016 (49 years), only four typhoon signal No. 10 were issued, the frequency of issuing typhoon signals No.10 has increased significantly in recent years.

Date/Time		Name	The Highest Signal Hoisted	Incidents (cases)									
Start	End			Flooding	Landslide	Fallen Trees	Buildings collapsed/ Concrete spalled off	Billboards/ Awnings/ Windows/ (Collapsed/ Tottered)	Scaffoldings / Fencings/ Crane (Collapsed/ Tottered)	Power cables/ Lampposts (Collapsed/ Tottered)	Injuries	Death	Others
11/6/2025 06H00	15/6/2025 15H30	Wutip 2501	3	0	0	2	2	1	0	0	0	0	0
25/6/2025 16H30	26/6/2025 16H00	Unamed	1	0	0	0	0	0	0	0	0	0	0
4/7/2025 13H00	6/7/2025 13H00	Danas 2504	1	0	0	0	0	0	0	0	0	0	0
19/7/2025 05H00	21/7/2025 06H00	Wipha 2506	10	0	0	35	7	55	21	3	2	0	0
13/8/2025 12H00	14/8/2025 18H00	Podul 2511	1	17	3	2	2	1	0	0	0	0	0
16/8/2025 21H00	17/8/2025 23H00	Unamed	3	0	0	0	0	1	0	0	0	0	0
23/8/2025 01H00	24/8/2025 13H00	Kajiki 2513	1	0	0	0	0	0	0	0	0	0	0
28/8/2025 19H00	29/8/2025 16H30	Nongfa 2514	1	0	0	0	0	0	0	0	0	0	0
6/9/2025 00H30	8/9/2025 23H00	Tapah 2516	8	0	0	0	0	0	0	0	0	0	0
18/9/2025 00H00	20/9/2025 06H00	Mitag 2517	3	0	0	0	0	0	0	0	0	0	0
22/9/2025 15H00	25/9/2025 06H00	Ragasa 2518	10	5	0	2	63	10	44	77	0	0	41
3/10/2025 23H00	5/10/2025 21H00	Matmo 2521	8	0	0	1	1	3	0	0	0	0	0
20/10/2025 19H00	21/10/2025 17H00	Fengshen 2524	3	0	0	0	0	0	0	0	0	0	0

Table 2 *Incidents during the tropical cyclones affected period.*

Macao experienced several severe rainstorms in 2025 (Refer to Table 3). Macao Meteorological and Geophysical Bureau issued a series of warning signals in response to heavy rains. These signals are divided into three levels: yellow, red and black, based on the rainfall intensity. A yellow signal means that rainfall reaches or exceeds 20 millimeters per hour, red signal indicates 50 millimeters per hour, and black signal means rainfall may exceed 80 millimeters per hour.

Some areas in Macao recorded relatively high cumulative rainfall. These heavy rains caused flooding in local areas. In recent years, the Government enhanced drainage network, including operational stormwater pumping stations and upgraded sewerage systems, which significantly improved flood-drainage and flood-prevention capacity in vulnerable zones. Meanwhile, the Government will continue to educate citizens on actions to take during rainstorms and broadcast rainstorm warning signals to the public in serious situations.

Incidents (cases)											
Start	End	Flooding	Fallen Trees	Buildings collapsed/ Concrete spalled off	Billboards collapsed or tottered	Scaffoldings collapsed or tottered	Windows collapsed or tottered	Awnings collapsed or tottered	Landslide	Injuries	Others
29-05-2025 00H05	29-05-2025 01H05	0	0	0	0	0	0	0	0	0	0
17-06-2025 06H35	17-06-2025 09H00	0	1	0	0	0	0	1	0	0	1
18-07-2025 12H15	18-07-2025 14H00	0	0	0	0	0	0	0	0	0	0

05-08-2025 05H22	05-08-2025 06H25	0	0	0	0	0	0	0	0	0	0
05-08-2025 08H00	05-08-2025 10H20	0	0	0	0	0	0	0	0	0	0
14-08-2025 13H35	14-08-2025 17H50	15	2	1	0	0	0	0	2	0	3

Table 3 *Incidents during red and black rainstorms period.*

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

To further deepen and promote the coordinated development of meteorological services between Macao and Zhuhai, Macao Meteorological and Geophysical Bureau and Zhuhai Meteorological Bureau jointly signed the "Comprehensive Deepened Meteorological Cooperation Plan between Zhuhai and Macao" in 2025. This marks the new stage of all-dimensional cooperative development in meteorological services of Zhuhai and Macao SAR.

Figure 2 *Macao Meteorological and Geophysical Bureau and Zhuhai Meteorological Bureau jointly signed the "Comprehensive Deepened Meteorological Cooperation Plan between Zhuhai and Macao" on 20 March, 2025 in Zhuhai, China.*

In addition, regarding the cooperation between Shanghai Meteorological Bureau and Macao Meteorological and Geophysical Bureau, The AI Agent for Multi-Hazard Early Warning: MAZU-Urban (Macao Edition) was officially launched in 2025. Shanghai Meteorological Bureau and Macao Meteorological and Geophysical Bureau will jointly commit to the application of MAZU-Urban (Macao Edition) in Macau and its international promotion, and continue to deepen cooperation, closely aligning with the requirements of the memorandum on the new round of Shanghai-Macao cooperation, to continuously advance meteorological science and technology innovation and application.

Figure 3 *The AI Agent for Multi-Hazard Early Warning: MAZU-Urban (Macao Edition) was officially launched on 29 September, 2025 in Macao, China.*

II. Summary of Progress in Priorities supporting Key Result Areas

1. Enhancement of objective tropical cyclone warning signal probability matrix

Main text:

To enable the public to be informed of the risk posed by each tropical cyclone to Macao and to take targeted precautionary measures in advance, Macao Meteorological and Geophysical Bureau (DSMG) integrates "kidney" graph (Nickname for a type of probability map based on historic tropical cyclone data that predicts the chance that certain level of local winds will be observed if tropical cyclones of certain intensities pass within certain areas on the map) with ensemble forecast tracks to construct a local warning signal risk matrix. However, limitations arise from insufficient historical samples and anomalous TCs (e.g., extreme size or motion), necessitating enhanced methodology.

As a result, a conditional probabilistic framework is introduced to leverage operational forecasting expertise and further exploits ensemble prediction system products. The procedure (Illustrated in Figure 4 in a case of Tropical Cyclone Signal No.8) is as follows:

1. **Define intensity-dependent risk domains** using 'kidney' and verified operational experiences, depicting spatial envelopes where TCs of specific intensity classes produce threshold wind speeds at Macau;
2. **Derive track-intersection probability** by quantifying the temporal distribution and count of EPS members crossing the risk domains at point 1;
3. **Compute wind-field impact probability** from EPS explicit forecasts of 34 kt, 50 kt, and 64 kt wind radii enveloping the Macao grid point;
4. **Apply warning signal-specific weighting** to blend track-based (Step 2) and wind-field-based (Step 3) probabilities, calibrated to satisfy objective verification benchmarks for each warning level.

DSMG will continue to experiment with different approaches to compute tropical cyclone warning signal probabilities, and will work to enhance objective prediction of risk and probabilities in forecast operation.

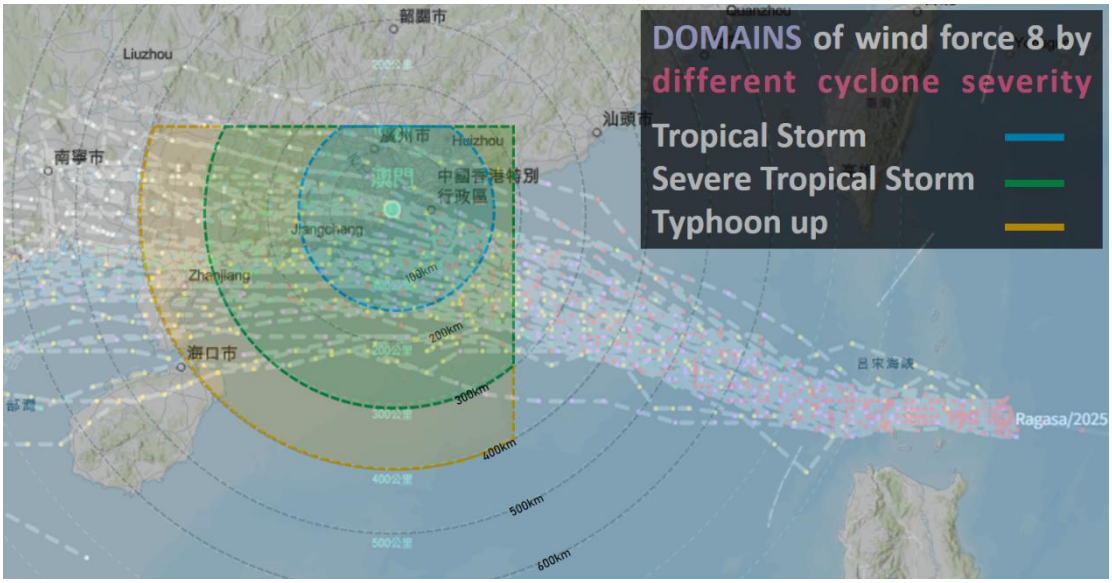

Figure 4 *– Example of a new conditional probabilistic framework: Count every ensemble member following the rules below. Signal No. 8 is triggered when 50 kt winds hit Macau (full count). Proxies use 50% weight each: (1) intensity-based distance thresholds (TS≤150 km, STS≤300 km, TY+≤400 km) with track SW of 23.5°N/115.5°E, and (2) 34 kt wind impact. (1) and (2) get the same weight because both conditions are equally reliable.*

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

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	

Contact Information:
Member: Macao, China
Name of contact for this item: Mr. LOK Chan Wa
Telephone: +853 88986273
Email: cwlok@smg.gov.mo

2. Application of AI technology forecasting tools

Main text:

In addition to traditional modeling predictions, DSMG has attempted to introduce AI based prediction models into operational forecasting in recent years. DSMG made use of machine learning methods to develop a local storm surge forecasting model. The model makes predictions by establishing a relationship between local wind speed, wind direction, gusts, and air pressure with local water levels. The results have shown a certain degree of effectiveness, and DSMG is continuously verifying and optimizing this project.

In addition, DSMG is currently utilizing the ECMWF-AIFS numerical model to generate basic products for operational reference in typhoon forecasting, and is also experimenting with the use of the Pangu model with ECMWF analysis fields as the initial field.

In the future, DSMG plans to adopt a broader range of AI forecast model outputs to enhance AI-driven forecasting products. Through continuous verification and analysis, these data will be progressively integrated into operational workflows to improve the accuracy and reliability of typhoon analysis and forecasting in Macao.

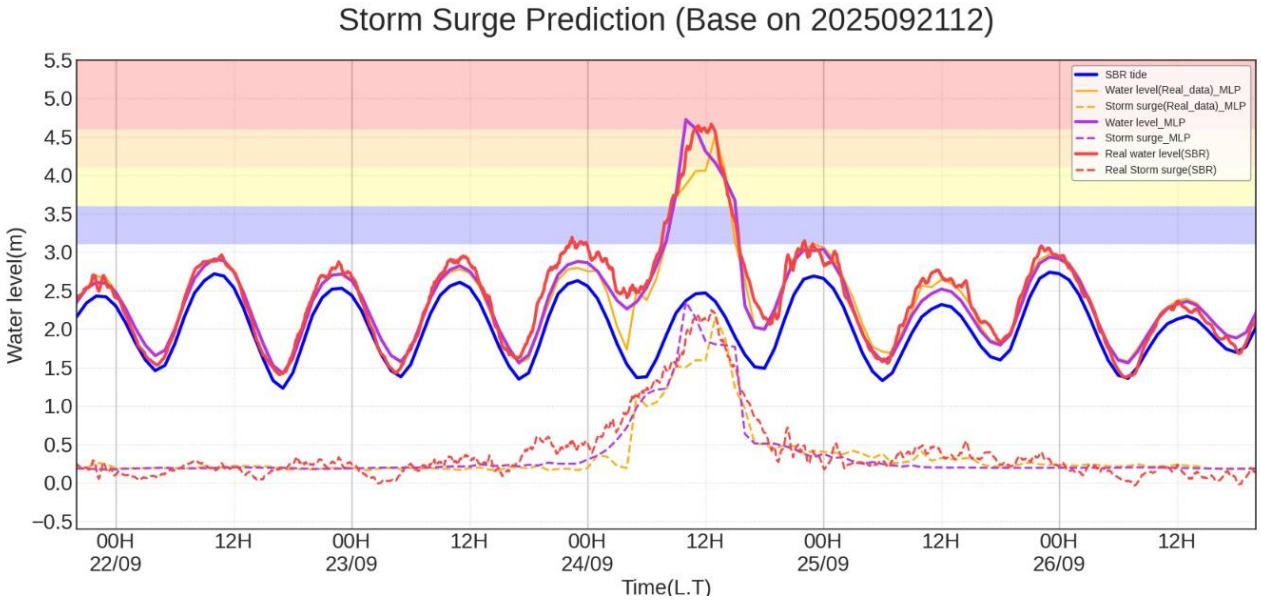

Figure 5 *Storm surge prediction in super typhoon RAGASA based on machine learning model of DSMG compared with observed data.*

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

Priority Areas Addressed:

<u>Meteorology</u>

- 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.

<u>Hydrology</u>

- 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.
- 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	

Contact Information:

Member: Macao, China
Name of contact for this item: Mr. LOK Chan Wa
Telephone: +853 88986273
Email: cwlok@smg.gov.mo

3. Expansion of meteorological and water-level monitoring networks

Main text:

To continuously optimize meteorological monitoring network of Macao, DSMG has established new meteorological monitoring stations in 2024 and 2025, including two wind stations at the Macao Bridge opened in 2024, and one meteorological station at the Lotus Bridge which connects Macau's Cotai Strip with the Hengqin Port in the Macau Port Area, all with backup stations, to enhance meteorological monitoring capabilities for the bridges of Macao.

To optimize the water level monitoring network of Macao, in 2025, DSMG has established one new water level station at “Caminho das Hortas” in Taipa, Macao to enhance water level monitoring capabilities at flooding black spots during heavy rains.

The above new meteorological and water-level stations have been providing real-time monitoring data to the public, helping to ensure the safety of citizens and drivers

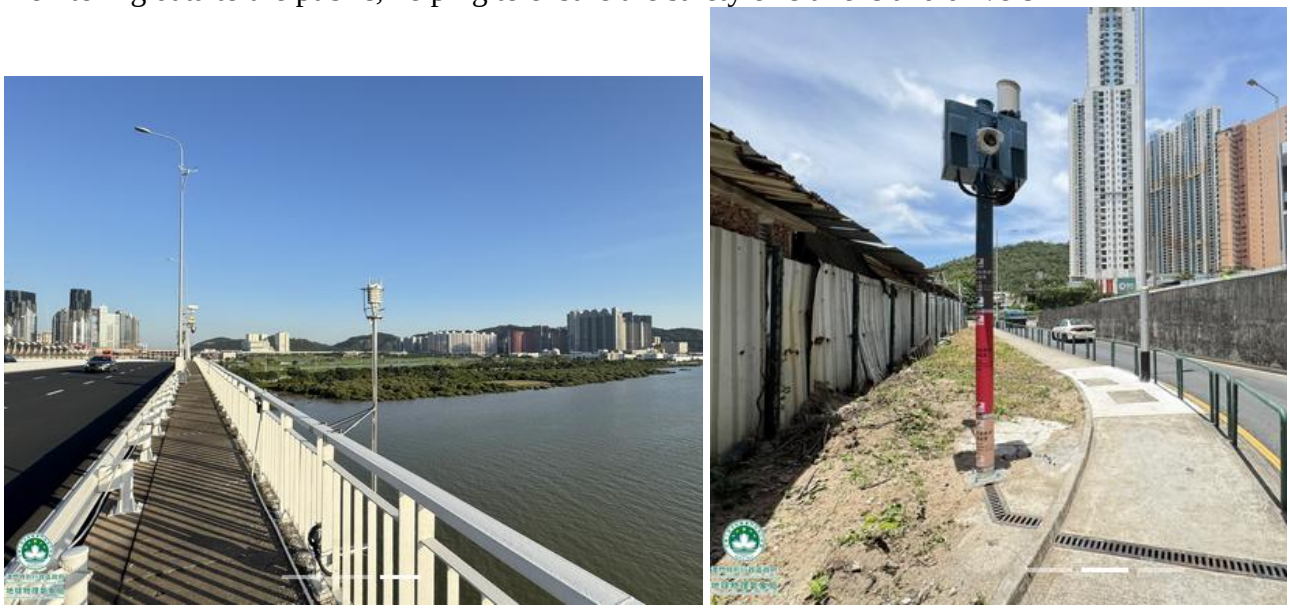

Figure 6 *Left: new meteorological station at the Lotus Bridge. Right: new water-level station at “Caminho das Hortas”.*

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

Priority Areas Addressed:

<u>Meteorology</u>

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

<u>Hydrology</u>

- 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.

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	

Contact Information:

Member: Macao, China
Name of contact for this item: Mr. LO Man Son
Telephone: +853 88986280
Email: mslo@smg.gov.mo

4. Introduction of new meteorological visualization system

Main text:

To enhance and improve weather information dissemination capabilities, DSMG introduced a new meteorological visualization system in operation, which is utilized by DSMG weather anchors to explain weather situations and predictions to the public in TV news broadcasts and DSMG WeChat video channels. The new meteorological visualization system features accurate, detailed and dynamic graphics and animations to demonstrate meteorological observations and forecasts to the public, enabling more effective communication of weather and disaster prevention information especially during tropical cyclone events.

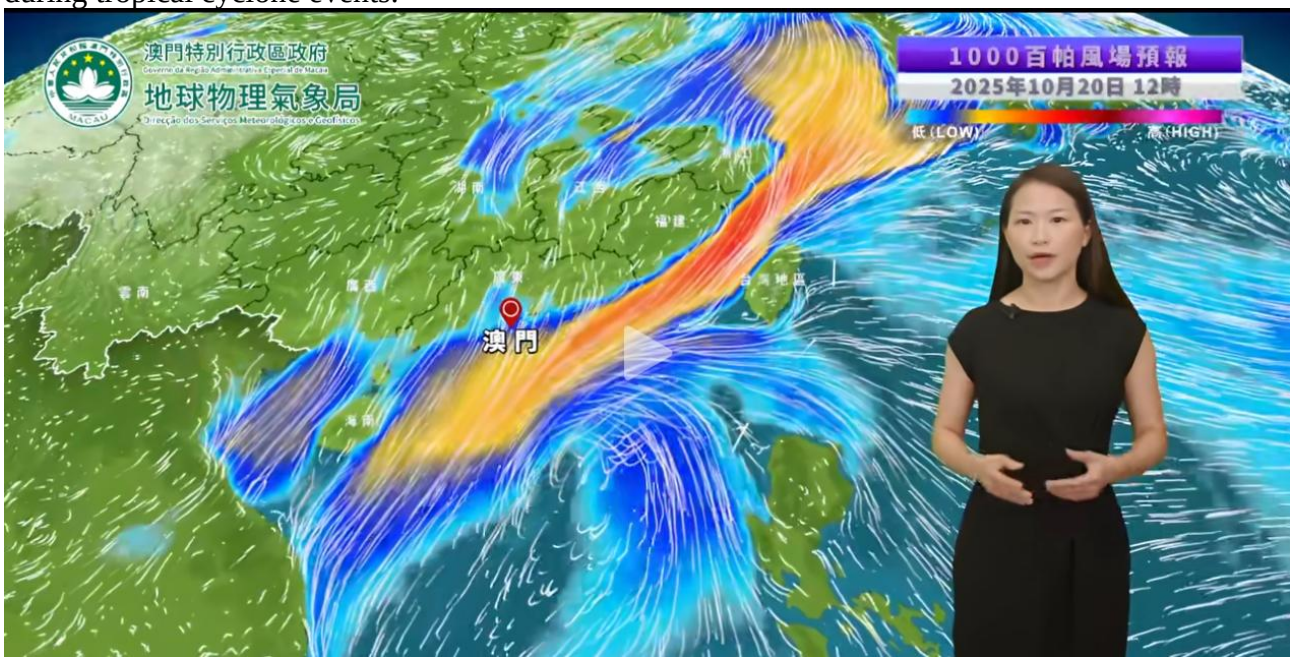

Figure 7 *– DSMG weather anchor explaining weather forecast in DSMG WeChat video channel during Severe Tropical Storm Fengshen.*

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

Priority Areas Addressed:
DRR

- Enhance Members' disaster risk reduction techniques and management strategies.

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	

Contact Information:
Member: Macao, China
Name of contact for this item: Ms. CHANG Sau Wa
Telephone: +853 88986180
Email: swchang@smg.gov.mo

5. Launch of the "Weather Outlook" service

Main text:

To enhance and optimize weather information dissemination, DSMG has introduced a new "Weather Outlook" service to the public, which provides description of tropical cyclone information and weather system changes in the region for the next 7 days, and also summarize weather changes on a daily basis. This enables the public to be more informed about the changes of weather trends and key weather information.

The "Weather Outlook" service page was launched on 20 November, 2025 and is available to the public through DSMG official website, mobile APP, and WeChat account.

Figure 8 *Launch of the "Weather Outlook" service of DSMG on 20 November, 2025.*

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

Priority Areas Addressed:
DRR

- Enhance Members' disaster risk reduction techniques and management strategies.

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	

Contact Information:

Member: Macao, China
Name of contact for this item: Mr. LOK Chan Wa
Telephone: +853 88986273
Email: cwlok@smg.gov.mo

6. Launch of the "Zhuhai-Macao Meteorological Warning Webpage"

Main text:

To enhance meteorological services for the Guangdong-Macao In-depth Cooperation Zone in Hengqin (hereinafter referred to as the Cooperation Zone), Macao Meteorological and Geophysical Bureau and Zhuhai Meteorological Bureau have jointly launched the "Zhuhai-Macao Meteorological Warning Webpage", which features real-time sharing of meteorological information of Zhuhai and Macao, covering all weather warnings such as tropical cyclones and rainstorms.

In addition, whenever severe weather warnings in Macao are issued, warning information will be displayed on 15 electronic screens at seven key ports and transportation hubs in Zhuhai.

The webpage and the above measures aim to further facilitate cross-border residents and travelers in accessing meteorological warning information for both Zhuhai and Macao, enabling better travel planning and response preparation for the public.

Figure 9 *Launch of "Zhuhai-Macao Meteorological Warning Webpage".*

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

Priority Areas Addressed:
DRR

- Enhance Members' disaster risk reduction techniques and management strategies.

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	

Contact Information:
Member: Macao, China
Name of contact for this item: Ms. CHANG Sau Wa
Telephone: +853 88986180
Email: swchang@smg.gov.mo

7. Tropical Cyclone Interdepartmental Video Meeting

Main text:

In order to assist the relevant members of the Civil Protection Structure in better responding to the impact of tropical cyclones, DSMG initiated and established the "Tropical Cyclone Interdepartmental Video Meeting" mechanism in 2022. Every time when a tropical cyclone is foreseen to affect Macao, DSMG arranged an Interdepartmental video meeting among relevant member departments in the Civil Protection Structure ahead of time. During the meeting, DSMG reports to the members the current situation and forecast of the tropical cyclone, and DSMG also provides information regarding possible scenarios of the tropical cyclone development, possible time period and degree of impact on Macao, and also information on the risks and forecast uncertainties.

The goal of the above mechanism is to let the relevant departments obtain the latest and most accurate official information regarding the forecast and possible impact of tropical cyclones. Meanwhile, it will allow more time for the departments to make appropriate preparations in response to the development of the tropical cyclones and the associated risks. This aims to achieve the purpose of improving the efficiency of disaster risk reduction work of Civil Protection.

In 2025, as an effort to enhance the effectiveness of the above mechanism, DSMG continues to improve the mechanism, including making adjustments to the content and information presented in the video meeting according to the needs of the member departments, and also arranging the meeting times depending on the tropical cyclone situation to allow the participating departments to have sufficient time to take disaster preparation and response actions.

Figure 10 *DSMG holds the Tropical Cyclone Interdepartmental Video Meeting for Typhoon MATMO.*

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

Priority Areas Addressed:
DRR

- Enhance Members' disaster risk reduction techniques and management strategies.

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	✓

Contact Information:

Member: Macao, China
Name of contact for this item: Ms. CHANG Sau Wa
Telephone: +853 88986180
Email: swchang@smg.gov.mo

8. Promotion and education of meteorology and disaster risk reduction knowledge

Main text:

DSMG makes use of its "Meteorological Science Popularization and Education Base" as a platform to organize diverse public education and outreach activities for different age groups and communities. DSMG continued to organize the "Tropical Cyclone and Storm Surge Exchange Meeting" for members of the Civil Protection Structure in 2025 to deepen their understanding of meteorological forecast operation and to make an effort to establish a common language between DSMG and the emergency response departments and strengthen the collaboration among members of the Civil Protection Structure.

In addition, organized by the Unitary Police Service and hosted by DSMG, the "Tropical Cyclone and Storm Surge Seminar and Visit" was held as an advanced training activity for Civil Protection Volunteers in 2025. The training activity aims to deepen their understanding of natural disasters in Macao, and strengthen awareness of disaster prevention and reduction, promoting the collaborative effort of implementing the United Nations Early Warnings for All initiative (EW4ALL).

Furthermore, DSMG organized other activities in 2025, including the "Closing the Early Warning Gap Together" Meteorological Fun Day activities and visits in Macao as part of the 2025 World Meteorological Day celebration, and interactive family activities such as "Family Fun Meteorology Visit" and "Meteorology Fun Exploration" targeting children and parents. The above activities and events allow the public to learn and gain awareness about meteorological science.

DSMG also organized activities targeting different age groups in cooperation with the Macau Science Center in 2025. "Young Weather Anchor Competition" (Macao Regional Selection) was organized to enhance students' creation and communication ability in weather knowledge and inspire their interest in meteorological science. "Weather Theaters" were organized to promote meteorology knowledge for primary school students. "Wonderful Pen on the Cloud" Image Creation Contest were held in 2025 to raise awareness and knowledge of weather conditions among citizens of different age groups.

Figure 11 *DSMG held the "Tropical Cyclone and Storm Surge Exchange Meeting" for members of the Civil Protection Structure in 2025.*

Figure 12 *DSMG hosted the Advanced training activity for Civil Protection Volunteers in 2025.*

Figure 13 *Meteorological Fun Day with the theme of "Closing the Early Warning Gap Together" in 2025.*

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

Priority Areas Addressed:
DRR

- Enhance Members' disaster risk reduction techniques and management strategies.

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	✓

Contact Information:

Member: Macao, China
Name of contact for this item: Ms. CHANG Sau Wa
Telephone: +853 88986180
Email: swchang@smg.gov.mo

9. Annual Emergency Exercise

Main text:

The annual emergency exercise simulating the activation of "Low-Lying Areas Evacuation Plan for Storm Surge during Tropical Cyclones" was held in 2025. The Evacuation Plan aims to strengthen communication and coordination among members of the Civil Protection Structure and the efficiency of the emergency plans among different participating departments. Residents were also welcome to participate the emergency exercise as education activity and familiarize with evacuation procedures, routes and operation of emergency shelters.

When storm surge reaches the Third Level Warning or above, the Civil Protection Structure will be activated simultaneously with the stage of Immediate Prevention or higher classification by Chief Executive declaration in accordance with the relevant provisions of the "Civil Protection Law".

Civil Protection Volunteers participated in the annual emergency exercise to assist in restoring normal living order. Meanwhile, the issue of alert signal and messages was also tested at the same time through Macao SAR Government app "Macao One Account", Unitary Police Service app "Civil Protection Information Macao", and WeChat mini APP "Peaceful and Safe Macao".

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

Priority Areas Addressed:
DRR

- Enhance Members' disaster risk reduction techniques and management strategies.

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	✓

Contact Information:
Member: Macao, China
Name of contact for this item: Mr. WONG Chi Keong
Telephone: +853 82900457
Email: copc@fsm.gov.mo

10.City Information Kiosk to display civil protection information

Main text:

In order to increase the channels for Macao residents and tourists to receive civil protection information, the Unitary Police Service added a new city information kiosk to display civil protection information in this year's emergency exercise.

The Macao government has installed 150 new urban information kiosks in various districts of Macao by mid-2023. The new device has a variety of functions, providing tourism and city information, including route guidance, and is located at popular tourist attractions, bus stations and public streets.

This operation is for the Unitary Police Service to coordinate with the Municipal Affairs Bureau to use city information kiosks to immediately switch to emergency civil protection messages when Macao enters the immediate precautionary state, and play them in a loop at city information kiosks in various regions of Macao.

The civil protection information currently displayed at the city information kiosks includes real-time typhoon signals, storm surge warning signals and some necessary disaster prevention and avoidance information, allowing residents and visitors to understand the current emergency situation in Macao at a glance.

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

Priority Areas Addressed:
DRR
- Enhance Members' disaster risk reduction techniques and management strategies.

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	✓

Contact Information:
Member: Macao, China
Name of contact for this item: Mr. SI Hio Ian
Telephone: +853 88900458
Email: copc@fsm.gov.mo

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.