MEMBER REPORT
Macao, China

ESCAP/WMO Typhoon Committee
19th Integrated Workshop
Shanghai, China
19 - 22 November 2024

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)

Up to 7th November, four tropical cyclones affected Macao, China in 2024, including Tropical Storm Maliksi (2402), Severe Tropical Storm Prapiroon (2404), Super Typhoon Yagi (2411) and Typhoon Trami (2420). 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.

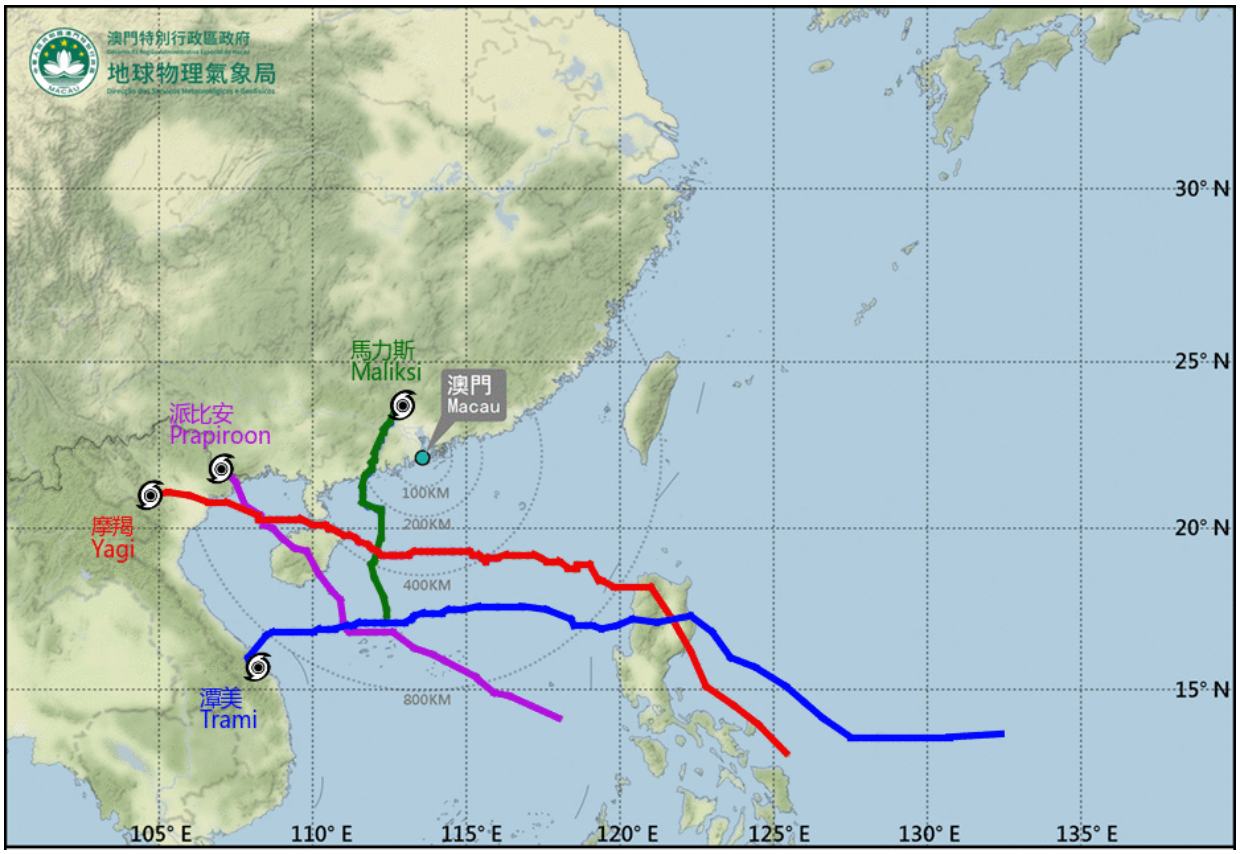

Figure 1 *Tracks of tropical cyclones affecting Macao, China in 2024.*

Tropical Storm Maliksi (2402)

Maliksi formed over the South China Sea on 30th May. On the next day, Maliksi intensified into a tropical storm and moved steadily northward towards western coast of Guangdong. It reached its peak intensity on 31st as a tropical storm, with maximum wind of 65 km/h near its centre and continued to track northward. It made landfall on the coast of western Guangdong in the early morning of the 1st June. Finally, it dissipated inland on the morning of 1st.

As Maliksi moved into the interior of Guangdong, its intensity also weakened. The wind force in Macao reached level 6. In addition, affected by the strong rain belt related to Maliksi, there were heavy showers in Macao on 1st. The total rainfall in some areas of Macao on 1st was about 50 mm.

Severe Tropical Storm Prapiroon (2404)

Prapiroon formed over the central South China Sea on 19th July, intensified into a tropical storm on the morning of the 21st, and moved steadily northwestward toward Hainan Island. In the early morning of the 22nd, Prapiroon made landfall over Hainan Island, then entered the Beibu Gulf in the afternoon of the same day, and intensified into a severe tropical storm. It made landfall over northern Vietnam on the morning of the 23rd, and finally dissipated into the interior of Vietnam on the evening of the 23rd.

Since Prapiroon stayed more than 500 kilometers away from Macao, its impact on Macao was relatively minor. As a result of the influence of Prapiroon, Tropical cyclone signal No. 1 was issued on the 20th. The outer rainbands of Prapiroon brought brief strong winds and heavy rain to Macao on the morning of the 22nd, with wind speeds briefly reaching force 6. The wind force on Macao briefly recorded force 6. The total daily rainfall in Macao did not exceed 30 millimeters. Meanwhile, under the combined influence of the astronomical tide, the blue storm surge warning was issued.

Super Typhoon Yagi (2411)

Yagi formed over the eastern seas of the Philippines on 1st September. It intensified into a tropical storm later that evening, and continued to move steadily northwest. After landing on Luzon Island at noon on 2nd September, Yagi entered the South China Sea on the early hours of the 3rd and continued to move in a northwesterly direction, heading towards Hainan Island. As Yagi rapidly intensified after entering the South China Sea, in the early morning of the 5th, Yagi reached the peak intensity of the super typhoon, with the maximum wind speed near the center reaching 205 km/h. Yagi made landfall on Hainan Island in the afternoon on the 6th and entered the Beibu Gulf in the early hours of the 7th, eventually dissipating inland in Vietnam later that evening.

Yagi was the only tropical cyclone this year to require a Signal No. 8 warning. Under the influence of Yagi, wind speeds in Macao reached force 8, with gusts exceeding force 9. Additionally, Macao issued a blue storm surge warning.

Typhoon Trami (2420)

Trami formed over the northwestern Pacific on 22nd Oct, and intensified into severe tropical storm on the afternoon of 23rd Oct. It made landfall on Luzon Island in the early hours of the 24th, then it entered the South China Sea later that day, and steadily moved westward across the central South China Sea. Then Trami intensified into a typhoon on the morning of the 26th and made landfall in central Vietnam on the morning of the 27th before dissipated.

As Trami passed 500 kilometers south of Macao, its impact on the Macao was relatively minor. Furthermore, due to the combined effect of Trami and the northeast monsoon, the wind force on Macao briefly recorded force 6.

Start Date	End Date	Name	The Highest Signal
30 May, 2024	1 Jun, 2024	Maliksi	No. 3
20 Jul, 2024	22 Jul, 2024	Prapiroon	No. 1
03 Sep, 2024	07 Sep, 2024	Yagi	No. 8
25 Oct, 2024	27 Oct, 2024	Trami	No. 3

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)

Up to 7th November, Macao was affected by four tropical cyclones in 2024. The most significant one was Super Typhoon “Yagi”, which prompted the issuance of Typhoon Signal No. 8- the highest alert issued this year. Schools and public transportation services halted, three cross-sea bridges and the Lotus Bridge closed, etc. Besides, a blue storm surge warning was issued, it means that the water level in the low lying area in Macao is expected to be under 0.5 meter above road level.

However, minor damages were caused by “Yagi”, 3 incidents were reported and 3 people injured during “Yagi”.

Tropical cyclone “Maliksi” resulted in issue of tropical cyclone signal No.3, and 5 incidents were reported. Tropical cyclone “Prapiroon” resulted in issue of tropical cyclone signal No.1, and no incidents were reported. Tropical cyclone “Trami” resulted in issue of tropical cyclone signal No.3, and no incidents were reported. (refer to the following tables for more details)

Date/Time		Name	The Highest Signal Issued	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
30/5/2024 17H30	1/6/2024 18H00	Maliksi 2304	3	0	1	3	0	1	0	0	0	0	0
20/7/2024 07H30	22/7/2024 20H00	Prapiroon 2305	1	0	0	0	0	0	0	0	0	0	0
3/9/2024 12H00	7/9/2024 08H00	Yagi 2411	8	0	0	0	0	3	0	0	3	0	0
25/10/24 06H00	26/10/2024 22H00	Trami 2420	3	0	0	0	0	0	0	0	0	0	0

Macao experienced several severe rainstorms in 2024. Macao government and Meteorological department 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 indicate 50 millimeters per hour, and black signal means rainfall that may exceed 80 millimeters per hour. Refer to the following table for the Red and Black rainstorms cases in 2024.

Some areas in Macao recorded relatively large cumulative rainfall. These heavy rains caused minor flooding in local areas, especially low-lying areas in the Inner Harbor area, but the overall impact was relatively small and no serious flooding was recorded.

The government has also strengthened relevant response measures, such as upgrading the water level monitoring system to monitor water level changes more accurately during heavy rains, especially the water pumping station and drainage system in the Inner Harbor South District.

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
30-04-2024 21H10	30-04-2024 22H20	3	6	0	1	0	0	0	0	0	3
04-05-2024 11H10	04-05-2024 12H15	10	0	0	0	0	0	0	0	0	2
12-05-2024 16H22	12-05-2024 17H45	12	0	0	0	0	0	0	0	2	2
03-06-2024 09H15	03-06-2024 12H15	7	0	0	0	0	0	0	0	2	3

15-06-2024 14H10	15-06-2024 15H15	0	0	0	0	0	0	0	0	1	2
15-08-2024 09H40	15-08-2024 11H00	3	1	0	0	1	0	0	0	0	0
17-08-2024 05H33	17-08-2024 07H10	5	1	0	0	0	0	0	0	0	2
18-08-2024 05H48	18-08-2024 06H30	4	0	0	0	0	0	0	0	0	0

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

To further promote the collaborative development of the meteorological departments of China and Macao SAR, the China Meteorological Administration and the Macao Meteorological and Geophysical Bureau jointly signed the "Arrangement in Long-term Cooperation in Meteorological Science and Technology between Chinese Mainland and Macao Special Administrative Region" in December, 2023. This marks a new page in the meteorological cooperation relationship between the meteorological departments of China and Macao SAR.

In addition, The Macao Meteorological and Geophysical Bureau and the Shanghai Meteorological Service jointly signed the "Cooperation Agreement in Meteorological Science and Technology between Shanghai and Macao SAR" in April, 2024. Both parties plan to work together to advance scientific research and innovation in meteorology, making positive contributions to the integrated development of meteorological services in both regions. The two meteorological departments will seek to establish a long-term and stable cooperation mechanism to enhance the research and application of multi-hazard early warning and forecasting technologies in urban areas, aiming to better address the increasing challenges posed by meteorological disasters.

Figure 2 *Delegation from the China Meteorological Administration and the Macao Meteorological and Geophysical Bureau at the signing ceremony of the "Arrangement in Long-term Cooperation in Meteorological Science and Technology between Chinese Mainland and Macao Special Administrative Region" on 13 December, 2023 in Beijing, China.*

II. Summary of Progress in Priorities supporting Key Result Areas

1. Launch of personalized weather subscription service

Main text:

To provide the public with more flexible, convenient, and enriched meteorological information service, Macao Meteorological and Geophysical Bureau (DSMG) launched a new WeChat Service Account "Macao Weather" in August 2024. DSMG's new WeChat account aims to provide weather warning subscription services by allowing users to subscribe to personalized weather warnings and alerts tailored to their needs.

The weather information subscription service includes multiple features, such as innovative integrated notification pages with detailed categories including all types of warning signals and special weather alerts issued by DSMG. Users can customize the warning signals types and levels they wish to receive and set the time window for receiving alerts according to their personal needs.

In addition, "Macao Weather" offers several menus, including the "Warnings and Alerts" menu for current warnings and alerts, and the "Monitoring and Forecast" menu for accessing current weather, weather forecast, radar images, air quality indices, and special information. These allow users to readily access various meteorological information.

In the future, DSMG will continue to review and optimize subscription features and push services of "Macao Weather", striving to offer users a more refined and enriched meteorological service experience.

Figure 3 *Infographics for the launch of new DSMG WeChat Service Account "Macao Weather".*

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	

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2. Enhancement of public weather service strategy

Main text:

With regard to information dissemination service related to severe weather, DSMG continues to enhance its public weather service by applying the "First qualitative, then quantitative" strategy.

For example, DSMG prepares and releases infographics posts 3-4 days before a severe weather system affects Macau. Posts are released via various online channels, including DSMG website and mobile App, WeChat, and other social media. Then 1-2 days before the predicted severe weather such as rainstorms, alert messages are released, which include more information regarding the time range and severity of the weather. Next, when the rain region approaches, a special alert is released to the general public and to relevant public departments. Finally, when a rainstorm is imminent or is occurring, DSMG issue the official rainstorm warning signals.

This service approach allows the public to be more prepared and well informed about the severe weather, and also allows the public adequate time to take precautions according to different risk management needs.

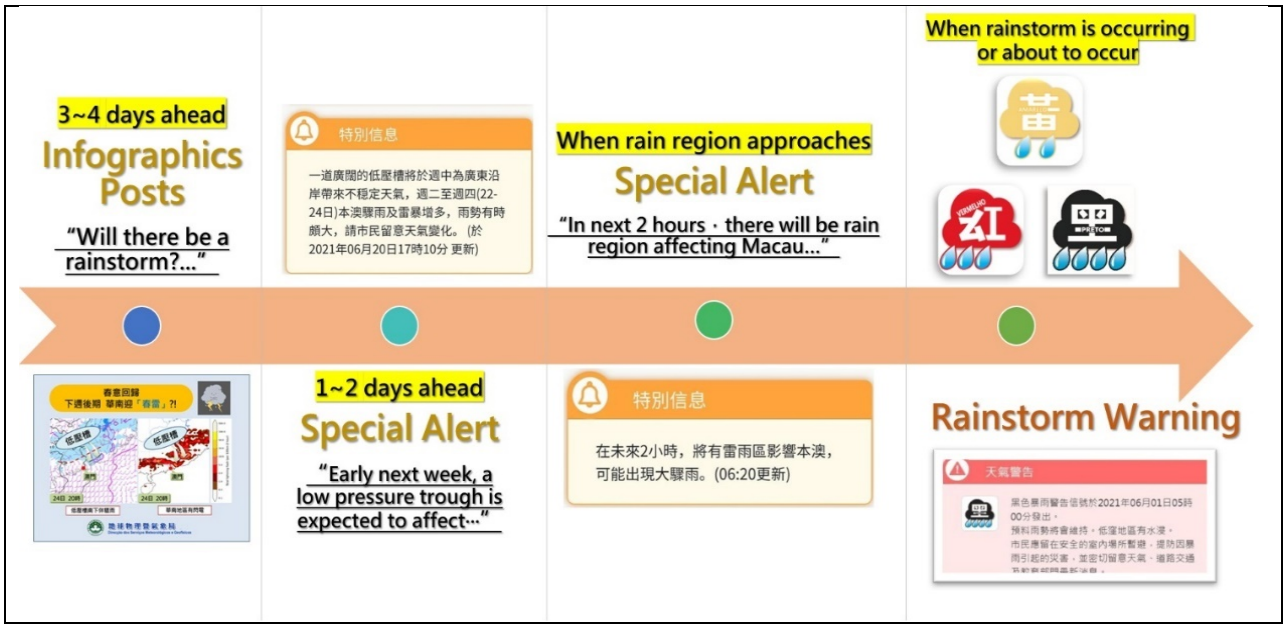

Figure 4 *Public weather service strategy of DSMG.*

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.

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	

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3. Upgrade of forecast tools and systems

Main text:

In the face of the impacts brought by tropical cyclones, storm surges, and rainstorms, DSMG continuously improve its tools to enhance forecast techniques and capacities. In 2021, DSMG introduced a nowcasting system for precipitation based on the method of optical flow by using the S-band radar data of Zhu-Ao Radar. In 2023, DSMG upgraded the nowcasting system by introducing a forecast method based on machine learning technology by using radar data of the past 7 years as training data to predict radar echoes development in next two hours, in addition to the existing method of optical flow. Furthermore, a lightning nowcasting system has also been introduced based on the above methods to produce lightning forecast information. In 2024, DSMG continues to improve on the nowcasting system by optimizing the parameters of the optical flow and machine learning models based on their performance in daily forecasting operation.

On the other hand, DSMG upgraded its tropical cyclone and storm surge integrated analysis system in 2023. Forecast data are incorporated with historical tropical cyclone data in statistical analysis to calculate and output the probabilities of different levels of tropical cyclone and storm surge warning signals in a risk matrix format, in such a way to provide objective basis and scientific support for meteorological operation decision-making during tropical cyclones. In 2024, DSMG continues to improve on the system by experimenting with different methods for assessing the risk matrix probabilities.

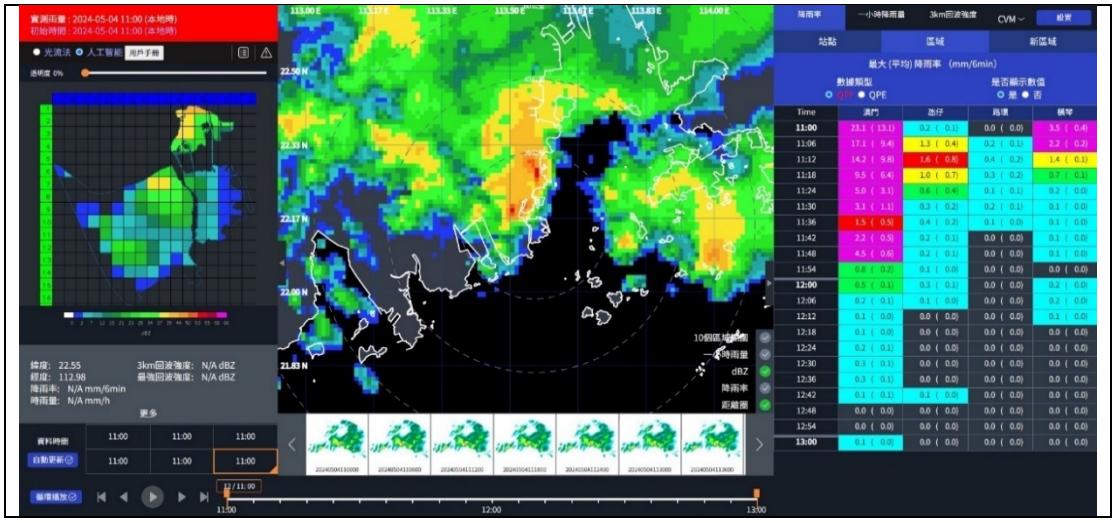

Figure 5 *DSMG nowcasting system providing precipitation forecast during a rainstorm case on 4th May, 2024 in which a black rainstorm warning signal was issued.*

Figure 6 *Risk matrix assessment for super typhoon YAGI as provided by the tropical cyclone and storm surge integrated analysis system of DSMG.*

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.

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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4. Developing AI technology forecasting tools

Main text:

In addition to traditional storm surge modeling predictions, DSMG has attempted to forecast storm surges using machine learning methods. Since there is a strong relationship between local winds, pressure and storm surge, a machine learning model was built. Then, by using NWP ensemble data as an input, a storm surge ensemble forecast can be obtained. By combining the results of traditional and machine learning storm surge models, they provide decision support and objective basis for issuing different storm surge warnings.

In response to some areas in Macau that frequently experience flooding due to heavy rain, DSMG is also attempting to combine the previously developed nowcasting system with machine learning methods to establish a flooding nowcasting system, to predict potential flooding caused by rainfall in some flooding blackspots within the next two hours. At the same time, DSMG have established a testing channel on Telegram, when the predicted values meet certain criteria. Furthermore, DSMG also invite some government departments to join the testing channel.

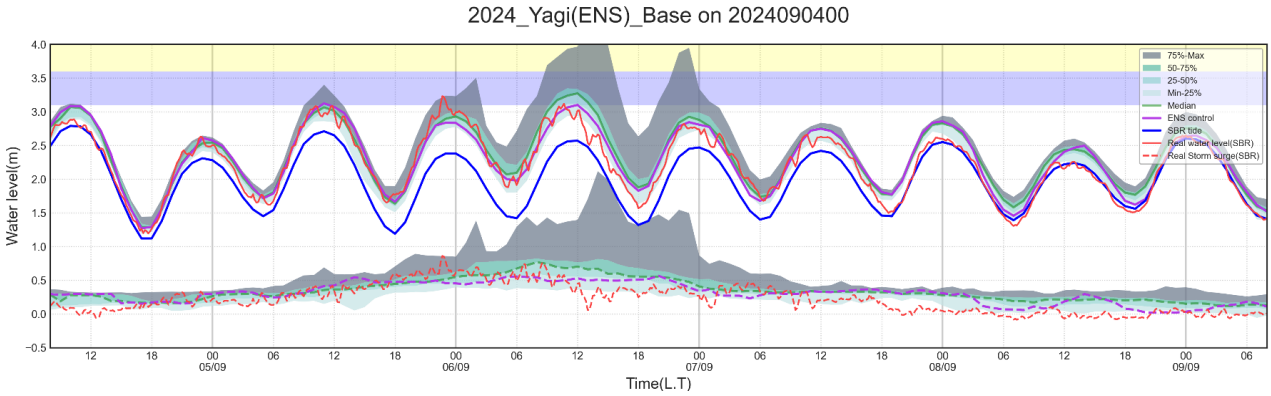

Figure 7 *Storm surge prediction in super typhoon YAGI based on machine learning and NWP ensemble data.*

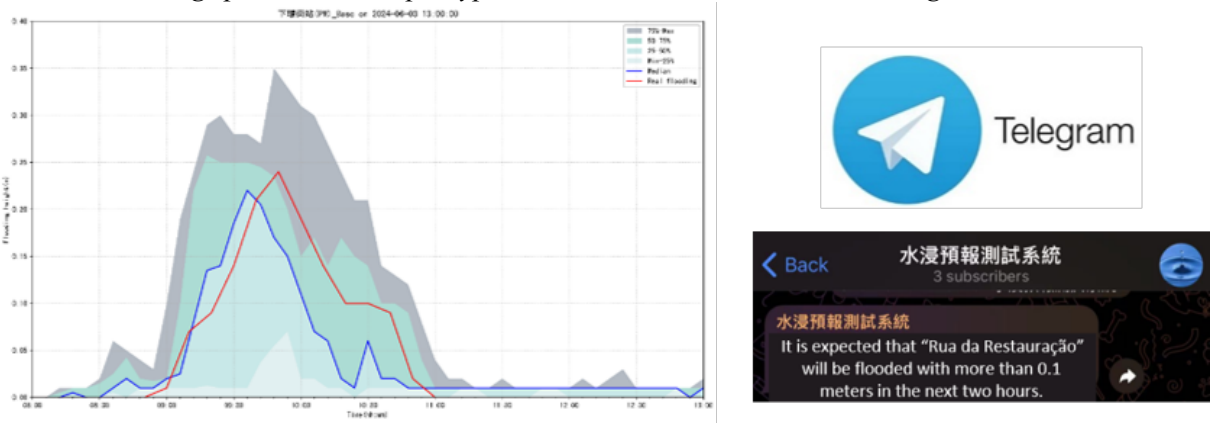

Figure 8 *Prediction of flooding heights due to heavy rain in the next two hours and notification messages from the Telegram testing channel.*

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.

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.
- 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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5. 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 2024, as an effort to enhance the effectiveness of the above mechanism, DSMG continues to make adjustments to the content and information presented in the video meeting according to the needs of the member departments.

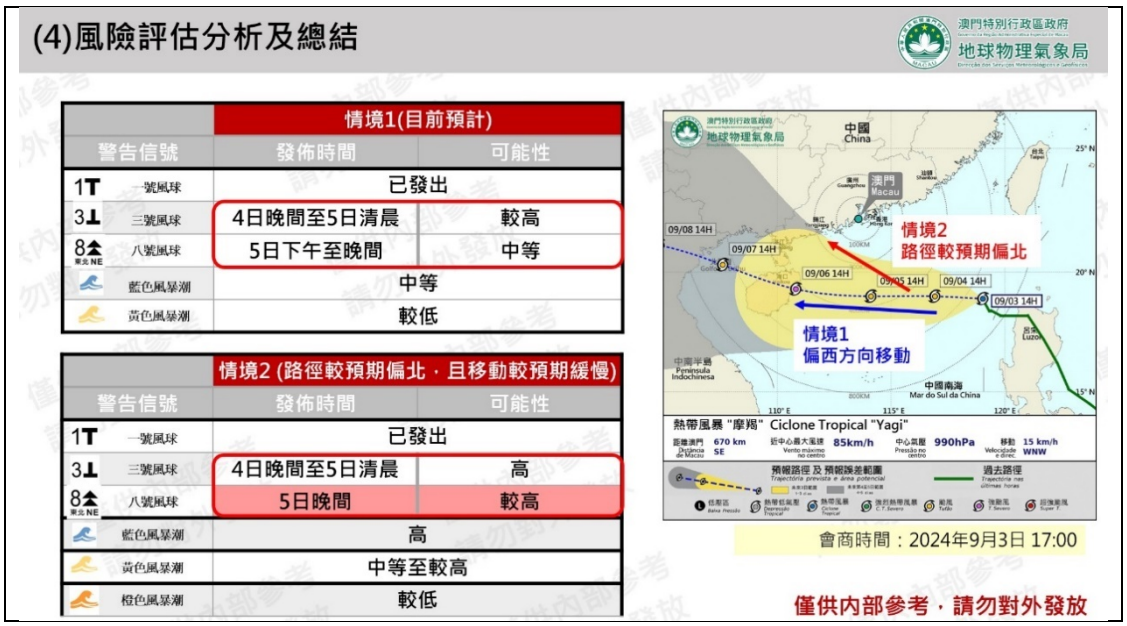

Figure 9 *DSMG presented two different possible scenarios and their respective predicted warning levels during the Tropical Cyclone Interdepartmental Video Meeting for super typhoon YAGI.*

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	

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6. Promotion of the knowledge of meteorology and disaster risk reduction

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 2024 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, DSMG organized "Meteorology for Everyday Life · Diverse Services" series exchange meetings targeting youth and media organizations in 2024, aiming to enhance understanding of meteorological knowledge and promote the collaborative effort of implementing the United Nations Early Warnings for All initiative (EW4ALL).

Furthermore, DSMG organized other activities in 2024, including the "At the Frontline of Climate Action" meteorological seminars and visits activities in Macao as part of the 2024 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 2024. "Young Weather Anchor Competition" (Macao Regional Selection) was first organized in 2024 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 2024 to raise awareness and knowledge of weather conditions among citizens of different age groups.

Figure 10 *DSMG holding the "Tropical Cyclone and Storm Surge Exchange Meeting" in May, 2024.*

Figure 11 *“Meteorology for Everyday Life · Diverse Services” series exchange meeting organized by DSMG in 2024.*

Figure 12 *DSMG holding “At the Frontline of Climate Action” meteorological seminar in March, 2024.*

Figure 13 *Award Ceremony of the "Wonderful Pen on the Cloud" Image Creation Contest, and Launch Ceremony of the "Young Weather Anchor Competition" (Macao Regional Selection) in June, 2024.*

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	✓

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7. Annual Emergency Exercise

Main text:

The annual emergency exercise, simulating the in force of "Low-Lying Areas Evacuation Plan for Storm Surge during Tropical Cyclones" was held. 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 in 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 to 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 programme of "Peaceful and Safe Macao".

In order to increase the channels for residents and tourists to receive civil protection information, the annual emergency exercise has added a City Information Kiosk to display civil protection information this year.

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	✓

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8. 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	✓

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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.