PTC -52 (28 April – 01 May 2025), Qatar

Conference Rapporteur Report

Please send the final report to (**Email: ptcsecretariat.imd@gmail.com**)

Host Country	**Qatar Meteorology Department**
Workshop name:	**PTC -52**
Session Chair:	**Mr. Abdulla AL MANNAI, Director of the Qatar Meteorology Department**
Workshop speakers:	**WMO, ESCAP, PTC Secretariat, RSMC New Delhi, PTC Member countries**

Day 1: Monday – 28th April, 2025

Item 1.1: Opening Ceremony

The 52nd Session of WMO/ESCAP Panel on Tropical Cyclones (PTC) over the the Bay of Bengal & the Arabian Sea was organised online by Qatar. The PR of Qatar chaired the opening ceremony. The list of participants/delegates from member countries are given in **Annexure - I**. The opening ceremony of the session commenced at 0830 UTC on 28th April, 2025 with the self-introduction by the participants from the PTC member countries.

Mr. Abdulla Al Mannai, Director of the Qatar Meteorology Department and Permanent Representative of Qatar to WMO chaired the opening ceremony. In his Welcome Address, he thanked RSMC New Delhi for supporting Qatar in arranging the Session. He welcomed all the member countries and appreciated RSMC New Delhi, India Meteorological Department for providing successful tropical cyclone forecasts and advisories over the NIO region including the Bay of Bengal & the Arabian Sea, and helping in capacity building of the tropical cyclone forecasters of the National Meteorological and Hydrological Services in the region. He urged every member of PTC to intensify our efforts and enhance scientific and practical cooperation to better understand atmospheric phenomena and effectively address them to protect lives and property of the region under the scenario of accelerating climate changes and increasing weather fluctuations. He also mentioned that the depressions and tropical storms are among the most impactful weather phenomena on communities and infrastructure, necessitating the development of early warning strategies and improvements in weather forecasting accuracy. He urged all members to grab the valuable opportunity to exchange expertise and explore the latest research and technologies in monitoring and analyzing depressions and tropical storms and sharing of the best practices in weather risk management and mitigation. He reaffirmed its commitment to supporting scientific and technical efforts and look forward to effective recommendations that will enhance the capabilities in dealing with the extreme atmospheric phenomena and strengthen regional and international cooperation. He also wished that 4 days discussions would yield fruitful outcomes that would support the collective efforts of PTC members in addressing climate challenges.

Dr. M. Mohapatra, DGM IMD, Secretary PTC and 3rd Vice President of WMO greeted all the dignitaries. He congratulated PR of Qatar to WMO for organizing the 52nd session. He highlighted that the region is very prone to various natural hazards like the tropical cyclones, storm surge, dust storm, thunderstorm, etc., that adversely impact the region. He urged the members to contribute, cooperate and collaborate to meet these disasters in view of climate change scenario. In his address he also expressed his condolences to the families of deceased citizens of Myanmar who lost their lives during recent earthquake. He also thanked all the members for sharing the observational data. Though, there are significant improvements in monitoring and forecasting of severe weather events over the region, still there are gaps and challenges. There is need to cooperate and collaborate to improve various components of early warning system.

In his address he highlighted objective of the regular annual sessions of PTC. The session aims to assess the progress on various actives of PTC in the field of Meteorology, Hydrology, Disaster Risk Reduction (DRR), Training, Research and Publication. Over the years there has been significant improvement in monitoring and forecasting of tropical cyclone in the region leading to significant reduction in death and damage. However, we need to introduce impact-based forecast and risk-based

warnings to minimize losses to property. He stressed upon the need to assess the impact of hazards associated with Severe weather. He urged members to collaborate, cooperate and exchange best practices. Further to support RSMC activities, there has been Severe Weather Forecasting Programme (SWFP) - For South Asia where RSMC New Delhi provides information about heavy rainfall, strong winds, high waves, cyclonic disturbance, storm surges, Flash flood guidance to 9 member countries in south Asia including Myanmar, Thailand, Bangladesh, Sri Lanka, Maldives, Pakistan and entire north Indian ocean. RSMC also conducts regular trainings to improve capacity of forecasters in the region. Recently RSMC New Delhi has conducted multi-hazard system interoperability training during 9th -13th Dec, 2024, He also urged WMO and UNESCAP to support training programs in the region to improve competency for the forecasters. He also mentioned about the Decision Support System (DSS) developed by IMD for the forecasters and another for the users. Similar facilities in all countries will help to improve early warning against the hazards. The DSS is essential to objectively analyse, compare and comprehend various guidance products as per the requirements. He hoped that the meeting would have fruitful discussions and deliberations on various operational plans and urged the members to work towards revival of various working groups on meteorology, hydrology, DRR, Training and research to regularly monitor the progress and hence improve forecasting and management of severe weather over the region.

Dr. DR Pattanaik Head RSMC, Tropical Cyclones, New Delhi, highlighted the activities of RSMC for improving various components of early warning system including observations, modelling, forecasting, early warning products generation and dissemination as well as capacity building activities.

Mr Cyrille Honoré welcomed participants to the 52nd session of the WMO/ESCAP Panel on Tropical Cyclones, extending gratitude to the PTC Secretariat, and Dr. Abdulla Al Mannai, Chair of the Panel and Permanent Representative of Qatar with WMO for hosting the session.
He commended the Panel's efforts in reducing tropical cyclone risks, highlighting improved forecasting, early warnings, and disaster management, and further emphasized capacity development—particularly the valuable training opportunities provided by RSMC New Delhi—as a critical aspect of the Panel's progress.

In his address, he underscored the importance of the Early Warnings for All (EW4All) initiative as a strategic priority, highlighting recent efforts by WMO to revise its Technical Regulations to strengthen the global and national framework for authoritative early warning services. These updates aim to enhance coordination, support capacity building, and reinforce donor and partner engagement. He encouraged continued Member input and collaboration to ensure the revisions remain scalable, sustainable, and aligned with national contexts and WMO strategies.
In closing, referring to RAII-18 meeting held from 22 to 25 April 2025 and its deliverables toward the 2030 Agenda and the EW4All initiative, he called on all Members to prioritize the EW4All initiative in their future planning, emphasizing the vital role of collective action in safeguarding communities, economies and environment from topical cyclone impact. Broad support and active engagement by Members were encouraged to ensure the initiative's success, paving the way for a safer and more resilient future for all.

On behalf of UNESCAP, Dr. Sanjay Srivastav, Chief DRR Division, UNESCAP extended warm congratulations to the Panel on Tropical Cyclones (PTC) on its 52nd year of advancing regional cooperation in disaster risk reduction. He appreciated Dr. Mrutyunjay Mohapatra and the new Secretariat for their leadership. He extended ESCAP's commitment and support to PTC's priorities, especially in strengthening impact-based forecasting and implementing Synergized Standard Operating Procedures. As climate risks intensify, enhancing early warning systems through AI-driven tools and regional collaboration is very vital. Together, we must ensure early warnings reach all, build resilience across borders, and scale up innovations that save lives and protect livelihoods across the North Indian Ocean Basin.

At the end Dr. A.K Das, Scientist-F, RSMC New Delhi presented the vote of thanks. He thanked all the PRs of PTC region, their representatives, PTC Secretary, PTC Chairman, WMO, ESCAP, Qatar Meteorological Department, RSMC New Delhi and PTC Secretariat for their contributions and active participation.

The session ended with a group photo of the participants.

Session 1

1.2: Election of the Chairperson and Vice-chairperson

The Panel elected a chairperson and vice-chairperson to serve during the session and for the period until the fifty-third Session. Mr. Abdulla Al Mannai, Director of the Qatar Meteorology Department and Permanent Representative of Qatar was elected the Chairperson until PTC-53rd session. Mr. Abdullah Al Khadouri, PR of Oman to WMO, RAII to President, Director General of Civil Aviation Authority Oman, Director General of Meteorology and Public Authority for Civil Aviation was elected as the vice chair during this period.

1.3 Adoption of the Agenda

PTC Secretariat presented the draft Agenda. The secretariat informed the PTC that as per the recommendations of PTC-51, for the first time the representatives of International Civil Aviation Organisation (ICAO) and UNESCO Intergovernmental Oceanographic Commission (IOC) have been invited to the PTC Session. However, the representative from ICAO expressed his inability to participate in the meeting due to prior commitments. Dr. T Srinivas, Head UNESCO-IOC ICG/IOTWMS Secretariat participated in the meeting. Accordingly, the Agenda Item on Activities of ICAO wrt WMO/ESCAP PTC was removed from the Agenda. The provisional annotated agenda was accepted in the session with consensus. The order of the agenda was time to time modified during the session, as per requirement. The final agenda adopted for session is placed at **Annexure-2**.

1.4 Working arrangements

The panel decided that the PR of Oman will chair the session in case of non-availability of PR of Qatar. In case both the PRs are unavailable, their representative may Chair the Session.

2: Follow-up actions on PTC-50 and PTC-51

Mrs. Monica Sharma, RSMC New Delhi presented the action taken report on the pending recommendations of PTC-50 and recommendations of PTC-51. The action taken report presented by her is placed at **Annexure-3.**

3: Report of the chairperson of the panel

Chairman appreciated the collaboration among the member countries, activities of RSMC New Delhi and PTC Secretariat which have enabled minimising deaths due to tropical cyclones in the region.

4: Review of the 2024 and 2025 Cyclone Seasons

4.1: Report of RSMC Tropical Cyclones

Dr. D. R. Pattanaik, Head RSMC New Delhi presented the Report of Cyclone Season 2024. Dr. Pattanaik addressed the gap areas and challenges faced, and the future scope to improve tropical cyclone forecast and early warning systems.

He informed the Panel that 13 cyclonic disturbances developed over the North Indian during 2024 as per details below:

1) Severe Cyclonic Storm "REMAL" over the Bay of Bengal: 24 – 28 May
2) Depression over the Bay of Bengal: 19 – 20 July
3) Deep Depression over North Jharkhand and Neighbourhood: 02 – 06 August
4) Cyclonic Storm "ASNA" over the land: 25 August – 02 September
5) Depression over Westcentral Bay of Bengal: 31 August – 02 September
6) Deep Depression over Westcentral and Adjoining Northwest Bay of Bengal: 08 – 10 September
7) Depression over Northeast Madhya Pradesh: 11 – 13 September
8) Deep Depression over Northeast Bay of Bengal and Adjoining Bangladesh: 13 – 17 September
9) Depression over Central Arabian Sea: 13 – 15 October
10) Depression over Southwest Bay of Bengal: 15 – 16 October
11) Severe Cyclonic Storm "DANA" over Eastcentral Bay of Bengal: 22 – 26 October
12)Cyclonic Storm "FENGAL" over Southwest Bay of Bengal: 29 November – 01 December
13)Depression over westcentral Bay of Bengal off Andhra Pradesh coast during 20 - 21 December, 2024

He further discussed the life history and forecast performance of 4 cyclones that developed over the region during 2024 as per details below:

(i) Severe Cyclonic Storm "REMAL" developed over the Bay of Bengal from a low-pressure area on 23rd May 2024. It intensified into a depression on 24th May, a cyclonic storm on 25th, and a severe cyclonic storm on 26th May. Moving nearly northward, REMAL made landfall between Sagar Islands (India) and Khepupara (Bangladesh), near Mongla, between 26th and 27th May with wind speeds of 110–120 kmph, gusting to 135 kmph. It gradually weakened into a cyclonic storm, then into a depression over Bangladesh, and eventually into a well-marked low-pressure area over south Assam by 28th May, after recurving northeastward. The track forecast errors for 24, 48 and 72 hrs

lead period were 71, 48 and 80 km respectively against the long period average (LPA) errors of 72, 112 and 156 km respectively based on data of 2019-23. The absolute errors (AE) in intensity (wind) forecast for 24, 48 and 72 hrs lead period were 5.7, 2.2 and 6.7 knots against the LPA errors of 7.1, 10.3 and 13.8 knots based on data of 2019-23 respectively. The landfall point forecast errors for 12, 24, 48 and 60 hrs lead periods were Zero, 20, 36 and 25 km respectively against the LPA errors of 11, 18, 42 and 56 km based on data of 2019-23 respectively.

(ii) Cyclonic Storm "ASNA" over the Arabian Sea (25th August-2 nd September, 2024): A low-pressure area formed over northwest BoB on 16th August 2024 and moved across Bangladesh from 17th to 22nd August. It then moved westward into West Bengal and northeast Jharkhand by 23rd August, intensifying into a well-marked low over southeast Uttar Pradesh and northeast Madhya Pradesh on 24th. It became a depression over northwest Madhya Pradesh on 25th and a deep depression over east Rajasthan later that day. Moving west-southwest, it reached Gujarat by 26th August, emerged into the northeast Arabian Sea on 30th, and intensified into Cyclonic Storm "ASNA" over northeast Arabian Sea (AS) before weakening into a low by 2nd September. The track forecast errors for 24, 48 and 72 hrs lead period were 56, 110 and 174 km respectively against the long period average (LPA) errors of 72, 112 and 156 km respectively based on data of 2019-23. The absolute errors (AE) of intensity (wind) forecast for 24, 48 and 72 hrs lead period were 3.2, 5.0 and 1.7 knots against the LPA errors of 7.1, 10.3 and 13.8 knots based on data of 2019-23 respectively.

(iii) Severe Cyclonic Storm "DANA" over the Bay of Bengal (22nd -26th October, 2024): A cyclonic circulation formed over the central Andaman Sea on 19th October 2024, shifting to the North Andaman Sea by 20th. A low-pressure area developed over the eastcentral Bay of Bengal that evening, becoming a well-marked low on 21st, a depression on 22nd, and Cyclonic Storm "DANA" on 23rd October. It intensified into a severe cyclonic storm by midnight and made landfall near Habalikhati and Dhamara, Odisha, between 2000–2200 UTC on 25th October, with wind speeds of 100–110 kmph, gusting to 120 kmph. It weakened rapidly afterward, becoming a low-pressure area over North Odisha by 26th October morning. The track forecast errors for 24, 48 and 72 hrs lead period were 32, 24 and 29 km against the long period average errors of 72, 112 and 156 km respectively based on the data of 2019-23. The absolute errors (AE) in intensity (wind) forecast for 24, 48 and 72 hrs lead period were 2.7, 5.0 and 3.8 knots against the long period average errors of 7.1, 10.3 and 13.8 knots based on the data of 2019-23 respectively. The landfall points forecast errors for 24, 48 and 72 hrs lead period were 4, 2 and 2 km respectively against the long period average errors of 18, 42 and 73 km based on data of 2019 – 23.

(iv) Cyclonic Storm FENGAL over Bay of Bengal (25-31 November):
Cyclonic Storm "FENGAL" originated from a low-pressure area over the East Equatorial Indian Ocean and adjoining southeast Bay of Bengal on 23rd November 2024. It moved west-northwestward, becoming a well-marked low on 24th, a depression on 25th, and a deep depression on 26th. It intensified into Cyclonic Storm "FENGAL" over the southwest Bay of Bengal on 29th November. Moving west-southwestward, it made landfall near Puducherry

between 1700–1800 UTC on 30th November with wind speeds of 70–80 kmph, gusting to 90 kmph. It weakened gradually into a well-marked low-pressure area over North Interior Tamil Nadu by 2nd December morning. The track forecast errors for 24, 48, and 72 hours lead periods were 45, 112, and 128 km, respectively, against the LPA errors of 72, 112, and 156 km respectively. The absolute errors in intensity forecast for 24, 48, and 72 hours lead periods were 4.2, 7.3, and 5.5 knots, respectively, against the LPA errors of 7.1, 10.3, and 13.8 knots respectively. The landfall point forecast errors for 24, 36, and 48 hours lead periods were 5.5, 22.3, and 15.3 km, respectively, against the long-period average (LPA) errors of 18.0, 30.3, and 42.4 km respectively.

At the last he concluded the following points which may be shared with all the member countries.

In his concluding remarks, he urged the member countries to share Observational data through GTS, lessons learnt, feedback etc. for further improvements. He also informed that RSMC regularly shares the report on each cyclonic disturbance with the members and conducts regular training on Satellite, Radar, NWP Models, and Severe Weather Forecasting. These trainings can be arranged for member countries as well as per request.

Rec.I: The PTC urged the members to share observational data, lessons learnt, best practices and feedback for further improvements in monitoring and forecasting of TCs in the region.

Rec.II: PTC appreciated the accurate & timely advisories issued by RSMC New Delhi and the capacity building initiatives through organization of attachment training, workshops and seminars. PTC urged RSMC New Delhi, WMO, ESCAP and all members to share information about the ongoing trainings, training materials etc with the Secretariat for wider circulation among members.

Action: All Members, RSMC New Delhi, PTC Secretariat, WMO and ESCAP

4.2. Report of members on the impact of cyclones over their region:

4.2.1. Bangladesh: Bangladesh Meteorological Department didn't participate in the meeting.

4.2.2. India: Dr. D. R. Pattanaik presented the impact of cyclones Remal, Asna, Dana and Fengal. Following damage was observed due to these cyclones:

✓ In the West Bengal state of India, Remal caused significant structural damages and loss of lives. 7 fatalities were recorded, including deaths from collapsing roofs, electrocution, and accidents caused by falling electric wires. Bangladesh faced a similar fate, with Cyclone Remal claiming at least 10 lives and destroying over 30,000 homes. In Northeast India, Mizoram bore the brunt of the cyclone's wrath, with 30 fatalities reported mainly due to landslides. Landslides, collapsed quarries, and disrupted connectivity caused widespread destruction. Assam, Nagaland, Meghalaya, Tripura, and Manipur also suffered casualties, injuries, and infrastructure damage. Floods, landslides, and road blockages hampered rescue and relief efforts, displacing thousands and damaging homes, bridges, and roads. The cyclone disrupted normal life, with power outages, disrupted communication networks, and extensive agricultural losses.

✓ Asna caused Flooding in Gujarat and killed 49 people during 25 and 31 August. The flooding

also resulted in the death of 2,618 livestock. Crops were destroyed in several districts in Kutch and Saurashtra regions. In Vadodara and elsewhere, there was extensive damage to houses, shops and businesses. 4,173 km of roads were damaged. Total 6,931 villages and 17 cities were affected by the loss of electricity. Total 88 substations were shut down during the flooding. An old bridge between Bodeli and Chhota Udepur on the national highway collapsed. An initial survey reported that the Government of Gujarat suffered damages worth more than ₹250 crore (US$29 million) to government properties and public infrastructure.

✓ Due to cyclone Dana, no death was reported from Odisha. One died in West Bengal due to electrocution. In Bangladesh, 1 person died due to falling of tree and another due to drowning in a lake. About 5,800 homes were damaged due to Cyclone Dana, eight lakh people were evacuated to 6,210 cyclone relief centres in Odisha. A total of 35.95 lakh people in Odisha were impacted by cyclone Dana and subsequent flooding in 14 districts. The worst-hit districts were Kendrapara, Balasore and Bhadrak (PTI, 17 October).

✓ Due to Fengal cyclone, 20 deaths were reported including 11 from floods, 7 from landslides, and 2 from wall collapse and electrocution from Tamil Nadu due to cyclone. 20 people died from drowning and landslides. About 1,317 homes were damaged due to Cyclone Fengal, eight lakh people were evacuated to 6,210 cyclone relief centres in Odisha. 17,117 hectares of agricultural lands were damaged in Tamil Nadu, 5,527 hectares in Puducherry, and 6,825 hectares in Andhra Pradesh. A total of 69 lakh people in Tamil Nadu were impacted by cyclone Fengal and subsequent flooding in 14 districts of Tamil Nadu. The worst-hit districts were Villupuram, Kallakurichi, Cuddalore, and Tiruvannamalai (Indianexpress, 03 December)

4.2.3. Iran:

Dr. Layeghi, Behzad Layeghi, Head of the Deputy for Development, Forecasting and Crisis Management of Weather Hazards, I.R. of Iran Meteorological Organization, (IRIMO) presented the status of observational network of surface monitoring stations, Upper-Air Observatories, and 10 meteorological Doppler radar. IRIMO also uses the output of the GFS (Global Forecast System) model from the National Center for Environmental Prediction (NCEP) of the United States of America. IRIMO issues the SWAN (Simulation Wave near Shore) regional model twice a day for the Persian Gulf and the Sea of Oman. Warnings are issued in the event of low pressure and tropical storms. Dr. Layeghi also shared the statistics of bulletins issued to marine community. He informed the Panel that during 2024, a total of 730 bulletins were issued by IRIMO for the Persian Gulf and the Sea of Oman. He informed the Panel that Iran being the Regional Training Centre, organised following trainings during 2024:

- Integrated Drought Management: Monitoring and Early Warning
- HYDRO SOSI
- Monitoring and Now-casting of Severe Convection

Rec.III: RSMC New Delhi requested IRIMO to share observational data for integration into the Decision Support System.

Rec.IV: PTC requested IRIMO to arrange training on Dust Storms monitoring and forecasting

Action: PTC, IRIMO, All members

4.2.4. Myanmar:

Representative from Department of Meteorology & Hydrology, Myanmar informed that during November 2024 to March 2025 During November to December 2024, 4 times low pressure areas totally formed over the Bay of Bengal. Out of them, some further intensified into one Well Marked Low Pressure Area, one Depressions, and one Cyclonic Storms. In monthly details, two low pressure area formed in November and one further intensified into a Cyclonic Storm "FENGAL". Two low pressure area formed in December and one intensified into a depression.

Discussing the weather observed, DMH informed that during January to March 2025, no low pressure areas formed over the Bay of Bengal. During November to December 2024 In the first week of November, due to the clouds of remnant Typhoon "Yinxing" in the South China Sea moving towards the Gulf of Thailand through the South China Sea, and the interaction of warm air from the Andaman Sea and the Bay of Bengal with cold air moving from the high pressure area over China, and atmospheric instability condition in the Andaman Sea and southeastern Bay of Bengal, new rainfall records were observed 8.23 inches in Phyu, 6.06 inches in Namsam (Southern Shan), 4.84 inches in Zalun, 4.09 inches in Pnlaung and 3.35 inches in Gyobingauk. In the third week of November, due to the Cyclonic Storm "FENGAL" which crossed North Tamil Nadu & Puducherry coasts caused heavy rainfall in West Coast, Northern, Deltaic and Central Myanmar Areas. In the second week of December, it was observed fairly widespread to widespread rain in Eastern, Deltaic and Southern Myanmar Areas, due to the easterly wave, clouds moving from the Andaman Sea and Bay of Bengal, and development of convective clouds.

In January, it was observed that isolated rainfall occurred only in Northern and extreme Southern part of Myanmar, and observed below normal condition in the whole country. In February, due to the convergence of warm air from the Andaman Sea and Bay of Bengal and cold air from the China high pressure system, the western disturbances and 8 eastern disturbances, untimely rain occurred in most parts of the country during 24th to 27th February 2025 and new rainfall records were observed 1.54 inches in Hmawbi, 1.34 inches in Laputta, 0.91 inche in Ngathaungchaung and 0.32 inch in Naypyitaw (Ela) on 25th -26th February. During this period, maximum temperature was recorded two stations in Southern Myanmar and minimum temperature was recorded at Myitkyina in Kachin State.

As Myanmar is affected by the remnant typhoons from Northwest Pacific also, DMH requested to share information wrt the remnant typhoons over their region. DMH also requested for support in development of Decision Support System (DSS), Common Alerting Protocol (CAP) and Impact Based Forecasting (IBF) & Risk Based Warnings (RBW) for their region.

DG IMD expressed his condolences to the victims of recent earthquake of Myanmar. He appreciated DMH, Myanmar for excellent presentation and informed the panel that Myanmar regularly shares hourly observation with RSMC during Cyclone period.

Rec.V: RSMC New Delhi may prepare guidelines for monitoring, predicting and sharing

information wrt the remnant typhoons from Northwest Pacific affecting the PTC countries especially Myanmar and Thailand.

Rec.VI: RSMC may consider organization of trainings on development of DSS, CAP and IBF & RBW for PTC member countries.

Action: PTC, RSMC, WMO, ESCAP, Members

4.2.5. Maldives:

During 2024, the Maldives experienced multiple severe weather events influenced by tropical cyclones and associated systems. On 9th January, a cyclonic circulation south of Sri Lanka extended its impact to the Maldives, bringing heavy rain, thunderstorms, and strong winds, particularly to central atolls on 12–13 January. Flooding in Male' affected 227 locations and damaged 75 houses. The southwest monsoon began in early May, bringing widespread rain. A tornado on 13th May in Ha. Dhidhoo damaged ten houses. Cyclone "REMAL," which intensified on 26th May, caused renewed winds across the Maldives after its landfall in Bangladesh on 28th May.

In August, dual circulations over Addu City and Sri Lanka enhanced convection, leading to intense rainfall, with HA. Kelaa recording 231.5 mm. From 4–14 October, multiple systems—including a low-pressure area over the Bay of Bengal and circulations near Addu City—triggered strong monsoon conditions and severe weather. Cyclone "DANA" impacted weather after forming on 24th October. In November, a circulation over Tamil Nadu caused widespread rain and flooding, with 104.9 mm recorded in V. Rakeedhoo. Later, Cyclone "FENGAL" and distant Cyclone "Robyn" brought strong winds. Timely warnings by MMS helped mitigate impacts throughout these severe weather periods.

Maldives informed that their country need more information about the cyclonic disturbances during genesis phase. Maldives also requested for support in development of DSS, CAP and IBF & RBW for their region.

Rec.VI: PTC Secretary took note of the distant impact of cyclonic disturbances. RSMC New Delhi may provide the information about cyclonic disturbances for the entire region upto 10^0S considering the impact on Maldives.

As there was regular request for trainings on development of DSS, CAP and IBF & RBW for their region, PTC Secretary Dr. M Mohapatra requested WMO and PTC to arrange additional training on development of DSS, CAP and IBF & RBW for the forecasters in the region. In this regard, PTC Trust Fund/ WMO/ member countries may provide support, as feasible. Dr. M Mohapatra informed the Panel, that the defunct working groups on various activities including meteorology, hydrology, DRR, training and research may be revived to identify the requirements, assess the progress in implementation of various programmes of WMO and other regional bodies and prepare financial requirements. The PTC Trust Fund may be utilised for execution of various activities recommended by these groups.

In this regard, WMO Secretariat, as PTC Trust Fund manager, reminded the Panel that the list of activities and their associated financial expenditures related to the use of the PTC Trust Fund has to be approved by the Panel. PTC may consider reviving the working groups to design the activities on the 4 components viz. Meteorology, Hydrology, DRR and Training & Research. Each Working Group may prepare an annual work plan initially for the year 2025 and also for subsequent years 2026 & 2027, with associated amounts of expenditure requested from the PTC Trust Fund. Those activities should be submitted to an "Advisory Working Group/Intermediary Group/task Team (name to be decided to avoid confusion) for consolidation of a proposal, assessment of the expenditures, advice to the Panel and approval by PTC Chair and the Panel. The Terms of Reference and the name of this Advisory Working Group/Intermediary Group/Task team have to be finalized and approved by the Panel.

Dr. Mohapatra suggested that the composition of Advisory Working Group/Intermediary Group/task Team may include Chairman from a member country, PTC Chairman, PTC Secretary, WMO representative, ESCAP representative, 2 members from any of the 13 countries and PTC Secretariat representative. The Advisory Working Group/Intermediary Group/task Team may have the allocation of funds to various groups approved by the PTC.

Dr. Honore suggested preparation of a timeline for early utilisation of funds during the 2025 year. In this regard, he suggested that Advisory Working Group/Intermediary Group/task Team may be constituted during this Session. These Working Groups may have online discussions to prepare their annual work plan in alignment with various activities of WMO and other regional bodies. He urged the members to have more discussions in this regard and take a decision. Dr. Mohapatra suggested WMO to present the PTC Trust Fund on Day-2 instead of Day-4 and have more discussions. He also suggested Secretariat to circulate terms of Reference of various working groups with members and seek 1 nomination each from the member countries.

Rec. VII: Secretariat may circulate the Terms of Reference (TOR) of each Working Group and seek nominations for each group from all the 13 member countries.

Rec.VIII: Various Working Groups may be constituted during this Session. The Task team may assess the proposal of each Working Group, submit a consolidated proposal to PTC Chairman for approval. Thereafter, it may be submitted to WMO. The TOR adopted by PTC for various working groups are given in Annexure-3

Rec.IX: PTC may approve the timeline for final preparation of working groups, preparation of Terms of Reference of each Group, assessment of work plan & budget requirements of each group and final approvals from PTC and WMO.

4.2.6. Pakistan:

Pakistan Meteorological Department (PMD) informed that during the year 2024, various severe weather events were observed in the country. It was climatically one of the most volatile in Pakistan's history, marked by extreme rainfall, record-breaking heat, and rare cyclonic activity.

With **31% above-average annual rainfall**, 2024 ranked as the **7th wettest year since 1961**, including record rains in **Sindh (+94%)** and **Balochistan (+82%)**, where such high rainfall is historically uncommon. The **Cyclonic Storm ASNA**, only the **4th August cyclone in recorded history (since 1893)**, struck the **Northeast Arabian Sea**, bringing wind gusts of **40–46 knots** and triggering **widespread flooding** in Karachi, Thatta, and Badin.

Tropical Cyclone (TC) *ASNA* Monitoring: During the year 2024, a rare feature was the development of Cyclonic Storm, CS (ASNA) in the month of August. Usually during peak monsoon, TCs do not develop in the North Indian Ocean and ASNA proved to be the only 4th CS in the recorded history (during 1893-2023) of the North Indian Ocean, the previous ones being in 1944, 1966 and 1976. PMD's Tropical Cyclone Warning Centre (TCWC), Karachi monitored the TC ASNA and issued 10 alerts from 29 Aug - 1 Sep. The TC *ASNA* formed on 30th August over the Northeast Arabian Sea off Pakistan southern coast, Sindh. The CS dates back to 16 August when a monsoon low developed over the Northwest Bay of Bengal and adjoining west Bengal and Bangladesh. It located over South Bangladesh during 17-19 August and then over North and West Bangladesh during 20-23 August. Moving westward, it concentrated first into a well-marked low over Uttar Pradesh (India) and then into a Depression over Madhya Pradesh (India) on 25 Aug. It further intensified into a Deep Depression (DD) over East Rajasthan (India) on 26 Aug and moved on to north Gujarat (India) on 27 Aug and then over Rann of Kutch (India) and adjoining southeast Tharparker (Pakistan) where it remained stationary for following two days. Having moved southwest and emerging over the Northeast Arabian Sea and meeting favourable environmental conditions (warm SSTs (28-29C), low/moderate vertical wind shear, VWS, and well-organized upper-air outflow/divergence) it further intensified into a Cyclone Storm (ASNA) off Pakistan's Sindh coast on 30th at 1100PST (0600 UTC). Thereafter, the CS (ASNA) kept tracking west-southwest for next two days. Reaching over Northwest Arabian Sea and encountering unfavourable conditions of cooler SSTs, higher VWS and dry air entrainment from Arabian Peninsula it then weakened first into a DD from 1st September night and then into a Depression from 2nd Sep morning.

On Friday, 31 August the CS, *ASNA,* induced squally winds of 40-46kts speed over Karachi, and other adjacent southern districts, Sujawal, Thatta and parts of Badin associated with widespread rain/thunderstorm with some extremely heavy falls over Sothern Sindh which uprooted dozen of trees, smashed signboards and blown away loose structures. Apart from this, its induced circulation
also produced heavy rains in Balochistan, Khyber Pakhtunkhwa (KP), Punjab, Gilgit Baltistan (GB) and Azad Jammu & Kashmir (AJK) during 25-31 August (source: pmd.gov.pk)

A low-pressure area first formed over Southeast Arabian Sea on 11 October, which later turned into a Depression and moved in northwest direction towards Oman coast. PMD monitored it and issued eight advisories from 11-15 October.

Day 2: Tuesday – 29th April 2025

As per discussion during Day-1, Item Agenda 5 was taken up first followed by pending country report from member countries.

5: Coordination with other activities in the Panel region

Item 5.1: Coordination within WMO Tropical Cyclone Programme (WMO Representative

Ms Anne-Claire Fontan (WMO Secretariat) provided an update on the WMO activities and the Tropical Cyclone Programme (TCP) coordination. She presented relevant resolutions from WMO constituent bodies since the PTC-51 (online, December 2024). She focused on the outcomes of, respectively, SERCOM-Ext (online, 18-20 March 2025) and RA II-18 (I) (online, 22-25 April 2025):

1. **SERCOM-Ext**
    a. Cataloguing on Hazardous events - approved.
    b. Technical Regulations for Early Warnings Systems approved, with a recommendation to the extraordinary World Meteorological Congress for approval.
2. **RA II-18 (I)**
    a. RA II Operating Plan adopted – strengthening and expanding regional partnerships, promoting inter-regional coordination and cooperation, and sharing good practices.
    b. EW4All - integrate EW4All in the RA II Operating Plan, increase cooperation, and coordinate across RA II structures and partners via a dedicated Task Team
    c. Partnership Strategy - Leverage (sub)regional intergovernmental mechanisms like PTC, South Asia Hydromet Forum (SAHF), RIMES, etc.; Establish a virtual network for all WMO centres in RA II
    d. Education and Training - enhance the alignment between the training activities of WMO RTCs and the capacity development needs of National Meteorological and Hydrological Services (NMHSs) across the region

She listed the TCP activities (trainings and sessions) in the other tropical cyclone regional bodies by the date of the session. She also noted that the 11th International Workshop on tropical Cyclone (IWTC-11) is scheduled for November 2026 in Shanghai, China and encouraged active participation by Panel Members.

She provided updates on the TC Probabilistic Forecast Project (TC-PFP), noting that phases two and three are currently underway. A three-day online workshop is planned for June or July 2025, and Members were encouraged to participate.

She concluded by informing the Panel on the new publications available in the WMO e-library; State of the Global Climate 2024, Guidelines on the Inventory of Interoperable Models and Platforms for Flood Forecasting and Early Warning Systems, Sustainability Strategy for the Flash Flood Guidance System with Global Coverage and Business Continuity Management Guidelines for WMO Members.

Dr. M. Mohapatra, Secretary PTC requested to share best practices available with WMO to prepare BCM Plan. He also stressed upon the need to have capacity building initiatives for the PTC region for development and implementation of IBF, RBW, DSS and CAP. In view of the climate change scenario and the increase in extreme weather events, he urged upon the need for development of an interoperable environment among various the agencies, WMO, Regional bodies and member countries.

He also suggested more trainings on Multi-hazard early Warning System Interoperability for the forecasters in the region.

Dr. Mohapatra also highlighted that the tropical cyclones are multi-hazard events and may have far reaching impact. He highlighted the challenges wrt implementation of EW4All. He requested WMO to guide PTC wrt linkages between various programmes of WMO including Systematic Observations Financing Facilities (SOFF), EW4All etc. In this regard, Dr. Anne Claire informed that there are regional bodies like RA II, PTC, Hydromet Forum etc. The Working Groups on Meteorology, Hydrology, DRR and Training may develop a plan to synergize with these groups.

Rec X.: WMO to share best practices for development of BCM Plan**.** PTC Members to develop region-specific BCM guidance and tools for tropical cyclone-related activities. Guidelines available on WMO website in this regard be followed.

Rec. XI: PTC, WMO and ESCAP may consider organisation of more trainings on development and implementation of BCM Plan, CAP, Multi-hazard Early warning system Interoperability.

Action: All members, PTC, WMO, ESCAP

5.2: Coordination with UNESCAP for tropical cyclone program

Dr. Sanjay Srivastava, ESCAP extended support of ESCAP to TC / PTC for development and implementation of Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System. Dr. Srivastava informed the Panel that through the ESCAP Trust Fund for Tsunami, Disaster and Climate Preparedness, ESCAP hopes to continue to support TC / PTC to shift from single to multi-hazard approaches through the SSOP programme. He also shared the progress in the new SSOP III project, to:

- ✓ Provide a people-centric, bottom-up approach to Multi-Hazard Early Warning Systems (MHEWSs) by bringing the SSOP concepts and guidance to the last mile/kilometer assisting vulnerable, underserved communities.
- ✓ Enhance regional cooperation and collaboration through joint training, education and awareness within a regional body and among regional bodies.
- ✓ Integrate current and new regional body project plans within the scope of the SSOP III project in order to synergize efforts and avoid unnecessary duplication.

The project activities will focus on strengthening collaboration between TC/PTC/RAV, SSOP training to NHMS/NDMAs and translating national MHEWS work to the local level

He informed the Panel that through support from the ESCAP Trust Fund for Tsunami, Disaster and Climate Preparedness, ESCAP and RIMES have been partnering to 'Enhance Weather and Climate Resilience in RIMES Member States through Capacity Building on Impact Forecasting', leading to the development of an online learning platform for IBF. He extended support of ESCAP to submit proposal for SSOP 3 – Managing compounding and cascading hazards (tropical cyclone, other coastal hazards – storm surges, tsunami) in the Bay of Bengal and Arabian Sea and support to PTC Attachment training 2025. He also recommended collaboration with RIMES to advance IBF at national level.

- Dr. Srivastava also urged the members to use the report on 'Tsunami Preparedness within a multi-hazard context: Opportunity for enhanced co-operation'.
- Second, rapid intensification of tropical cyclones: The recent years have seen rapid intensification, curvature, newer and complex tracks of tropical cyclones both in the Bay of Bengal and Arabian Sea.
- Third, impact-based forecasting (IBF): IBF narrows the gaps that exist between forecasters and the end-users. It is time to translate cyclone track, intensity and landfall prediction into impact scenarios to support early and anticipatory actions.
- Fourth, cyclone early warnings for All: The UN Early Warnings for All Executive Action Plan 2023-2027 has been built on four pillars – knowledge of risk, monitoring and forecasting, warning dissemination and communication, and preparedness for response. PTC@51 can envision to take forward cyclone early warnings for All to all its members.
- Fifth, strengthening PTC architecture: The PTC evolved through a regional architecture comprising its secretariat, RSMC, and network of members supported by the WMO and ESCAP. The PTC secretariat at IMD/RSMC is key to driving operations and to ensure that the panel is fully owned, funded, administered, and governed by its members.

A Regional Strategy of EW4All to Tropical Cyclone needs to be backed by the Synergized Standard Operating Procedures (SSOP) for Coastal Multi-Hazards Early Warning System. This is essential to facilitate the shift from Single to Multi-Hazard EWS across the full value chain [regional – national – local]. Another essential key is risk knowledge and impact forecasting from transboundary EWS perspectives. There is scope to scale up IBF to support early actions: This is done through PTC Attachment training, WMO/ESCAP dedicated IBF training, SASCOF, FOCRII, ASEANCOF In addition, there has been a scaling up IBF through the UN Early Warnings for All initiative– Pillar 2 – Impact based Forecasting IBF needs to be included in Synergized Standard Operating Procedure for Coastal Multi-hazards Early Warning System (SSOP III) in PTC member Countries Resource mobilization for IBF – GCF, CREW, ESCAP Trust Fund, PTC members is essential. I would like to thank the organizers for their efforts in arranging this important event and wish you all a successful and productive participation.

Dr. M. Mohapatra, Secretary PTC thanked ESCAP for support to SSOP I&II. Both the documents were excellent but need updation. Therefore, there is need for SSOP-III for Bay of Bengal & Arabian Sea to streamline activities with respect to MHEWS, IBF & RBW.

Dr. Srinivas, UNESCO extended support for development of SOP's and training activities for PTC member countries.

Rec. XII: PTC may prepare proposal for SSOP-III for Bay of Bengal & Arabian Sea which will aim to manage compounding & cascading coastal multi-hazards (Tropical cyclones, Storm surges, Tsunami etc.)

Rec. XIII: PTC to explore ways and means to get support from ESCAP for training on development and implementation of DSS, CAP & IBF.

Rec. XIV: Members may translate cyclone track, intensity and landfall prediction into impact scenario to support anticipatory actions

Rec. XV: PTC to take forward cyclone early warnings for all with respect to 4 pillars viz. knowledge of risk, (ii) monitoring & forecasting, (iii) warning communication & dissemination and (iv) preparedness for response through capacity building,

XVI: PTC should be fully owned, funded, administered and governed by its members

Rec.XVII: PTC and members may develop with the help of UN ESCAP an SSOP for coastal Multi-hazards Early Warning System (SSOP III)

Action: All members, PTC, UN ESCAP, UNESCO

5.3. The Panel's Trust Fund by TCP, WMO

Ms. Anne Claire Fontan, WMO Secretariat presented the details of PTC Trust Fund as per details below:

(a)Final Statement of Income and Expenditure for the Period 1 January to 31 December 2024

Contributions from Members from 1 January to 31 December 2024: six Members
Expenditure:

a. Attachment training at RSMC New Delhi, hybrid, 19-30 August 2024

b. Supporting cost: 13% of the total expenditure

c. Balance of fund: **232,094 USD**

d. An audit report will be available around June 2025.

(b) Contributions for 2025

The letter inviting the PTC Members to contribute to the Trust Fund (PTCTF) has been sent on 20 March 2025. (WMO note verbale 02590/2025/S/DMPS and letter 02601/2025/S/DMPS/TCP/PTCTF : Contribution to the WMO/ESCAP Panel on Tropical Cyclones Trust Fund for 2025 (02590/2025/S/DMPS_en, 02590/2025/S/DMPS_ar.)

(c) **Work plan for 2025**

RSMC New Delhi Attachment Training: USD 12'000
WMO will provide a round-trip ticket for 5 PTC participants in July.

The work plan for 2025 was approved at PTC-51.
The work plans for 2026 is listed below:

- RSMC New Delhi Attachment Training: USD12'000, each year
- WMO provides a round-trip ticket for 5 PTC participants.

Rec. XVII:

- Attachment training on storm surge modelling and forecasting: USD 6'000 –will be approved formally during inter sessional period

- ❖ TOR of WGs (meteorology, Hydrology, DRR, Training & Research) have been discussed and approved during PTC-52. Meeting will be held during inter-sessional period to finalise the TOR of Advisory Group. Chair of each WG will suggest the funding requirements to the Advisory Group. The Advisory Group may submit final requirements to Chairman PTC for finalisation during inter-sessional period.
- ❖ PTC Secretariat to facilitate arrangement of the online meeting to finalise TOR of Advisory Group etc.

Rec. XVIII : PTC to review the PTC TF final financial statement for 1 January to 31 December 2024.
Rec. XIX: PTC to encourage Members to contribute to the PTC Trust Fund for the purpose of sustainable supporting of activities of the Panel.
Rec. XX: PTC to note the workplan for 2025.
Rec. XXI : PTC to approve workplan on biennial basis, i.e. 2026, 2027.

Rec. XXII: WMO recommended PTC to move forward with the development of actionable annual workplans in a phased manner. PTC in its 52nd session held online during 28th April to 01st May recommended constitution of the working groups as follows. There will be working groups on (i) Meteorology, (ii) Hydrology, (iii) DRR, (iv) Training & Research each to assess the priorities relevant to their activities based on annual operational plan approved by WMO/ESCAP PTC.

The PTC Secretariat will coordinate with PTC Chair and facilitate the finalisation of the constitution of the relevant working groups by end of June, 2025.
In alignment with the other Plans of the PTC, each working group will identify activities:

- ❖ within their scope of expertise
- ❖ within budget (Trust Fund or in-kind country contribution can be considered),
- ❖ submitting their workplans 2026 and 2027 - by October 2025,

Each group will submit report to the Advisory Group. The Advisory Group will evaluate the proposal of each Working Group and submit a consolidated proposal to PTC for final approval. The proposal will consist of training and other capacity building activities.

In the ensuing discussion, the Panel was further briefed by the WMO Secretariat from the perspective of sound and transparent managment of the PTC Trust Fund, in accordance with the Rules and procedures of the Panel and Term of the Reference of the Panel.
The PTC noted the summary from the PTC Chair on a possible additional activity in 2025 requiring use of the PTC Trust Fund in this intersessional period. If there were any proposal, the PTC Secretary, in consultation with those concerned, will consolidate its concept note and estimated budget for submission to the Chair, to assist him in obtaining approval from the Members.
To ensure the sound use of the PTC Trust Fund in the future (2026 and beyond), the PTC approved the Terms of Reference for the Working Groups on Meteorology, Hydrology, Disaster Risk Reduction, and Training and Research. The PTC Secretariat will facilitate the population and identification of chairperson of the relevant working groups during the intersessional period. Further

elaboration will take place during the intersessional period related to the definition of the ToRs of the "intermediate group/task team/Advisory working group (AWG)" (name to be chosen) and its submission for approval to PTC-53. In addition, the submission on the budget requirement will be made to the anticipatated "intermediate group" (referred to in the meeting as the 'Task Team' or 'Advisory Working Group') as follows. In this regard, the PTC Secretariat will organize a series of intersessional meetings with relevant people (PTC Chair, PTC Secretariat, RSMC New Delhi representative, WMO and ESCAP representatives) to discuss the AWG's Terms of Reference and membership for formal approval at PTC-53.

WMO secretariat shared the outcomes of the work of the task team established in 2021-2022 to address the PTC Structure Working groups, PTC Secretariat, and terms of reference) and internal matters (Rules of procedures, Status, etc). The outcomes are made available here PTC Internal matters - All Documents,

PTC approved the PTC trust fund with 12'000 USSD for the RSMC New Delhi Attachment training in 2026.

Rec. XXIII: Workplans 2026 and 2027 will be approved at PTC-53 based on the recommendation of working groups on meteorology, hydrology, DRR, Training & research and consolidated & finalized by the PTC Advisory Group.

Dr. M. Mohapatra urged upon the need to organize training on IBF, RBW & CAP in 2025. For this purpose, PTC trust fund may be utilized and requested WMO to check if there were any plans for this region by WMO.

Rec. XXIV: All Members were requested to contribute for the PTC trust funds for the year 2025. In this regard, WMO informed that members can provide by annual contribution also voluntarily i.e. they can contribute for the year 2024 as well. Already WMO has sent Note Verbale to the PRs of PTC.

Action, PTC, WMO & all members

4.2: Reports of Members on the Impact of Tropical Cyclones contd.

4.2.7. Sultanate of Oman:

Representative of Oman shared the significant weather information as per details below:

- **Al-Riyan Trough**: Between March 4 and March 6, 2024, the weather in the Sultanate was influenced by a trough associated with a low-pressure system. This resulted in rainfall across several governorates, including Al Dakhiliyah, North and South Sharqiyah, Dhahirah, and Al Wusta. The intensity of the rainfall varied from heavy to moderate, accompanied by active descending winds and hail in mountainous regions.
- **Al-Mutayr Low-Pressure System**: The Sultanate experienced the effects of a low-pressure trough from April 13 to April 18, 2024, which resulted in heavy rainfall and severe flash floods. The weather event, known as the "Al-Mutayr Low-Pressure," was closely monitored and extensively reported through various media channels, including television, radio, and social media. The coverage included 85 interviews and approximately 102 social media posts, ensuring

the swift dissemination of alerts and information to all segments of society. Awareness campaigns were conducted in three languages: Arabic, English, and Urdu. During this period, two reports and four alerts were issued.This weather event was deemed exceptional, as some Civil Aviation Authority stations recorded exceptionally high rainfall in a short period. For instance, the Wadi Bani Khalid station recorded 91.6 mm of rain in just one hour. Additionally, significant daily rainfall totals were noted, with the Shinas station recording 180.2 mm. The highest wind gusts were registered at the Ibri station, where wind speeds reached 69.9 knots.

- **Tropical Storm (Asna)**: The tropical system initially developed as a low-pressure area northeast of the Indian subcontinent on August 24, 2024, and strengthened into a tropical storm by August 30, 2024, with estimated wind speeds of 34-40 knots near its center. At the time, the system was approximately 920 kilometers from the coasts of the Sultanate of Oman.The storm's impact on Oman included rough wave heights ranging from 3 to 5 meters, cloud formation, and scattered rainfall in the governorates of South Sharqiyah and Al Wusta. On September 1, 2024, the storm's classification was downgraded to a tropical depression as it gradually weakened and moved southward through the Arabian Sea.
- **Tropical Depression and Upper Air Low Trough (Al Sayyal)**: Between October 14 and October 17, 2024, a weather system emerged, combining a tropical depression over the Arabian Sea, approaching the southeastern coasts of Oman, and an upper air trough over the northern parts of the Sultanate. This system brought significant rainfall, exceeding 200 mm in some areas, accompanied by severe flash floods.
- During Jan- Apr 2025 there was no significant weather.

4.2.10 Sri Lanka

Representative of Sri Lanka shared the significant weather information as per details below:

Extreme Rainfall event on 1st June, 2024

Convective showers were enhanced with the formation of low-level disturbance in the vicinity of Sri Lanka on 1st June. Extreme rainfall was reported in the southwestern part of the country. This high intense rainfall reached maximum at 460 mm at rainfall station at Labugam area during 24 hours on the day. Heavy rainfall leading to flash floods and other hydrometeorological hazards in the southwestern part of the country. According to Disaster Management Center (DMC), approximately 118,000 people were affected including twenty-three deaths, seven injured and one missing in the event. The most affected areas were Rathnapura district in Sabaragamuwa province (nearly 60,000 affected), Kaluthara district in western province (nearly 32,000 affected), and Matara district in southern province (nearly 21,700 affected).

Table 1. Stations received above 250 mm rainfall in 1st June 2024

Date	Station	24hour Rainfall (mm)
01st June 2024	Kalatuwawa	490.0
01st June 2024	Labugama	464.8
01st June 2024	Elstan	307.1

01st June 2024	Padukka Estate	296.3
01st June 2024	Keragala	285.2
01st June 2024	Rathnapura	281.9
01st June 2024	Batuwangala	264.2
01st June 2024	Kukuleganga	264.0

Extreme Rainfall due to cyclonic storm Fengal 25-30 November 2024

The cyclonic storm Fengal over Bay of Bengal caused heavy rainfall in the country particularly from 22nd November to 27th November. In 24th of November heavy rainfall reported from eastern parts. Rainfall activities were enhanced in the 25th of November and wide spread extreme rainfall were reported with highest rainfall during 24 hours at 311.1 mm from Ampara district in Eastern Province. In 26th of November also wide spread rainfall were reported in many areas. According to Disaster Management Center (DMC), highest number of people were affected in eastern province (149,491 individuals were affected in Ampara district, 71,618 individuals were affected in Batticaloa district, and 10,416 individuals were affected in Trincomalee district), northern province (68,103 were affected in Mannar district, 64,621 were affected in Jaffna district, 9,169 were affected in Kilinochchi district, 7,524 were affected in Mullaitivu district and 4,851 were affected in Vavuniya district) and Northcentral province (6,619 were affected in Anuradhapura district).

Table 1: Stations that received above 250 mm 24 hours rainfall during 25th to 30th, November 2024

Date	Station	24 hour Rainfall (mm)
25th November 2024	Nawakiriaru Tank	256
25th November 2024	Ampara Tank	311.1
25th November 2024	Pannalgama	256.7
25th November 2024	Sagaman Tank	274.0
25th November 2024	Elkaduwa	255.0
25th November 2024	Ulhitiya	286.6
25th November 2024	Aralaganviala	259.2
25th November 2024	Girandurukotte	290.8
26th November 2024	Jaffna	253.0
26th November 2024	Thunukkai-Mullaitivu	250.5

4.2.11 Thailand

Representative of Thailand shared the significant weather information as per details below:

- In May 2024, the tropical cyclone “REMAL” (01B) initially originated in the Bay of Bengal and affected rainfall in Thailand during 24 -27 May 2024.
- DDPM reported that the tropical cyclone “REMAL” (01B) caused windstorm that affected 119 households across 34 districts, 62 subdistricts and 148 villages in 21 provinces. The tropical cyclone also caused flooding that affected 294 households across 10 districts, 17 subdistricts and 71 villages in 9 provinces.
- There were no injuries and casualties from both accidents.

4.2.12 United Arab Emirates (UAE)

Representative of UAE shared the significant weather information as per details below:

Depression (09–19 October 2024)

- 15 October: Strong southeasterly winds (exceeding 60 km/h) affected some internal and coastal regions, reducing visibility to less than 2000 m. This was caused by the pressure gradient between the approaching low-pressure system and a high-pressure system over the region.

- 16–17 October: As the depression moved inland, its associated cloud band passed over parts of the UAE. Rainfall of varying intensity was reported, especially in Al Ain, some internal areas, and the Western Region. Upper-level high pressure suppressed convection in other areas.

- 18 October: The subtropical jet stream over the Arabian Gulf began to weaken and shift, allowing the low-pressure system from the south to dominate at the 700 hPa level. This supported broader rainfall across the western regions and islands, continuing through 19 October.

Rec. XXV: RSMC New Delhi requested all members to share realised weather information after each cyclonic disturbance over North Indian Ocean for inclusion in the report.

4.2.13. UNESCAO-IOC:

Dr. Srinivasa Kumar Tummala, Head of the UNESCO-IOC IOTWMS Secretariat, presented the updates on the UNESCO-IOC Tsunami Programme, which included four regional systems—CARIBE-EWS, IOTWMS, NEAMTWS, and PTWS—each coordinated by an Intergovernmental Coordination Group. He highlighted IOTWMS activities such as the IOWave23 exercise, Capacity Assessment Survey, training workshops, and implementation of the Tsunami Ready Recognition Programme (TRRP). The IOTWMS has 27 member states, with active participation from PTC countries including Bangladesh, India, Iran, Maldives, Oman, Pakistan, and UAE. A regional project, funded by the UNESCAP Trust Fund, has supported the development of Probabilistic Tsunami Hazard Assessments and Tsunami Early Warning Chains for the Makran region. Member States also contributed to the 2024 Capacity Assessment and nominated Tsunami Ready Focal Points to strengthen local preparedness. A TEMPP training was held in India in April 2025, and the ICG/IOTWMS XIV Session in Indonesia developed a 2025–2026 work plan. Dr. Tummala also reflected on the 2nd Global Tsunami Symposium and the Ocean Decade Tsunami Programme. Member States were urged to remain engaged, consider IOWave23 recommendations, and expand tsunami readiness initiatives. UNESCO-IOC reaffirmed its commitment to collaboration with PTC Member States and partners. He also extended support for capacity building programmes for PTC members in the region.

Day 3: Wednesday – 18th December 2024

Session 3

6: Activities of WMO/UNESCAP (by all PTC members) Country Report

Members presented country report on:

6.1 Meteorological activities: Country report

6.2 Hydrology activities: Country report

6.3 Disaster prevention and Preparedness: Country report

6.4 Training/Capacity building: Country report

6.5 Research: Country report

6.6 Publication: Country report

All reports are available at PTC-52 Session page on PTC website.

Item 7: Review of the tropical cyclone operational plans

Item 7.1: Tropical cyclone operational plan: Ms. Monica Sharma, RSMC New Delhi

The Panel examined the draft of the updated Operational Plan submitted by the rapporteur to the session. It contained an explicit formulation of the procedures adopted in the Bay of Bengal and Arabian Sea region for the preparation, distribution and exchange of information and warnings pertaining to tropical cyclones.

Mrs. Monica Sharma, Scientist-D, RSMC New Delhi, the Rappotreur for 2024 Edition of TCP-21 presented the Tropical Cyclone Operational Plan (TCP-21) draft edition 2024 on 18th December, 2024 during PTC-51 meeting as the rapporteur. The draft report was shared with all members on 16th November. She thanked all the Member countries for their valuable inputs for updating of Tropical Cyclone Operational Plan. The presentation mainly highlighted the initiatives taken by countries for the TCP-21 (edition 2025) and improvements/ updations in observations, modeling, warning services and dissemination mechanism of the countries during 2024 and upto April 2025.

In her presentation, she shared (i) the New Cone of Uncertainty wef March 2025 for depression and above catergories, (ii) Cone of uncertainty with effect from March 2025 from pregenesis track forecast at the stage of well marked low pressure area, (iii) Confidence level in fixing the location and intensity of the cyclonic disturbance. She also requested the members to update the status of observational network including the list of synoptic stations, Radars, Buoys etc. in the TCP-21. She also shared the contact details of the focal points and requested the members to inform updates if any. She thanked all the member countries & WMO for their support in preparation & publication of TCP-21 annually.

The PTC appreciated Mrs. Monica Sharma for her contribution as a Rapporteur for TCP-21, 2025 edition. The PTC approved the draft TCP-21 (edition 2025).

Rec. XXV: Also, PTC urged the members to provide detailed activities of meteorology, hydrology, DRR components taken up in the year for updation of TCP-21(edition-2026). PTC also urged Mrs. Monica Sharma to continue as Rapporteur for TCP-21 Tropical Cyclone Operational Plan for the year 2026.

7.2 Coordinated Technical Plan (CTP) (2024-2027): Dr. Ananda K. Das, CWD, IMD

Dr. A K Das, Scientist-F, RSMC presented the **CTP (2024-2027).** The CTP aimed to reduce damage from cyclones and floods in the Bay of Bengal and Arabian Sea through regional cooperation. Its goals

include aligning priorities, providing resources for forecasting, encouraging joint projects, raising awareness, and training specialists. The Plan was discussed among the members and approved by the members. The CTP 2024 may be used by members as a guiding document for their national plans. The CTP 2024-27 is placed at Annexure-4.

Rec.XXVI: As implementation of WMO Information System (WIS) may take time, the secretariat may initiative to establish common data portal.

Action: PTC Secretariat

Rec.XXVII: The CTP 2024 may be used by members as a guiding document for their national plans

7.3 Annual operational Plan (2025): Dr. Ananda K. Das, CWD, IMD

Dr. A K Das, Scientist-F, RSMC presented the Annual Operation Plan (AOP) for the year 2025. The AOP outlines specific initiatives and projects to achieve expected results. It includes actions and performance indicators aligned with strategic goals, and is prepared and revised annually during PTC sessions. The Plan was discussed among the members and approved by the members. The AOP 2025-26 is placed at Annexure-5.

Rec.XXVIII: Secretariat may suitably modify annual operation plan and coordinated technical plan with inclusion of development and implementation of IBF, RBW, DSS, CAP, difficult cases information and climate change impact. Secretariat may circulate both the documents for suggestion and comments by 10th May.

Rec.XXIX: Members may prepare Action Taken Report on CTP

Rec.XXX: The AOP 2025 may be used by members as a guiding document for their national plans. Action: All Members

Rec.XXXI: Members may prepare Action Taken Report on AOP and CTP

Rec.XXXI: The PTC appreciated Dr. A.K Das & the Secretariat for updation of CTP & AOP.

7.4 Constitution of working groups on Meteorology, Hydrology, Disaster Risk Reduction, training & research: Ms. Monica Sharma, RSMC New Delhi

As per the recommendations of PTC- 51 it was proposed to revive the defunct working groups on Meteorology, Hydrology, Disaster Risk Reduction, training & research. Accordingly, secretariat updated the TOR for meteorology, hydrology and DRR and prepared the TOR for training and research and the task team of PTC. These documents were circulated among all the members for suggestions and comments. The objective of these working groups is to identify priority issues and area of cooperation, promote and facilitate exchange of information, develop EOP and CTP, identify funding requirements, promote implementation of various programs of WMO and other regional bodies and develop strategies for development and implementation of IBF, RBW, CAP and DSS. The TOR for various working groups are placed at Annexure-6.

8: Report of PTC Secretariat

8.1 Annual Review: **Dr. D. R. Pattanaik, Head RSMC, New Delhi**

The publication "Annual Review" was revived recently by the PTC Secretariat. The draft "Annual Review – 2024" prepared by PTC Secretariat was presented by **Dr. D. R. Pattanaik, Head RSMC, New Delhi**. The same will be published by July 2025 after incorporating the inputs from all member

countries, WMO Secretariat, UNESCAP.
Dr. Pattanaik informed all members to provide the inputs for the year 2024 pertaining to all 5 components viz., (i) Meteorology, (ii) Hydrology, (iii) Disaster Risk Reduction (DRR), (iv) Training Activities and (v) Research and Publications.

Rec. XXXII: The Annual Cyclone Review 2024 may be published by WMO and uploaded on PTC and RSMC website **Action: RSMC New Delhi and All members**

Rec. XXXIII: PTC appreciated RSMC, New Delhi & Chief Editor for preparation of annual cyclone review, 2024.

8.2 Editorial Board for Annual Review 2023 and 2024: **Dr. D. R. Pattanaik, Head RSMC, New Delhi**

It was also discussed about the Editorial Board for Annual Review -2025, which will be published in 2026 during the PTC-53 session. It was discussed that the Chief Editor of Annual Review- 2024, Dr. D. R. Pattanaik may continue for Annual Review-2025. With regard to the member of the Editorial board, the member country may provide the name in consultation with the respective PR of the country.

Rec. XXXIV: PTC requested the members to suggest the editors for the next Annual Cyclone Review 2025.

8.3. News Letter:

Mrs. Monica Sharma, Scientist RSMC New Delhi and PTC Secretariat urged the members to share inputs for the issue of PTC Newsletter (January 2025). She emphasized that all member countries may provide relevant inputs of their activities to incorporate in the PTC Newsletter for wide publicity of their activities.
It may have followed components (i) Severe weather realize during 2024 and January to April 2025, (ii) Significant events (iii) Workshops, seminars organized (iv) Training (v) Awards and appreciations (vi) Research paper published.

Day 4: Thursday (Final day) – 19th December 2024
Session 4

Item 9: Special Lectures

As part of the PTC-52, 5 special lectures were arranged as per the details given below.

(i) Regional Impact Based Forecasting by **Dr. A. R. Subbaiah**, Director RIMES, Bangkok, Thailand.
(ii) AI/ML applications for TC monitoring and forecasting by **Dr. Atul Kumar Sahai**, Scientist, Indian Institute of Tropical Meteorology (IITM), Pune.
(iii) Leveraging AI to scale Early Warnings for All by **Dr. Sanjay Srivastava**, Chief, Disaster Risk Reduction, UNESCAP, Bangkok
(iv) WMO State of the climate reports - WMO, **Ms. Claire Ransom and Dr. Omar Baddour,** WMO.\

(v) IOC Tsunami Activities in the Indian Ocean (IOTWMS), **Dr. T Srinivasa Kumar**, Head UNESCO-IOC ICG/IOTWMS Secretariat

The WMO Secretariat, represented by the WMO Climate Monitoring Section (Mr. Omar Baddour and Ms. Claire Ransom), presented the WMO "State of the Climate" reports. These reports are published annually at both global and regional levels, as well as for each decade. Each report follows a consistent and detailed structure. Ms. Ransom informed the Panel about the process for contributing information to these reports via the online Members' reporting platform.
In addition to the regional climate reports, a new report focusing on the Aral League region will be published soon. She also presented examples of national-level reports and shared a case study on Hurricane Irma and its linkages to the Sustainable Development Goals (SDGs). Ms. Ransom concluded by sharing useful links with the PTC Members.
Extreme Events Dashboard; State of the Global Climate; Regional & Decadal SoC

IOC Tsunami Activities in the Indian Ocean (IOTWMS), Dr. T Srinivasa Kumar, Head UNESCO-IOC ICG/IOTWMS Secretariat:

Dr. Srinivasa Kumar Tummala, Head of the UNESCO-IOC Indian Ocean Tsunami Warning and Mitigation System (IOTWMS) Secretariat reported on the UNESCO-IOC Tsunami Programme, that comprises of 4 Regional Tsunami Warning and Mitigations Systems - CARIBEEWS, IOTWMS, NEAMTWS and the PTWS, each coordinated by an Intergovernmental Coordination Group (ICG).
Dr. Tummala provided an update on the key elements, governance and most recent activities in the IOTWMS, including the conduct of the Indian Ocean Wave Exercise (IOWave23), Capacity Assessment Survey, Capacity Development Workshops & Trainings and implementation of the Tsunami Ready Recognition Programme (TRRP).

Dr. Tummala provided details on Membership of the IOTWMS that comprises 27 Member States / Territories in the Indian Ocean region. PTC Member States including Bangladesh, Maldives, Myanmar, Oman, Pakistan, Sri Lanka, Thailand, UAE and Yemen represented by their National Meteorological Hydrological Services and the Disaster Management Organizations have engaged actively in the work programme of the IOTWMS.

India, Iran, Pakistan, Oman and UAE are actively engaged in a regional project on "Strengthening Tsunami Early Warning in the Northwest Indian Ocean through Regional Collaboration" with funding from the UNESCAP Multi-donor Trust Fund. This project facilitated the development of Probabilistic Tsunami Hazard Assessment (PTHA) for Makran and national working processes for the development of Tsunami Early Warning Chains, Tsunami Evacuation Maps and Plans to prepare for a Makran Tsunami Threat.

Bangladesh, India, Iran, Maldives, Myanmar, Oman, Pakistan, Sri Lanka, Thailand and UAE are amongst the PTC countries that actively participated in the IOWave 23 Tsunami Exercise and the workshop on Standard Operating Procedures with India, Iran, Maldives, Sri Lanka and UAE also conducting community evacuations.

Bangladesh, India, Iran, Maldives, Myanmar, Oman, Pakistan, Sri Lanka, Thailand and UAE participated and provided inputs to the 2024 Capacity Assessment of Tsunami Preparedness that highlighted the strengths, capacity gaps and priorities for the end-to-end tsunami early warning and mitigation system.

To promote community preparedness, National Tsunami Ready Focal Points (TRFPs) were nominated by the Member States who are responsible for promotion and implementation of Tsunami Ready activities within their countries. To date there are 26 Tsunami Ready Communities within the PTC Member States (India) and several other countries are in the process of implementation.

To facilitate the implementation of Tsunami Ready Recognition Programme (TRRP), a training programme on Tsunami Evacuation Maps, Plans and Procedures (TEMPP) was organised in Hyderabad, India during 15 to 23 April 2025 that saw the participation of PTC Member States of Bangladesh, India, Iran, Maldives, Oman and UAE.

Several countries from PTC also participated in the ICG/IOTWMS XIV Session in Banten, Indonesia during 17 – 19 November, that came up with a work plan for the next intersessional period 2025-2026.

Dr. Tummala also highlighted the outcomes of the 2nd Global Tsunami Symposium that was organized in commemoration of the 20 years of the 2004 Indian Ocean (Aceh) Tsunami and the work being undertaken as part of the Ocean Decade Tsunami Programme that contributes to the UN EW4All, SFDRR and other DRR Frameworks.

Considering the important role that the tsunami early warning and mitigation systems play in enhancing the technical capacities of member states as well as the preparedness of coastal communities to deal with tsunami and other ocean hazards, UNESCO-IOC requests the PTC Member States to:

- continue strong engagement with the activities of the ICG/IOTWMS and the Ocean Decade Tsunami Programme to strengthen the end-to-end tsunami early warning and mitigation system
- consider recommendations of the IOWave23, 2024 IOTWMS Capacity Assessment of Tsunami Preparedness and the Intergovernmental Coordination Group (ICG) session of the IOTWMS-XIV into their work plans
- strengthen tsunami observing networks in gap areas and take necessary steps for implementation of the UNESCO-IOC Tsunami Ready Recognition Programme (TRRP) within their vulnerable coastal communities, including the setting up of National Tsunami Ready Boards.

UNESCO-IOC will continue strong collaborations with the WMO UNESCAP PTC Member States, the PTC Secretariat and the PTC working group on Disaster Risk Reduction (DRR).

List of Documents:

1) Executive Summary Report of the 14th Session of the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWMS-XIV), Jakarta, Indonesia, 16–19 November 2024
2) IOWave23 Exercise Report
3) 2024 Capacity Assessment of Tsunami Preparedness in the Indian Ocean Report
4) Summary Report of the 2nd UNESCO-IOC Global Tsunami Symposium, Banda Aceh, Indonesia, 11 – 14 November 2024
5) Research, Development and Implementation Plan for the Ocean Decade Tsunami Programme

All these talks were very informative and participants were benefitted with the knowledge of new development in the field of AI/ML, IBF, Indian Ocean Tsunami Activities by IOC and the state of the climate report presented by WMO Secretariat.

PTC Chairman from Qatar and PTC Secretariat from RSMC New Delhi thanked all the speakers for

spending their valuable time in delivering these talks.

Item 10: Support for the panel's program Item

Item 10.2: Resources and Support:
(WMO/UN ESCAP/PTC members)

Item 10.3: Other issues that may be raised during the session.

Item 11: Hosting arrangement for future annual sessions
By convention, annual meetings of the Panel are normally hosted on a rotation basis. To facilitate Members to make early decisions and preparations, a sequence of hosting countries in alphabetical order is followed. The final arrangements are confirmed in consultation with the host country, PTC Secretariat, WMO and ESCAP.

Decision regarding Hosting arrangement for future annual sessions
As proposed during PTC-50, next session i.e. PTC-53 will be held in Iran in February 2026. Thereafter, the subsequent Sessions will be hosted by member countries in alphabetic order of the country names as mentioned in Table 1. It is suggested that these PTC sessions from 2026 onwards, may be conducted in February/March so that the annual plan can be discussed well before the commencement of the cyclone season over the Bay of Bengal and the Arabian Sea. **(Action: WMO/PTC Secretariat).**
Table1: Names of WMO/ESCAP PTC member countries in alphabetic order:

S.No.	Names of Member Countries
1	Bangladesh
2	India
3	Iran
4	Maldives
5	Myanmar
6	Pakistan
7	Qatar
8	Saudi Arabia
9	Sri Lanka
10	Sultanate of Oman
11	Thailand
12	United Arab Emirates
13	Yemen

Item 12: Adoption of the report
Agreed by all.
Item 13: Closing Ceremony

Annexure-1

List of Participants

S NO.	COUNTRY	NAME	DESIGNATION	EMAIL ID
1	ESCAP	Dr. Sanjay Srivastava	Chief, Disaster Risk Reduction, IDD	srivastavas@un.org
2		Dr. Leila S Goodarzi	ESCAP	leila.salarpour@un.org
3	IRAN	Dr Behzad Layeghi	IRIMO	layeghi2001@yahoo.com
4		Ms Martha Abbasi	IRIMO	marthaabbasi@yahoo.com
5		Ms Hajar Shojaeian	IRIMO	hajarshojai@yahoo.com
6	MYANMAR	Ms Han Swe	Assistant Director, Department of Meteorology and Hydrology	hanswedmh@gmail.com
7		Dr. Khin Win Maw (Ms)	Assistant Director, Department of Meteorology and Hydrology	khinmaw54@yahoo.com
8		Ms Khin Wah Wah Win	Assistant Director, Department of Meteorology and Hydrology	khinwahwahwin.dmh@gmail.com
9		Ms May Sabai Oo	Staff Officer, Department of Meteorology and Hydrology	maysabaioo.dmh@gmail.com
10	OMAN	Mr. Abdullah Al Khadouri	RAII WMO President, WMO PR of Oman	a.alkhadouri@caa.gov.om
11		Mr. Said Al Harthi	Director, Technical Services Department	s.alharthy@caa.gov.om
12		Mr. Khalifa Al Sudairi	Director, Research & Development Department	Khalifa.sudairi@caa.gov.om
13		Mr. Ahmed Ghawas	Director, Dhofar Meteorology	AhmedS.Ghawas@caa.gov.om

			Department	
14		Mr. Mohammed Kashoob	Head, Meteorological Operations Section	Mohammed.Kashoob@caa.gov.om
15		Mr. Hilal Al Hajri	Head, General Forecasting and Early Warning Section	Hilal.Alhajri@caa.gov.om
16		Mr. Nasser Al Ismaili	Director, Forecasting and Early Warning System Department	Nasser.ismaili@caa.gov.om
17	QATAR	Dr. Abdulla Mohd Al-Mannai	Director Of Meteorology Dept	abdulla.almannai@caa.gov.qa
18		Mr. Abdulrahman Saleh Al-Ansari	Head of Climate Research Section	abdulrahman.alansari@caa.gov.qa
19		Mr. Ali Mohamed Al-Mannai	Senior Weather Forecaster Specialist	ali.almannai@caa.gov.qa
20		Mr. Fahad Faisal Haji	Senior Weather Forecaster Specialist	Fahad.Haji@caa.gov.qa
21		Mr. Mariam Khamis Al-Khulaifi	Senior Weather Forecaster Specialist	Maryam.Khulaifi@caa.gov.qa
22		Dr. KRISHNA KUMAR KANIKICHARLA	Expert Meteorology	krishna.kumar@caa.gov.qa
23		Dr. NAJIM AL-BARAZANCHI	Senior Meteorology Expert	Najim.albarazanchi@caa.gov.qa
24		Mr. Omar Abdulaziz Al-Obaidan	Head of Meteorological Networks Section	Omar.Obaidan@caa.gov.qa
25		Mr. HUSSIN ARHAMA H.A. AL DOSARI		
26	THAILAND	Mr. Nattawut Dandee	Deputy Director-General for Technical Services	wut.tmd@gmail.com
27		Mr. Chaichan Sitthiworanun	Director of Central Weather Forecast Sub-division	tttoon11@gmail.com
28		Ms. Prapaporn	Director of Numerical	prapaporn.w@tmd.mail.go.t

		Wongsaming,	Weather Prediction Sub-division	h
29		Ms. Chayaphon Chaloemsaen	Foreign Relations Officer, Meteorological Development Division	meen_chayaphon@hotmail.com
30		Ms. Nilobol Aranyabhaga	Hydrology expert, National Water Command center	pann_san@hotmail.com
31		Ms. Sumalee Phungkham	Director of Applied Hydrometeorology Sub-Division	sphungkham2@gmail.com
32		Ms. Namthip Lohakit	Hydrologist	namtip.lhk@gmail.com
33		Mrs. Supinda Wattanakarn	Director of Hydrology Division	water.rid@gmail.com
34		ACM Somneuk Swatteuk	Specialist in Early Warning	ss_acdt18@hotmail.com
35		Mr. Attapol Chitrbhandh	Plan and Policy Analyst	foreign.dpm.th@gmail.com
36	UAE	Maryam Alshehhi	Head of Marine Meteorology	MAlShehhi@ncm.gov.ae
37	Pakistan	Mr. Sahibzad Khan	PR of Pakistan/Vice President of RA-II Region	sahibzad@gmail.com
38		Dr. Hassan Ali Baig	Director Forecasting	drmuhammadhasanali@gmail.com>
39		Ms. Ayesha Kanwal	Meteorologist	ayeshahk.met@gmail.com
40	Yemen	Dr. Mohammed Saeed Hamid Alzuraiqi	Asstt Deputy Chairman for Metgy, Civil Aviation & Metgy Authority	
41		Dr. Rashed Alariqi	Director	rash_areqi@yahoo.com
42		Dr. Abdulaziz Alwazir	Director	
43	Sri Lanka	Mr.M.M.P.Mendis	Director - forecasting and decision support	merilmdi@gmail.com
44	IOC	Dr. T Srinivasa Kumar	Head UNESCO-IOC ICG/IOTWMS	sk.tummala@unesco.org

			Secretariat	
45		Ms. Nora Gale	IOC	n.gale@unesco.org
46	Saudi Arabia	Dr. Mohammed Nather Al-Din	Director	M.Al-Din@ncm.gov.sa
47		Dr. Mohammed Ahmad Al-Kably	Director	M.Al-Kably@ncm.gov.sa
48	Maldives	Mr. Ali Shareef	Deputy Director General Meteorology, Maldives Meteorological Services	ali.shareef@met.gov.mv
49		Mr. Ahmed Rasheed	Director Meteorology	ahmed.rasheed@met.gov.mv
50	India	Dr. M. Mohapatra	DG IMD and 3rd Vice President of WMO	mohapatraimd@gmail.com
51		Dr. D R Pattanaik	Scientist F and Head RSMC	drpattanaik@gmail.com
52		Dr. A K Das	Scientist F and Head CWD	akuda.imd@gmail.com
53		Ms Monica Sharma	Scientist D, CWD	moniimd@gmail.com
54		Dr PLN Murty	Scientist E, MSD	murtyiitd@gmail.com
55		Dr Amit Bhardwaj	Scientist C, NWP	amit.bhardwaj.iitd@gmail.com
56	WMO	Dr. Cyrille Honore	Director DRR Division, MHEWS Office and Public Services, WMO Services Department	chonore@wmo.int
57		Dr. Anne Claire Fontan	Scientific Officer, Tropical Cyclone Programme, WMO Services Department	acfontan@wmo.int

Annexure-2

PTC -52 Agenda

(28th April-01st May, 2025. 0830-1130 UTC): Online

Day 1: Monday – 28th April, 2025

	Session 1
0830-0945 UTC	**Item 1.1 : Opening Ceremony**
	● Self-introduction by participants ● Welcome Address by Chairman PTC (Mr. Abdulla AL MANNAI, Chairman PTC, Director of the Qatar Meteorology Department and PR of Qatar to WMO) ● Address by Secretary, PTC (Dr M Mohapatra, Director General of Meteorology, India Meteorological Department and PR of India to WMO) ● Address by Head RSMC New Delhi (Dr. D R Pattanaik, Scientist-F, IMD) ● Address by WMO (Mr Cyrille Honore**,** Director of the Division DRR, MHEWS Office and Public Services (DMPS) Services Department, WMO) ● Address by UNESCAP representative (Dr. Sanjay Srivastava, Chief, Disaster Risk Reduction, UNESCAP, Bangkok) ● Vote of Thanks (Dr. AK Das, Scientist-F, IMD, PTC Secretariat)
	Group Photo (Online)
0945-1130 UTC	**Session 1**
	Item 1.2: Election of the Chairperson and Vice-chairperson Item 1.3: Adoption of the agenda Item 1.4: Working arrangement
	Session
	Item 2: Follow-up actions on PTC-51: (Ms. Monica Sharma, Scientist D, RSMC New Delhi) Item 3: Report of the chairperson of the Panel: Dr. Abdulla Mohammed Abdulla Almannai, Director of Meteorology Deptt., Chairman PTC
	Health Break (15 minutes)
	Session 1
	Item 4: Review of the 2024 Cyclone Season Item 4.1: Report of RSMC Tropical Cyclones: Dr. D. R. Pattanaik, Head RSMC New Delhi Item 4.2: Report of Members on the impact of Tropical Cyclones during 2024– All members (Bangladesh, Iran, Maldives, Myanmar, Pakistan, Qatar, Saudi Arabia, Sri Lanka, Sultanate of Oman, Thailand, United Arab Emirates, Yemen)

Day 2: Tuesday – 29th April 2025

	Session 2
0830-1130 UTC	**Item 5:** Coordination with other activities in the Panel region **Item 5.1**: Coordination within WMO Tropical Cyclone Programme (WMO Representative): Anne-Claire FONTAN, WMO Secretariat **Item 5.2:** Coordination with UNESCAP for tropical cyclone program – **UNESCAP** **Item 5.3:** The Panel's Trust Fund by TCP, WMO Item 5.4. ICAO Activities with respect to PTC by Regional Director of ICAO, Bangkok **Item 6: Activities of WMO/UNESCAP PTC** **Presentation of country report by members** Bangladesh, India, Iran, Maldives, Myanmar, Pakistan, Qatar, Saudi Arabia, Sri Lanka, Sultanate of Oman, Thailand, United Arab Emirates, Yemen) **on:** 6.1 Meteorological activities 6.2 Hydrological activities 6.3 Disaster risk reduction 6.4 Training activities 6.5 Research & Publication

Day 3: Wednesday – 30th April 2025

	Session 3
0800-0930 UTC	**Item 6: Pending presentations on Country Report**
0930-1030UTC (15 minutes each for Item 7.1-7.4)	**Item 7: Review of Operational Plans** **7.1** Review of the tropical cyclone operational plan – Ms. Monica Sharma, RSMC New Delhi **7.2** Coordinated Technical Plan (2025-2028)—Dr AK Das, RSMC New Delhi **7.3** Annual Operational Plan (2025)— Dr AK Das, RSMC New Delhi **7.4** Working groups **7.4.1.** Constitution of working groups on: (i) Meteorology (ii) Hydrology (iii) Disaster risk reduction (iv) Training and Research **7.4.2.** Mandate of working groups and responsibility of members Item was postponed to Day-4
1030-1100 UTC	**Item 9: Special lectures** 9.1. Regional Impact based forecasting by Dr. R Subbaiah, Director RIMES, Bangkok, Thailand 9.2. AI/ML applications for TC monitoring and forecasting by Dr. A.K. Sahai, Scientist, IITM

Day 4: Thursday – 1st May 2025

	Session 4 (4x 30 minutes each)
0800-0815 UTC	**Item 9 contd: Special lectures** 9.3. Leveraging AI to scale Early Warnings for All by Dr. Sanjay Srivastava, Chief, Disaster Risk Reduction, UNESCAP, Bangkok
0815-0830 UTC	9.4. WMO State of the climate reports - WMO, Claire Ransom and Omar Baddour
0830-0845 UTC	9.5. IOC Tsunami Activities in the Indian Ocean (IOTWMS), Dr. T Srinivasa Kumar, Head UNESCO-IOC ICG/IOTWMS Secretariat
0845-0915 UTC	**Item 8: Report of PTC Secretariat** **8.1 Annual review** **8.2 Editorial Board for Annual Review 2025.** **8.3 PTC Newsletter (January Issue)**
0915-0945 UTC	**Item 10: Support for the panel's program** I Item 10.1 was discussed on Day-2 under Item 5.3 Item 10.2: Other issues that may be raised during the session.
0945-1130 UTC	**Item 11**: Scheduling of future annual sessions and Hosting arrangements **Item 12**: Adoption of the report **Item 13:** Closing Ceremony

Annexure-3

Action Taken report by PTC Secretariat and RSMC New Delhi
Follow-up actions on PTC-50 and PTC-51 recommendations:

1. Special issue in a reviewed journal on Cyclone forecasting over North Indian (Ref. Action Point 2.4 b) of PTC-51 Report)

Action Taken: Received presentations by all experts. The lectures were streamed live and are available on PTC web page. However, detailed papers from the experts have not been received. IMD has published a Special Issue in International Journal Mausam to commemorate 150 years of establishment of IMD. The same is available on Mausam website at https://mausamjournal.imd.gov.in/index.php/MAUSAM/issue/view/324

Follow-up actions on PTC-51 recommendations:

Rec.1: PTC took note of the development in monitoring, forecasting & warning dissemination system and recommended member countries mayto take advantage of the tools and products developed by IMD for their use in formulating various forecasts and warnings. (Ref.: Action Point 2.1 of PTC-51 Report), Action**:** All members and RSMC New Delhi

Action Taken: IMD (collocated with RSMC New Delhi) is a peer adviser for member countries in the region. Additionally, IMD has been organizing regular attachment training every year since 2005 with the participation of various member countries. All scientific and technological issues are discussed with the participants. All data is shared through GTS to all member countries. RSMC is always open to supporting members develop their Decision Support System for the improvement of forecast and warning services of respective NMHSs. The members from participating countries were presented the utility of the DSS.

Rec.2.: During the deliberations, various gap areas in science and challenges in predicting genesis, rapidly intensifying cyclones, recurving cyclones were identified. PTC recommended to share difficult details of difficult cyclones with members (Ref.: Action Point 2.2 of PTC-51 Report) Action: All members and RSMC New Delhi

Action Taken: Reports of all cyclonic disturbances are prepared and shared with member countries along with best track parameters, lessons learned, gaps, and challenges for capacity building, confidence building, and encouraging R & D activities. RSMC New Delhi has prepared the list of difficult cyclones during last 5 years and uploaded the same on RSMC website (www.rsmcnewdelhi.imd.gov.in).

Rec.3: PTC along with ESCAP to prepare a plan to accelerate the work of tropical cyclone forecasting with AI tools for the improvement of track and intensity prediction. (Ref.: Action Point 2.3 of PTC-51 Report) Action: RSMC and ESCAP

Action Taken: Both organisations are working closely to develop impact-based forecasting for the member countries. Collaboration in other areas like the development of AI applications is in progress. Further RSMC New Delhi is using AI DT from CIMSS website alongwith other T.Nos. to decide the intensity of cyclones. AI model based on physical models as available from various global sources like ECMWF AIFS is used by RSMC for forecasting genesis, track and intensity of TCs.

Rec.4: The PTC while noting the improvement suggestions urged upon NMHSs and RSMCs to enhance

the real-time and past data sharing, improve the R&D on tropical cyclone monitoring and forecasting. (Ref. Action Point 2.5 of PTC-51 Report)

Action Taken Report:

Reports of all cyclonic disturbances are prepared and shared with member countries alongwith best track parameters, lessons learnt, gaps and challenges for capacity building, confidence building and encouraging R & D activities. Realtime data is shared by member countries particularly during cyclone time, members share hourly observations as well.

For the information of all members, RSMC New Delhi has published and updated following documents on the RSMC website:

- Preliminary reports on all cyclonic disturbances during 2024 (https://rsmcnewdelhi.imd.gov.in/archive-report.php?internal_menu=MjY=&year=MjAyNA==),
- Annual Report on CDs during 2024 (https://rsmcnewdelhi.imd.gov.in/report.php?internal_menu=Mjc=) ,
- Updated all the bulletins (https://rsmcnewdelhi.imd.gov.in/system-archive.php?internal_menu=MzQ=&year=MjAyNA==)
- Updated best track data on Electronic Atlas (E-Atlas) (http://14.139.191.203/login.aspx?ReturnUrl=%2f)
- Forecast Verification (https://rsmcnewdelhi.imd.gov.in/genesis-forecast.php#)
- Updated Standard Operation Procedures (https://rsmcnewdelhi.imd.gov.in/index.php#)

Rec.5: ESCAP proposed to align its ongoing activity on a regional strategy to early warnings for all in collaboration with PTC secretariat to support PTC members. ESCAP suggested reviving PTC working groups and taking up demonstrative pilot on loss and damage due to the tropical cyclones in PTC region (Ref. Action Point No. 2.6).

(Action: WMO/PTC Secretariat).

Action Taken Report: Secretariat has prepared "Annual Operation Plan" and 4 Years Coordinated Technical Plan. Secretariat has also prepared draft composition for Working Groups on Meteorology, Hydrology, DRR, Training, Research & Publication and a document on Mandate of Working Group and Responsibilities of members. Same will be presented during the meeting.

Rec.6.: Panel requested RSMC to organize the Tropical Cyclones Forecasters Attachment Training Programme, 2024 in hybrid mode for greater participation. (Refer Action Point No. 2.7 in PTC-51 Report) (Action: RSMC New Delhi/WMO)

Action Taken Report: The 20th attachment training for TC forecasters in the region was held in hybrid mode, with 9 offline participants and 34 online participants during 19-30 August.

Rec.7: APIs of tropical cyclone track and intensity forecast up to 5 days will be provided by RSMC New Delhi to all member countries. (Refer Action Point 2.9 of PTC-51 Report) (Action: RSMC New

Delhi)
Action Taken Report: RSMC New Delhi has requested Govt of India for approval. APIs will be shared at the earliest.

Rec.8: PTC requests that ICAO and IOC representatives may be invited to PTC Session. (Refer Action Point 2.9 of PTC-51 Report) (Action: WMO/PTC Secretariat)
Action taken Report: PTC has requested both the agencies to participate in the meeting. Already Dr. T Srinivasa Kumar, Head UNESCO-IOC ICG/IOTWMS Secretariat has concurred his approval to participate in the meeting and make a presentation.

Rec.9: **Expert from Saudi Arabia made a presentation on "Cloud Seeding experiments".** RSMC New Delhi requested to share the findings of cloud seeding program to the members for their knowledge. (Refer Rec. No.4.2.6). Action: Saudi Arabia.
Action Taken Report: The presentation has been shared with Secretariat and is available at PTC-51 proceedings on the PTC webpage. PTC also requests all members to keep PTC in loop while organsing training activities to improve capacity building in the region.
Rec.10: Sultanate of Oman highlighted the rough to very rough sea conditions experienced in association with the depression during 13-18 April 2024 and thus requested for wave height information during the cyclonic disturbances period. (Refer Point. No. 4.2.8 of PTC-51 Report)
Action: RSMC New Delhi
Action taken report: RSMC New Delhi will share desired information from ensuing cyclone season.

Rec.10: During the meeting Pakistan Meteorological Department highlighted challenges in monitoring & prediction of tropical cyclones and associated adverse weather, in particular the intense rains, storm surge and strong winds. PTC urged the members to conduct research and share findings: (Refer Point No. 4.2.9 of PTC-51 Report)
Action Taken Report: Secretariat has prepared the draft for composition of working group on Research & Development to address these challenges.

Rec.11: Expert from UAE highlighted the impact of depression over central Arabian Sea (13-15 October) in terms of strong surface winds leading to reduction in visibility. They also made a presentation on Cloud Seeding Experiment in UAE. (Refer Rec. No. 4.2.10). PTC urged UAE to share the findings with all members for their knowledge and further R & D activities
Action taken Report: RSMC provides the information in association with depression from low pressure area till its weakening into a low pressure area. The presentation has been made available on the PTC-52 page**.** Secretariat has also prepared draft composition for Working Groups on Meteorology, Hydrology, DRR, Training, Research & Publication and a document on Mandate of Working Group and Responsibilities of members. Same will be presented during the meeting.

Rec.12: WMO presented progress on implementation of EW4All, TC forecaster competency, decision on the amendments to the Technical Regulations to include Early Warnings Systems and resolution on Business Continuity Management (BCM). PTC urged members to develop region-specific BCM

guidance and tools for tropical cyclone-related activities. The contact is Ms Xiao Zhou xzhou@wmo.int. WMO informed the Panel about the activities and priorities of the Advisory Group on Tropical Cyclones, Common Alert Protocol (CAP) by Panel Members, COPE initiatives, and WMO's initiative for translation of the books in local languages. The contact is Ms Xiao Zhou xzhou@wmo.int. She concluded by informing the Panel on the new publications available in the WMO e-library; State of the Climate in Asia, State of the Gobal Climate 2023 and Update of the Climate 2024. (Refer point 5.1 of PTC-51 Report)

PTC urged members to implement CAP and popularise the translation of books for the Youth in local languages and to engage in outreach activities**.**

Action Taken report: IMD has implemented CAP and issues advisories, press briefings, press releases and Do's & Dont's, FAQs etc. in English and local languages as well.

Rec. 13: ESCAP urged stronger cooperation on multi-hazard early warnings, citing rising cyclone intensity, unpredictable tracks, and climate-linked disasters. Emphasis was placed on impact-based forecasting, regional strategy under "Early Warnings for All," and resource mobilization. Integrating IBF into SSOP III and scaling training efforts are essential for effective, anticipatory early action. (Refer Point No. 5.2 of PTC-51 Report). PTC and members may develop with the help of UN ESCAP an SSOP for coastal Multi-hazards Early Warning System (SSOP III). Action: All members, PTC and UN ESCAP.

Action taken Report: Secretariat has prepared draft composition for Working Groups on Meteorology, Hydrology, DRR, Training, Research & Publication and a document on Mandate of Working Group and Responsibilities of members. Same will be presented during the meeting. Working Group on DRR may further monitor progress.

Rec. 14: In pursuance of Vision 2035**,** Panel, All members, WMO and ESCAP to ensure enhanced co-operation and collaboration to build a cyclone disaster resilient region. (Refer Point 7.4 of PTC 51 Report)

Action taken Report: PTC Secretariat presented Vision 2035 which was unanimously approved by the members. Vision 2035 has been uploaded on PTC webpage for wider circulation. PTC urges all members for enhanced cooperation in the region.

Rec. 15: PTC News letter commemorating 50 years of panel was released during PTC-51st Session. The Panel urged PTC to continue publication of PTC News Letter. (Refer Point 7.5 of PTC 51 Report).

Action Taken Report: Secretariat requests all members to share inputs for the News Letter issue January 2025**.**

Rec.16: The Annual Cyclone Review 2023 may be published by WMO and uploaded on PTC and RSMC website. (Refer action Point No.8.1). Action: RSMC New Delhi and All members

Action taken Report: Annual Cyclone Review 2023 has been uploaded on RSMC website and sent to WMO for publication. Annual Cyclone Review 2024 will be presented in the meeting for approval from all members.

Rec. 17: Panel urged RSMC to continue preparation of Annual Cyclone Review 2024 (Refer Action Point No. 8.2)

Action Taken Report: For the Annual Cyclone Review 2024, Secretariat has requested members to nominate experts

Rec. 17: WMO urged the members to contribute to PTC Trust Fund for sustainable support to PTC activities (Refer Point No. 10.1)

Action Taken Report: Secretariat thanks Myanmar, Thailand, India, Pakistan, Maldives and Sri Lanka for their contributions during 2023. PTC urges all members to contribute to the Trust Fund.

Rec. 18: 21st Annual Attachment Training for Tropical Cyclones Forecasters may be held in March, 2025. (Refer Point 10.3 of PTC-51 Report)

Action taken report: RSMC has already initiated process in this regard for necessary approvals from the Govt. of India to conduct the training in July 2025.

Rec. 19: Attachment trainings for Multi-hazard early warning system interoperability and Impact Based Forecasting and Common Alerting Protocol

Action taken report: RSMc New Delhi conducted the training in December and has sent the recommendations to WMO.

Rec. 20: ESCAP to contribute towards development, implementation and training wrt IBF tool for all PTC member countries.

Action taken report: Special lectures on IBF was arranged during last PTC Session and similar lectures will be arranged in PTC-52. No further proposal has been received from any country.

Rec.21: Members are requested to support the PTC fund. Additionally, members may have an agreement regarding utilizing PTC Trust Fund with WMO. PTC Sectt may establish a work plan and share with members, WMO & ESCAP.

Action taken report: A Committee may be constituted in 52nd Session for this purpose

Rec. 23: Establishment and hosting of Common data Sharing Portal. PTC Secretariat to add in the work plan.

Action taken report: The recommendation has been added in the Annual Operating Plan and Coordinated Technical Plan.

Rec. 24: All members to collaborate and share experiences and best practices with PTC, WMO, ESCAP for further improvements

Action taken report: No such example has been received so far

Rec. 25: All members to share information about realized weather and impacts in association with the cyclonic disturbances impacting their country for inclusion in the report published by RSMC New Delhi. It will also help in verification of forecast, validation of models and development of impact-based forecasting & risk-based warnings.

Action taken report: action is over. RSMC Report has been published.

Rec. 26: All members to work towards sharing observational data (surface data, buoy data, radar) for better monitoring and forecasting tropical cyclones

Action taken report: It is a continuous practice.

Rec. 27: All members are encouraged to organize Annual Conference/workshops online on Indian Ocean Tropical Cyclones and Climate Change.

Action taken report: recommendation stands for implementation by all members.

Annexure-4

Coordinated Technical Plan (2025-28)

COORDINATED TECHNICAL PLAN (CTP): 2025-2028

4.1. INTRODUCTION AND BACKGROUND

Hydro-meteorological disasters account for approximately 70-80% of disaster losses in the world. Among them, tropical cyclone-associated disasters remain serious threats to people in both developed and developing countries in the tropical cyclone-prone regions. This is true for the North Indian Ocean region, where the devastating disasters repeated during the past decades proved that this region is extremely vulnerable to tropical cyclone risks.

WMO/ESCAP Panel on Tropical Cyclones for the Bay of Bengal and Arabian Sea has been exerting its effort to mitigate the impact of tropical cyclones in this region since its inauguration in 1973. The Panel's activities are a fundamental contribution to improving regional and national resilience against tropical cyclone threats.

Because of the growing demand for further mitigation of tropical cyclone disasters in this region as well as enhancement of the visibility of its activities, the CTP (2009-2011) was developed by the PTC Policy Working Group chaired by Dr. Qamar-uz-Zaman Chaudhry, Secretary of PTC and adopted by the PTC during its 36th Session (Muscat, Oman, 2-6 March, 2009).

The present CTP (2024-2027) is an updated version of previous Coordinate Technical Plans and has also taken into consideration the WMO Strategic Plan 2023-2027 and the Strategic Plan for the Enhancement of National Meteorological and Hydrological Services in Regional Association II (2023-2027).

4.1.1 Panel Region

Currently, the Panel is composed of 13 Members; Bangladesh, India, Maldives, Myanmar, Oman, Pakistan, Sri Lanka, Thailand, Yemen, Iran, Saudi Arabia, United Arab Emirates and Qatar.

The Panel region covers a vast expanse of the North Indian Ocean and contains a large and diverse range of ecosystems, including deserts, forests, rivers, lakes and seas. The desert extends from Middle East into Pakistan and northwest India. Compared to other WMO tropical cyclone regions, this region includes the highest mountains, the rainiest areas and the driest deserts, with their associated variation in culture and biodiversity. Over the long period of human occupation in the region, exploitation of

natural resources, urbanization, industrialization and economic development have led to land degradation and environmental pollution. Climate change and climate variations also represent present and future stress.

Tropical cyclone warning services of Members vary in duties, size and status of advancement, geography and state of development. Therefore, they are highly differentiated in capabilities and vulnerabilities. Some Members have very advanced facilities while others have limited budgets; shortage of observation instruments, spare parts, and consumables; lack of calibration, data collection, processing and communication facilities; insufficient qualified staff; and old technology.

2. Vision and mission of the Panel

4.1.2.1. Vision of the Panel

To promote and coordinate the planning and implementation of the multi-hazard early warning based Disaster Risk Reduction system to attain sustainable development measures through minimizing loss and damage caused by tropical cyclones and associated meteorological, hydrological and other ocean hazards in the Bay of Bengal and the Arabian Sea.

4.1.2.2. Mission of the Panel

a. *To review regularly the progress made in the various fields.*

b. *To recommend measures to improve the multi-hazard early warning systems in the Bay of Bengal and the Arabian Sea, including necessary training and research, with regard to meteorological, hydrological and other ocean hazards such as storm surges and tsunamis*

c. *To recommend measures to improve information dissemination system to ensure timely provision of warnings for community preparedness and disaster risk management.*

d. *To advise on possible sources of financial and technical support for such measures.*

e. *To coordinate the activities among the Panel Members, including all other activities carried out as part of or in conjunction with the WMO and regional tropical cyclone programmes.*

f. *To encourage and carry out capacity building.*

4.1.3 Priorities of the Panel

The Panel agreed that the following are priority issues:

a. Maintenance of existing system and further development of land, Ocean and atmosphere observing and telecommunications systems and data processing facilities for better information

sharing;

b. Natural disaster reduction, mitigation and prevention through the implementation of improved detection, prediction and warning systems of tropical cyclones, depressions and associated storm-surge, high waves, flash/urban floods, tsunamis etc.;

c. Implementation of CTP to provide better services to the public, governments and users, through improved infrastructure and modern technology in a user-friendly manner;

d. Enhancement of capacity building and technology transfer for early warning dissemination and response at the national and community levels to bridge the gap between the Members through bilateral and multilateral arrangements;

e. Enhancement of the collaboration and cooperation among the Members and RSMC New Delhi by exchange of information and knowledge and research studies related to tropical cyclones including numerical modeling and climate change impacts. Member countries to encourage and promote research on Multi hazards associated with tropical cyclones

f. Encouragement to improve hydrological forecasting and warning services for flood prone areas;

g. Encouragement to plan and manage water resources, including assessment of surface and ground water resources in relation to tropical cyclones;

h. Improvement of the operational linkages between hydrological and meteorological services and disaster management agencies with the aim of minimizing the impacts of natural disasters;

i. Facilitation of tropical cyclone disaster risk assessment at the country level, especially along the coast, delta, and urban areas where risks are the highest to reach sustainable development goals

j. Increase tropical cyclone risk awareness at the community level through awareness events, school education, training, and drills where technical knowledge could be properly supplied and adopted by authorities;

k. Strengthening information exchange with various disaster-related information systems in the region;

l. Strengthening partnerships with relevant international and regional bodies, such as UN-ISDR, UNDP, UNESCO/IOC, UNEP, ESCWA, ASEAN, SAARC, IFRC, ADRC, ADPC, ICHARM, JICA, KOICA, TICA, USAID, ADB, ICAO, RIMES, BIMSTEC and WB;

m. Enhanced public & private partnerships including industries, non-governmental organizations (NGOs) etc. for awareness, feedback and information dissemination etc. aiming at disaster risk reduction (DRR);

n. Enhancement of resource mobilization activities for implementation of CTP.

4.1.4 Challenges and Opportunities

The panel is facing challenges and opportunities that have been raised in recent years in its implementation of the activities to fulfil its vision, such as rapid changes in technology, globalization, commercialization, urbanization, and emerging scientific research results. This section identifies in broad terms the challenges and opportunities of which the Panel Members could take advantage through a strategic regional approach.

4.1.4.1 Meteorology

4.1.4.1.1. Observation systems

Observation systems are fundamental to the operations of National Meteorological and Hydrological Services (NMHSs). Standardization of observation ensures that data collected by each country are compatible with other countries. This includes accuracy, instrument response times and other characteristics of instruments, frequency of observations, exposure, network densities and other related matters.

The existing gaps in the observational data coverage of the Panel region continue to be due to the deficiencies in the operations of both land, Ocean &atmosphere observing systems and telecommunication networks, high cost and therefore the lack of consumables and spare parts.

New types of earth-observing satellites including meteorological satellites which are useful for weather monitoring, forecasting, and research have been launched from time to time. However, no single receiving system is capable of receiving and processing the data from all these satellites. This poses difficulty to some Members who may not afford to have more than one satellite receiver. It would be useful if imageries and data from different satellites can be put under and distributed through one or two low-cost distribution channels.

4.1.4.1.2. Telecommunication

The WMO Information system (WIS) is the single coordinated global infrastructure responsible for the telecommunications and data management functions. It is the pillar of the WMO strategy for managing and moving weather, climate and water information in the 21st century. WIS

provides an integrated approach suitable for all WMO Programmes to meet the requirements for routine collection and automated dissemination of observed data and products, as well as data discovery, access and retrieval services for all weather, climate, water and related data produced by centres and Member countries in the framework of any WMO Programme. WIS is an enhanced information system capable of exchanging large data volumes, such as new ground- and satellite-based systems, finer resolutions in numerical weather prediction and hydrological models and their applications.

The GTS part includes the national meteorological telecommunication networks (NMTNs) and the regional meteorological telecommunication networks (RMTNs), respectively. The NMTNs are implemented and operated by each country according to both the telecommunication services available and the financial and technical capacities of each country.

4.1.4.1.3. Data-processing and forecasting systems

While there had been considerable improvements in the infrastructure and models in some WMO Integrated Processing and Production System (WIPSS) centers of the Region, there are still large deficiencies in the capabilities of some Members in their forecasting function, i.e., the production of forecasts and warnings. Some of the data processing systems of NMHSs have not been automated and the Members concerned were not able to derive full benefits from the technological advances that have taken place in the recent past. Some WIPSS centres in the Region still plot stations and produce weather charts manually.

As regards the generation and dissemination of the WIPSS products, the Regional Specialized Meteorological Centre (RSMC) New Delhi produces a large number of products on a daily basis. The availability on the Internet of high-quality products from advanced high-resolution NWP systems operated by major WIPSS centers within and outside the Region has opened up new opportunities for NMHSs to enhance their capability in providing weather forecast service to their respective users.

4.1.4.2. Hydrology and Water resources

Freshwater is a natural resource vital to the survival of all living things; however, it is limited. The sources of freshwater are river basins, groundwater reserves, lakes and manmade reservoirs. These are increasingly under pressure to meet increased domestic needs as well as demands from agriculture, industry and other human activities.

Weather is the most important factor in water availability as it determines the timing and the location of precipitation and the amount lost to evaporation. Some arid countries in the region like Oman, Yemen, Southern Pakistan and Northwest India have such low precipitation (as little as a few millimetres per year) and high evaporation, that only a small amount of freshwater can be captured for human use. By contrast, some countries receive abundant rainfall each year (thousands of millimeters). Seasonality is particularly pronounced throughout the region and, in most cases, plays a major role in water availability; those countries which receive high rainfall - Bangladesh and India for example - are inundated with rainfall during the monsoon season, but lack rainfall the rest of the year.

This seasonality problem can be tackled by preventing the precipitation during the wet season from running off into the sea. The traditional method of rain harvesting, that is, retaining water through construction of ponds/lakes etc in individual villages or towns could ensure the optimum use of precipitation. Many demonstration projects have established that with proper storage techniques, rainfall during a season could be utilized throughout the year for agriculture and other human activities. It is such mini projects, rather than big dams, that are most cost-effective in conserving freshwater resources.

The decline of hydrological networks in the region is a challenge at a time when more high-quality hydrological data are required, often in near real-time. Hydrological networks need to be improved together with the capacity of Hydrological Services to provide relevant information to a variety of users of hydrological data. In this respect, the need for improving forecasting systems particularly to predict floods and droughts that could lead to disasters is a high priority in the region. The management of international rivers in the region is a most challenging problem as well. In the context of integrated water resources management, the joint management of river basins opens a window of opportunity for transnational collaboration in hydrology.

The potential extension of several HYCOS projects into the region are expected to foster this process and contribute to the capacity building of National Hydrological Services as well as integrated water resources management on the basis of timely, reliable hydrological data. Especially for prediction and forecasting of extreme events, the data collection and forecasting capacities of the meteorological and hydrological branches of national Services need to be integrated to provide the results required by the general public.

Likewise, the introduction of rational water resources assessment methods, promoted by WMO and the United Nations Educational, Scientific and Cultural Organization (UNESCO), are expected to enhance the capacity of National Hydrological Services in the region to act as service providers for planning, decision-making and implementation of water resources projects. A crucial issue for much needed regional collaboration between national Hydrological Services is the free exchange of hydrological data and information which has been documented in Resolution 25 of the Thirteenth Congress of WMO.

4.1.4.3 Disaster Risk Reduction

The Panel region is one of the most disaster-prone regions in the world. It has a very high frequency of disaster events and suffers from immense damage due to various types of disaster such as tropical cyclones, storm surges, floods, landslides, drought, earthquakes, volcanic eruptions, tsunamis, etc.

A large percentage of these disasters has occurred in many countries of the Region. A rapid urbanization, high population increase rates, and high population densities without reducing the poverty levels led their societies to be with high vulnerability to disasters, resulting in heavy loss of life and property damage. The Disaster Risk Reduction component of the CTP will aim at reducing tropical cyclone disaster risks at the community level by enhancing the local and institutional capacities to cope with the risks.

4.4.3.1. Tropical cyclone related disaster risks

In the Bay of Bengal, tropical cyclones usually form over the southern end and then move either towards the east coast of India, Myanmar or to Bangladesh and a few of them emerge into the Arabian Sea after crossing the Indian Peninsula and Sri Lanka. A few tropical cyclones form in the Arabian Sea and move to the north affecting the western part of India, southern Pakistan, Yemen, Oman, Iran and indirectly UAE, Qatar and Saudi Arabia. These tropical cyclones can generate very heavy rainfall and cause severe flooding and landslides, high wind and waves, and are often accompanied by devastating storm surges which are the most common risk factor to the tropical cyclone deaths. Quantification of associated risks might help to plan appropriate DRR actions.

4.4.3.2. Regional technical coordination on tropical cyclones

Regional cooperation and coordination in disaster prevention and mitigation among the Members are gaining importance in the region. India Meteorological Department was designated by WMO a Regional Specialized Meteorological Centre (RSMC) to monitor and forecast the track and intensity of all tropical cyclones in this region, associated severe weather like high waves, storm surge and coastal inundation and heavy rainfall to provide the track and intensity information to the international community, and to provide real-time advisory information and guidance to NMSs in the region. Mechanism may be set up to foster tele conference (audio/video) for consultation among members and RSMC, New Delhi, though there has been video conferencing in recent years with individual countries by RSM and RSMC has constituted a WhatsApp group for exchange of information, data and views.

4.1.4.3.3. Inter Regional Co-operation on Tropical Cyclones (done)

There exist a synergised SOP between the RSMC, New Delhi and RSMC, Tokyo for monitoring and prediction of cyclonic disturbances migrating into each other's area of responsibility and naming nomenclature to be followed. Additionally, both agencies also support each other in capacity-building initiatives and the resource persons from both organizations participate in the training programs organized by the RSMCs.

4.1.4.3.4. Risk assessment and management

Accurate and timely tropical cyclone forecast and warnings issued by the NMHSs is crucial information to reduce risks. The challenge is that such information needs to be reached to the communities at risk for prompt action. This is quite a challenge, especially in rural areas in developing countries where the communication system is limited. Even if reached on time, false information or technical information lacking clear directions and guidance for a specific location may mislead response to the warning and hinder people's willingness to take action for the next events. It is vital to understand the perception of individual and collective behaviors when receiving the warning. Another important issue is whether people have a safe place when responding to the warning. Without such places, people would be ended up facing the risks. Whether they can move quickly to a safe place is an additional issue, particularly, for infants, small children, the elderly, and the handicapped.

Risk level needs to be evaluated based on the tropical cyclone forecast over a region utilizing the past

climatology. The assessed risk level needs to be communicated to the disaster managers for suitable actions at their levels. Post-disaster risk assessment based on loss and damage survey is also essential to identify the gaps and improve the risk assessment for the future.

4.1.4.3.5. Linkages with International Framework Initiatives

Activities of the Panel on Tropical Cyclones may be linked appropriately with important initiatives such as the ESCAP/WMO Typhoon Committee, International Network for Multi-Hazard Early Warning Systems (IN-MHEWS) established at the Third United Nations Conference on Disaster Risk Reduction in March 2015, and the Climate Risk Early Warning System (CREWS), Early Warning for All, Impact Based Forecasting and risk-based warning initiatives of WMO and UN launched at the Conference of the Parties of the United Nations Framework for Climate Change in December 2015-2022. In this regard, WMO and ESCAP may extend institutional support the Panel on Tropical Cyclones.

4.1.4.4. Capacity Building

In considering the rapid changes in technology and the social, political and economic circumstances in addition to the global environmental issues, Members need to respond to these challenges in such a way as to enable them to properly manage their meteorological and hydrological services, and to have qualified and trained manpower and adequate facilities. Therefore, proper management, continuing training and development are important for the advancement of those services.

RSMC New Delhi, Indian National Centre for Ocean Information Services (INCOIS), Hyderabad and academic institutions to support the plans and requirements related to capacity building and transfer of technology in close cooperation with the Members.

Capacity building is to be underpinned by infrastructure and human resource development through training and technology transfer in the areas of:

- Forecasting of tropical cyclone intensity and track, and associated storm surge, inland flooding and coastal inundation

- Observing and processing data and interpretation of outputs from regional centres;
- Information and communication technology (ICT);
- Equipment maintenance;
- Provision of weather services for the public, including service-oriented media/communication skills;
- Provision of weather services for aviation and shipping, including marketing of services and liaison with clients;
- Provision of climate information services;
- Application of NWP products;
- Nowcasting of severe weather; and
- High level and middle management skills.
- Climate change impacts on tropical cyclones and associated phenomenon
- Maintenance of competency standards
- Training through fellowships, seminars and workshops with assistance from outside the region needs to be also intensified.

4.1.5 International and regional projects relevant to the Panel's activities

The following international/ regional projects with significant potential benefits to Members especially the developing ones are worth pursuing:

4.1.5.1. Early Warning System for Tsunamis

After the devastating tsunami which affected most of the countries of the Panel towards the end of December in 2004, there has been an urgent need to establish an Early Warning System for the Panel region. In this connection, WMO, along with other International Organizations, worked towards bringing the countries of the region to work together in identifying an ideal mechanism that will support an Early Warning System for the region. The Panel should take advantage of this situation and participate in all the forums that are called upon by WMO in this regard.

It is important that the Panel collaborates with the adjacent regions in establishing this project. It should then draw up a plan for implementation having all the Members participate.

4.1.5.2 Storm Surge Watch Scheme

In view of the fact that storm surges associated with the recent tropical cyclones Sidr and Nargis in the Bay of Bengal, which caused widespread flooding in the exposed coasts of Bangladesh and Myanmar,

were the major cause of devastation and loss of lives in the most populous and low-lying areas of these countries, the WMO Executive Council, at its 60th session in 2008 (EC-LX), addressed the need for the provision of storm surge guidance information to the WMO Members exposed to these risks as a matter of priority.

The Council therefore agreed that a storm surge scheme attached to the tropical cyclone advisory arrangements would help to increase advisory lead-time and thus contribute to saving lives and properties, and would be the first step towards a comprehensive and integrated marine multi-hazard forecasting and warning system for improved coastal risk management. It appealed to all the regional tropical cyclone bodies to develop Storm Surge Watch Scheme (SSWS) that will make available to WMO Members concerned with the storm-surge advisories including daily marine processed data and information they require for real-time uses.

In the Panel region, efforts have to be continued under CTP for attachment training on country-specific advanced storm surge forecasting and inundation modeling.

4.1.5.3 Hindu Kush-Himalayan Hydrological Cycle Observing System (HKH-HYCOS) Phase II project

The Hindu Kush-Himalayan Hydrological Cycle Observing System (HKH-HYCOS) Phase II project, which was funded by the government of Finland, was successfully completed on December 31, 2015. The HKH-HYCOS Phase III project proposal has been prepared and is being circulated to potential donors.

4.1.5.4. Mekong-HCOS project

The Mekong-HCOS project was successfully completed on 30 November 2012. The project was financially supported by the Agence Francaise de Developpement (AFD). AFD is further supporting additional efforts with the Mekong River Commission on extending the MRC-HYCOS network and improving its sustainability, as well as improving data usage based on statistical hydrological analyses

4.1.5.5. WMO's Severe Weather Forecasting Programme (SWFP)

The World Meteorological Organization's (WMO's) Severe Weather Forecasting Programme (SWFP) previously known as Severe Weather Forecasting Demonstration Project (SWFDP) is aimed to enable

all National Meteorological and Hydrological Services (NMHSs) to issue effective severe weather warnings to disaster management and civil protection authorities in their respective countries. Using a 'Cascading Forecasting Process', the Programme makes global-scale products from Global Data Processing & Forecasting System (GDPFS) Centres available to Regional Centres. The Regional Centres in turn interpret model guidance and provide guidance products to National Meteorological and Hydrological Services (NMHSs). These NMHSs liaise with regional centres, disaster management agencies & media and issue advisories for general public. The primary objective of this programme is to enable the NMHSs to have greater capability to identify hazardous weather conditions in the short- and medium-range and issue forecasts and warnings accordingly. Capacity development through regular trainings on forecasting and service delivery aspects has also been a critical component of the subproject. Forecasters need to know how to make optimal use of the various numerical weather prediction (NWP) products and satellite information coming from the contributing centres. First ever SWFDP regional subproject was initiated in 2006 with involvement of just five countries in south-eastern Africa. The success story of this subproject provided basis for expansion of SWFDP into whole Southern Africa in 2009 with involvement of sixteen countries and later into other sub-regions of the world including Eastern Africa and South Pacific. Currently, SWFP involves over 85 developing countries, least developed countries (LDCs) and small island developing states (SIDS) in nine sub-regions of the world including Southern Africa, Eastern Africa, West Africa, Central Africa, Southeast Asia, South Asia, Central Asia, Eastern Caribbean and South Pacific, with contributions from the WMO Centers, Regional Centers and support from development partners and donors. There are three SWFP regional subprojects in WMO Regional Association (RA) II (Asia) region Viz., SWFP-Southeast Asia; SWFP-South Asia; and SWFP-Central Asia.

India Meteorological Department (IMD), New Delhi is acting as a Regional Specialised Meteorological centra (RSMC), leading WMO's SWFP-South Asia to predict the severe weather namely heavy rain, strong winds, high waves, cyclonic disturbances and storm surge. IMD issues forecast for 9 member countries including Bangladesh, Bhutan, India, Maldives, Myanmar, Nepal, Pakistan, Sri Lanka, and Thailand since May, 2016. The domain covered for monitoring, analyzing and predicting various severe weather events under RSMC New Delhi is bounded by 10°S to 45°N and 45°E to 110°E. In 2019, textual products were also added with inclusion of guidance in short & medium range, risk tables in short range and probability tables in medium range. 2023 marked the introduction of impact-based forecast and risk-based warnings in GIS and QGIS for heavy rainfall,

strong winds, significant wave height, cyclonic disturbance and storm surge for 95 met-subdivisions in the region covering the land areas of member countries and the entire Bay of Bengal and Arabian Sea.

4.1.5.6. Flash Flood Guidance System with Global Coverage (FFGS)

In collaboration with NOAA-National Weather Service, the US Hydrologic Research Centre, WMO, and USAID/OFDA, this project is currently being implemented in the Mekong River Basin in collaboration with MRC. Other areas under development for the implementation of the project are South Asia, southern Africa and near/middle East. The reference project has been implemented over the past years in Central America. The success of the project there was the basis to expand it globally where feasible. The core of the project is to provide flash flood guidance (not forecasting!) to disaster managers based on real-time satellite-derived precipitation estimates merged with resolution GIS and hydraulic conditions of rivers that trigger an alert once "bankful" flow conditions are to be expected based on the precipitation estimate for a given time under prevailing ground and hydraulic conditions. The first Steering Committee meeting held in New Delhi recommended linking flash flood guidance provided by regional flash flood guidance centers for South Asia with SWFDP-BOB. The South Asian flash flood guidance system, New Delhi has been operational since 2020.

4.1.5.7. WMO Programme for the Least Developed Countries (LDCs)

This Programme was established by the Fourteenth Meteorological Congress in May 2003 to contribute efficiently and in a timely manner to the social and economic development efforts of LDCs through the enhancement of the capacities and capabilities of their NMHSs. A number of activities are being carried out in support of NMHSs of most of the 50 LDCs under the WMO Programme for LDCs and through the other WMO scientific and technical programmes. This includes the development and implementation of Internet connection projects in LDCs; provision of fellowships; supporting the participation of experts from LDCs in WMO meetings; carrying out special advocacy and project-formulation activities; and the organization of innovative capacity-building initiatives including workshops on good practices in the beneficial and effective use of weather-, climate-, and water-related services in sustainable socio-economic development.

Planned activities include the following:

- Development and organization of demonstration/pilot projects on the contribution of meteorological and hydrological and related environmental information, products and services to the sustainable development of the LDCs and Small Island Developing States (SIDS), especially in poverty alleviation, disaster risk reduction, environmental protection, food security, health, energy and water resources management;
- Organization of capacity-building activities for senior- and middle-level staff of LDC NMHSs, particularly in leadership, management, resource mobilization, strategic planning, marketing and communication;
- Preparation and implementation of development and modernization plans of NMHSs of LDCs and SIDS, including projects that are of relevance to, and consistent with, national development strategies and programmes and of high impact value to the relevant commitments enshrined in the Brussels Programme of Action for the LDCs;
- Promoting the awareness of policy- and decision-makers and other stakeholders of the socio-economic benefits of weather-, climate- and water-related services;
- Preparation of guidelines for promoting the contributions of NMHSs and WMO towards the attainment of internationally agreed development goals including those contained in the Millennium Declaration.

4.1.6. WMO Programmes and other Regional/International Programmes in support of the Panel Members

4.1.6.1. WMO Programmes

The major WMO Programmes concerned are the World Weather Watch (WWW), the World Climate Programme (WCP), Tropical Cyclone Programme (TCP), PWS (Public Weather Service), DPFS (Data Processing and Forecasting System), MMO (Marine Meteorology and Oceanography), DRR (Disaster Risk Reduction), SP (Satellite Program), AEM (Aeronautical Meteorology), HWR (Hydrology and Water Resources), RAP (Regional Office for Asia and the Pacific), ETR (Education and Training), WWRP (World Weather Research Programme), Global Framework for Climate services (GFCS).

4.1.6.2. Regional and international programmes

Programmes of the following organizations are of interest:

ESCAP; the ASEAN Subcommittee on Meteorology and Geophysics (ASCMG); the Interstate Council on Hydrometeorology of the Countries of the Commonwealth of Independent States (ICH CIS); the Coordinating Committee on Hydrometeorology and Pollution Monitoring of the Caspian Sea (CASPCOM); the UNESCO Intergovernmental Oceanographic Commission (IOC); the United Nations Environment Programme (UNEP); UNDP; the Global Environment Facility (GEF); the Economic Cooperation Organization (ECO); the Economic and Social Commission for Western Asia (ESCWA); the South Asia Association for Regional Cooperation (SAARC); the League of Arab States (LAS); the Permanent Meteorological Committee; (BIMSTEC);Regional Integrated Multi-hazard Early Warning System (RIMES);(ADPC); and the Regional Organization for the Protection of the Marine Environment (ROPME).

4.1.7. Agreements and conventions

Members are encouraged to undertake national responsibilities or contribute to national obligations under many regional and international agreements and conventions. Some of the most important ones are the WMO Convention; Agenda 21 adopted at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992; the 1994 Global Conference which adopted the Barbados Programme of Action for Sustainable Development of Small Island Developing States; Resolution 40 of Twelfth Congress (1995) on the policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities; Resolution 25 of Thirteenth Congress (1999) on the exchange of hydrological data and products; the Geneva Declaration of Thirteenth Congress (1999); Millennium Development Goals (2000); Sustainable Development Goals 2015-2030; Hyogo Framework for Action 2005-2015; Sendai Framework for Disaster Risk reduction (2015-2030); the United Nations Framework Convention on Climate Change (UNFCCC); the United Nations Convention to Combat Desertification (UNCCD); the Convention of the International Civil Aviation Organization (ICAO); the Convention of the International Maritime Organization (IMO); the International Convention for the Safety of Life at Sea (SOLAS); and the Convention on the Protection of the Ozone Layer and most recent and important Paris agreement on Climate Change 2015.

There are also a number of United Nations programmes and agencies having activities related specifically to meteorology, climate or hydrology or providing financial support to countries. These include UNEP, the United Nations Development Programme (UNDP), the Food and Agriculture

Organization (FAO) of the United Nations and others.

4.2. DEVELOPMENT OF COORDINATED TECHNICAL PLAN

4.2.1 Purpose of Coordinated Technical Plan

The coordinated Technical Plan aims to promote and coordinate the planning and implementation of the measures required to minimize damages caused by tropical cyclones and associated floods and storm surges in the Bay of Bengal and the Arabian Sea. It is expected to establish an effective integrated regional early warning system for those hazards in the region covering all five components; meteorology, hydrology, disaster prevention and preparedness, training and research.

Specific purposes of the Coordinated Technical Plan are:

- To develop an understanding among the Panel Members on the priorities and objectives for their individual development and the overall development of the Panel region through cooperation; and to guide the implementation of Panel's programmes and activities for achieving these objectives;

- To develop and provide access to appropriate databases, resources and expertise to produce appropriate advice and products required for forecasting and warning services to the private and public sectors as well as to the decision-makers and ordinary people;

- To encourage the development of joint projects by all Members or some of them with the projects under formulation and/or consideration by the Members;

- To raise general awareness of the status of the work of the Members and to have a framework under which development assistance would be provided and coordinated among the Members and the various contributing agencies; and

- To develop a system for training specialists of the Members, transferring and exchanging experience in observation and data processing, and taking advantage of advances in science and technology.

4.2.2 Institutional Arrangement

A coordinated Technical Plan needs institutional arrangements for successful implementation. Such arrangements should include a mandate, program management, human resources, funding, sectoral and organizational linkages, and reporting. These are to be considered when formulating the Plan.

4.2.2.1 Countries and organizations involved

Members will work together to contribute towards the implementation of joint programs and activities, deriving benefits from the pooling of resources within the region with the support of WMO and ESCAP.

4.2.2.2 Duration of the Coordinated Technical Plan

Coordinated Technical Plan is to cover a four-year term to keep pace with the financial periods of WMO (4 years) and ESCAP (2 years). The present Coordinated Technical Plan, therefore, covers the period from 2016- to 2019 to coincide with the financial periods of WMO and ESCAP as mentioned above. Coordinated Technical Plan is a live document and continues to be reviewed and updated by the PTC every four years.

4.2.2.3. Regional programmes and projects

Regional programmes or projects involved in the Plan are those that address problems that are common to the whole Panel region. Initial pilot phases may be undertaken in a limited number of countries only. Sub-regional programmes and projects are those which address problems that are common to only a few Members. Country-specific projects are those that are specifically required by a particular Member to address a problem in that country, given its particular circumstances. Country-specific projects are unique to individual countries and are identified through in-country consultations.

4.2.2.4. Steps for the implementation of the Coordinated Technical Plan

The steps for implementing the Coordinated Technical Plan include:

a. Panel, WMO and ESCAP, through cooperative efforts to assist and/or support the implementation of the Coordinated Technical Plan;

b. Development of projects for implementation by Panel and its Members, and other regional and sub regional economic groups and institutions to implement effectively the Coordinated Technical Plan to enable Members to play their full role in sustainable socio-economic development of their countries.

4.2.3 Reporting

As part of implementation of the Coordinated Technical Plan, Members will report on progress on the implementation of the Plan to the PTC at annual sessions.

4.3. EXPECTED RESULTS AND STRATEGIC ACTIONS

4.3.1 Meteorology

4.3.1.1 Expected Result 1

- *Developed capabilities of Members to produce and provide impact-based forecasts and risk-based warnings of tropical cyclones, storm surges and associated hazards*

This is expected to be achieved based on the development of an efficient and expanded observation and telecommunication network and with the acquisition of the latest forecasting technology, improved exchange of data and development of skills of personnel through national, bilateral and regional programs.

4.3.1.2 Strategic Actions

1-a To further improve and expand the observing system of surface, upper-air, ship, buoy, aircraft, radar and satellite observations in the Member countries.

1-b To ensure the real-time operational use of the WMO Information System (WIS) for operation-critical data exchange through dedicated telecommunication means of the GTS, and through broadband Internet access for Data Discovery, Access and Retrieval service.

1-c To further increase the accuracy, timeliness and usefulness of tropical cyclone forecasts and warnings.

1-d To develop the capacity of member countries for providing impact-based forecasts and risk-based warnings

1-e To extend the operational use of ensemble prediction techniques and probabilistic forecasts for more effective disaster risk assessment and management.

1-f To continue to upgrade the computing facility of RSMC New Delhi and NMHSs so as to facilitate efficient data processing and data assimilation from different observing systems/platforms to suit the national and regional needs.

1-g To ensure the operational use of the recently established a regional storm surge watch scheme to provide Members with the storm-surge advisories including daily marine processed data and information they require for real-time uses

4.3.2 Hydrology

4.3.2.1 Expected Result 2

- Enhanced capabilities of Members to produce and provide better hydrological forecasts and assessments

Members will formulate accurate and timely forecasts and warnings on floods and other water related hazards with a view to supporting preparedness and response mechanisms of their governments and the public.

4.3.2.2 Strategic Actions

2-a To further improve regional cooperation in real time monitoring and exchange of relevant data and information, forecast/products and technical expertise related to hydrological hazards.

2-b To improve flood forecasts and warnings particularly in deltaic and coastal areas by coupling meteorological storm surge forecasts with river flow forecasting.

2-c To enhance regional capabilities relating to flood hazard mapping in delta and coastal regions through continued interaction with the user agencies.

2-d To further improve management of water resources, including assessment of surface and ground water resources in relation to cyclonic disturbances;

4.3.3 Disaster Risk Reduction (DRR)

4.3.3.1 Expected Result 3

- Enhanced capabilities of Members to promote tropical cyclone disaster resilient communities through providing guidance on multi-hazard early warning dissemination and response mechanism

Disaster risk reduction in the region will be improved through the establishment of institutional and legal frameworks at the country level involving improved multi-hazard early warning

and Decision Support Systems (DSS) of vulnerability and community-based disaster risk management (CBDRM) initiatives aiming at enhanced public awareness, and participation of stakeholders to be more effective. These are expected to be achieved through improvement in standard procedures on DRR and the exchange of national and international experiences and information on disaster management among the Members.

4.3.3.2 Strategic Actions

3-a To improve regional cooperation in policies and strategies on DRR, especially those related to tropical cyclones, coastal hazards and other extreme weather events.

3-b To establish a regional information system to support the development of policies and strategies on DRR as well as interfacing with the national level systems by creating an updated comprehensive database on disaster information and best practices on DRR.

3-c To further enhance public awareness and appreciation of the impacts of tropical cyclones and other extreme weather events, for possible mitigation and response actions through effective communication with the media before, during, and after such events.

3-d To further strengthen coordination and interaction between meteorological/hydrological services on the one hand and emergency management/disaster response agencies on the other through integrated emergency management, disaster response and preparedness programmes.

3-e To strengthen regional cooperation on DRR information exchange through networking by making available disaster preparedness and mitigation information through Internet web sites, involving web GIS tools and other means.

3-f To enhance disaster risk management, especially those related to cyclone-related disaster preparedness by developing and implementing pilot projects on multihazard disaster risk management programmes into the development plan of the Panel Members in the next four years.

4.3.4 Training

4.3.4.1 Expected Result 4

- *Development of a strategic approach to capacity building with a regional perspective*

Training activities will be enhanced by strengthening the skills of personnel engaged in various aspects of cyclone prediction and early warning through regular training programs including the organization of workshops, seminars, etc.

4.3.4.2 Strategic Actions

4-a To promote training programs on the use of NWP model products and their application in

cyclone (track and intensity) and storm surge prediction.

4-b To promote training programs on media coordination during disasters and their effectiveness on “human response”.

4-c To promote training programs on the use of remote sensing data including satellite and Doppler Weather Radar products in cyclone forecasting.

4-d To promote visits of experts among Member countries to share their experiences and expertise in cyclone-related fields.

4-e To enhance WMO’s fellowship support on tropical cyclones and other multi-hazard risk reduction-related programs.

To set up a small group of its Members to develop a draft training plan. The training plan could identify the training needs and available opportunities as well as the gaps that will need to be addressed to support the successful implementation of the Coordinated Technical Plan.

4-f To develop TC Forecasting Competency as per the recommendation of EC-65 & EC-66.

The Panel noted that the Executive Council at its 66th session stressed the need for, and urged the Secretariat to support the, development of TC forecasting competencies in all tropical cyclone basins by regional tropical cyclone committees under the initiativeof RSMCs. Implementation of tropical cyclone competencies is an essential component of improving service delivery as it sets common global recommended practises providing a safety net of “our staff are trained to at least the minimum recommended standards” and providing a leverage for members to obtain funding of “we need to train our staff to at least the minimum recommended standards” to provide quality services. Development and implementation of a competency framework is part of a quality approach to ensuring service delivery as it requires parallel reviews of policies and forecasting processes and procedures to be successful.

The Panel also noted that Members in RAI, RA IV and RA V and the ESCAP/WMO Typhoon Committee have already undertaken considerable work in the development and implementation of tropical cyclone forecasting competencies at national and regional level. The Panel was informed that RSMC New Delhi had developed a set of tropical cyclone forecasting competencies, and circulated among the Panel Members a draft version of the tropical cyclone forecasting competencies for the Panel. The Panel is invited to discuss further this document and provide recommendations to implement these competencies.

4.3.5 Research

4.3.5.1 Expected Result 5

- *Enhanced capabilities of Members to cope with high-impact weather through research*

The collaboration will be promoted on research activities related to updating forecasting technologies, including NWP, storm surge and flood forecasting models.

4.3.5.2 Strategic Actions

5-a To assess the impact of climate change on tropical cyclones in the region.

5-b To further improve monitoring capabilities to characterize physical and dynamical characteristics of tropical cyclones.

5-b To further improve regional NWP models for tropical cyclone track, Intensity and structure predictions.

5-c To develop and further improve the storm surge and river flood coupling model over specific river basins for forecasting of coastal inundation.

5-d To update vulnerability maps for various parameters like wind force/peak storm surge etc., based on latest available database.

5-e To identify research issues and develop research proposals for technical and funding support

4.3.6 Partnership

1. **Expected Result 6**

- *Enhanced cooperation among Members and with partner organizations in the provision of forecasts and warnings for tropical cyclones and storm surges*
- Partnerships will be further developed both within and outside the region to take advantage of experience, expertise, infrastructure and other resources, and for future initiatives and development projects.

4.3.6.2 Strategic Actions

a To promote the exchange of information and data among Members and with regional bodies to enhance regional cooperation in the five components: meteorology, hydrology, DRR, training and research.

b To enhance cooperation with other regional bodies, organizations, service providers and

sectors for more effective provision of the forecasts and warnings.

c To develop and implement joint projects in the areas of the above five components and resource mobilization.

4.3.7 Management and Governance

4.3.7.1 Expected Result 7

- *Effective management and functioning of the Panel.*

Effective management and governance will be pursued to ensure the fulfilment of Panel's vision, mission and strategic objectives.

4.3.7.2 Strategic Actions

a To further improve the coordination and decision-making process of the Panel.

b To enhance effectiveness in the implementation of CTP and AOPs.

c To continue to ensure effective and collaborative relationships among working groups of Meteorology, Hydrology and DRR.

d To further improve the coordinated technical planning process as well as monitoring and evaluation.

4. 4. ANNUAL OPERATING PLAN

The Annual Operating Plan (AOP) is designed to turn the expected results into specific initiatives and projects that are needed to achieve the expected results. The AOP will contain detailed actions and performance indicators to meet the Strategic Actions of each of the expected results. The AOP will be prepared and adopted at the annual PTC sessions and the detailed actions and performance indicators are subject to revision by PTC during its sessions.

4.5. CONCLUSION

Coordinated Technical Plan (CTP) for the WMO/ESCAP Panel on Tropical Cyclones for the Bay of Bengal and Arabian Sea (2024-27) has been developed based on the general framework of CTP adopted at the 31st session and the draft CTP submitted to the 50th session by the CTP Working Group, as well as suggestions from the Panel Members. It also took into account Sendai Framework for Disaster Risk Reduction (2015-2030) adopted during the World Conference on Disaster Reduction in 2015.

Annexure-5

Annual Operating Plan (2025)

Annual Operating Plan for 2025-26

Annual Operating Plan for 2025-2026		
Expected Result	Strategic Goal	Activity
ER-1 (Meteorology) Enhanced capabilities of Members to produce better forecasts and warnings of tropical cyclones and storm surges.	1-a To improve and expand the observing system of surface, upper-air, ship, buoy, aircraft, radar, wave radar and satellite observations in the Member countries.	To strengthen the cooperative relationship with the Airlines for the development of the regional Aeronautical Meteorological Data Relay (AMDAR) programme (WMO).
	1-b To implement and operate adequate Members' connection to the WMO Information System (WIS) for operation-critical data exchange through dedicated telecommunication means.	Members to implement plans to deploy WIS functionality.
	1-c To increase the accuracy, timeliness and usefulness of tropical cyclone forecasts and warnings.	1) To establish and enhance the communication between the operational forecasters in RSMC and the Members (RSMC, PTC-S). 2) To develop collaborative links with the Severe Weather Forecasting Programme and the Coastal Inundation Forecasting Programme of WMO (Members, RSMC, BMD, PTC-S, WMO) 3) To promote implementation of Common Alerting Protocol (CAP) in partnership with WGDRR (WMO, Members). 4) To implement TC Landfall Forecast programme (RSMC, Members) 5) To prepare an assessment report on the current status and needs of the Members with respect to data, products, analytical and forecasting procedures (Working Group on

		Meteorology in association with RSMC, New Delhi) 6) To arrange the training on Dvorak's technique, microwave imageries & products and application of Ensemble Prediction System (EPS) for tropical cyclone monitoring and prediction with the support of WMO. 8) WMO/PTC may facilitate training on the utilization of INSAT-3DR and S data and products including RAPID and Nowcasting tools among the Member countries. (in conjunction with some other training activity of WMO).
	1-d To upgrade the computing facility of RSMC New Delhi and NMSs so as to facilitate efficient data processing and data assimilation from different observing systems/platforms to suit the national and regional needs.	RSMC New Delhi may inform the Panel Member countries about the changes/upgradation in their telecommunication systems so that necessary measures taken by the members.
ER-2 (Hydrology) Enhanced capabilities of Members to provide better hydrological forecasts and assessments.	2-a To improve regional cooperation in real-time monitoring and exchange of relevant data and information, derived (forecasting) products and technical expertise related to hydrological hazards.	1) To develop and implement a regional information exchange strategy during 2025-2026. 2) To organize regional workshops on data transmission mechanisms with special reference to water-related hazards. 3) To collaborate with the Commission for Hydrology (CHy) and RA-II to carry out the activity on actions 1 and 2.
	2-b To improve flood forecasts and warnings, particularly in deltaic and coastal areas by coupling storm surge forecasts with river flow forecasting.	1) To develop delta hydraulic models for river forecasting by coupling any hydrodynamical model being used in the countries) with the storm surge forecasts for at least one river delta in each country. 2) Developing/application of coastal flood models and associated

		flood hazard and risk maps in the line as mentioned above. 3) To organize workshops for enhancing the capabilities of the countries (in conjunction with WMO training etc.)
	2-c To enhance regional capabilities relating to urban floods/ riverine flood risk reduction in delta and coastal regions through continued interaction with the member countries and user agencies.	1) To undertake flood hazard mapping at least in one major delta/coastal area in each country during the next four years. 2) To organize workshops for capacity building (in conjunction with WMO training activity etc). 3) To collaborate and share experiences with the Typhoon Committee (WMO, ESCAP, PTC-S)
ER-3 (DRR) Enhanced capabilities of Members to promote tropical cyclone disaster resilient communities through providing guidance on multi-hazard early warning dissemination and response mechanism.	3-a To improve regional cooperation in policies and strategies on DRR, especially those related to tropical cyclones, coastal hazards and other extreme weather events.	1. ESCAP, WMO and PTC to organize capacity development training programme for PTC member countries particularly in the areas of impact-based forecasting, risk-based warning. 2. ESCAP and WMO to work with PTC member countries for developing a regional component of International Network of Multi Hazard Early Warning System (IN-MHEWS) and implementation of MHEWS Interoperability Environment (MIE)
	3-b To establish a regional information system to support development of policies and strategies on DRR as well as interfacing the national level systems by creating an updated comprehensive database on disaster information and best practices on DRR.	1. To strengthen regional cooperation on DRR information exchange through networking by making available disaster preparedness and mitigation information through Internet websites, involving web GIS tools

		and other means. The web link may be provided to GMAS. WMO will provide a guideline to the member countries. 2. ESCAP to support PTC member countries in attending regional co-operation related activities including IN-MHEWS, Asian Pacific Centre for Development of Disaster Information Management (APDIM).
	3-c To improve public awareness and appreciation of the impacts of tropical cyclones and other extreme weather events, for possible mitigation and response actions through effective communication with the media before, during, and after such events.	ESCAP and WMO to support strengthening multi-stakeholder forums such as monsoon forums, and national climate outlook forums in PTC member countries.
	3-d To improve coordination and interaction between meteorological/hydrological services on the one hand and emergency management/disaster response agencies on the other through integrated emergency management, disaster response and preparedness programmes.	ESCAP and WMO to continue supporting initiatives such as Common Alerting Protocol (CAP) in PTC member countries.
	3-e To improve disaster risk management, especially those related to cyclone-related disaster preparedness by developing and implementing pilot projects on multi-hazard disaster risk management programmes into the development plan of the Panel Members in the next four years.	WMO and ESCAP to support piloting a standard methodology project on impact based forecasting and risk based warning in PTC member countries.
ER-4 (Training) Training plan for capacity building with a regional perspective.	4-a An expert group of members (Bangladesh, India, Maldives & Sri Lanka) to prepare a draft training plan from 2025-26.	1. Expert Group (Sri Lanka, Oman and Thailand) to produce a training plan including a prioritized list of training needs and opportunities of PTC Members through a survey and advise WMO for

		reporting, planning and implementation purposes. PTC will write to member countries regarding the constitution of the expert group and request for the nomination of experts and focal persons. 2. The plan is to be submitted to PTC Secretariat by the end of December 2024. PTC will forward the report to WMO with a request to organize training as per the plan.
	4-b To arrange training programmes on the use of NWP model products and their application in Cyclone (track and intensity) and storm surge prediction.	1. To continue the attachment training programme in RSMC, New Delhi for cyclone forecasters. 2. PR of India with WMO to arrange training on storm surge forecasting in India for the PTC member countries. 3. To continue to organize a training programme at INCOIS, Hyderabad in India on the utilization of Ocean data and wave forecasting. 4. ESCAP to continue supporting training programme for information dissemination and media coordination in multi-hazard early warning system.
	4-c To arrange training programmes on the use of Satellite and Doppler Weather Radar (DWR)data & products in Cyclone forecasting as well as DWR calibration and maintenance	
	4-d To arrange training programmes on information dissemination tools and media coordination during disasters and their effectiveness on "human response".	
	4-e To exchange visits of experts among Member countries to share their experiences and expertise on cyclone & related disaster management aspects.	-
	4-f To enhance WMO's fellowship support on tropical cyclone related programmes.	-

ER-5 (Research) Enhanced capabilities of Members to cope with high impact weather through research.	5-a To produce regional assessment of the impact of climate change on tropical cyclones.	To collect data/materials/papers from the Member countries which are relevant to the regional assessment.
	5-b To develop storm surge and river flood coupling model over specific river basins for forecasting of coastal inundation.	-
	5-c To update vulnerability maps for various parameters like wind force/peak storm surge etc., based on latest available database.	-
ER-6 (Partnership) Enhanced use of forecasts and warnings for tropical cyclones and storm surges for decision making and implementation by Members and partner organizations.	6-a To promote exchange of information and data among Members to enhance regional cooperation in meteorology, hydrology, DRR, training and research.	-
	6-b To enhance cooperation with other regional bodies, organizations, service providers and sectors for more effective provision of the forecasts and warnings.	-
	6-c To develop proposals for joint projects in the areas of five components including resource mobilization.	-
ER-7 (Management and Governance) Effective management and functioning of the Panel.	7.a To improve the coordination and decision-making process of the Panel.	-
	7.b To enhance effectiveness in implementation of CTP and AOPs.	-
	7.c To ensure effective and collaborative relationships among working groups of Meteorology, Hydrology and DRR.	-

	7-d To improve coordinated technical planning process as well as monitoring and evaluation.	-

Annexure-6

Terms of Reference of Working Groups

Item No. 7.4.1.

Terms of Reference as adopted in 52nd session of the PTC Working Group on Meteorology (WGM)(Draft)

In order to coordinate efforts in the implementation of various programmes and activities related to meteorology with the aim to better support the socio-economic development process in the PTC region and to help accomplish the strategic goals and objectives as mentioned under the Meteorological Component of the Coordinated Technical Plan of the WMO/ESCAP Panel on Tropical Cyclones (PTC) for the Bay of Bengal and the Arabian Sea, the PTC has established the Working Group on Meteorology (WG-M) as decided during 39th Session of PTC (Myanmar, 5-9 March, 2012) with the following Terms of Reference and operational modalities. It was further reviewed in the 49th Session of PTC.
Due to the various developments in recent years the terms of reference have been updated as mentioned below based on the decision of the 52nd session of PTC.

Terms of Reference (ToR):
The WG-M will promote cooperation among the Members in the implementation of various programmes and activities under the Meteorological Component of the PTC's Coordinated Technical Plan with the aim to support the socio-economic development process and enhance cooperation among the Members in all the five major components towards this end.

The WG-M is expected to advise and assist the PTC in:

- Identifying priority issues and areas of cooperation in the Meteorological Component;
- Promoting and facilitating the exchange of experiences and knowledge on the latest developments and techniques related to the above issues and areas;
- Coordinating and implementing priority activities and programmes of the PTC aiming at strengthening capacity of the Members in meteorology;
- Mobilizing resources to carry out priority activities of the PTC related to the Meteorological Component;
- Developing Annual Operating Plan (AOP) for meteorology and reporting on the activities under the AOP;
- Reporting overall progress in the implementation of the Meteorological Component of the PTC‟s Coordinated Technical Plan;
- Recommending to the PTC‟s priority areas, programmes and activities for cooperation in meteorological research by related experts of the Members; and
- Performing any other task as assigned by the PTC.
- Promoting and facilitating the development & implementation of TC impact based forecasting

(IBF) and risk based warnings (RBW) in member countries
- Promoting and facilitating the development & implementation of TC decision support system (DSS) and common alerting protocol (CAP) in member countries.

Membership:
Chairperson
2 Vice-Chairs
Members: Representatives from remaining member countries
All Member countries will be represented at the WG-M.
The PTC invites WMO and ESCAP to continue their involvement in the work of WG M. The PTC also requests the other concerned agencies to participate in the activities of WG-M. The term of service on the WG-M is 1 year, which shall be automatically extended for similar durations unless modified or terminated by the PTC.

Operation modalities in view of the limited financial resources of the PTC Trust Fund, the WG-M is expected to perform its work through email, video conferencing and other means. The WG-M shall hold physical meetings during the annual Session of PTC. The WG-M members, however, may also meet during the inter-sessional period, if so necessary through video conferencing.

Reporting requirements The Chairperson of the WG-M is required to report to the PTC on overall progress in the implementation of the Meteorological Component of the Coordinated Technical Plan as well as on the activities with regards to the annual operating plan (AOP) for meteorology through the PTC Secretariat to the PTC Chairperson and the PTC Members for their consideration under the framework of the PTC. This report may also include recommendations related to priority activities to be undertaken in the coming years.

The working group will suggest fund requirement for the activities to be carried out during next one year. It will be submitted to the Advisory Working Group (AWG) to evaluate the proposal of various working groups. The report of the AWG will be examined and approved by the PTC.

Item 7.4.2.

Terms of Reference of the PTC Working Group on Hydrology (WG-H) (Draft as adopted in 52nd Session of PTC)

In order to coordinate efforts on the implementation of various programmes and activities related to hydrology with the aim to better support the socio-economic development process in the PTC region and to help accomplish the strategic goals and objectives as mentioned under the Hydrological Component of the Coordinated Technical Plan of the WMO/ESCAP Panel on Tropical Cyclones (PTC) for the Bay of Bengal and the Arabian Sea, the PTC has established Working Group on Hydrology (WGH), as decided during 39th Session of PTC (Myanmar, 5-9 March, 2012) with the following Terms of Reference and operational modalities. It was further reviewed in 49th session of PTC. Due to the various development in recent years the terms of reference has been updated as mentioned below based on the decision of 52nd Session of PTC.

Due to the various development in recent years the terms of reference has been updated as mentioned

Terms of Reference (ToR):

The WGH will promote cooperation among the Members in the implementation of various programmes and activities under the Hydrological Component of the PTC`s Coordinated Technical Plan with the aim to support the socio-economic development process and enhance cooperation among the Members in all the five major components towards this end. The WGH is expected to advise and assist the PTC in:

- Identifying priority issues and areas of cooperation in the Hydrological Component
- Promote and facilitate the exchange of experiences and knowledge on the latest developments and techniques related to the above issues and areas;
- Coordinating and implement priority activities and programmes of the PTC aiming at strengthening capacity of the Members in hydrology and water resources;
- Mobilizing resources to carry out priority activities of the PTC related to the Hydrological Component;
- Developing Annual Operating Plan (AOP) for hydrology and reporting on the activities under the AOP;
- Reporting overall progress in the implementation of the Hydrological Component of PTC`s Coordinated Technical Plan;
- Recommending to the PTC`s priority areas, programmes and activities for cooperation in hydrological research by related experts of the Members; and
- Performing any other task as assigned by the PTC

Membership:

Chairperson
2 Vice chairpersons
Members: Representatives of remaining member countries
All Member countries will be represented at the WGH.
The PTC invites WMO and ESCAP to continue their involvement in the work of WGH. The PTC also requests to other concerned agencies to participate in the activities of WGH. The term of service on the WGH is 1 year subject to extension authorized by the PTC.

Operation Modalities:
In view of the limited financial resources of the PTC Trust Fund, the WGH is expected to perform its work through email, video conferencing and other means. The WG members shall meet if necessary. The WGH can have the physical meeting during the PTC session.

Reporting Requirements:
The Chairperson of the WGH is required to report to the PTC on overall progress in the implementation of the Hydrological Component of the Coordinated Technical Plan as well as on the activities with regards to the annual operating plan (AOP) for hydrology through the PTC Secretariat to the PTC Chairperson and the PTC Members for their consideration under the framework of the PTC. This report may also include recommendations related to priority activities to be undertaken in the coming years.
The working group will suggest fund requirement for the activities to be carried out during next one year. It will be submitted to the Advisory Working Group (AWG) to evaluate the proposal of various working groups. The report of the AWG will be examined and approved by the PTC.

Item 7.4.3

Terms of Reference of the PTC Working Group on DRR (Draft as adopted in 52nd Session of PTC)

In order to coordinate efforts on the implementation of various activities under the Disaster Risk Reduction (DRR) Component to better support the socio-economic development process in the Panel on Tropical Cyclones (PTC) Area and to help accomplish the DRR related goals and objectives in the Coordinated Technical Plan (CTP) 2009-2011, PTC established the Working Group on Disaster Risk Reduction (WGDRR), with the following Terms of Reference and operational modalities. It was further reviewed in 49th session of PTC. Due to the various development in recent years the terms of reference have been updated as mentioned below based on the decision of 52nd Session of PTC.

Terms of Reference (ToR):

The WGDRR will promote cooperation among the PTC Members in the implementation of activities under the DRR Component of the PTC's Coordinated Technical Plan to support the socio-economic development process and enhance cooperation among the Members in all the five components towards this end, the WGDRR is expected to advise and assist the PTC:

- Identifying priority issues and areas of cooperation in the DRR Component;
- Promoting and facilitating the exchange of experiences and knowledge on the latest developments and techniques related to the above issues and areas;
- Coordinating and implementing priority activities of the AOP and programmes of the PTC aiming at strengthening capacity of the Members in DRR;
- Mobilizing resources to carry out priority activities of the PTC related to the DRR Component; Monitoring and evaluating overall progress in the implementation of the DRR Component of the Coordinated Technical Plan;
- Recommending to the PTC priority areas, programmes and activities for cooperation in DRR research by experts of the Members;
- Promoting measures for more effective cooperation with other components of work of the Panel, including the development of the conceptual framework on multi-hazard early warning systems and public outreach programs; and,
- Reporting overall progress in the implementation of the DRR component of the CTP.
- Monitoring and promoting the early action based on early warning in short to medium range multi-hazard monitoring, impact-based forecasting and risk-based warning for DRR.
- Monitoring and promoting the anticipatory actions based on extended range/monthly/seasonal forecast.
- Monitoring and promoting the implementation of Common Alert Protocol for early warning dissemination.
- Monitoring and promoting multihazard inter-probability for DRR.

Membership

The WGDRR will consist of the following members:
Chairperson:
2 Vice Chairpersons:
Members: Representatives from remaining member countries
All member countries will be represented at WGDRR
The PTC invites ESCAP and WMO to continue their involvement in the work of WGDRR. The PTC also requests the other concerned agencies such as the UNESCO-IOC IOTWMS to participate in the activities of WGDRR. The terms of service on the WGDRR are 1 year subject to extension authorized

by the PTC.

Operation modalities:
In view of the limited financial resources of the PTC Trust Fund, the WGDRR is expected to perform its work through email, video conferencing and other means. The WG members shall meet if necessary. Physically, they can meet during the PTC session or side events.

Reporting requirements
The Chairperson of the WGDRR is required to submit an annual report on DRR activities with regards to the implementation of Coordinated Technical Plan through the PTC Secretariat to the PTC Chairperson and the PTC Members for their consideration under the framework of the PTC. This report will include recommendations related to priority activities to be undertaken in the coming years.
The working group will suggest fund requirement for the activities to be carried out during next one year. It will be submitted to the Advisory Working Group (AWG) to evaluate the proposal of various working groups. The report of the AWG will be examined and approved by the PTC.

Item 7.4.4.

Terms of Reference of the PTC Working Group on Training and Research as adopted in 52nd Session of PTC

In order to coordinate efforts on the implementation of various activities under the capacity building initiatives through training and research, the Working Group on training and research (WGTR) will have the following Terms of Reference and operational modalities:

Terms of Reference (ToR):

WGTR is to promote research and training activities on various aspects of tropical cyclone analysis and forecasting, including assessment of tropical cyclones' impacts on Members' socio-economic development processes, and to encourage cooperation of efforts among Members.

Towards this end, WGTR is expected to:

- assist in identifying scientific and technical problems in the analysis and forecasting of tropical cyclones and their impacts on water resources and measures for disaster prevention and preparedness;
- facilitate the exchange of experience and knowledge on the latest development and techniques related to the above problems;
- coordinate training and research programmes, including activities in support of cross-cutting initiatives and other collaboration programmes among Members such as twinning and mentoring arrangement, aimed at improving the technical capacity and capability of Members to better serve the people in the region;
- evaluate the effectiveness of training and research activities undertaken by WGTR, and
- provide support to other working groups in performing such evaluation;
- recommend to the Committee priority areas and long-term plans for cooperation in research and training in support of the targets and strategic plans.
- Suggest and promote training on impact based forecasting (IBF), risk based warnings (RBF), common alerting protocol (CAP) and artificial intelligence/machine learning (AI/ML) etc in the WMO/ESCAP Panel region.
- Prepare the list of research papers and share annually to all members relevant to the region.
- Support the publication of PTC News letters & other publications.

Membership:

Chairperson

2 Vice-Chairs

Members: Representatiives from remaining member countries

All Member countries will be represented at the WGTR.

The PTC invites WMO and ESCAP to continue their involvement in the work of WGTR. The PTC also requests the other concerned agencies to participate in the activities of WGTR. The term of service on the WGTR is 1 year, which shall be automatically extended for similar durations unless modified or terminated by the PTC.

Operation modalities:

In view of the limited financial resources of the PTC Trust Fund, the WGTR is expected to perform its work through email, video conferencing and other means. The WGTR shall hold physical meeting during the annual Session of PTC. The WGTR members, however, may also meet during the inter-sessional period, if so necessary through video conferencing.

Reporting requirements:

The Chairperson of the WGTR is required to report to the PTC on overall progress in the implementation of the training & research component of the Coordinated Technical Plan as well as on the activities with regards to the annual operating plan (AOP) for training and research through the PTC Secretariat to the PTC Chairperson and the PTC Members for their consideration under the framework of the PTC. This report may also include recommendations related to priority activities to be undertaken in the coming years.

The working group will suggest fund requirement for the activities to be carried out during next one year. It will be submitted to the Advisory Working Group (AWG) to evaluate the proposal of various working groups. The report of the AWG will be examined and approved by the PTC.

Item 7.5.5.

Terms of Reference as adopted in 52nd session of the PTC Working Group on Advisory Working Group (AWG) (Draft)

Terms of reference of the Advisory Working Group were proposed in the 49th Session of PTC. Due to the various developments in recent years the terms of reference have been updated as mentioned below based on the decision of the 52nd session of PTC.

Guidance

In the establishment of the Advisory Working Group, the PTC provided the following guidance for their assistance in planning and implementation of measures required for mitigation of Tropical Cyclone-related disasters**.**

- To improve the efficiency and effectiveness of the PTC, the PTC, and PTC Secretary.
- To promote international cooperation in the three components of Meteorology, Hydrology, and Disaster Risk Reduction.
- To promote the use of advanced information technology and resource sharing among Members of the Tropical Cyclone Committee.
- To facilitate the implementation of the Strategic Plan, Annual Operating Plan, and Annual Budget.
- To enhance resources mobilization.

Terms of Reference (ToR)

The Advisory Working Group (AWG) will assist the Chairperson of the PTC and the PTC Secretary to coordinate the implementation of PTC decisions. The AWG will also act as a "Think Tank/Steering Group" function to advise and offer options or proposals, as required, to the PTC Members, the PTC, the PTC Chairperson, and PTC Secretary.

- To monitor, review, and evaluate the Strategic Plan's Key Results Areas, Strategic Goals, and Activities; the objectives/action of the Annual Operating Plan; and Annual Budget and make proposals concerning these documents and the evaluation of the results achieved to the Committee.
- To provide overall direction and oversight for the Associated Activities – Integrated listed in the Strategic Plan.
- To provide options and proposals to enhance the effectiveness of the PTC, PTC Chairperson, and the PTC Secretary.
- To assist in the consideration and coordination of prioritizing project proposals and their budgets provided by the three components of PTC. Training and Research are incorporated as part of each of these three.
- To provide options and assistance on collaborative activities among the three components and priority options to the PTC.
- To provide options and assistance on mechanisms aimed at improving the implementation of the Strategic Plan and Annual Operating Plan.

- To assist in mobilizing resources to achieve the goals and objectives as determined by the PTC in the Strategic Plan and Annual Operating Plan.
- Coordinate and harmonize activities among WGs, TRCG, and PTC Secretary.
- Monitor and ensure that the projects/activities authorized by the PTC are being accomplished in a timely manner.

- Development, review and propose the format of the Members' written reports and Members' oral reports at the PTC Sessions to focus on the results achieved on the Strategic Plan and Annual Operating Plan.
- Perform missions as required on strategic planning and project/grant proposals to selected Members.

Members

- Chairperson and Vice-Chairperson(s) of AWG as appointed by PTC.
- Chairpersons of the four working groups (i) meteorology (ii) hydrology (iii) DRR (iv) Research & Training and the Head of RSMC, New Delhi, and
- Representatives of WMO and ESCAP (as ex-officio members)

Term of Service of the Chair and Vice-chair(s) of the AWG

The term of service of the Chair of the AWG is two years subject to extension authorized by PTC. The limit of service for the Member providing the Chair shall be two consecutive terms.
The term of service of the Vice-chair(s) of the AWG is two years subject to extension authorized by the PTC. The limit of service for the Vice-Chair(s) shall be three consecutive terms.

Operational modalities

In view of the limited financial resources of the PTC Trust Fund, AWG is expected to perform most of its work, coordination and communication through correspondence including e-mail, video conferencing and other means which would be supported by regular reporting from the PTC Secretariat. As described in the above Terms of Reference of AWG, a considerable number of important issues and projects for PTC and its Members will be discussed and accomplished by AWG. To enhance the efficiency of the operation of PTC, it is recommended that an AWG meeting be held at least every year. At the request of the PTC or PTC Chairperson, the AWG will investigate and review issues, make recommendations and proposals, assist in implementing approved projects, activities, etc.