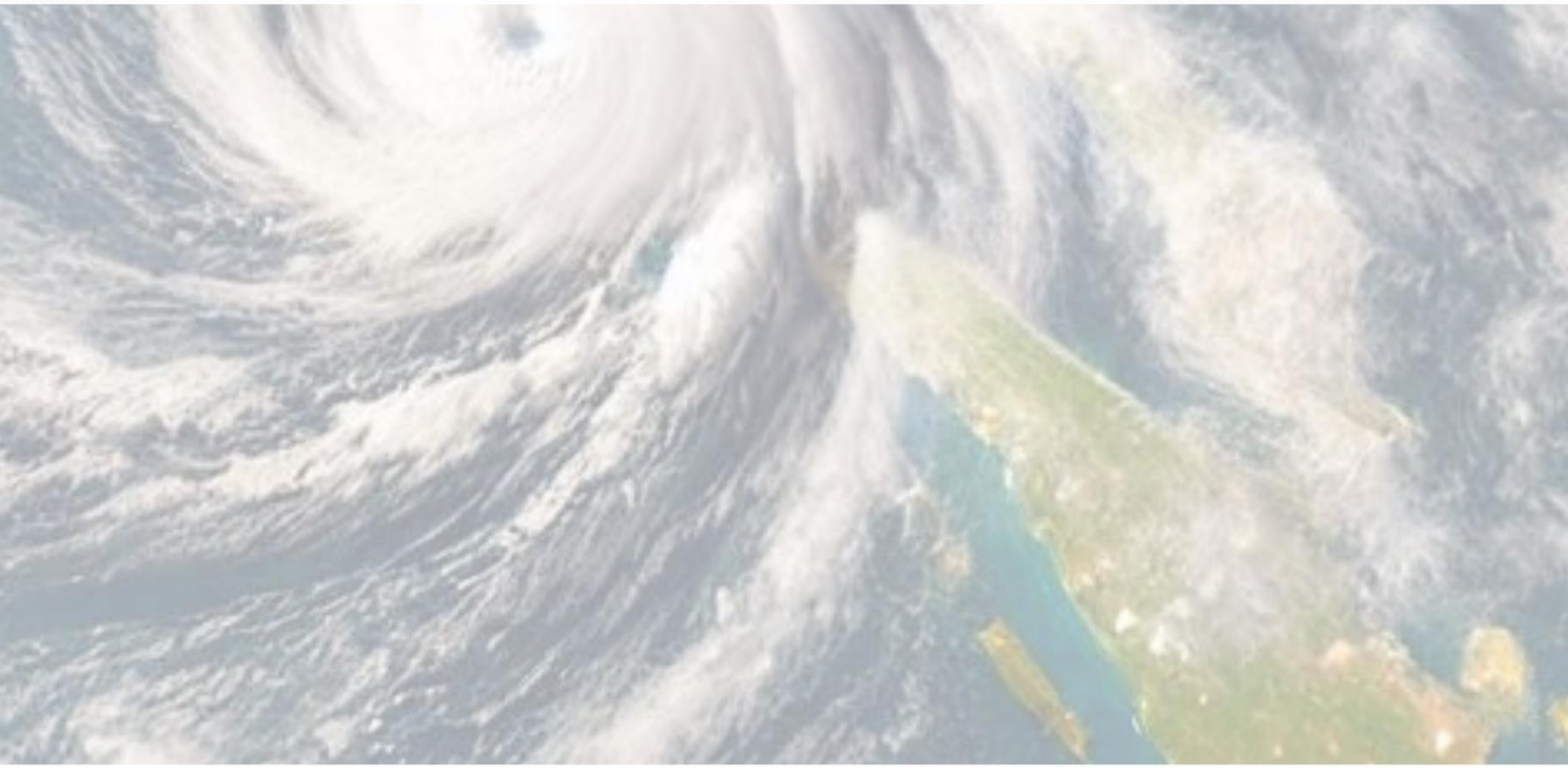
REGIONAL TRAINING WORKSHOP

FOR SAHF FORECASTERS' FORUM (FFORUM) EXPANDED SERVICE SUPPORT

BANGKOK, THAIALND | 29-30 JULY 2024

TRAINING OUTCOME REPORT



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SOUTH ASIA HYDROMET FORUM

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BACKGROUND

Within the South Asia Hydromet Forum (SAHF) framework, the Forecasters' Forum (FForum) was established on February 17, 2022, to harness regional expertise and enhance operational forecasting and service delivery across South Asia (SA). This initiative was driven by the recognition that effective management of extreme weather events requires a collaborative approach, leveraging the collective knowledge and experience of operational forecasters across the region. The FForum has become a cornerstone of this effort, serving as a platform for regular interaction among operational forecasters from SAHF member countries, which include Afghanistan, Bangladesh, Bhutan, India, Maldives, Myanmar, Nepal, Pakistan, and Sri Lanka. Through weekly meetings, monsoon reviews and special sessions, the FForum has focused on enhancing the precision of weather forecasts and improving disaster response efficiency by facilitating the exchange of forecasting techniques, methodologies, and innovations.

The "Regional Training Workshop for SAHF FForum Expanded Service Support," was held in Bangkok, Thailand, from 29-30 July 2024 in hybrid mode to advance regional collaboration and refine forecasting capabilities among South Asian National Meteorological and Hydrological Services (NMHSs). Given the escalating frequency and severity of extreme weather events in the region, there is a critical need for more effective and integrated forecasting mechanisms. The workshop aimed to address this challenge by offering a comprehensive platform for forecasters to discuss and learn about the latest technologies and forecasting products, including Artificial Intelligence (AI) and Machine Learning (ML). Participants had the opportunity to share best practices, discuss common challenges, and explore innovative solutions to improve forecasting accuracy and timeliness. The workshop provided valuable insights into advanced forecasting tools and methodologies, with a focus on practical applications and real-world scenarios. It also served as a platform for strengthening regional networks, enhancing the dissemination of forecast information, and developing actionable strategies to sustain and expand the FForum's initiatives. By addressing existing gaps and exploring new technologies, the workshop was instrumental in planning and developing strategies for enhancing the collective capacity of SA NMHSs to effectively manage and respond to extreme weather events. The outcomes of the workshop are expected to contribute significantly to improving regional forecasting capabilities and fostering a more resilient approach to weather-related challenges in SA.

RATIONALE FOR THE TRAINING

The Regional Training Workshop for SAHF FForum Expanded Service Support was organized to address the need for improved forecasting capabilities in SA, where extreme weather events are becoming increasingly frequent and severe. This workshop aimed to enhance regional collaboration and operational effectiveness by integrating advanced technologies such as AI and ML into forecasting processes. It provided a platform for forecasters from different countries to share best practices, discuss challenges, and

explore innovative solutions. By focusing on the latest tools and methodologies, the workshop sought to bridge gaps in current forecasting capabilities and foster a more coordinated and effective approach to managing extreme weather events in the region.

TRAINING OBJECTIVES

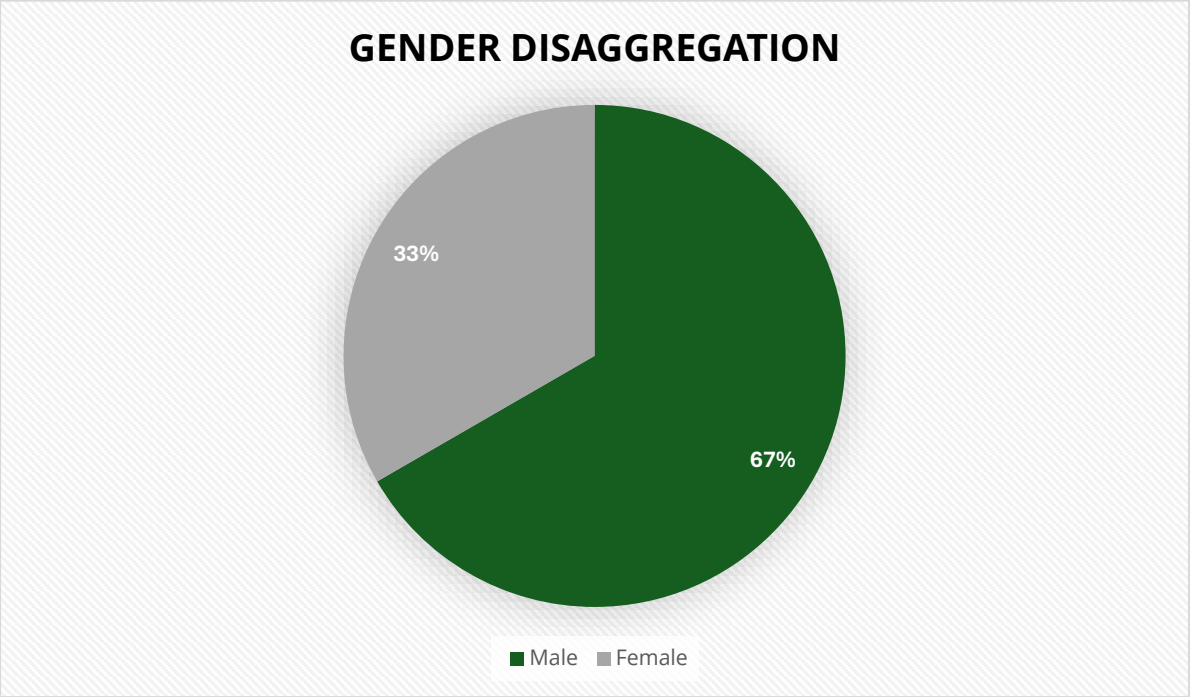
- Strengthen connections and collaboration among operational forecasters from South Asian NMHSs to foster a more cohesive regional network.
- Explore and disseminate information on new technologies and products, including AI and ML that can improve forecasting accuracy and response to extreme weather events.
- Sharing experiences and skills in accessing, interpreting, and applying advanced forecasting products from both regional and international sources, including medium and extended-range forecasts.
- Facilitate the sharing of experiences and case studies related to extreme weather events among participating countries, highlighting successful strategies and addressing common challenges.
- Discuss current limitations and gaps in existing forecasting products and methodologies and propose solutions for enhancing their effectiveness and applicability.
- Create actionable plans to ensure the continued relevance and success of the FForum, including strategies for integrating its outputs into broader forecasting processes and maintaining member engagement.

PARTICIPANTS

1: Participants, resource persons and RIMES team at the FForum Regional Training Workshop

The training comprised 18 professionals from South Asian NMHSs, with a gender distribution of 12 males and 6 females. Participant represented hydrometeorological departments and institutions across SAHF member countries. Their roles varied widely,

ranging from senior divisional meteorologists to directors and heads of forecasting departments, reflecting a diverse spectrum of experience and organizational responsibility. The age distribution primarily falls within the 41-60 year range, indicating that most participants bring substantial professional experience to the training. There are also younger professionals in the 25-40 year age group, adding fresh perspectives and new ideas to the mix. This diverse demographic profile ensured that the training addressed a broad range of expertise and perspectives, fostering a rich and varied learning environment. The inclusion of both experts and emerging professionals, alongside a gender-diverse group, enhances the training's ability to meet the diverse needs and expectations of all participants.



2: Gender distribution among study participants

Knowledge and Skills Baseline

The baseline training survey reveals a broad spectrum of knowledge and skills among the participants before the training. Participants assessed their proficiency in integrating climate change considerations into their professional work as generally moderate to poor. This indicates that there is a substantial need for development in this area, suggesting that many participants sought to improve their capacity to address climate change impacts effectively.

In terms of specific forecasting techniques, the survey highlights significant variability in expertise. Participants rated their knowledge of applying AI and ML in weather forecasting, as well as using ensemble data to enhance forecast accuracy, from very poor to good. This variability reflects differing levels of exposure and familiarity with these advanced technologies. Similarly, their understanding of forecasting and monitoring extreme weather events, techniques for medium and extended-range forecasting, and the utilization of Ocean State Forecast (OSF) products ranged across a wide spectrum.

These differences suggest that while some participants had a strong foundation, others are still developing their skills in these crucial areas.

Attitudes and Training Expectations

The general attitude towards the training was positive, with participants expressing a strong desire to enhance their professional knowledge and skills. The survey responses indicate that many participants are committed to improving their abilities in severe weather forecasting, particularly using AI and ML. They expected the training to provide valuable insights and practical tools for these advanced forecasting methods. Participants also anticipated gaining a deeper understanding of how to integrate new technologies and data sources into their forecasting practices. Specific areas of interest include learning new techniques for detecting and predicting extreme weather events and enhancing skills in medium and extended-range weather forecasting. There was a notable emphasis on acquiring knowledge about the best practices for integrating forecast data into operational bulletins and effectively managing both local and model data during extreme weather situations.

HIGHLIGHTS

SAHF Forum - Updates and Review

Summary of Session: The RIMES team presented recent updates and reviews of the SAHF Forum's activities, highlighting key achievements and ongoing projects. They discussed the impact of the Forum's initiatives on regional forecasting capabilities and decision-making processes, showcasing examples of improved accuracy and responsiveness to extreme weather events.

Output: Participants gained a clear understanding of the FForum's recent work and its significance, laying the groundwork for more detailed discussions in subsequent sessions.

Technical Session I: Review of Forecasting Products and Country Experiences

Session Chair: Dr. G. Srinivasan, Adjunct Faculty, Asian Institute of Technology (AIT)

Session 1: Forecast products and information used in the FForum including the introduction of AI and ML Forecast products

Resource Person: Dr. K.J. Ramesh, Advisor-Weather and Climate Services, RIMES
Type of Methodology Used: Presentation, Demonstration and Discussion

Summary of Session:
The session focused on the diverse forecasting products utilized within the SAHF FForum and their integration with AI and ML technologies providing a detailed overview of how these products, including precipitation and soil moisture anomalies, are employed in forecasting. The session highlighted the importance of understanding the resolution and

timeliness of forecasting models, noting that many available products may not always be real-time or have fine resolution. Practical examples were discussed to illustrate the limitations of models like the "leaky bucket model," emphasizing the need for regular verification to assess the accuracy of forecasts. Recent verification results were also showcased, pointing out discrepancies between forecasted and observed rainfall, and stressed the importance of critical evaluation of all forecasting products. Ongoing dialogue and feedback from participants to refine forecasting tools and methodologies was encouraged.

Output:

- Increased awareness on the availability of various forecast products including AI and ML products that will assist in improving the operational weather forecast accuracy in detecting high impact weather events.
- Recognition of limitations and potential inaccuracies in various forecasting models. Need for regional validation of Numerical Weather Prediction (NWP) products such as soil-moisture over South Asia and prioritizing products to specific operational requirements of forecasters were noted.
- Understanding of the need for continuous verification of forecast products to ensure accuracy.

Session 2: Country Presentations - Sharing Experiences and Best Practices in Forecasting and Monitoring Extreme and High-Impact Events

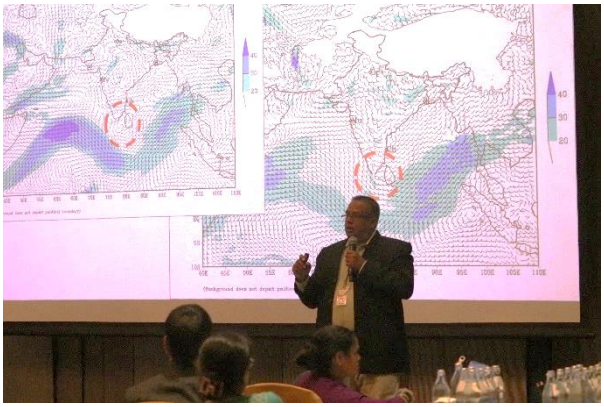
Moderator: Dr. G. Srinivasan
Type of Methodology Used: Case Study Presentations And Group Discussion

Summary of Session:

In this session, representatives from each participating country presented detailed case studies of extreme weather events they had encountered. These case studies included events such as cyclones, floods, droughts, and heatwaves. Each presenter elaborated on the forecasting models and tools they had employed, innovations in data collection methods, and the role of computational advancements in enhancing predictive accuracy. They shared both successful strategies that led to accurate forecasts and timely warnings, and the challenges they faced, such as technological limitations, data gaps, and communication barriers. Additionally, they discussed how the FForum had contributed to improved forecasting capabilities through knowledge transfer, capacity building, and collaborative projects. The session concluded with a discussion where participants exchanged lessons learned from their experiences. They focused on improving forecast accuracy, strengthening regional cooperation, building capacity, and engaging communities effectively. This discussion allowed for a deeper exchange of best practices and strategies to enhance predictive precision, foster regional collaboration, and improve public communication regarding forecasts and warnings.

Output:

- Participants shared and learned from diverse forecasting experiences and tools used in various countries.
- Identified recurring issues such as technological limitations, data gaps, and communication barriers.
- Highlighted effective strategies and practices for forecasting and disaster response that can be adapted regionally.
- Encouraged collaboration on forecasting and monitoring efforts, fostering joint projects and knowledge transfer.
- Provided new insights and practical solutions to enhance forecast accuracy and disaster response.
- Emphasized the need for ongoing training and resources to equip NMHSs with advanced skills and tools.
- Equipped participants with actionable strategies to implement in their countries, promoting regional resilience to climate-related challenges.




3: Participants presenting case studies of extreme weather events experienced in their respective countries

Session 3: Existing and Emerging Products for Medium and Extended-Range Forecasts and Detecting Extreme Events

Resource Person: Dr. Mohan. S. Thota, Scientist E, National Center for Medium Range Weather Forecasting (NCMRWF) , India
Type of Methodology Used: Presentation And Discussion

Summary:
The presentation focused on the medium and extended-range forecasting products developed by NCMRWF, India. The presentation covered both ensemble and deterministic models, which are used to predict weather patterns over medium to extended time frames. The session highlighted how these products are designed to forecast the onset and progression of extreme weather events, such as fog and radiation events, which are critical for various applications. The performance of these models was

discussed, emphasizing their ability to capture and predict the behaviour of such events, even under challenging conditions. The presentation also covered the limitations and uncertainties associated with these forecasts, particularly how the integration of different models and data sources affects forecast accuracy and reliability.

Output:

- Participants gained a comprehensive understanding of the medium and extended-range forecasting products provided by NCMRWF.
- Improved awareness of how these products handle extreme weather events, including their predictive strengths and limitations.
- Fostered informed discussions on the practical application of these forecasts in real-world scenarios, considering their reliability and the uncertainties involved.

Session 4: Roundtable Discussion on the Interpretation and Use of NCMRWF Products

Moderator: Dr. Mohan
Type of Methodology Used: Group discussion

Summary of Session:

This interactive roundtable discussion provided an opportunity for participants to delve into the practical aspects of accessing and using NCMRWF's forecasting products. The session facilitated a dialogue on the practical challenges and needs related to these products. Participants shared their experiences regarding the usability and accessibility of the products, highlighting specific issues and proposing solutions. The discussion focused on identifying gaps in product availability and functionality, as well as strategies to enhance the overall user experience (detailed discussion highlight in annex 2).

Output:

- Identified strategies to enhance access to and usability of NCMRWF products.
- Established actionable insights for improving the effectiveness of forecasting operations, ensuring that the products meet the practical needs of users.

Technical Session II: Review of forecasting products and country experiences

Session Chair: Dr. Satya Kumar, Director-In-Charge (Retd), IMD

Session 5: Roundtable Discussion On The Existing Products Including Medium And Extended Range Products Used By The NMHS, Existing Gaps And Requirements

Moderator: Dr. G. Srinivasan
Type of Methodology Used: Presentation and Group Discussion

Summary of Session:

The session covered a detailed discussion on the current forecast products utilized by NMHSs. There was an emphasis on the necessity for more precise and user-friendly forecast products to better serve the needs of various regions. Participants highlighted significant confusion regarding the usage of different forecasting models. Many countries are currently employing a variety of models based on trial and error, leading to inconsistent results and challenges in achieving reliable forecasts. The discussion further explored the difficulties in selecting appropriate models due to regional variability. This variability makes it challenging to adopt a one-size-fits-all approach to forecasting. The necessity for a more systematic approach to evaluate and select suitable models was emphasized. Participants suggested the periodic review and updating of models to ensure they meet the specific needs of different regions effectively. Recommendations for future directions included fostering a collaborative approach to share insights and best practices in model usage. The importance of ongoing discussions and workshops to address these issues was underscored, with a focus on improving the efficacy and reliability of forecast models. The session concluded with a consensus on the need for structured methodologies to enhance forecast accuracy and applicability across diverse regions.

Output:

- Identification of key gaps and challenges in the usage of forecast models.
- Consensus on the need for a more structured approach to model evaluation and selection.
- Recommendations for collaborative efforts and continued dialogue to enhance forecast accuracy and applicability.

Session 6: OSF Products and Detecting Extremes and Potential Areas of Tropical Cyclones

Resource Person: Dr. Ajay Kumar, Scientist D, Indian National Center for Ocean Information Services (INCOIS)
Type of Methodology Used: Presentation, Demonstration and Discussion

Summary of Session:

The session focused on OSF products, particularly those related to detecting extremes and identifying potential areas of tropical cyclones. The presentation covered various forecasting tools and models used by INCOIS, including real-time data on sea surface temperatures, wave heights, currents, and wind patterns. The presentation detailed the methodologies behind numerical models, such as data assimilation and ensemble forecasting, which enhance the accuracy and reliability of predictions. A significant portion of the session was discussed the detection of extreme oceanic events, explaining how advanced algorithms and satellite data are used to monitor phenomena like cyclones, tsunamis, and storm surges. Several case studies were presented to illustrate the effectiveness of these forecast products in real-world scenarios, highlighting their role in aiding timely evacuations and disaster management. The session also covered the identification of potential areas for tropical cyclones, discussing the criteria and indicators used to predict cyclone formation and track their paths. The subsequent discussion allowed participants to engage with the technical aspects of the presentation, ask questions, provide feedback, and explore opportunities for collaboration.

Output:

- Enhanced participants' understanding of OSF products.
- Improved ability to interpret and apply OSF products for predicting ocean conditions and extreme events.
- Increased awareness of the importance of tropical heat potential in cyclone detection.

Session 7: Open Discussion on The Coastal Zone and Ocean Related Products and Warning; Existing Mechanisms and Further Requirements.

Moderators: Dr. Ajay Kumar
Type of Methodology Used: Group Discussion

Summary of Session

The session featured a brief roundtable discussion on the interpretation and use of OSF products. The session focused on the practical applications and challenges associated with OSF products. Participants shared their experiences and insights on integrating OSF data into decision-making processes for maritime operations, disaster management, and coastal planning. The discussion highlighted the importance of accurate data interpretation and the need for real-time updates to support critical operations. Participants also discussed the customization of OSF products to meet specific needs and the necessity for accessible, user-friendly interfaces (detailed discussion highlights in annex 2).

Output:

- Participants gained insights into the practical uses and benefits of OSF products.

- Key challenges such as data accessibility and the need for user-friendly interfaces were identified.
- Emphasis on the necessity of real-time updates for effective decision-making.
- Recognition of the need to customize OSF products to meet specific user requirements.

Session 8: Round table discussion on existing gaps in utilizing existing forecast products and tools; use of ensemble products and new tools, AI, ML etc. to improve the forecasts; strategy for strengthening and sustaining the FForum; strategy to integrate outcomes from weekly FForum into IBF process

Moderators: Dr. G. Srinivasan, Dr. Anshul Agarwal, and Mr. Tshencho Dorji
Type of Methodology Used: Group discussion

Summary of Session:

The round table session provided an in-depth analysis of current challenges and opportunities in the utilization of forecasting products and tools, with a focus on leveraging ensemble forecasting and advanced technologies like AI and ML. Participants identified key gaps in existing forecast tools, noting issues with accuracy, reliability, and user-friendliness, particularly during extreme weather events. The discussion highlighted the potential of ensemble forecasting. These technologies can analyse vast datasets to uncover patterns and deliver more personalized, location-specific forecasts, such as predicting storm intensification or refining climate models. However, challenges related to data accessibility, interoperability, and standardization were noted, emphasizing the need for improved data sharing and integration protocols. Training and capacity building emerged as crucial elements for maximizing the effectiveness of advanced tools. Comprehensive training programs for both forecasters and end-users were highlighted as necessary to enhance proficiency and ensure the effective use of new technologies.

Strategies were proposed to strengthen and sustain the FForum by improving content quality, exploring extended discussion formats, and enhancing engagement through standardized presentations and structured feedback mechanisms. The session also focused on integrating the outcomes from the weekly FForum into the IBF process. Participants discussed ways to make weekly bulletins more actionable and user-friendly, incorporating localized impact assessments and scenario-based forecasts. Enhanced collaboration between operational forecasters and IBF Working Group members was emphasized to ensure that bulletins reflect the latest insights and effectively support decision-making. The session underscored the importance of adopting advanced technologies, improving data management, and trainings to address existing gaps and enhance forecasting practices. The proposed strategies aim to sustain the relevance and effectiveness of the FForum and improve the integration of forecast outcomes into the IBF process (outcome report in annex 1 and detailed discussion highlight in annex 2).

4: Participants and experts engaged in discussion on existing gaps in utilizing existing forecast products and tools.

Outputs:

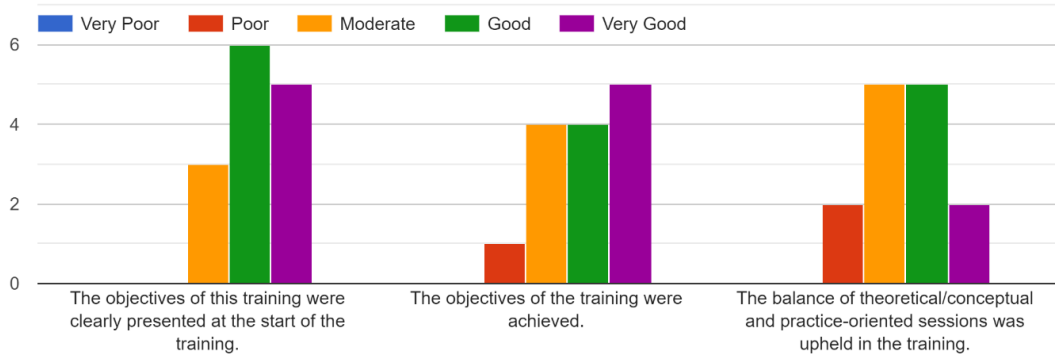
- Participants agreed on the importance of integrating ensemble forecasting techniques to improve accuracy and reliability in weather predictions. The use of multiple simulations to provide probabilistic insights was endorsed as a method to better quantify uncertainties and support decision-making.
- The session highlighted the need to incorporate AI and ML technologies to analyse large datasets more effectively and generate personalized, location-specific forecasts. The development and deployment of these technologies were identified as critical for refining climate models and improving forecast precision.
- A consensus emerged on the need for standardized data formats and improved data sharing protocols to address challenges related to data accessibility and interoperability. This will facilitate better integration of forecasting tools and enhance the overall utility of forecast data.
- Participants emphasized the necessity of comprehensive training programs for both forecasters and end-users to maximize the effectiveness of advanced forecasting tools. Enhanced training is essential to ensure that users can effectively interpret and utilize new technologies.
- Strategies were proposed to make weekly forecast bulletins more actionable by incorporating localized impact assessments and scenario-based forecasts. Improved collaboration between operational forecasters and IBF WG members was outlined to ensure that the bulletins are up-to-date and effectively support IBF.

OUTCOMES

Knowledge, Skills, and Abilities (KSA) findings

The KSA findings post training indicate a significant advancement in participants' expertise across various aspects of weather forecasting. Participants reported a notable increase in their understanding of the application of AI and ML in weather forecasting. The training successfully enhanced their knowledge of these technologies, illustrating their potential to improve forecast accuracy and operational efficiency. Additionally, there was a substantial improvement in understanding forecasting and monitoring practices for extreme and high-impact weather events, which are critical for timely and accurate weather warnings. Participants also acquired valuable insights into techniques for medium and extended-range weather forecasting, bolstering their ability to predict long-term weather patterns. The training further advanced participants' capabilities in detecting and predicting extreme weather events and utilizing OSF products, including those for tropical cyclone prediction. The improved understanding and application of ensemble data were also highlighted, emphasizing its role in enhancing forecast accuracy.

In terms of skills, the training's practical components were instrumental in developing participants' abilities to effectively apply forecasting tools and techniques. Participants reported improved proficiency in integrating new forecasting methods into their daily operational workflows. The interactive elements of the training facilitated the development of skills crucial for accurate weather prediction and operational integration. Participants felt more equipped to utilize advanced forecasting products and methods, translating their theoretical knowledge into actionable skills. Regarding abilities, the training enhanced participants' capacity to integrate new forecasting techniques and technologies within their operational contexts. They anticipated being better at collaborating with regional forecasting centers and sharing information across agencies, which is essential for improving forecasting accuracy and coordination. Participants also demonstrated a greater ability to adapt new approaches and advocate for the adoption of innovative forecasting tools and methods.



5: Participants' overall assessment of the training's alignment and structure

Learning:

- Participants gained substantial knowledge about the integration and application of AI and ML in weather forecasting.
- They developed a deeper understanding of techniques for forecasting extreme and high-impact weather events.
- Skills were notably improved in utilizing and interpreting new forecasting products and tools.
- Participants developed understanding on application of ensemble data to improve forecast accuracy and integrated forecast data into operational bulletins.
- Improved abilities in collaborating with regional forecasting centers and sharing forecasting information.
- Enhanced confidence in advocating for and adopting innovative forecasting methods within their organizations.

Training Gaps:

- Greater emphasis on practical, hands-on training sessions is needed to reinforce theoretical knowledge and improve application skills.
- More in-depth training on specific tools and techniques, particularly regarding AI and ML applications, would benefit participants.
- Training should include more case studies and examples relevant to participants' local contexts to better address regional forecasting challenges.
- Longer training sessions or multiple phases of training could provide more comprehensive coverage of advanced topics and facilitate deeper learning.
- Incorporating insights and experiences from local meteorological departments and experts could enhance the relevance and applicability of the training.
- Future training should focus on improving the integration of new forecasting technologies into existing workflows and operational plan

FEEDBACK

- Participants generally rated their satisfaction with the training as "very good." They appreciated the alignment between the training objectives and the content provided, indicating that the training successfully met their expectations and enhanced their knowledge and skills.
- The training effectively improved participants' understanding of advanced forecasting techniques, including AI and ML in weather forecasting.
- Participants also reported a deeper comprehension of ensemble data usage for forecast accuracy, forecasting extreme weather events, and medium to extended-range forecasting.
- Areas for Improvement:
    - More hands-on training to apply theoretical concepts effectively.

  - Additional advanced material, particularly related to AI and ML technologies.
  - Interactive elements and engagement opportunities with trainers and peers to facilitate better knowledge exchange.
- The training was praised for its well-structured format and balanced approach. However, some feedback suggested improvements in time management and a more focused approach to cover essential topics in greater depth.
- The competence of trainers was highly regarded, though additional guest speakers or case studies were suggested to further enrich the training experience.

RECOMMENDATIONS:

Delivery:

- Integrate more interactive and practical sessions into the training plan. This will enable participants to engage directly with advanced forecasting techniques such as AI and ML, enhancing their ability to apply these methods effectively in real-world scenarios.
- Ensure that the training content is directly applicable to participants' daily forecasting tasks. Incorporate more case studies, simulations, and real-life scenarios to bridge the gap between theory and practice.
- Consider extending the training sessions to provide additional time for in-depth exploration of complex topics and hands-on practice. This will help address the concerns about time limitations and allow for a more comprehensive learning experience.

Usefulness:

- Deepen the focus on emerging technologies, particularly AI and ML. Provide detailed sessions on these topics to cater to varying levels of expertise and interest among participants, ensuring they gain practical knowledge relevant to their work.
- Integrate a wider range of case studies and examples from different regions to illustrate the practical application of forecasting tools and techniques. This will enhance the training's relevance and help participants understand diverse forecasting challenges and solutions.
- Tailor the training to address specific needs identified through pre-training assessments. Focus on filling knowledge gaps and addressing the unique challenges faced by participants in their respective roles.

Next Steps:

- Schedule follow-up workshops to reinforce learning and address new developments in forecasting technologies. This will help participants stay current and continue to build on their newly acquired skills.

- Create opportunities for participants to connect with experts and peers through forums, discussion groups, and collaborative projects. This will foster knowledge sharing and enhance collaborative efforts in forecasting.
- Continuously gather feedback from participants to improve future training sessions. Use this feedback to adjust content, delivery methods, and focus areas, ensuring that the training remains relevant and effective in meeting participants' needs.

ANNEX 1: OUTCOME REPORT

Venue & Date: DoubleTree by Hilton Sukhumvit, Bangkok, Thailand, 29-30 July 2024

OUTCOME REPORT

The Regional Training Workshop for the South Asia Hydromet Forum (SAHF) Forecasters' Forum (FForum) Expanded Service Support was held during 29-30 July 2024 in Bangkok, Thailand. This workshop, supported by experts from the National Centre for Medium Range Weather Forecasting (NCMRWF), the Indian National Centre for Ocean Information Services (INCOIS), and the Regional Integrated Multi-Hazard Early Warning System (RIMES), aimed to enhance forecasting capabilities and foster collaboration among SAHF member states. Participants included operational forecasters and SAHF Impact-Based Forecasting (IBF) Working Group members.

KEY DISCUSSIONS

FForum Content and Format:

- Standardized reporting template for weather observed and forecasts to be developed to ensure consistency in reporting by member states. This will also help in comparing the reports from different member states.
- Align and enhance FForum discussions to extreme weather events and their impacts Whenever severe weather event is experienced, a session to share the experiences related to prediction and monitoring may be organized.
- Participants recommended sharing recorded discussions and notes from each FForum session in addition to discussion summary for benefit of more forecasters who could not participate in weekly sessions.
- An extended session to be organized every month dedicated to review model performance used by SAHF members for extreme weather forecasting.
- Analysis of satellite images need to be integrated in weekly discussions .
- In-depth discussions on specific topics to be conducted during some specific weeks based on availability of forecasters and experts.
- FForum weekly sessions should be limited to operational forecasters and meteorologists to ensure relevance and specific focus of the forum.

Interpretation and Verification of NWP Products:

- Specialized training programs are required to enhance forecast interpretation and verification skills.
- Access to graphical and digital NWP products from NCMRWF will be provided through SAHF and NCMRWF collaboration.
- A lecture series focusing on forecasting tools and techniques, including the High-Resolution Rapid Refresh (HRRR) model and the Common Alert Platform (CAP),to be introduced.

- Periodic face-to-face meetings, in addition to virtual interactions, was emphasized to enhance engagement and coordination.
- Heatwave and heat index criteria specific to SA need to be defined, considering regional variations. This will support forecasters to issue heatwave alerts.
- A proactive approach to impending extreme weather events is essential for improving preparedness and response. Priority be given to NWP products that are adequately validated over South Asian region and of practical value to operational forecasters.
- Capacity-building initiatives are required to effectively utilize AI and machine learning (ML) based forecast tools and products.
- End-of-season reports on weather hazards and predictions to be prepared by FForum participants for the region.

RECOMMENDATIONS

- Introduce a standardized template for weekly country presentations to ensure consistency and clarity, including assessments of IBFs, if any
- Conduct detailed discussions on one extreme weather event experienced in the region each month.
- Provide early guidance on impending extreme weather events to enhance preparedness.
- Share recordings of FForum weekly sessions with participants to facilitate review and knowledge retention.
- Organize extended sessions once a month for in-depth discussions on critical topics.
- Focus discussions on seasonal weather parameters to align forecasts with current conditions.
- Specialized training for forecasters, focusing on interpreting model outputs, evaluating all available observations, and verifying forecast models in a local context.
- Comprehensive guidance document to compile best practices, address common challenges, and provide practical solutions related to the implementation and customization of forecasting models.
- Facilitate periodic sharing of experiences from operational forecasters.
- Prepare and review end-of-season reports and outlooks through FForum to enhance planning and forecasting.
- Provide expert support to countries in predicting and monitoring potential impending weather extremes.

ANNEX 2: DISCUSSION HIGHLIGHTS

Roundtable Discussion on the Interpretation and Use of NCMRWF Products:

Key Points Discussed:

- Participants emphasized the importance of identifying models that are well-suited for their specific regions. This is crucial as different areas have unique climatic and geographical features that influence the accuracy of weather predictions.
- The discussion highlighted the need to integrate various data sources, including local synoptic data and model outputs to develop a comprehensive understanding of weather patterns.
- Forecaster's experience in interpreting model outputs in local conditions is most important part of forecasting. Training of newly recruited forecasters by experienced forecasters and professionals who understands local climate is very important. .
- Absence of radar data in some regions is a significant challenge to validate model predictions especially in events like heavy rainfall.
- Participants shared instances of extreme weather events, such as continuous lightning storms, which were unprecedented for the region. These cases highlighted the challenges faced when models do not fully capture such events and need to identify the models which can give reliable forecast for extreme events.
- Forecasters experience of issuing warnings and communication with the public during extreme weather events were also discussed. This highlights that understanding of local climatology and experience of forecasters becomes very important in the absence of data and when models do not provide clear signals.
- There was a consensus on the need for data sharing through DataEx, and also for more widespread radar coverage. Integration of observed and radar data will help to improve the accuracy of NCMRWF products in the region.
- Roundtable concluded with discussions on the importance of training for forecasters, particularly in interpreting model outputs, evaluating all available observations, and verification of forecast models in local context. This needs to be conducted considering one extreme event in recent past in each of the SAHF member countries. Also, this training will serve as knowledge sharing on how forecasters in different countries are handling complex weather events to build collective expertise.

Roundtable Discussion on the Interpretation and Use of Ocean State Forecast (OSF) Products

Key Points Discussed:

- The session highlighted the importance of marine forecasting tools such as the OSF, which provides vital information on ocean conditions, including tsunami alerts, storm surge predictions, and coral bleaching alerts.
- The discussion underscored the need for accurate and timely marine forecasts, particularly in regions prone to natural disasters or those heavily dependent on marine resources. Participants agreed that the integration of such tools into regional planning and decision-making processes is crucial for enhancing safety and sustainability.
- There is a need for clear guidance and best practices in the use of OSF products.
- In terms of evaluation of data used in forecasting models, it is crucial to assess the quality, relevance, and usability of the data it relies on.
- Participants shared their experiences, highlighting the lessons learned from past efforts to apply OSF products in various regions. The value of learning from both successful and unsuccessful implementations of forecasting models was a key point of discussion.
- The session emphasized the importance of creating a platform for sharing these experiences, allowing users to benefit from the collective knowledge and avoid repeating mistakes. Such a platform could also facilitate the exchange of innovative solutions and best practices, fostering continuous improvement in the use of OSF products.
- A follow-up action from training on OSF (held in May 2024 in INCOIS Hyderabad) and active role from SAHF coastal countries will help in customizing OSF products. INCOIS extended all possible support required.

General discussion on challenges associated with forecasting

- Participants discussed the importance of improving the accuracy of ocean state forecasts by leveraging region-specific data and models. Several attendees highlighted that while general forecasting models can provide broad insights, region-specific OSF tools are essential to account for local oceanographic conditions like coastal currents, sea surface temperature variations, and seasonal marine events.
- The main discussion topic was how different countries and regions select and use forecasting models. Discussion indicated that mostly countries rely on a trial-and-error approach to model selection, leading to inconsistencies in the effectiveness of forecasts. A systematic verification of models in required in all SAHF member countries.
- Another challenge discussed was that a single forecasting model cannot be universally applied across diverse geographical and environmental contexts. Dr. Ajay and other participants emphasized the need for region-specific customization of these models to address local needs more effectively.
- The group discussed the difficulties in choosing the single model for a specific area, considering that environmental factors, data availability, and priorities can

significantly differ. It is important to identify the models suitable for different contexts.

- Participants discussed the risks associated with using models which lacks observation data and can lead to inaccurate predictions. They highlighted the importance of establishing a rigorous data evaluation protocol to ensure that the data driving forecasts is reliable and applicable to the specific region and context.
- The group also discussed the challenges associated with data collection and management, many regions struggle with limited data availability and access to up-to-date information. Data sharing policies of countries also limit data sharing. SAHF can facilitate the data sharing process for its member countries and modelling centres.
- The group recommended the creation of a comprehensive guidance document that would compile best practices, common challenges, and practical solutions. This document would serve as a valuable resource for users, helping them navigate the complexities of model implementation and customization.
- The guidance would also address the importance of region-specific customization, and the steps required to evaluate and select the most appropriate models for different contexts.

Discussions to Identify Gaps in Utilization of Existing Forecasts Products and Tools Including the Use of Ensemble Data to Improve the Forecast Processes and New Tools (AI, ML, etc.) and Products to be Adopted to Support Operational Forecasting

Key Points Discussed:

- Participants discussed the strengths and weaknesses of current forecast products. There was a consensus that while existing tools are useful, they often fall short in terms of accuracy and reliability, especially under extreme weather conditions.
- The importance of user-friendly interfaces and accessibility of forecast data was emphasized. Many participants pointed out that complex data formats and lack of training hinder effective utilization.
- The discussion highlighted the potential of ensemble data in providing more accurate and reliable forecasts. Ensemble forecasting can help quantify uncertainties and provide a probabilistic approach to forecasting.
- Participants shared examples of successful implementation of ensemble data in operational forecasting and how it has improved decision-making in various sectors, such as disaster management and maritime operations.
    - Sri Lanka highlighted the use of ensemble data in disaster management, particularly for anticipating and managing tropical cyclones and heavy rainfall, which improved preparedness and response in sectors like fisheries and agriculture

    - Nepal uses ensemble data to enhance flood prediction and collaborated with disaster management agencies. The integration of ensemble forecasts helped improve decision-making, particularly in monsoon season

- There was significant interest in the adoption of AI and ML to enhance forecast processes. Participants discussed how these technologies could analyse large datasets more efficiently and identify patterns that traditional methods might miss.
- AI and ML were noted as tools that could provide more personalized and location-specific forecasts, which are crucial for timely and accurate decision-making. Examples included using AI to predict storm intensification and ML algorithms to refine climate models.
- Data accessibility and interoperability were major concerns. Participants pointed out that data often exists in silos, making it difficult to integrate and use effectively.
- The need for standardized data formats and protocols to facilitate easier sharing and integration of data from different sources was emphasized.
- Another significant challenge discussed was the lack of training and capacity building. Participants noted that even when advanced tools are available, their effective use is often limited by a lack of user expertise.
- The discussion also focused on the development of new tools and products that can integrate seamlessly with existing systems. There was a call for tools that are more adaptive and can evolve with changing needs and technologies.
- Participants expressed the need for forecasting products that are not only accurate but also timely and actionable. Real-time data updates and alerts were highlighted as crucial features for operational forecasting.

Discussion Between Operational Forecasters and IBF WG Members to Enhance the Weekly Forecast Bulletins to Integrate Weekly FForum into the IBF Process

Key Points Discussed:

- Participants reviewed the current format and content of weekly forecast bulletins, identifying strengths and areas for improvement. The discussion highlighted the importance of making these bulletins more actionable and user-friendly for various stakeholders.
- It was noted that while the existing bulletins provide valuable information, there is a need for better integration with the IBF process to enhance their impact on decision-making.

- The integration of the weekly FForum into the IBF process was a key focus. Participants explored how the forum, which serves as a platform for discussing upcoming weather patterns and potential impacts, could be leveraged to provide more detailed and context-specific forecasts.
- Suggestions were made to include more localized impact assessments and scenario-based forecasts in the weekly bulletins, which could help users better prepare for and respond to various weather events.
- The importance of collaboration between operational forecasters and IBF WG members was emphasized. Participants discussed ways to enhance communication and data sharing to ensure that the weekly bulletins reflect the latest insights and expertise from both groups.
- There was a consensus on the need for regular interactions and joint efforts to refine the forecasting process and address any gaps in the current system.
- Gathering feedback from end-users of the weekly bulletins was identified as crucial for continuous improvement. Participants highlighted the need for structured feedback mechanisms to understand user needs and preferences better.
- The discussion also touched on the importance of training for forecasters and end-users to ensure they can effectively interpret and utilize the information provided in the bulletins.
- The potential for technological advancements to enhance the weekly forecast bulletins was explored. Participants discussed leveraging tools such as AI and ML to analyse weather data and generate more precise and tailored forecasts.
- The need for user-friendly platforms that can disseminate the bulletins effectively and provide real-time updates was also highlighted.

Discussions to Develop a Strategy for Strengthening and Sustaining the FForum

Key Points Discussed:

- FForum contents can be refined by improving satellite image analysis and tailoring forecasting models to meet the specific needs of different regions. This will help in providing more relevant and actionable insights to forecasters.
- Participants highlighted the need for a practical guidance document for supporting operational forecasting. This document can Integrate interpretation guidelines and importance of trends in weather/climate for supporting forecasters to make decisions in complex weather situations.

- Training sessions on critical topics such as high-impact weather to deepen participants' understanding and equip them with the skills necessary to better manage extreme weather events.
- There was a strong interest in exploring extended session formats to allow for more comprehensive discussions. This approach would provide participants with the time needed to delve deeper into complex topics and ensure thorough coverage of relevant issues.
- Feedback suggested the need to reassess and optimize the timing of weekly sessions to align better with participants' schedules, ensuring maximum attendance and engagement.
- The idea of developing standardized templates for country presentations was discussed, aimed at ensuring consistency and facilitating easier comparison of data and insights across regions.
- The discussion also touched on the benefit of narrowing the focus to the 2-3 most relevant forecasting models during sessions. This would help maintain focus and deepen participants' understanding of the most critical tools.
- The forum recognized the need to encourage more active participation through established communication channels, such as WhatsApp, to create a more dynamic and collaborative environment.
- Integrating NWP products into operational forecasting was highlighted as a key area of focus, bridging the gap between theoretical models and practical applications.

ANNEX 3: TRAINING NOTE AND AGENDA

REGIONAL TRAINING WORKSHOP FOR SAHF FORECASTERS' FORUM (FFORUM) EXPANDED SERVICE SUPPORT

Venue & Date: Bangkok, Thailand, 29-30 July 2024

CONCEPT NOTE

Background

To enhance coordination in managing extreme weather-triggered disasters in the region, it is crucial for the National Meteorological and Hydrological Services (NMHSs) in South Asia to work closely together. The South Asia Hydromet Forum (SAHF) facilitates regional collaboration among its member countries: Afghanistan, Bangladesh, Bhutan, India, Maldives, Myanmar, Nepal, Pakistan, and Sri Lanka.

The Forecasters' Forum (FForum) was established on February 17, 2022, under the SAHF umbrella, with the aim of leveraging regional knowledge sharing to improve operational forecasting and service delivery. The Forecasters' Forum convenes weather forecasters from the NMHSs of SAHF countries on a weekly basis to sustain dialogue and share the latest forecasts on extreme weather events, emerging technologies, and innovative ideas. The FForum has the following objectives:

- **Communicate and discuss forecasts:** Review and discuss weather and climate forecasts for the upcoming days and weeks, including uncertainties and limitations.
- **Evaluate models and forecast skills**: Assess the performance of forecasting models and improve forecast accuracy.
- **Share innovations**: Exchange new ideas and technologies to enhance weather and climate forecasting.
- **Improve regional communication**: Enhance mechanisms for sharing forecast information about impending extreme weather events among NMHSs.
- **Enhance dissemination:** Develop better strategies for disseminating forecast information to relevant sectors and the public.

Since its inception, the forum has conducted 119 regular weekly sessions, along with three special sessions focused on extreme events such as tropical cyclones, and special lecture series on the South Asian monsoon seasons of 2022 and 2023. The forum has had a significant impact on operational forecasters, enhancing their daily weather forecasts, extreme weather predictions, and monitoring capabilities. This impact was well-articulated by the NMHSs in the annual assessment of the forum. Moreover, the forum has further enhanced collaboration and communication among NMHSs through the Forecasters' Forum's WhatsApp group and the SAHF Knowledge Hub, facilitating regular and effective information sharing.

To strengthen the momentum of the FForum, enhance networking among forecasters of the SAHF NMHSs, and discuss emerging technologies and products in weather forecasting and extreme event monitoring, a regional workshop for the SAHF FForum has been envisaged.

Objectives of the training workshop

The workshop titled ***"Regional Training Workshop for SAHF Forecasters' Forum (FForum) Expanded Service Support"*** is scheduled to take place from 29-30 July 2024 in Bangkok, Thailand. The workshop will be technically guided by experts from the National Centre for Medium Range Weather Forecasting (NCMRWF), the Indian National Centre for Ocean Information Services (INCOIS), India and the Regional Integrated Multi-Hazard Early Warning System (RIMES). Additional international experts will be invited for specific sessions based on need and relevance.

- The primary objective of the workshop is to enhance networking among the operational forecasters of SAHF NMHSs, and to discuss and share knowledge and skills related to emerging technologies and products for extreme weather forecasting, warnings, and impact monitoring. The specific objectives of the workshop are:
- Training in accessing and interpreting forecast products using advanced technologies such as Artificial Intelligence (AI) and Machine Learning (ML) tools, and high-resolution, skilful products from international centers.
- Learning from each other about the existing capabilities and technologies of the NMHSs and share experiences and best practices.
- Enhancing the networking between NMHSs and improve the sense of ownership of the FForum's among the member countries.
- Case-study discussions of specific extreme weather events that occurred in the region

Expected outcomes of the workshop

The expected outcomes of the workshop are:

- Introduce new products and tools and identify emerging technologies relevant for the South Asia region.
- Appreciate the use of new regional and global products for extreme weather forecasting and monitoring.
- Develop a strategy to strengthen and sustain the Forecasters' Forum beyond the SAHF phase.

Workshop Agenda

DAY 1: 29 JULY		
Programme	**Time**	**Presenter/ Moderator (s)**
Registration	9:00-9:15	Coordinated by the RIMES team
Welcome Remarks	9:15-9:20	RIMES
Introduction of participants	9:20-9:30	Moderated by MC (Ms. Kousalya V Kumar, Training Coordinator, RIMES)
SAHF Forum-Updates and Review	9:30-9:40	RIMES

Technical Session I: Review of forecasting products and country experiences **Session Chair: Dr. G. Srinivasan, Adjunct Faculty, AIT**		
Forecast products and information used in the FForum including the introduction of AI and ML forecast products	9:40-10:30	Dr. K. J. Ramesh, Adviser- Climate and Weather Service, RIMES
10:30-11:00 (Coffee Break and Photo Session)		
Country presentations-sharing experiences and best practices in forecasting and monitoring extreme and high-impact events. - *Afghanistan* - *Bangladesh* - *Bhutan* - *India* - *Maldives* - *Myanmar* - *Nepal* - *Pakistan* - *Sri Lanka*	11:00-13:00	Moderated by session chair
13:00-14:00 (Lunch Break)		
Roundtable discussion on the existing products used by the NMHS, gaps and requirements	14:00-15:00	Moderators: Dr. Satya Kumar and Dr. Srinivasan
Existing and emerging products for medium and extended range forecasts, and detecting extreme events	15:00-15:45	Dr. Mohan Sc-E, NCMRWF, India
15:45-16:00 (Coffee Break)		
Roundtable discussion on the interpretation and use of NCMRWF products	16:00-17:00	Moderators: Dr. Mohan and RIMES team
DAY 2: 30 JULY		
Session II: Review of forecasting products and country experiences **Session Chair: Dr. Satya Kumar, Director-In-Charge (Retd), IMD**		
Recap of Day 1	9:00-9:10	Country Representative
Roundtable discussion on the existing products including medium and extended range products used by the NMHS, existing gaps and requirements.	9:10-10:30	Moderators: Dr. Srinivasan and Dr. Satya Kumar
10:30-11:00 (Coffee Break)		
Presentation and discussion of group discussion outcomes	11:00-11:40	Group Representatives

Ocean state forecast products and detect extremes and potential areas of tropical cyclones	11:40-12:25	Dr. Ajay Kumar, INCOIS
Open discussion on the coastal zone and ocean related products and warning; existing mechanisms and further requirements.	12:25-13:00	Moderators: Dr. Ajay Kumar and Dr. Mohan
13:00-14:00 (Lunch Break)		
Round table discussion on existing gaps in utilizing existing forecast products and tools; use of ensemble products and new tools, AI, ML etc. to improve the forecasts; strategy for strengthening and sustaining the FForum; strategy to integrate outcomes from weekly FForum into IBF process	14:00-15:30	Moderators: Dr. Anshul/Tshencho
15:30-16:00 (Coffee Break)		
Feedback from discussion	16:00-16:30	RIMES
Assessment of the FForum and evaluation of the training workshop	16:30-16:45	Ms. Kousalya V Kumar
Closing Remarks	16:45-17:00	Countries, RIMES, WB

ANNEX 4: PARTICIPANTS LIST

S No.	Name	Designation	Organization	Gender
1	Azeema Ahmed	Assistant Meteorologist	MMS, Maldives	Male
2	Chaw Su Hlaing	Staff Officer	Department of Meteorology and Hydrology	Female
3	Fawad Auobi	Head of Forecast	Afghanistan Meteorological Department	Male
4	Imran Ahmad Siddiqui	Meteorologist	NWFC, Islamabad	Male
5	J. W. Karunaratne	Meteorologist In charge, Katunayake Airport	DoM, Sri Lanka	Male
6	Khurram Shahzad	Deputy Secretary	Ministry of Aviation, Islamabad	Male
7	M. M. P. Mendis	Deputy Director Forecasting	DoM, Sri Lanka	Male
8	Manorama Mohanty	Sc-F	MC Bhubaneshwar, IMD, India	Female
9	Mohammad Khalid Halim	Weather Forecast General Manager	Afghanistan Meteorological Department	Male
10	Mohammad Mustafa Zadran	Manager of Early Warning	Afghanistan Meteorological Department	Male
11	P.H.C De Silva	Meteorologist In charge, National Meteorological Centre	DoM, Sri Lanka	Male
12	Pratibha Manandhar	Senior Divisional Meteorologist	Department of Hydrology and Meteorology, Nepal	Female
13	Raju Dhar Pradhananga	Senior Divisional Meteorologist	Department of Hydrology & Meteorology, Nepal	Male
14	Shanti Kandel	Senior Divisional Meteorologist	Department of Hydrology and Meteorology, Nepal	Female
15	Sheshakumar Goroshi	Sc-E/DGM	IMD, India	Male

16	Shwe Yee New	Staff Officer	Department of Meteorology and Hydrology	Female
17	Tin Mar Htay	Deputy Director	Department of Meteorology and Hydrology	Female
18	Zaheer Ahmad Babar	Director	NWFC Islamabad	Male

ANNEX 5: GROUP DISCUSSION GUIDELINES

REGIONAL TRAINING WORKSHOP FOR SAHF FORECASTERS' (FFORUM) EXPANDED SERVICE SUPPORT

GROUP DISCUSSION I

EXISTING PRODUCTS USED, GAPS AND REQUIREMENTS

Temperature Extremes [focus of heat]

***<u>Within your Groups list top five</u>* –**

1. **Products that you/your forecasters' teams use regularly.**

   [*3-day, 10-day NWP forecasts from LAMs like WRF or Global Forecasts models, what variables you look at, observational data analysis used, any remotely sensed monitoring products; derived indices; extended range of products*]

2. **Resources that you access.**

   [*internal – within the NMHSs, Regional – like ASMC, BIMSTEC-NCMRWF, RIMES and others, global forecasting Centers – list top 5 that you regularly access and use*]

3. Steps followed for issuing temperature.

   [*Stepwise list of actions and checks before preparing an operational temperature extreme forecast, also indicate local time when first forecast is generated and update schedules*]

4. **Gaps and requirements**

   [*wish list of five products or support actions required to improve towards operational forecasts for extreme heat days, trainings etc.*]

HEAVY RAINFALL/DRY SPELL WARNINGS

1. **Products that you/your forecasters' teams use regularly.**

   [*3-day, 10-day NWP forecasts from LAMs like WRF or Global Forecasts models, what variables you look at, observational data analysis used, any remotely sensed monitoring products; derived indices; extended range of products*]

2. **Resources that you access.**

   [*internal – within the NMHSs, Regional – like ASMC, BIMSTEC-NCMRWF, RIMES and others, global forecasting Centers – list top 5 that you regularly access and use*]

3. **Steps followed for issuing temperature.**

   [*Stepwise list of actions and checks before preparing an operational heavy rainfall forecasts, also indicate local time when first forecast is generated and update schedules*]

4. **Gaps and requirements**

[*wish list of five products or support actions required to improve towards operational forecasts for rainfall and linked, trainings etc.*]

GROUP DISCUSSION II

COASTAL ZONE AND OCEANIC RELATED WARNINGS

1. **Products that you/your forecasters' teams use regularly.**

   [*Ocean/coastal Forecasts model, what variables you look at, observational data analysis used, any remotely sensed monitoring products, derived products]*

2. **Resources that you access.**

   [*internal – within the NMHSs, Regional – like INCOIS and others, global forecasting Centers – list top 5 that you regularly access and use.*

3. **Steps followed for issuing temperature.**

   [*Stepwise list of actions and checks before preparing an operational ocean/coastal zone forecasts, also indicate local time when first forecast is generated and update schedules*]

4. **Gaps and requirements**

   [*Wish list of five products or support actions required to improve towards operational ocean and coastal zone forecasts, trainings etc.*]

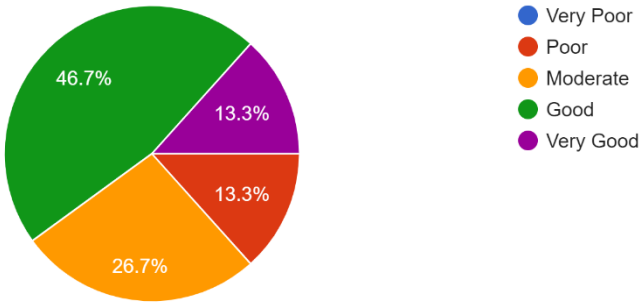
ANNEX 6: TRAINING ASSESSMENT

PRE TRAINING ASSESSMENT

Knowledge, Skills and Attitude (KAP)

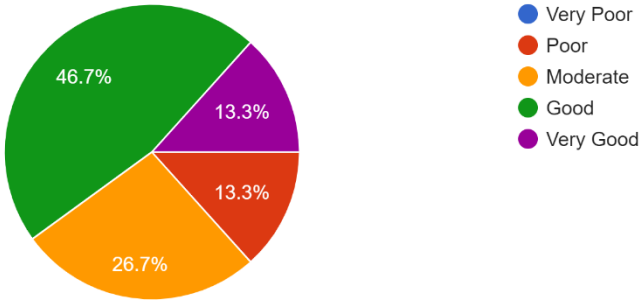
Rate your level of experience in integrating climate change considerations into your professional work.

15 responses

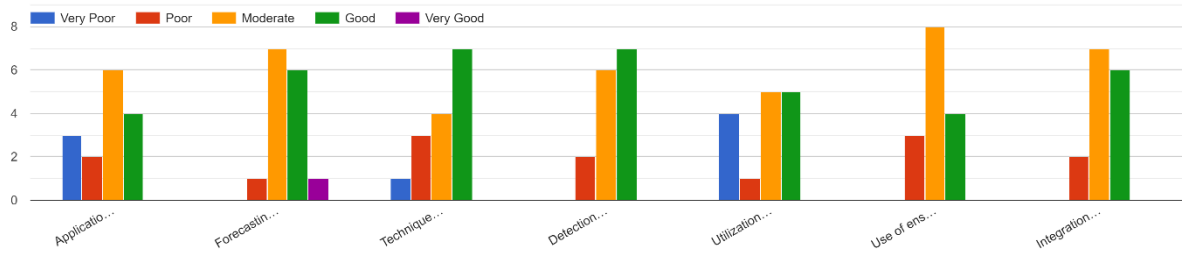


Rate your level of experience in integrating climate change considerations into your professional work.

15 responses



Rate your level of knowledge/expertise in the following areas before the training:



How can this training help you in your work?

(Please describe your expectations and what you hope to gain from this training.)

- enhance knowledge and skills in weather forecasting
- May be
- knowledge enhancement
- I am an operational forecaster, and I hope this training will be useful for me in using AI/machine learning in my operational forecasting. In addition to this, i will gain knowledge in Ensemble forecasting and medium range forecasting and forecasting of extreme events.
- Use of AI and machine learning. Experience sharing and networking
- I hope to get information, knowledge and some useful links which can apply in our weather forecasting.
- it is good for more understanding and learning new things
- I learn many things like how to use the GFS AND GSM models for forecasting >
- We shall have better understanding of various data sources and various parameters indices sources and use of AI in weather forecasting.
- How to manage local and model data in extreme weather events
- I hope to gain new system for forecast and know about the other country's how they issue Warning
- This training is very useful for me being a policy maker. This training gave me firsthand information about the challenges being faced by the forecasters. Forecasters have multiple challenges including usage of correct model, synoptic forecasting challenges, operational forecasting challenges etc. This training tried to solve the problems being faced by forecasters. I really like the presentation of Dr Mohan regarding new products and models for forecasting. Actually, the main issue being faced by all forecasters is identification of correct model in their country for maximum accuracy. In today's world due to global warming the weather patterns have changed, and forecasting is the first step to minimise the loss of human lives ,cattle's, crops etc. I really appreciate the SAHF administration for organising this event for benefit of the regional countries.
- Quantitative precipitation forecast has become a big demand from the general public nowadays. However, it has still become a big challenge as a forecaster even with the current technology. Therefore, I hope to learn how to utilize emerging technology, model products such as ensemble forecast and AI to improve forecasting skill to address user demands.
- It enhanced the application of some very useful products
- To understand the detection and prediction of extreme weather events.

What are your expectations from this training?

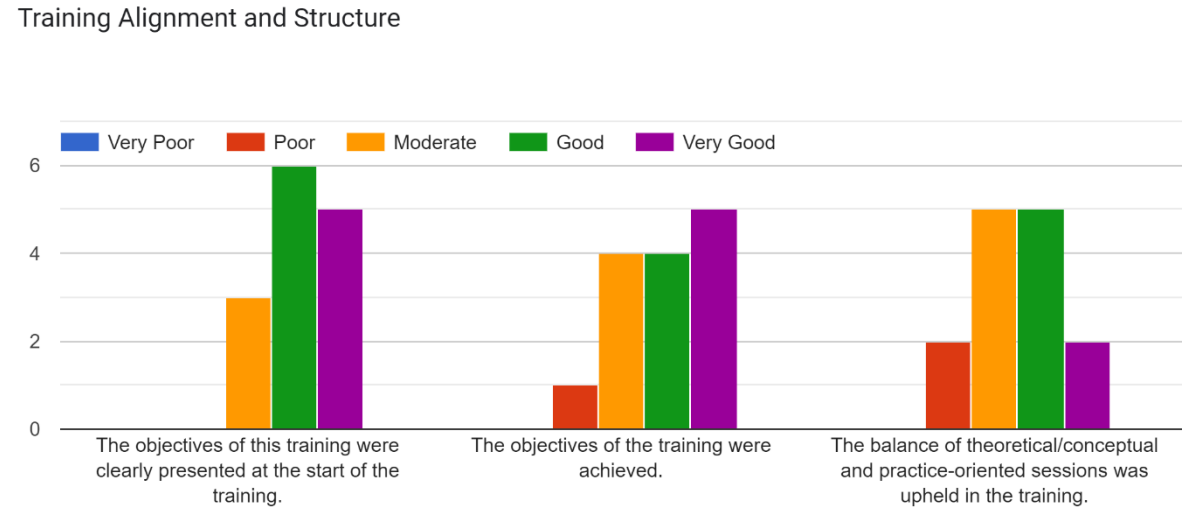
(Please share any specific topics or skills you are interested in learning more about.)

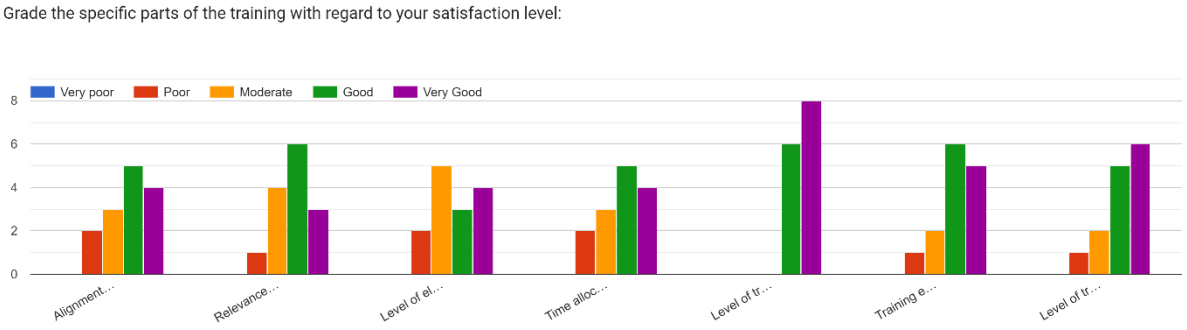
- better knowledge and understanding of for severe weather forecasting
- I hope we can catch a lot of information from this training.

- increase knowledge
- To gain knowledge on AI and Machine learning in IBF, medium range weather forecasting, Ensemble forecasting and forecasting of extreme events.
- Artificial learning and ensemble forecast
- To get accurate Products and how to apply these products for the Extreme Events
- its good shearing knowledge
- I want to learn more about using the forecast models in face to face training
- Extreme weather prediction techniques, Data integration techniques, Machine learning language and use of AI in weather forecasting.
- Share knowledge among Forecasters in the region
- The SAHF administration has tried to enhance the forecasting skills of the regional countries through this training. My expectations from the SAHF administration are to guide the regional countries regarding usage of correct forecasting Models for maximum accuracy. Every country is using the forecasting models through trial and error mechanism. There are so many forecasting models which are creating confusion regarding the selection of accurate Model. The SAHF administration can enlist top 03 best Models regarding a particular country or area on their website so that countries took maximum benefits from these models in today's changing world where Artificial intelligence is taking the control of traditional technologies. Last but not the least successful precautionary measures by different Government agencies are dependent on accurate forecasting so that minimum available resources can be utilised for maximum benefits.
- To learn how to utilize NWP products and emerging technology such as AI to improve forecasting skill.
- Expected to get information on a new data source that can be used over the Maldives area to study various climate influences, trends, and variability of monsoon.
- To get new tools and technique of detection and prediction of extreme weather events.

POST TRAINING ASSESSMENT

Knowledge, Skills and Attitude (KAP)





Among your expectations from this training, which ones were not met?

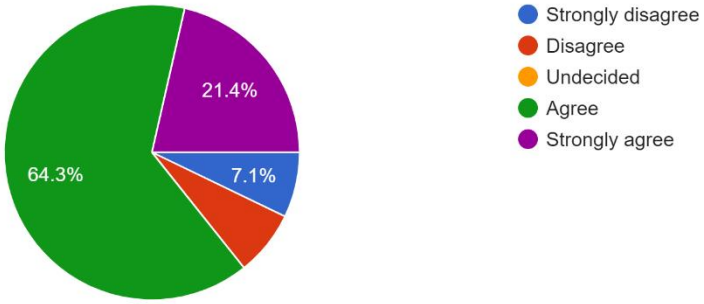
- No one
- AI and ML
- use of AI and Machine learning, very limited time of NCMRWF and IBF related presentations and discussions.
- no comments
- Everything was good .

- Almost ok, We discussed many important points to do in future.
- Although Forecasters Forum is providing an excellent opportunity for close cooperation and finding solutions regarding various issues being faced by the regional countries yet there is a need for more close cooperation for promoting successful stories in today's changing world due to global warming. Last but not the least RIMES and SAHF forum is trying it's best to improve the skills of operational forecasters in a very successful way.
- non
- Utilization of AI and ML in forecasting
- -
- It is difficult to catch up from online what discussing in the training.
- Data analysis and verification of best models on country area
- use of various Software to prepare warning maps

Relevance

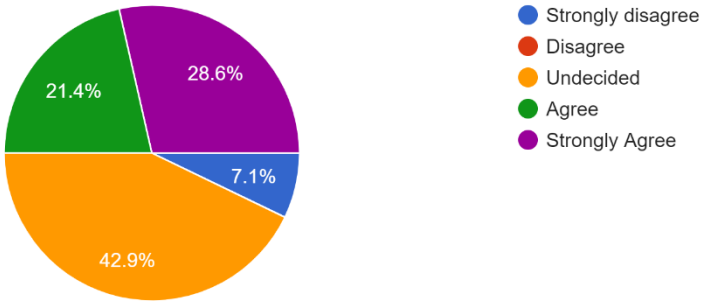
The training was designed based on the needs of the target beneficiaries.

14 responses



The training followed an inclusive and participatory approach to engage stakeholders to ensure relevance to local needs and ownership

14 responses



Comments

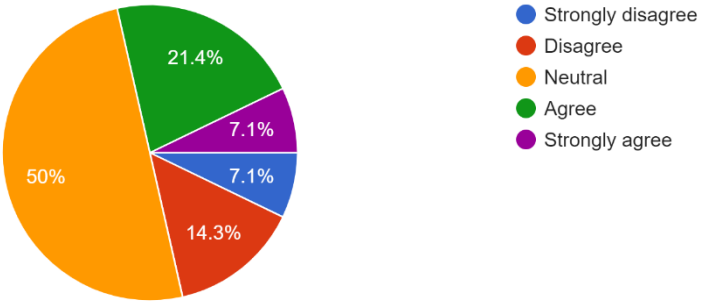
- No comments

- Nil
- Training is useful
- Overall good but due to time limitation we cannot discuss and exchange information between us as we want.
- wants more like this but face to face
- Very useful... thanks for organising. We met experts who were working in this field. Meny advice from them. Thanks RIMES. GREAT WORK
- A very comprehensive discussion is being held during this meeting. I am sure that all the participants have learnt something and improved their skills in forecasting. RIMES/SAHF being a guiding/advisory forum may guide the regional countries for maximum benefits within their limited resources by using best models and by using Artificial intelligence in forecasting. RIMES/SAHF has done it's best to improve the skills of the regional countries.
- Not much effective from online
- It was a useful training, and more country participants are needed for discussion in local context.
- more case studies from various countries for both success and failure events need to be analysed to understand the events

Coherence

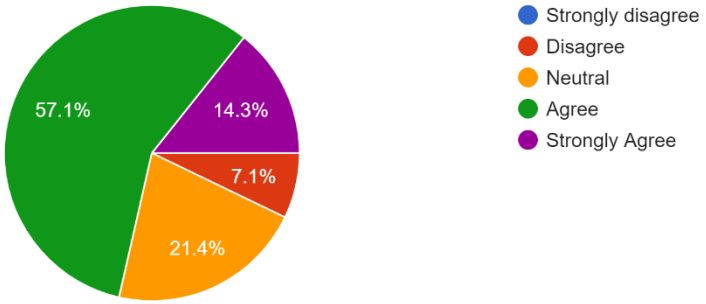
The workshop enhanced understanding of the integration of new forecasting technologies, such as AI and ML.

14 responses



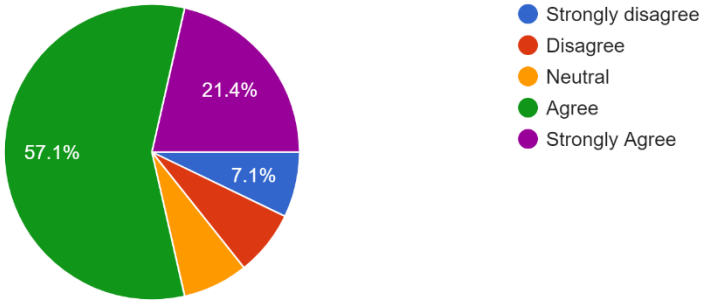
The sessions on country experiences provided valuable insights into the practical application of forecasting tools.

14 responses



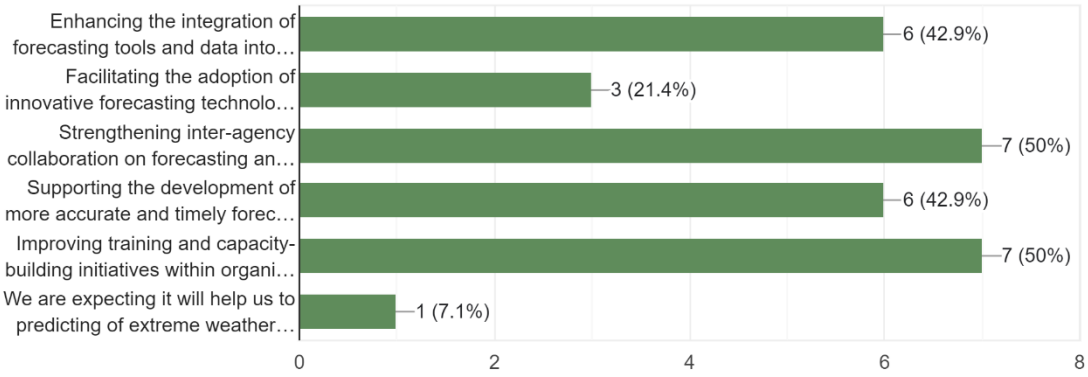
The roundtable discussions were effective in identifying regional needs and gaps in forecasting capabilities.

14 responses



Please specify how the training is complementing/contributing to other programs, projects, and activities related to forecasting and weather information application in operational plans and decisions

14 responses

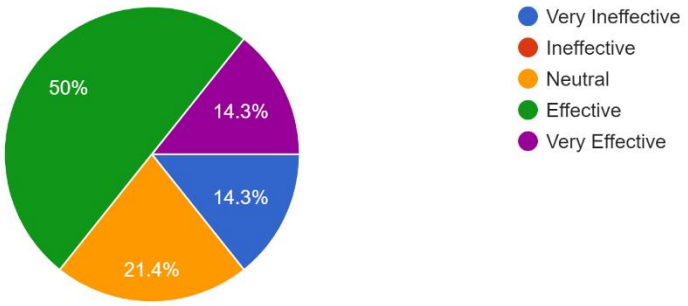


Comments10 responses

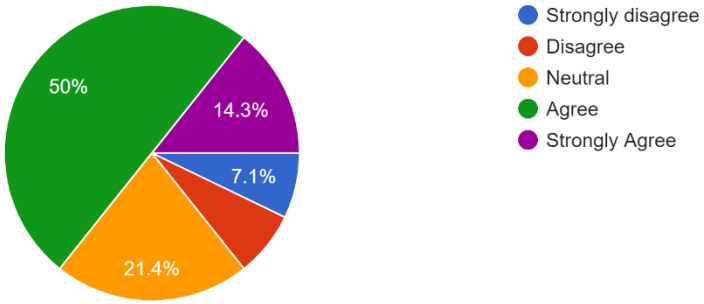
- Nil
- discussions were good to enhance some extent of extreme weather forecast preparation and dissemination processes
- if use more technique it will be better
- Got chance to discuss and make good relationships with other responsible agencies like NCMRWF
- RIMES/SAHF officials really work hard to make this training successful. The have really try their best to upgrade the capabilities of forecasters.
- non
- As Maldives data was not integrated, it cannot be that useful to analyse local conditions.
- Realtime data sharing is required

Effectiveness

How effective was the workshop in improving your skills in utilizing forecasting products and tools?
14 responses

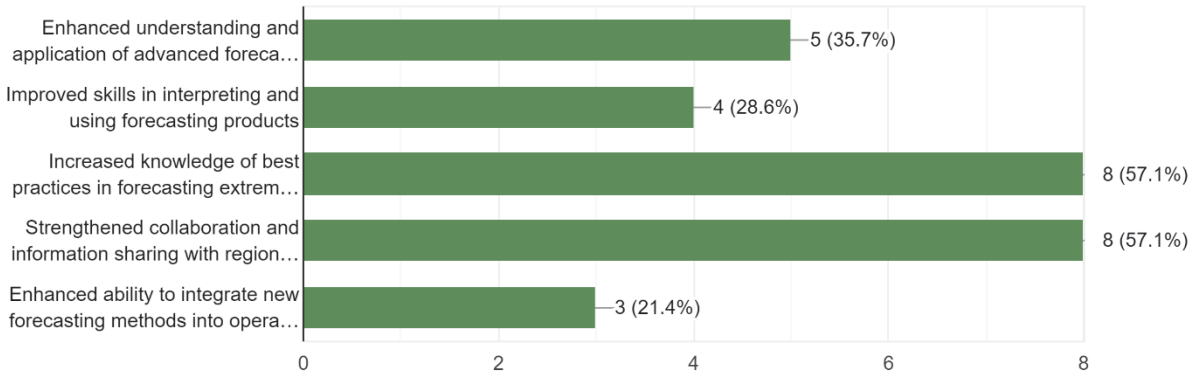


The workshop provided practical strategies for enhancing forecasting accuracy and preparedness for extreme events.
14 responses



Please identify how the training has been effective in addressing gaps in forecasting techniques and the application of new tools in your work:

14 responses



Comments

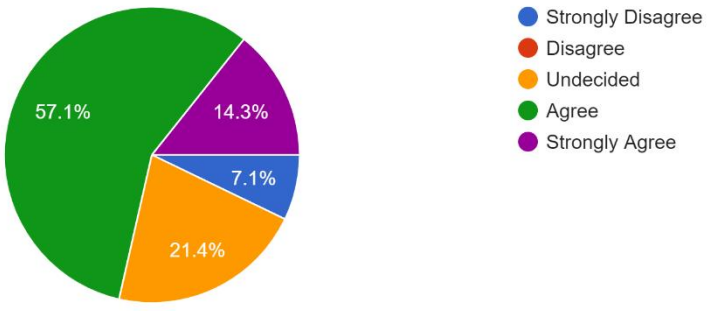
8 responses

- Nil
- no comments
- As mentioned above
- non
- .
- -
- Maldives data need to be incorporated
- Presentation of forecast before Media

Impact

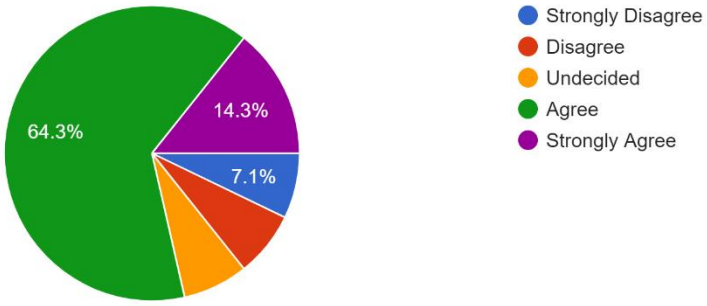
You will apply the knowledge and skills learned in your daily forecasting activities.

14 responses



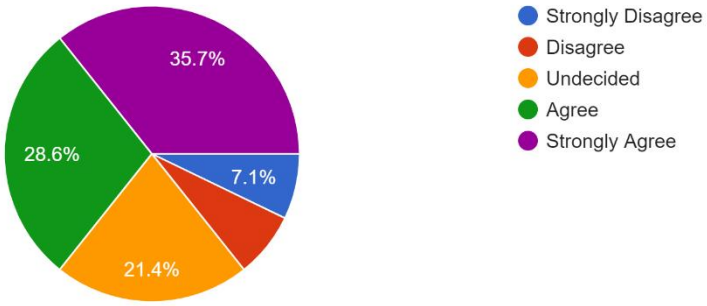
The workshop will influence your approach to forecasting and disseminating weather information.

14 responses



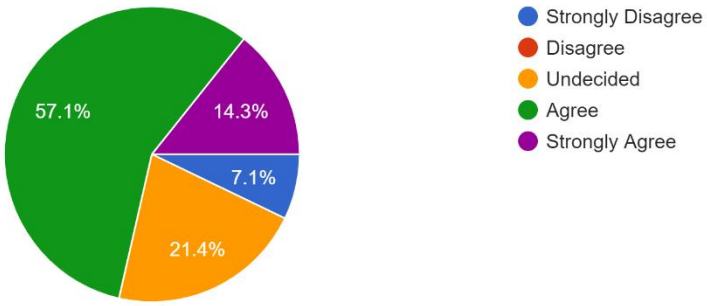
You are likely to recommend the workshop to your colleagues and other professionals in the field.

14 responses



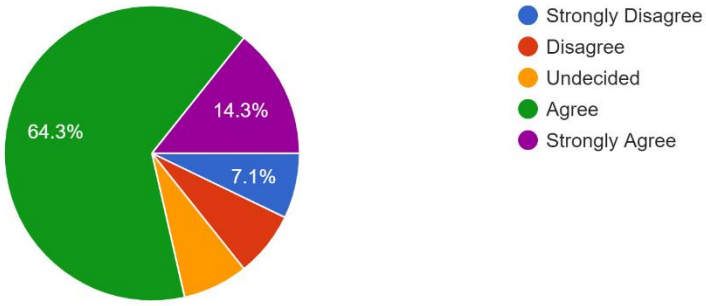
You are likely to use the training outcomes in your work.

14 responses



The training changed your mindset/ perspective on how you would do your work differently.

14 responses



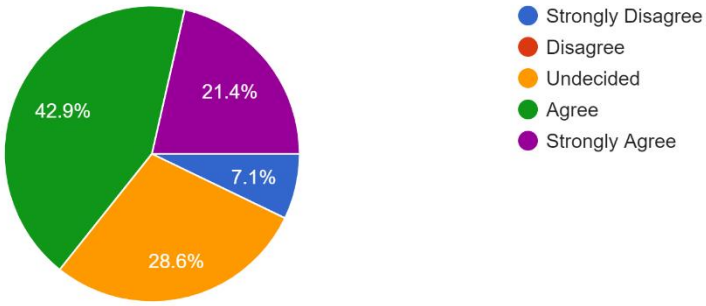
Comments6 responses

- Nil
- As mentioned above
- non
- -
- It will help to brief weather conditions to end users
- This kind of workshop enhances our knowledge

Sustainability

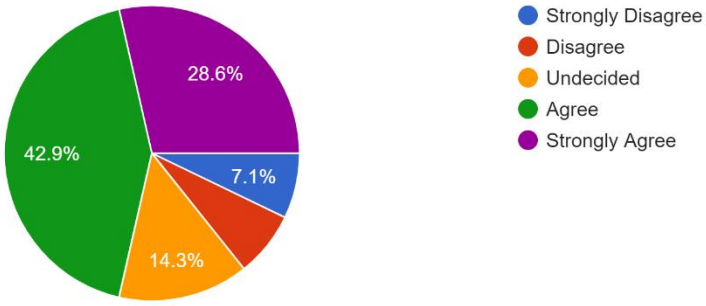
You will share the course material and learnings among your colleagues.

14 responses



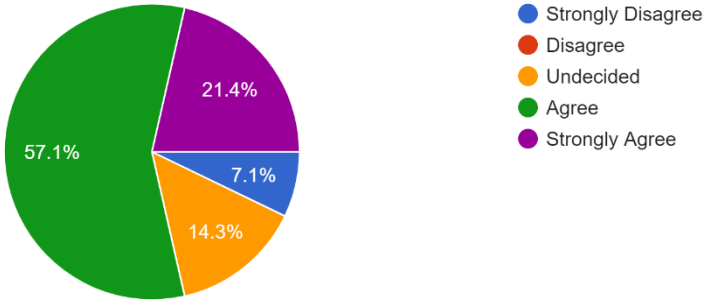
The training you received has inspired you to explore new ideas and approaches.

14 responses



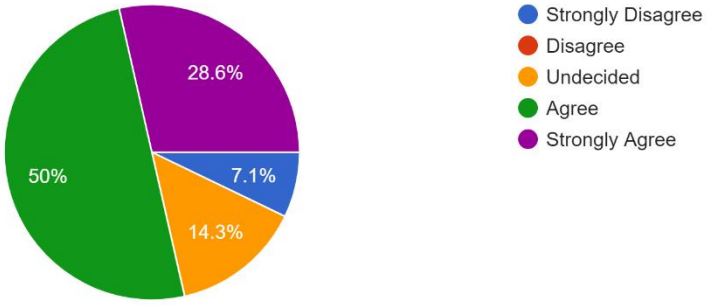
The workshop has encouraged ongoing learning and professional development in forecasting.

14 responses



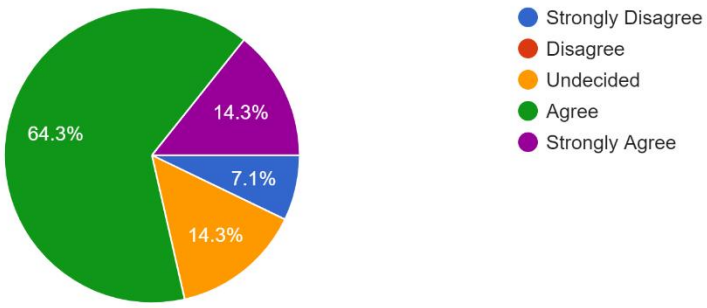
The training is likely to improve your collaboration with other colleagues/units in your agency

14 responses



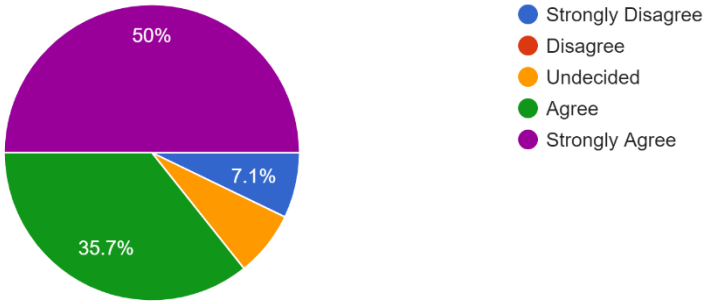
You recommend integrating the learnings of the training into your internal documents.

14 responses



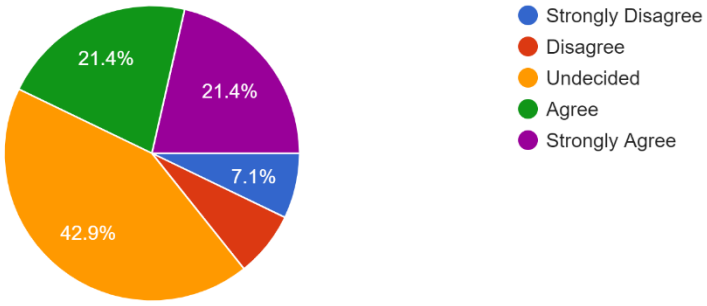
You would like to see similar workshops organized regularly to keep up with advancements in forecasting technologies.

14 responses



You recommend this training to the other related governmental organizations

14 responses



Comments

- Nil
- These trainings need to be focused for operational forecasting services and focused to meteorologists/forecasters .
- don't have
- As mentioned above

- non
- -
- It is important to conduct local training awareness programs by using these products to make them understand the uncertainty in forecasts and how to deal with them
- to refresh/update our knowledge, the training is very useful.

Lessons Learnt and Recommendations

What went well? What areas need improvement?

- Discussion went well. More hands on training
- More hands on sessions
- sharing of new products from NCMRWF. using of AI and ML need more information
- Discussion on SAHF forum, gaps , challenges, opportunities and requirement went well. More classes for AI and Machine learning would be useful.
- most of the things went well
- Forecast
- Guidance for extreme weather forecast
- All okay regarding enhancement of the knowledge of the operational forecasters ,however RIMES/SAHF can guide the regional countries regarding usage of latest models and usage of AI in more accurate forecasting.
- Implementation of new technique in to forecasting
- More organized practical sessions are needed
- Our Country
- Not going well with online.
- Having a reliable data source is good. Data analysing and application need some more time
- Everything was fantastic. A visit to the local meteorological department to learn the methodology they use.

What insights/opportunities have you gained from this training?

- Experience sharing in the forecasting
- Advanced learning tools
- sharing of information and adopting new technologies needed to better forecast severe and extreme weather
- use of NCMRWF new products and experiences of IMD in forecasting extreme events.
- knowledge regarding the extremes and brief knowledge of Ai and ML
- using the Models
- This question is very good. I had tremendous opportunity to work with very senior people and also the young generation who working in weather forecasting section. Advice from senior people is very much appreciated. Invite to give us pictures about
- My knowledge regarding forecasting increases manifold. All the participants have learnt something from this training and hopefully they will implement new available tools and strategies when they go back to their countries

- Collaboration and sharing the knowledge with regional experts
- Sharing knowledge among the experts
- -
- Improve knowledge related with forecasting.
- When such an integrated system of s available a reliable forecast can be issued like other countries
- AI/ML

What recommendations can be made for enhancing subsequent trainings?

- More physical meetings
- More physical meetings
- visit to national meteorological center and more technical sessions
- longer term and focused training would be much more useful. Thank you for your great effort in organizing this training.
- AI and ML based learning
- to be among the Forecasters
- Invite to related expert for a lecture about a special event... like radar image interpretation....or someone who has sound knowledge on Monsoon predictions
- Met departments in regional countries are comparatively weak and they have less patronage so my recommendation is to invite at least one officer from their respective controlling Ministries so that they can experience the difficulties and sensitivities of the accurate forecasting in today's changing environment.