

Summary Report



SOUTH ASIA **HYDROMET FORUM**

SECOND SAHF EXECUTIVE COUNCIL MEETING

19-20 SEPTEMBER 2022, THAILAND



EUROPEAN UNION



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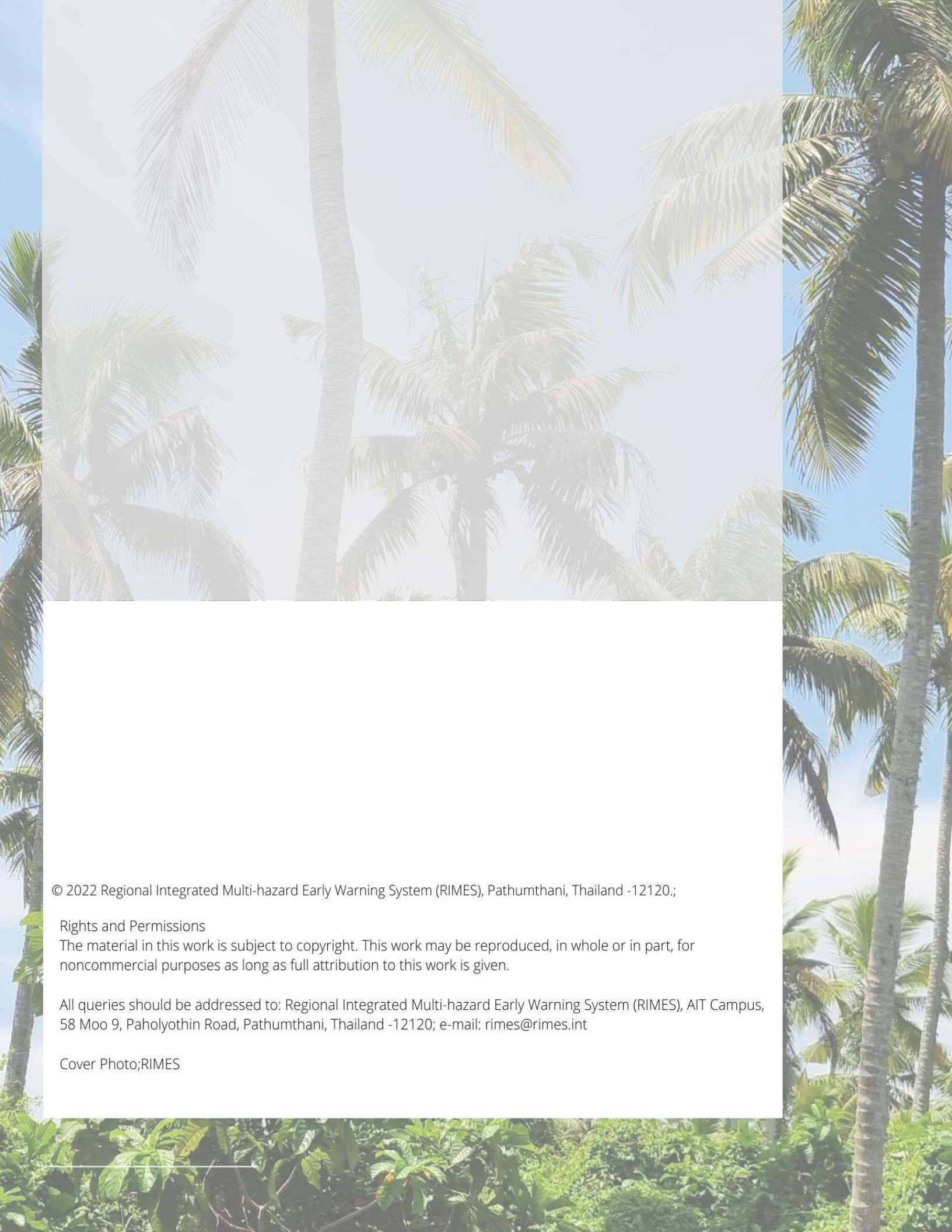


GFDRR

Global Facility for Disaster Reduction and Recovery



Foreign, Commonwealth
& Development Office



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ACRONYMS

AMD	Afghan Meteorological Department
ARRCC	Asia Regional Resilience to a Changing Climate
AWLS	All Weather Landing System
AWS	Automatic Weather Station
BHA	Bureau for Humanitarian Assistance
BIMSTEC	The Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation
CAP	Common Alerting Protocol
CARA	Climate Action for Resilient Asia
CE	Capacity Enhancement
DSS	Decision Support System
EC	Executive Council
ECMWF	European Centre for Medium-Range Weather Forecasts
FForum	Forecasters' Forum
GrADS-DODS	Gridded Analysis and Display System-Distributed Oceanographic Data System
IBF	Impact Based Forecasting
IMD	India Meteorological Department
INCOIS	Indian National Centre for Ocean Information Services
JICA	Japan International Cooperation Agency
KMA	Korea Meteorological Administration
MHEWS	Multi-Hazard Early Warning System
MICAPS	Meteorological Information Comprehensive Analysis Process System
MMS	Maldives Meteorological Service
MoES	Ministry of Earth Sciences
NCMRWF	National Centre for Medium-Range Weather Forecasting
NMHS	National Meteorological and Hydrological Services
NWP	Numerical Weather Prediction
OBN	Observational Networks

PHCPS	Pakistan Hydro-Met and Climate Service Project
RADAR	Radio Detection And Ranging
RDAS	Regional Data Analytics Systems
RIMES	Regional Integrated Multi-Hazard Early Warning System for Africa and Asia
RTC	Regional Training Center
SA	South Asia
SAHF	South Asia Hydromet Forum
SASCOF	South Asian Seasonal Climate Outlook Forum
SATARK	System for Assessing, Tracking and Alerting Disaster Risk Information based on Dynamic Risk Knowledge
SDG	Sustainable Development Goals
SESAME	Specialized Expert System for Agro-Meteorological Early Warning
SKHub	SAHF Knowledge Hub
SUFAL	Supporting Flood Forecast-Based Action and Learning
TNSMART	Tamil Nadu System for Multi-hazard potential impact Assessment and Emergency Response Tracking
UCAR	University Corporation for Atmospheric Research
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
USAID	United States Agency for International Development
WBG	World Bank Group
WG	Working Group
WISER	Weather and Climate Services Asia Pacific Programme
WMO	World Meteorological Organization
WP	Working Paper
WRF	Weather Research and Forecasting

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Draft

SECOND SESSION OF THE SAHF EXECUTIVE COUNCIL (EC) 19-20 September 2022

OUTCOMES STATEMENT

The SAHF Executive Council:

1. **Appreciated** the progress made by the South Asia Hydromet Forum (SAHF) in its current phase during 2021-22, starting with the establishment of the Executive Council (SAHF EC), the Working Groups (SAHF WGs), and the SAHF III Annual Session during November 2021. These components form the SAHF process which is recognized as an effective regional coordination mechanism that brings regional synergy to strengthen hydromet services delivery. Including a wider range of user institutions, private sectors and communities were considered crucial for SAHF progress, while taking a phased approach to widening the scope of inclusivity of stakeholders. The Council particularly appreciated the progress made in implementing the SAHF process despite the challenges of working remotely due to the Covid-19 pandemic right from the project inception stage.
2. **Noted** the regional activities undertaken by Regional Integrated Multi-Hazard Early Warning Systems (RIMES) and ongoing national initiatives underway in Member countries. Several project initiatives are being supported by development partner agencies and there is a need to pool all such resources and capacities being created in individual countries through SAHF so that their benefits can be sustained and available as a regional resource to other countries. SAHF EC Members expressed their appreciation for the continuing technical support provided by RIMES through various project initiatives. Recommended bringing a synergy of initiative within the region to fill residual gaps for strengthening hydromet service delivery.
3. **Endorsed** the SAHF Regional Approach articulated based on the SAHF Working Papers (WP) focusing on Capacity Enhancement (CE), Numerical Weather Prediction (NWP), Impact-based Forecasting (IBF) and Observational Networks (OBN). Contributions made by the SAHF WG Members were appreciated and regional priorities identified were noted with suggestions. The EC identified IBF as the priority capacity requirement of the SAHF region. The SAHF Forecasters' Forum has been recognized as an effective communication and knowledge-sharing platform between the operational forecasters for the SAHF NMHSs. The

EC invited the consideration of climate change as an additional thematic area due to its direct linkage to extreme events being experienced regularly in the region.

4. **Operationalized** the SAHF Knowledge Hub (SKHub) as a one-stop platform for forecast products, regionally relevant data exchange, real-time communications channel and capacity enhancement resources centre. Outreach material such as podcast series to be included as they become available. The Council also took note of the platform as a regional resource of experts and a dynamic repository of capacity enhancement needs expressed by stakeholders.
5. **Recognized** the need to create a pool of hydromet resources available within South Asia from all initiatives in the region. A coordinated and collaborative approach is to be established between NMHSs and the development partners.
6. **Recommended** the need to mobilize resources in collaboration with development partners to translate the SAHF Action Plan into a sustained operational program.
7. **Proposed** the holding of the 3rd EC session during March-April 2023 following the biannual format. Sought proposals from the EC Members to host the next session based on their convenience within December 2022.

ANNEX I- SUMMARY OF SESSIONS

1. Opening Session

The second session of the SAHF EC meeting was opened by Dr. Mrutyunjay Mohapatra, Director General, India Meteorological Department and Mr. Karma Dupchu, Director, National Centre for Hydrology and Meteorology, Bhutan on Monday 19 September 2022.

Mr. A. R. Subbiah, Director, RIMES welcomed the Executive Council members and all participants to the meeting. He acknowledged the participation and efforts of the SAHF Working Groups in the formulation of the WPs. He stressed the importance of SAHF as a regional mechanism through which the needs and demands of the region are prioritized and articulated. He recalled the SAHF III annual session of the forum that laid the foundational strategy and action for a framework of implementation to build forecasts and products in the South Asia (SA) region.

Ms. Arati Belle, Senior Disaster Risk Management Specialist, World Bank Group (WBG) in her opening remarks emphasized that the second SAHF EC meeting is crucial to envision and advance SAHF as an entity for regional collaboration. She highlighted that some of the shared goals of the forum are:

1. deeper regional engagement for shared benefits
2. bridging and framing regional and national hydro-met investments
3. technical activities for co-creation of knowledge, innovation, and practice
4. to build multi-tier linkages with users, private sectors, and academia beyond the NMHSs.

SAHF is envisaged to be a central feature for shared knowledge, real-time communication and practices while playing a central role in shared regional practices. She called on the council to consider how to enhance the systematically trained regional technical skilled task force in the region supported by SAHF capacity building activities. The need to bridge and frame regional-level initiatives within national-level investments including those by the user and private sectors that are part of the regional hydromet ecosystem was noted.

The EC Chair remarked that South Asia is constantly threatened by disasters and hydromet hazards causing widespread damage. The physiological conditions of the region including the mountain terrains, the coastal areas and arid landscapes enhance the impacts of the threats. A significant change in the frequency, intensity and duration of extreme weather events are observed in SA due to climate change impacting the socio-economic conditions of the region.

The Chair noted the important initiatives of SAHF that focused to:

1. identifying objectives and action plans for the forum

2. forming Working Groups to realize the objectives and implementing the plan
3. generating institutional mechanism under the leadership of RIMES
4. developing the SAHF Knowledge Hub that is conducive for networking between forecasters, users, and user sectors for the exchange of hydromet data and information.

The Chair also noted that SAHF will lead to at least a 10-15% improvement in forecast accuracy and regional improvement in services provided to the existing and emerging sectors. He highlighted the importance of SAHF in the region and the overall achievements of the forum.



The SAHF Co-chair, Mr. Karma Dupchu, welcomed all the council members and participants to the EC meeting. He noted the evolution of SAHF since 2018 and commended the progress of the forum despite several challenges. He emphasized the need for interconnectivity for development, and the importance of collaboration and exchanging of data. He also mentioned the support of organizations such as the World Bank, United Nations, RIMES, ECMWF, and WMO as well as the various NMHSs for the growth of hydromet services in the SA region.

The agenda was presented to the EC and was adopted by the council. The adoption of the agenda was followed by the introduction of the participants.

5. SAHF Progress

Dr. G. Srinivasan, Chief Scientist, RIMES presented the progress of the forum focusing on the progress, challenges and opportunities encountered during the course of the engagement while emphasizing on past, present, and future of regional cooperation to strengthen hydro-met service delivery in SA. The SAHF implementation strategy and process including the formation of the EC and WGs, and formulation of the WPs, was presented. Some of the major activities of the forum like the development of the regional approach, SAHF Knowledge Hub (SKHub) with DataEx, weekly Forecasters Forum (FForum), SAHF training framework and podcast series were highlighted. Considering the diverse ongoing initiatives and increasing risk of extreme weather events in the region, the need for SAHF to orchestrate a regional synergy in hydromet activities were highlighted. It was noted that regional collaboration is crucial to derive actual benefits and return of investments from the ongoing initiatives in the region. The process of enhancing the collaboration should begin with the involvement of core stakeholder institutions and progressively involve private institutes, academia, NGOs, and communities. The key to addressing the challenges in enhancing hydromet service delivery in the region is to find an institutional anchor through SAHF to sustain the engagement.



The EC members jointly reviewed the progress of the forum. Besides, the EC member from Pakistan noted the cooperation built through the SASCOF that helped in building better institutional linkages through the SAHF process. He recalled the benefit of regional data and forecast sharing that assisted Pakistan to issue timely warnings, especially during the heavy rainfalls in Pakistan in 2022. The council expressed their interest in continuing such collaborations. The SAHF FForum was stated to be a very important component of the

engagement, supporting prediction, and issuing warnings in advance irrespective of the crisis. The council acknowledged that the SKHub will help improve the expertise in forecasting and verification of forecasters in the region. It was noted that the future direction of the forum will depend on the WG outputs along with the existing plan for sustenance.

As the forum moves forward, it will be important to tackle hydro-met challenges like curating seasonal forecasts and focusing on forecast modelling. Challenges like internalizing regional collaboration at national levels and operationalizing data sharing mechanisms have to be addressed along with the engagement of private institutions and academia. There is a need for collaborative partnerships between NMHSs and building national capacity to support hydromet service delivery. In addition to the existing four SAHF thematic areas, the climate change aspect was recommended to be considered given its importance in early warning and mitigation of severe weather events like urban flooding and flash floods.

The focus of the forum requires a shift to what can be improved for each of the ongoing SAHF activities including the Forecasters' Forum. Technical leadership and ownership from countries can be leveraged by bringing together global, international, and regional experts from academia and private institutions along with meteorologists and hydrologists from NMHSs. Examples from the region in the form of case studies should be utilized to handle the hydromet challenges of the region. Innovation to improve the lives/livelihood of people in the region should be built through fruitful collaboration.

Director, RIMES noted the need for deeper regional collaboration while urging the Member countries to pay attention to the holistic climate value chain process including community outreach. The EC Chair highlighted the transition of NMHSs to digital platforms and how the SAHF FForum has been facilitating the process with the DataEx Platform providing model data on demand. He also highlighted that the FForum has been successful and has further scope for improvement. He welcomed the Member countries to share regional data with SAHF to improve forecasts for regional benefits.

6. The Changing Landscape of Hydromet Service Delivery in the SA Region

Dr. Anshul Agarwal, Lead-Hydrology, RIMES, presented the ongoing RIMES initiatives in the SA region focusing on the pillars of the climate service value chain aligned to the four SAHF thematic areas. The presentation outlined initiatives including:

1. **DataEx** (WBSAHF)- for enhancing data exchange between RIMES member countries through sharing data for improved modelling and forecasting. Satellite and re-analyzed datasets are available through the platform.

2. **Support to countries for NWP modelling**- support to improve short-range forecast and climate services.
3. **Climate Service Toolkit** (Bhutan-WMO)- customized for country-specific requirements supporting extended range forecasts to Bhutan.
4. **FOCUS tool** (Regional Training Center (RTC) Pune and UKMET)- All seasonal climate outlooks in one place and support countries to generate seasonal and monthly forecasts.
5. **Forecast Customization System** (ARRCC)- supports long-range forecasts and helps improve seasonal and sub-seasonal forecasts in the countries.
6. **Regional Data Analytics Systems (RDAS-WBCARE)**- a repository of climate and sectoral data to generate analysis. Data can be converted for impact analysis.
7. **Hydrological and hydraulic modelling (SA)**- covering basins of South Asia.
8. **Decision Support System (DSS)**- Specialized Expert System for Agro-Meteorological Early Warning (SESAME) for enhancement of agromet advisory system, FloCAST for enhancement of Flood Forecasting System, Transport DSS under WBCARE.
9. **Multi-Hazard Early Warning System (MHEWS)**- Tamil Nadu System for Multi-hazard potential impact Assessment and Emergency Response Tracking (TNSMART) and System for Assessing, Tracking, and Alerting Disaster Risk Information based on Dynamic Risk Knowledge (SATARK)- IBF, Web/smartphone-based decision support system for generating risk-based alert with fully automated dissemination platform.
10. **Dynamic Flood Risk Mapping (SUFAL Bangladesh)**- real-time monitoring of change in water levels for decision support.
11. **Regional cooperation workshop** for enhancing cooperation for flood forecasting and drought monitoring in SA.
12. **Monsoon Forum**- for community outreach and feedback from users.
13. **Winter Forum**, Bangladesh- (ARRCC).
14. **Empowering last mile users** in early warning information delivery and application (**UCAR**)-Strengthening last mile communication in SA.
15. **Application of multi-time scale forecast in Bangladesh** (ARRCC)



Following the presentation, the countries were called to express their views and comments. The countries deliberated on the ongoing initiatives in their respective countries established in collaboration with RIMES and other organizations/partners in the region.

Afghanistan

The NMHS currently has access to ECMWF data through the Data Ex platform. AMD is responsible for providing daily weather forecasts and seasonal forecasts and therefore requires weather stations, forecast training and other relevant training. AMD requires weather models such as ECMWF and WRF. AMD could also benefit from the development of sectoral DSSs.

Bangladesh

RIMES has many ongoing initiatives in Bangladesh with dedicated office space in the Bangladesh Meteorological Department (BMD). Agromet and flood forecasting products are being developed in collaboration with RIMES.

Bhutan

Bhutan has an existing flood decision support system operational in one basin of the country supported by RIMES. Bhutan has also developed an agriculture DSS. NCHM continues to share data both upstream and downstream after quality checks. The NCHM also shares historical data with RIMES. The Climate Service Toolkit (CST) launched in September 2022 was developed through collaboration between The National Center for Hydrology and Meteorology (NCHM), WMO and RIMES that is planned to be replicated in other countries.

India

First agromet advisory in India was developed through the RIMES DSS system. Also, DSSs like TNSMART in Tamil Nadu AND SATARK in Odisha developed in collaboration with RIMES have been helpful in the country. The forecasts in the country are passed through IMD before being shared with the state government. There are existing plans to develop similar systems like SATARK in other states of India. India-RIMES unit has been established to continue implementation of existing plans for other DSSs

Maldives

Day-to-day forecast products delivered by MMS are developed through WRF models developed in collaboration with RIMES. ECMWF and IMD products are also used. MMS utilizes ocean state forecasts developed by RIMES and INCOIS to deliver marine forecasts. Forecast dissemination is done through social media. Ocean state forecast system- RIMES INCOIS used for marine forecast. Dissemination of forecast and early warning during severe weather events is done through mobile applications, public and social media. CAP early warning system has also been introduced. A monsoon forum for stakeholders to deal with forecast products is regularly conducted. A probability forecast for rain harvesting to deal with drought during the northwest monsoon has been established. MSS continues to participate in the FForum. Through support from RIMES and other international organizations, Maldives plans to establish IBF in the country.

Myanmar

With the support of RIMES, Myanmar has been able to sustain the National Monsoon Forum independently, which has been happening since 2007. RIMES has supported improving the WRF model, agromet SESAME DSS, flood forecasting and climate services in the country. OBN in the country is currently supported by the JICA project with the installation of three RADARS and thirty AWS stations. Forty ASOS stations have been installed in the country through the KMA project. 19 AWS and 10 AWLS stations was installed through the WB AIRBM project that has currently been terminated. Although the country has had many developments in the last 5 years, there are still requirements to improve NWP and IBF in the country.

Nepal

Nepal recently had a bilateral meeting with Bangladesh for data sharing. A joint technical team on flood forecasting activities has been established through a flood forecasting scheme between Nepal and India for sharing of hydromet data. Nepal requires assistance in all four SAHF thematic areas. IBF is currently being piloted in Nepal.

Pakistan

The ongoing hydromet initiatives in Pakistan include Pakistan Hydro-Met and Climate Service Project (PHCPS), regional Flash Flood Guidance System and IBF pilot (supported by ARRCC and ICIMOD). The hydromet services in Pakistan will be extended until the sea level to strengthen EWS in the country through the PHCPS project.

Sri Lanka

Sri Lanka has hosted 26 monsoon forums in collaboration with RIMES so far. The DoM has also implemented SESAME DSS and utilizes the ocean state forecasts developed by RIMES and INCOIS to develop advisories. The SAHF FForum along with the ocean state forum included recently is being utilized by DoM. Sri Lanka is currently piloting the empowering last mile users in early warning information delivery and application. Also, there are many initiatives planned to be started under the RIMES masterplan for Sri Lanka including improvement in NWP, IBF, CE and sector specific DSS. It would be useful to customize the CST for Sri Lanka.



The participants suggested that the focus of the FForum could also include sub-seasonal forecasts. Thresholds are crucial for implementation of IBF and therefore support for model verification could be helpful. Accessing GrADS-DODS type of server was suggested to be considered. DSSs are designed to be upscaled and upgraded. Therefore, the countries were encouraged to consecutively use seasonal and sub-seasonal forecasts to implement DSS. The thresholds for DSS are to be fixed through partnership while focusing on the time for extended forecasts. Multi-model forecasts can also be considered.

16. SAHF Regional Approach to Strengthen Hydromet Service Value Chain

The Co-chairs of the SAHF WGs presented the highlights of the WPs covering the four SAHF thematic areas. Dr. K.J. Ramesh, Senior Advisor, RIMES presented the SAHF regional strategy highlighting the key strategic objectives of the approach and implementation strategy. The SAHF Communication Mechanism was presented by Mr. Tshencho Dorji, Project Officer, RIMES covering the priorities, elements of the mechanism and its operational aspects.

The participants were called to provide their comments and views on the regional approach, WPs and communication mechanism. The participants suggested that it would be beneficial, to begin with, one hazard and proceed to multiple hazards while developing IBF including the development of tables and hazard maps. Acquiring assistance for obtaining data for the MICAPS system was discussed. The absence of vulnerability and socio-economic data compared to other widely available high-resolution data was noted during the discussion. IBF at most times requires different human resources depending on the disaster. However, the forecast process requires hazard and vulnerability data combined with topographic data and therefore it was suggested that cross-sectoral data is appropriate for the process.

Sustainable institutional mechanisms for the provision of the required exposure, vulnerability and other relevant data should be set up and reinforced through the provision of incentives to sectoral users. The NMHSs can work to accelerate the process of achieving the SDGs. Action is expected to follow IBF and therefore the forecasting should be initiated only when a certain level of forecast accuracy is achieved to maintain the confidence among users. The participants were briefed on the strategy to implement IBF at the national level by the EC Chair focusing on the four stages of implementing IBF by WMO.

In conclusion, the EC Chair obtained the approval of the EC members for the endorsement of the regional approach. . The EC endorsed the regional approach document with the direction to modify the approach based on the comments provided during the meeting and be circulated.

17. Launch Of SAHF Knowledge Hub

Ms. Kousalya V Kumar, Project Coordinator, RIMES introduced the SKHub to the council and participants outlining the objectives, goals, and features of the hub. Following the presentation, the EC Chair and Co-chair jointly launched the SKHub and made it operational for users. The SKHub was then demonstrated in detail to all the participants by Dr. Itesh Dash, Lead-Systems R & D, RIMES.



The council congratulated the RIMES team for the launch of the SKHub while it was agreed that the future of the hub will depend on the utilization of the hub by forecasters in the region and the quality of the data being used.

The participants provided their suggestions to improve and sustain the hub beyond the current phase:

1. Training components of SAHF can involve on-the-job training at RIMES headquarters in Thailand.
2. Training of forecasters for using SKHub can be sourced through deputation.
3. Provide access through a GrADS-DODS¹ type of server, which is stable, secure, easy to install, and easy to configure data server that enables sub-setting and analysis services across the region. The sub-setting capability allows a user to request a specified range of time and space from a large dataset, eliminating the need to download everything simply to access a small relevant portion of a dataset. This will allow forecasters to run scripts remotely on an operational basis. data servers can be considered.
4. A banner or alert about the time of operational update of data will be also useful for operational forecasters.
5. There is a requirement for automation of downloading datasets to curtail the duration of processing data manually.
6. Analysis of extreme events and predictability of models can be considered to be done through SKHub.

1 DODS-Grided Analysis and Display System-Distributed Oceanographic Datasystem-NOAA, USA

7. Country-wise reports/case studies after every monsoon can be curated and used in the SKHub.

It was noted that as the development of the SKHub continues, Jupiter notebooks can be provided for running python. In-country training on the SKHub can also be hosted while preliminary training is already planned through the weekly FForum sessions. Secondment training can be hosted through nominations from a council constituted within SAHF. Probabilistic forecasts through multi-model ensemble prediction with existing models, analytics and diagnostics can also be made available through the hub. The Chair suggested for the countries explore the Knowledge Hub further and provide feedback.

SAHF Podcast series was introduced to the participants. The SAHF podcast series is a learning tool to share experiences in the modernization of hydromet services in SA from different perspectives. The podcast series currently has 5 episodes and future episodes planned. The SAHF podcast will become a part of the SKHub

8. Activities and Initiatives of Development Partners

The Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC)- Center for Weather and Climate (BCWC), Ministry of Earth Sciences (MoES)

National Centre for Medium-Range Weather Forecasting (NCMRWF), currently doubling as BCWC, is at present focusing on the development of weather, climate prediction models, data assimilation development and maintenance of Data Assimilation (DA) Systems and state of art Seamless Prediction systems. The centre also has the Mihir HPCS supercomputers and runs a wide array of models including the 330 m Delhi Fog Model, Global NCMRWF Unified Model (NCUM), Global Ensemble Prediction System (NEPS), Regional NCUM and Couple NWP. Over the years the centre has been able to improve accuracy and forecast which is attributed to increased model resolution, data assimilation and data assimilation techniques. The performance of the centre is currently on par with other global centres. BCWC provides probabilistic and deterministic forecast products such as Meteogram and EPSgram to Member countries. IMDAA Regional Reanalysis of the centre is available from 1979 to 2020. BCWC has hosted a number of workshops like the online workshop cum training on “use of ensemble model forecast products for weather and climate” in 2021, a workshop on “recent development in weather/climate modelling and data assimilation in 202 and a workshop in “outstanding challenges in forecasting” with models in March 2022.

UKMET Office

ARRCC Programme that has recently concluded focused on enhancing capacity for weather and climate prediction across timescales. ARRCC has supported a vast population to adapt to effects of climate change, established regional and national partnerships, piloted forecasting systems and tools, helped enhance the SA climate outlook forum and SA climate change forum, and helped develop early warning systems. The UKMET office jointly with FCDO is supporting the pan regional initiative Climate Action for Resilient Asia (CARA) covering South Asia, Southeast Asia and the Pacific. CARA is a multi-thematic and multi partnership initiative with various themes led by different development partners. Within CARA the UKMET office is leading the weather and climate services component-Weather and Climate Services (WISER) Asia Pacific Programme. WISER will focus on reducing the impacts of extreme weather events and climate change through reliable and tailored services. The programme is aligned with the priorities of SAHF. WISER has an ongoing assessment of gaps and needs to inform the design of the programme and is planned to draw on the achievements and learnings from related initiatives to date. UKMET is keen to support the development of SAHF as a global producing centre, delivery of SAHF training, a repository for learning and knowledge sharing and other relevant regional initiatives.



United States Agency for International Development (USAID)

Bureau for Humanitarian Assistance (BHA) is a unit within USAID interested in climate and climate services especially the last mile of early warning. The resources of the bureau are focused on this last mile. It is important to demonstrate the importance of investing in the value chain that will aid to bring in resources. It is crucial to leverage the value of work done by the NMHSs irrespective of the current level of accuracy of forecast and modelling to obtain the required resources. It is prime time for NMHS to leverage their strengths to acquire necessary

resources since there is much focus on climate change and extreme events. Partners are working on preparedness, with different sectors, and with local and vulnerable communities with whom communication can be established to utilize existing information to reduce risk and generate more resources. With reasonably demonstrated value, finances including those from the private sector can be easily obtained.

United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP)

ESCAP in partnership with WMO and UK Met Office has developed methodologies and enabling tools supported by a risk and resilience data portal, manual and e-learning module to operationalize impact forecasting. A regional learning platform for sharing knowledge and experiences on multi-hazard risk assessment and early warning for floods and droughts including those with transboundary origins and impacts is in place. Further, ESCAP, through South Asia Climate Outlook Forum and Panel on Tropical Cyclone, is building the institutional capacity of members to support impact forecasting.

UNESCAP has put in place the Risk and Resilience Portal to deepen policymakers' understanding of cascading risks, national, sub-national and transboundary risk hotspots. The portal provides risk scenarios including the economic cost, multi-hazard risk hotspots as well as adaptation priorities for 56 countries including all South Asian countries.

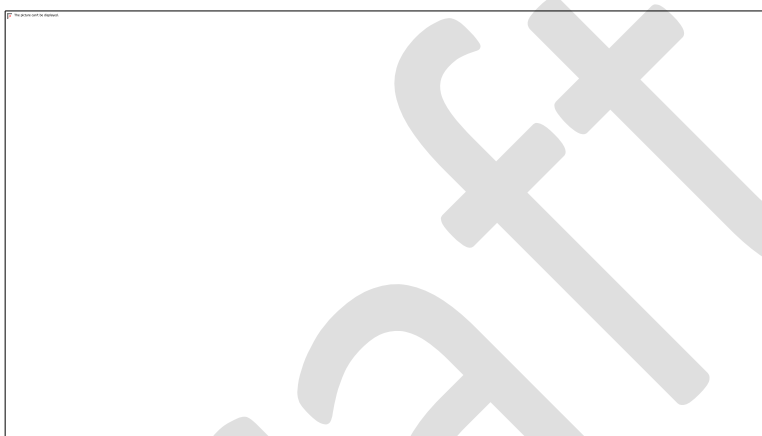
ESCAP, through the Trust Fund for Tsunami, Disaster and Climate Preparedness, has been a strong supporter of regional cooperation for early warning systems. The Trust Fund was instrumental in the establishment of RIMES and the Trust Fund continues to support countries through multiple RIMES projects.

“Enhancing Weather and Climate Resilience in RIMES Member States through Capacity Building on Impact Forecasting – Phase 2” is a current RIMES project supported by the Trust Fund of which Bhutan, Maldives and Sri Lanka are among nine countries receiving training and capacity development of weather and climate information users, specifically on Impact-based forecasting and facilitating national Monsoon Forums.

9. Evolution of the Hydromet Services in the Region at the National and Regional Levels

Dr. David Rogers reflected on the current position of SAHF and the future of the forum in terms of how it will evolve to meet the ongoing demands. His presentation traced the general challenges for hydromet services, the vision of SAHF, the forum's priorities, the WBG priority for SAHF, and the steps to be taken for the forum to go further.

It is important to consider how countries can be involved in leading different aspects of the forum. Moving ahead, it is also important to consider how the existing academic expertise in SA can be utilized extensively and how to leverage other development projects and initiatives for regional benefits. It is key to have a mechanism to ensure the SAHF countries learn from each other, and the benefits are shared amongst all. It is critical to look at what can be done to justify economic investments that have been made. SAHF to enhance dialogue between and make use of existing diagnostics tools to understand ongoing requirements.



Dr. Alice Soares, WBG, facilitated the discussion with participants to reflect on key considerations presented earlier. Some of the major reflections of the participants are as follows:

1. Experts from different NMHSs can be a part of RIMES and SAHF (facilitate through attachment trainings) for improving engagements while RIMES team can visit member countries to engage scientists in the process
2. Sector-wise involvement and policy guidelines for NMHSs are essential for enhanced engagement.
3. Bridging the gap between national and sub-national organizations is eminent to strengthen country involvement.
4. Engaging stakeholders like disaster management, agriculture, and tourism sectors among others in the forum's activity could be effective to enhance engagement.
5. Although academia and other institutes can undertake the R&D activities, the NMHSs will always be on the frontline of service delivery.
6. RIMES needs to be strengthened through the identification of expertise from academia and NMHSs to lead the activities.

7. Experts from each country can guide mitigation of extreme weather events by helping each other through the provision of guidance under the leadership of RIMES.
8. The constitution of a forum within SAHF with identified experts and academics from member countries could be instrumental to improve dialogue between NMHSs and development partners.
9. Development partners have been contributing to CE activities in areas identified by SAHF. But the efforts are usually focused on individuals or a limited number of countries.
10. The SKHub and the DataEx platform support the leveraging of ongoing initiatives.
11. From a regional perspective, RIMES can identify projects and collaborators and bring them together to deliver assistance to regional countries
12. The regional expertise can be exchanged through RIMES and all the sources can be pooled in one place for the use of countries.
13. Station networks can be optimized to support regional captures.
14. Capacitating the entire region with existing resources and required resources is crucial.
15. Coastal inundation forecasts and modelling could be beneficial for coastal countries like the Maldives and Sri Lanka.

Closing Session

Ms. Melanie Simone Kappes, WBG, shared the closing remarks. WBG recognized the considerable progress made by SAHF in the last two years, under the technical support of RIMES and the guidance of the EC. The EC has endorsed the vision of SAHF, its strategic objectives and approach, in support of all 9 SAHF countries towards enhanced regional cooperation in the hydromet value chain. As reiterated during this EC meeting, there is an increased need to support each other, pool resources and share data. Despite the considerable challenge ahead, a foundation has been laid through joint efforts to implement IBF, improve NWP and create and share data. There are numerous opportunities to leverage funding, external support and pilot activities among the SAHF countries. The meeting underlined the importance of deepening the skill base of SA with the support of the member countries.

It was agreed by the council that the proceedings of the meeting will be drafted by the RIMES and circulated among the members for their suggestions and comments. The Chair deliberated the outcomes of the forum taking into account all the past activities of SAHF (*all outcomes listed in the outcomes statement*). The Co-chair thanked WBG for initiating the SAHF and achieving considerable progress since its inception. He expressed the need for continued support from WBG to the member countries and SAHF for enhanced networking and partnership. There are

numerous projects that should be leveraged and linked for regional benefits through investments by donors and partner agencies.

The council members acknowledge that the EC meeting has been helpful to understand the ongoing initiatives and projects in the region. They appreciated the fruitful regional collaboration that has been established through SAHF. They also expressed their expectations to utilize the SKHub continuing ahead. The council members thanked the EC Chair, Co-chair and RIMES supported by the WBG for facilitating the meeting. The willingness of the member countries to host the next EC meeting in 2023 was requested to be communicated to RIMES.

Mr. Ali Shareef, Deputy Director General of Maldives Meteorological Services, and focal point for the RIMES Secretariat delivered the vote of thanks expressing his gratitude to all the EC members, WG members, development partners, and participants for their active participation in the meeting.

The EC Chair also thanked the participants, council members, financial and technical partners for taking part in the meeting. He congratulated the RIMES team for successfully hosting the EC meeting.

Recommendations:

1. SAHF podcast series to be made operational and shared on the SAHF Knowledge.
2. External organizations and expertise existing beyond the current scope of SAHF are to be identified and integrated with the forum by RIMES.
3. Identify future mechanisms for engagement of NMHSs in a coordinated manner and involve the experts and user sectors.
4. Focus on deeper engagement between NMHSs, users, academia, and development partners.

ANNEX II- AGENDA

Time (Bangkok, Thailand (UTC+7))	Programme	Duration (min)	Speaker/Presenter
DAY 1 (19 September 2022)			
Registration of participants (9:30 am onwards)			
1. OPENING SESSION (10:00-11:00)			
10:00 -10:10	Welcome Remarks	10	Director, RIMES
10:10-10:20	World Bank	10	Ms. Arati Belle, Sr. Disaster Risk Management Specialist
10:20-10:30	Opening Remarks: Chair of SAHF EC	10	Dr. M. Mohapatra, DG, IMD, India
10:30 -10:40	Opening Remarks: Co-chair SAHF EC	10	Mr. Karma Dupchu, Director, NCHM, Bhutan
10:40-10:45	Adoption of the agenda	5	Led by Chair & Co-chair
10:45-11:00	Introduction of participants	15	All participants
Group Photo and Tea Break (11:00-11:30)			
2. SAHF PROGRESS (11:30-12:45)			
<i>The session will highlight the progress and ongoing activities of SAHF, challenges and opportunities for moving SAHF programme forward.</i>			
11:30-11:45	SAHF progress and activities in 2021 and 2022 including challenges, opportunities, and way forward	15	Dr. G Srinivasan, RIMES
11:45 -12:45	Review of progress [comments from the EC and WG members on the SAHF progress and impacts]	60	EC and WG members
Lunch (12:45-13:45)			

3. THE CHANGING LANDSCAPE OF HYDROMET SERVICE DELIVERY IN SA REGION (13:45-14:35)

The session will take stock of ongoing activities/projects/programmes and contributions to regional hydromet service delivery by the World Bank, RIMES, and other development partners from 2015 to 2022.

13:45-13:55	Ongoing initiatives of RIMES	10	Dr. Itesh Dash & Dr. Anshul Agarwal, RIMES
13:55-14:30	Intervention-Countries [Countries to share brief points of their ongoing hydro service delivery initiative and contributions to SA region] <ul style="list-style-type: none"> · Afghanistan (Mr. Mohammad Nasim Muradi, Director, AMD) · Bangladesh · Bhutan · India · Maldives (Mr. Ali Shareef, Deputy DG, MMS) · Myanmar · Nepal (Dr. Rajan Bhattarai, Deputy DG, DHM) · Pakistan (Mr. Mahr Sahibzad Khan, DG, PMD) · Sri Lanka 		
14:30-15:00	Discussion	30	
Tea Break (15:00-15:30)			
<h3>4. SAHF REGIONAL APPROACH TO STRENGTHEN HYDROMET SERVICE VALUE CHAIN (15:45-17:15)</h3> <p><i>The session will discuss the output of the SAHF WG members and endorsement.</i></p>			
15:30-16:10	Outcome of the SAHF WGs		
	Capacity Enhancement (CE)	10	Dr. Somnath Dutta (IMD, India) Co-chair, CE WG
	Impact-based Forecasting (IBF)	10	Dr. Shiromani Jayawardane (DoM, Sri Lanka) Co-chair, IBF WG
	Numerical Weather Prediction (NWP)	10	Mr. Ahmed Rasheed (MMS, Maldives) Co-chair, NWP WG
	Observational Networks (ON)	10	Mr. Asif Hussain (PMD, Pakistan) Co-chair, ON WG
16:10-16:20	Summary of SAHF Regional Approach	10	Dr. K. J. Ramesh, RIMES
16:20-16:30	Plan for Communication Mechanism	10	Mr. Tshencho Dorji, RIMES

16:30-17:15	Endorsement of Regional Approach initiatives and Working Group targets and activities. <i>(Discussion to be led by EC Chairs)</i>	45	EC and WG members
DAY 2 (20 September 2022)			
5. LAUNCH OF SAHF KNOWLEDGE HUB (09:30-10:30) <i>The session will introduce the SAHF Knowledge Hub and demonstrate the various components of the Knowledge hub including its formal launch.</i>			
10:00- 10:10	Introduction of SAHF Knowledge Hub	10	Ms. Kousalya V Kumar, RIMES
10:10-10:15	Formal launch of the SAHF Knowledge Hub	5	EC Chair and Co-Chair
10:15-10:55	Demonstration and discussion of the Knowledge Hub	45	Dr. Itesh Dash & team, RIMES
10:55-11:00	Introduction to the SAHF Podcast Series	5	Dr. David Rogers, World Bank
Tea Break (10:30-11:30)			
6. ACTIVITIES AND INITIATIVES OF DEVELOPMENT PARTNERS (11:30-12:30) <i>The session will discuss the ongoing activities/projects and initiatives of the development partners in the region</i>			
<ul style="list-style-type: none"> • BIMSTEC activities [Dr. Abhijit Sarkar] • ARRCC- Activities for SA under ARRCC and future initiatives [Mr. David Corbelli] • FCDO [Ms. Archana Shukla] • USAID [Dr. Michael Ernst] • UNESCAP [Dr. Sanjay Srivastava and Ms. Temily Baker] 			
Lunch (12:30-13:30)			
7. EVOLUTION OF THE HYDROMET SERVICES IN THE REGION AT THE NATIONAL AND REGIONAL LEVELS (13:30-15:00)			
13:30-13:45	Set the scene for the evolution of SAHF	15	Dr. David Rogers, World Bank

13:45-15:00	<p>Discussion [to be moderated by Alice Soares, World Bank]</p> <ul style="list-style-type: none"> · Enable more institutions to take responsibility for SAHF including actively engaging in and leading activities · Involve a wider network of experts, especially from academia in the region · Leverage the large number of past and present development projects to sustain capabilities and capacity through regional cooperation and coproduction · Put more emphasis on quantifying the economic benefit of services · Ensure continuous engagement of development partners · Better use of existing diagnostic tools · Sustain observational networks <p><i>Wrap-up [Dr. Alice Soares and Dr. David Rogers]</i></p>		
Tea Break (15:00-15:30)			
8. CLOSING SESSION (15:30-16:30)			
15:30-15:40	Closing remarks from World Bank	10	Ms. Melanie Simone Kappes, Disaster Risk Management Specialist
15:40-16:15	Outcomes, date & venue of next EC meeting and closing remarks	35	EC chairs and members
16:15-16:30	Vote of Thanks	15	Mr. Ali Shareef, RIMES Secretariat

ANNEX III- PARTICIPANTS LIST

DAY 1

VIRTUAL PARTICIPANTS

Name	Designation
EC & WG Members	
Dr. Kyaw Moe Oo	Director General, Department of Meteorology and Hydrology, Myanmar
Dr. Shiromani Jayawardena	Director (Forecasting), Department of Meteorology of Sri Lanka
Mr. Mohammad Nasim Muradi	Director, Afghan Meteorological Authority, Afghanistan
Dr. Somenath Dutta	Scientist E, CRS Pune, Meteorological Training , Institute, India (CE- Co-Chair)
Ms. Tin Yi	Deputy Director General Department of Meteorology and Hydrology
Ms. Chaw Su Hlaing	Staff Officer Department of Meteorology and Hydrology
World Bank	
Ms. Arati Belle	Senior Disaster Risk Management Specialist, World Bank
Dr. Alice Soares	Senior Hydromet Advisor, World Bank
Dr. David Rogers	Lead Meteorological Consultant, World Bank
Ms. Dechen Tshering	Disaster Risk Management Specialist, World Bank
Mr. Efrem Ferrari	Consultant, World Bank
RIMES	
Mr. Abhushan Gautam	Communications Specialist, RIMES
Ms. Papakumari Murugan	Documentation Specialist, RIMES

IN-PERSON PARTICIPANTS

EC & WG Members

Mr. Md. Zahid Newz	Senior Assistant Secretary, Ministry of Defense, Dhaka
Mr. Md. Momenul Islam	Meteorologist , Bangladesh Meteorological Department (BMD) Dhaka
Dr. Karma Dupchu	Director, National Center of Hydrology and Meteorology (NCHM), Royal Government of Bhutan (RGoB)
Dr. Mrutyunjay Mohapatra	Director General of Meteorology, India Meteorological Department, Government of India
Mr. Ali Shareef	Deputy Director General of Maldives Meteorological Service,
Mr. Ahmed Rasheed	Director Meteorology, Maldives Meteorological Services, Maldives.
Mr. Mahr Sahibzad Khan	Director General, Pakistan Meteorological Department
Mr. Muhammad Asif	Programmer/Deputy Director, Climate Data Processing Centre, Karachi
Dr. Zaheer Ahmed Babar	Director, National Weather Forecasting Center, Pakistan.
Ms. Temily Isabella Baker	Programme Officer, Disaster Risk Reduction Section (DRS), UNESCAP
RIMES	
Mr. A.R. Subbiah	Director, RIMES
Dr. G. Srinivasan	Chief Scientist, RIMES
Dr. K.J. Ramesh	Senior Advisor, RIMES
Dr. Anshul Agarwal	Lead-Hydrology, RIMES
Dr. Itesh Dash	Lead-Systems R&D RIMES
Mr. Tshencho Dorji	Project Officer, RIMES
Ms. Kousalya V Kumar	Project Coordinator, RIMES
Mr. Mitesh Sawant	Project Officer, RIMES
Mr. Ramraj Narasimhan	Chief, Special Programs Management, RIMES

DAY 2**VIRTUAL PARTICIPANTS**

Name	Designation
EC and WG Members	
Dr. Kyaw Moe Oo	Director General, Department of Meteorology and Hydrology, Myanmar
Dr. Shiromani Jayawardena	Director (Forecasting), Department of Meteorology of Sri Lanka
Mr. Mohammad Nasim Muradi	Director, Afghan Meteorological Authority, Afghanistan
Dr. Somenath Dutta	Scientist E, CRS Pune, Meteorological Training , Institute, India (CE- Co-Chair)
Ms. Tin Yi	Deputy Director General Department of Meteorology and Hydrology
Ms. Chaw Su Hlaing	Staff Officer Department of Meteorology and Hydrology
World Bank	
Ms. Arati Belle	Senior Disaster Risk Management Specialist, World Bank
Dr. Alice Soares	Senior Hydromet Advisor, World Bank
Dr. David Rogers	Lead Meteorological Consultant, World Bank
Ms. Dechen Tshering	Disaster Risk Management Specialist, World Bank
Mr. Efrem Ferrari	Consultant, World Bank
Ms. Melanie Kappes Simmone	Disaster Risk Management Specialist, World Bank
Development Partners	
Dr. Sanjay Srivastava	Chief of Disaster Risk Reduction UN Economic and Social Commission

Mr. David Corbelli	Senior International Development Manager, UKMET Office
Dr. Michael Ernst	Senior DRR and Hydro-Meteorological Hazards Advisor, Bureau of Humanitarian Assistance (BHA), U.S. Agency for International Development (USAID)
Dr. Abhijit Sarkar	Scientist-F, Ph.D. (IIT Kharagpur), In charge of BCWC
RIMES	
Mr. Abhushan Gautam	Communications Specialist, RIMES
Ms. Papakumari Murugan	Documentation Specialist, RIMES

IN PERSON PARTICIPANTS

EC & WG Members

Mr. Md. Zahid Newz	Senior Assistant Secretary, Ministry of Defense, Dhaka
Mr. Md. Momenul Islam	Meteorologist , Bangladesh Meteorological Department (BMD) Dhaka
Dr. Karma Dupchu	Director, National Center of Hydrology and Meteorology (NCHM), Royal Government of Bhutan (RGoB)
Dr. Mrutyunjay Mohapatra	Director General of Meteorology, India Meteorological Department, Government of India
Mr. Ali Shareef	Deputy Director General of Maldives Meteorological Service,
Mr. Ahmed Rasheed	Director Meteorology, Maldives Meteorological Services, Maldives.
Mr. Mahr Sahibzad Khan	Director General, Pakistan Meteorological Department
Mr. Muhammad Asif	Programmer/Deputy Director, Climate Data Processing Centre, Karachi
Dr. Zaheer Ahmed Babar	Director, National Weather Forecasting Center, Pakistan.
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