13th Meeting of the RIMES Council

REPORT | 2021

13th RIMES Council Meeting Report

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Acronyms

ADB	: Asian Development Bank
ADPC	: Asian Disaster Preparedness Center
ARRCC	: Asia Regional Resilience to Changing Climate
BMD	: Bangladesh Meteorological Department
BRRI	: Bangladesh Rice Research Institute
CARE	: Climate Adaptation and Resilience Project
CREWS	: Climate Risk and Early Warning Systems
CSUF	: Climate Services User Forum
DEM	: Digital Elevation Model
DHM	: Department of Hydrology and Meteorology
DMG	: Department of Mines and Geology
DSS	: Decision Support System
EA	: Early Action
EAPs	: Early Action Protocols
ECMWF	: European Centre for Medium-Range Weather Forecasts
ERP	: Extended Risk Prediction
EWS	: Early Warning System
FAO	: Food and Agriculture Organization
FARM	: Forecast Application and Risk Management
FBA	: Forecast-based early action
FbF	: Forecast-based Financing
FGD	: Focus Group Discussions
FOCUS	: Forecast Customization System
GCF	: Green Climate Fund
GFCS	: Global Framework for Climate Services
GTS	: Global Telecommunication System
IBFWS	: Impact-Based Forecasting and Warning Services
ICT	: Information and Communication Technology
IMD	: India Meteorological Department
INCOIS	: Indian National Center for Ocean Information Services
INSPIRE	: Internet-based Simulation Platform for tsunami Inundation and Risk Evaluation
IOC	: Intergovernmental Oceanographic Commission
IOT	: Internet of Things
KII	: Key Informant Interview
LDC	: Least Developed Countries
MHEWS	: Multi-hazard Early Warning System
MoU	: Memorandum of Understanding
NMHSs	: National Meteorological and Hydrological Services
NWP	: Numerical Weather Prediction
OSDMA	: Odisha State Disaster Management Agency
PAGASA	: Philippine Atmospheric, Geophysical and Astronomical Services Administration
RCC	: Regional Climate Center

RDAS	: Regional Resilience Data and Analytics Services
RIMES	: Regional Integrated Multi-Hazard Early Warning System
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
SESAME	: Specialized Expert System for Agro-Meteorological Early Warning
SIDS	: Small Island Developing States
SMART	: System for Multi-Hazard Potential Impact Assessment and Emergency Response Tracking
SOFF	: Systematic Observations Financing Facility
SUFAL	: Supporting Flood Forecast-based Early Action and Learning
TNSMART	: Tamil Nadu System for Multi-hazard Potential Impact Assessment, Alert, Emergency Response Planning and Tracking
UKMO	: United Nation Meteorological Office
UN	: United Nations
UNESCAP	: United Nations Economic and Social Commission for Asia and the Pacific
WMO	: World Meteorological Organization

1. Introduction

The 13th Meeting of the RIMES Council was held from 20-22 January 2021 virtually over Zoom due to the prolonged COVID-19 pandemic related travel restrictions. The meeting was presided by Dr. Ravichandran, Secretary, Ministry of Earth Sciences, Government of India, and RIMES Council Chair. The online event gathered around 100 participants from the 45 Member and collaborating countries and development partners of RIMES (refer to Annex 1 for the list of participants).

The 13th RIMES Council was designed around the five pillars of the information value chain, adopting a user-centered bottom-up approach. Seven sessions were conducted over two days to explore the various RIMES programs underway and updates by member countries on the innovative institutional mechanisms to seamlessly connect all the pillars. Engagement with key development partners on regional programmes, with the WMO in formulation of a Joint Strategy and Action Plan, and with the European Centre for Medium-Range Weather Forecasts (ECMWF) on data sharing was also presented.

1.1 Opening Session

Dr. Ravichandran, Secretary, Ministry of Earth Sciences, Government of India and Chair, RIMES Council, opened the session with welcome remarks and introduced the agenda for the RIMES Council meeting. This was followed by remarks from key partners including WMO (Prof. Petteri Taalas, Secretary-General), UNESCAP (Dr. Armida Salsiah Alisjahbana, Executive Secretary) and the RIMES Secretariat (H.E. Ms. Khadeeja Naseem, Minister of State for Environment, Climate Change and Technology, Republic of Maldives). They highlighted the implementation of the WMO RIMES Joint Strategy and Action Plan and ECMWF data exchange mechanism for NMHSs. They also stressed on the need to further strengthen institutional ties between RIMES, UNESCAP, WMO and development partners to guide future RIMES programs effectively.

"The WMO and RIMES partnership program has demonstrated huge benefits in translating the WMO Global Framework for Climate Services. Your initiative this year to institutionalize WMO and RIMES partnership through involvement of WMO regional offices of Africa and Asia and South-west Pacific will be a trendsetter innovation."

Dr. M. Ravichandran, Secretary, Ministry of Earth Sciences, Government of India and Chairman RIMES Council

Given the transboundary nature of multi-hazards, institutionalized regional cooperation is much needed for integration of climate adaptation, early warning systems, and weather and climate services. RIMES has ensured integration of advanced forecast technology from global institutions like ECMWF to transform data into usable information for decision-making at sub-national and community levels to anticipate and manage disaster events. Member states, however, expressed that ECMWF needs to release more observational data to WMO member states to enhance national and regional forecasts.

"Our continued collaboration with RIMES will ensure that the processes linked to the larger Sustainable Development Goals keep a focus on building disaster and climate resilience, the capacities for managing disaster and public health emergencies, to respond to these converging risks is key to recover from the COVID-19 and prepare better for the climate crisis."

Dr. Armida Salsiah Alisjahbana, Executive Secretary, UNESCAP

The institutional partnership between RIMES and WMO is significant for translating the WMO Global Framework for Climate Services into operational programs with close engagement of the WMO regional offices of Africa and Asia and South-west Pacific. The WMO RIMES Joint Strategy and Action Plan has further cemented ties between WMO and RIMES.

"There are system gaps in forecast models as evident in several regions. It is important to move from physical forecast to impact-based forecast. And, it is important to ensure the whole chain from observation to service delivery at the customer side is functioning well."

Prof. Petteri Taalas, Secretary-General, World Meteorological Organization

WMO plans to co-sponsor the RIMES 4th Minister's Conference to be held in Colombo, Sri Lanka post-COVID. Various financing initiatives are also being planned by WMO to improve early warning capabilities of the member states and strengthen work on observation and impact-based forecasting. Meanwhile, there is a need to move from physical forecasts to impact-based forecasts by mitigating key gaps and ensuring effective functionality throughout the value chain.

"RIMES has ensured integration of best of forecast technology from global institutions of excellence such as the ECMWF into national levels and has further supported to transform it into usable information for decision-making at sub-national and community levels to anticipate and manage disaster events."

H.E. (Ms.) Khadeeja Naseem, Minister of State for Environment, Climate Change and Technology, Republic of Maldives and RIMES Secretariat

Ongoing and future programs and projects at RIMES will contribute to the overall RIMES 2030 vision for provision of integrated services covering both climate change mitigation and adaptation through NMHSs and other institutional stakeholders and address the emerging needs and demands of all member states.

1.2 Member Countries Responses

Member countries appreciated the efforts towards establishing WMO RIMES partnership through the Joint Strategy and Action Plan and called for further institutional engagement to build new synergies and provide sustained capacity building support to member states.

The RIMES Joint Strategy and Action Plan based on shared principle and knowledge, enhances the centrality of the NMHSs for national development and ensures proper utilization of resources, sustainability of programs and effectiveness of investments with full national meteorological ownership. The need was highlighted for leveraging the joint plan for NMHSs in the Africa region to draw resources for services and replicate successful RIMES initiatives and programs in Africa region by connecting five pillars of climate and early warning information value chain seamlessly.

It is quite challenging for NMHSs especially in LDCs and SIDS to find resources and infrastructure to optimally serve the end-users. WMO RIMES partnership and the Joint Strategy and Action Plan could help build new synergies between the member states, and especially for small island developing nations to address their geo-physical and socio-economic needs through better services and optimization of resources in the region.

The WMO Regional Office for Africa plans to organize the 6th LDC conference in Seychelles later in 2022 which could consider some of these issues raised by Mozambique and Seychelles.

"The deliberations during WMO RIMES working group meetings in 2021 were indeed very rich, bringing us even closer at working level and has chalked clear and precise pathways to translate WMO strategies into actionable practice with the partnership of RIMES in all RIMES countries in Africa, Asia and the Pacific region."

Mr. Ali Shareef,
Deputy Director General,
Maldives Meteorological Service and Focal Point for RIMES Secretariat

Maldives stated that the WMO and RIMES partnership program has demonstrated huge benefits in translating WMO programs, particularly Global Framework for Climate Services (GFCS) into a reality. The establishment of the WMO working group was groundbreaking with participation of WMO Regional Offices for Africa, Asia, and the South West Pacific as part of the 12th RIMES Council resolution. The working group meetings have chalked clear and precise pathways to translate WMO strategies into actionable practice with the partnership of RIMES in all RIMES countries in Africa, Asia and the Pacific region. Such continued partnership will ensure optimization of resource investments with cost effectiveness and national meteorological and hydrological service ownership and guarantee sustainability of the WMO investments and programs. According to India, the SAHF program and regional priorities had been discussed during the SAHF-III meeting and that the WMO and RIMES Joint Program and Action Plan also incorporated SAHF priorities. Lastly, Armenia stated that the WMO leadership has been very keen to assist low-income countries to get more resources in the future and bridge the gap between the developed and less developed countries.

The opportunities to formulate and implement WMO and RIMES joint projects in the year 2022 and beyond will be huge. It was agreed that continued guidance from WMO leadership will be essential for its technical departments and regional offices to implementation WMO alliance for hydromet development under WMO and RIMES JSAP, and how WMO could leverage RIMES capabilities and collective ownership by member states to implement some of the high profile projects such as GBON, SOFF and CREWS among others.

2. RIMES Programs

2.1 RIMES Secretariat Report 2021

The RIMES Secretariat report for 2021 presented by Mr. Ali Shareef, DDG, Maldives Meteorological Services, and Focal Point for RIMES Secretariat, noted the following outcomes:

- Provided remote administrative support to the RIMES program unit to provide uninterrupted services during 2021 despite COVID-19 imposed travel constraints.
- Facilitated and signed the UNESCAP MoU to integrate ESCAP programs with RIMES countries by leveraging RIMES technical and institutional resources.
- Facilitated the establishment of a working group with the participation of the Ministry of Foreign Affairs, Thailand, Indian Ambassador in Thailand, Maldives Ambassador in Thailand, and Maldives Secretariat and Programs Unit to accelerate the process of Thailand signing the RIMES headquarters agreement. The first meeting of the working group was held on 17 May 2021 and that has initiated this process systematically.
- The Secretariat will continue to spearhead the process of expanding RIMES Council membership in close interaction with many countries and remains ready to offer any further support as required for strengthening RIMES technical and financial capacities to meet needs and demands of RIMES members and collaborating countries.

2.2 RIMES Services across the Early Warning Information Value Chain

RIMES Member States and collaborating countries face immense challenges in addressing the impacts from a changing climate, ensuring resilience in the face of more frequent and intensifying hazards and safeguarding sustainable development. The National Meteorological and Hydrological Services (NMHSs) and the technical institutions providing vital early warning information deliver critical services to their governments and citizens that encompass all three distinct, yet interconnected domains of Climate Change Action, Disaster Risk Reduction and Sustainable Development.

This provides a great opportunity for NMHSs/technical institutions providing early warning and the user stakeholder institutions collaboratively to: capitalize on the awareness around these areas and leverage the renewed interest towards services aimed at addressing the social needs and demands, lead the co-production of tailor-made services and decision-support-systems co-developed by NMHSs and sectoral user/stakeholder institutions and advocate at highest levels for ensuring adequate public investments to provide these services by focusing on, and highlighting their benefits to the society. The climate/weather/hazard information value chain approach encapsulates this opportunity perfectly. This information value chain is also seen as an upstream to downstream service provision with services ultimately geared towards downstream users. While the funding needs and investments are maximum at the basic infrastructure level, the perceived value as seen by the users is highest for the services they receive.

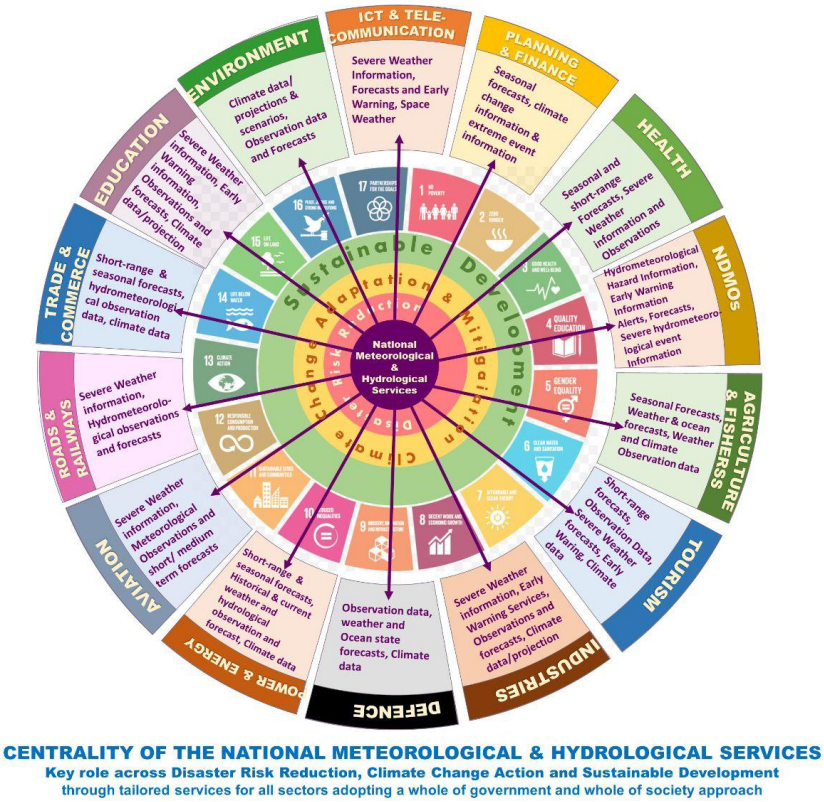
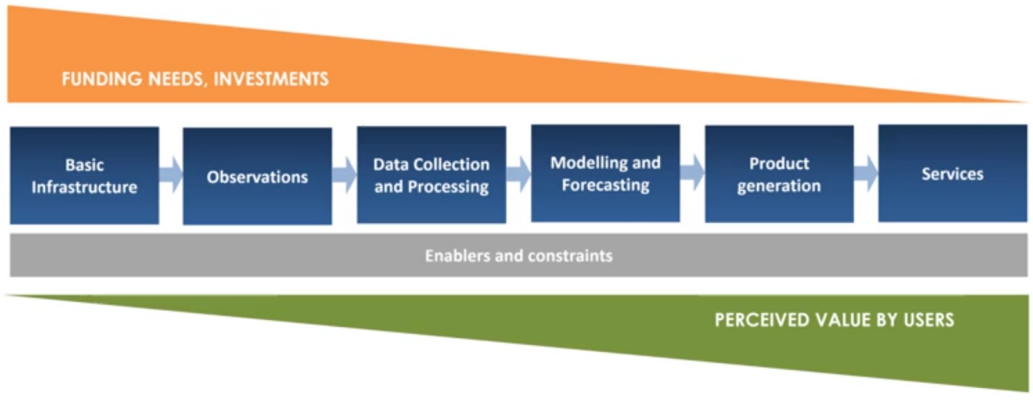


Figure 1. Centrality of the NMHSs (WMO-RIMES Joint Strategy and Action Plan)

RIMES portfolio of services are strategically designed around the five pillars of this value chain, adopting a **user-centered bottom-up approach**. This approach, by design, focuses on the user needs and demands as a driving factor to guide the entire process of climate/weather service co-production as below:

- the identification and articulation of societal demands
- leading to design of tailor-made services to address these demands
- that are operationalized through integrated decision-support systems
- which are built around the modelling and forecasting capabilities
- drawing upon robust observation and monitoring systems



NMHS Information Value Chain *(WMO)*

Figure 2. Perceived value of climate information by the end users lies toward the user-facing services, versus the NMHS information value chain

2.3 Meeting Societal Demands

The societal demands on the user end differ from communities due to different decision contexts of stakeholders and availability of resources, manifestation of hazards and impacts of these hazards in the communities. RIMES has been assisting NMHSs in addressing these user requirements in close collaboration with sectoral institutions through a combination of various institutional mechanisms, co-production processes, data and analytics services, decision support systems and tailor-made services.

Figure 3. Utilizing climate information for end-users application

2.3.1 Climate service co-production

In order to assess and address evolving societal demands and needs for the development of user-centered climate or early warning services, a co-production approach has been undertaken in RIMES programs. In Bangladesh, this approach involved iterative stages of exploring, designing, delivering and refining these services in collaboration with relevant stakeholders.

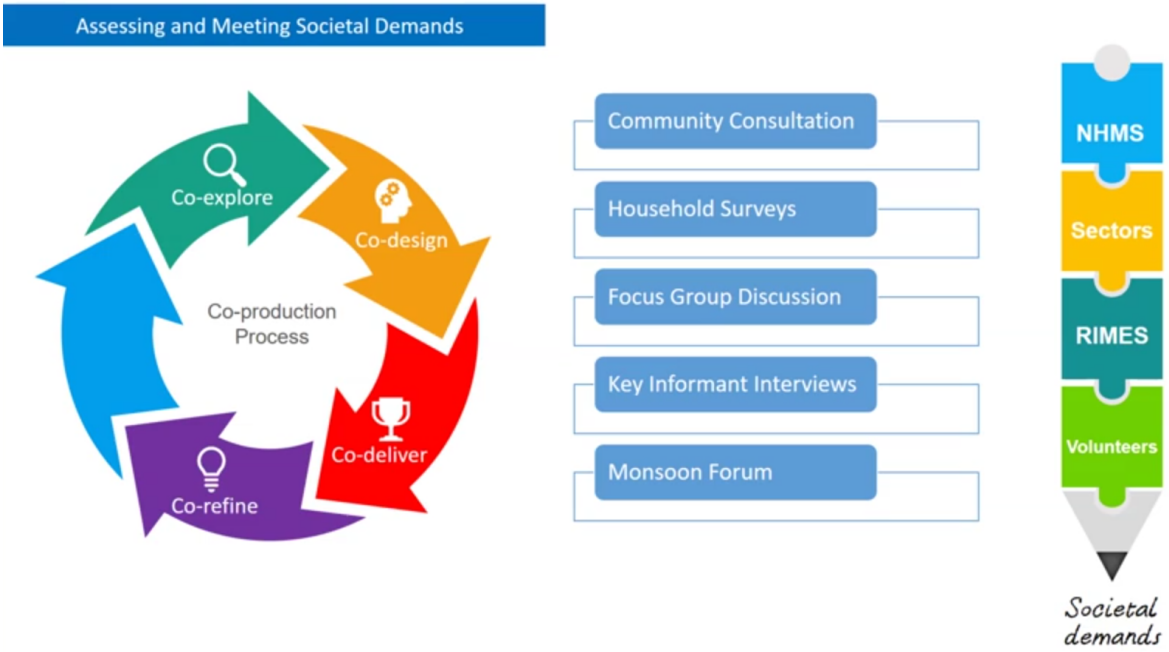


Figure 4. Co-production process to address and meet societal demands (Bangladesh case)

The societal demands are assessed during the co-exploration and design phases through various methods. At the community level, user requirements and demands are captured through community consultations, household surveys, Focus Group Discussions (FGDs) while at the sub-national and national level, Key Informant Interviews (KIIs) are conducted and additional requirements collected from the field through periodic discussions in the monsoon forums.

2.3.2 CARE for South Asia Project

The Climate Adaptation and Resilience for South Asia (CARE for South Asia) project supports the South Asia region, specifically- Bangladesh, Nepal and Pakistan- in building resilience to climate change by improving the availability of regional data and knowledge, developing guidelines, tools and capacities, and promoting climate-resilient decisions, policies and investments across key sectors in South Asia. The project is being implemented by RIMES jointly with ADPC, and supported by the World Bank.

Figure 5. Key Components of CARE South Asia project

RIMES engagement in the component on promoting evidence-based climate smart decision-making is focused on development of the Regional Resilience Data and Analytics Services (RDAS) for South Asia (elaborated in Section 2.5) and Strengthening Sectoral Decision Support Systems (DSS).

Strengthening Sectoral Decision Support Systems (DSS) in Bangladesh, Nepal and Pakistan:

As user requirements and decision-making context vary across different sectors in different regions, support is administered for the use of relevant data through the provision of sectoral decision-making DSS tools and capacity building activities across six sectors- finance and planning, agriculture, water resources management, livestock, roads and transport, early

warning and disaster risk management. The DSSs under development will be piloted in Bangladesh, Nepal and Pakistan, and could also be customized for other countries based on evolving requirements.

Figure 6. Sectors supported through DSS tools in Bangladesh, Nepal and Pakistan

2.4 Delivering Tailor-made Services

RIMES engages with both the service providers and end-user to create an enabling environment for a sustainable delivery of tailor-made service. RIMES enhances capacities at all levels: NMHSs to generate user-tailored forecast products and services, and end-users to receive, understand and internalize forecasts and warnings through improved dissemination of impact forecasts and risk management advisories.

2.4.1 Support for forecast based financing and early action

RIMES's collaboration with stakeholders- NMHSs, agriculture sectoral agencies, disaster risk management agencies and most importantly communities at risk, in the member states has been pivotal for the co-development and implementation of customized forecast products, further promoting synergies with existing programs and projects.

For the initial phase, RIMES conducted stocktaking of available forecast products and services in Southeast Asia. Products and services were assessed and inventories created across weather, climate and water related hazards to understand and evaluate triggers and warning levels. We also identified forecast products at global, regional and national level that are available for forecast-based financing in alignment with the national priorities and local-level needs in the pilot locations.

Building upon this preliminary analysis, RIMES is supporting the UN agencies, IFRC and German Red Cross on development of thresholds and triggers for forecast-based financing and early action in Laos (drought), Cambodia (drought), Philippines (flood), Myanmar (flood and drought) and Vietnam (typhoon).

2.4.2 Expanding Impact Forecast Production for DRM and Agro-Met Services

In collaboration with the Department of Agriculture, Sri Lanka, RIMES co-developed crop decision trees for 7 major crops in Sri Lanka. With feedback from farmers led by field officers, these decision trees incorporated critical farm-level activities like crop variety selection, planting methods, management of water, nutrients, pest etc. and harvesting to assist the farmers for informed climate-sensitive decision making.

RIMES has also partnered with the International Center for Tropical Agriculture for the integration of crop decision trees to enhance SESAME DSS in Cambodia and Myanmar. A co-production process is employed in the design and development of the DSS.

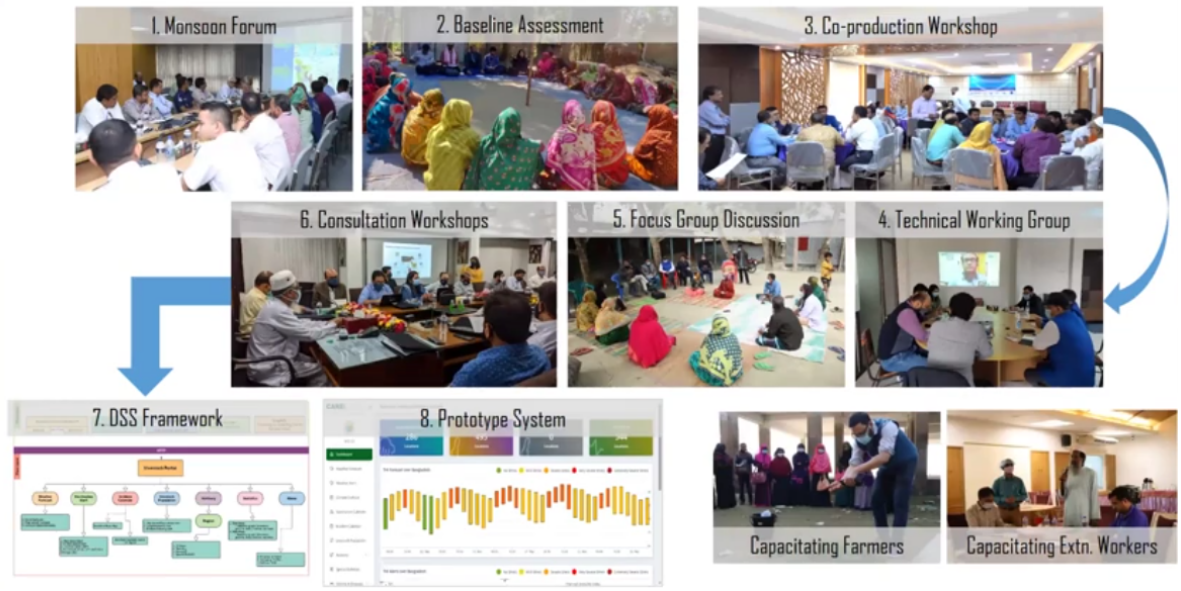


Figure 7. Co-production in action from various stages of stakeholder engagement to the development of DSS.

Indicators of exposure and vulnerability were mapped and are currently being used to design Early Action Protocols and advisories for farmers, planning agencies, last-mile users etc. to effectively pilot forecast-based action projects in the Southeast Asia region.

2.4.3 Linking Agro-Met Services to User capacity building

In order to enhance user's capacity to receive and utilize early warning information, we conducted Forecast Application and Risk Management (FARM) Training of Trainers for field officers and orientations farmers in Monaragala and Mullaitivu, Sri Lanka. Similar programs have been replicated in Bangladesh.

Furthermore, to ensure an end-to-end early warning system, RIMES helped the Department of Agriculture (DoA), Srilanka, in establishing a pilot feedback mechanism for forecast and agromet advisories. These feedbacks provide input to DoA and DHMs about the effectiveness of forecasts and guide further customization of advisory generation.

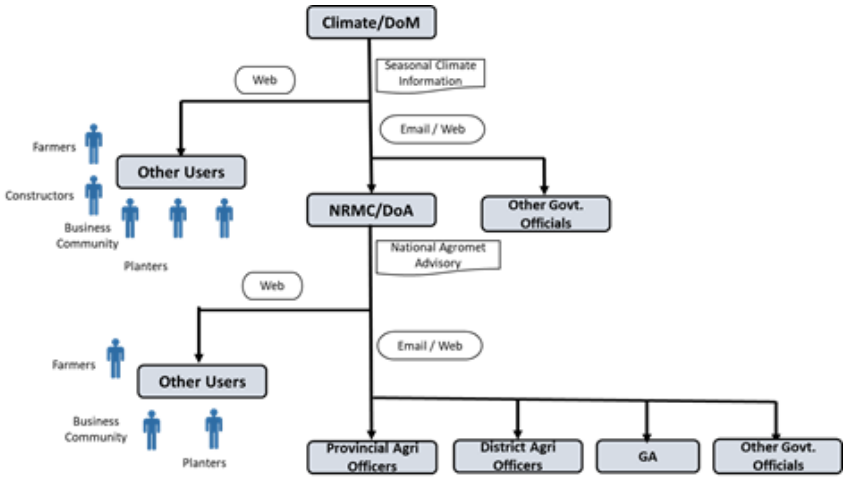


Figure 8. Communication channels between forecast providers and end-users

2.5 Data Analytics and DSS for Integrated Services

2.5.1 Regional Data Analytics platform

Regional Data Analytics platform is a component of the World Bank funded CARE for South Asia project implemented by RIMES.

The open access RDAS platform makes regional data (on hazard, vulnerability, exposure and hydrometeorology) accessible to national/local user institutions and facilitates analysis of climate information vis-a-vis different parameters in different sectors in South Asia such as finance, planning, agriculture and transport. This ultimately promotes climate-resilient decision-making for stakeholders and contributes towards planning, policy reforms and investments in climate resilience.

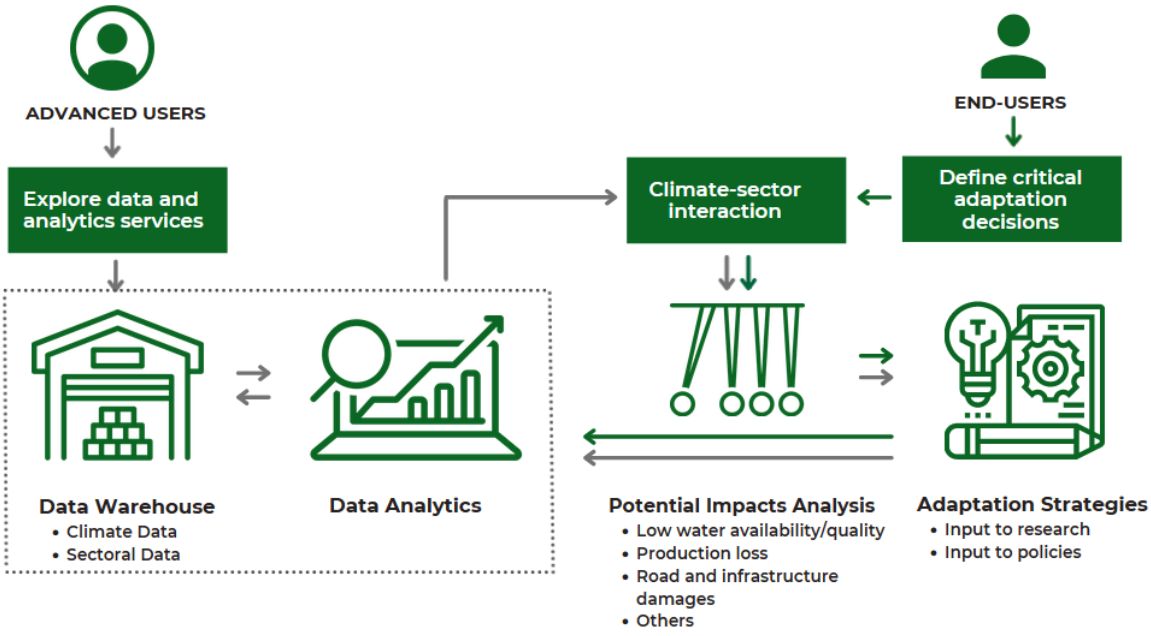


Figure 9. RDAS prototype concept

RDAS combines state-of-the-art data analytics methods including new developments in artificial intelligence, algorithms and data training pipelines, on top of a regional data portal. The platform uses machine learning to train models based on historical climate analysis and combines models from different sectors to improve accuracy and learn relevant data features. The trained models are deployed to infer and predict on new or unknown datasets for future decision contexts. Users have seamless access to these trained regional models and datasets through API services without the need for rigorous training on the user's end.

RDAS features

Comprehensive data catalog: curated list of data sources and data sites providing an extensive data portal from policy-makers to decision makers at local levels for improved regional data and knowledge management. Data types from various sources collected at different time and spatial scale and apply them into relevant sectors viz. climate, agriculture, water resources, transportation, planning and finance

Historical climate analytics: Repository of historical observed data trends and patterns, visualized on an interactive dashboard factoring climate change projections.

Climate change projections and indices: Translating climate projections into indices for sectoral application and interpretation as defined by WMO.

Decision context: Sectoral data like agriculture, transport etc. aggregated by indicators from domain experts and linked to climate resilient decision making; a user-friendly platform for analytical services to process and transform data into actionable information

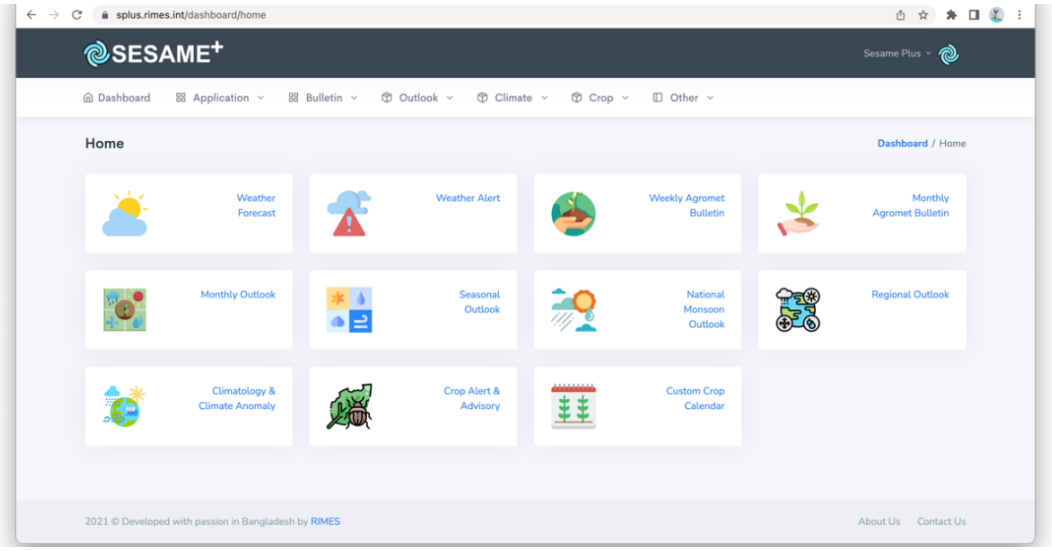
2.5.2 Decision Support System (DSS): updates and developments

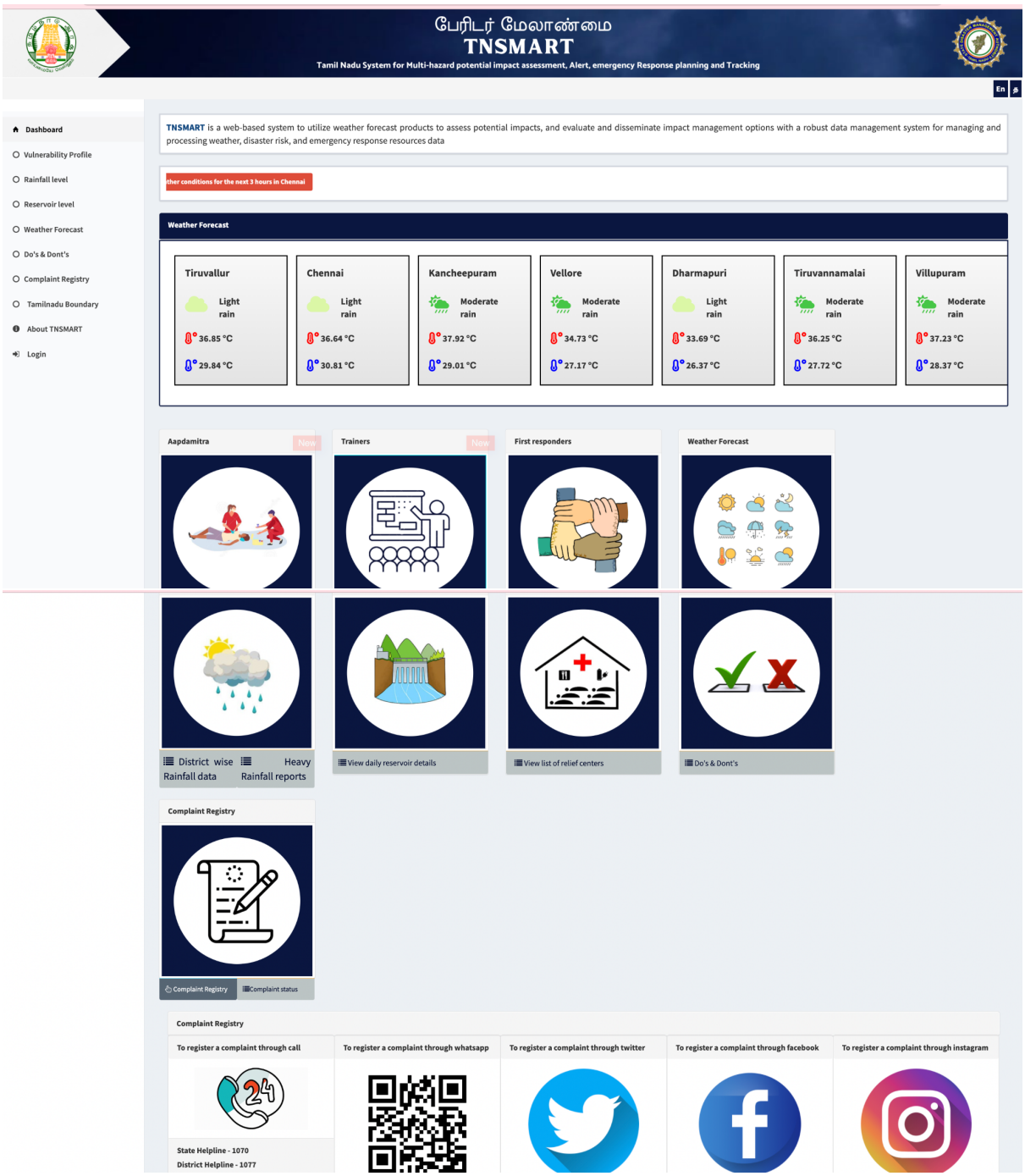
DSS platform integrates weather/climate forecast and observed/realized weather from climatology perspective and includes customized advisory generation and dissemination system based on the decision context. There is ongoing development in user interface and data visualization as well as enhancing capabilities with high resolution forecast products including bias correction for greater forecast accuracy.

Table 1. Significant developments relating to DSS

Agriculture	SESAME is developed and in different stages of operation and customization in 8 member countries to support agro-meteorological decision frameworks. SESAME integrates dynamic crop information systems with climate/weather advisories for improved decision making. Decision makers can utilize advisories on crop management and informative visualization without bearing the pains of rigorous analysis performed on the backend.
Livestock	Analytical services and indicators relevant to the livestock sector viz. livestock impact and exposure, livestock analysis and visualization, vaccination/disease calendar, livestock analysis and visualization of impact and exposure. are being incorporated for decision making. The system is an ongoing development in Bangladesh under CARE South Asia.

Water related hazards	Data portal integrated with climate projections combining historical as well as observed water-level discharge and hydrological information for monitoring and effective advisory generation with outputs relevant to agriculture, road management and transportation.
Public Health	Visualization of incidence and spread of disease like malaria and dengue, associated with climate changes, to develop risk matrix for informed early intervention. The platform can be expanded to include additional layers of support and services like ambulance services, hospitals etc. These platforms are also especially useful for disease surveillance and monitoring to plan national to community level programs.
Disaster Management	TNSMART and SATARK are operational in India, where forecast products are integrated from IMD. In addition to the Disaster Management Authorities accessing the system for guiding their risk management decisions across the entire DRM cycle, Meteorological Centers in both states can access the system to add value and customize the forecast products to generate alerts based on their needs. A key feature of these systems is the capacity to incorporate local level exposure and vulnerability datasets that are overlaid using GIS technology to generate a dynamic real-time visualization of potential impact of the risk for decision making.
Transport	DSS for transport is operational in Odisha, through the Odisha State Disaster Management Authority, where accident databases, climate information and infrastructural parameters are assimilated for monitoring in real-time mode. RIMES also extended decision support systems for the transportation sector in Nepal and Bangladesh through CARE-SA. The platform combines several key parameters relevant for risk informed decision-making in transportation, such as Climate information (extreme temperature, flood, landslide, climate change projection, climate indicators, satellite data); Transportation data (exposure data, road types, condition, road and city map, locations and vulnerability, maintenance cost); Potential impact (Economic impacts, risk maps) and Adaptation plan (Operation and maintenance of infrastructure, policies and plans).





Based on the unique demands of sectoral stakeholder and national priorities, RIMES continues to develop decision support tools by:

- Integrating forecast products of high resolution and varying scales with localized decision context based on country's demands
- Integrating localized analytics, and advanced technology for information access - Internet of Things (IOT) and Artificial Intelligence (AI)
- Improving visualization and interactive dashboard
- Incorporating redundant dissemination mechanism
- Scaling up DSS to support action oriented advisory and warning services generation

2.6 Forecast Modeling and Analytics: Weather, Climate, Hydrological and Ocean State and Coastal Forecast services

2.6.1 Integrated Hydromet Services

RIMES shares weather forecasts on demand basis to all the member states on a daily basis. Ongoing services include: 3 days (72 hours) flood forecasting system in Myanmar, Nepal, Bhutan, Philippines, Sri Lanka and India (Odisha), and 15 days flood forecast, flash flood forecast, seasonal flow outlook have been supported in Bangladesh. In 2021, RIMES assisted Member Countries through the specific actions on integrated hydromet services, as tabulated below.

Table 2. Program updates and accomplishments across hydromet services

Projects and engagements	Country	Program |Donor
Community based risk and resources management systems based on improved weather and flood forecast were implemented	Bangladesh	SUFAL (EU)
Supported NMHSs for **operational flood forecast system**	Myanmar, Nepal	WMO
Conducted **trainings on *Developing hydrological models for flood forecasting***	Philippines	
Developed **72 hours and 15 days flood forecast** for river basins in Odisha	India	
Evaluated performance of existing flood models based on observed versus forecasted values	Myanmar, India	
Performed **system improvement** in Flood Model; ODISHA Flood Model - SATARK	Philippines, India	
Provided **research support**: Comparison of gridded precipitation datasets for prospective hydrological applications	Sri Lanka	
Improved forecast visualization services and graphics engine with an integrated platform to access and customize climate information		
Customized Extended Risk Prediction (ERP) tool with datasets sourced from IMD to generate a 7 day forecast for upto 4 weeks.	Bhutan	WMO
Expanded feature to **WMO climate services toolkit** - to incorporate information across temporal and spatial scale and develop climate indices using observed local weather for sectoral applications in agriculture, water resource management, infrastructure planning etc	Bhutan	WMO

Projects and engagements	Country	Program |Donor
Enhanced FOCUS - Seasonal Forecast tool that generate probabilistic forecast using multi-modal ensemble based technique with verification		UKMet, ARRCC
Floods and drought regional workshop to expand regional cooperation; next session is scheduled for Q1 2022	Regional	ARRCC
Regional and National level Climate Outlook Forums: supported NCOFs and conducted 3 SASCOF and 2 CSUF sessions	Bangladesh, Nepal	ARRCC
Conducted **workshop for *Customizing CST toolkit for water, agriculture and health sector***	Bhutan	WMO
Capacity building for meteorological services in generating seasonal forecasts: Remote Science exchange workshops	Bangladesh (BMD, DAE, BRRI), Nepal (DHM and NARC)	ARRCC
Science to Society: i) **innovations in forecast communication** in delivering weather, seasonal and climate information and advisories through co-production workshops ii) **development of DSS for agriculture**	Bangladesh, Nepal	ARRCC

2.6.2 Ocean State and Coastal Forecast Services

RIMES tsunami services through the 24/7 operational warning facility, provide earthquake alert and tsunami watch services to member countries. To ensure accuracy of earthquake information, densified real-time seismic observation data is required, and has been supported in Asia through previous projects. Similarly, real-time sea-level data from tide gauges or buoys are crucial in validating the occurrence of tsunami, its propagation and completion. In this regard, as part of its mandate RIMES facilitates establishment and maintenance of observation stations and provides technical support to countries as needed.

Timely estimation of an earthquake event and an assessment of its potential to generate tsunami is crucial in forecasting potential impact at the coast. Standard Operating Procedure is employed to detect earthquake location, magnitude, origin time, generate forecasts at the coast and disseminate advisories at various stages of tsunami event.

The Ocean State and Coastal Forecast system employs tools to generate scientific forecasts, tsunami and ocean state models and automate assessment of risk from forecasted events. Forecast information is translated into actionable useful information such as advisories to provide guidance on how to manage potential impacts. Advisories are disseminated through various channels such as websites, emails, sms packs to national focal points.

Figure 10. Sea Level Station, West Philippines Sea

In addition to tsunami forecasts, the system is also able to generate impact-based forecasts online through the generation of an inundation model linked to INSPIRE. The system offers a comprehensive loss estimation assessment for potential damage to lives and infrastructure.

Ocean State Forecasting Service (OSFAS): RIMES, in collaboration with INCOIS provides a continuous 3-day forecast on wave, swell, current, wind direction and speed for countries in the Indian Ocean region. Ocean models developed by INCOIS are validated by using real-time observational data from tide gauges, buoys, satellites and feedback from users. Additionally, OSFAS also provides information on weather forecasts and generates localized advisories to guide planning activities.

With collaboration among stakeholders, RIMES continues to push its research and development agenda to cater regional needs through:

- **Improved ocean information systems and services** to address member state's priorities-based requirements for higher forecast resolution and addition of relevant ocean parameters like sea-surface temperature, salinity etc., DEM upgrade and user feedback for model validation
- **Synthesis across discipline** to combine different aspects of maritime activities, planning, management of hazards and resources
- **Integration of historical hazard and loss database** to identity and flag locations of high risk areas based on frequency of past events and their impacts.
- **Enhancement of user-experience** by improving visualization and Geo-spatial planning feature for a comprehensive one-stop platform to integrate and overlay various layers of ocean-related datasets to provide a general overview of an area at a particular time for customized advisories and resource allocation.

3. Institutional innovations for improving EW Information Value Chain

Institutional mechanism is a crucial element in promoting an enabling environment of collaboration among governments, NMHSs and user- sector. Cooperation and resource sharing that spans regionally and nationally in ensuring an ecosystem of effective climate service co-production and delivery.

Highlights of institutional and organizational innovations, concerns and recommendations that support the overall information and service value chain were discussed.

3.1 Sri Lanka National Center for Climate Application

The Department of Agriculture, Department of Meteorology, Department of Irrigation jointly with the Ministry of Irrigation and Ministry of Disaster Management had signed a MoU in 2019 to establish the National Center for Climate Application in the Department of Irrigation.

The center is equipped jointly by the Department of Irrigation and RIMES. Available models, forecast information and advisories are shared with the center to get optimum benefits in the irrigation and agriculture sector.

The center is working with RIMES to address capacity gaps in the human resources and technology. The Ministry of Irrigation plans to further strengthen the SNCCA capacities through the World Bank funded project- *Climate Resilient Multi-phase approach and its Hydromet components*.

3.2 Bangladesh Center for Climate Applications

The Bangladesh Center for Climate Applications (BANCCA) is designed as an umbrella framework for Government of Bangladesh to bring together service providers and stakeholders to assess specific needs and decision context to develop DSS that span a range of domains viz. meteorological services, disaster management, health and education, urban and rural development, infrastructure, transport and civil aviation, water resources, fisheries and aquatic resources, agriculture, forestry, animal husbandry, planning and finance.

BANCCA is responsible for operation and maintenance of DSS and developing the capacity of sectoral stakeholders to utilize and apply these services in their respective fields. BANCCA also monitors and documents evidence for the system in climate applications, provides technical guidance and drafts policy papers to influence climate resilient investment and development.

BANCCA steering committee, headed by the senior secretary of the Ministry of Defense, comprises 12 members from different ministries; the Director of BMD serves as a member secretary. BMD stands ready to share the learnings to replicate good practices within the region, and build upon the ongoing collaboration between BMD and RIMES for improved climate service delivery and application:

- BMD started the modern day Numerical Weather Prediction in collaboration with RIMES.

- Monsoon Forums have been systematized and evolving to bring together forecast producers and stakeholders
- On-going development DSS like SESAME and livestock support system
- Training program and capacity building workshops
- Piloted advisory dissemination and effective communication channel
- Community outreach program to support forecast based anticipatory actions

BANCCA has made steady progress in its institutional development since its creation in 2020 following the discussion on the concept of climate applications center.

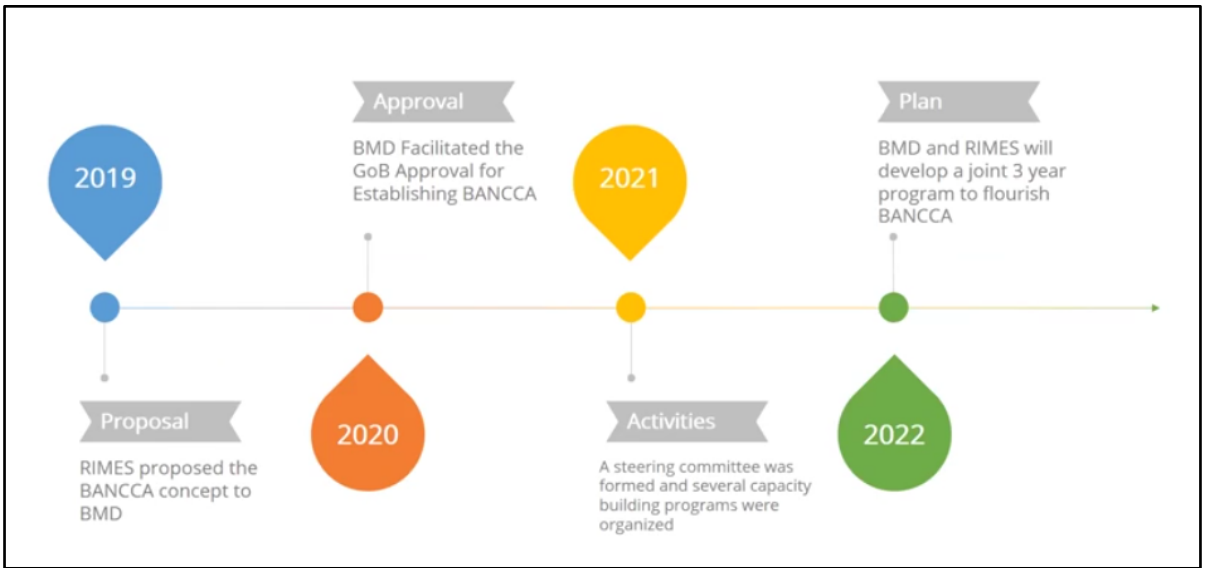


Figure 11. Timeline on the evolution of BANCCA and user-engagement

BANCCA capacity Building efforts since 2021 have spanned a range of activities from localised forecast to training for users, extension services and humanitarian actors.

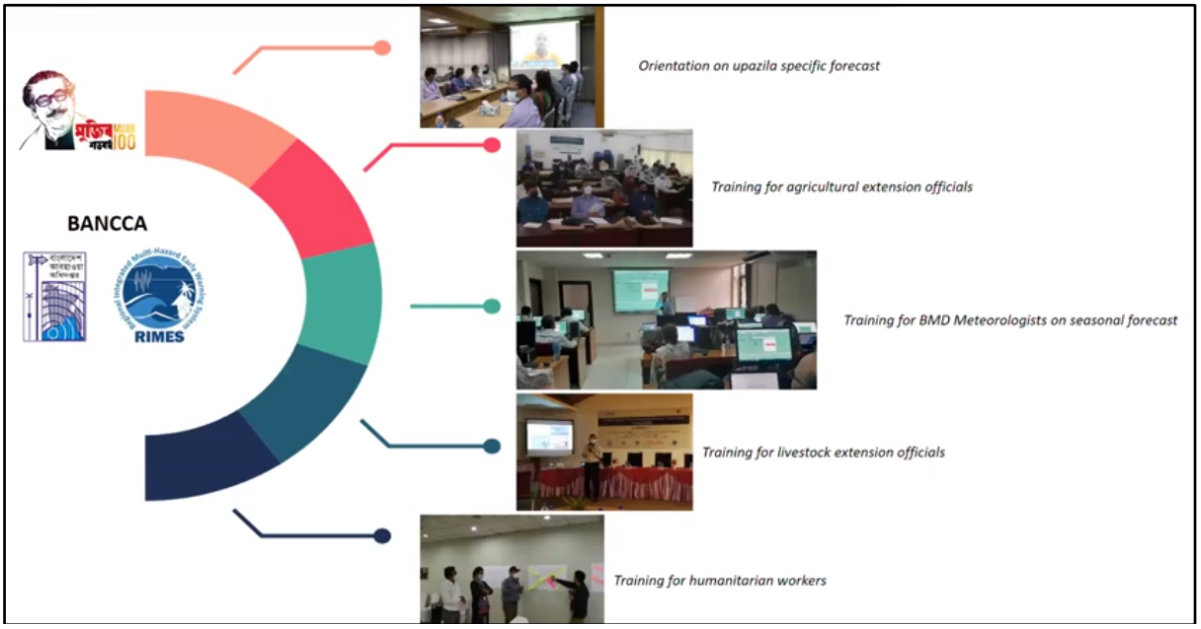


Figure 12. Capacity building and stakeholder engagement under BANCCA-RIMES

Going forward, BMD and RIMES will jointly develop projects and capacity building programs to extend climate services to the stakeholder departments. RIMES will provide technical support for the establishment of BANCCA at BMD and develop BANCCA as a RIMES Regional Center. BMD and RIMES will jointly collaborate with all stakeholders, departments, ministries and institutions for a regionally integrated development of weather and climate services.

3.3 RIMES sub-regional hub for Pacific & PNG National Multi-hazard Early Warning Center

RIMES acknowledges the significant leadership from the National Weather Service in enhancing the services and realizing the vision of a fully operational PNG National Multi-hazard Early Warning Center and sub-regional hub for Pacific. RIMES assists to closely monitor operations of the center and provide guidance for implementation. While the pace has been slow amidst the pandemic situation, steady progress has been made in:

- bringing together multiple areas: agriculture, DRM, climate change and environmental services stakeholders
- Building agreement to share sectoral data to transform into impact-based forecast and sector-specific decision support tools
- Designing linkage of the sub-hub with RIME

The center further urges WMO to support the center's priority areas:

- Capacity building robust early warning system
- improved ICT infrastructure with active connectivity
- data access and sharing
- development of multi-hazard decision support systems and applications at national, sectoral and community levels including Pacific Island countries.

Beyond 2025, the center is anticipated to be completely operational as a regional sub-hub in Phase-II. RIMES is set to provide residual services including fail-safe backup systems and other systems to maintain and improve quality of the outputs. There is need for additional technical and institutional support for delivering end-to-end early warning services as regional sub-hub to 14 pacific countries.

3.4 RIMES Sub Regional Center, Madagascar & National Multi-Hazard Early Warning Center

Madagascar National Multi-hazard Early Warning Center and sub-regional Center has been receiving technical and implementation support from RIMES and aims to leverage on the WMO-JSAP to bring synergies among programs in national and sectoral levels.

The proposed RIMES Sub Regional Center in Madagascar is not yet operational due to multiple stakeholders and institutional challenges, as well as need for financial support from partners for implementation of the center. Madagascar as a LDC is financially and institutionally limited to set up a center on its own. Governments financial priorities have changed due to COVID-19; previously financial allocation was 1,500,000 USD.

Further discussion on establishment of the RIMES sub regional center would be undertaken in engagement with the National Risk Management Council chaired by the Prime Minister as the supreme decision making authority.

3.5 IMD-RIMES Unit

IMD in collaboration with RIMES is working to enhance impact-based forecasting and risk-based warning for severe weather in the region. IMD-RIMES Unit (IRU) is created to expand these services in India in collaboration with the State Disaster Management Authorities, for sectoral applications which are operational (or under development) in Odisha and Tamil Nadu.

Demand for accurate forecasts that translate early warning into impact-based forecasts is increasing with the growing frequency of severe weather events. IMD pivoted towards impact-based forecasts after the devastating flood in Kedarnath, Uttarakhand in 2013. IMD had followed WMO guidelines in providing color-coded warning systems for heavy rainfall along with warnings for cyclones. Since 2018 the service has expanded to include associated impact based on historical data and local parameters for generating warnings.Impact forecasts are based on hazard modeling and defined thresholds for severe weather parameters, requiring a co-production approach. IMD is well poised with on-going developments in dynamic impact-based forecast and warning systems for tropical cyclones and flash-flood warning and guidance systems during heavy rainfall in monsoon season.

3.6 Monsoon Forums

Monsoon Forums since their inception in 2009 have played an instrumental role in informing and building capacities of the users to utilize DOM services. The user feedback and shared learnings from the forums in turn support improvements in services guided by the needs of communities and the planning agencies.

Cost-benefit analysis shows that investment made in climate services ensures greater return and enables conditions for sustainable and climate-resilient development by mitigating preventable damages to physical as well as socio-economic infrastructures.

3.6.1 Monsoon Forum, Sri Lanka

The 25th Monsoon Forum was held virtually on October 5, 2021. Monsoon rain, including the north-east monsoon, is important for agriculture in Sri Lanka. Model prediction was able to factor influence of La Nina during October/December 2021.

RIMES is engaged with DOM Sri Lanka on activities relating to the Monsoon Forum through National training on forecast translation, integration of ocean information system, capacity building on the generation and application of downscaled climate change projection, seasonal forecast customization system and development of DSS to connect climate information with irrigation and agriculture.

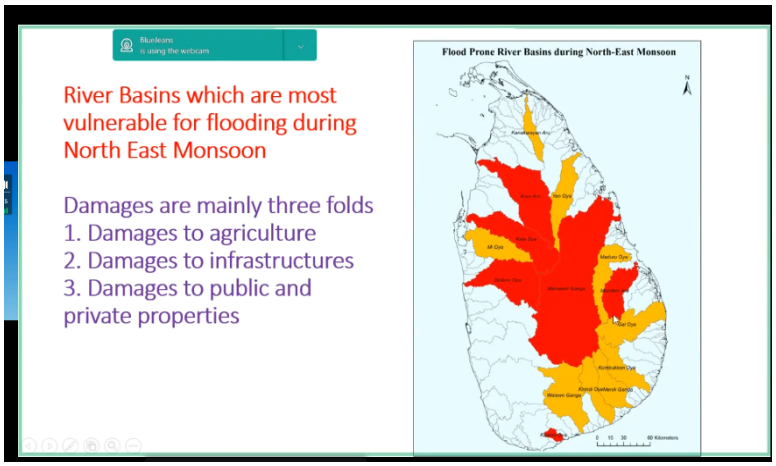


Figure 13. River basin outlook from Monsoon Forum

3.6.2 Monsoon Forum, Myanmar

The 26th National Monsoon Forum in Myanmar was conducted virtually on May 4, 2021. The region is already experiencing abnormal climate phenomena and effects of global warming. Monsoon rainfall variability, spatial and temporal variation of rainfall, increasing temperature has become more pronounced. Seasonal rainfall has caused great losses to sectors like agriculture, livestock breeding, fishery, which sustain over 70% of Myanmar's population. Myanmar's economy is susceptible to climate variability worsened by climate change.

Myanmar has been hosting National Monsoon Forum twice a year, pre-monsoon forum since 2007 and post-monsoon forum since 2011 engaging stakeholders from national as well as community levels.

RIMES is committed to strengthening the monsoon forum through institutional development, capacity building and collaboration in effective service delivery. DMH services will be further enhanced by implementation of institutional development and modernization projects with support and assistance from RIMES, WB, ADB, UNESCAP, Government of India and JICA.

Furthermore, DMH looks forward to deepening collaboration with RIMES on weather forecasting, generation of climate scenarios, application of modern instrumentation in active monitoring, installation of telemetry system, computer model for hydrological forecasting along major rivers and enhancing ability in planning and efficient delivery of accurate forecasting information

4. Contribution of Partners to RIMES Programs

4.1 INCOIS contribution on seismic, oceanic observations and monitoring systems and ocean information services

The Indian National Center for Ocean Information Services (INCOIS) supported initiatives that are implemented across countries in the Indian Ocean, South Asia and SouthEast Asia through Government of India funding to RIMES. On ocean and tsunami services since 2013, key support from INCOIS include:

- Tsunami inundation simulation and estimation system capacity building
- Access to a dedicated country-specific web portal from the INCOIS website that can be accessed by each Member Country for their operational requirement.
- Products provided include data on wave height, direction and period, sea-surface current, temperature, mix-layer depths, depth of 26 degree isotherm, astronomical tides, windspeed, direction and trajectory information.

Moving forward, the efforts are directed towards achieving a seamless near-shore bathymetry and topography Digital Elevation Model (DEM), provision of customized ocean forecasts, operational mechanisms for forecast validation and active monitoring of user feedback to improve dynamic forecast accuracy.

4.1.1 Status of the seismic network set up in Bhutan

8 broadband seismic observation network has been established since 2017, supported by RIMES with technical expertise from INCOIS. Stations are running in good condition.

Figure 14. Seismic Station, Bhutan

Bhutan is setting up stations for densification of the network in terms of strong motion network setup (intensity meter). Building on the infrastructure set up in Bhutan by RIMES with support from the INCOIS project, all 205 sub-districts are in the process of being connected through seismic monitors through JICA funding. Micro seismic events have been

able to generate data that are not reported through the regional system. Minor Issues relating to battery exhaustion and communication are being handled locally.

4.1.2 Status of the observation networks set up in Nepal

Seismic Network expansion:

RIMES has been supporting the Department of Mines and Geology (DMG) for the establishment of real-time broadband stations, continuous GPS stations, hydrometeorological sensors: Bardibas (operational) and Dang stations (interrupted). The 2 broadband seismic stations established by RIMES have been integrated into the main workflow of SeisComp3 at NEMRC data center. The data from the stations are telemetered by sim card to National Earthquake Monitoring & Research Center (NEMRC) data center, Kathmandu for processing. RIMES also provided SOP manuals for operations, and proposed secondment training for DMG staff for human resource development (pending due to the pandemic).

DMG requests provision of proper maintenance, operations of the broadband seismic station (data transmission and sharing, spare parts) and funding assurance for the establishment of the remaining 2 seismic stations according to the RIMES-DMG agreement.

Hydrometeorological Network Expansion:

RIMES has supported 12 hydrometeorological stations in Nepal: 10 hydrological stations (4 radar sensors, 6 bubbler sensor) and 2 automatic meteorological stations.

Figure 15. Hydrological Station in Rasuwa, Nepal

Bubbler sensors have been found unsuitable for measurement in fast-flowing rivers, either washed away during flood or filled with sediment or damaged by debris; 3 have been replaced by DMH. DMH is exploring non-contact sensors like radar sensors to monitor river water level.

4.1.3 Status of the observation networks set up in Myanmar

DMH Myanmar is the governmental organizations responsible for issuing earthquake alerts and tsunami warnings in Myanmar has installed 10 broadband seismic stations in Myanmar, under *Crustal deformation measurement and seismicity monitoring over the Indo-Southeast Asian region (2017-18)* supported by INCOIS, taking total number of stations in Myanmar to 21. Stations are sharing data to the global seismic network through IRIS. DMH has also set up 3 sea-level stations and receives real-time sea-level data from other Indian Ocean countries through tidal surveys implemented by RIMES.

Figure 16. Seismic station in Myanmar

DMH has secured government budgets for additional instrumentation and maintenance of seismic and sea-level stations. Going forward, DMH will need installation of additional seismic stations, require more technical collaboration for seismic research work and expand the seismic monitoring network including training and workshops to build capacities.

4.1.4 PAGASA- Philippines

INCOIS supported project, ***Enhancement of observation and monitoring capacity of Department of Meteorology and Hydrology***, enhanced data availability in support of flood forecasting and warning through establishment of automatic weather stations and automatic water level stations. RIMES facilitated and conducted site identification, survey, and selection, equipment acquisition, onsite installations and telemetry, testing and integration into national and regional systems as well as onsite training on operation, maintenance, and troubleshooting.

PAGASA is also implementing the first ever **Green Climate Fund** project on multi-hazard impact-based forecasting. Expertise of RIMES and other member countries will be an advantage to achieve the strategic goal of the initiative.

4.2 World Bank initiatives for climate resilience and regional cooperation

The **CARE South Asia** initiative is supported by the World Bank with the strategic objective of utilizing Impact-based Forecast tools and Decision Support System and empowering user-sectors. The initiative is aimed at fostering an enabling environment for climate resilience policies and investments in select sectors and countries in South Asia.

While regional in nature, the project has national focus with specific deliverables spanning agriculture and livestock, water, finance, planning, transport, DRM and climate change; the project caters to beneficiaries from 29 ministries and departments of Bangladesh, Nepal and Pakistan.

The first component: **Promoting evidence-based climate smart decision making**, is implemented by RIMES through:

- Development of **Regional Resilience Data and Analytics Services (RDAS)**. RDAS is a public domain data and analytics platform for informing policies, planning and investment decisions for climate-resilient development. RDAS promotes climate resilient planning and integration of regional, national, local climate and sectoral data.
- **Customized decision support system for climate risk-informed planning:** Strengthening sectoral DSS for risk-informed planning and investment spanning DRM, hydromet, agriculture, transportation, finance, water resource management.
- **Capacity building:** Training and capacity building of policymakers and other stakeholders on the use of RDAS and sectoral DSS, following the deployment of the RDAS prototype.

RIMES acknowledges the significant role of an integrated approach in CARE for linking climate weather services into DSS, which is a significant anchor to connect to the demands of the users in the value chain. However, what determines the success and sustainability of climate service lies beyond the technological innovation that goes into the development of DSS and into the key enabling factors like institutional ownership of NMHSs who provide data, end-user facing departments who share their sectoral data and receive operational support in return and their capacity to apply these services to serve the user needs.

South Asia Hydromet Forum (SAHF), facilitated by RIMES, further promotes integration of services and synergy between programs and institutional efforts. As a regional Knowledge hub, SAHF aims to build capacity, support NMHSs and forecast providers, and strengthen key elements of the hydromet service value chain by leveraging regional cooperation.

The First Joint Executive Council and Working Group Meeting was held on 14th June 2021 to take forward this initiative. All 9 participating countries nominated one member each to the four working groups: Numerical Weather Prediction, Impact Based Forecasting, Observational Networks and Capacity Enhancement.

SAHF annual conference- III, held in November 15-18, 2021, brought together a wide range of stakeholders: representatives from NMHSs, public, academic and private institutions.The forum conducted sessions focussing on service delivery, regional collaboration, and innovation

Figure 17. Highlights of the SAHFIII virtual event

4.3 UKMET Asia Regional Resilience to a Changing Climate Initiative

Asia Regional Resilience to a Changing Climate (ARRCC) is aimed at enhancing production and uptake of climate information services in South Asia with regional approach and national level focus on 4 countries: Nepal, Pakistan, Bangladesh and Afghanistan.

The first phase, which started in 2018, leveraged RIMES' reach and capacity to deliver on program goals and support key areas under the 5 pillars of climate service and information value chain that are of strategic importance to UKMet, UK Foreign, Commonwealth & Development Office and RIMES.

Phase I delivered on regional capacity building and continued to support the implementation of SAHF to enhance regional cooperation. ARRCC continues to support multiple other climate forums, trainings and workshops at regional and national level as well as WMO-supported severe weather forecasting programs.

A number of impact-based forecasting pilots are being implemented at national level covering rainfall and landslide in Nepal, tropical cyclone in Bangladesh, agro-meteorological services in Pakistan. The main focus being technical training to forecasters in the hydromet services, integrating hydro-met services with disaster management agencies and finally, bringing in end-users as well as NGOs working at the community level to develop and test approaches for impact based forecast application.

ARRCC has also proposed setting up regional forums for climate projection applications. Regional sea-level rise projection for Bay of Bengal and South Asia has been completed and

decision support tools will be made available to utilize and interpret these projections towards the end of Phase I.

Figure 18. Capacity building trainings on forecast interpretation and application for farmers as part of the pilot experiment with Bangladesh Rice Research Institute under the ARRCC program

ARRCC has been approved for extension into Phase II from 2022 through 2027 with a significant focus on building regional cooperation and capacity with continued support to regional forums like South Asia Seasonal Climate Forum and SAHF.

4.4 USAID People-centered Early Warning Systems and Forecast based Actions

USAID is committed to supporting early warning response and risk reduction, which is key to humanitarian assistance in the case of disaster and imminent hazards due to climate change.

USAID support to RIMES, aims to contribute towards climate resilience through effective use of early warning information among last mile users and vulnerable communities. This includes intervention in select locations in Pakistan, Bangladesh, Nepal and Sri Lanka, with learnings that will be relevant for the entire region.

5. ECMWF RIMES Cooperation on Regional Data Sharing, Management and Analytics

ECMWF-RIMES cooperation since 2012 has been instrumental in supporting impact forecasting needs of the member countries through improved data sharing mechanisms, data integration systems and generation of high-resolution forecast products.

ECMWF has been sharing medium, extended range and seasonal NWP products in real-time. RIMES reports on the use and application of ECMWF products. This reciprocal partnership is further strengthened by **DataEx** to facilitate sharing of historical and real-time observation data from the member states which typically include minimum/maximum temperature, precipitation, average wind-speed and relative humidity etc. that can be used for forecast verification and generating more accurate models. DataEx serves as a two-way communication mechanism for participating countries to both share their observation data and receive quality products from ECMWF

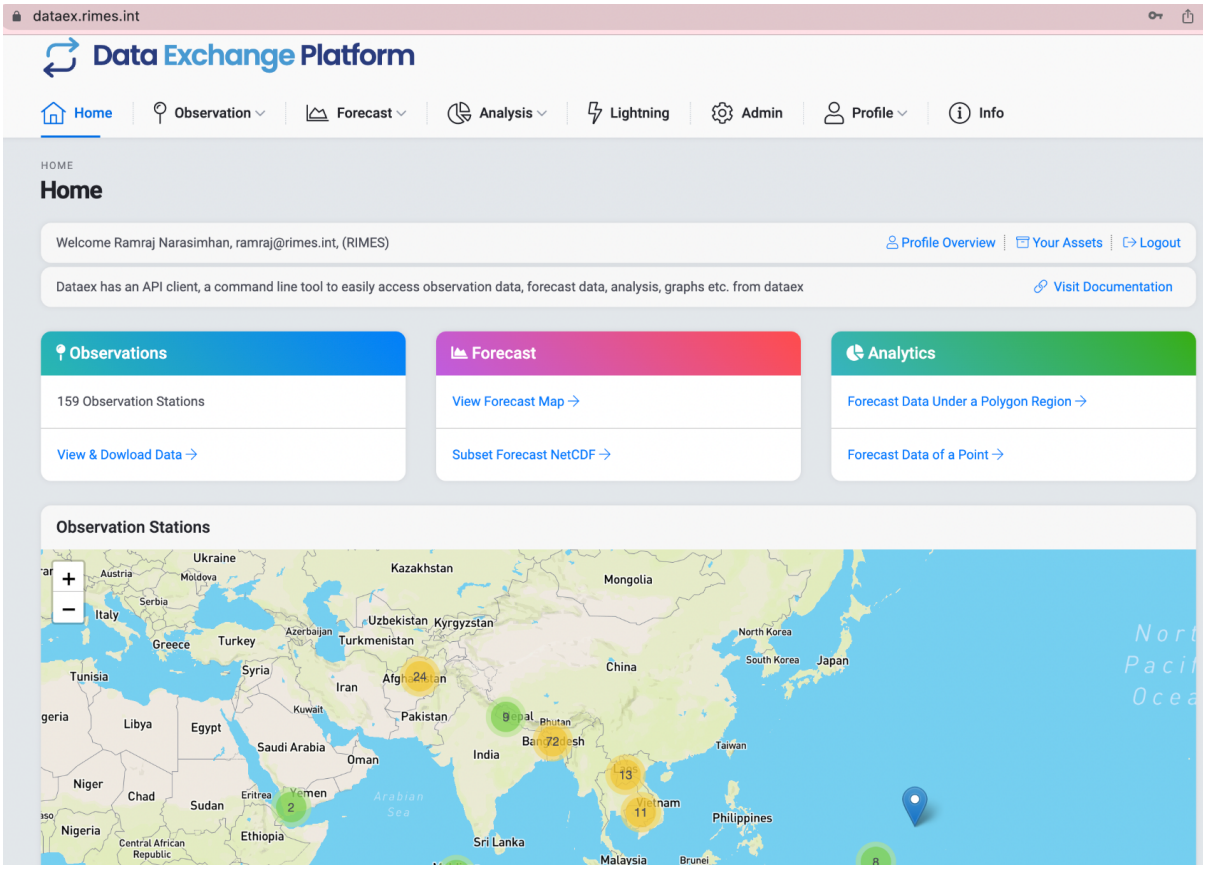


Figure 19. DataEx dashboard featuring a range of data analytics and visualization services.

Enhanced collaboration with RIMES could lead to inclusion of observations in real-time. As an upgrade to the system, these data are available in JSON format. Going forward, the member states are encouraged to :

- Share more meta-data - critical parameters like station heights among others, whether data is already available via GTS; currently, not all data that is shared is

assimilated into ECMWF models since data is assimilated only after important meta-data are accounted for and shared in standardized format.

- Share data in standardized formats; additional capacity building is required which could be facilitated by RIMES
- Share not only meteorological information but also data on river discharge observations to benefit from more robust flood forecasting products and model calibration.

RIMES engaged with 23 member states through 2021 for participation in data exchange mechanisms; 14 countries are already sharing data while others are in different stages of formalities.

Data available via RIMES DataEx (October 2021)

Country	No. of Station Sharing Data	Data Available Period	Total Records (Daily)	% Missing Data
Afghanistan	25	2010-01-01 to 2021-01-01	401800	67.1%
Bangladesh	47	1981-01-01 to 2020-01-01	2830011	0.6%
Bhutan	18	1996-01-01 to 2020-01-01	438210	1.41%
Nepal	16	1981-01-01 to 2021-01-01	1122690	12.1%
Maldives	5	1981-01-01 to 2021-01-01	367272	2.98%
Yemen	2	1983-01-01 to 2015-01-01	101176	1.18%
Combodia	9	1981-01-01 to 2021-01-01	444520	25.98%
Laos	17	1981-01-01 to 2021-02-16	747456	0.01%
Papua New Guinea	9	1981-01-01 to 2021-01-01	664752	8.51%
Timor-leste	1	1981-01-01 to 2021-01-01	43830	24.4%

Figure 20. Status of data sharing by the member states on DataEx platform.

ECMWF is moving to open data: ECMWF Strategy for 2021-2030 highlights science and technology, impact and organization and people. Moving towards open data is a strategic decision to maximize impact of ECMWF products. ECMWF is set to release ***Open Data (real-time) dataset*** in 2022. In order to improve access to global weather data, given the high volume, **ECMWF is exploring cloud solutions**. European Weather Cloud is offered for use by NMHSs of WMO; service charge applies.

ECMWF is adopting the use of Free and open charts (Opencharts). Since this release, the number of ECMWF product access per day has increased from an average of 50K/per day to 190K/per day. The contents of the ECMWF archive catalog are provided with an open license.

EMWF will continue supporting WMO Systematic Observations Financing Facility (SOFF), possibly also by participating in the evaluation of the progress with GBON.

5.1 Country updates, needs and future developments

The member states appreciate ECMWF's support in providing access to high resolution digital forecast products to the low capacity developing countries where the needs are critical and demands, increasing. **The delegates envision that data sharing will result in enhancement of forecast and warning services and reciprocally provide scientific basis for analysis, and benefit from improvement of forecast accuracy and model development process.**

The member states reiterated that shared data are used by ECMWF for forecast evaluation and research linked to improve these processes and not be directly or indirectly used for commercial interests. Additional support was also sought for devising suitable data transfer protocols through consultation between officials from ECMWF, RIMES and the respective country.

Table 3. Member country responses to RIMES-ECMWF data sharing

Member Country	Updates, needs and future developments relating to data sharing
PNG	- PNG appreciated and requested ECMWF's continuous support for making digital forecast data available and products for multi-hazard systems to RIMES. - Prioritized availability of high quality forecast data and products at full resolution (upto 1km) to address increasing need of high resolution localized forecast in the renewed RIMES-ECMWF agreement
Philippines	- PAGASA is doing final revision of MoU between RIMES and ECMWF for data sharing
Mongolia	- Historical data is already shared from 20 hydrological stations and 120 meteorological stations. Historical data sharing is different among stations; so far no comments have been received on the data quality - The center is ready to share real-time data, although some technical issues have been encountered in connecting to the sharing platform
Armenia	- Armenia confirmed readiness to share real-time and historical data within RIMES and ECMWF data sharing platform
Lao PDR	- Lao PDR confirmed support and willingness to deepen collaboration in the regional data sharing
Myanmar	- Myanmar confirmed full support in regional data sharing; - Requires technical support in real-time data sharing
Nepal	- Data from 32 stations will be shared through GTS and RIMES to represent spatial homogeneity

Member Country	Updates, needs and future developments relating to data sharing
	- Historical data (1981 until now) from 16 stations are already being shared to the data exchange platform through GTS - 11 Automatic Weather Station (AWS) are in the pipeline to share data through GTS - additional 5 AWS will be sharing data via RIMES DataEx; - Requested that ECMWF and RIMES share digital versions of the high resolution data (currently receiving in image format) which can be used in hydrological models as input and boundary conditions to high-resolution NWP models. - Hourly synoptic data will be shared with parameters viz. Temperature, relative humidity, pressure, wind and precipitation
Maldives	- Data from 5 major stations have already been shared (1981-until now) which are the most comprehensive climate datasets in repository - Readiness to share data from all the reliable stations; providing access to real-time AWS datasets to RIMES via API calls; - Requested establishment of proper mechanism for real-time data sharing from AWS stations; currently AWS datasets can be accessed via API calls - Needs addition of more atmospheric and ocean related datasets including parameters for ocean currents and wave conditions - Needs training program to access and generate localized forecast information from the high resolution datasets.
Timor Leste	- DMH is sharing data from 1 station and is committed to sharing more with the establishment of new stations; - Requested technical support to use high resolution forecast data into actionable information, ensuring data quality and secure data flow from local observation system to ECMWF
Mozambique	- Currently already using 4kmX4km resolution through Regional Specialized Meteorological Center(RSMC), South Africa from WMO; - Requested technical support to ensure quality and sustained data flow to ECMWF in a form that is useable for DMH, complementary to data shared to WMO via GTS - Center needs higher resolution data for generating localized forecasting of thunderstorm otherwise not supported in 4km resolution; anticipates that the forecast product from ECMWF is of a higher resolution maked a stronger case to invest in data sharing platform and recover cost by generating localized products
Seychelles	- Seychelles supports WMO unified data policy and data sharing addressing data climate services;

Member Country	Updates, needs and future developments relating to data sharing
	- Requested Transparency about ownership of data and meta-data and in ensuring secure data sharing i.e. putting mechanism in place before data is shared with any third party.
Djibouti	- Djibouti requested Technical support to keep stations up and running; out of the 7 stations with data sharing with RIMES, only 2 are in operation. - Requested prioritization of efforts to address capacity gap in data management
Madagascar	- Madagascar confirmed support to the data exchange and that historical data have been shared.
Bangladesh	- Bangladesh requested access to high resolution multi-layered 51 model Ensemble data product from ECMWF, which could be downscaled to basins and local levels - Further demonstration on the products/tools, feedback from use-case scenarios in other countries/context would enable the BMD to evaluate adopting new products from RIMES and help improve the platform
Kenya	- Kenya noted that following the consultation meeting with RIMES, KMD is identifying stations to share data and support this initiative to benefit from high resolution forecast products from ECMWF

ECMWF noted that DataEx as a data sharing, management and analytics platform is promising and holds potential to mutually benefit the region with high quality products and systematize sharing observations. ECMWF plans to further explore features of the platform like forecast verification, post-processing steps and sharing of forecast products.

ECMWF empathized with member state's concern for sharing data openly with its possible impact on revenue generated by rendering forecast services. However, **considering the inevitable trend towards open data, it would arguably benefit one and all to revise revenue models and set up transparent institutional mechanisms that evolve with and embrace open data policies.**

RIMES is well-positioned and committed to building trust for open data sharing and ensuring that there is a non-exploitative level-playing field, accounting for the centrality of NMHSs and their source of revenue. RIMES will continue to support Member countries to create a secure and transparent environment around data ownership and prevent unintended use by any third party.

6. Partnerships

6.1 WMO and RIMES Partnership and the Joint 4th Ministers Conference

WMO Secretary General, Dr. Petteri Taalas was appreciated by all Member Countries for his leadership in institutionalizing WMO and RIMES partnership and the WMO technical support to Member Countries on impact based forecasting programs.

WMO-RIMES Joint Strategy and Action Plan

As expressed in the 12th RIMES Council Resolution, the member states requested WMO to institutionalize its collaboration with RIMES. WMO expressed its commitment to a partnership approach to develop the WMO-RIMES Joint Strategy and Action Plan (JSAP) and support the fourth Minister's Conference. Building on the centrality of the NMHSs, WMO-RIMES JSAP has four key strategic objectives:

- Facilitate **capacity development of NMHSs** to support their mandates at the county level and meet the information needs of Member States for effective DRR, undertaking urgent Climate Actions for resilient and sustainable development
- Promote and facilitate the **development of effective support systems for decision making** across DRR, Climate Action and sustainable development domains by implementing innovative institutional mechanisms
- Ensure **functional tools and decision support systems** are operationalized to guide evidence-based and risk-informed decision-making that draws upon the weather, climate and water services offered by NMHSs.
- Contribute to **strengthening the operational capacities and mechanisms of NMHSs for last-mile outreach** to safeguard the lives and assets of citizens.

The WMO-JSAP institutional aspects will help to:

- **build capacities of national meteorological and hydrological services** for continuous engagement to identify necessary services and products and customize to country-specific requirements
- **pilot test in user environment**, refine and transfer to national institutions
- **Provide technical support and mobilize financial resources** to integrate best practices into member state's operational context until new technologies and management practices are fully absorbed into national early warning framework
- **Enhance capacity of forecast information usage**, integrated with a new generation of probabilistic forecast information into planning and decision making for disaster risk reduction and resource management

Pathway to the Fourth Ministers' Conference jointly organised by WMO and RIMES

End of 2021 : Continued review of Joint Strategy and Action Plan
Early 2022 : Updated MoU finalized and signed
Joint Strategy and Action Plan finalized
WMO's support to Minister's Conference elaborated
Early 2022 : Joint Strategy and Action Plan implemented in pilot countries
Nov. 2022 : Fourth Minister's Conference to endorse the Joint Strategy and Action Plan

The Government of Sri Lanka, as host of the 4th Ministers' Conference, noting the uncertainty brought about by the pandemic situation and health restrictions imposed by the Government, **informed the Council that the Ministers' Conference would be postponed to 2023**.

6.2 Ongoing and Planned Programs

6.2.1 UNEP and RIMES Collaboration on GCF Project Development

UNEP is a strategic partner of the Green Climate Fund and a preferred Accredited Entity for eligible countries, with effective and continuously strengthened operations in supporting developing countries' access to GCF resources for low emission and climate resilient development.

As a part of GCF Climate Information/Early Warning Systems Portfolio funds have been allotted to Pacific SIDS program ($49.9 mil.) and Timor-Leste ($21.7 mil.); 8 GCG proposals are in the pipeline for Azerbaijan, Sudan, Ghana, Maldives, El Salvador, Lebanon, Atlantic SIDS and Afghanistan.

RIMES, as one of the technical partners in ***Enhancing Early Warning Systems to build greater resilience to hydro-meteorological hazards*** in Timor-Leste and for ***Strengthening Climate Services and Multi-hazard Early Warning for Resilience*** in Sudan.

Similarly, as a proposed technical partner in Maldives ***Toward Risk-Aware and Climate-resilienT communities (TRACT)- Strengthening climate services and impact-based multi-hazard early warning***, RIMES has following opportunities for partnership:

- Enhancing National climate outlook forums
- Enhancing climate data collection and archiving capacity
- Establishing an integrated observing and high-resolution forecasting system
- Enhancing downscaled weather, water and climate modeling
- Establishing sector-specific impact-based forecasting and DSS.

RIMES and UNEP share a valuable partnership in developing and implementing GCF.

6.2.2 Asian Development Bank potential collaboration

As the Asia Pacific's climate bank, ADB is scaling up climate financing ambition to a cumulative $100 billion from 2019 through 2030, to support the developing member countries across the region. Drawing on the revised disaster and emergency assistance policy, approved by the board of directors in September 2021, ADB is scaling up to supporting national adaptation plans

ADB plans to invest in at least 75% of the projects that will address climate change risk mitigation and adaptation by 2030. Revised disaster and emergency assistance policy better positions ADB to support disaster and emergency preparedness actions. Possible areas of support could range from improved hazard forecasting, monitoring and early warning capacity to including increased use of radar and satellite technology, installation of automatic weather stations and dissemination of warnings through various means.

As a member of Alliance for Hydromet Development, ADB welcomes the creation of SOFF, which will provide innovative financing for climate and weather observation. This collaboration provides opportunities for ADB and partners like RIMES, to leverage the facility and provide disaster risk financing to address national priorities in the early warning multi-hazard space.

6.2.3 UNESCAP MoU for enhanced collaboration

UNESCAP signed an MoU with RIMES in August 2021, further deepening the existing collaboration already shared in multiple areas. Following the regional learning platform, UNESCAP committee on disaster risk reduction has identified possible areas where RIMES expertise can provide a high-level tracking and monitoring of existing climate services at sub-regional level to **identify gaps and actions required to achieving climate-related SDGs**.

RIMES and UNESCAP collaboration has also made significant progress in South Asia Climate Outlook Forum (SASCOF) on impact forecasting on multiple sectors. With the support of RIMES, UNESAP is looking to **explore the long-term impact of climate** including social, economic and environmental parameters.

6.2.4 Trigger Thresholds for Forecast based Actions, FAO collaborative programme

FAO has extended partnership with RIMES to **link early warning systems with anticipatory action**, funded by the European Union. This collaboration will contribute and support implementation and technical rigor of early warning systems through the lens of anticipatory action. With a national focus on Philippines, Vietnam and Myanmar for 2021/22, the initiative will look at floods, typhoons and drought to understand the premium time to act before a hazard strikes in a specific region. Beyond technical support, the collaboration seeks to engage key actors in the community, government, UN agencies, NGOs and local bodies.

6.2.5 WFP collaborative programme on Last-mile Information System and Feedback

WFP and RIMES have an active partnership in piloting last mile climate advisory service in Sri Lanka. The main objective of this component of the project is to ensure proper application and dissemination of climate advisory services intended to build adaptive capacity of farmers and communities at risk in the case of extreme weather events.

Due to increased climate variability, particularly changes in rainfall pattern, farmers face difficulties in planning from year to year where the existing traditional knowledge and dependencies do not reflect changing climate. Last mile communication mechanisms provide direct guidance for farmers where the available climate information in the country is difficult to interpret.

WFP-RIMES partnership has completed the Training of Trainers program: 3 day training program for agrarian extension officers; ToT and 62 participants received training in Monaragala and Mullaitivu. RIMES, with support from WFP CO and government agencies, has been supporting in developing Feedback Loop to assess agro-meteorological advisories's timeliness, application and outcomes in farm-level planning and decision making.

6.2.6 Swiss Agency for Development Cooperation collaboration

Swiss Agency for Development and Cooperation (SDC)-RIMES collaboration is designed to support the Swiss Humanitarian Aid Hub for SE Asia and the Pacific to address multiple demands across climate adaptation and disaster risk reduction. SDC-RIMES are collaborating in the development of a multihazard portal for Laos PDR and Cambodia. The portal will support Swiss Humanitarian Aid Hub decision making across all aspects of its work relating to climate preparedness, mainstreaming sustainable climate adaptation and people-centered early warning system into SDGs and rapid response to support communities and national disaster management agencies for response and recovery.

7.0 Conclusion

At the conclusion of the meeting, the countries resolved to:

- Replicate inspiring experiences in Bangladesh, India, Papua New Guinea, and Sri Lanka of building national multi-institutional mechanisms for co-production of climate services with users stakeholder institutions
- Replicate South Asia program experience in all other RIMES Sub Regions Africa , South West Indian Ocean, West Asia, Central Asia, South East Asia and the Pacific – through WMO and RIMES Joint Strategy and Action Plan and present in RIMES Fourth RIMES Ministers Conference
- Continue sharing local observational data with ECMWF through data sharing arrangements, to facilitate enhanced exchange of observational data, both real-time and historical, within the domain of the RIMES Member countries and ECMWF products.
- Implement SAHF III priorities and outcomes and to replicate SAHF in other RIMES sub-regions
- Contribute to CARE project implementation and sustain the CARE Project outcome
- Broaden RDAS to include other RIMES sub-regions, in collaboration with sectoral agencies that hold hazard, exposure, vulnerability, and capacity data and deliver climate services for adaptation and mitigation
- Enhance Member State contributions based on value-added services received from RIMES

13th RIMES Council Meeting and Annual Program Meeting

23-24 November 2021

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11	**WMO**	87	**Dr. Petteri Taalas** Secretary-General World Meteorological Organization 7bis, avenue de la Paix, Case postale 2300 CH-1211 Geneva 2 Switzerland Email: ptaalas@wmo.int	
		88	**Mr. Ben Churchill** Head, Regional Office for Asia and the South-West Pacific World Meteorological Organization 36 Kim Chuan Road Singapore 537054 Tel: +65 8518 1796 | E-mail: bchurchill@wmo.int	
		89	**Dr. Amos MAKARAU** Director, WMO Regional Office for Africa	

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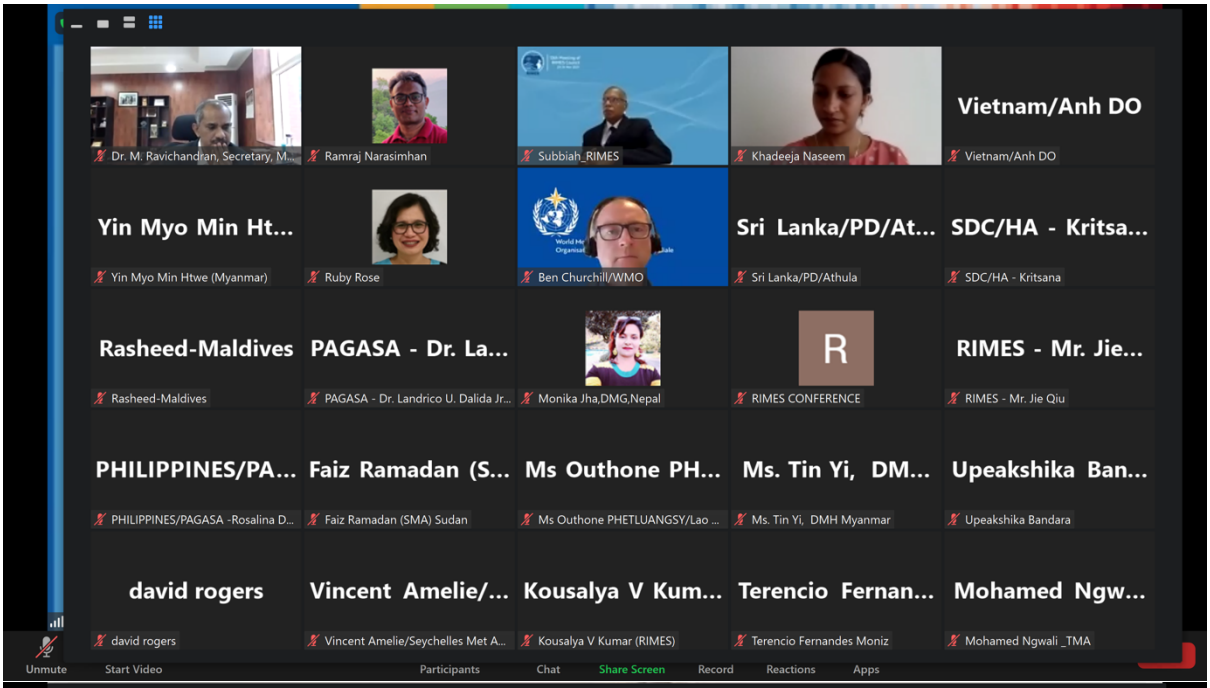
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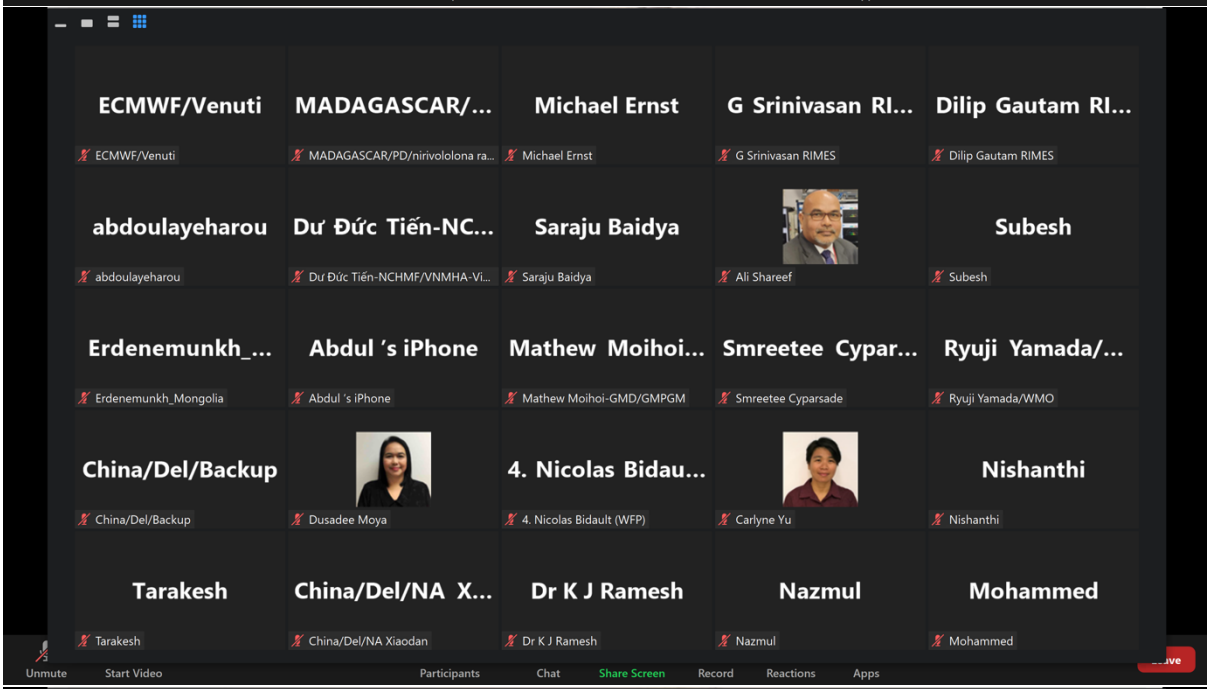
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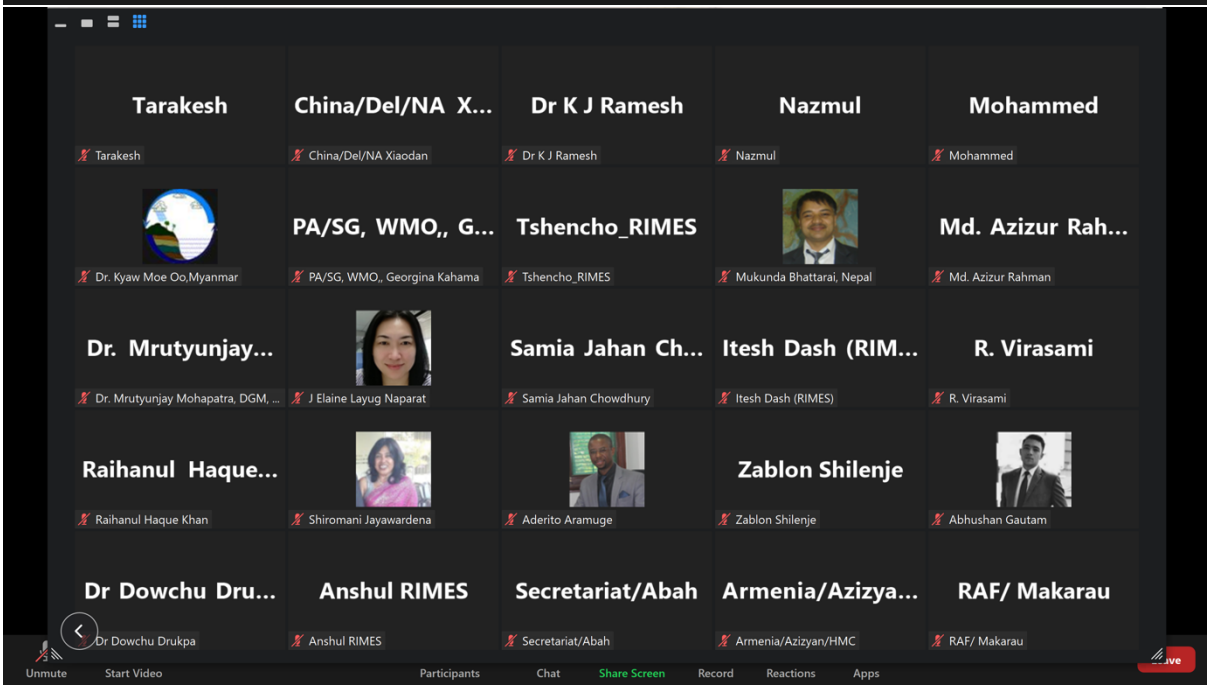
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Mukunda Bhattarai, Nepal
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Md. Azizur Rahman
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Dr. Mrutyunjay Mohapatra, DGM, ...
J Elaine Layug Naparat
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Itesh Dash (RIM...
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Raihanul Haque...
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13th Meeting of RIMES Council

23-24 November 2021, Virtual Sessions

(time is indicated in Bangkok time, i.e., UTC+7)

Day 1 November, 23, 2021

01.30 pm – 2.45 pm [Bangkok Time UTC+7]	**Opening Session**	
	• Welcome Remarks and introduction of Agenda RIMES Secretariat by Dr. M.Ravichandran Secretary to the Government of India, Ministry of Earth Sciences and Chairman RIMES Council	(10 min)
	• Address by Professor Petteri Taalas Secretary-General, WMO	(10 min
	• Member Countries Statement on addresses and responses from SG WMO and Chair RIMES Council	(10 min)
	• Remarks by Dr. Armida Salsiah Alisjahbana Executive Secretary, UNESCAP .	(10 min)
	• Remarks by H.E. (Ms) Khadeeja Naseem, Minister of State for Environment and Climate Change, and Technology Government of Republic Maldives and RIMES Secretariat	(10 min)
		(10 min)
	Secretariat's Report by Mr. Ali Shareef, DDG, Maldives Meteorological Services, and Focal Point, RIMES Secretariat	(5 min)
	Break (10 minutes)	
2.45 pm – 3.:45 pm [Bangkok Time UTC+7]	**Session 1: RIMES Programs** *The objective of this session is to take stock of RIMES delivery of value-added services and future plans*	
	RIMES Experiences in:	
	• Seamless provision of Climate/ weather/ hazard information value chain along the 5 pillars of Information Value Chain *Mr. Ramraj Narasimhan, RIMES*	(7 min)
	• Meeting Societal Demands: *Pillar 1* *Ms Ruby Rose & Mr. Raihanul Haque Khan, RIMES*	(7 min)
	• Delivering tailor-made services to meet societal demands*: Pillar 2* *Ms. Carlyne Yu, RIMES*	(7min)
	• Data Analytics: DSS: Integrated Services to support tailor made Services: *Pillar 3* *Mr Itesh Dash , RIMES*	(7 min)
	• Forecast Modelling and Analytics: Weather, Climate, Hydrological and Ocean State and Coastal Forecast services to support Integrated Services*: Pillar 4* *Mr Itesh Dash, Ms.J.Elaine Layug and Mr Anshul Agrawal, RIMES*	(15 min)
	•	(10 min)

	• Q and A	(17 min)
4:00 pm –5.00 pm [Bangkok Time UTC+7]	**Session 2: Institutional innovations to seamlessly connect all 5 pillars of Information Value Chain** *Follow up and Progress on 12th RIMES Council Resolution on institutional Mechanisms to connect NHMS and User Stakeholder institutions for co-production of Climate Services through incentive-based data sharing mechanisms facilitated by RIMES*	
	• Sri Lanka: Sri Lanka National Center for Climate Application, *Department of Irrigation, Sri Lanka*	(5 min)
	• Impact Based Forecasts and Early Warning Services: IMD and RIMES Unit (IRU), *DG IMD*	(5 min)
	• Bangladesh National Center Climate for Climate Applications, *Director BMD*	(5 min)
	• PNG*:* National Multi-hazard Early Warning Center and RIMES Sub-regional hub for Pacific: *Director, NWS, PNG* (5 min)	(5 min)
	• Madagascar: National Multi-Hazard Early Warning Center and RIMES Sub Regional Center: *DG DGM Madagascar*	(5 min)
		(5 min)
	Monsoon Forum Sri Lanka DG DoM	(5 min)
	Monsoon Forum Myanmar DG DMH	(5 min)
		(5 min)
	• Q and A	(15 min)
5.00 – 6:15 pm [Bangkok Time UTC+7]	**Session 3*:* Contribution of Partners to RIMES Programs** *Contribution of ECMWF, World Bank SAHF and CARE and ARRCC and USAID Programs covering the 5 Pillars of Information Value Chain*	
	• RIMES Master Plan (2021-2026) - Updates and its Contribution to DRR, Climate Action and SDGs *Mr. Ramraj Narasimhan, RIMES*	(10 min)
	• ECMWF Cooperation in strengthening resilience in RIMES Member States and Collaborating countries *Mr. Fabio Venuti, Head of Cabinet, Office of DG, ECMWF*	(15 min)
	• World Bank: South Asia Hydromet Forum (SAHF) *Ms. Arati Belle- Senior DRM Specialist, World Bank*	(5 min)
	• World Bank: Climate Adaptation and Resilience for South Asia (CARE) *Mr. Hemang Karelia –Team Lead CARE Project, World Bank*	(5 min)
	• Asia Regional Resilience to a Changing Climate (ARRCC) *Mr. David Corbelli, Senior International Development Manager, UKMET*	(5 min)
	• People-centred Early Warning Systems and Forecast based Actions, *Mr. Michael Ernst, USAID Regional Office Bangkok*	(5 min)
	• Q and A	(5 min)
6. :15 pm- 6: 30 pm	**Closing remarks for Day 1 and summary by Chair, RIMES Council**	

Day 2 November, 24, 2021

02.00 – 3.00 pm [Bangkok Time UTC+7]	**Chair, RIMES Council: Remarks to initiate the day's proceedings** **Session 4*:* Regional Data Sharing, Data Management, Data Analytics** *The NMHSs-RIMES-ECMWF Data Exchange Platform set up to share observation data and receive high-resolution forecast data from ECMWF, its participants and status* • Demonstration of NHMS ECMWF and RIMES Data exchange Mechanisms *Mr. Itesh Dash, RIMES* • Data sharing discussions with Member countries for enhanced sharing of data from the region with ECMWF under the renewed RIMES-ECMWF Collaboration Agreement - Countries participating/ agreed to participate in the Data Sharing Mechanism- DGs /Directors of NHMS (2 minutes each): Tonga, Samoa, PNG , Philippines, Timor Leste, Mongolia, Armenia, Lao PDR, Cambodia, Myanmar, Bangladesh, Nepal , Bhutan , India , Maldives, Pakistan, Afghanistan, Sudan, Djibouti, Yemen, Kenya, Mozambique, Comoros, Seychelles and Madagascar - Remarks by ECMWF*, Mr. Fabio Venuti, Head of Cabinet, Office of DG, ECMWF* • *Seismic observation Hydrological//sea level monitoring stations – Status Report : Bhutan , Nepal, Myanmar and Seychelles*	(7 min) (5 min) (10 min)
3:00 – 4:00 pm [Bangkok Time UTC+7]	**Session 5*:* WMO and RIMES Joint 4th RIMES Ministers Conference: Preparations & Updates:** *The objective of this session is to provide update on RIMES and WMO Joint Strategy and Action Plan in the context of the 4th Ministers Conference* • WMO and RIMES Joint Strategy and Action Plan- 2021 2025 *Mr. Ben Churchill, WMO Regional Office for Asia and Pacific, Singapore* *Mr. Amos Makaru, WMO Regional Office for Africa, Addis a Baba* • Replication of RIMES South Asia Program in other sub-regions of Asia, Pacific and Africa through WMO and RIMES Ministers Conference: Discussion : RIMES *Mozambique, Seychelles, PNG, Armenia (5 Minutes each)* • RIMES Ministers Conference Preparation Status: Post-Covid, November 2022 *DG, Dept of Irrigation Government of Sri Lanka* • Any other interventions	(10 min) (10min) (15 min) (5 min) (20 min)
4:00 – 4:30 pm [Bangkok Time UTC+7]	**Session 6*:* Development partners - on-going and planned programs** • ADB Potential Collaboration with RIMES (5 Minutes) Mr. Steven J.Goldflinch DRM • UN ESCAP – The MoU between ESCAP and RIMES for enhanced Collaboration	

	• Trigger Thresholds for Forecast based Actions, RIMES-FAO collaborative programme, *Ms. Catherine Jones, Emergency and Rehabilitation offices RAP FAO*	(5 min)
	• *Potential Collaboration between SDC and RIMES Dr.Basabe R.Pedro*	(5 min)
	• RIMES-WFP collaborative programme on Last-mile Information System and Feedback, M*r. Nicolas Bidault, Senior Regional Monitoring and VAM Adviser, WFP*	(5 min)
	• Discussions	(10 min)
	Session 7*:* UNEP and RIMES Collaboration on GCF Project Development	
4:30 – 5:15 pm [Bangkok Time UTC+7]	• Updates from UNEP on collaboration on GCF Project Development, *Mr.Jochem Zoetelief Senior Programme Officer*	(10 min)
	• **Country Statements on GCF Project Development Status**	
	i. Timor Leste	(5 min)
	ii. Sudan	(5 min)
	iii. Maldives	(5 min)
	iv. Bhutan	(5 min)
	v. PNG	(5 min)
	vi. Madagascar	(5 min)
5:15 – 6.00 pm	**Draft resolutions**	
6.00 – 6:05 pm	**Closure of the 13th RIMES Council Session**	

RESOLUTION OF THE THIRTEENTH MEETING OF THE RIMES COUNCIL
(ANNUAL PROGRAM MEETING)
Virtual Meeting, 24 November 2021

We, heads/representatives of National Meteorological and Hydrological Services/ national scientific/ technical agencies that generate early warning information for Afghanistan, Armenia, Bangladesh, Bhutan, Cambodia, China, Comoros, Djibouti, Eritrea, India, Kenya, Lao PDR, Madagascar, Malawi, Maldives, Mauritius, Mongolia, Mozambique, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, Samoa, Seychelles, Solomon Islands, Somalia, Sri Lanka, Sudan, Tanzania, Thailand, Timor-Leste, Tonga, Uzbekistan, Vanuatu, Vietnam, and Yemen, met online from 23-24 November 2021 to discuss the progress of RIMES work in 2021, provide direction to RIMES work for the next decade 2021-2030, and share best practices on enhancing preparedness for, response to, and mitigation of natural hazards. We hereby:

Warmly welcome Dr. M. Ravichandran, Secretary to the Government of India, Ministry of Earth Sciences, as Chairman of RIMES Council;

Appreciate Dr. M. Rajeevan Nair, former Chair of RIMES Council for his valuable contribution to RIMES programs;

Appreciate the Maldives RIMES Secretariat role in providing continued support to RIMES institutional development processes despite the COVID-19 pandemic

Appreciate RIMES Program Unit's continuous delivery of weather, water, climate, earthquake, tsunami, ocean, and capacity building services, despite the public health emergency brought by the still ongoing COVID-19 pandemic;

Appreciate the Secretary General of the World Meteorological Organization (WMO), Professor Petteri Taalas, for his opening remarks and his concrete measures to institutionalize WMO and RIMES partnership by evolving WMO and RIMES Joint Strategy and Action Plan (JSAP) through the participation of WMO Regional Office for Africa and WMO Regional Office for Asia and the South West Pacific to synergize efforts for providing sustained support to NHMSs.

Appreciate Heads of WMO Regional Office for Africa and WMO Regional Office for Asia and the South West Pacific for their engagement with RIMES through meetings and collaboration to evolve WMO and RIMES Joint Strategy and Action Plan (JSAP), putting it into implementation in select countries and to present outcomes and results in the 4th RIMES Ministers Conference.

A**ppreciate** further commitment by Secretary General of the World Meteorological Organization (WMO), to co-sponsor the 4th RIMES Ministers Conference planned to be held in Colombo, Sri Lanka, post-COVID.

Request WMO to implement WMO programs such as GBON and CREWS/SOFF within the framework of the WMO-RIMES JSAP in all RIMES countries in Africa, Southwest Indian Ocean, Pacific and Asia regions;

Resolve to replicate inspiring experiences of Bangladesh, India, , Papua New Guinea, and Sri Lanka for putting in place national multi-institutional mechanisms for interfacing with users stakeholder institutions for co-production of climate services such as Impact Based Forecasting;

Welcome and appreciate RIMES collaboration with the European Centre for Medium-Range Weather Forecasts (ECMWF) on exchange of RIMES countries' observation data and use for enhancing model outputs and provision of high-resolution forecasts to participating countries;

Welcome and appreciate establishment of RIMES Regional Data Exchange Platform to enable quality checked data flow between participating NHMS and ECMWF, forecast verification and ECMWF products;

Resolve to continue sharing local observational data with ECMWF through data sharing arrangements, to facilitate enhanced exchange of observational data, both real-time and historical, within the domain of the RIMES Member countries and ECMWF products. Modalities, time-period and terms of the exchange will be evolved through consultations between ECMWF and RIMES teams, taking into consideration Member State priorities, concerns, and respecting the data policies of the respective organisations.

Request all RIMES Member Countries to participate in NHMS-ECMWF Data exchange mechanism facilitated by RIMES thereby contributing to enhancing forecast model performance;

Appreciate ECMWF for sharing high full-resolution real-time and archived forecast digital data sets with RIMES and its Member countries through agreed protocols to facilitate operational use of ECMWF forecast products in the region;

Request ECMWF to share further higher resolution data to RIMES Countries;

Appreciate the World Bank and RIMES for conducting successfully the 3rd South Asia Hydromet Forum (SAHF) from 15-18 November 2021 to synergize the development of weather and climate services in the region through capacity development in Numerical Weather Prediction, including ensemble prediction systems, impact-based forecasting and observational networks;

Appreciate Chair and Vice Chair of SAHF Executive Committee for their leadership and all 36 Working Group Members for their active engagement in working group deliberations and their inputs for evolving Hydro-Met Service delivery enhancement programs through SAHF Regional Cooperation; further appreciate the World Bank Team for providing support to leverage global and regional resources for SAHF Program implementation by RIMES;

Resolve to implement SAHF III priorities and outcomes and to replicate SAHF in other RIMES sub-regions;

Appreciate the World Bank for providing all support for CARE project implementation towards the development of a Regional Resilience Data and Analytics Services (RDAS) platform for South Asia and linked sector decision-support systems for Bangladesh, Nepal and Pakistan to improve the availability and use of climate information and analytics informing planning/decision-making and thereby contribute to an enabling environment for climate resilience policies and investments in these sectors, countries, and region;

Resolve to broaden RDAS to include other RIMES sub-regions, in collaboration with sectoral agencies that hold hazard, exposure, vulnerability, and capacity data; and to provide climate services for adaptation and mitigation

Resolve to contribute to CARE project implementation and sustain the CARE Project outcome**;**

Appreciate and welcome World Bank's initiative toward integration of SAHF and CARE projects

Appreciate SAHF and CARE projects integration will ensure seamless integration of both upstream and downstream nodes of early warning /climate information value chain in South Asia Region

Appreciate USAID-NOAA-UCAR for approving Forecast Based Action Project in October 2021 to be implemented by RIMES in pilot countries in South Asia Region

Appreciate outputs from CARE DDSs outputs will be transformed into tailor made services to reach to communities through USAID/NoAA/ UCAR project

Appreciate SAHF and CARE integration and USAID/NoAA/ UCAR's support and resolve to demonstrate the value of seamless integration of climate/early warning information value chain to enhance climate resilience in South Asia Region

Resolve to replicate South Asia program experience in all other RIMES Sub Regions Africa , South West Indian Ocean, West Asia, Central Asia, South East Asia and the Pacific – through WMO and RIMES Strategy and Action Plan (2022-2027) and present in RIMES Fourth RIMES Ministers Conference

Appreciate the RIMES Program Unit for continuously developing demand-driven decision-support systems, integrating cutting-edge technologies during system development and updating such systems during operational phase to keep abreast with new user requirements and latest technologies;

Resolve RIMES to provide integrated services covering both climate change mitigation and adaptation through NMHSs and user institutional stakeholders to cater to the needs and demands of existing and emerging decarbonized climate resilient New Economy in the decade of 2021-2030

Appreciate Sri Lanka's commitment to host the 4th Conference of Ministers, post COVID-19 in early-/mid-2023;

Appreciate Department of Irrigation (DoI) Government of Sri Lanka 's commitment to leverage technical capacity of RIMES to implement World Bank supported project.

Appreciate WMO and the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) for their continuous institutional and programmatic support to RIMES;

Appreciate ESCAP for signing a Memorandum of Understanding with RIMES to institutionalise ESCAP and RIMES partnership to formulate and implement joint programs;

Appreciate ECMWF and UK Met Office for their continued technical and programmatic support to RIMES;

Appreciate the United Nations Environment Programme (UNEP) for RIMES-UNEP partnership in mobilizing resources from the Green Climate Fund (GCF) for implementing priority country projects, and especially for submitting proposals by Maldives, Sudan and Timor-Leste to GCF pursuant to the RIMES-UNEP Memorandum of Understanding;

Appreciate UNEP for the accomplishment in getting GCF 's Board Approval for GCF Timor Leste project in October 2021 with RIMES as one of the implementing partners within the shortest possible time

Urge NMHSs to request their respective National Designated Authorities (NDAs) to prioritize NMHS' GCF proposal over any other overlapping proposals, by drawing experiences from Timor-Leste, Maldives and Sudan and provide periodic updates to RIMES Program Unit to enable it to report to the Council;

Appreciate IFAD for approving EWS Project for Bangladesh to be implemented through Department of Disaster Management

Appreciate the Food and Agriculture Organization of the United Nations (FAO), World Food Program (WFP), and United Nations Office for Disaster Risk Reduction (UNDRR) for their programmatic support to RIMES; and

Appreciate the Asian Development Bank, for participation in the Council Meeting

RIMES MEMBER AND COLLABORATING STATE REPRESENTATIVES IN ATTENDANCE

Afghanistan
Mr. Mohammad Nasaim Muradi
Director
Afghan Meteorological Authority

Armenia
Dr. Levon Azizyan
Acting Director
Hydrometeorology and Monitoring Center State Non-Commercial Organization

Ms.Valentina Grigoryan,
Principal Adviser to Director
Hydrometeorology and Monitoring Center
Ministry of Environment

Bangladesh
Mr. Md. Azizur Rahman
Director and PR with WMO
Bangladesh Meteorological Department

Bhutan
Mr. Tayba Buddha Tamang
Chief
National Center for Hydrology and Meteorology

Cambodia
Mr. Oum Ryna
Director
Department of Meteorology

China
Ms. NA Xiaodan
Deputy Director
Division of Multilateral Cooperation
Department of International Cooperation
China Meteorological Administration

Comoros
Mr. Saifou-Dine Aliani Toiha
Chef de Service
Prévisions, Alertes et Recherche Direction Technique de la Météorologie Agence Nationale de l'Aviation Civile et de l Météorologie

Djibouti
Dr. Mohamed Isamel Nour
Director-General and PR with WMO
National Meteorological Agency

Eritrea
Mr. Bereket Tsehaye
Head of Agricultural Policy and Strategy Unit
Ministry of Agriculture

India
Dr. M. Ravichandran
Secretary
Ministry of Earth Sciences and Chair
RIMES Council

Kenya
Ms. Stella Maris O. Aura
Director and PR with WMO
Kenya Meteorological Department

Lao PDR
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Director General and PR with WMO Department of Meteorology and Hydrology

Madagascar
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Director General and PR with WMO
Madagascar Meteorology Department

Malawi
Mr. Jolamu L. Nkhokwe
Director and PR with WMO
Department of Climate Change and Meteorological Services

Maldives
Mr. Ali Shareef
Deputy Director General Meteorology
Maldives Meteorological Service
and Focal Point for RIMES Secretariat

Mauritius
Mr. Premchand Goolaup
Director and PR with WMO Mauritius
Meteorological Services

Mongolia
Dr. Oyunjargal Lamjav
Director Weather Forecasting
National Agency for Meteorology and
Environmental Monitoring of Mongolia

Ms. Erdenemunkh Byambaa
Director, Finance, Planning and International
Cooperation
National Agency for Meteorology and
Environmental Monitoring of Mongolia

Mozambique
Dr. Adérito Celso Félix Aramuge
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Instituto Nacional de Meteorologia

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Dr. Kyaw Moe Oo
Director General and PR with WMO
Department of Meteorology and Hydrology

Nepal
Mr. Saraju Kumar Baidya
Director General
Department of Hydrology and Meteorology

Pakistan
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Director General and PR with WMO
Pakistan Meteorological Department

Papua New Guinea

Mr. Jimmy Gomoga
Director
National Weather Service

Mr. Mathew Moihoi
Acting Assistant Director ,Geohazards
Management Division
Dept Mineral Policy & Geohazards Management

Philippines
Dr. Landrico U. Dalida Jr.
Deputy Administrator for Operations and
Services
Philippine Atmospheric, Geophysical and
Astronomical Services Administration

Samoa
Dr. Luteru Tauvalele
Director
Samoa Meteorology Division (SMD)
Ministry of Natural Resources and Environment

Mr. Silipa Mulitalo
Acting Assistant Chief Executive Officer
Meteorology Division
Ministry of Natural Resources and
Environment

Seychelles
Mr. Vincent Amelie
Chief Executive Officer and PR with WMO
Seychelles Meteorological Authority

Solomon Islands
Mr. David Hiriasia PR with WMO
Director General and PR with WMO Solomon
Islands Meteorological Service

Mr. Lloyd Tahini
Acting Director
Solomon Islands Meteorological Service

Somalia
Mr. Nour Yousuf Nour
Director General
Ministry of Agriculture and Irrigation

Sri Lanka
Mr. A.M. Karunanayake
Director General and PR with WMO
Department of Meteorology

Eng. K.D. Nihal Siriwardana
Director General of Irrigation
Department of Irrigation

Sudan
Ms. Hanan Magzoub Hagahmed Rabbah
Director General and PR with WMO Sudan
Meteorological Authority

Tanzania
Mr. Mohamed Ngwali
Director, Zanzibar Office
Tanzania Meteorological Authority

Thailand
Mr. Kemkaeng Yutidhammadamrong
Director General
Department of Agriculture Extension

Ms. Supinda Wattanakarn
Chief of Hydrological Information and
Forecasting Branch, Hydrology Division
Royal Irrigation Department

Timor-Leste
Mr. Terencio Fernandes Moniz
Director and PR with WMO
National Directorate for Meteorology and
Geophysics

Tonga
Mr. Ofa Fa'Anunu
Director of Meteorology and PR with WMO
Tonga Meteorological Services

Uzbekistan
Dr. Nishonov Baxriddin Erkinovich
First Deputy Director General and PR with WMO
Centre of Hydrometeorological Service of the
Republic of Uzbekistan

Mr. Davron Azimov
Deputy Chief of Department of Water Cadaster
and Meteorological Measurements
Centre of Hydrometeorological Service of the
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Vanuatu
Mr. David Gibson
Director
Meteorology & Geo-Hazards Department

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Mr. Dinh Thai Hung
Director
Science-Technology and International
Cooperation Department
National Hydro-Meteorological Service

Dr. Do Tien Anh
Acting Director General
Department of Science, Technology and
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Yemen
Mr. Mohammed Saeed Hamid Al-Zuraiqi
Assistant Deputy Chairman for Meteorology
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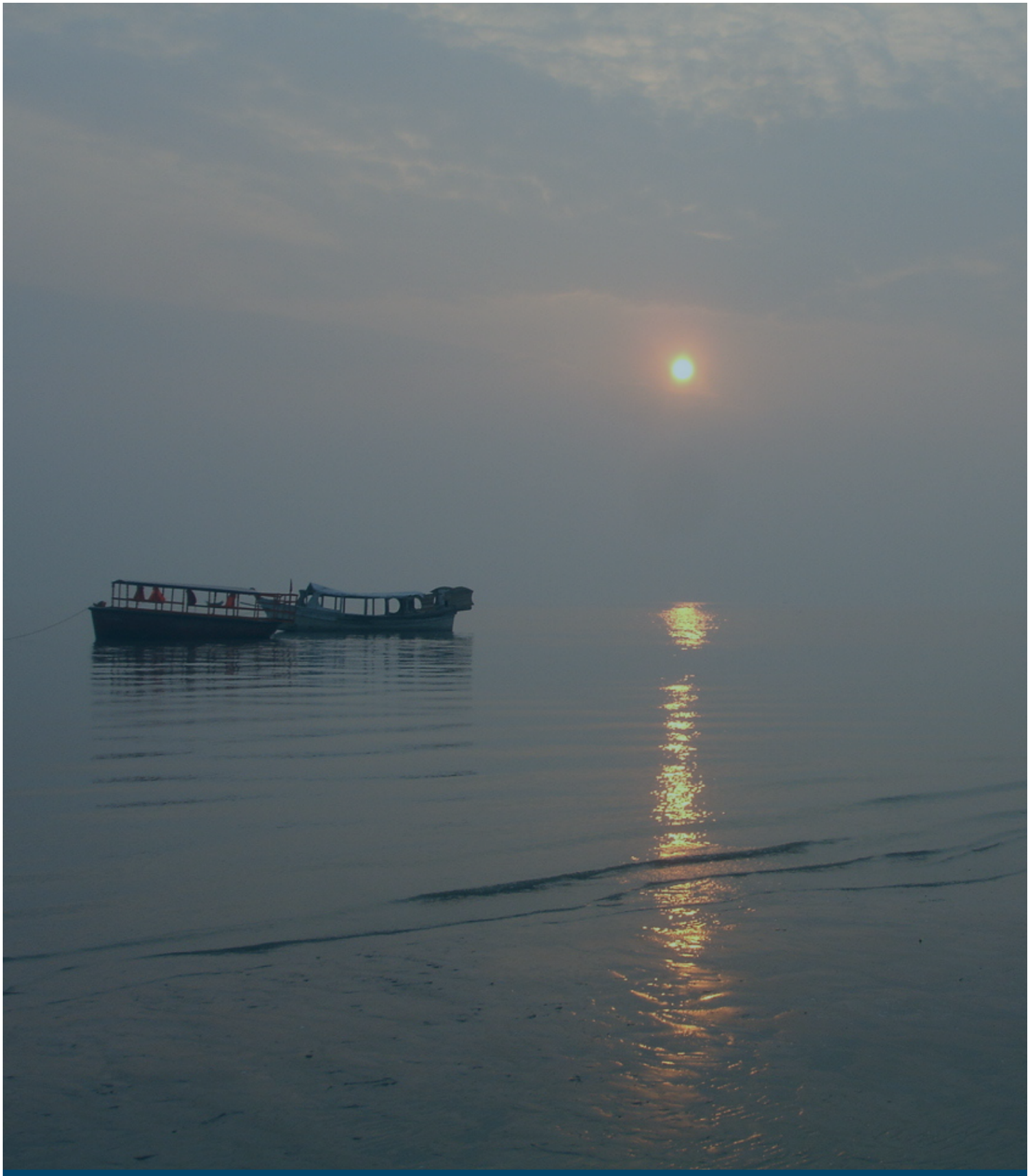

Regional Integrated Multi-Hazard Early Warning System

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