

## Enhancing climate services in south Asia

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**सार** - वर्तमान जलवायु में विविधताओं और भावी जलवायु में परिवर्तन के बीच तालमेल बैठाने के लिए दक्षिणी एशियाई देशों में जलवायु सेवाओं का विकास महत्वपूर्ण है। दक्षिणी एशियाई देशों की राष्ट्रीय मौसम विज्ञान और जल विज्ञान सेवाओं (NMHS) को विश्व मौसम विज्ञान संगठन (WMO) और रिम्स (RIMES) द्वारा जलवायु सेवाओं को बढ़ाने के लिए सहायता कर रही है। इस शोध पत्र में उपयोगकर्ता इंटरफ़ेस प्लेटफॉर्म को स्थापित / मजबूत करने, निर्णय लेने में उपयोगकर्ता द्वारा जलवायु की जानकारी का उपयोग करने, जलवायु जानकारी को बढ़ावा देने के लिए उपयोगकर्ताओं के साथ जुड़ने और लंबी अवधि के लिए जलवायु सेवा को बनाए रखने के लिए नीति प्रक्रिया शुरू करने के काम पर ध्यान केंद्रित किया गया है।

दक्षिणी एशियाई जलवायु आउटलुक फोरम (क्षेत्रीय स्तर पर) और राष्ट्रीय जलवायु आउटलुक फोरम / मानसून फोरम (राष्ट्रीय स्तर पर) के कार्यान्वयन दो महत्वपूर्ण उपकरण थे जिनका उपयोग दक्षिण एशिया में यूजर इंटरफ़ेस प्लेटफॉर्म की स्थापना / मजबूती के लिए किया गया था। विशिष्ट देश के लिए प्रशिक्षण पाठ्यक्रम भी विकसित और कार्यान्वित किया गया जो प्रभाव आकलन, जलवायु प्रदर्शन, जोखिम प्रबंधन, रोगों की निगरानी और जल विज्ञान संबंधी प्रबंधन के लिए जलवायु सूचना उपयोग पर केंद्रित था। एनकोफ (NCOF) और सैसकोफ (SASCOF) जैसे उपयोगकर्ता इंटरफ़ेस प्लेटफॉर्म के माध्यम से प्राप्त सिफारिश को पूरा करने के लिए क्षेत्र स्तरीय प्रदर्शन और वेब-आधारित निर्णय समर्थन प्रणाली (DSS) चुनिंदा देशों में विकसित किए गए। सैसकोफ (SASCOF) और मानसून मंचों जैसे आयोजनों में विभिन्न बैठकों, यात्राओं और चर्चा के माध्यम से जलवायु संबंधी अनुभव, सीख और जलवायु सेवाओं को बनाए रखने की आवश्यकता के बारे में नीति निर्माताओं को अवगत कराया गया है।

**ABSTRACT.** Developing climate services in South Asian countries is important to build resilience to current climate variations and future climate change. National Meteorological and Hydrological Services (NMHSs) of the South Asian countries were supported by the World Meteorological Organization (WMO) and RIMES to enhance climate services. The work focused on established/strengthen user interface platform, build the capacity of user to use climate information in decision making, engage with users to promote climate information and initiate the policy process for sustain the climate service for long term.

The implementation of the South Asian Climate Outlook Forum (at regional level) and National Climate Outlook Forum/ monsoon forums (at National Level) were two important tools used for establishment/strengthening user interface platform in south Asia. The country-specific training curriculum was also developed and implemented, focused on climate information utilization for impact assessment, climate projection, risk management, diseases surveillance and hydrological management. To fulfil the recommendation, received through user interface platform such as NCOF and SASCOF, field level demonstration and web-based decision support systems (DSS) were developed in the selected countries. The various experience, lesson learnt and needs to sustain the climate services has been conveyed to the policy makers through various meetings, visits and discussion during events such as SASCOF and monsoon forums.

**Key words** – Climate, South Asia.

### 1. Introduction

Information beyond the period of days are broadly termed as “climate information” and are available as statistical aggregates associated with probabilities, rather than more exactly determinable outcomes. Hence the relevance of “climate information” is highly context dependent, making it imperative for a close liaison with users so that the information is appropriately interpreted to

their specific situations. The World Meteorological Organization (WMO) established the Climate Information and Prediction Services (CLIPS) project, as early as 1995, “to provide the best possible climate information, including expectations of future conditions, to improve economic and social decisions that will reduce risks and improve economic vitality as well as quality of life.” CLIPS fostered development of Regional Climate Centres (RCCs) and also played a key role in the development of Regional

Climate Outlook Forums (RCOFs) that now serve as platforms for generating consensus-based seasonal climate outlooks. CLIPS support training workshops, helped build capacities for climate services. All these efforts contributed to development of fundamental strengths amongst the National Meteorological and Hydrological Services (NMHSs) in South Asia. The present Global Framework for Climate Services (GFCS) with a vision “to enable society to better manage the risks and opportunities arising from climate variability and change, through the development and incorporation of science-based climate information and prediction into planning, policy and practice” carries forward and builds on the solid foundation laid by CLIPS in the region.

The World Meteorological Organization (WMO) Programme on Implementing the Global Framework for Climate Services (GFCS) at the Regional and National Scales funded by the Government of Canada through the Federal Department of the Environment was implemented by the Regional Integrated Multi-hazard Early-warning System for Asia and Africa (RIMES) during February 2016 to March 2018 in the South Asian region. This paper presents a brief account of this work to facilitate user engagements at different levels to enhance climate services. The work was undertaken by RIMES with full collaborative support of NMHSs of countries in South Asia - Afghanistan, Bangladesh, Bhutan, India, Maldives, Myanmar, Nepal, Pakistan and Sri Lanka with the technical support of WMO.

## 2. Approach

The WMO - RIMES implementation of the GFCS in South Asia in collaboration with NMHSs broadly addressed the following aspects:

- (i) Mapping/assessment of status of climate information usage and needs of user institutions
- (ii) Establishment/strengthening of climate outlook capabilities and user interface platforms for provision of relevant climate information to user sectors
- (iii) Enabling integration of climate information into the planning and decision-making processes of sectoral users, both high-level and end-users
- (iv) Sensitization of policy makers on the importance of and need to sustain climate services.

### 2.1. Status of climate information usage and needs

Regional and national climate information needs were assessed through reviews carried out based on

secondary information and in country consultations. Informal interviews and focused group discussions with stakeholders from priority sectors identified by GFCS were conducted at national meetings hosted by respective NMHSs.

### 2.2. Strengthening climate outlook generation capacities and establishment of user interface platforms

Organization of seasonal climate outlook forum (SASCOF Sessions organized/ Establishment of Climate Services User Forums at SASCOF sessions; organization of National Climate Outlook Forums (NCOFs) / Monsoon Forums.

### 2.3. Enabling integration of climate information into planning and decision-making process of sectors

Integration of weather and climate information into specific decision contexts, generation of site and sector specific tailored products, including bottom-up awareness building of user communities. Scaling-up of reservoir management and flood management systems in Sri Lanka Agro-met services in India and Maldives.

### 2.4. Awareness among policy makers for mainstreaming climate information and services

Through RIMES Council and Ministerial meeting briefing sessions; involving senior policy makers in opening sessions and awareness workshops; sharing outcomes at feedback sessions on DSS tools developed.

Hewitt *et al.* (2017) identified three levels of engagement with users of climate information as illustrated in Fig. 1. As the process of transition progress from Stage 1 to Stage 3, the requirement of time and expense of engagement increase.

Stage 1 engagement maybe able to disseminate significant volume of climate information to a diverse group of users. But, user sector feedback indicate need for specific rather than generic climate information for their planning and risk preparedness decisions. It is therefore necessary to establish in-depth linkages by moving on to stages 2 and 3, to create sustained operational climate services. The GFCS - South Asia project tried to map and enhance the process of climate services in the region.

## 3. Mapping

In many countries, the use of climate information and services to specific areas like disaster preparedness is

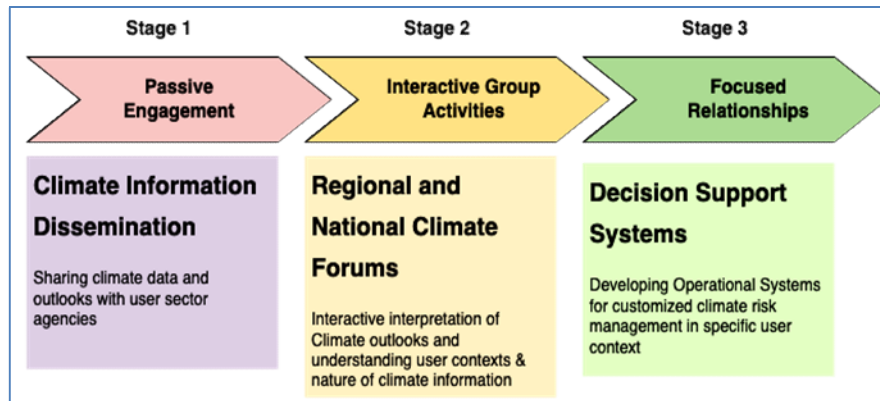


Fig. 1. Levels of engagement of climate information with users (based on Hewitt *et al.*, 2017)

limited due to weak institutional linkages. Lack of awareness and appreciation of climate information leads to poor demand. Capacities for service provision is also at a very rudimentary level because of scarce resources, untrained manpower and sparse climate data. The available information and data, do not link to key user sectors like agriculture, health and disaster management.

### 3.1. Agriculture

Besides farm level decision-making for each growing season, there is need to consider climate information for agricultural long-term planning. As small land in a climatically suitable location can produce same amount of food grain as from a larger area from an unsuitable area. The climate knowledge can be useful for land use planning and thereby bring balance between fallow land and land used for the Urbanization and development of industries.

The inclusion and development of sub-sectors like Animal husbandry, Fisheries and Agro-forestry, through climate information/ climate knowledge can help add more saving to the farmers and can make agriculture as an attractive business.

Crop diversification and organic farming are the future directions that the sector is moving towards and tailored climate information is required to support these efforts.

### 3.2. Health

Climate knowledge can be helpful for understanding how the health is currently influenced by climate and how it will be impacted in future for which we need to be prepared.

Empirical mapping of the vector borne diseases through climate knowledge tool was attempted through

the Health sector Decision Support System developed by RIMES during the WMO GFCS project. Such tools were demonstrated to have advantages, both for enhancing the use of climate information and raising awareness amongst health sector community.

Availability of sector data and research to understand climate triggers that trigger epidemic outbreaks present challenges.

### 3.3. Water

Climate information can be very helpful in reservoir management to know about the amount of water available and losses due to runoff and deep percolation. Such climate information can be vital for long term planning of water sector. The correlation between weather information and available water can be drawn.

Climate information and services can be helpful for the Public Works Department (PWD) to get estimates about evaporation losses, which is influenced by variables such as sunshine and cloud cover.

### 3.4. Other considerations

#### 3.4.1. Climate Data

Good coverage and quality long-term climate data is essential to build robust climate services. While agencies external to the NMHSs can contribute substantially towards collection of climate data, an effective collaboration from the very beginning is key to sustained sector-specific monitoring systems. Observed data needs to be well organized and accessible through appropriate Climate Data Management Systems (CDMS). NMHSs worldwide are now implementing such systems.

### 3.4.2. Operationalizing

Operationalizing systematic use of such information requires a well-coordinated end-to-end institutional system that begins with monitoring of weather and climate events and ends with a community level response. The main challenge of such a system would also be the customization of information to climate sensitive points of decision-making. This needs to be evolved iteratively through an interactive process of stakeholder engagement.

### 3.4.3. Climate as resource

Climate from an applications perspective needs to be viewed at a risk as well as a resource. Effective interface with users can deliver climate information that is clear, precise and relevant. Working with stakeholders involves knowledge and understanding of a wide range of issues that run across the traditional science domains within which NMHSs generally function. Continued communications through National Climate Forums (NCFs) with updates through e-mails and web-site, video-conferencing, social-networks and text messages through cellular networks is crucial. Partnership with interface institutions and agencies working directly with target communities are essential to render climate services.

### 3.4.4. Impact based forecasting

There is currently a movement towards “impact-based forecasting” that produces “impact variables” relating directly to stakeholder activities. Impact-based forecasting suites that link climate forecasts to impact models can be operationalized by scaling up successful demonstration projects.

### 3.4.5. Integration with weather scale

From a sector user perspective, climate information cannot be viewed separately from the information being provided by NMHSs on the weather time scales, typically short- and medium-range covering periods from 3 to 10 days ahead. This is because sector generally tend to use climate and weather information “telescopically”, with short lead-time information for responsive actions and longer lead-time information for strategic planning and preparedness. DSS therefore need to bring both weather and climate information together, in a customized platform to address specific decision-contexts.

## 4. Regional and National Climate Forums

This section describes briefly the various activities implemented within the WMO GFCS project period that contributed to the enhancement of climate services in the

region. Many of these activities are now being sustained either within the operations of the institutions or through allied project initiatives now funded by other development partners. The project also created a significant awareness among the sectoral stakeholders enabling them to evolve and emphasize the need for including climate risk components in their plans and new project initiatives.

Credible climate information is an important starting point for effective climate services and risk management decisions. Globally, the Global Producing Centers (GPCs) coordinated by WMO offer a large sub-set of climate predictions months in advance. The Regional Climate Centers (RCCs) help in contextualizing the global products for the region and also build capacities within the region to interpret such results from a national perspective. RCOFs (SASCOF in the South Asia) serve as platforms for all these groups to get together and distill a climate outlook for the region. The regional outlooks further form the guidance for national climate outlooks considering unique features that influence climate in a national domain.

Perceptions of credibility are also linked with relevance of the climate information being provided and its legitimacy. The process of generation of the information needs to be perceived as unbiased and fair. All these can be optimized by understanding end-user decision contexts, conducting rigorous scientific analyses, ensuring proper communication and engaging end users in knowledge creation processes (Gerlak *et al.*, 2018).

### 4.1. Climate outlook generation and user interface platforms

The Regional Climate Outlook Forums (RCOFs) providing consensus seasonal climate information on a regional scale are recognized as a key component of GFCS-CSIS (GFCS-Climate Services Information System). Such forums also serve to interface with user sectors at a regional level to understand and enhance the use of climate information. South Asian countries, supported by the World Meteorological Organization (WMO) came together to establish the South Asian Climate Outlook Forum (SASCOF) in 2010. Since then the SASCOF sessions are being organized every year before the summer monsoon season. Four sessions of summer SASCOFs were directly supported by WMO from project funds in South Asia. All these sessions were preceded by training workshops where NMHSs officers participated to enhance their capacities to generate seasonal climate outlooks. RCC's in the region and some of the GPCs provided support in terms of their products and resource persons. RCC, IMD, Pune played a pivotal role to organize two of the training workshops.

The crucial role of winter rains and the growing recognition of the benefits of SASCOFs in sharing seasonal climate outlooks led to the need for conducting a winter SASCOF in the region. This opportunity was leveraged and with available project funding the first winter SASCOF session (SASCOF 7) was organized in close collaboration with the IMD at Chennai, Tamil Nadu, India during Oct 14-15, 2015. In the subsequent winter seasons of 2016 and 2017, two more SASCOF winter sessions were conducted supported by funding from the project. These SASCOF sessions also initiated the conduct of the Climate Services User Forums (CSUF), to bring together user agencies at a regional level.

#### 4.2. *National Climate Outlook Forum (NCOFs)/ Monsoon Forum*

Climate Outlook Forum was organized at national level to initiate a dialogue process between climate service providers and stakeholders for climate-informed decisions and planning processes. The NCOFs focused on understanding climate risks and orienting users to climate information products available from NMHSs, guiding users on application of these products in analyzing potential sectoral impacts and need for inter-agency coordination for managing these potential impacts. In all five NCOFs/Monsoon Forums activities were conducted in Bangladesh (1), Bhutan (2), India (1) and Myanmar (1) during the project duration Feb 2016 to March 2018. The NCOF scheduled to be conducted in Maldives could not be held due to the emergency situation in February 2018.

In all the NCOFs conducted the participating sector agencies recommended the forum to be conducted regularly at least once every year. They also wanted to receive periodic updates of the seasonal outlooks in sub-seasonal scale. In many instances, well validated and authentic historical climate information was sought. NCOFs serve as a starting point for long-term interactions with the priority user sectors of the government like agriculture, water resources, health and disaster risk management. The involvement of other user agencies were specific to the national context. NCOFs also served a platform to discuss traditional knowledge sources and beliefs.

## 5. **Integration of climate information into planning and decision-making**

### 5.1. *Health sector, Tamil Nadu*

Diseases like Malaria and Dengue that are prevalent in several districts of the southern Indian state of Tamil Nadu have known climate linkages that need to be understood quantitatively. Customized weather and

climate information would be useful in preparedness for these disease outbreaks. The Public Health Department, State Government of Tamil Nadu identified both Malaria and Dengue as the diseases that are climate sensitive and are a cause of concern when favorable climate acts as a predisposing factor. Climate however is not the only factor that can cause outbreaks. Other factors like susceptible locations that are known to be congenial to vectors and availability of a critical numbers of infected people is equally, if not more, important factor. But the department did recognize that weather and climate information could be very useful for giving them lead-time for preparedness.

Based on earlier experience and data Malaria - Ramanathapuram (11 Blocks) and Dengue Tiruppur (13 Blocks) were identified. Preliminary disease incidence data were used for building DSS prototype and analysis is being carried out. It has been reported that the water storage adopted by the people may be providing ideal conditions for Dengue vectors to become prolific when seasonal climate becomes congenial. Based on available studies and information provided by the Public Health Department of Tamil Nadu a prototype DSS to flag hotspot locations at sub-district level for possible disease outbreaks was implemented and demonstrated. Initially the system was built to run on operational 3-day short range and 10-day medium range weather forecasts with features to ingest climate predictions at seasonal and sub-seasonal scales. The prototype system is being tested by the Public health department and also dynamic integration of epidemiological data is being explored for another pilot location. Availability of disease data at required temporal and spatial resolution limits precise identification of environmental thresholds. Nevertheless, the system was recognized a useful tool by the Public Health Department officials for collating proper and necessary information to guide their preparedness.

### 5.2. *Water sector, Sri Lanka*

In close collaboration with Department of Meteorology (DoM) and the Department of Irrigation (DoI) a pilot project was developed to showcase the use of weather and climate information in the water sector. The *Kirindi Oya* basin located at southern part of Sri Lanka was identified during a joint meeting on 30<sup>th</sup> May, 2016. There is a strong connect with agriculture as the reservoir serves a command area of about 13,000 acres that benefits more than 7000 farmer family cultivating paddy. The flood and water logging problems in some downstream hamlets also provides a disaster risk reduction aspect. So, overall the pilot location identified was quite ideal for our intent to demonstrate the use of climate information in the water sector.

The objective was to develop an integrated DSS to manage the operations at *Lunugumvehera* reservoir to ensure daily and hourly releases through downstream channel within the acceptable limits. With this objective, the prototype DSS for water sector was developed with the following components:

- (i) Inflow forecasting system to the reservoir located within *Kirindi Oya* basin
- (ii) Facilitate enhanced operations of the reservoir based on weather and climate predictions
- (iii) Link real time observations with the integrated hydrological & reservoir modelling setup
- (iv) An updating technique that improves the model state through a feedback process thus matching the available observations prior to forecast and correcting the predictions in the forecast period

Inflow forecasting with enough lead time enabled the Engineers/ Operators/ Decision makers to manage the reservoir operations in an effective manner and ensure minimum impact resulting from extreme flows downstream of the reservoir, save water for drier times of the year. The prototype DSS was developed and deployed after hands-on training sessions for the engineers working on-site. The DSS was transferred to the DoI during September, 2017 and is currently undergoing operational testing. DoI is now considering to implement similar DSSs in several other river basins of Sri Lanka.

## 6. Sensitizing policies and future work

Senior policy makers were involved in sessions of important forums such as SASCOFs and NCOFs. This contributed significantly to sensitization of the high-level policy makers to availability and strategic uses of climate information.

The project has made significant contributions to the following:

Regularity in organization of the SASCOF summer sessions in the region with active participation of the countries in the region and other global and regional providers of high-quality climate information and products. Besides the introduction of the new winter season SASCOF session, the project has provided space for sector-oriented discussions that opened new windows

of opportunities to make use of climate information. It is required to ensure sustained conduct of SASCOFs through support and ownership of countries in the region and other regional development partners.

National Monsoon Forums or Climate Outlook Forums (NCOFs) communicate climate and hydrological outlooks for the forthcoming monsoon season in May-June. The COFs enable preparations for mitigating risks in climate-sensitive sectors and provide a platform for inter-agency coordination of policies, sectoral plans and programs for addressing the impacts of hydro-meteorological hazards. In future we need to encourage countries towards sustained conduct of NCOFs in the region through provisions made within the budget of the respective NMHSs.

Sector specific DSSs have been demonstrated in Agriculture, Health and Water sector in some of the countries of South Asia. In some countries, these prototype systems have been taken up for expansion into other locations. Such context specific work however needs more time for evaluation. Also, sector level data is many a times quite unorganized or not accessible/available. Even in such cases, the process of design and integration of a DSS itself provides a motive to enhanced data gathering and use.

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