Climate Services for Regional Policy Planning

Date: October 15th, 2020 | Time: 15:00-17:00 hrs IST | Location: (Online) WebEx webinar

Event Report

Welcome Address:

The webinar started with the welcome address by **Dr. Ajay Mathur**, **Director General, TERI, New Delhi.** He shared that the world has already started experiencing adverse effects of changing climate with the average temperatures risen above 0.7 °C during the past 100 years. He pointed that while looking at the monsoon; it is evident that the regional extremes have also increased substantially. The overall rain in the county across the twelve months has declined but regional extremes are grown by much more. He then mentioned about the hydro met and flood impacts and pointed that about 40 million hectors land in India is vulnerable to riverine and flash floods. Hydro met disasters are single largest cause of economic and life loss in the country. Dr. Mathur then stated that with increasing variability of precipitation, the floods are increasing over the years. Similarly as the ocean warming is happening, there is an increase in intensity of cyclone and number of storms which are converted into cyclones are increased dramatically over last decade.

Talking about the climate tools, Dr. Mathur pointed that these tools are providing a significant way of enabling policy decisions for tomorrow. So as we develop more climate smart policy framework, it will in turn build climate resilient infrastructure. He then mentioned that the climate tools that are releasing today are a kind of atlas of extremes climate of India. He highlighted that the tools assess policy planning at regional level and help decision making to be climate ready. The vast numbers of models that are available globally are at the level of large chunks of space. So, we used high resolution downscaled datasets. Hence, it provides the regional patch work of the kinds of extremes that we expect in the future. He then drew focus towards Flood Early Warning System mentioning that flood is also merged with the issue of local topography. He stressed that this tool helps in the identification of key areas where intervention is required and mentioned that we look forward to the use of system by disaster management authority as well as city administration to plan its adaptation strategies for disaster preparedness

Key Note Address:

The key note address was delivered by **Sh. Jishnu Baruah**, Additional Chief Secretary, Government of Assam, Revenue and Disaster Management Department. He started his talk highlighting that climate change poses a major threat to the world today in view of its far-reaching implications for environment, agriculture, water availability, social well-being etc. He

then pointed that the series of assessment reports of the United Nations Intergovernmental Panel on Climate Change (IPCC), with the Fifth Assessment Report (AR5) being the latest, provides clear scientific evidence that there is significant human influence on the climate system and recent anthropogenic emissions of green-house gases (GHG) are the highest in history. Recent climate changes have had widespread impacts on human and natural systems. Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen. These changes are projected to continue through the twenty-first century, as the GHG concentrations continue to rise.

He then shared some valuable insights on regional scale changes by mentioning that its robust attributions and projections to anthropogenic forcing are more complex than global-scale changes mainly due the strong internal variability at local scales. He then highlighted that the IPCC Fifth Assessment Report (AR5) reported large inter-model spread in the climate change response of the Indian monsoon precipitation, Indian Ocean regional sea-level rise, Himalayan snow cover, and other aspects of the regional climate system. Quoting the recently published MoES report on Climate change assessment over India, he stressed that India's average temperature has risen by around 0.7°C during 1901–2018. This rise in temperature is largely on account of GHG-induced warming, partially offset by forcing due to anthropogenic aerosols and changes in LULC. By the end of the twenty-first century, average temperature over India is projected to rise by approximately 4.4°C relative to the recent past (1976–2005 average). He then highlighted that the frequency and intensity of extremes including warm days and warm nights are projected to increase over India in the next decades, while that of cold days and cold nights will decrease. The pre-monsoon season heat wave frequency, duration, intensity and areal coverage over India are also projected to substantially increase during the twenty-first century.

Sh. Baruah then emphasized on the impacts of changing climate in Assam and stated that this state is also no exception from this global and national phenomenon and is extremely vulnerable to climate change due to both, its geographic proximity to the delta region and poor socio-economic conditions. He pointed that Assam has been found to be the most vulnerable state in the Indian Himalayan Region to climate change and this vulnerability is reflected in the exposure, sensitivity and adaptive capacity of the local population to climate induced extreme events such as floods. The state is characterized by high rainfall and a subtropical climate. It gets annual floods and frequent droughts, both of whose severity has risen due to adverse climatic conditions. According to the State Action Plan for Climate Change, he stressed that the annual mean temperature in the state has increased by 0.59 degrees Celsius over the last 60 years (1951 to 2010), and is likely to increase by 1.7-2.2 degree Celsius by 2050. Climate projections in the state action plan also predict that extreme rainfall events will increase by 38%.

He then highlighted that climate models have proven remarkably accurate in simulating the

climate change experienced to date. Global climate models project a continuation of human-induced climate change during the twenty-first century and beyond. Although there have been substantial advancements in climate modelling and projections, there still exists several uncertainties in understanding climate change and its impact at regional level. Such uncertainties pose huge limitations in policy making for meeting the demands of adaptation to climate change. He then stated that advancing our understanding of the science of regional climate change requires a multidisciplinary and integrated approach and is imperative that we prepare and develop multifaceted strategies and initiatives for the mitigation of risks associated with the increased number of extreme events, along with the measures to adapt and expand the local/regional disaster risk reduction efforts.

Talking about the science based tools, he emphasized that these kinds of tools like like TCT and FEWS backed by robust scientific knowledge is necessary to mainstream robust climate information, early warning and risk reduction services into policy and decision-making. It is one of the most crucial steps towards providing the policy makers with a clear comprehensive view on the possible future climate change projections and support disaster risk reduction efforts. These tools inform the policy makers about climate related vulnerabilities and risks at various levels of detail and help them with informed decision and policy making. ICT enabled tools like TCT and FEWS are need of the hour which is essential for the mitigation of risks and to expand the regional disaster risk reduction efforts of various cities including Guwahati in Assam, which is located at the banks of the river Brahmaputra. He then pointed that the city has reported increasing intensities of rainfall in recent past; in addition to that it is frequently affected by seasonal flash floods. Quoting the report by National Disaster Management Authority, he mentioned that the massive flooding in major cities of India including Guwahati which are not only economic centers with substantial international operations but also are hub of large commercial activities and varied demography. The recent historical past has also seen increasing impacts of hydro-meteorological disasters in urban areas of India, especially due to the floods. About 12% (about 40 million hectares) of India's geographical area is subject to riverine and flash floods of which about 8 million hectares are susceptible to annual flooding. Hydro-meteorological disasters especially flood has highest percentage share of total deaths in India and a comprehensive resilience and disaster preparedness plan is needed to tackle with this situation in future.

Sh. Baruah then drew focus on to the huge need for wide range of climate screening tools and robust climate information in the advent of an impending climate change impacts and extreme events. He added that this kind of climate science based tools form crucial part considering the aim of making cities and other areas flood resilient. In this regard, TCT and FEWS play a significant role which can be used for better disaster preparedness and planning and allows the stakeholders to strengthen their ability to understand the information and leads to an informed decision-making at national and local levels.

Special Address

Ms. Camilla Dannevig, Councillor – Cooperation, Royal Norwegian Embassy in India delivered the special address. She began her address by thanking everyone for the invitation and extending the warm greetings from the Ambassador Hans Jacob Frydenlund. She then drew focus on to the special report of the Intergovernmental Panel on Climate Change which states that the changing climate leads to changes in the frequency intensity, spatial extent duration and timing of weather and climate extremes and can result in unprecedented extremes. We know now, that all this is having will have severe consequences on the lives and economy of the country on already stressed infrastructure, and on agriculture, which heavily depends on monsoon rainfall. This will also have impact on the health of the citizens.

Ms. Dannevig then highlighted that the adverse impacts of climate change cannot be immediately stopped, even if the emission of greenhouse gases into the atmosphere is interrupted today. Although mitigation is crucial to limit long term impacts due to climate change, effective climate change adaptation strategies are necessary to complement mitigation measures. To have this climate tools such as the Atlas or the warning system that we will see presented here today are essential. She then pointed that adaptation to climate change implies cascading decisions which involve individuals and public bodies from local to national scale. Effective adaptation to climate change can best be achieved through both multi-level and multi sectoral approaches. She stated that Norway has been addressing the climate change challenges and is dedicated to implement the Paris agreements, the UN sustainable development goals and has committed to reduce its greenhouse gas emissions by 50% and towards 55% by 2030 Compared to 1990 levels.

Ms. Dannevig pointed that Norway is a strong supporter of efforts to address climate change. The Norwegian contribution to the Green Climate Fund for 2019 to 23 is about 360 million US dollars and the contribution to the Global Environment Facility is about 80 million US dollars annually. In 2018, the Norwegian government launched a new India strategy, which gave renewed impetus to our bilateral cooperation. She added that the areas for cooperation include the oceans, energy, climate and environment, and research and higher education, in addition to global health and democracy and rule based world order. In the recent past Norway has also strengthened its emphasis on sustainable management of marine resources by launching a high level panel for sustainable ocean economy and have numerous initiatives with two very important ones in India; one for marine litter and one for integrated ocean management. Ms. Dannevig then stressed that India has a critical role to play in addressing global climate, environment and resource challenges. India has a key role to play in the formation of global policy and in international negotiations on climate change and environmental issues. Norway highly values our cooperation with India and Indian institutions such as TERI within climate, environment and energy. She emphasized that Norway and India both play an active role in national, regional and global partnerships to promote inclusion, inclusive development. We see developments in inextricably linked to peace and stability, and both Norway and India have

recently been selected for seats in the UN Security Council from January 2021. This will be another opportunity for Norway in India to work together and serve the world community.

Ms. Dannevig added that one of Norway's focus areas in addressing situations on the Security Council's agenda is how climate change impacts security. Norway has expertise in a number of fields relating to climate change and the environment cooperation with India could offer considerably opportunities for Norway, Norwegian actors in the areas of environmental management and environmental technology. And this could help India in address the climate change Challenge. She pointed that the embassy is supporting a number of projects in India in the field of climate resilient infrastructure, building resilience in the agricultural sector, marine pollution prevention and climate research, including the framework cooperation with TERI on which the two studies being presented today have been carried out.

Launch of TCT

Mr. Saurabh Bhardwaj, Fellow and Area Convener, TERI shared with the attendees some insights on the science based tools and pointed that there was strong need between the scientific information that was available and the policy action needed at the local level. He mentioned that this paved way to build a tool like TCT which would not only help translate that knowledge from global science to the regional science and climate but also help policy makers or any decision maker, a researcher, a common person who would like to know what has happened in the past over their city, their state, or their district, or in the future, how the climate will change.

Mr. Saurabh has then launched the Climate tool TCT and shared a presentation that described the working of TCT which is available at tct.teriin.org. Once you log in to the website, it loads a GUI where you can select India or different states. He demonstrated the tool by selecting India precipitation days which means daily precipitation days or rainy days over India with season as annual. He mentioned that if you click on any point over India, it gives you a trend plot. Such kind of tools and information can assist in the developmental planning over a multiple level of detail. He added that this kind of information is available both spatially as well as temporally.

Mr. Saurabh gave acknowledgments to colleagues at Centre for Climate Modelling, TERI, colleagues at NORCE and to everyone included in scientific products and also the technical partners which have created the front end, Skymet services. He also acknowledged the support of Norwegian embassy.

Launch of FEWS-J

Mr. Prasoon Singh, Associate Fellow, TERI, shared a presentation that described the working of the FEWS model and mentioned that FEWS-Jorhat is the extension of the recently launched flood early warning system for Guwahati. He informed the attendees that this tool has been

developed under the NFA agreement with TERI and Norwegian embassy for the city of Jorhat. He added that the flood early warning system at city level provides very high spatial and temporal resolution level flood information for the disaster risk reduction. Mr. Prasoon then explained the model and introduced the interface of the webpage which is available at fews.teriin.org.

He emphasized that TERI in collaboration with the Indian Metrological Department and with the support from Norwegian embassy, started the project in 2018 and was able to complete it on time. The model uses advanced hydrological system where the IMD rainfall forecast which is available for pan India at 3km spatial resolution with hourly data is used. He stated that this forecast has been used in the hydrodynamic models and these models are fully automated. He pointed that spatial plot for the flood information for the city will be generated after the simulation of model. MIKE urban model has been used where all the drainage system of the city has been incorporated. The lead time for this forecast is selected 72 hours. He also highlighted that based on the hydrologic model results; it can predict the water level discharge and the flood level across the different regions of the city, while also alerting the authorities if and when the threshold limits are crossed.

Panel Discussion

The panel discussion focussing on the use of climate services products in policy and planning was moderated by **Mr. R R Rashmi**, Distinguished Fellow and Programme Director, TERI.

The panel discussion involved various eminent panellists for the discussion on general outline of climate services and products and its use in policy and planning. Mr Rashmi emphasized on the scale and the intensity of threat posed by climate and the disasters caused by climate variability or changes in the climate patterns. He then mentioned that the question which we will be discussing is how the state level agencies or the ground level agencies are preparing themselves to cope with these disasters, and what kind of capacities do they have and what is it that needs to be done to enable them to help adapt to these climate change and also reduce the losses and damages caused by such disasters? No prevention of disaster is a totally different issue. He stated that we are all aware that it is anthropogenic, at least the climate change part of it, but certainly there are many natural phenomena associated with this. But what we can certainly do at different levels in the governance and the civil society is that we can build our capacities. In this panel, our effort will be to address four major questions.

1. To understand is how these sciences based tools can help the states in meeting in handling the disasters.
2. To understand how can we communicate them effectively to the vulnerable communities in time, so that they can prepare themselves and take timely action to adapt to or prevent the disasters on and minimize the losses and damages? Do we have sufficient systems

available with us to mount an effective communication strategy built on the back of this information gathered from the risk assessment tools?

3. Is it possible that a regional or interstate cooperation to optimize the application and development of these tools? Are we doing something about this? And has there been any major effort been mounted in this direction? There are several national and state level agencies involved?
4. How should a strategy or effective data sharing and communication which are extremely critical for the use of these science based tools? How can it be integrated and made a regular part of the developmental work?

Mr. Rashmi mentioned that these are the four dimensions we would like the panelists to address in today's discussion, and for looking at the various issues involved in these different dimensions of urban climate change and the natural disasters.

Panel discussion:

Sh. B.P. Yadav: DGM- Hydrology, IMD

He provided an overview of the food prone areas and the riverine flood happening over the country. He stated that not only the eastern parts of the country, but also the western part of the country like Rajasthan, Gujarat which is traditionally prone to drought is also getting riverine floods now. Almost every part of the country is now prone to floods. He highlighted that the primary reason for the cause of floods is rainfall. He stressed that the major cause of floods in states which are drought prone is mainly attributed to the regional imbalance and climatic variability. Rainfall has become either too less or too heavy as the monsoon has changed from the last two to three decades. There is also a strong year to year variation in monsoon season along with new development of seasons. He then pointed that the length of the dry spell has increased, but the total quantum of rainfall did not change. So, it means when light rainfall or the no rainfall days are increasing and the total quantum rainfall remains the same which means that the heavy rainfall events are increasing. Keeping this in mind, he emphasized the importance of city specific and watershed specific flood forecast systems and not district or state level systems. He then informed the attendees that IMD has taken lead to develop a system for urban and flash flooding system in the country. He also provided an overview on South Asia Flash Flood Guidance System.

Shri M S Manivannan Chief Executive Officer, Assam State Disaster Management Authority:

Shri. M S Manivannan focused on the occurrences and proneness of floods in the state of Assam every year. He mentioned that during 2019, the entire 33 districts and around 53 lakh populations were affected, with more than 122 lives lost. Flood is a challenging task to Assam. Urban flood

is especially challenging mainly over the cities such as Guwahati, Jorhat, Dibrugarh and Silchar. He pointed that these tools will be helpful in addressing the challenges in the state of Assam. He then emphasized that a tool alone cannot help address the issue but only the effective utilization of the tool is required and for this, it essential to sensitize the community, concerned departments and other stakeholders. He also focused on the importance of strengthening the committee level response system in urban areas as the regular flood areas are all through the districts and it is challenging to concentrate all over the state if the flood happens across the state simultaneously. He then stressed on the need of not only the development of risk assessment tool, but also of developing an effective communication strategy to reach out the vulnerable communities.

Dr. Lu Li, Research Scientist, NORCE, Norway

Dr. Lu Li shared an overview of climate services related activities in Norway and NORCE. Norway also faces several challenges from climate change similar to India and other countries. She pointed that the survey on Norwegian municipalities reveals that 60% had inadequate storm water capacity for projected future precipitation and lack the local competence tools and procedures for sustainable management for urban storm water. She then added that modelling, mitigating and predicting the urban and semi-urban flooding is based on the micro models such as Mike 21, Mike hydro and Mike-urban models. She also mentioned that they mainly focus on climate adaptation over a longer time period at climate scale perspective for using climate service products for policies and planning. She then highlighted the climate adaptation activities and guidelines as well as the flood forecasting and warning systems in Norway.

Mr. K. Kalamegam, Environment Engineer, DST&E, Govt. of Puducherry:

Mr. K. Kalamegam focused on the climate change impacts over the UT of Puducherry. He pointed that all the four enclaves of the UT are highly vulnerable to climate change as they are all adjacent to coastal areas and are all low lying areas. He added that the major threat Puducherry is facing is from severe to very severe cyclones and rising sea level. He stated that it is important to develop tools concerning to cyclones and sea level rise for different scenarios. Puducherry has Coastal zone management plan, which has an inbuilt hazard mapping of the coastal areas which has been done by Survey of India and the National Center for coastal Management, by taking into consideration the coastal erosion and the sea level rise and flooding for a period of next hundred years. So that that's a very useful tool for planning the coastal zone management. He also emphasized that it is important to develop a web based tool to disseminate this information in a larger public which can disseminate this information in a better way. He then highlighted that India needs to have a web tool for monitoring and evaluation at national level as well as at the regional level on the climate change action plan and the actions, as these are all multi sectoral activities and various departments are involved in this kind of action plans.

Mr. Sandeep Arur, Industry expert

Mr. Arur pointed the importance of creating awareness about climate change and the need of internet based tools enabling the common man getting access to it. He then highlighted the need of tying up climate change impacts with environment impact assessment and to integrate with developmental projects. Climate tools like TCT should be utilized for the projects like smart cities. He added that when the temperature goes up from 15 to 20 years' time frame since the large investments typically are brought in to last 15 to 20 years. So, these are not short-term investments. Since we have been seeing the change in temperature over years, it's an exponential impact. He then stressed that most of these large industrial facilities have to leverage the benefits of being located close to the coast areas and the coastal areas are the most impacted by climate change. So use of climate change tools in facilities design is to be looked at as policy plan, even in the environmental impact assessment aspects.

Mr. Pran Krishna Gogoi, District Project Officer, District Disaster Management Authority, Jorhat:

Mr. Gogoi shared an overview of urban flood events and its problems in the present scenario in the city of Jorhat. He pointed that with a population of 1.5 lakhs, the risk of urban flooding in the city is gradually increasing. Like other cities, the unplanned development, encroachment in drainage system, water bodies and wetlands etc. contributes majorly to the urban flooding in Jorhat. Another major cause is the poor and unplanned faulty artificial drainage network in which most of these drainages are constructed by several agencies and departments not maintaining the proper gradient and the slope. This also aggravates the urban flooding in Jorhat town. He highlighted that there is no appropriate waste disposal and management system and are usually thrown in the drainage system which also blocks the channels. Mr. Gogoi also attributes urban flooding in Jorhat to the change in rainfall pattern. Extensive heavy rainfall occurs in a short period of time during the monsoon season and the present drainage channels are unable to discharge the storm water properly. He then mentioned that various initiatives have been taken by concerned departments to replace the faulty drainage system and to increase their carrying capacity. Some positive results are also being visible in the city after this kind of maintenances. He emphasized that the early warning system for the city of Jorhat FEWS will definitely be a useful tool as the urban flooding is increasing in the city.

Concluding Remarks by Mr. R.R.Rashmi:

I. The tools developed need to be integrated with the developmental programs and they should become a part of regular monitoring and implementation program of the government as part of development, only then they become sustainable and effective.

II. These tools should also become part of communication strategies. Along with the development of these tools, state governments and other agencies must also have effective strategy for communicating the information to the vulnerable communities. May be the tools themselves may need to be modified or enhanced or elaborated that some stage by these research agencies to be able to help to the authorities in communicating the information automatically on auto pilot basis to the vulnerable communities

III. While assessing the environmental threats, they need to take account early warning systems and risk assessment tools as part of the larger environmental assessment.

Vote of Thanks

The vote of thanks was delivered by **Mr. Karan Mangotra**, Associate Director, TERI in which he thanked all the partners for their support in bringing together the TCT and FEWS model. He acknowledged the entire team for delivering these quality products in time. Mr. Mangotra also reiterated the importance of the importance of climate services and products in assisting various developmental planning at multiple levels of detail and enhancing local resilience of cities that face issues of urban flooding.

Agenda

Climate Services for regional policy planning ***Date: 15 October 2020 I Time: 15:00-17:00 hrs IST***	
1500 - 1510	Welcome Remarks by ***Dr Ajay Mathur**, Director General, TERI*
1510 - 1520	Keynote address by ***Sh. Jishnu Baruah***, Additional Chief Secretary, Government of Assam, Revenue and Disaster Management Department
1520 - 1530	Special Address by ***Ms. Camilla Dannevig***, Councillor – Cooperation, Royal Norwegian Embassy in India
1530 - 1550	Launch of ***TERI Climate Tool (TCT- Atlas)*** and ***Flood Early Warning System (FEWS-J) for Jorhat*** • About TCT: Mr. Saurabh Bhardwaj, Fellow and Area Convener, TERI • About FEWS-J: Mr Prasoon Singh, Associate Fellow, TERI
1550 - 1640	**Panel Discussion** on ***Use of climate services products in policy and planning*** Moderated by *Mr R R Rashmi, Distinguished Fellow & Programme Director, TERI*
	• National Perspective - *Shri B.P. Yadav, Deputy Director General of Meteorology-Hydrology, India Meteorological Department (IMD)*
	• Research Perspective - *Dr. Lu Li, Research Scientist, NORCE, Norway*
	• Sub-national perspective - *Shri M S Manivannan Chief Executive Officer, Assam State Disaster Management Authority* - *Mr. Pran Krishna Gogoi, District Project Officer, District Disaster Management Authority, Jorhat* - *Mr. K. Kalamegam, Environment Engineer, DST&E, Govt. Of Puducherry*
	• Industry perspective - *Mr. Sandeep Arur, Industry expert*
1640 - 1655	Discussion and questions from participants
1655 - 1700	Vote Of thanks by *Mr. Karan Mangotra, Associate Director, ESCC, TERI*

Webinar Screenshots