

OCEAN SOCIETY OF INDIA (OSI) – KOCHI CHAPTER

Panel discussion on

IMPACTS OF 2018 MONSOON IN KERALA

Jointly with Centre for Marine Living Resource and Ecology (CMLRI), MoES, GoI &
CSIR-National Institute of Oceanography (NIO, RC)
Kochi, 5th October 2018

REPORT

The Ocean Society of India – Kochi Chapter in the wake of the very active southwest monsoon and the resulting unusual flood in Kerala has organized a ‘Panel Discussion’ in Kochi on 5th October 2018. The strong winds and large waves from the beginning of the monsoon resulted in the erosion of Kerala’s remaining beaches and flooding of the coastal belt. The August extreme activity caused in addition to the floods in the coastal plains, huge landslides in the higher reaches. Though Kerala bravely managed the calamity, several scientific, technological and policy related questions are coming up in the forefront. An expert panel discussed the various aspects in the OSI-KC Panel Discussion with a major objective to analyse scientifically the causative factors for the 2018 monsoon and its impacts in Kerala and came up with a few recommendations for future action.



OSI had sent the recommendations emanated from the panel discussion to the Governments and institutions for further action. The list of experts who attended the meeting as Panellists is given in the annexure. Altogether about 50 participants from various institutes from India attended and actively involved in the deliberations and discussion.

The Panel Discussion was inaugurated by Dr.M.Rajeevan, Secretary, MoES, Gol at 10.00 am through video conferencing. The Secretary not only appreciated the efforts of OSI Kochi Chapter, CMLRE & NIO in organizing such a panel discussion and offered full support for the future action plans. The Secretary reviewed the 2018 monsoon in Kerala and also expressed the concern over loss of life, huge damage to land, water and infrastructure. He has also expressed the inadequacy faced in areas such as management of dams, absence of precise mapping of land slide prone areas and lack of proper awareness in maintaining ecosystems. He hoped that the Panel Discussion will come up with recommendations for future action.

Dr.M.Sudhakar, Director CMLRE welcomed the panellists and others attending the Panel Discussion. The fury of current year's monsoon rains followed by overflowing rivers and dams, landslides and inundation of low-lying areas resulting in the loss of more than 480 lives and displacement of over one million people in Kerala.



Dr.M.Baba, President of Kochi chapter of OSI chaired the session. In his introductory remarks requested the panellists that the discussions should be focussed on the scientific and technical aspects? He wanted the panel to come up with specific recommendations on the studies and actions required for mitigation and also measures for preparedness for

future calamities. Then he invited the six experts representing various fields to give the key note presentations. He requested the rest of the expert panel members to take active part in the discussions which will follow.

Monsoon of 2018

Dr.P.V.Joseph, formerly Director, India Meteorological Department made a critical analysis of monsoon in Kerala from 1871 to 2018. Kerala in the past 150 years received heavy monsoon rains not only this year but also in 1878, 1924 and 1961. The monsoon rains of 1924 were much higher at 61% excess of the normal than the monsoon rains of 2018 with only 23% excess. In 2018 there were two spells of heavy rainfall in Kerala that along with the release of the stored water in the reservoirs caused the floods. The first heavy rain spell was from 7 to 19 July and the second was from 7 to 17 August. Rainfall on 14, 15 and 16 August was extremely heavy.

The conditions in western Pacific Ocean influence our Indian monsoon and in 2018 cyclones / typhoons there had greater impact on monsoon than the El Nino according to Dr.Joseph. The West Pacific Ocean recorded increased rain and cyclone (typhoon) activity during the two heavy rain spells of Kerala, particularly during 14, 15 and 16 August. Increased heating of the atmosphere due to the latent heat release in the rains of western Pacific ocean increased the strength of the moisture laden westerly winds hitting the Sahyadri mountains of Kerala producing the heavy rain spells according to Dr. Joseph.

Dr.Joseph recommends that to monitor continuously the westerly wind flow through Kerala we may use the Atmospheric Radar of Cochin University of Science and Technology. He recommends that for monitoring the raining clouds and surface rainfall distribution we may use the existing Doppler Weather Radars at Trivandrum, Kochi and the one being installed at Mangalore. By Establishing a Doppler Weather Radar at Calicut the large gap between Kochi and Mangalore could be filled and the entire Kerala State could be covered in weather parameter generation, storage and retrieval. The rainfall measurements by rain gauges installed in Kerala is not adequate and more areas should be covered, especially in hilly areas and in proximity to rivers. For accurate rainfall distribution installation of a dense network of automatic rain gauges in the river catchment areas are recommended. Flood forecasting centres for Kerala should be well identified and roles of various organisations including CWC are to be defined and implemented.

Flood Forecasting

Dr. M V Ramanamurthy, Director, National Centre for Coastal Research (NCCR), MoES called for flood forecasting in Kerala on the lines of the Coastal Urban Flood Modelling and Impact Based Risk Analysis Facility of Chennai. After 2005 floods in Chennai, a good working flood warning system is in place now for Chennai which is known as C-FLOWS. He mentioned that flood modelling and forecasting is an integrated effort. Important components of C-FLOWS

are hydrological, hydraulic and hydrodynamic models. It requires data to be collected regularly on river flow and discharges. Crowd sourcing data collection methods is to be adopted. In this the government's role is also very important and a flawless Decision Support System should be in place for flood warning. Dr.Ramanamurthy suggested that immediate steps are necessary to implement a flood forecasting system for Kerala on the lines of C-FLOWS of Chennai. Kerala needs lot of terrain data to be incorporated. A mobile App (Flood info Crowd Sourcing-FCS) can be used to collect data on flood levels and this information can be directly uploaded on server. Field data validation is required with proper rain gauge data.

Flood Mapping

Mr. John Mathai (NCESS) gave an excellent review on Hazard Monitoring and Mapping in Kerala. He has categorized natural hazards into geological, climatic, chemical, biological and accident related. Based on the mammoth surveys conducted by his team during 2006-09 collected large amount of data and mapped flood, landslides, coastal erosion, lightning, earthquake and tsunami prone areas. Hazard Zonation maps for entire Kerala district wise was available. The recent floods and landslides had been an opportunity to test the maps generated for its correctness. According to him the aquifers in Kerala are not thick enough and hence landslides do occur repeatedly due to the steep slope, thin soil cover over hard rock, rapid changes in landuse and other anthropogenic activities mainly cutting and levelling of hill facets. Through he has pinpointed that earth quakes at the tune of 6.0 to 6.5 in Richter scale is mere probability. Therefore he has cautioned that the building designs should be carefully prepared particularly in the Kochi - Ernakulam low lying areas on account of its liquefaction potential. He has emphasised that programmes should be undertaken for identification of hazard prone areas of a particular hazard or multiple hazards in micro scale or village scale and warrants risk / vulnerability assessment of such areas. Increase the capability of prediction with accuracy for early warning. Programmes for popularising the mitigation measures in the vulnerable areas and mitigation measures through peoples participation mode has to be organized. Disaster preparedness is very necessary for which we need to use the modern technologies.

Dr. N Poornachandra Rao, Director, National Centre for Earth science Studies said though flood hazard maps were prepared for Kerala ten years back by CESS (NCESS) for the first time in the state, they did not attract much attention of implementing agencies. NCESS is currently going through these studies and making efforts to update this information. The need of the hour is to have a proper early warning system for floods in Kerala. Though the probability of floods in Kerala is low compared to other places, indiscriminate sand mining in rivers and sudden releases of water through dams can lead to 'Hungry water effect', which happens when sediment starved river flows with excess water resulting in catastrophic floods. Flood Hazard maps earlier prepared and the upgradation taken up now need to be brought to the attention of implementing agencies.

Coastal Erosion

Dr.M.Baba (formerly Director of CESS) discussed about the impact of the present monsoon on Kerala coast. Kerala experienced high wave activity for much longer periods this year. Starting from Ockhi the beaches could not rebuild to their usual high profile level. Subsequent storm conditions eroded the beaches much before the onset of SW monsoon. In August, when the erosion is supposed to cease, it intensified. At many occasions the coastal areas got flooded. Considering the different factors affecting the coast Dr.M.Baba suggested that Minimum Beach Level (MBL) and Minimum Flood Level (MFL) be estimated for different morphological units of the Kerala coast. Buildings in low-lying areas should take into account for the MFL and invariably be constructed on piles. The safe elevation will vary between locations and should be determined and referenced in building permits. He mentioned that flood waters in Vembanad took more time to flush out to sea although tides were not that high causing inundation of the low lying areas. The narrow inlets may be a reason for the slow flushing out of the flood waters. For long term planning of the coastal areas sea level rise and other climate change factors need to be accounted, for which Guidelines are being issued by the Central Water Commission. Research in the areas of climate change, its impacts and adaptation measures need to be taken up on high priority in Kerala.

Cyclones in Arabian Sea

Dr.A. D. Rao, Professor IIT Delhi discussed about the storms and storm surges in a Kerala perspective. He spoke about the salient features, genesis and intensification of Ockhi wherein this cyclone crossed more than 1000 km in one day covering the longest distance ever (2538 km). No model could predict this cyclone until it really arrived and was reported by IMD followed by others. He mentioned that IMD doesn't consider the heat content in their models and it needs to be taken into account. Analysis of cyclones and storm surges during the two epochs during 1998-2007 and 2008-2017 revealed that more number of cyclones occurred in the latter period. It's again a pointer towards climate change scenario. Ironically so far cyclones formed in our seas did not make a direct land fall off Kerala (Kochi) including recent Ockhi cyclone as per Dr. Rao. Only one cyclone which occurred in 1925 made a direct land fall off Kerala (Kochi).

Dr. Rao pointed out that the Cape Comorin area seems to be developing as a new cyclogenesis region in the sea. The long-term return period of intense cyclones need to be accounted for developmental activities. Oceanic heat content is an important parameter for cyclone prediction and this parameter is not used at present for prediction of cyclones. Efforts should be made by concerned agencies to incorporate upper ocean heat content into cyclone prediction models. Heat content over the Cape Comorin area is increasing and therefore there is more possibility of more cyclonic storms, particularly in post-monsoon season. He has also stated that more observations on the atmospheric / oceanic parameters at Cape Comorin are required for better understanding and prediction of cyclogenesis in the

west coast. Dr. Rao also talked about how climate change influences the storm surges. Maximum total water elevation (TWE) is very important to be taken into account due to climate change. A recent study of the long-term storm surges in a climate change scenario along the Indian coast revealed that though Kerala coast has the least projections of about one meter with a return period of 50 years, it needs to be accounted in the development planning along the coast.

Ecosystems

According to Dr.Faizi (UNDP) Kerala floods are a result of extreme case of climate change. The Kerala deluge is a direct result of global warming and needs to be projected as such so that it can feed into the process of ameliorating the escalation of the ambient temperature as more such floods are in store in the near future as the IPCC 2007 has predicted 4-5 year cycles of floods in place of the 100 year cycle. The Kerala flood was obviously not due to the loss of forest cover as some seek to argue. Kerala has a forest and tree cover of 23280 sq km which is 60% of the terrestrial 2017 report on forests in the country by the Forest Survey of India - the legally notified forests, however, is only 29.11% of the geographic area of the state.

Dr.Faizi stated that the floods were also not due to the loss of water bodies either as some argue. The water bodies in the forest districts, the state expanded its spread by 71 sq km during the decade of 2005-15, the FSI report records. Obviously, the local environmental factors hardly had any influence in the making of the tragedy. Global warming operates as an invisible process and one can miss it and get engaged with local factors digressing from the central issue of global warming as the cause. As predicted by IPCC the number of rainy days were less and the volume of precipitation far greater than the normal average. Uninterrupted rains from 9 to 15 August, which was over 257 per cent of the normal rainfall this period in the past years. And this unending rain was falling on a soil that was already soaked by rains that started on June 1st which was already in excess of the normal by 41 per cent. The carrying capacities of the water bodies to hold the run off water were also exhausted. And the rain of 130 mm on 15 August was an unbearable as it was 13 times the average of the previous years on the same day. And the deluge followed.

Why globalising the Kerala deluge is critically important? Dr.Faizi concludes that a) it fits well with the prediction of IPCC 2007, b) more such floods and other extreme climatic events are likely to happen in the near future if there is no reversal of the global warming trend, and no amount of local actions can effectively mitigate the damages c) this reversal is critical for the survival of Kerala and other vulnerable places across the world and it can only happen with greater pressure on countries, especially developed countries, to reduce the CO2 emissions and Kerala floods can be a compelling example here, d) the developed countries who have a greater share in causing global warming have a moral, in a way also legal obligation, to compensate Kerala for the massive damages it has suffered. The multilateral funding mechanisms under UNFCCC are also to respond to the rebuilding needs of Kerala.

Recommendations

Subsequent to the detailed presentations the Panellists took active role in the discussions and the meeting puts forward the following **recommendations**:

- In order to give a precise flood weather forecasting we require more flood forecasting centres, setting up of maximum number of rain gauges with interconnectivity. By Establishing a Doppler Weather Radar at Calicut the entire Kerala State could be covered in weather parameter generation, storage and retrieval.
- For accurate rainfall distribution installation of a dense network of automatic rain gauges in the river catchment areas are recommended. Immediate steps are necessary to implement a flood forecasting system for Kerala on the lines of C-FLOWS of Chennai. For flood forecasting and management each district needs to be considered separately taking into account their geometry and issues. Flood forecasting centres for Kerala should be well identified and roles of various organisations are to be defined and implemented.
- Extreme weather events are on the increase due to global warming (IPCC Report). There is urgency to constitute a committee of scientists, technologists and administrators to study issues involved in severe weather episodes and other natural calamities affecting Kerala and recommend measures to be taken.
- The natural hazard maps earlier prepared by Centre for Earth Science Studies needs upgradation, taking into account the availability of latest information and advanced tools, for its convenient utilization by the implementing agencies.
- Flood Hazard maps earlier prepared by National Centre for Earth Science Studies and the upgradation taken up now need to be brought to the attention of implementing agencies.
- Programmes for creating awareness about the vulnerable areas and mitigation measures through peoples participation mode has to be organized.
- Guidelines being issued by the Central Water Commission for climate change adaptation in long term planning of the coastal areas need to be utilized in Kerala.
- Research in the areas of climate change, its impacts and adaptation measures need to be taken up on high priority in Kerala. Various institutions doing Climate Change research should come together and work in a well-coordinated manner to understand climate change aspects.
- Heat content over the Cape Comorin area is increasing and it can be a potential location for cyclogenesis. Hence, more observations on the atmospheric / oceanic parameters off Cape Comorin are required for better understanding and prediction of cyclogenesis in the Arabian Sea.

- Globalising the Kerala deluge, which is climate change driven, and hence multilateral funding mechanisms under UNFCCC are also to respond to the rebuilding needs of Kerala.
- There should be an institutional mechanism for the disaster studies and a knowledge bank accessible to all be created.
- Remote sensing and satellite communication facilities should be fully utilized in flood and other hazard forecasting.
- Flood forecasting centres for Kerala should be well identified and roles of various organisations be clearly defined. The regular forecasts made by the nodal agency should be disseminated and made available to all through all popular media.
- Awareness campaigns be conducted on a continuous basis. The awareness programs should also include the functions and limitations of the equipment.
- De-siltation of reservoirs and waterways and design of new bridges to allow debris flow should be considered.
- Close grid water level, discharge and bed level monitoring be done in rivers, lakes and reservoirs on a regular basis.
- The disaster insurance net be enlarged and made accessible.
- Tidal inlets need a detailed study and restructuring to facilitate them also to flush the flood waters.
- Immediate steps are required to assess the damage to the ecosystems due to the abnormal rain and flood.

The meeting came to a close by 5.00 pm

ANNEXURE

List of Panellists

Dr.P. V. Joseph, formerly Director, India Meteorological Department (IMD); Dr. M V Ramanamurthy, Director, National Centre for Coastal Research (NCCR); Dr. N Poornachandra Rao, Director, National Centre for Earth science Studies (NCESS); Dr.M.Baba (formerly Director of CESS); Prof. A. D. Rao, Centre for Atmospheric Sciences, IIT Delhi; Dr.Faizi (Eco-Consultant, UNDP); Mr. John Mathai (NCESS); Dr.Jayakumar Seelam, National Institute of Oceanography (NIO), Goa; Dr. Chakrapani, Cochin University of Science and Technology (CUSAT); Dr. T. N. Prakash (NCESS), Dr. C. Revichandran, National Institute of Oceanography, Kochi; Dr C V K Prasad Rao (Ex-NPOL); Dr. T. Pankajakshan, National Institute of Oceanography, Kochi; Prof. K. V. Jayachandran (Ex- KUFOS); Dr. R. Sajeew (CUSAT); Dr. K. V. Thomas (KUFOS); Dr N. P. Kurian (Formerly Director, NCESS); Dr. Celine George (CWRDM); Dr. B.K. Jena National Institute of Ocean Technology (NIOT); Dr. Sudarsan (NPOL); Dr. Anantha Narayanan (Formerly Director, NPOL); Dr. Boopendranath (KUFOS).