Course Report

Online Training Programme

on

Climate Change, Urbanization & Multi-hazard Management

[20th -22nd September, 2021]

Conducted by

Mahatma Gandhi State Institute of Public Administration, Punjab

Institutional Area, Sector – 26, Chandigarh

In collaboration with

National Institute of Disaster Management

(Ministry of Home Affairs, Government of India)
A-wing, 4th Floor, NDCC-II Building, Jai Singh Road,
New Delhi – 110001

nidm
Resilient India - Disaster Free India

सत्यमेव जयते

MGSIPA

Azadi Ka Amrit Mahotsav

Prime Minister's 10 Point Agenda on DRR: Agenda 8

3-day Online Training Programme on "Climate Change, Urbanisation and Multi-hazard Management"

Monday – Wednesday
20th – 22nd September 2021
02:00 pm - 04:00 pm

Register Here: https://training.nidm.gov.in/

Patrons

Maj. Gen. M. K. Bindal, VSM
Executive Director,
NIDM

Mrs. Jaspreet Talwar, IAS
Principal Secretary Punjab
cum Director General, MGSIPA

Guidance

Prof. Surya Parkash
Head, GMR Division,
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Shri Sibin C, IAS
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GM (Training),
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Ms. Nitika Singla
DM Professional,
MGSIPA

Mr. Anil Kathait
Junior Consultant,
NIDM

Distinguished Speakers

Dr. Purnima Jalihal
Scientist G,
NIOT

Dr. U. Rajasekar
Chair, Urban Resilience,
NIUA

Ms. Moumita Shaw
Research Analyst,
IRADe

Dr. Prabuddh Kumar Mishra
Assistant Professor,
Shivaji College, DU

Dr. Harjeet Kaur
Junior Consultant,
NIDM

Dr. Raju Thapa
Junior Consultant,
NIDM

Organised by:

National Institute of Disaster Management,
Ministry of Home Affairs, GOI
&
Mahatma Gandhi State Institute of Public Administration (MGSIPA),
Govt. of Punjab, Chandigarh

LIVE STREAMING YouTube

Day 1: https://youtu.be/jgB3sZagwr0

Day 2: https://youtu.be/_L6FpJymwlQ

Day 3: https://youtu.be/dHaUiG38_W4

Website: www.nidm.gov.in / nidmmhaindia / nidmindia

PREFACE

Mahatma Gandhi State Institute of Public Administration (MGSIPA), Punjab at Chandigarh is the Administrative Training Institute (ATI) of the Government of Punjab engaged in imparting quality training in various disciplines to officers and officials of the State Government and its Boards, Corporations, Central Government, and other Organizations; as well as undertaking research studies including evaluation and consultancy in public administration, public policy, and governance.

Disaster risks have risen over recent decades, and more extreme weather conditions in future are likely to increase the number and scale of disasters. At the same time, the existing methods and tools of disaster risk reduction, and climate risk management in particular, provide powerful capacities for substantially reducing risks and adapting to climate change.

Climate change is no longer in doubt. The science has been thoroughly elaborated and assessed in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), even if some details remain to be researched. Furthermore, new evidence is accumulating of changes around us, such as Arctic ice melting that is happening faster than was predicted by the IPCC reports. It seems that the more we know from new evidence, the more serious and challenging our future is.

Over the period 1991-2005, 3470 million people were affected by disasters, 960,000 people died and economic losses amounted to US$ 1.193 billion. Poor countries are disproportionately affected, because of intrinsic vulnerabilities to hazards and comparatively low capacities for risk-reduction measures, and they will suffer the most from climate change. Small countries are also particularly vulnerable.

Disaster risk is accumulating largely as a result of unplanned settlements and environmental degradation, though climate change is also beginning to show its hand. Many significant steps need to be taken, with serious commitment and concrete actions, if we are to properly address the climate change problem. It is vital to vigorously propagate the culture ‘‘be prepared and have no regrets’’ in the contexts of climate change and growing disaster risk.

It is in this context, MGSIPA, Chandigarh has been dynamically engaged in disaster preparedness and response operations in-order to minimize or address issues of climate change. We also endeavor to develop safer communities resilient towards disasters by strengthening institutional/ individual capacities, building partnerships, identifying the disaster risk management needs, and mainstreaming risk reduction measures in our projects and programs.

ACKNOWLEDGEMENT

At the outset, I would like to express my sincere gratitude to Mrs. Jaspreet Talwar, IAS, Principal Secretary-cum-Director General, MGSIPA, Government of Punjab and Major General Manoj Kumar Bindal, VSM, Executive Director, National Institute of Disaster Management, Ministry of Home Affairs, Government of India for their leadership, encouragement and support to bring up this training programme.

I am also obligated to Shri. Sibin C., IAS, Secretary-cum-Director, MGSIPA, Government of Punjab and Prof. Surya Prakash, Head, Geo Meteorological Risk Management Division, National Institute of Disaster Management, Ministry of Home Affairs, Government of India for extending their valuable guidance & support.

I must convey my deep appreciation to Programme Co-ordinator Mr. Anil Kathait from National Institute of Disaster Management for his sincere and untiring efforts in the coordination of this training programme.

I would like to place on record significant contributions made by the resource persons associated especially Dr. Purnima Jalihal, Ms. Vaishnavi Shankar, Ms. Moumita Shaw, Dr. Prabuddh Kumar Mishra, Dr. Raju Thapa, Dr. Harjeet Kaur and Mr. Anil Kathait for their valued contributions in making this training programme a success and valuable.

It gives me immense pleasure in acknowledging the cooperation and support of my team members to include Ms. Nitika Singla, Mr. Bhavneet Singh and Mr. Shiv Murat in steering the proceedings of the training programme.

I would also like to express my sincere thanks to all the participants from the different parts of the country and world who have helped us in the successful accomplishment of the training programme by being a part of it and making valuable contributions to this effort.

Last but not the least, we are appreciative to NIDM, MHA, Government of India for entrusting us with this programme and providing guidance, motivation and extending support in many ways.

(Col. Dalbir Singh)
General Manager
(Training, Project & Consultancy)
MGSIPA, Punjab

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ABOUT THE INSTITUTE

Mahatma Gandhi State Institute of Public Administration (MGSIPA), Chandigarh, Punjab is the Administrative Training Institute (ATI) of the Government of Punjab engaged in imparting quality training in various disciplines to officers and officials of the State Government and its Boards, Corporations, Central Government and other Organizations; as well as undertaking research studies including evaluation and consultancy in public administration, public policy and governance.

MGSIPA houses subject–specific Centres for Management Development, Study of Laws, Urban Governance, Sevottam, Secretariat Staff Training, Engineering Studies and RTI. MGSIPA has three Regional Centres located at Bathinda, Jalandhar and Patiala. The Institute also runs a Civil Services Coaching Centre.

MGSIPA organizes over 200 training programmes a year, which include Foundation Training Programmes, Induction Training Programmes, Trainer Development Programmes, In-Service Training Programmes and regular domain-specific three-day and five-day training programmes for various categories of employees of the Government.

ABOUT THE TRAINING PROGRAMME

Background

Albeit, earth has been experiencing the phenomenon of climate change since its inception but in current era it is of greater concern due to the rapid rate and the magnitude in which the changes are materializing. The bigger threat imposed by the climate change is the augmentation in intensity and frequency of the extreme weather-related events. The world is experiencing more episodes of weather associated hazards such as intense heat waves, flooding, urban flooding, cloudbursts, flash floods, droughts, landslides, coastal hazards and so on.

Today more than half of global population belongs to cities. The increasing concentration of population is exposing greater number of people to the window of climate change vulnerability, especially in developing countries. The phenomenon of urban heat island in which the gradient of core city temperature is higher than that of its outer surrounding, shows how the built environment created by the human institutes its own kind of micro climate as consequences of alteration in land-use and land-cover. The intensity of such trends will further intensify due to changing climatic conditions exposing urbanites to extreme weather-related hazards. The urban dwellers along with the key services in urban areas such as energy, transportation, health, water supply and wastewater management, sanitation, solid waste management and communication will be at risk enforced by the climate change and extreme weather events. The risks involved include losses of lives, economic and disruption in the smooth functioning of the cities. The impact of climate change and resultant extreme weather events impacts each and every region inconstantly and to combat the challenges we need cross-cutting, cross-departmental and cross-

sectoral holistic multi-hazard management approaches. Mainstreaming action plans for climate change in urban planning is the need of the hour.

National Institute of Disaster Management (NIDM), Ministry of Home Affairs, Government of India has been mandated under Disaster Management Act 2005 to develop training modules and educational materials, undertake training, research, documentation and publication for capacity development and dissemination of knowledge / information related to disaster management, assist in formulation of policies, plans, strategies and frameworks for disaster risk reduction and resilience as well as promote awareness among different stakeholders for enhancing human capacity to avoid, prevent, mitigate, prepare, respond and recover efficiently in a proactive, holistic and integrated manner.

In pursuance to the mandate of Disaster Management Act 2005, Mahatma Gandhi State Institute of Public Administration (MGSIPA), Government of Punjab in collaboration with NIDM, Ministry of Home Affairs, Government of India has conducted an **Online Training Programme on Climate Change, Urbanization and Multi-hazard Management from 20th – 22nd September 2021.**

The online training programme was intended for middle and senior level functionaries from the central and state governments representing offices engaged with urban planning and development. The nodal officers for disaster management were the key stakeholders who work in a coherent and coordinated manner with other ministries, departments and organizations as well as NDMA, MHA, NIDM, State Revenue and Disaster Management Department, SDMAs, DDMAs, SDRFs, QRTs, NDRF, ATIs, SIRDs, Police, Researchers, Academicians and other stakeholders working in this subject area.

Objectives

***At the end of this course, participants were able to*:**

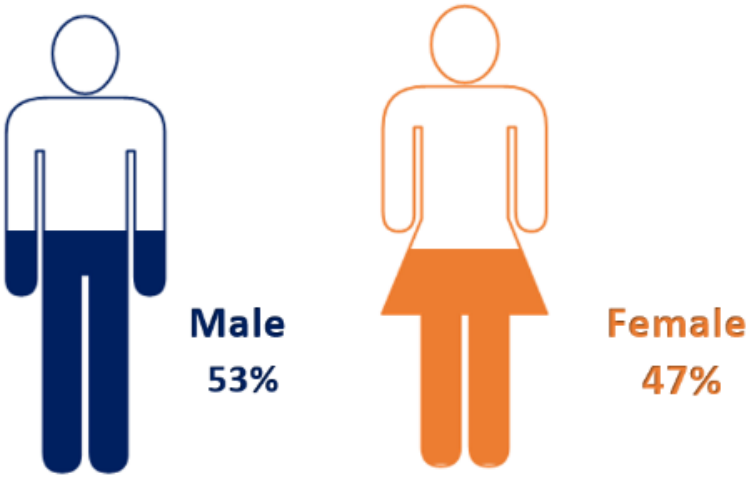
- develop better understanding about climate change and extreme weather events;
- learn about the relevant Act, Policy, Plan, Guidelines and SOPs on Disaster Management in the country;
- know about the important international agreements and declarations on disaster risk reduction, climate change, urbanization and sustainable development;
- develop solutions for managing the adverse impacts of climate change and extreme weather events in urban areas;
- initiate activities on formulation of disaster management plan for their functional and geographical regimes;
- discuss the collaboration and strengthening mechanisms for effective implementation of disaster management related activities at national, state as well as local level.

Demography of Participants

A total of 471 officials from various departments of State/ Central Government including Department of Agriculture, Revenue, Health & Family Welfare, Animal Husbandry & Fisheries, Housing and Urban Development, Industrial and Tourism Development, Police, Home Affairs, Water Supply and Sanitation, Rural Development, Food Civil Supplies and Consumer Affairs, Defence Services Welfare, Local Government, Education, Municipal Corporation, Social Security, Women & Child Development, Finance, etc. and various other stakeholders who

are engaged in the management of disasters, attended this online training programme.

Gender-wise Distribution of Participants



Learning Methods

Zoom Platform was used for this programme. The training was conducted through various methods including power point presentations by the speaker/experts. The training programme was also live streamed on You Tube.

YouTube Live Streaming Links

Day 1: https://youtu.be/jgB3sZagwr0
Day 2: https://youtu.be/_L6FpJymwlQ
Day 3: https://youtu.be/dHaUiG38_W4

PATRONS

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KEY SPEAKERS

Dr. Purnima Jalihal
Scientist G, National Institute of Ocean Technology (NIOT), New Delhi

Dr. Prabuddh Kumar Mishra
Assistant Professor, Department of Geography, Shivaji College, University of Delhi

Ms. Moumita Shaw
Research Analyst, Integrated Research and Action for Development (IRADe), New Delhi

Ms. Vaishnavi Shankar
Lead – Training & Capacity Building, National Institute of Urban Affairs, New Delhi

Dr. Raju Thapa
Junior Consultant, NIDM, Government of India

Dr. Harjeet Kaur
Junior Consultant, NIDM, Government of India

PROGRAMME SCHEDULE

Day 1 – 20th September, 2021

INAUGURATION

1350 hrs	Participants and Faculty Members join the programme
1400 hrs	*Welcome Address* – **Col. Dalbir Singh** General Manager (Training, Project & Consultancy), MGSIPA
1405 hrs	*About the Programme* – **Ms. Nitika Singla** Disaster Management Professional, MGSIPA
1410 hrs	*Keynote Address* – **Prof. Surya Prakash** Head-GMR Division, NIDM, Ministry of Home Affairs, GoI
1415 hrs	*Inaugural Address* – **Shri Sibin C., IAS** Secretary, Government of Punjab and Director, MGSIPA
1420 hrs	*Vote of Thanks* – **Shri Gulshan** Chief General Manager (Training & Administration), MGSIPA

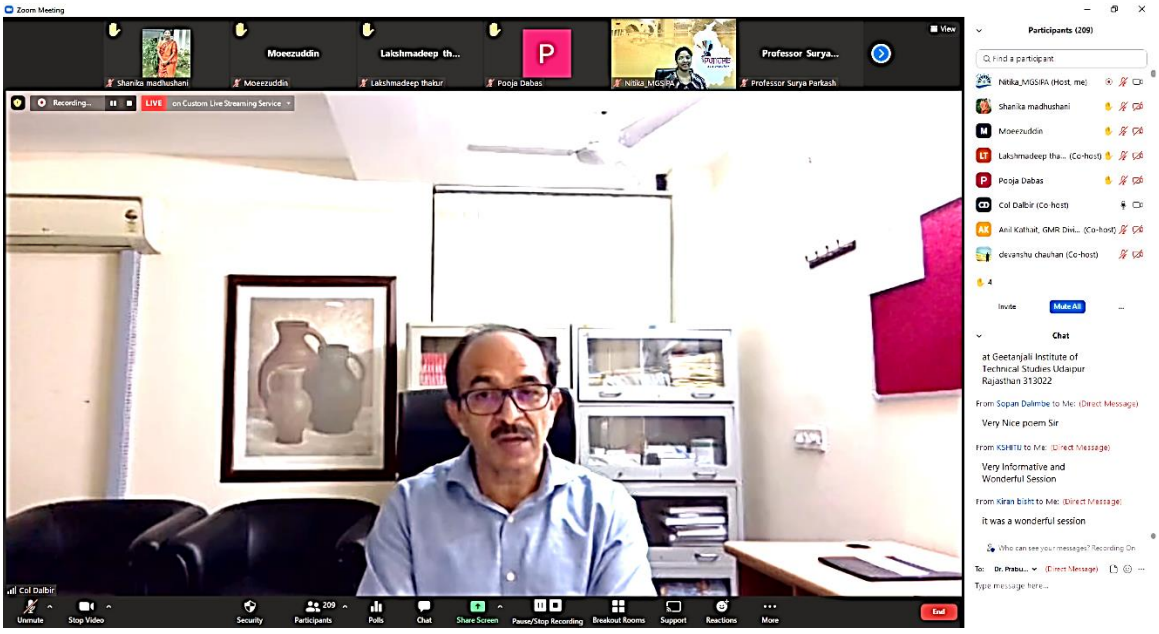
Time	**Title**	**Facilitator**
Day 1 – 20th September, 2021		
14:25-15:00	Management of Urban Flooding	Dr. Harjeet Kaur Junior Consultant, NIDM
15:00-15:45	Early Warning and Communication	Dr. Raju Thapa Junior Consultant, NIDM
15:45-16:00	Interactions, Discussions, Q & A	• Dr. Harjeet Kaur • Dr. Raju Thapa • Col. Dalbir Singh • Ms. Nitika

Day 2 – 21st September, 2021		
14:00-14:10	Recapitulation	• Col. Dalbir Singh • Ms. Nitika
14:10-14:40	Energy and Water from the Oceans for the Mitigation of Climate Change Impact	Dr. Purnima Jalihal, Scientist G, NIOT
14:40-15:10	Mainstreaming Urban Resilience Across Indian Cities	Ms. Vaishnavi Shankar Lead – Training & Capacity Building, NIUA
15:10-15:40	Hazard and Risks of Climate Change	Anil Kathait, Junior Consultant, NIDM
15:40-16:00	Interactions, Discussions, Q&A	• Dr. Purnima Jalihal • Ms. Vaishnavi Shankar • Anil Kathait • Col. Dalbir Singh • Ms. Nitika
Day 3 – 22nd September, 2021		
14:00-14:10	Recapitulation	• Col. Dalbir Singh • Ms. Nitika
14:10-14:50	Climate Adaptive Action Plans for Indian Cities	Ms. Moumita Shaw, Research Analyst, IRADe
14:50-15:30	Community Perception of Climate Change in the Himalayas	Dr. Prabuddh Kumar Mishra, Assistant Professor, Department of Geography, Shivaji College, DU
15:30-15:45	Interactions, Discussions, Q&A	• Ms. Moumita Shaw • Dr. Prabuddh K. Mishra • Col. Dalbir Singh • Ms. Nitika
VALEDICTION		
15:45-15:50	Live Feedback & Summary	Ms. Nitika Singla
15:50-15:55	Closing Remarks	Prof. Surya Prakash
15:55-16:00	Vote of Thanks	Col. Dalbir Singh

INAUGURAL SESSION

Welcome Address

Col. Dalbir Singh, General Manager (Training, Project & Consultancy), MGSIPA, Chandigarh unfolded the inaugural session and expressed a great pleasure in collaboratively working with NIDM in in its endeavor of creating awareness on Climate Change, Urbanisation and Multi-hazard management across the nation. Alongwith a warm welcome address, Col. Dalbir Singh gave a pointer that many significant steps need to be taken, with serious commitment and concrete actions, if we are to properly address the climate change problem. It is vital to vigorously propagate the culture "be prepared and have no regrets" in the contexts of climate change and growing disaster risk.



About the Programme

Ms. Nitika Singla, Disaster Management Professional, MGSIPA, Chandigarh briefed about the minutes and the technical sessions of all the 3-days of the training programme thus introducing the programme and the key speakers to the participants. Sharing the aim of the programme, she brought to limelight about what the participants would be able to gather as learning outcome after the successful completion of the course.

Keynote Address

Prof. Surya Prakash, Head of Geo Meteorological Risks Management Division, NIDM initiated his address by sensitizing the participants on Covid-19 Pandemic. He enlightened on the current situation of extreme weather events being faced by the world around. Thus, Prof. Surya acknowledged to sustain, encourage and promote the 17 sustainable development goals in a way developing a culture of prevention, mitigation and preparedness. With this note Prof. Surya Prakash urged the organisations and communities to change perspective from being post active to proactive.

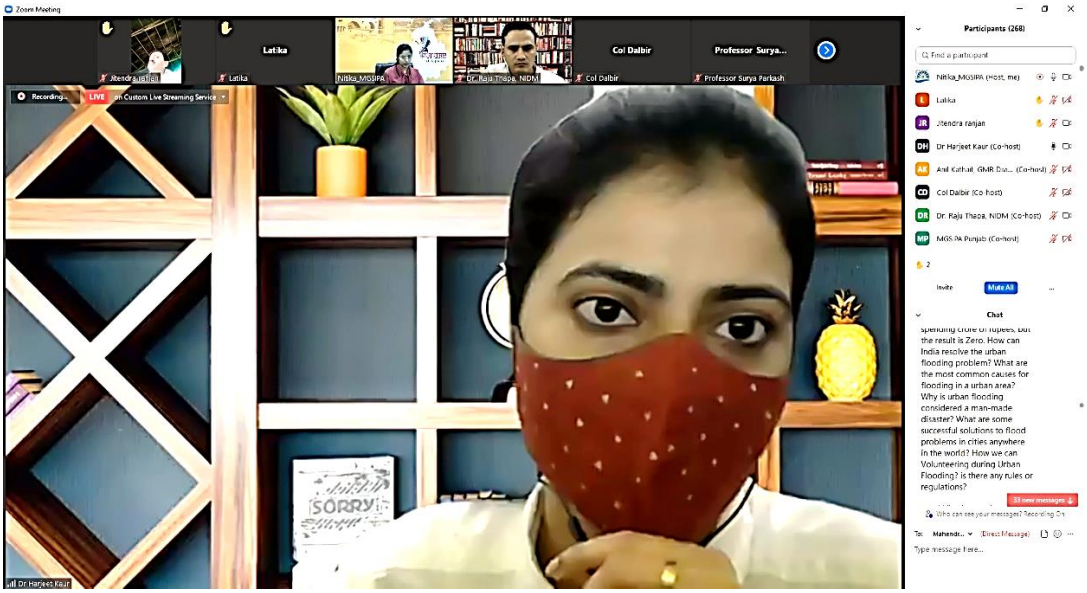
TECHNICAL SESSIONS

Day 1 – 20th September, 2021

Dr. Harjeet Kaur, Junior Consultant, NIDM held a session on the Management of Urban Flooding. Urban flooding is significantly different from rural flooding as urbanization leads to developed catchments, which increases the flood peaks from 1.8 to 8 times and flood volumes by up to 6 times. Consequently, flooding occurs very quickly due to faster flow times (in a matter of minutes). Urban areas are densely populated and people living in vulnerable areas suffer due to flooding, sometimes resulting in loss of life. It is not only the event of flooding but the secondary effect of exposure to infection also has its toll in terms of human suffering, loss of livelihood and, in extreme cases, loss of life. Urban areas are also centres of economic activities with vital infrastructure which needs to be protected 24x7. In most of the cities, damage to vital infrastructure has a bearing not only for the state and the country but it could even have global implications. Major cities in India have witnessed loss of life and property, disruption in transport and power and incidence of epidemics. Therefore, management of urban flooding has to be accorded top priority. Increasing trend of urban flooding is a universal phenomenon and poses a great challenge to urban planners the world over. Problems associated with urban floods range from relatively localized incidents to major incidents, resulting in cities being inundated from hours to several days. Therefore, the impact can also be widespread, including temporary relocation of people, damage to civic amenities, deterioration of water quality and risk of epidemics.

Dr. Harjeet brought to limelight about the urban flooding, its causes and the various categories of urban floods. She discussed about the Urban

Flood Risk and its impacts on the economic and social fabric of life. Dr. Harjeet further brought to the notice of participants the issues in Urban Flood Disaster Risk Management. Concluding her presentation, Dr. Harjeet shared some of the urban flood studies in India and their key takeaways.



Key Takeaways: Management of Urban Flooding

- Municipalities are well advised to spend adequate resources for comprehensive flood risk assessments.
- Community participation in flood risk assessment as well as in planning and implementation of risk management measures.
- Flood management measures have to be planned across administrative and sectoral boundaries.
- Finding an adequate compromise between storm water drainage and source control needs profound consideration and consultation with all stakeholders.
- There is need to combine structural and non-structural, spatial and organizational measures.

- Recognizing sustainable, flood aware urban planning.
- Monitoring and evaluation of implemented measures.

Dr. Raju Thapa, Junior consultant, NIDM held his session on the topic Early Warning and Communication. Early warning systems have been implemented and are now operated at the local level for some hazards such as floods; and at the national level to address a variety of hazards. In addition, efforts have been carried out under the umbrella of the United Nations since the nineties to promote the implementation or improvement of early warning systems around the world, including through international cooperation. Dr. Raju discussed in detail about the need, components and effective early warning system and communication in respect to increasing number of disasters in last twenty years. He also outlined the monitoring, warning, dissemination, and communication services during an emergency response. Further he enlightened us all on the standard operating procedures for responding to natural disasters and pre-disaster needs assessment by a discussing a case study of Deployment of an experimental People-centric Landslide Early Warning System at Giddapahar Village, Kurseong, Darjeeling district, West Bengal.

In recent years, the concept of multi-hazard early warning systems has been promoted at the international level. Such systems address several hazards and/or impacts of similar or different type in contexts where hazardous events may occur alone, simultaneously, cascading or cumulatively over time, considering the potential interrelated effects.

Key Takeaways: Early Warning and Communication

- Disaster risk knowledge based on the systematic collection of data and disaster risk assessments.

- Detection, monitoring, analysis and forecasting of the hazards and possible consequences.
- Dissemination and communication, by an official source, of authoritative, timely, accurate and actionable warnings and associated information on likelihood and impact.
- Preparedness at all levels to respond to the warnings received.
- Communication infrastructure hardware that must be reliable and robust, especially during the natural disasters.
- Appropriate and effective interactions among the main actors of the early warning process such as the scientific community, stakeholders, decision makers, the public, and the media.

Later, we had Q&A Session where chance was given to the participants to get their doubts and questions clarified live onboard by the speakers. Dr. Harjeet Kaur and Dr. Raju Thapa very convincingly and patiently addressed all the issues of the participants thus sharing very valuable and fruitful information with all.

Day 2 – 21st September, 2021

Dr. Purnima Jalihal, Scientist G, National Institute of Ocean Technology, India delivered a presentation on the topic, "Energy and Water from the Oceans for the Mitigation of Climate Change Impact." Embarking her presentation, Dr. Purnima gave a glance of activities undertaken by her esteemed institution, National Institute of Ocean Technology. At the outset she discussed about the greenhouse gases, climate change and global warming and enlightened on the importance of renewable energy. Dr. Purnima further shared about the Wave Energy Site, an Oscillating Water Column Structure at Vizhinjam, Kerala. She also brought to the limelight the waste water treatment, industrial waste water treatment and desalination carried out in the Indian scenario. Discussing about the various Conventional Desalination technologies, Dr. Purnima shared about the various desalination plants, their impacts and outcomes, one of them being the Kavratti Plant. Dr. Purnima concluded her presentation saying that Oceans can be a solution for Green Energy and Clean Water. With this Dr. Purnima addressed the questions of the participants live onboard.

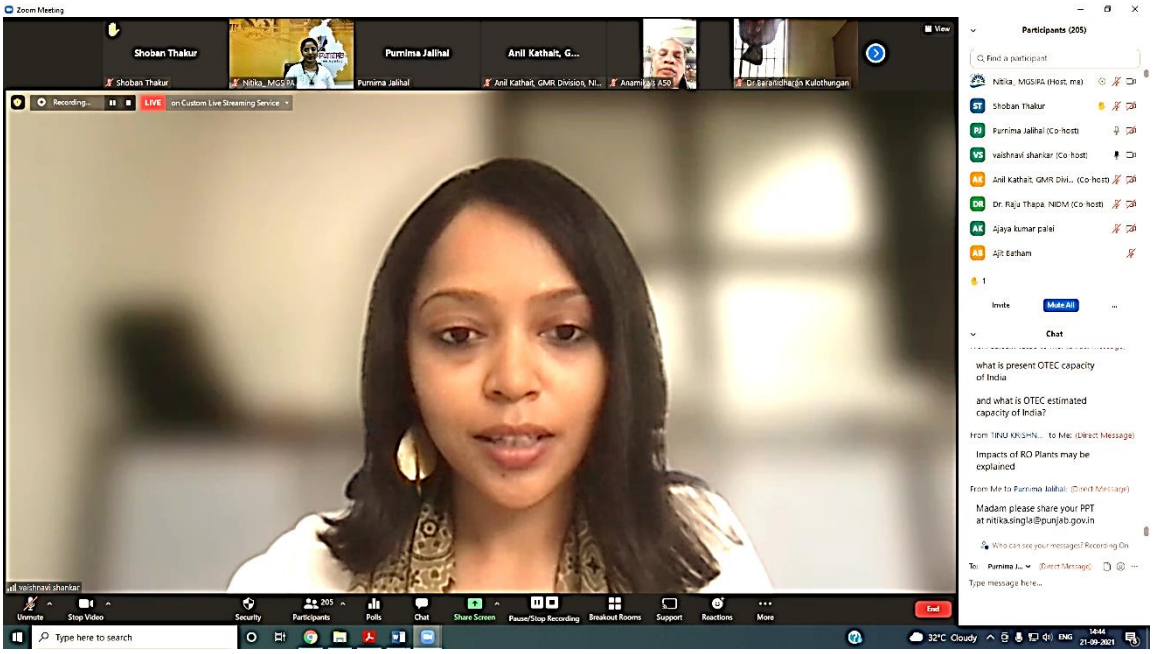
Key Takeaways: Energy and Water from the Oceans for the Mitigation of Climate Change Impact

- Development of incentives (e.g., carbon taxes and innovative power purchase agreements) that can encourage the expansion of ocean-based energy systems.
- Marine spatial planning should integrate the future role of offshore renewable energy with the many other activities affecting ocean and coastal areas.
- Development of appropriate legislation and regulation of ocean-based renewable energy to allow easier integration in national electricity grids is also required.
- Establishment of national targets and strategies to increase the share of ocean-based renewable energy in national energy mix.
- Stable economic and regulatory framework to stimulate investments in required infrastructure for an accelerated deployment of ocean-based energy systems.

Ms. Vaishnavi Shankar, Lead – Training & Capacity Building, NIUA delivered a session on, ''Mainstreaming Urban Resilience Across Indian Cities''. She discussed through session how Building urban resilience is imperative for safeguarding urban investments and paving the way for a forward-looking, risk-aware, inclusive and integrated approach to sustainable urban development in India.

International frameworks such as the Sustainable Development Goals (SDGs) 2030, Sendai Framework for Disaster Risk Reduction, Paris Climate Agreement, and the New Urban Agenda (announced at Habitat III conference), provide pathways for reducing risks of climate change. The SDG 11 ''Sustainable Cities and Communities'' and SDG 13 ''Climate

Action'' together lay out indicators for reducing vulnerability of the people and building resilient infrastructure.



The New Urban Agenda (NUA), in its policy section on 'Urban Ecology and Resilience', highlights the need for resilient development specifically in the next decade as 70% of the urban infrastructure demand is yet to be achieved (UN-Habitat, 2015).

However, given the significance of India's urban development, it is imperative to mainstream 'urban resilience' for safeguarding infrastructure investments, mobilizing Policy Brief institutional resources, and improving efficiency of urban governance. This is especially important in light of the recent national urban development missions [viz. Smart Cities Mission, Atal Mission for Rejuvenation an Urban Transformation (AMRUT), Pradhan Mantri Awas Yojana – Urban (PMAY-U) and Swachh Bharat Mission – Urban (SBM-U)] that resulted in earmarking of an overall investment of INR 6,85,758 crores in 4,041 Urban Local Bodies (ULBs) across the country (MoHUA, 2018). These include projects on affordable housing, sustainable mobility, solid waste

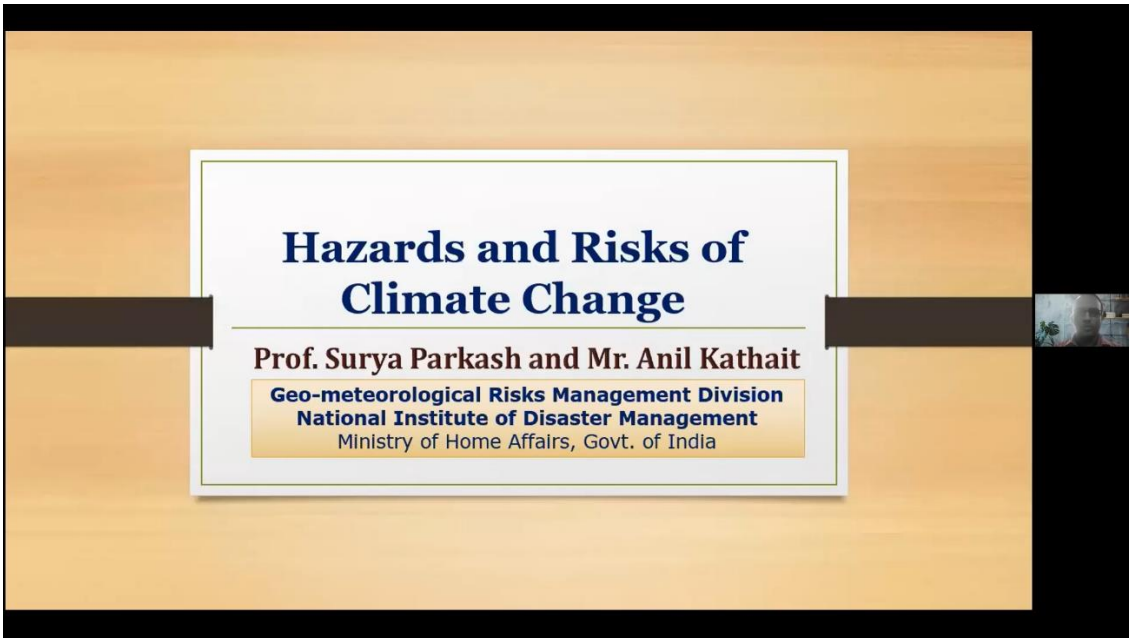
management and sanitation, water supply and sewerage, development of open/green spaces, heritage conservation, redevelopment and renewal of core areas, and smart governance, among others. Applying a resilience lens to these programs and projects can pave the way for a forward-looking, riskware, inclusive and integrated urban transformation in India.

Key Takeaways: Mainstreaming Urban Resilience Across Indian Cities

- Mainstreaming resilience into national urban policies, infrastructure investment programs and city planning processes will enable local governments in prioritizing and financing resilience projects.
- Bringing together different stakeholders to champion and prioritize the urban resilience agenda.
- Informed decision-making through data-driven governance and performance monitoring.
- To improve the overall quality of life of urban dwellers through sustainable infrastructure, services and smart governance.
- Multi-stakeholder collaboration is imperative in resilience building initiatives.
- City leaders play an important role in championing resilience, and urban planners and city engineers play an important role in implementing resilience strategies.
- Need for fostering research and local innovation for developing resilient urban solutions.
- Need for promoting urban innovation by private sector, research and academia alongside improvement in institutional capacities.

Anil Kathait, Junior Consultant, NIDM delivered a presentation on the topic, "Hazard and Risks of Climate Change". At the outset, Mr. Anil discussed about the difference between the weather and climate and Global Warming and Climate Change. He threw light on signs of climate change and Hazard and risks of climate change. Climate change can increase disaster risk in a variety of ways - by altering the frequency and intensity of hazard events, affecting vulnerability to hazards, and changing exposure patterns. Risk associated with weather-related hazards is disproportionately concentrated in developing countries and within these countries in poorer sectors of the population. Poverty and constrained access to productive assets mean that rural livelihoods that depend on agriculture and other natural resources are vulnerable to even slight variations in weather and seasonality. Patterns of risk that may be driven by climate change are also related to factors such as the growth of informal settlements in exposed areas, lack of investment in drainage infrastructure, and deficiencies in urban and local governance. By addressing these, we can build resilience to climate change. The impact of climate change in rural and urban areas in is intimately linked. As the sustainability of rural livelihoods declines and disaster risk increases, it is possible that increased rural to urban migration may occur. Related to climate change, in rural areas more frequent and extreme droughts, as well as changes in mean temperature and precipitation levels will cause further stress to these already vulnerable livelihoods.

Mr. Anil further discussed the Hazard and Vulnerability Profile of India and the key Natural Hazard Statistics of the nation for 1985-2018. With this he concluded his session talking about the ways of addressing the climate change. Addressing the underlying risk drivers is key to both disaster risk reduction and climate change adaptation.

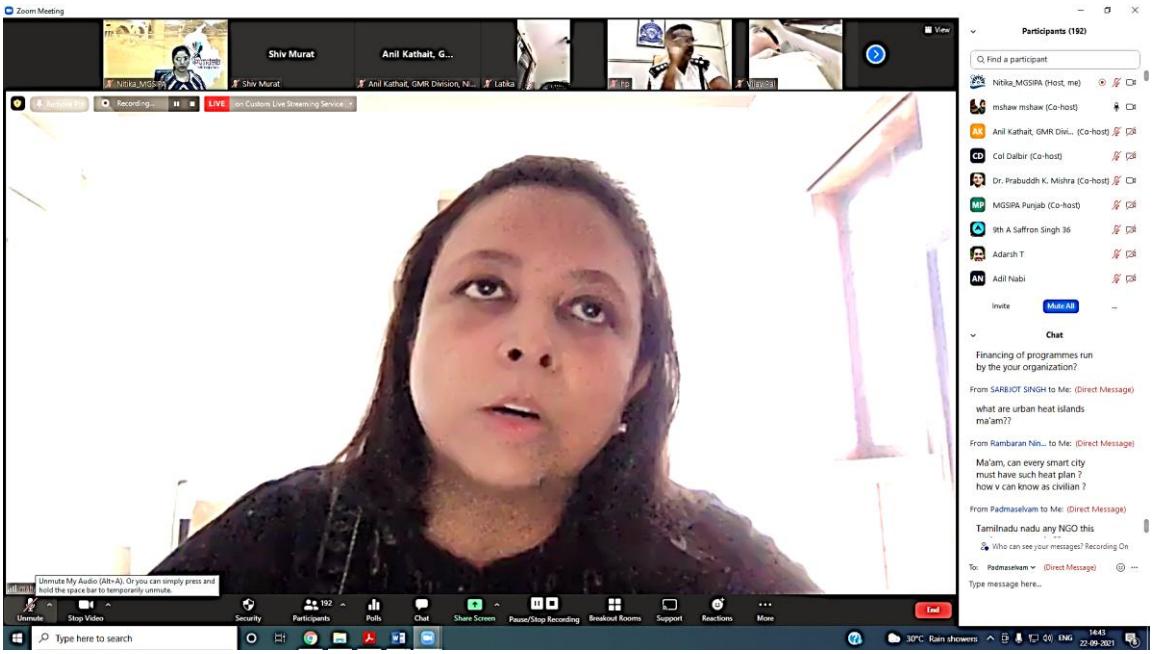


Key Takeaways: Hazard and Risks of Climate Change

- Enhance knowledge of, and capacity to understand, assess and predict, current and future climate variability, trends in long-term climate change, the occurrence and scale of extreme events, and their impacts;
- Enhance capacity to understand vulnerability to, and to use information on, climate change, current and future climate variability and extreme events, and their impacts, including use of this information to analyse these impacts; and capacity to assess climate related risks, impact thresholds, trends, and implications for sustainable development;
- Share and use information on, and analysis of, experiences in climate risk assessment and management;
- Promote the use of tools and systems for these purposes.

Day 3 – 22nd September, 2021

Ms. Moumita Shaw, Senior Research Analyst, IRADe made a remarkable presentation on, **"Climate Adaptive Action Plans for Indian Cities."** The Intergovernmental Panel on Climate Change estimates that rising global temperatures will increase the amount and severity of heat waves. In India, these heat waves are exacerbated by the heat generated by human activities in urban areas. This has a considerable impact on the health of vulnerable communities, including a rise in fatalities. According to the Indian Meteorological Department, in 2015 alone more than 2,400 people died of heat-related causes. Despite projections by climate models of a warming climate and increasing frequency of extreme heat events in the coming years, in India the public recognition of the magnitude of these hazards remains low. Administrative support systems generally lack preparedness measures and data to quantify how heat stress affects human health, work productivity, and livelihoods.



The researchers, in collaboration with the municipal corporations, will identify the spatial vulnerability of populations during extreme heat events; analyze the impact of extreme heat events on health, work productivity, and livelihoods; select appropriate, innovative, and affordable climate adaptation measures that consider associated cost effectiveness and gender-based implications; provide training to urban planners, municipal commissioners, city engineers, officials from various healthcare centres, and municipal health officers to improve their ability to execute heat stress action plans; and organize policy workshops to facilitate the implementation of the heat stress action plans into municipal disaster strategies in the selected areas.

The research process and plans developed are expected to influence appropriate adaptation actions and associated policy at the municipal scale, which will improve resilience and reduce vulnerability of more than 10 million at-risk people in the selected areas. The plans will be made available to the Natural Resources Defense Council and the Indian Institute of Public Health to enable an analysis of their potential to be applied to other cities in India.

Key Takeaways: Climate Adaptive Action Plans for Indian Cities

- Developing a 'City Climate Action Plan' provides the local government an opportunity to mainstream climate considerations into regular urban development processes.
- The key to successful implementation of the resilience interventions/actions is the 'institutionalization' of climate action planning into sectoral development plans.

- City Climate Action Planning will be effective only when identified prioritized actions are included in annual municipal budgets and in other relevant schemes.
- Resilience actions have to leverage and build upon cities' existing developmental plans and resource opportunities (like Central/State schemes or programmes) to be feasible and applicable for implementation.
- Building the capacity of local municipal officials is critical for sustained efforts in implementation of the action plan.
- Developing institutional structures (climate core and stakeholder committees) helped in securing the buying of all officials and in creating a sense of ownership amongst key stakeholders.
- Formulation of a city climate action plan not only helps in forecasting future climate change impacts and identifying infrastructural implications, but also helps in understanding urban infrastructure gaps.
- Extensive data needs to be collected for the preparation of a city climate action plan; institutionalizing data capture formats and processes eases this process. This data capture process also support larger urban development initiatives of the city.
- Developing a climate action plan is a 'dynamic process'; a city should revise it depending on its evolving priorities as well as data availability.
- The action plans propose climate targets through implementation of various actions across sectors such as building, water supply, sewerage and street lights, besides transportation and solid waste management.

Dr. Prabuddh Kumar Mishra, Assistant Professor (Geography) at Shivaji College, University of Delhi elucidated on, "Community Perspective of Climate Change in the Himalayas." The Himalaya region has been experiencing the multitude of undesired change that cut across both biophysical and social realms. Observed biophysical changes include unpredictability in the timing and magnitude of rainfall, frequent occurrence of extreme heat during the summer season, glacial retreat and melting snow. Temperature is rising over the past 100 years. These changes have already been posing serious threats on water, biodiversity, human health, agriculture, and consequently on food security throughout the region and downstream.

Vulnerable social and economic conditions pose further threat to the region. Recent social changes include rapid exodus of able-body manpower from the country, frequent economic crises, social and political unrest, and shrinking human capital. Since the region is the water tower of Asia and the lifeline for nearly one-fifth of world population, the current trend of climate change in the region will continue presenting an immense threat to humanity. While any one of these factors will likely pose significant challenges on livelihoods of the people of the Himalaya region, the threat posed by changing climate and uncertainty associated with it cannot be ignored.

Lack of money, lack of access to information, and lack of awareness or understanding are considered the three largest hurdles besides low priority for adaptation, recognized by community members as barriers to adaptation planning and actions. Adaptation plans must be integrated into both top-down and bottom-up approaches to plan for enabling sustainable development and the efficient use of information for adaptation. Finally, traditional knowledge seems to be useful not only in contrasting climate change impacts, but also in recovering several

ecosystem services that work all together for enhancing the quality of life of villagers at local scale.

Hazard mapping would help both decision-makers and local communities understand the current situation, thereby enabling them to anticipate or assess their flexibility to adapt to future changes through proper planning and technical design.

Key Takeaways: Community Perspective of Climate Change in the Himalayas

- Supporting community-led adaptation: One approach to vulnerability and local level adaptation is 'bottom-up' community-led processes built on local knowledge, innovations, and practices.
- The focus should be on empowering communities to base adaptations to a changing climate and environment on their own decision-making processes, and on participatory technology development with support from outsiders.

- Full disclosure and prior information for grass-root societies: Indigenous and local communities should be fully informed about the impacts of climate change.
- Engagement of the media and academia: Awareness and knowledge among stakeholders about the impacts of global warming and the threat to the ecosystem, communities, and infrastructure are generally inadequate.
- Facilitation of international policy dialogue and cooperation: Regional and international cooperation needs to advance in order to address the ecological, socioeconomic, and cultural implications of climate change in the Himalayas.

VALEDICTION SESSION

Feedback and Summary

Ms. Nitika Singla, gave a summary of the programme with a recapitulation of all the technical sessions and the faculty concerned. She made a quick review of how the three-day online Training Programme was very well brought up by the wonderful and remarkable technical sessions of the experts from NIDM, Ministry of Home Affairs, Government of India and various other prestigious institutions/ organizations of the country.

Closing Remarks

Prof. Surya Prakash, Head, GMRM Division, NIDM highlighted that the climate change adaptation and disaster risk reduction can be best addressed and sustained over time through integration with existing urban planning and management practices. Significant financial support is needed. Local governments need to leverage existing and new resources to meet the shortfalls in service delivery and basic infrastructure adaptation. He also stressed that the success of the training programme lies in the dissemination of knowledge generated during the training programme. He urged the participants to pass on the knowledge related to climate change, urbanization and multi hazard management approach gained through the programme among their community and organizations.

Vote of Thanks

Col. Dalbir Singh, General Manager (Training, Project & Consultancy), MGSIPA proposed a vote of thanks to all the key speakers and faculty who shared their vast knowledge and experience during the 3-days online training programme. He appreciated National Institute of Disaster Management (NIDM) for collaborating with MGSIPA, Chandigarh and expressing the vitality and relevance of the Climate Change, Urbanisation and Multi-hazard management training and the impeccable experience of it being conducted online. At last, thanked the participants for being consistent and curious learners, for showing up every day and making the training endearing and engaging!

LEARNING OUTCOMES

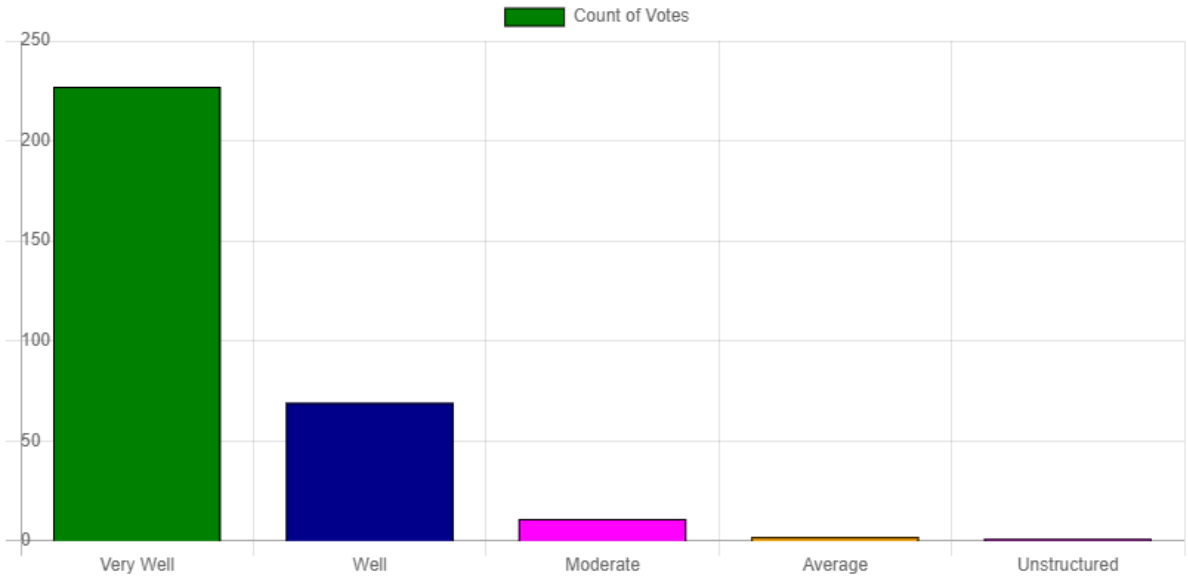
The generic learning outcomes of this Online Programme encompass a series of capacities that will allow the participants to demonstrate knowledge and understanding to:

- The rapid urbanization, haphazard land-use planning to meet the necessity of quality key infrastructure and services beside climate change are exposing more number of populations to the vulnerability index. The need of hour is to enhance land-use planning and integrating climate change action plans along with disaster risk reduction and resilience strategies into the development activities.
- To curb the emission of carbon dioxide we have to focus on energy efficiency, reduction of fossil fuel use, fuel switching, fuel-efficient hybrid vehicles or bio-fuel transportation.
- The learning of past's disastrous events should be employed into future development activities to strengthen the resilience of infrastructures and structures.
- Dilapidated drainage system in the urban areas is one of the major reasons for the urban flooding. There is need to redesign and regular monitoring of these drainage systems.
- States like Rajasthan that are drought prone must ensure the proper conservation of their water bodies. Public awareness is also needed to preserve the fading water resources.
- Climate change is augmenting intensity and frequency of the extreme weather related events. The combat the challenges of these events we need to adopt holistic multi-hazard approaches.

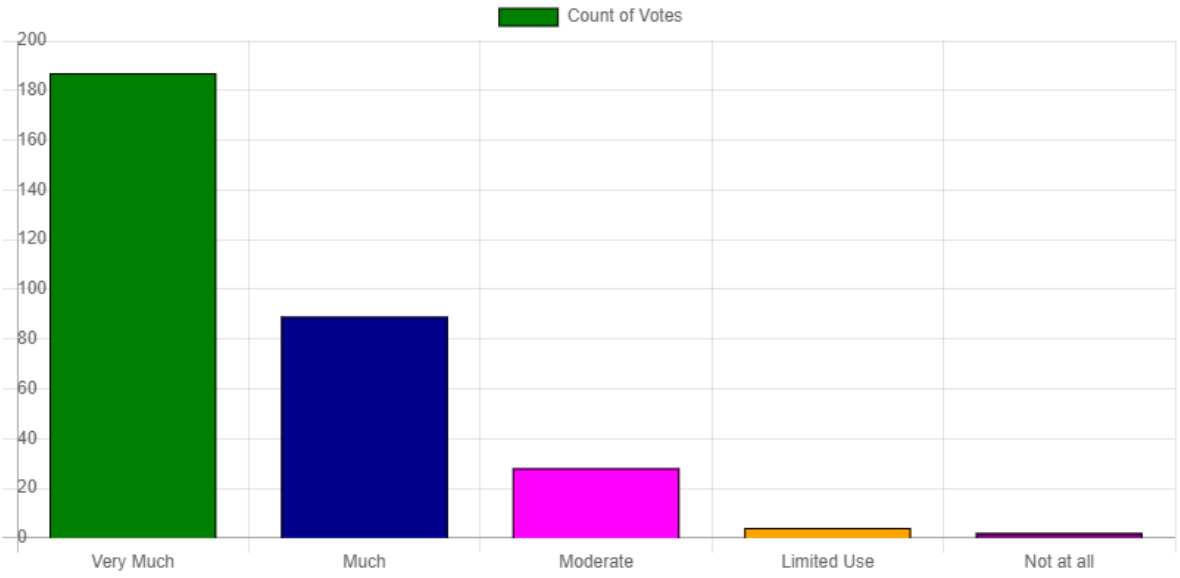
- COVID-19 pandemic has adversely affected the city's economy, health sector and supply chain. The coordinated response mechanism having multidisciplinary and multi-departmental stakeholders should be taken to tackle the challenges of such pandemic.
- Strong institutional framework and capacity development of the human resources are utmost important in chemical and industrial disaster management.
- There should be certification system for the disaster management plan of chemical as well as other industries. Proper enforcement, audit and practice of the plan should be carried out at regular interval.

COURSE FEEDBACK

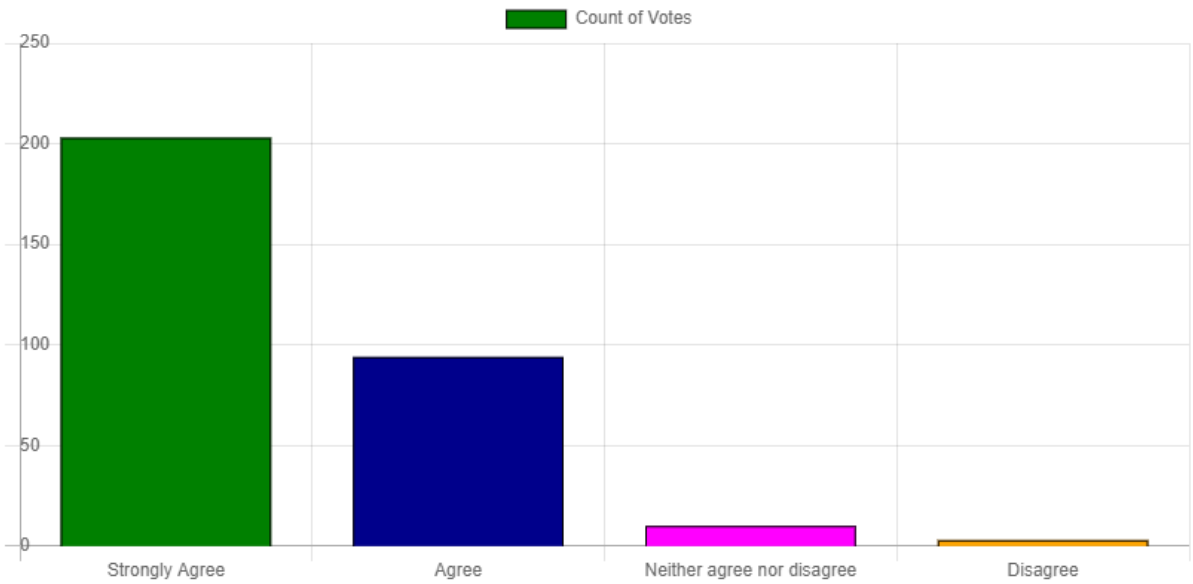
I think the structure and organization of the course fulfilled the objectives of the Training programme.



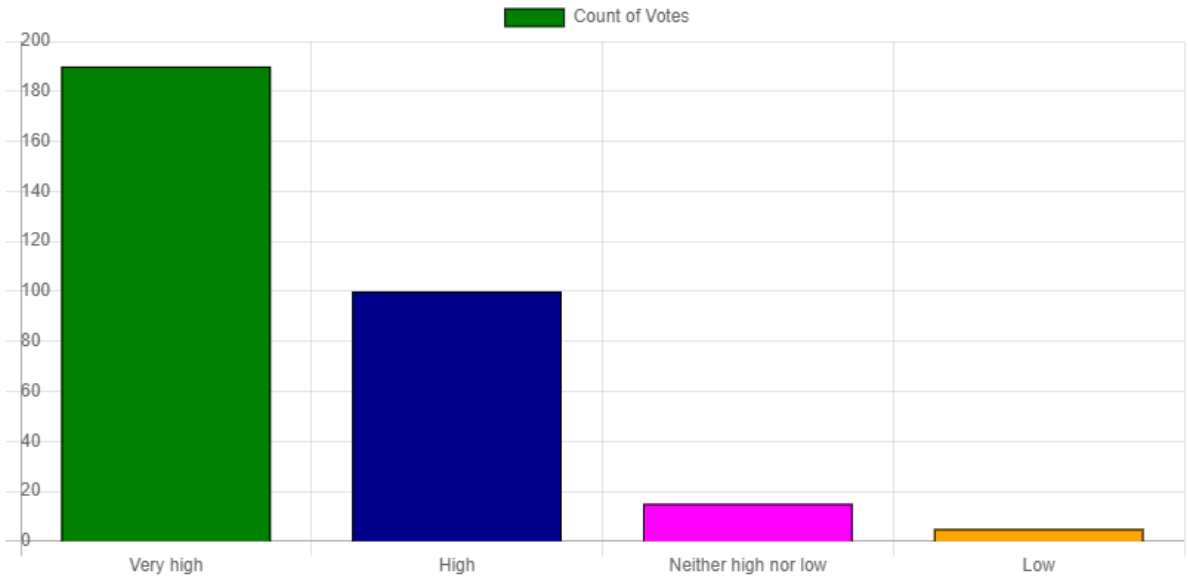
I feel this programme would be useful to me immediately in my job.



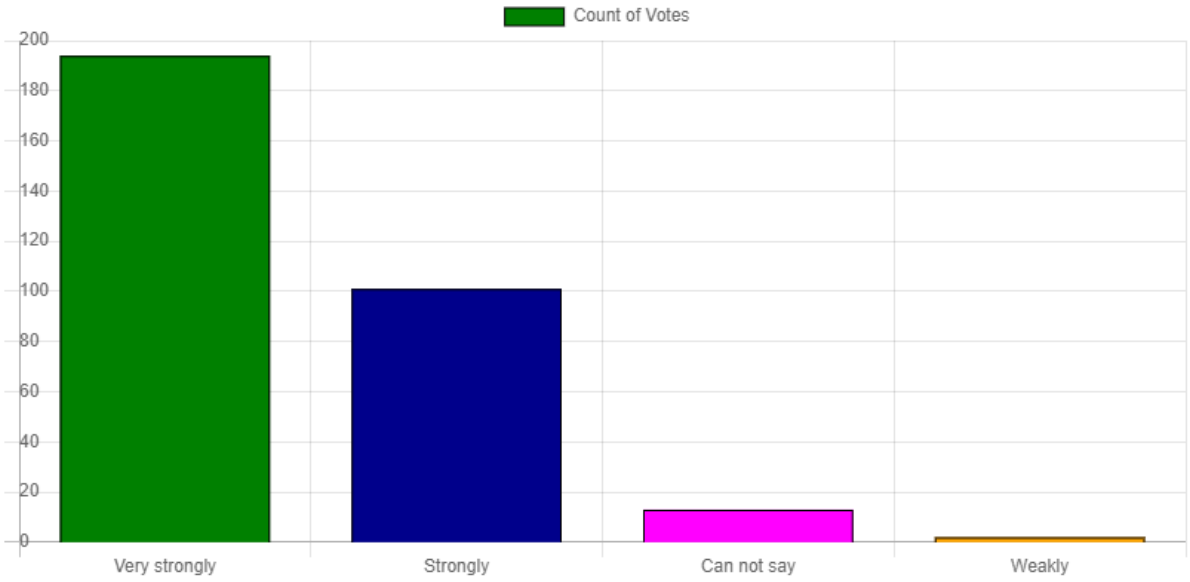
I believe this will help me in my future job related to Disaster management.



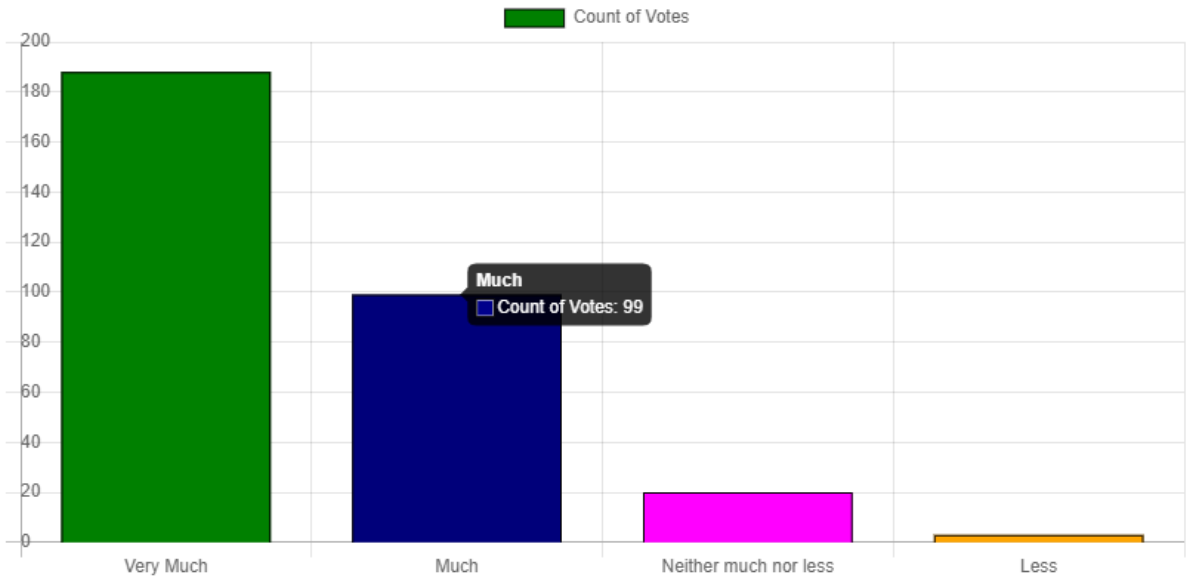
Practical orientation of the Training programme.



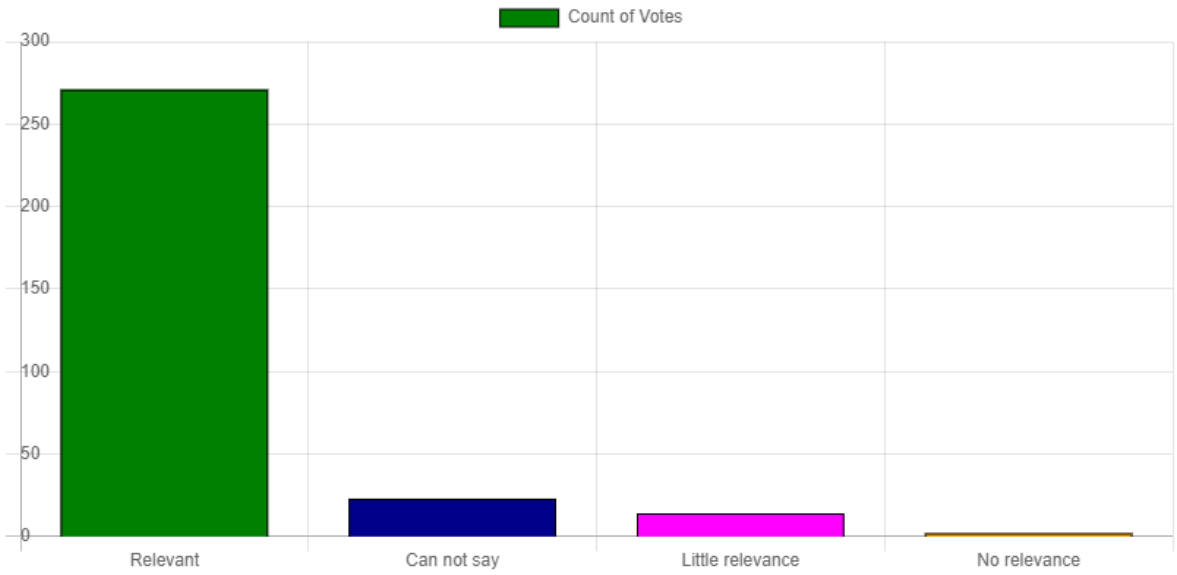
I feel this inspires me to take up assignments related to Disaster Management.



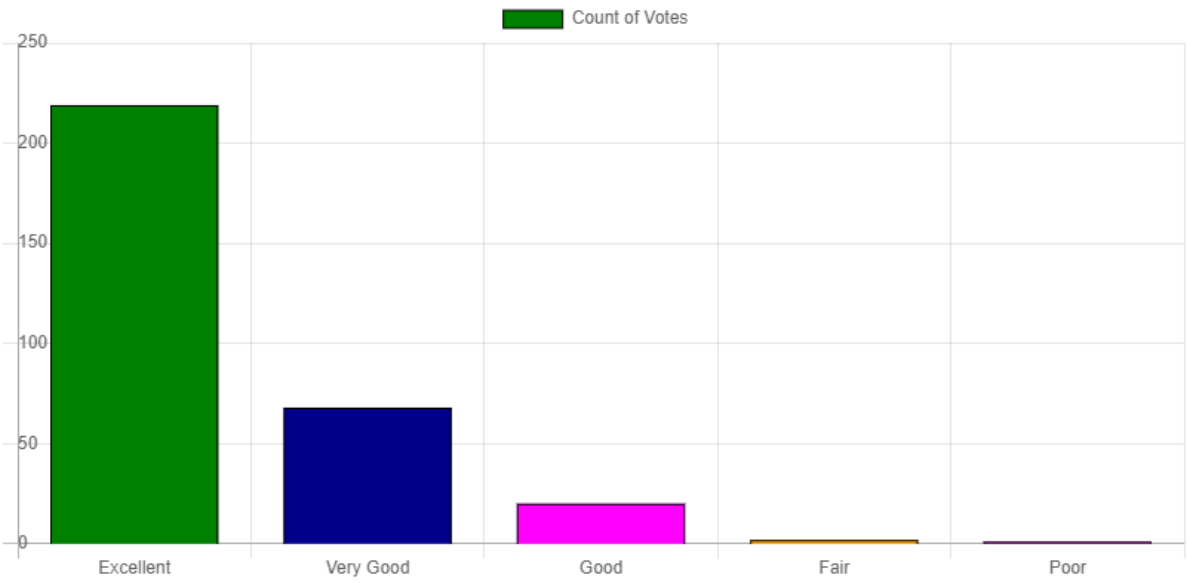
I have benefited from interaction with fellow participants in the course.



I found the course materials supplied to us to be



Your overall impression of the training programme.



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Reading Material

Basic of Early Warning and Communication

Prof. Surya Parkash & Dr. Raju Thapa
Early Warning and Communication (EWC) Centre,
Geo-Meteorological Risks Management Division
National Institute of Disaster Management
Email: razoothapa44@gmail.com

Physical distancing

Use face mask properly

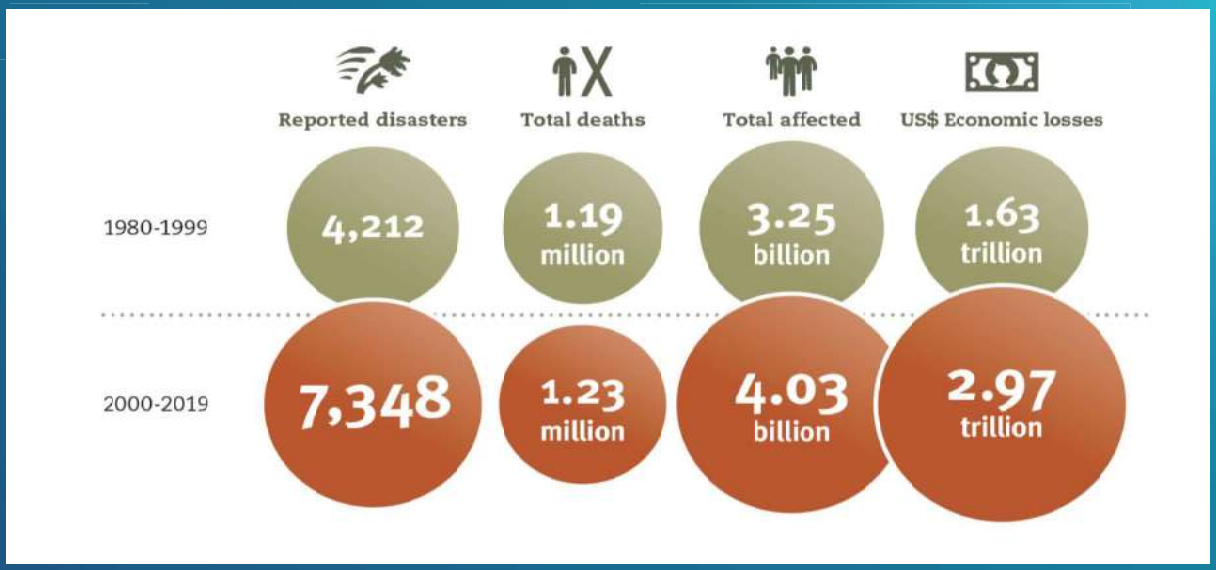
Regular washing hand

Covering one's mouth

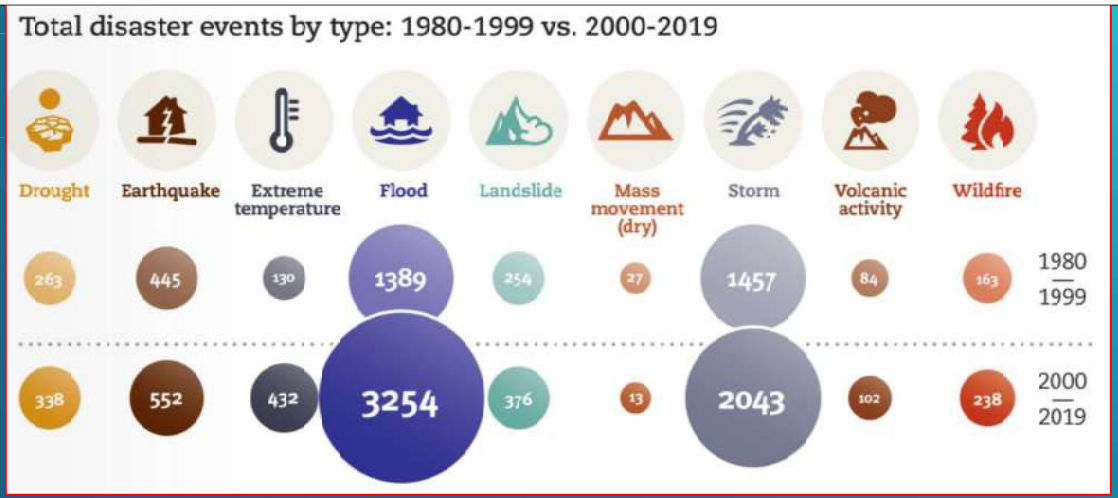
Self-monitoring of health

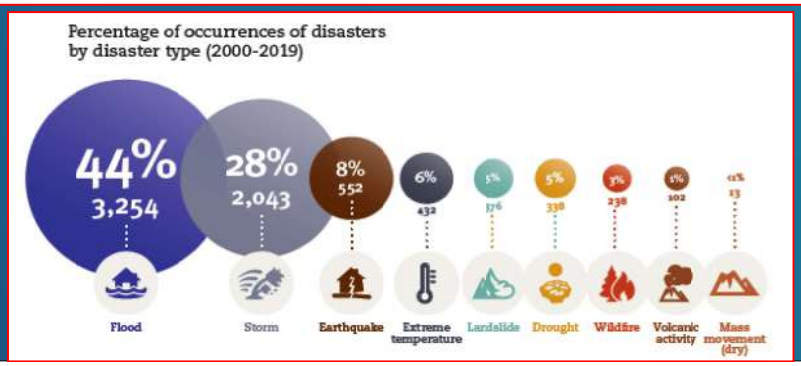
Get Vaccinated

Disaster Impacts: 1980-1999 vs. 2000-2019



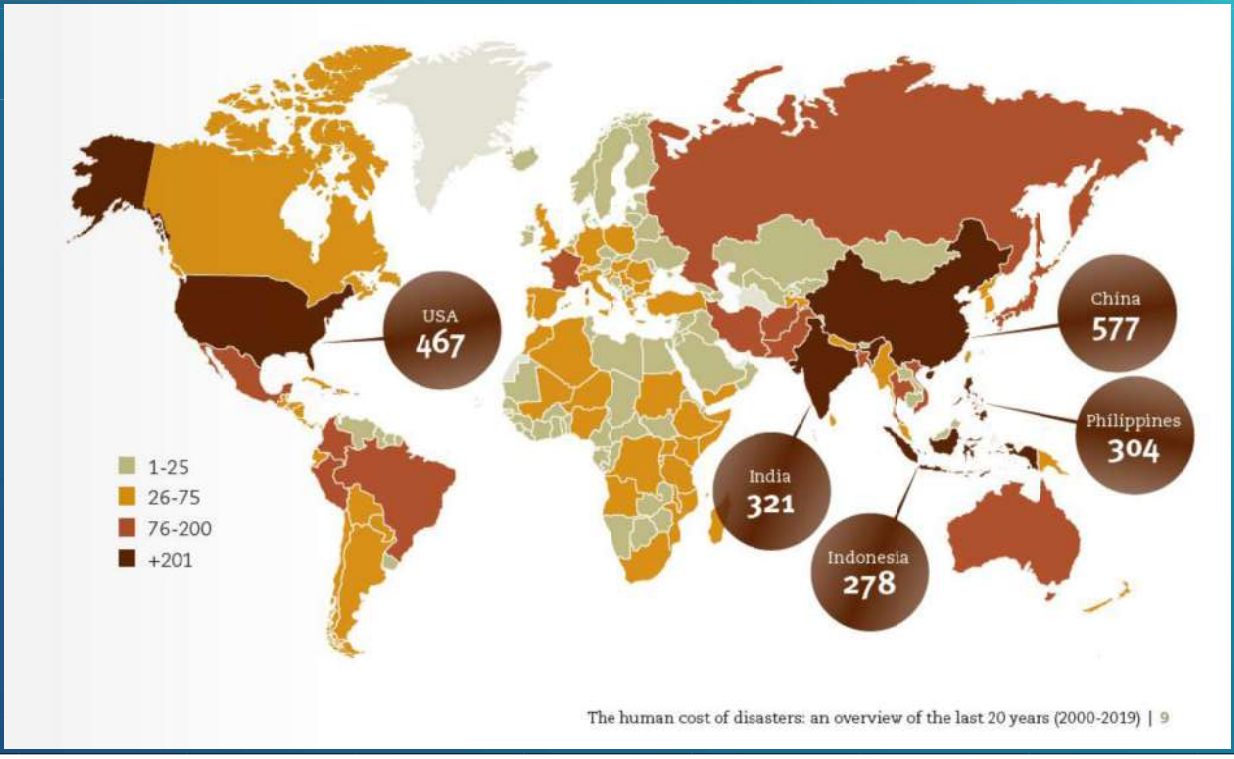
Source : The human cost of disasters: an overview of the last 20 years (2000-2019)



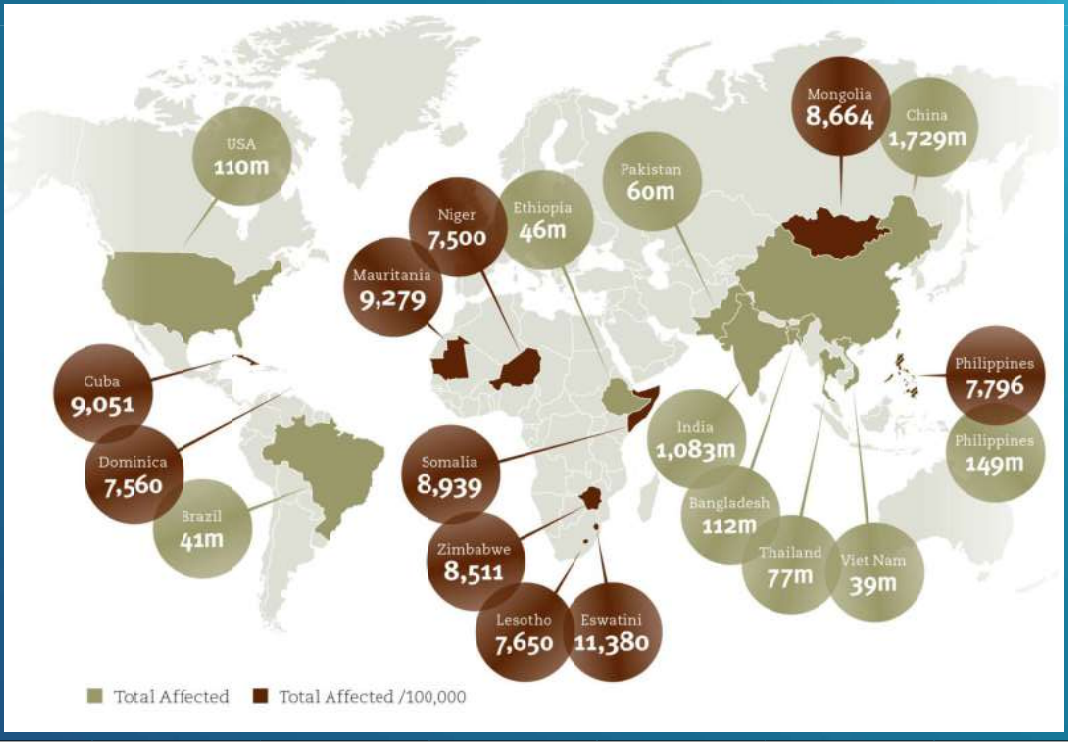


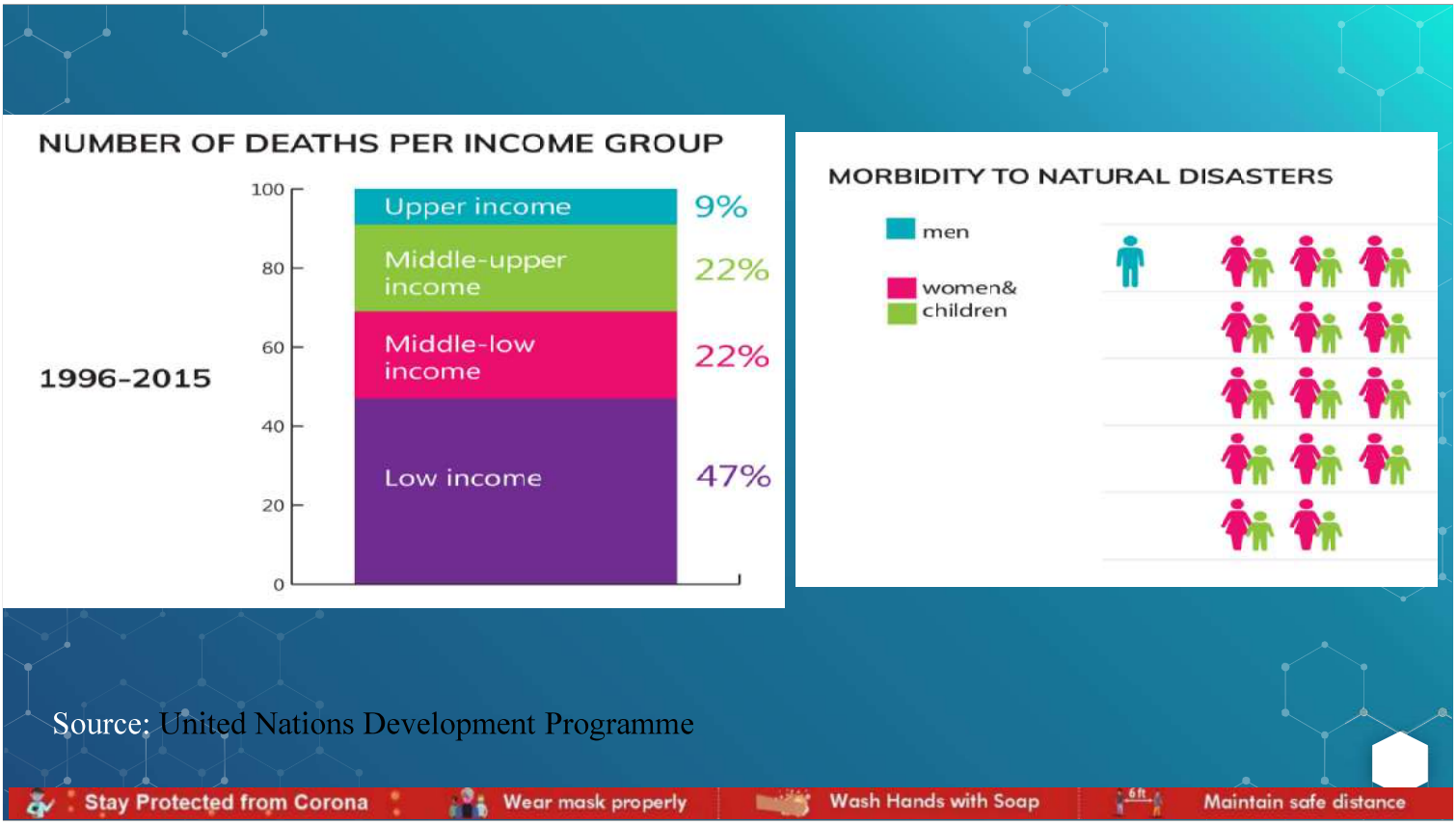
Source : The human cost of disasters: an overview of the last 20 years (2000-2019)

Number of disasters reported per country / territory (2000-2019)

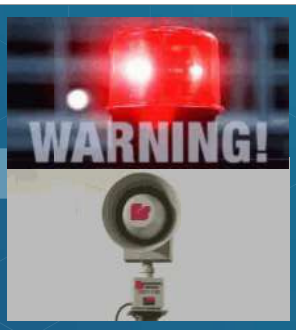


Top ten countries by total population affected by disasters (2000-2019)




NUMBER OF DEATHS PER INCOME GROUP
1996-2015
100
80
60
40
20
0
Upper income
9%
Middle-upper income
22%
Middle-low income
22%
Low income
47%
MORBIDITY TO NATURAL DISASTERS
men
women& children
Source: United Nations Development Programme
Stay Protected from Corona
Wear mask properly
Wash Hands with Soap
6ft
Maintain safe distance


Traditional Approach
Disaster
Landslide
Cyclone
Flood
Earthquake
Tsunami
Fire
Response
8



Early Warning

Early Action

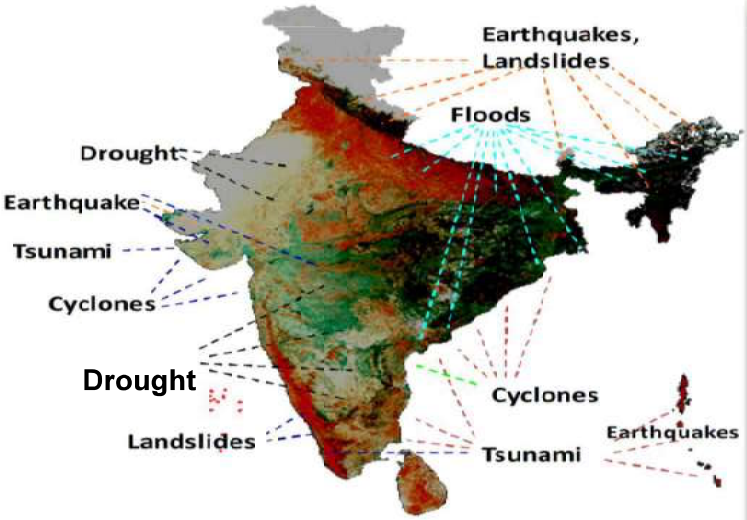
Enhanced Approach

Response

Disaster Event

9

India and the disasters



Disaster Risk in the country

- 12% of land area (40 mha) - Flood prone
- 8% of land area (along 5,500 km long coast tract) - Cyclone prone
- Over 65% of land under cultivation - Drought prone
- Around 25% land area - Earthquake prone - Seismic zone IV-V
- Himalayan and Western Ghats region - Landslide prone
- Andaman Nicobar Islands, parts of East Coast, and Gujarat coast – Tsunami

Average Annual Loss

- Direct: Loss of life: 4350 ; Crop area affected: 1.42 Mha; Houses damaged: 2.36 M; Direct loss: 2 % of the GDP (Rs. 25000 Cr)
- Indirect: Expenses on emergency response and relief ; diversion of developmental fund; Indirect socio-psychological losses that can not be quantified

Stay Protected from Corona | Wear mask properly | Wash Hands with Soap | Maintain safe distance

Early warning and Communication

Effective EWC

1977 Andhra Pradesh cyclone

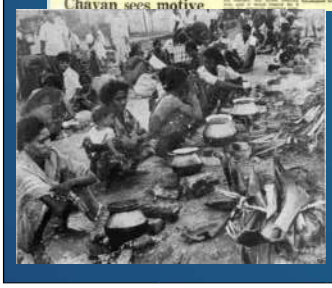

SUNDAY STANDARD

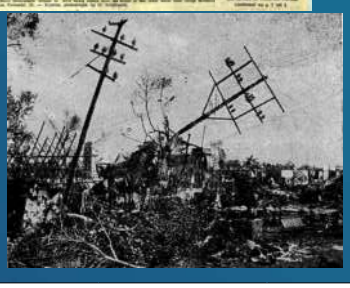
Over 2 m homeless in Andhra cyclone

Crops worth Rs 300 crores lost

Sadat to invite US, USSR for peace talks

Chavan sees motive





1999 Odisha and Andhra Pradesh cyclone

Paris Agreement (COP-21)

Sustainable Development Goals

SFDRR 2015-2030

PM's 10 Point Agenda

Stay Protected from Corona | Wear mask properly | Wash Hands with Soap | Maintain safe distance

Need of Early Warning System

14

Components of EWC

Risk Knowledge

Monitoring & Warning Services

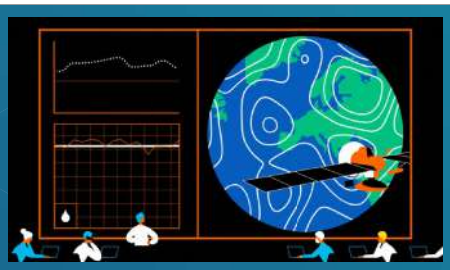
Response Capability

Dissemination and Communication

Risk Knowledge

16

Monitoring and warning Services



Source: https://hellofuture.orange.com/en/data/

Satellite imagery can aid in estimating temperature, wind speed, precipation

Land based radar for estimating downpour

On-ground points of measurement for water flow rainfall, wind speed, etc.

Trend analysis of online communication to find indications of future disasters

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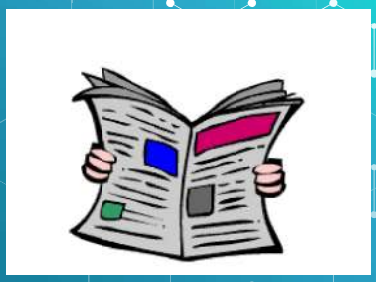
Dissemination and communication

Radio

Television

Social Media

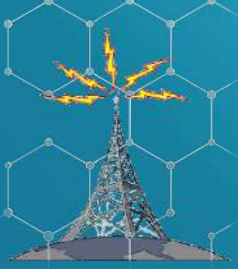


Print Media

Mobile Apps, SMS

Website, Email

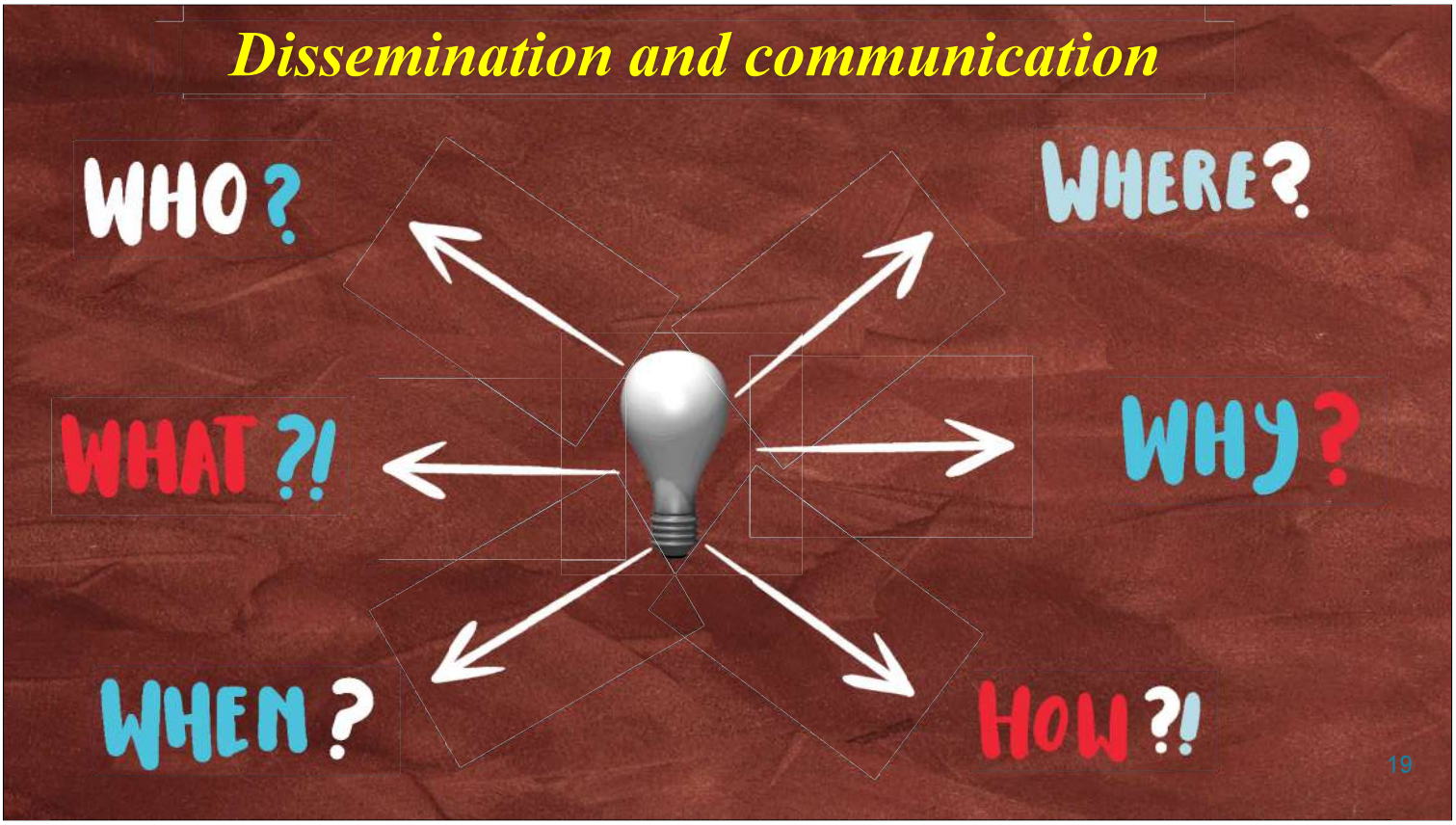
Siren, Speakers



Community Radio

18

Dissemination and communication

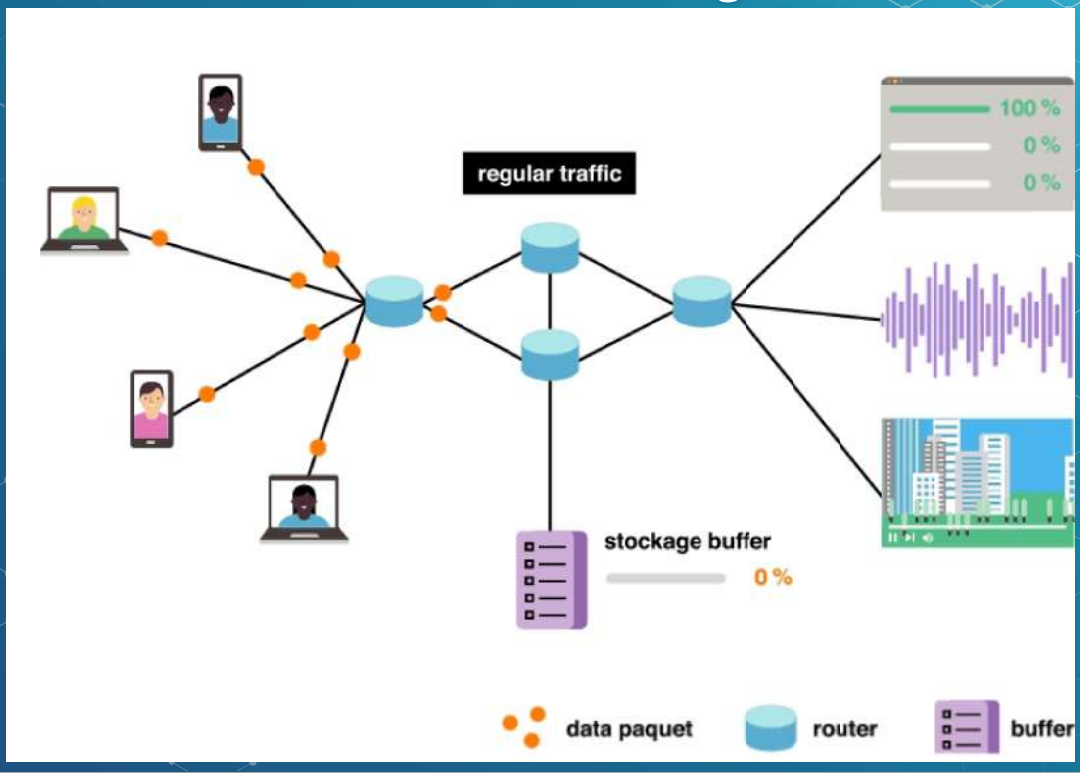


19

Response Capability

20

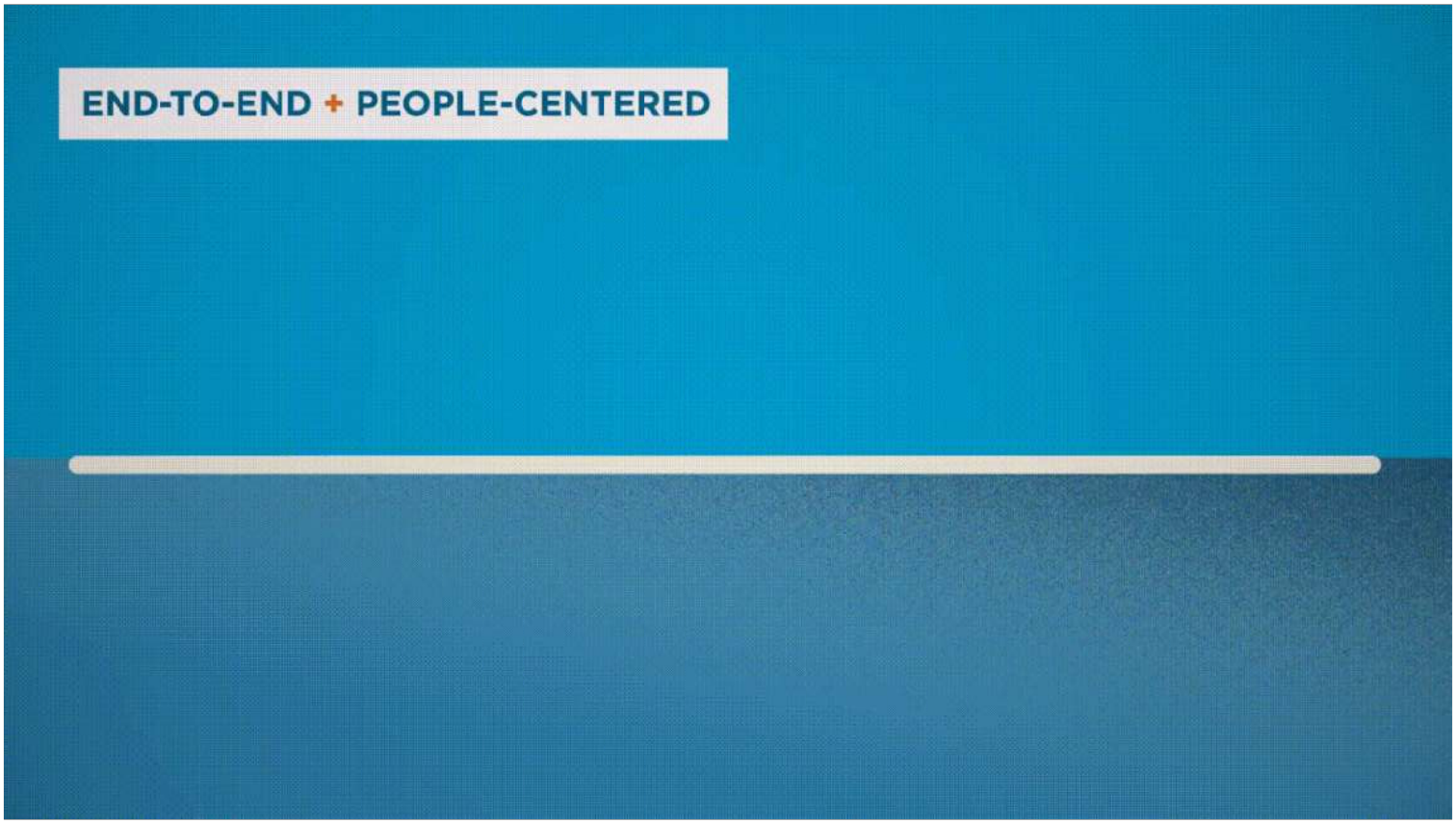
Communication During Disasters



21

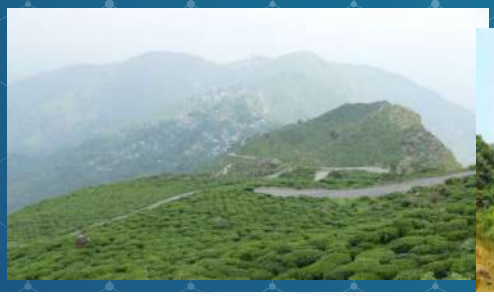
Effective Early Warning System

Stay Protected from Corona | Wear mask properly | Wash Hands with Soap | Maintain safe distance



SN	Hazard	Ministry	Agency
1.	Avalanches	MOD	Snow and Avalanche Study Establishment (SASE)
2.	Cold Wave	MOES	India Meteorological Department (IMD)
3.	Cyclone	MOES	India Meteorological Department (IMD) Regional Specialized Meteorological Centre (RSMC) Tropical Cyclone Warning Centres (TCWC) for different regions
4.	Drought	MAFW	Central Drought Relief Commissioner (CDRC) and Crop Weather Watch Group (CWWG)
5.	Earthquake	MOES	India Meteorological Department (IMD)
6.	Epidemics	MHFW	Ministry of Health and Family Welfare (MHFW)
7.	Floods	MOJS	Central Water Commission (CWC)
8.	Heat Wave	MOES	India Meteorological Department (IMD)
9.	Landslides	MOM	Geological Survey of India (GSI)
10.	Tsunami	MOES	India National Centre for Oceanic Information Services (INCOIS)

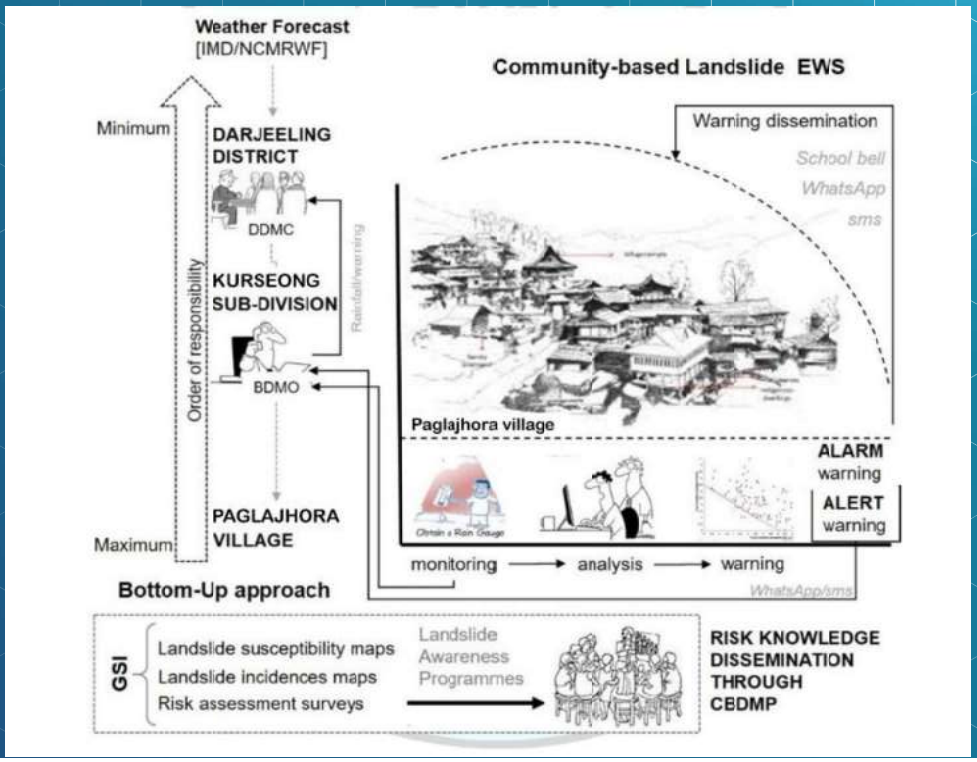
Deployment of an experimental People-centric Landslide Early Warning System at Giddapahar village, Kurseong, Darjeeling district, West Bengal



Source: GSI

25

People-centric Landslide Early Warning System (L-EWS) works



Source: GSI

26

Landslide risk awareness programme

Source: GSI

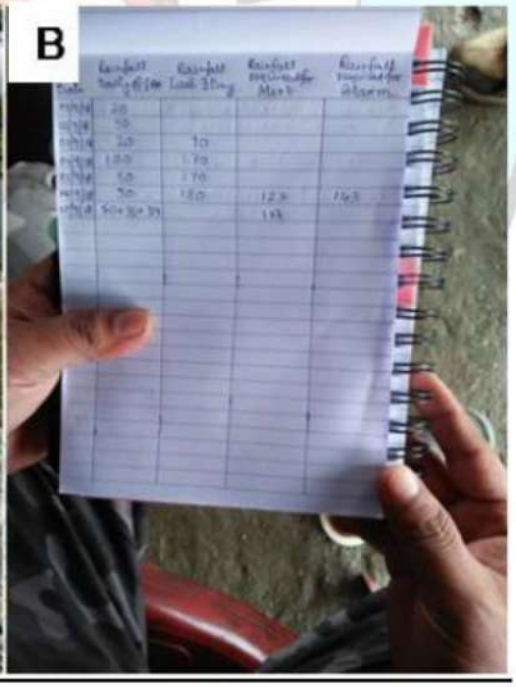
27

Billboard installed at Giddapahar depicting the key elements of the People-centric Landslide Early Warning System.

Source: GSI

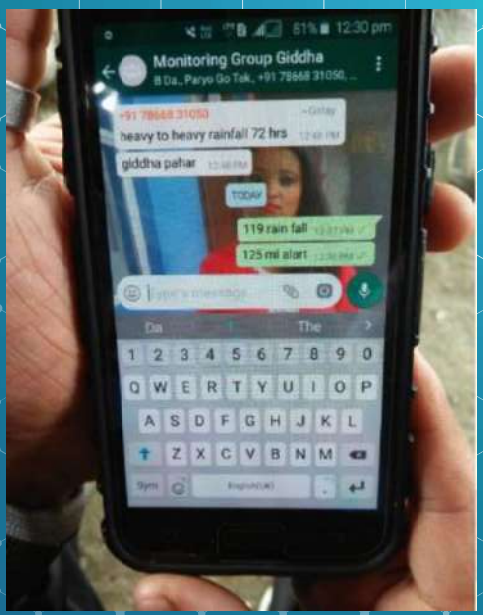
28

GSI official providing training to in-charge on rainfall measurement using rain gauge (A) and calculation of rainfall for threshold estimation (B



Source: GSI

Dissemination and communication



Giddapahar WhatsApp group for dissemination and communication of warning messages.

30

Mock-drill carried out at Giddapahar to sensitize the local community on preparedness and response:

Source: GSI

31

CROSS-CUTTING ISSUE

Effective Governance and Institutional Arrangements

A Multi-Hazard Approach

Involvement of Local Communities

Consideration of Gender Perspectives and Cultural Diversity

Stay Protected from Corona | Wear mask properly | Wash Hands with Soap | Maintain safe distance

Key Actors

Communities

Local governments

Central governments

Regional institutions and organizations

International bodies

Non-Governmental Organizations

Private sector

The science and academic community

Way Forwards

- Requirement for strengthening disaster risk
- Public and private investment in disaster risk prevention and reduction
- Requirement for strengthening disaster risk governance
- Technological innovation Broadcasting techniques
- Better data collection


THANK YOU :)
35

Early Warning in Urban Flooding

Prof. Surya Parkash and Dr. Harjeet Kaur
NATIONAL INSTITUTE OF DISASTER MANAGEMENT
MINISTRY OF HOME AFFAIRS, GOVERNMENT OF INDIA
NEW-DELHI, INDIA

What is Urban Flooding

Causes of Urban Flooding

- Unplanned urbanisation
- Expansion of the urban areas
- Increases in built-up areas and metal roads
- Filling of low-lying areas to construct buildings
- Construction of insufficient storm sewers
- Lack of maintenance and co-ordination
- Dynamic weather patterns due to Climate Change Urban Flooding
- 55% of India's population would be in urban areas by 2030 and go up to 65 – 70% by 2050

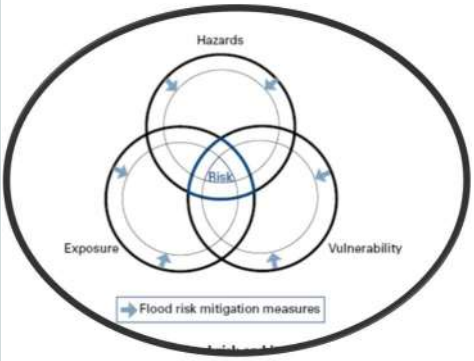
Categories of Urban floods

- ❖ Local Floods
- ❖ Riverine Floods
- ❖ Coastal Floods
- ❖ Flash Floods

Urban Flood Risk

1. Risk = Hazard x Vulnerability

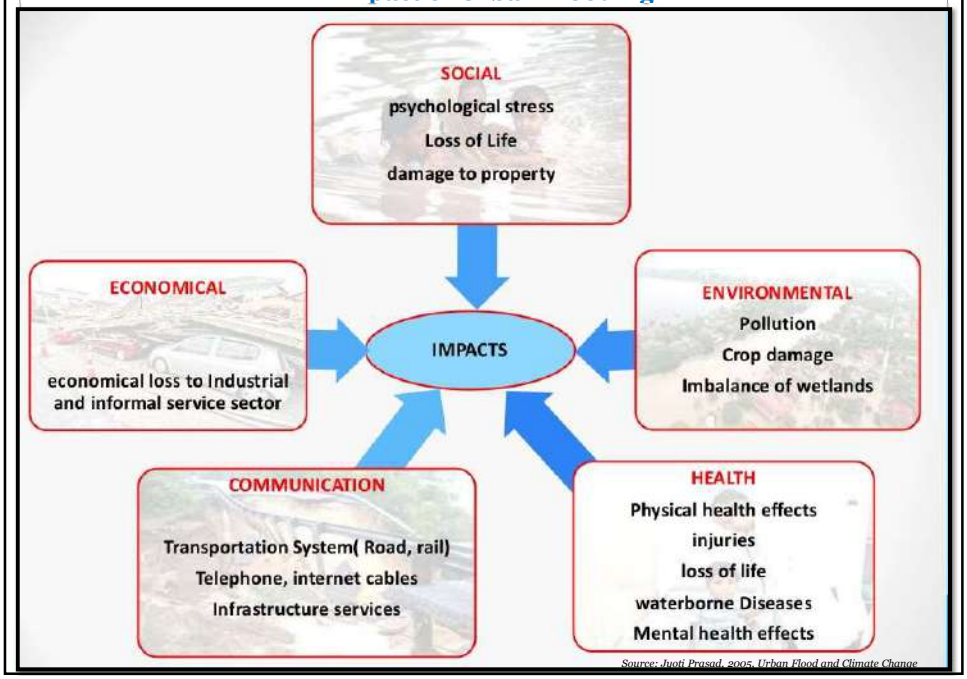
*(*Wisner et al, 2003 ; *Tingsanchali, 2012)*



2. Risk = function (Hazard x Exposure x Vulnerability)

Figure: Construct of flood risk and its reduction (WMO, 2008)

Impact of Urban Flooding



History of Urban Flooding in India

Major cities in India are subjected to urban flooding namely:

-Ahmadabad (2001)

-Delhi (2002, 2003)

-Chennai (2004, 2010, 2015)

-Mumbai (2005, 2017)

-Bengaluru (2005)

-Surat (2006)

-Kolkata (2007)

-Hyderabad (2008)

-Jamshedpur (2008)

-Srinagar (2014)

National Status

❖ The Central Public Health and Environmental Engineering Organization (CPHEEO), under the Ministry of Urban Development (MoUD), GoI, has published the "**Manual on Sewerage**" (1993).

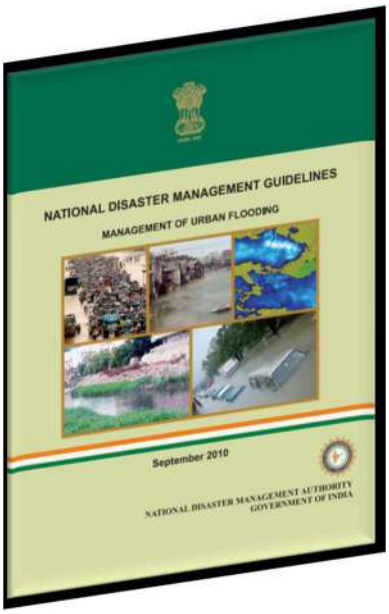
❖ under **JNNURM**, rainfall data obtained from Self-Recording Rain Gauge stations is followed, which takes into account the rainfall pattern of the cities.

❖The **Manual on Solid Waste** brought out by the CPHEEO, MoUD, (2000) will be followed in cleaning shallow surface drains

❖MoUD has, in 2008, constituted an "Expert Committee for the preparation of (a separate) **Urban Storm Drainage Manual**".

❖In 2012, the comprehensive **Urban Storm Drainage Design Manual** released .

❖Real time rainfall data for urban areas should be collected by the Urban Local Body (ULBs)



https://ndma.gov.in/images/guidelines/management_urban_flooding.pdf

Issues in Urban Flood Disaster Risk Management

Following are some of the shortcomings in management of Urban Flooding:

- Comprehensive risk assessment,
- Factoring risks in development planning,
- Coordination among different institutions
- Lack of information sharing,
- Disintegrated investment decisions, and
- Lack of consultation with stakeholders.

Early Warning System and Communication

1. National Hydro-meteorological Network

[Action: CWC, MoUD and States/UTs]

2. Local Networks for Real-Time Rainfall Data

[Action: MoUD, States/UTs, IMD, CWC and ULBs]

3. Doppler Weather Radars

[Action: IMD and MoUD]

4. Data Integration and Sharing

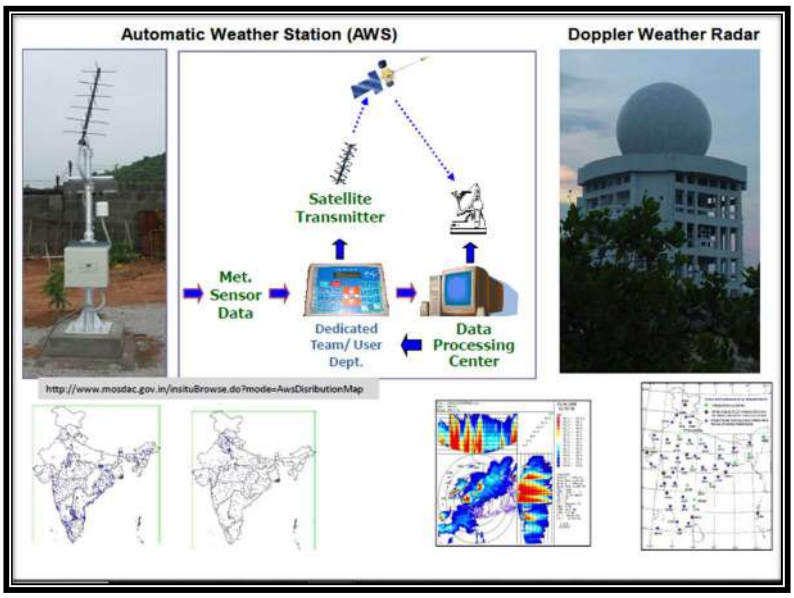
[Action: IMD, CWC, MoUD, States/UTs, and ULBs]

5. Building as underlying sensor web flow

[Action: DIT and SWAN]

6. Infrastructure and other Baseline Data

[Action: MoUD, NRSC, SoI, SRSACs and ULBs]



Continued.....

7. Operational Support

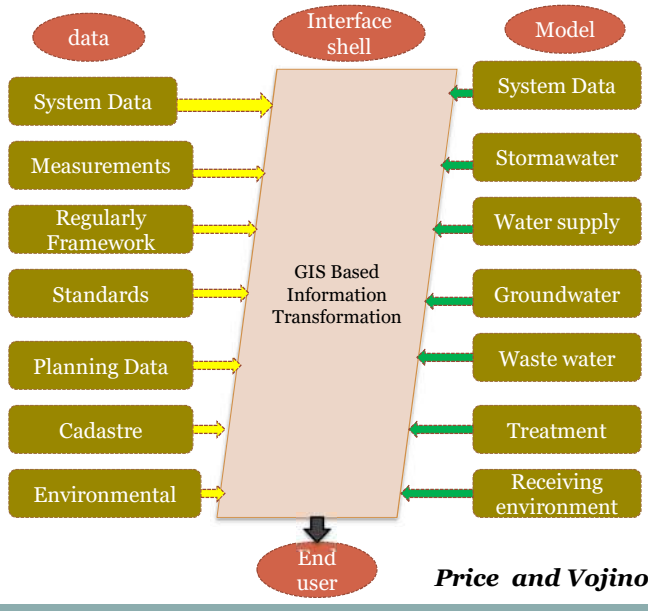
8. Measurement of Flood Levels
[Action: States/UTs and ULBs]

9. Decision Support System
[Action: States/UTs and ULBs]

10. Establishing Technical Umbrella for Urban Flood Forecasting and Warning (At the National Level)
[Action: NDMA, MoUD IMD, CWC, SoI and NRSC]

11. Establishing Technical Umbrella for Urban Flood Forecasting and Warning (At the State Level)
[Action: MoUD, States/UTs, SRSACs and ULBs]

'Digital city' concept



Price and Vojinovic 2008

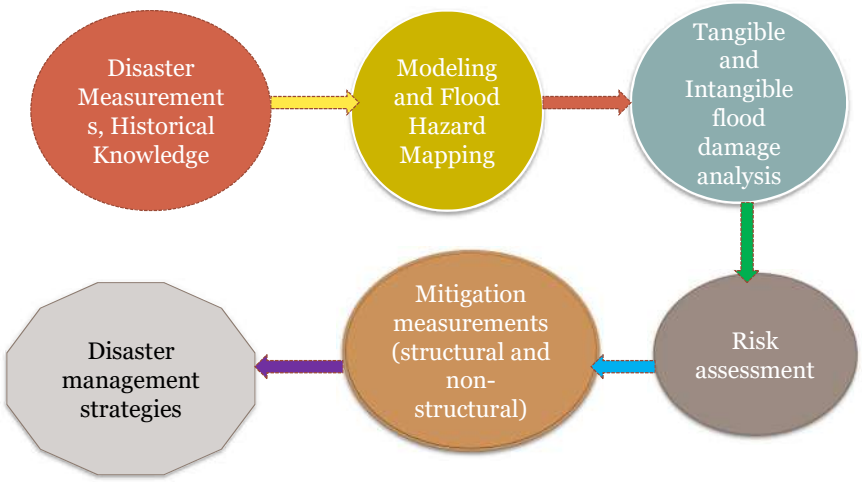


Figure. A schematisation of steps associated with proactive flood management (R.K. Price and Z. Vojinovic, 2008)

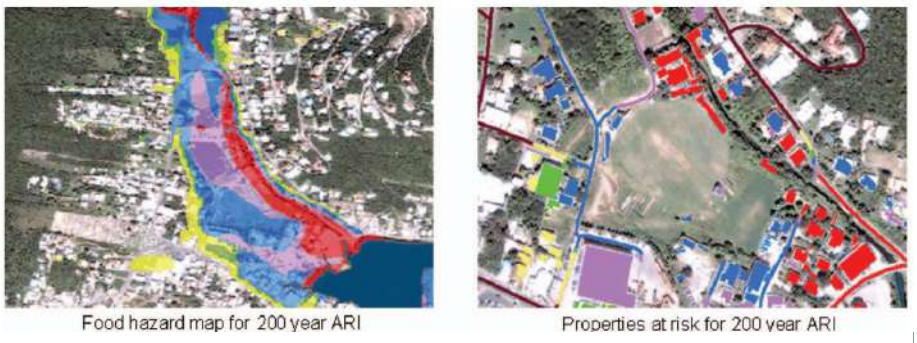


Figure: information generated by a model with GIS for the purpose of developing a disaster management plan

Urban Flood Studies in India

Chennai - (Anna University+PWD+US Agencies)

- Flood risk mapping of Chennai city

Hyderabad - (GHMC+NDMA+US Agencies)

- Urban Flood Disaster Management

Bangalore- (NRSC+IISc)

- Urban Flood study was taken up in collaboration with IISc, Bangalore

Mumbai - (IIT, Mumbai+MMC+MDMC)

- Early warning system installed for mitigating urban flooding.
- 30 AWS with tipping bucket rain gauges (average density 1 in 10 km²) in each grid fire station; manned 24 hrs.
- Data transmitted to Emergency Operations Centre (EOC) in the MCGM headquarters every 15 minutes through LAN.
- Rain gauges have been calibrated to give alarm at predefined values of rainfall intensity (40 mm/h)

Key takeaways

✓Municipalities are well advised to spend adequate resources for comprehensive flood risk assessments.

✓Community participation in flood risk assessment as well as in planning and implementation of risk management measures.

✓Flood management measures have to be planned across administrative and sectoral boundaries.

✓Finding an adequate compromise between storm water drainage and source control needs profound consideration and consultation with all stakeholders.

✓There is need to combine structural and non-structural, spatial and organizational measures.

✓Recognizing sustainable, flood aware urban planning.

✓Monitoring and evaluation of implemented measures.

Thank you
for your kind attention

Energy and Water from the Oceans for the Mitigation of Climate Change Impact

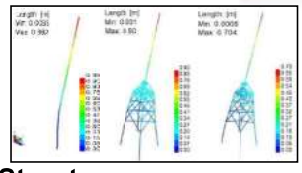
Dr Purnima Jalihal
Head, Energy and Fresh Water
National Institute of Ocean Technology, MoES

Climate Change, Urbanisation and Multi-Hazard Management, NIDM
September 21, 2021

NIOT Activities at a Glance




Energy and Freshwater



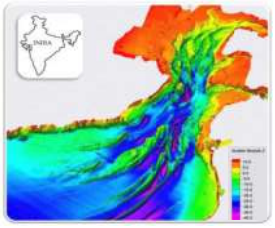
Offshore Structures

Deep Sea Technology



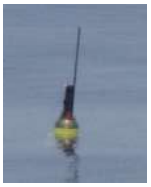
Ocean Observation System


Ocean Acoustics


Coastal & Environmental Engineering


Marine Sensor Systems


Marine Bio Technology


Ocean Electronics

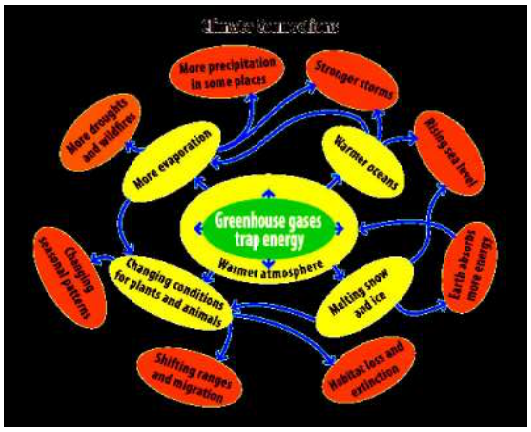


Gas Hydrates


Vessel Management

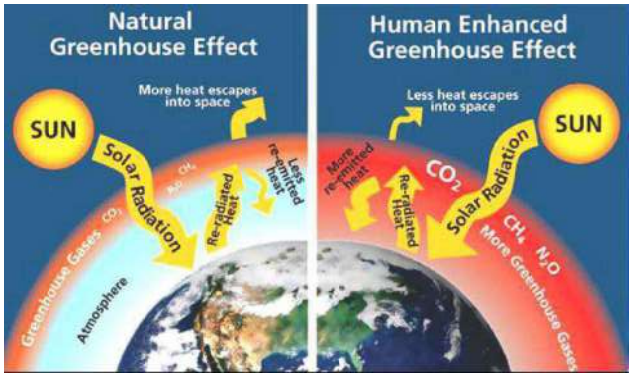
Green House Gases

Gases released by burning fossil fuels and tiny particles produced by incomplete burning trap the sun's energy in the atmosphere. These are GHGs.
Fossil fuel and related uses of coal and petroleum are
the most important sources of GHGs and black carbon (power generation, industry, transportation, buildings).
Sea levels are rising, temperature of world's oceans are rising, glaciers retreating, melting of Polar Ice cap, fish species moving to suitable temperatures.



Climate Change and Global Warming

Global warming is the slow increase in the average temperature
Of the earth's lower atmosphere due to an imcreased amount of energy being trapped in the atmosphere
Since all systems in the global climate system addign heat to the system
Causes the global climate as a whole to change
Climate change refers to significant long term changes in
the global climate



(Source : Center for Climate and Energy Solutions)

Renewable Energy - Why

Renewable energies have much lower carbon footprint than natural gas, coal, and other fossil fuels.

The combustion of fossil fuels for energy results in a significant amount of greenhouse gas emissions that contribute to global warming.

Renewable energy emits no or low air pollutants.

Leads to global health, fewer floods and droughts, job creation

India has committed to generate 40% of energy from non fossil fuels by 2030 in the Paris Agreement 2016
Target - 175GW by 2022 and 450GW by 2030

Solar, Geothermal, Biomass, Hydropower, Wind

…….. The Oceans……

Wave Energy Site at Vizhinjam, Kerala

- An Oscillating Water Column Structure made of concrete caisson.
- Location: 45m from Vizhinjam Fisheries Breakwater, near Trivandrum, in 10m water depth
- Annual Average potential at the site: 15kW/m
- Four configurations of turbine-generator systems were studied.

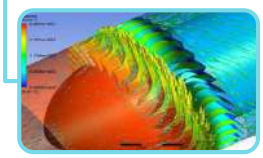
- Reverse osmosis plant of 10000 litres/day was installed in 2003.
- Plant was run using the power generated from wave energy plant.
- The plant drew both its water input and its energy from the sea. First of its kind!
- After successful demonstration, the wave energy plant was decommissioned.

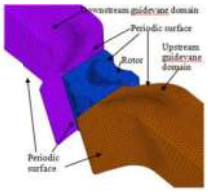
Backward Bent Ducted Buoy

Open sea trials 2011 with ϕ 165 mm UDI power module

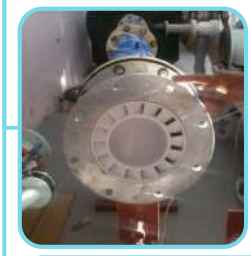
Open sea trials with orifices 2014

CFD Analysis on turbine





Fabrication and testing of 196mm turbine



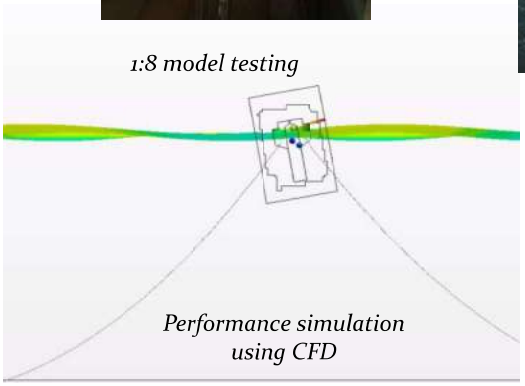
Open sea trials with new power module 2015

Wave Powered Navigational Buoy

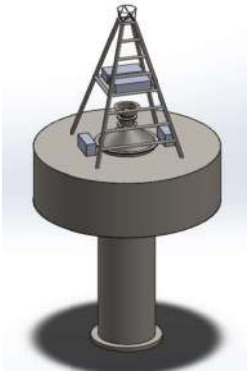
A typical navigational buoy

Video

1:8 model testing



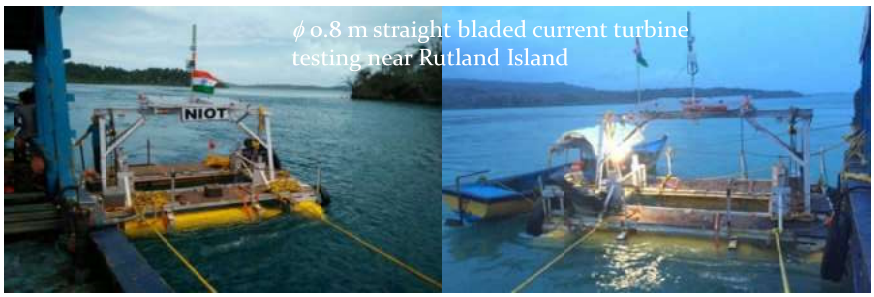
Performance simulation using CFD



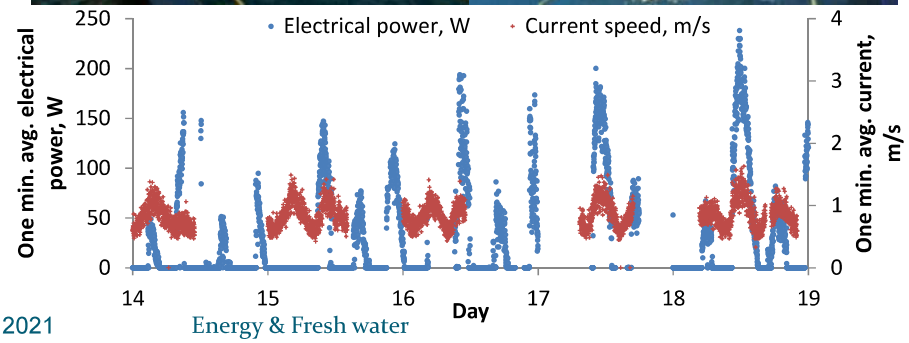
NIOT's Wave powered Navigational Buoy

Open sea trials at Andaman

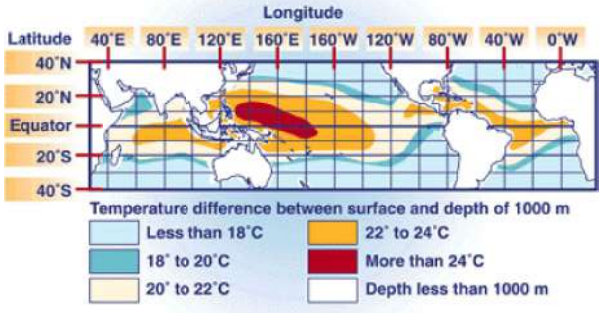
- The turbine underwent extensive computational and field trials.
- Studies indicated that straight bladed configuration yielded a higher coefficient of performance when compared to helical blades.
- Open sea trials on the in-house developed horizontal axis ocean current turbine prototype of 0.8 m in diameter and with 1 m long blades were carried out in the Macpherson Strait at 2m below water surface in Andaman.



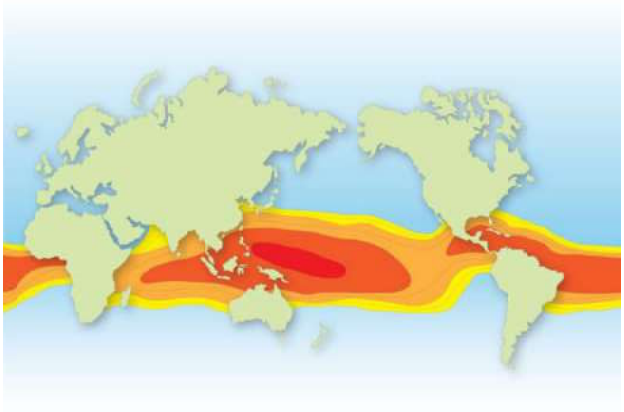
ϕ 0.8 m straight bladed current turbine testing near Rutland Island



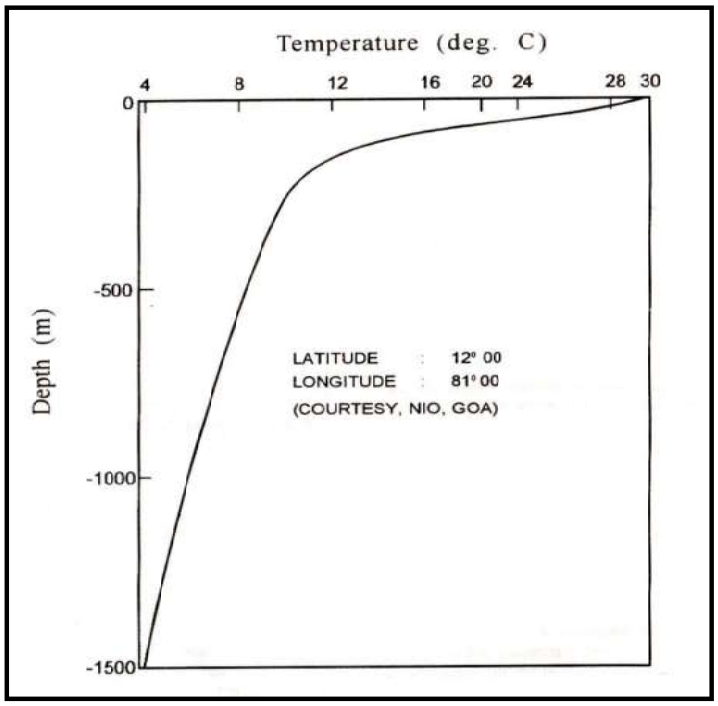
Temperature difference around the world for OTEC



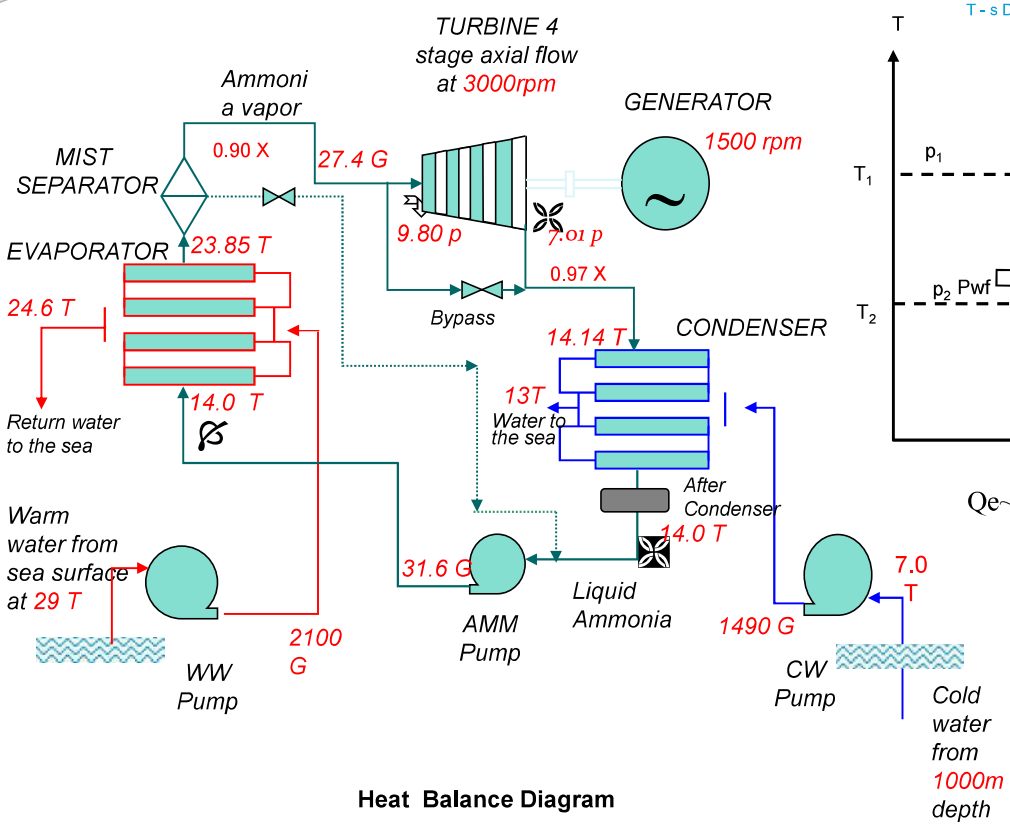
Asia Pacific countries well suited For OTEC



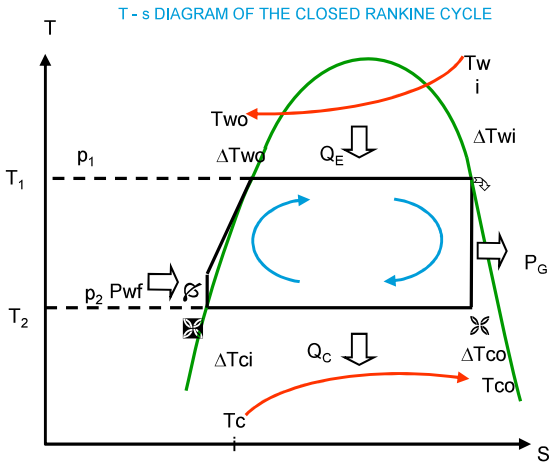
Ocean Temperature Profile



Ocean Thermal Energy Conversion



Heat Balance Diagram



Qe~38.50 MW Qc ~37.27 MW

T : Temperature (C)
p : Pressure (bar)
G: Flow Rate (kg/s)
P: Power (kW)
E: Enthalpy(kJ/kg)
X: Dryness Fraction

Water Stress

- Unavailability of fresh water or water scarcity.
- Reasons:
  - Reduction of per capita availability due to mammoth increase in India's population
  - Severe pollution of rivers and lakes and contamination of ground water
  - Over exploitation of ground water
  - Poor management practices and wastage

Climate change will certainly cause additional water stress

Climate Change and Water

Climate change's big impact is on the hydrological cycle resulting in:

1. Wet areas getting wetter, dry ones getting drier
2. More severe weather occurring at higher frequencies
3. Floods, sea level rise and storm surges
4. In turn affects quality and availability of water resources.

Other impacts on water are population and industrial growth creating several challenges

Water Augmentation - Waste Water Treatment

About 80% of domestic water use is converted into wastewater. Domestic water comprises of greywater which includes wastewater from bathrooms (30%), washing machines (10%), showers and sinks (15%) and *black water*, which includes urine and faeces (40%).

In India, many of the water sources are contaminated with wastewater as less than 30% of the wastewater generated is getting treated.

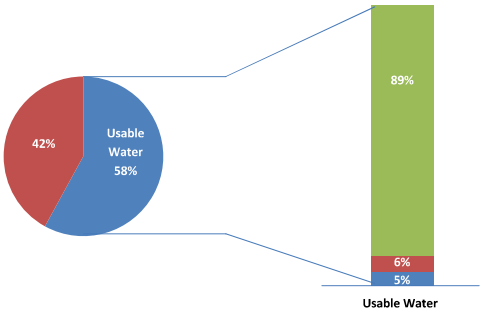
Water Augmentation - Industrial Waste Water Treatment

Industries are consuming about 12-15% of the total available water for various processes. The impending water scarcity can adversely affect the industrial production.

In India, sugar and distillery, tannery, textile, pharmaceutical, chlor -alkali, electroplating and cock oven industries consume large quantities of water and generate highly polluted waste water.

Water Augmentation - Desalination

By 2030 Indian water demand will be around 1.5 trillion cu.m
(Middle class increasing, more demand for food grains)
Current supply around 740 billion cu m
Simply not enough….



Generation/Creation

Courtesy Water Resources Group 2030

Indian Scenario

Indian oceans – Third largest body of water in the world – covering about 20% of earth's water surface.

Indian geographic area – 3.29 million sq. km.

Indian Exclusive Economic Zone (EEZ) – 2.1 million km^2

Indian coast line – 8,129 km

Tropical country – High temperature difference between surface seawater and the deep water.

About 30% of the population lives along the coast.

SEAWATER DESALINATION….

Conventional Desalination technologies

Distillation

- Multi Stage Flash distillation (MSF)
- Multi Effect Distillation (MED)
- Thermal Vapor Compression (TVC)

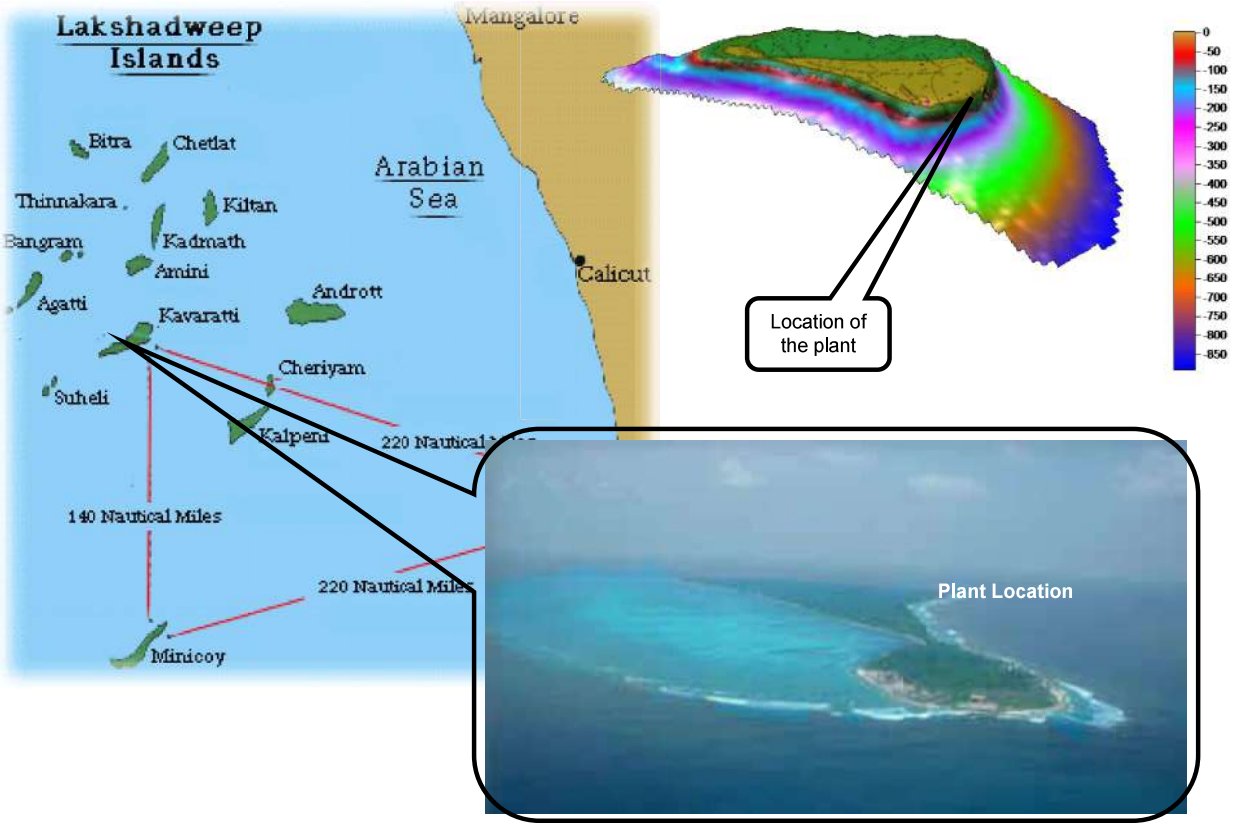
Membrane/ Mechanical

- Mechanical Vapor Compression (MVC)
- Reverse Osmosis (RO)
- Electro Dialysis (ED

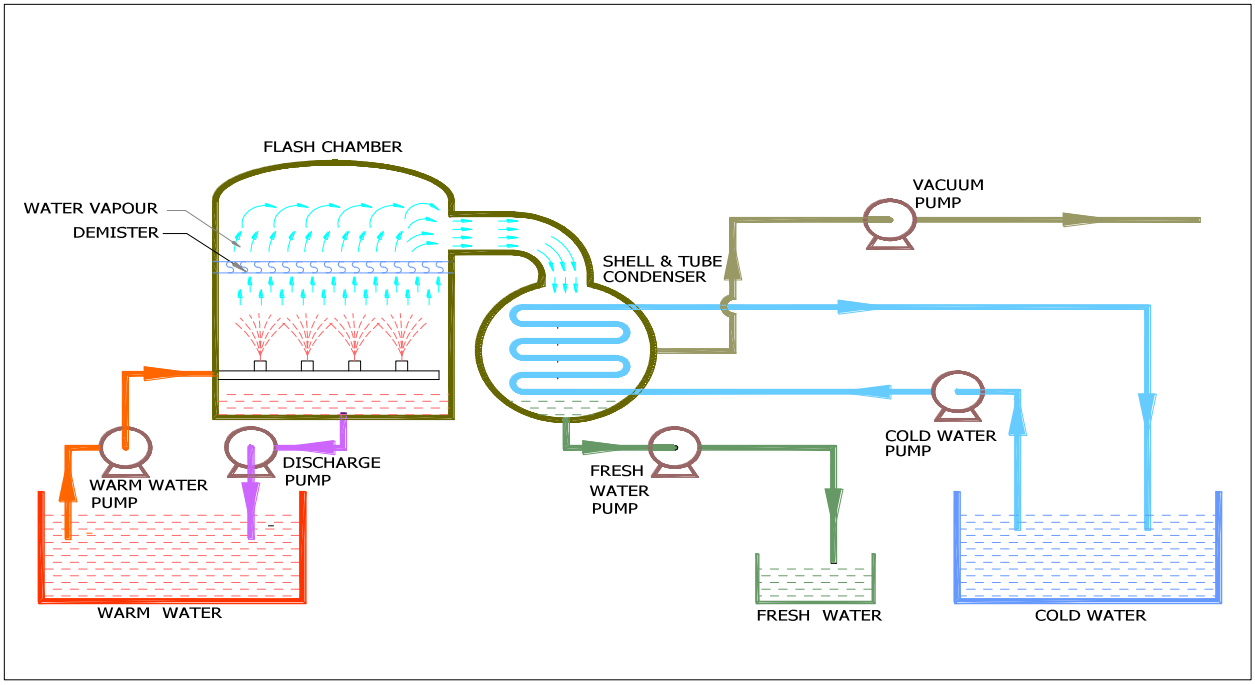
Hybrid Systems

- MSF-RO
- MED-TVC etc

Lakshadweep Islands



Thermal Cycle



National Institute of Ocean Technology Chennai

Fresh Water being distributed

Impact and Outcomes of Kavaratti Plant

For islanders:

- Main source of good drinking water
- Health improved considerably according to Doctor reports
- Local islanders trained to run and maintain plant – interest generated for running the other plants

For NIOT:

- First ever plant in the world from concept to commissioning using naturally occurring temperature difference
- Expertise in complex civil construction and installation of pipelines
- In house design and indigenous components
- **Engineering translated to true societal benefit**
- UT administration entrusted job of putting up more plants

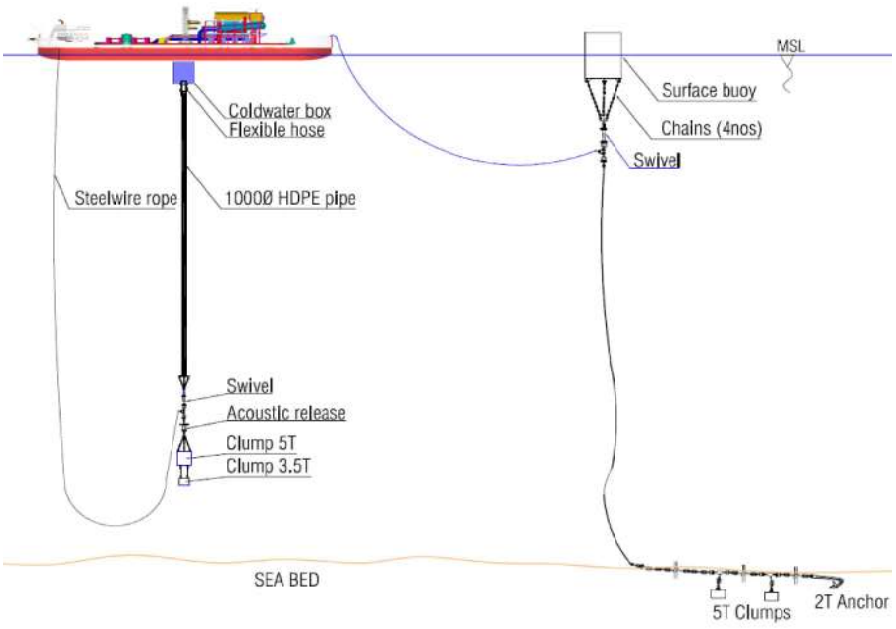
Similar plants at Agatti and Minicoy

No environmental impact till date
16 years after Kavaratti installation

1MLD Barge Mounted LTTD Plant

- For Mainland applications, the necessary depth for the availability of 10-12°C water is at 40 -150km from shore. Necessitates a floating platform.

- 1 MLD plant on barge Sagar Shakthi single point moored in deep waters was successfully demonstrated and good quality water was produced.



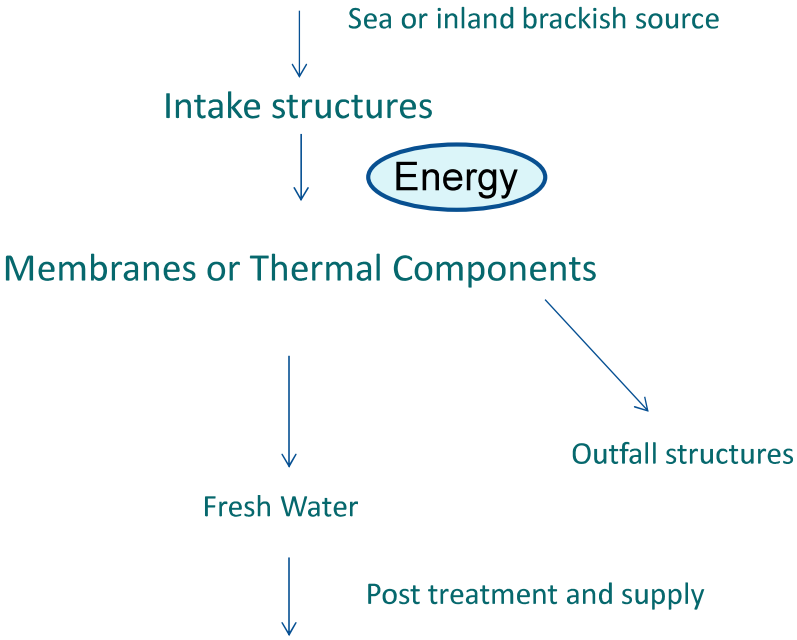
View of Barge Mounted Desalination Plant

LTTD Using Condenser Reject Water (waste heat) in North Chennai Thermal Power Station

- Coal fired Plant with Once through CW System
- Capacity: 3x210 MW.
- Condenser reject water: 3 x 32,000 m^3/hr at about 8°C above ambient.
- Water generated of very good quality
- **Does not need steam**
- Can be incorporated in existing plants along coast

Can create fresh water
and remediate environment
by reducing outlet temperature

Components of Desalination



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Renewable Energies for Water use

With fossil fuels depleting and treatment and desalination systems requiring large amounts of energy, renewables are the need of the hour.

- Irrigation can use solar pumps.
- Membrane desalination systems like RO can use solar PV or wind or wave
- Thermal desalination systems can use Solar thermal or Ocean Thermal Energy Conversion

Renewables and green and clean energy need emphasis from climate change perspective.

Wave Energy Plant at Vizhinjam, Kerala

- An Oscillating Water Column Structure made of concrete caisson.
- Location: 45m from Vizhinjam Fisheries Breakwater, near Trivandrum, in 10m water depth
- Annual Average potential at the site: 15kW/m
- Four configurations of turbine-generator systems were studied.

- Reverse osmosis plant of 10000 litres/day was installed in 2003.
- Plant was run using the power generated from wave energy plant.
- The plant drew both its water input and its energy from the sea. First of its kind!
- After successful demonstration, the wave energy plant was decommissioned.

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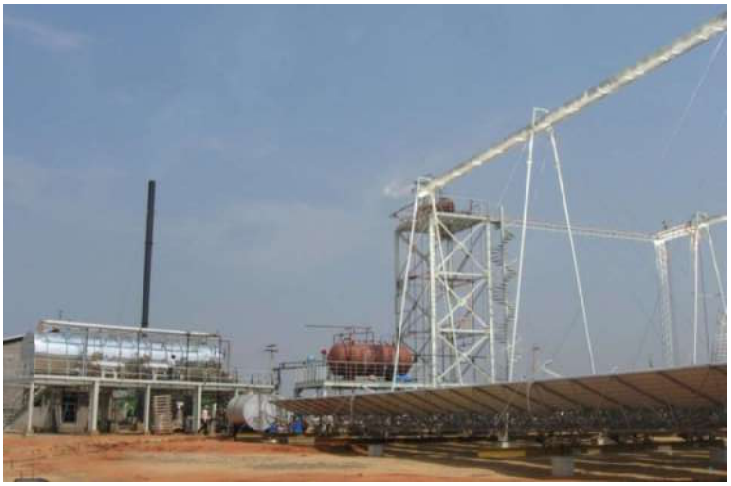
Solar Desalination

KGDS, DST and NIOT jointly have developed a Solar / Biomass MED system at Narippeyyur

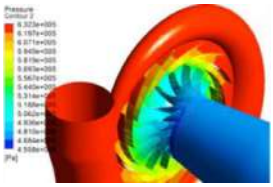
Commissioned successfully



Self Powered Desalination

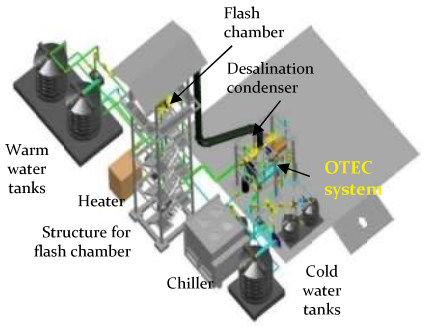
2 kWe laboratory set-up at NIOT

- A 2 kW OTEC turbine using R134a as working fluid was designed for the first time ever at NIOT.
- The OTEC – desalination laboratory has recently been commissioned. Can run open and closed cycles as well as hybrid with desalination

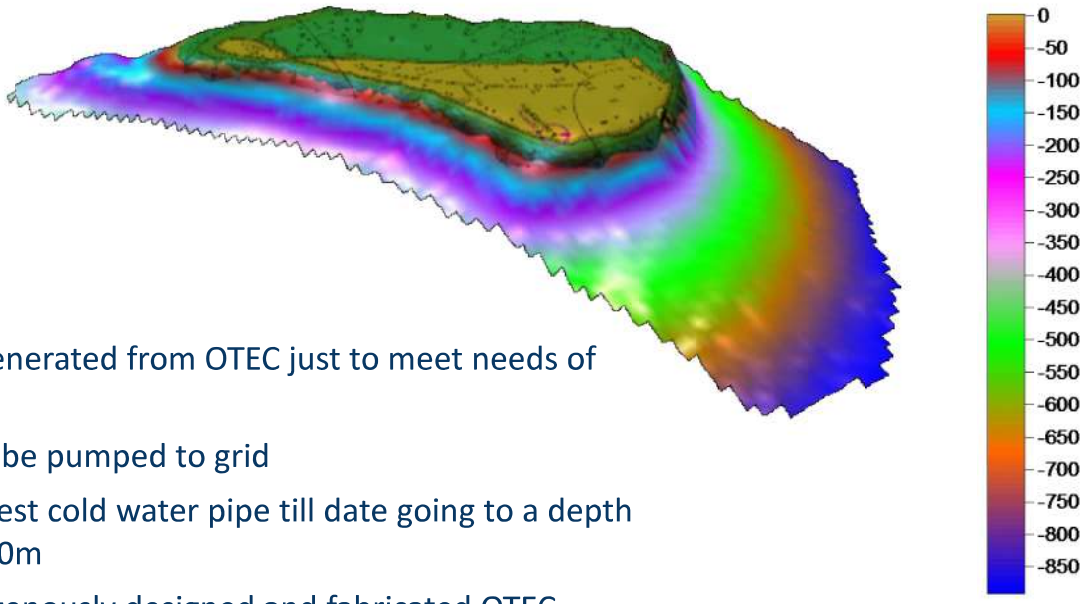


2 kW OTEC turbine
Performance simulation using CFD

2 kW OTEC turbine



New Challenge - OTEC Powered Desalination Plant for Kavaratti



- Total power generated from OTEC just to meet needs of desalination.
- No power will be pumped to grid
- Will have longest cold water pipe till date going to a depth of around 1000m
- First ever indigenously designed and fabricated OTEC turbine

Oceans can be a solution for Green Energy and Clean Water

Thank you

Hazards and Risks of Climate Change

Prof. Surya Parkash and Mr. Anil Kathait

Geo-meteorological Risks Management Division
National Institute of Disaster Management
Ministry of Home Affairs, Govt. of India

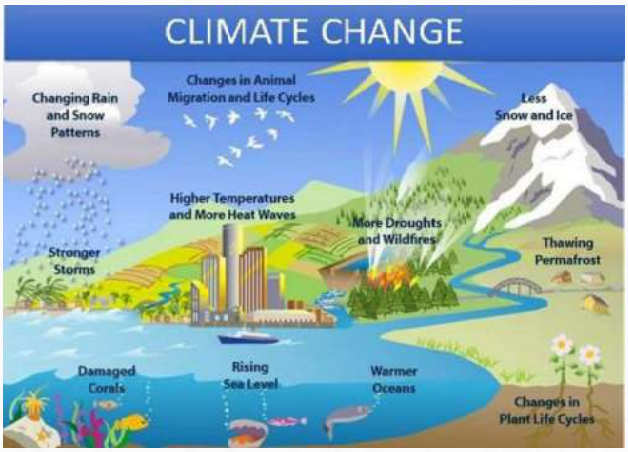
Weather & Climate

Weather is the condition of the atmosphere at a particular location and moment.

Climate is the collective state of the atmosphere for a given place over a specified interval of time.

Climate Change ?

Climate Change is the "*change that can be attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods*"
United Nations Framework Convention on Climate Change (UNFCCC)



GLOBAL WARMING Vs. CLIMATE CHANGE

GLOBAL WARMING

Vs.

CLIMATE CHANGE

Signs of Climate Change

- Rising Temperatures
- Extreme Droughts
- Tropical storms becoming more severe
- Less snowpack
- Sea levels are rising

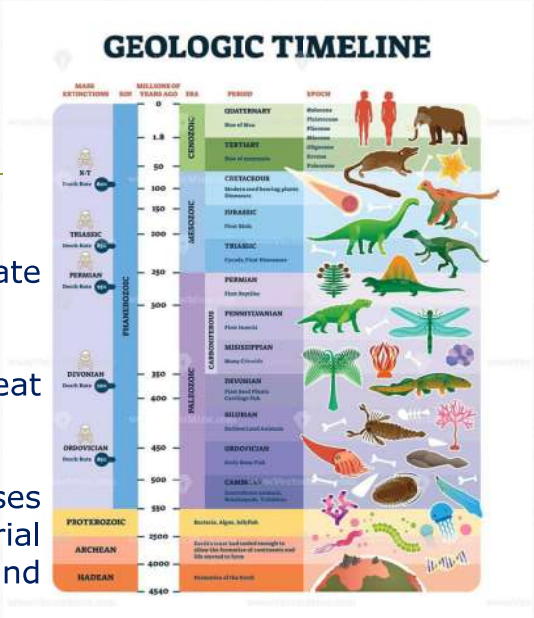
Is Climate Change New Concept ?

NO

Geological records clearly indicates climate change;

Current rapid rate and the magnitude is of great concern;

Human activity has increased greenhouse gases in the atmosphere since the Industrial Revolution, leading to more heat retention and an increase in surface temperatures.



HAZARDS AND RISKS OF CLIMATE CHANGE

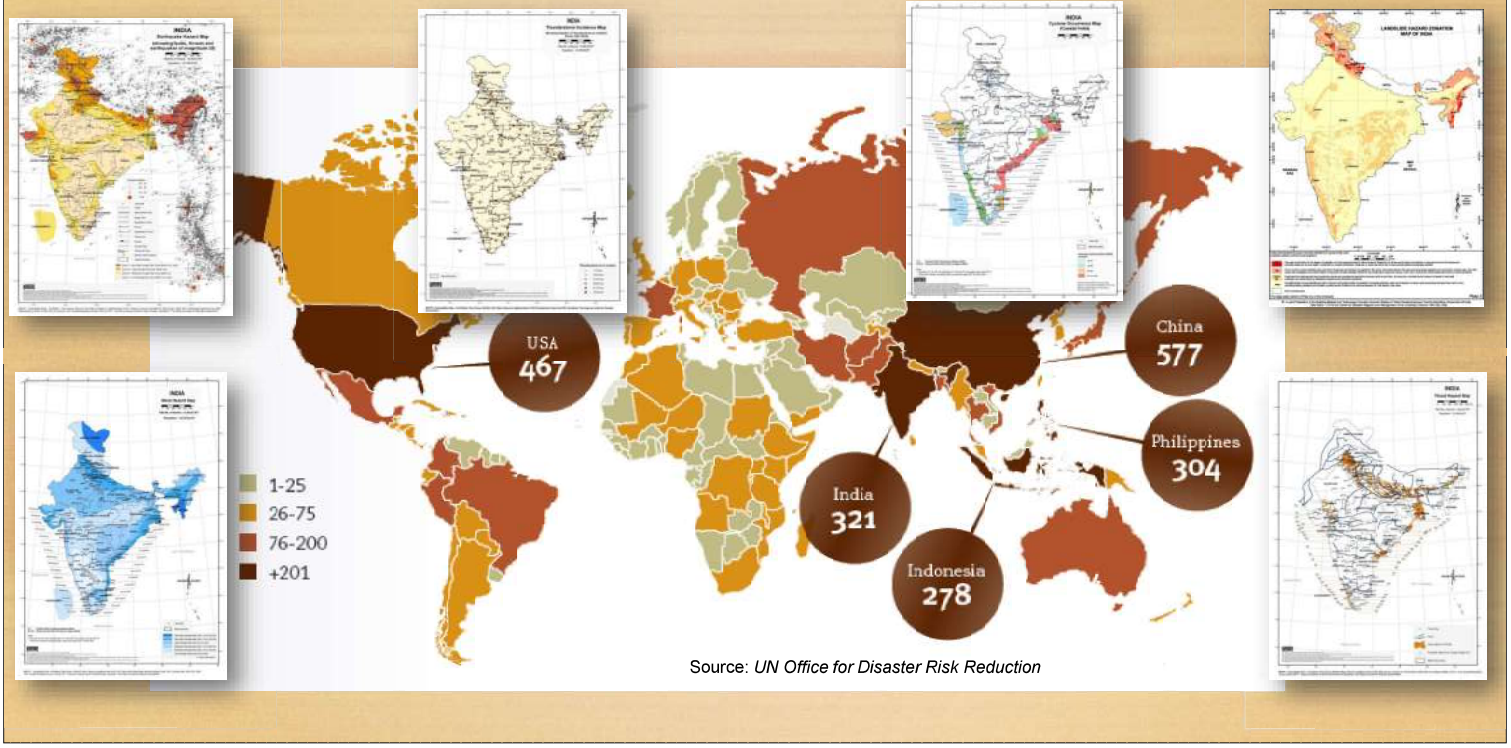
Altering the frequency and intensity of hazard events

Frequencies of extreme weather related hazards such as floods, drought expected to increase.

Response options

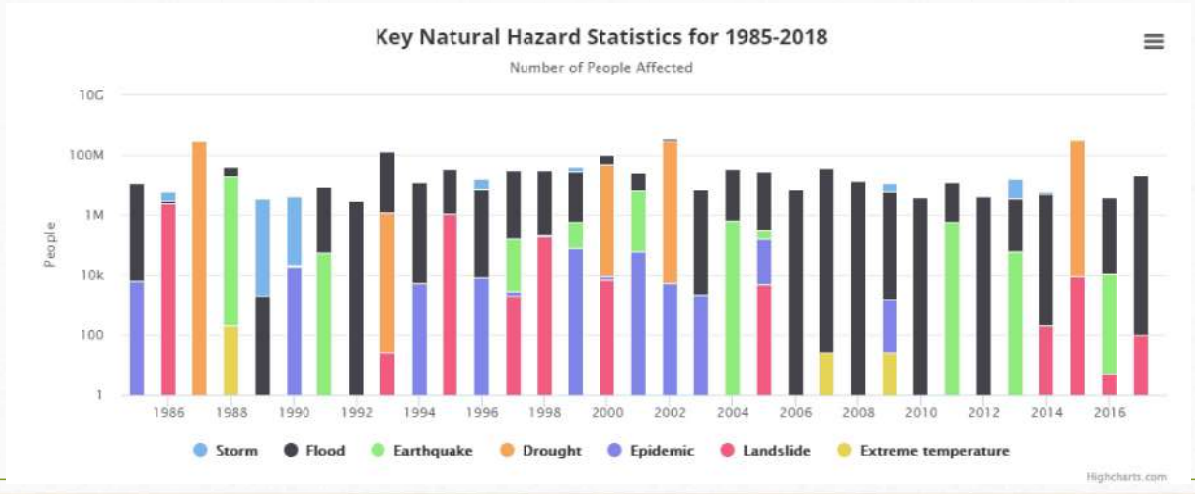
Source: Nicholas P. Simpson and Christopher Trisos, Climate change risk is complex: here is a way to assess it https://theconversation.com/climate-change-risk-is-complex-here-is-a-way-to-assess-it-159978

India and Hazards Vulnerability



Source: *UN Office for Disaster Risk Reduction*

Costs of Climate Change and India



Addressing the Problem of Climate Change

Thank you

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