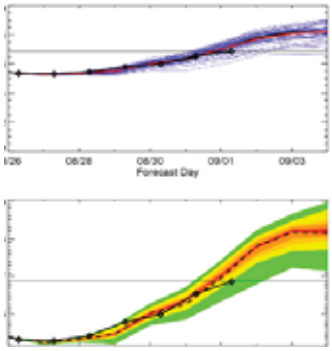
Comprehensive Disaster Management Program (CDMP)

Improved Adaptive Capacity to Climate Change for Sustainable Livelihoods in the Agriculture Sector - PHASE II




Training Report

Adaptive Learning in Action: Local Level Climate Change and Livelihoods Adaptation Training Program in Bangladesh

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Submitted by:
Asian Disaster Preparedness Center (ADPC)

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Project Implementing Partners:
Department of Agricultural Extension (DAE)
Food and Agriculture Organization of the United Nations (FAO)
Asian Disaster Preparedness Center (ADPC)

Jointly organized by:
ADPC and Project Management Unit, LACC-II

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1. Introduction

The Livelihoods Adaptation to Climate Change Phase II (LACC II) aims to introduce, improve or further strengthen disaster risk reduction and climate change adaptation capacities for sustainable livelihoods and food security in the rural sectors including crops, livestock, fisheries and forestry and other key factors of rural livelihoods in drought prone and coastal regions of Bangladesh.

Building on and using the human resources and capacities of several technical departments, the project, led by the Department of Agricultural Extension, will (i) further strengthen institutional and technical capacities for improved adaptation to climate variability and change at all relevant levels, addressing climate information needs, knowledge gaps, key skills and competencies, and technology needs, and (ii) implement in a participatory way and jointly with local communities good practices and strategies to effectively address climate variability and change, and related natural disasters.

Under the project, Asian Disaster Preparedness Center (ADPC) is providing support to the LACC II Project Management Unit (PMU) in building capacity of the local level professionals in climate change and livelihoods based climate change adaptive capacity in the agriculture sector. In a recent initiative of a round of "Local Level Climate Change and Livelihoods Adaptation Training" program was organized and various levels of district, sub-district (upazila) and block level operational professionals are trained taking from the six different districts of the project pilot area. The initiative was an integral part of the overall capacity of the DAE and other agency professionals in building skills in climate change and adaptive capacity building for operations at local level.

1.1 Objectives and outcome of the training

The major objectives of the training program was to increase adaptive capacity of the local level (upazila and block/implementation level) and other operational professionals in a systematic way. Through this training the local level officials and operational professionals were given orientation on the major issues and themes of climate change, adaptation and its linkages with overall risk management through systematic adaptation process.

The trainees were exposed to the Climate change fundamentals, its relationship with overall disaster management, climate forecast applications and the various ways, means and options of agricultural climate change in a practical ways. The livelihoods adaptation measures from local perspective as well as from scientific perspectives were elaborated for their internal understanding and capacity building.

The specific objectives of this local level training program were to:

- provide exposure to fundamentals of climate change and science relevant for agriculture and allied sector in Bangladesh;
- capacitate the participants to understand and gain applicable knowledge in climate change and climate change impacts on agriculture and allied sectors;
- provide participants systematic understanding of the climate change adaptation (options, measures, scientific adaptation, spontaneous adaptation, adaptive capacity etc.) and various types of livelihoods based adaptation options and their evaluation process in agriculture and allied sectors;
- provide introductory knowledge and understanding of the various available Climate Forecast Application Systems. Increased understanding of the available sources of forecasting, prediction and early warning systems related to Flood, Drought, Cyclone and so forth.
- Facilitate an “active learning environment” for discussing climate change and climate change adaptation related discussions at local level by the professionals engaged in agriculture and allied sectors.

1.2 Training delivery modality and participants

The delivered training sessions were largely based on the information exchange and capacity building in a shared mode. A total of over hundred professionals were training in the four trainings in two rounds. Some of the principles that were followed for that are as follows:

- Training programs were “one-day” event and were be divided into multiple modules;
- Training programs were carried out separately in two different days. On the first day, the “upazila level official”(e.g. Upazila Agriculture officer, Upazila fisheries officer, PIO and equivalent level of professionals etc.) were trained. Discussion based approaches were carried out in this day along with PowerPoint presentations;
- In the day-two the training program was carried out for the “Operational level officers” (e.g. SAAOs, Project officers and so forth). In this training session more workshop oriented and more easy access materials were shared and a “hands-on approach” was adopted for the participants;

- In both type of sessions the experiences of the trainees were explored from the empirical situation and tried to share during the training discussions;

- Lectures were delivered in a way that each group can "internalize" the new issues of climate change in a practical manner and be able to generate a dialogue on the issue reflecting their own context and situation. In this respect, the examples of the drought prone areas for the northern two trainings in Pubna round were shared while the coastal vulnerabilities, coastal adaptations and other issues of coastal climate change issues were shared in the final two trainings in the Khulna round training;

- The delivery language was primarily "Bangla". For those presentations and materials which remained in English were delivered through simultaneous translation through the pool of resource trainers and necessary interpretation were made available to the participants;

- The ADPC team took actions to maintain the quality of the training sessions. ADPC professionals shared the overall outline of the training and had briefed both the training team and the trainers at the beginning of the session;

1.3 Schedule of training events

The training program was carried out in two rounds: Pabna round and Khulna round. Considering the two different regions of the project: drought prone northwestern area and in southern coastal area this arrangement was made. The Participants were invited from all project pilot areas and were divided in four "one-day" training programs as per the structure adopted for participation. The training dates and locations are mentioned in the table below.

Region	Date	Location	Training audiences
Drought prone pilot upazilas of northern districts	October 19, 2008	Pabna	**Training 1:** Upazila level officials from the drought prone pilot upazilas
	October 20, 2008	Pabna	**Training 2:** Project implementation level operational officers from the drought prone pilot upazilas
Coastal pilot areas of southern districts	October 22, 2008	Khulna	**Training 3:** Upazila level officials from the coastal pilot upazilas
	October 23, 2008	Khulna	**Training 4:** Project implementation level operational officers from the coastal pilot upazilas

1.4 Resource persons and specialization:

The training program at local level were developed with active contribution of the resource persons from various areas of climate change, agricultural adaptation and disaster management related professionals. Trainers come from multi-disciplinary background and with a wide range of experience of working in the livelihoods based adaptation in agriculture sector as well as disaster and climate change programs. The training team comprises of both international and national professionals. Some of the key resource professionals and trainers for this local level capacity building exercise are as follows:

- Mr. Atiq Kainan Ahmed, Livelihoods Vulnerability and Climate Change Adaptation Expert (Lead Trainer)
- Dr. Jayaraman Potty, Climatologist, Early Warning Team, ADPC
- Dr. Abu Wali Raghib Hassan, Integrated Pest Management Expert and Agricultural Expert
- Dr. Satendra Singh, Disaster Management and Institutional Expert; and
- Mr. Sanjib Saha, Agriculture and Capacity Development Expert.

In addition to the above trainers, expert guidance for were received from Dr. Stephan Baas, Lead Technical Officer from FAO headquarters and from AR Subbiah, Director, Climate Risk Management Department of ADPC for developing the training materials in a sequential manner.

1.5 Logistic arrangements

The logistics arrangements for the training program were kindly organized by the PMU in coordination with the FAO-R office Bangladesh and with the respective DAE field offices. The NSCM/NPD of LACC-II from PMU has made initiatives to invite the participants into the training. For training venue and event management the respective venue in charges have given an active support. The contributions of officials in charge for two horticulture centers in Pabna and in Khulna are acknowledged.

2. Training delivery experiences

The course was designed in three technical modules and with an additional formal opening session for effective administration of the training sessions. The ADPC trainers with active support from the PMU have taken initiatives to accommodate any necessary adjustments deemed necessary on the spot of after training and maintained the quality check for each training materials and sessions rigorously. After each day of training, the training resource team has sat together for necessary modifications and adjustments for the subsequent sessions. The two rounds of "back to back" trainings has been found useful for the participants as they could share their immediate experiences with each other after during and after the sessions in their own field of work.

The sessions under three technical modules and opening session as progressed are outlined in the following table.

Module	Session
Opening Session	• Opening Remarks: PMU,CDMP, ADPC, National/local host • **Presentation:** LACC-II Project overview • Overview of CDMP (only in Khulna round) • Structure and outline of training • Orientation of the participants and briefing on logistics
Module One: Climate Science and Fundamentals	• **Ice breaker Exercise:** Observation on CC and its impact on agriculture (in card) • **Lecture:** Climate Change Fundamentals • **Lecture:** Climate Forecast Applications • **Exercise and discussion:** Climate Forecast Applications at local level

Module	Session
Module: Two: Climate change Impacts and Adaptation	• **Lecture:** Climate Change Impacts and Adaptation in Agriculture Sector • **Group exercise and discussion:** Identification of sectoral impacts of climate change
Module: Three: Climate change Adaptation and Evaluations	• **Guided adaptation evaluation:** Participant's evaluation of LACC-II Adaptation measures • **Mini talk(s) on CCA/participants presentation:** Innovative Agriculture Risk Management Approaches (e.g. IPM/Integrated Fisheries/Extension as adaptation) • **Group discussion and plenary**
	Concluding remarks

The experiences gathered from the training programs and as the sessions progressed are discussed below in a gradual manner.

2.1 Opening Session: situating project activities and training objectives

The training program started in each morning around 8:30 with a formal opening session. In the brief formal opening session each day, opening remark from PMU, CDMP (in Khulna round), ADPC, and national experts assessed the need for training and capacity building of professionals on emerging issue of climate change and climate change adaptation. From the PMU an overview of the LACC project was given to situate the project activities and the training. At each day, the structure of the training was also explained upfront so that the participants understood the process and mode of the training. This was useful in making a routine track of the day's activities and adjustment of the session timings during the course of the day.


In the opening session a self-orientation of the participants and resources persons were carried out to let everyone introduce with others. Usually the logistics brief would end the formal opening session and situate a farm background for rest of the day's activities.

Module One

2.2 Ice-breaker exercise on Climate change

Before starting the first technical module (Module 1: Climate Science and Fundamentals), a unique session was designed and carried out for participants ice breaking. As the participants came from various areas and the issues is relatively new, the ice breaker exercise was found very useful to start the module activities. There are three ice breaker questions were given to the participants one after another and asked the participants to write their answers in a card (distributed separately earlier). Each of the cards were collected up on completion and then participants one by one shared their existing thoughts and answers on those questions.

The three ice-breaker questions are as follows:

1. Define "climate change" in your own terms? *(Jolobayu poriborton bolte apni ki bojhen?*)

2. Please identify some elements of climate change *(Jolobayu poriborton er koyekti niyamok chinhito korun)*

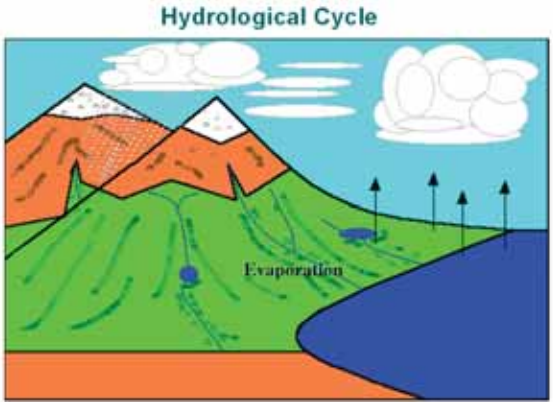
3. Please indicate some impacts of climate change *(Jolobayu poribortoner koyekti probhab chinhito korun)*

Some of the definitions of the participants on climate change are as follows:

- Climate change is an issue of long term trend
- Climate change is a change of temperature
- Climate change is a factor of erratic change in natural phenomena
- Climate change means a change in temperature and rainfall
- Many others articulated in the training by the participants.

2.3 Lecture on Fundamentals of Climate Change

In the first module of the training it was thought that the participants should have a clear idea about the scientific reasoning of climate change. Keeping this in mind, a lecture on fundamentals of climate change was designed. In this lecture, the concept of climate change, the differences between the weather and climate change, issues and reasons of green house effect, hydrological cycle process and other features are discussed in an easy format. Special attention was given to make the scientific issues present in a very simple manner to the participants so that they can understand easily the whole gamut of climate change science part relatively easily but can discuss effectively afterwards as well.



In the discussions the definitional issues were discussed taking time and making necessary references to the scientific literature existing from standard sources such as IPCC Fourth Assessment Report and so forth. Some of the definitions are as follows:

Defining two mutually different terms "Weather" and "Climate",

- **The Weather**: the state of the atmosphere (Earth) at a given time. (hours -days)
- **Climate**: the average atmospheric conditions over longer periods of time (say 30 years).

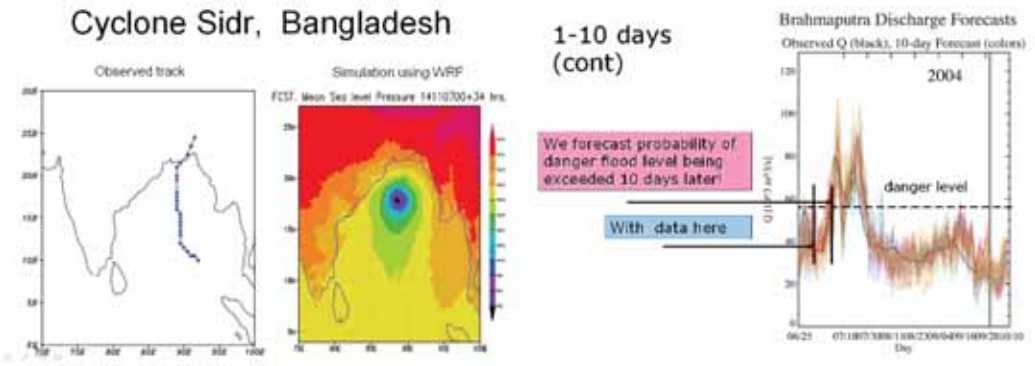
Defining the term "Climate Change",

> "… any change in climate over time, whether due to natural variability or as a result of human activity" (IPCC: 2007)
>
> "… a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods" (UNFCC)

2.4 Lecture on climate forecast applications and an exercise

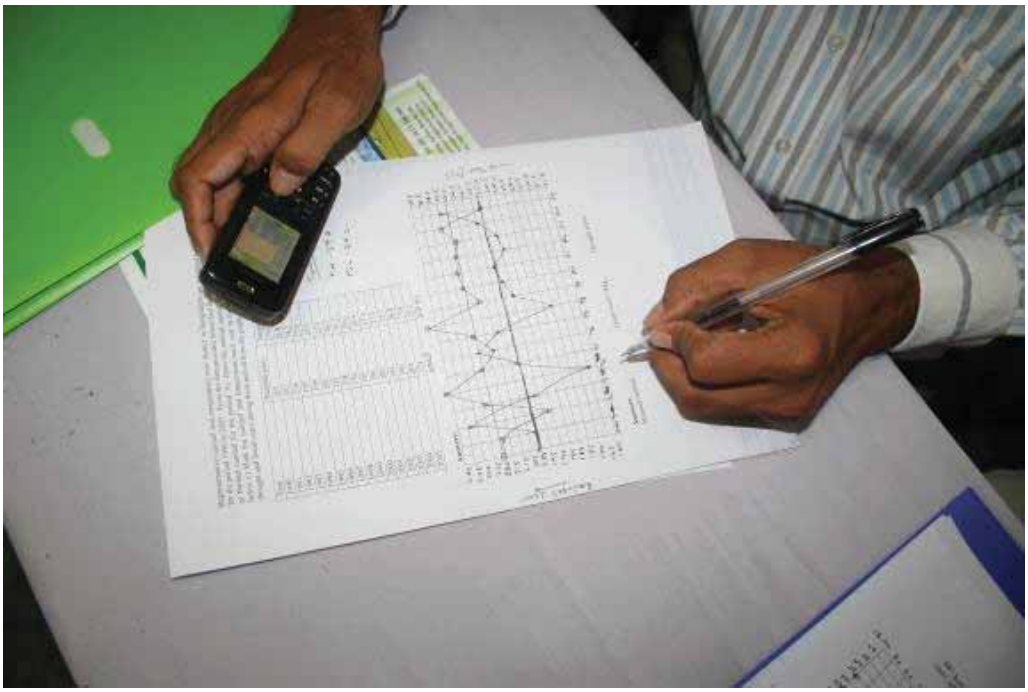
After delivering on the fundamentals of climate change it was clearly understood (also articulated) by the participants that the climate change will increase both the frequency and intensity of various types of hazards in future and these hazards will make more disasters to the agriculture and allied sectors in coming days.

With this background it was emphasized that climate forecast applications can help people to prepare for future such risks and develop their adaptive capacity in this line. In the second lecture on climate forecast applications examples are given of various forecast applications such as CFAB project for flood preparedness and mathematical weather forecasting examples of tracking cyclone and so forth.



From the first two lectures the participants understood that although the climate change is quite apparent scientifically, this can be both mitigated further as well as the adaptation is possible to these future climatic risks.

This module ended with a facilitated exercise on hand on forecasting using past representative rainfall and temperature data over districts in Bangladesh. A data table was given for the period 1990 to 2005. From the data participants were asked to generate:
a) normal rainfall for the period; b) draw the normal rainfall line in a chart (give to then in a sheet), c) mark the rainfall and temperature each year in the chart, and d) find out the drought and flood years during those period from the graph. The whole exercise was facilitated by the resource trainers and the participants appreciated this kind of hands on exercise very much.



Module Two

2.5 Lecture on Climate Change Impacts and Adaptation

From the first module which was more on science and its applications, the second module was solely more on climate change adaptation and its societal applications for increasing adaptive capacity at local and sectoral levels. In the second module, issues of climate change relating to Bangladesh were given priority and the need for climate change adaptation was made clear to the participants. The lecture started with situating the climate change context of the country and parameters of anticipated changes are likely for 2030, 2050 and 2100 in Bangladesh. The potential level of mean temperature, precipitation and Sea Level Rise were discussed following the national and international standards.

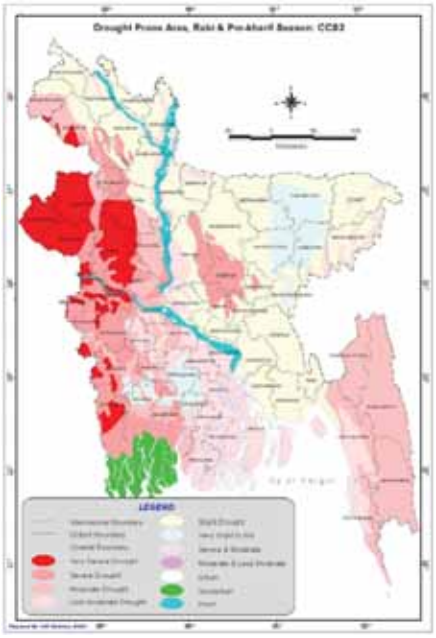
Year	Mean Temperature Change (°C)			Mean Precipitation Change (%)			Sea Level Rise		
	Annual	DJF	JJA	Annual	DJF	JJA	IPCC (Upper range)	SMRC	NAPA
2030	1.0	1.1	0.8	5	-2	6	14	18	14
2050	1.4	1.6	1.1	6	-5	8	32	30	32
2100	2.4	2.7	1.9	10	-10	12	88	60	88

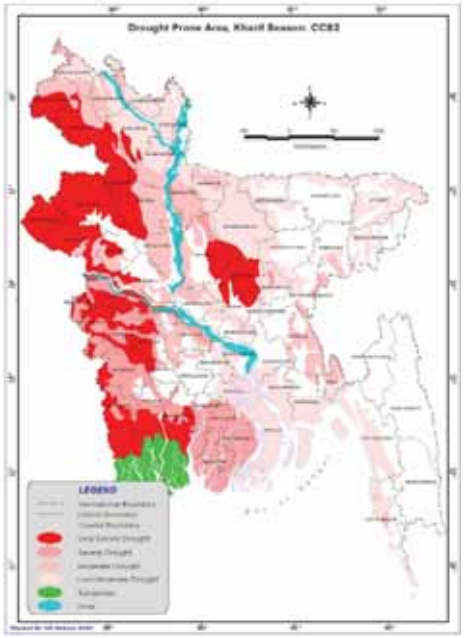
Note: DJF= December-January-February; JJA= June-July-August, SMRC= SAARC Meteorological Research Center *(Source: Adopted from IPCC 2001, OECD Report 2003)*

To contextualize the drought situation, both the existing and the anticipated changes, various issues were discussed and references were shard with the participants. Some of the likely impacts were discussed with the participants and discussions carried out within the lecture on such issues. This session was a lecture and discussion driven session and the participants could actively participate in the discussion for necessary clarification and new understanding. Some of the following maps are also shared with the participants to show the potential impact of drought, water, soils, SLR etc.

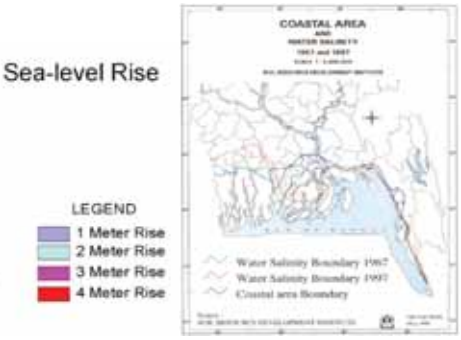
Necessary updated reference materials were shared with the participants. For the coastal zone relevant parameters were shared as well.

Drought maps:





Likely coastal impacts (SLR, water salinity, soil salinity, cyclone/storms etc.):



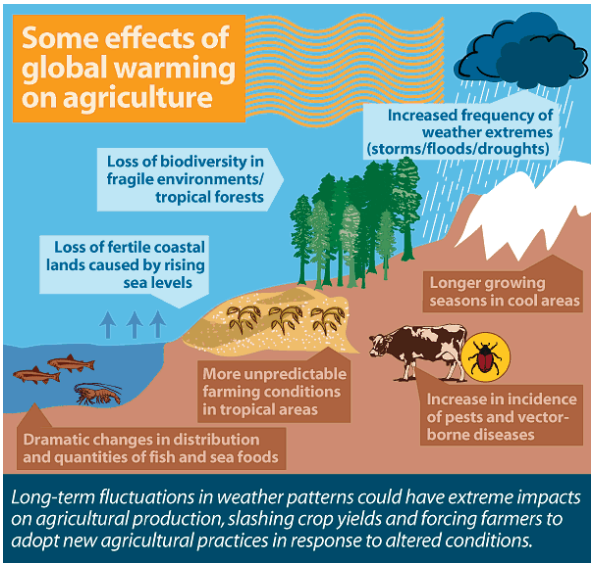
Primary Physical Effects / Agents of Change		Salt-water Intrusion	Drainage Congestion	Coastal Morphology	Cyclone and Storm Surges
Climate change (temperature, precipitation, evapo-transpiration)		+	+	-	+++
Changes of upstream river discharge	Peak	-	++	+++	-
	Low	+++	-	-	-
Sea level rise		+++	+++	++	++
Subsidence		++	++	++	++

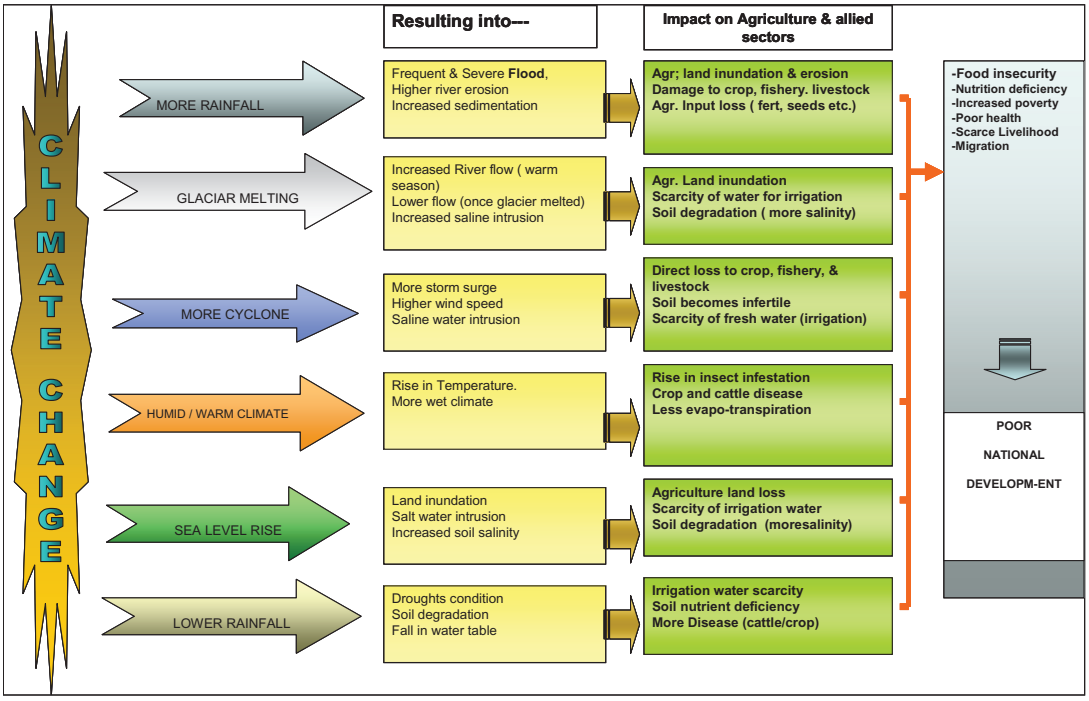
Source: Rahman, A., and Alam, M., 2004

This lecture has covered the climate change impacts on agriculture and allied sectors and shared the issues of likely impacts on the agriculture and allied sectors.

Some of the likely impacts anticipated by scientists are as follows:

- Changes in water resources demand and availability. Precipitation, evaporation, transpiration, etc., can all change. Flood control, drainage, and irrigation infrastructure will have to evolve with the changes.
- Greater risks for monoculture.
- Changes in disease and pest ranges and severity. Changes in temperature, hydrologic regime, frost dates, etc., will affect disease and pest prevalence, and host susceptibility.
- Coastal inundation, saline groundwater intrusion, drainage congestion. As sea level rises, low-lying countries will be affected.

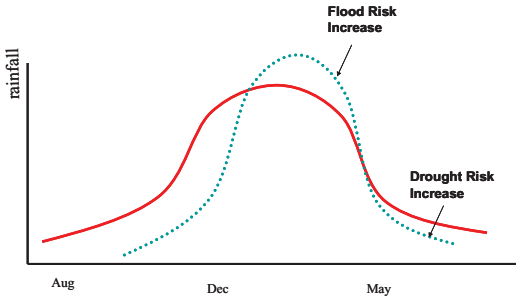




In this module, a major issue of delivery was to discuss and clarify the term of "adaptation" and share why adaptation is needed and how a systematic livelihoods based adaptation can uplift the adaptive capacity of the people and local level institutions in a gradual manner.
Some of the issues discussed as below:

Why wee need adaptation?

- Climate change impacts become apparent
- Failing to reduce greenhouse gas emissions
- Responding to a changing climate requires adjustments and changes
- Sustainable development linkage



What is "Adaptation"?

> "Adaptation is the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (IPCC:2007)

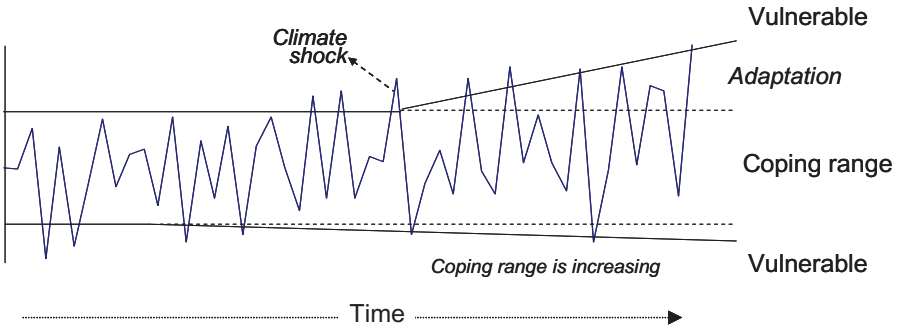
Other definitions:

> "Adaptation" is possible adjustments (spontaneous or planned) of people, plants or ecosystems to climate change to reduce adverse impacts, to take advantage of opportunities or to cope with the consequences of climate change".

Various types of practiced types of adaptation (WRI: 2007):

- Serendipitous/unanticipated adaptation
- Climate-Proofing of Development Efforts
- Discrete Adaptation

During the discussion in this module it was discussed that adaptation is actually a process of adjusting to changes in variables that influence (e.g. human wellbeing and survival, ecosystems) and it can take place at different levels, with different actors, different levels of consciousness, purpose and timing. It was also discussed that "livelihoods based adaptation" is a people centric solution based on both local-knowledge with the scientific facilitation. It is dual-way process and builds on the adaptive capacity through a systematic process.



It was shown to the participants that for this gradual adaptation in a "systematic ways" a processual approach is needed and he LACC project with DAE is taking that unique approach to build capacity at local and institutional levels.

Module Three

2.6 Exercise on the evaluation of adaptation measures

In the final module a very useful round of group work on climate change adaptation evaluation was developed. On the basis of the acquired knowledge of the participants from the previous two modules, participants were asked to evaluate the adaptation measures (that are collected earlier under the LACC-I and LACC-II project) using a "Criteria for evaluation". In this exercise of evaluating the adaptation measures following four criteria were used. Participants were given all the lists of the adaptation measures in four groups (usually by sectors such as agriculture, fisheries, forestry and livestock) and requested to classify each of these measures under any of the four criteria.

Four criteria are:

- Climate issues related measure
- Climate change and Development measure
- Development only measure
- Non-climatic measure

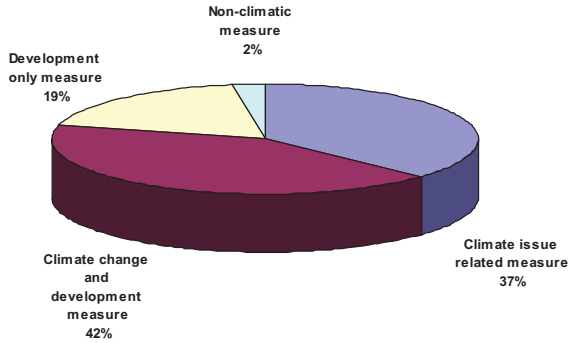
These four criteria were defined in following lines.

	Adaptation options/ measures	Rationale for considerations
Inclusion criteria	Climatic issues related measures	To consider the immediate and urgent issues of climate change
	Climate change and development related measures	To consider the mainstreaming and policy confonnity issues
Exclusion criteria	Development only measures	These are not regular measures rather than climate change related.
	Non-climatic measures	These are not related to climate change vulnerabilities or reduction of it.

This exercise made the participants understand the differences of the "adaptation specific measures" from the "regular development measures" which are not always associated to the climate change adaptation immediate or long term options. Participants found this exercise useful for generating discussions with their own rationales but with increased knowledge this time with the knowledge of knowing which is a adaptation measures and which is not.

Outputs of the adaptation option evaluation results

The evaluation exercise was carried out in 11 (eleven) groups from the four trainings (both for the senior and junior officers rounds) and the results shown below is an outputs and analysis of the major trends from these 11 sets of results.



The results indicate that (shown in the pie diagram on the right) the participants perceive that most of the adaptation options identified in the project are either directly related on the climate issues (37%) or of dual nature of climate change and development (42%). It indicates that almost 80% of the adaptation measures are in some way contributes towards the climate change adaptation for the livelihoods. A very small number (2%) of the measures are identified as these do

not have any relationships with climate change at all. A proportion of 19% measures from the list are also identified as are often solely contribute towards the regular development work of the departments and agencies.

A more detailed account (from the dominant perceptions) are shown in the table below for each of the adaptation options as identified by the participants in their 11 group exercise results.

Table. Adaptation measures as classified by the participants from their evaluations

SL	Adaptation Options	Climate issue related measure	Climate change and development measure	Development only measure	Non-climatic measure	Remarks
1	Seedbed method for T. Aman rice					
2	Depth of transplanting for T. Aman					
3	Weed control-reduce water seepage					Mixed responses
4	Manual closing of soil cracks Farmers					
5	Strengthening field bunds (Ail lifting)					
6	Impact of water saturated soil condition on rice cultivation					
7	Raise seedbed in the high land and prepare floating seedbed					
8	Zero tillage potato and maize cultivation					
9	Cultivation of local and HYV T. Aman rice to assess the comparative advantages of the varieties in the recurrent drought and saline condition					
10	Cultivation of saline tolerant local and HYV Boro rice to assess the comparative advantages of the varieties in the recurrent saline problems in the coastal area					
11	Re-excavation of traditional ponds					Dual response
12	Re-excavation of khari canals (north-west)					
13	Excavation of canals					
14	Water Control Structures					
15	Excavation of mini-ponds					
16	Re-excavation of traditional canal and preserving fresh/sweet water in the canal by erecting mud bund/wall for subsequent irrigation					
17	Canal re-excavation for supplementary Irrigation (south-west)					
18	Facilitate drainage by re-excavating the traditional canals					
19	Supplemental Irrigation					
20	Installation of shallow and Deep Tube Wells					
21	System of Rice Intensification					
22	Direct sown rice (drum seeder)					Dual response
23	Drought resistant rice varieties					
24	Green Manure - T.Aman system					
25	T. Aus - Chini atap system					
26	T. aman - Mustard/linseed system					
27	T. aman - Chickpea					
28	T. aman - Mung bean					
29	Relay cropping of T. Aman with grass pea and mustard					
30	Cultivation of pulse, oil, spices crops					
31	Famine reserve crops					
32	Jujube cultivation					Dual response
33	Homestead vegetable gardening					
34	Mulberry intercropping in rice					Dual response
35	Fodder cultivation					

SL	Adaptation Options	Climate issue related measure	Climate change and development measure	Development only measure	Non-climatic measure	Remarks
36	Fish cultivation in mini ponds					
37	Cottage industries					
38	Manufacturing industries					
39	Mini Nursery					
40	Mixed Fruit Garden					
41	Cultivation of Pigeon Pea (Arahar) in the Fallow Land					
42	Boat garden					
43	Indigenous fish culture in pond such as Koi, shing, Rui, Katla etc					
44	Pata (Compartmentalization by bamboo mat in stagnant water) fish cultivation					
45	Prawn (golda) culture in low land/ T. Aman rice field					
46	Small pond Fish breeding practices					Mixed responses
47	Cultivate saline tolerant fish					
48	Protecting fish by putting-up fench/net around the pond					
49	Vegetable cultivation at the boundary of shrimp/prawn field (gher)					Dual response
50	Snail Cultivation in water lodged area					
51	Goat rearing					
52	Duck rearing					
53	Drought resistant poultry (Cok) rearing					
54	Cultivation of water lily in the water logged area					Dual response
55	Flower cultivation					
56	Mango cultivation					
57	*Maize cultivation					Mixed responses
58	*Papaya Cultivation					
59	Community based biogas and tree planting					
60	Improved stove					Dual response
61	Seed storage for higher viability					
62	Farm Yard Manure					
63	Compost preparation					Dual response
64	Cultivation of green manuring crops					
65	Timber and fruit tree plantation in the roadside and in the homestead					
66	Establishment of embankment to restrict saline water intrusion from the sea					
67	Establishment/maintenance of embankment and sluice gate for saving crops from high tide and flood					
68	Social mobilization for the Management of embankment and sluice gates through the water user groups in one union as pilot basis for growing rice and other crops as suitable to the area					

2.7 "Mini talk" on innovative CCA

Besides the technical lectures, group-work and discussions several new issues have also emerged and was accommodated for sharing in the form of "Mini Talk" during the training. Some of the unique innovative measures emerged in these sessions (specific to the context) as follows:

- Integrated Pest Management (IPM)
- Fisheries adaptation,
- Hydroponics (*bayra*) in Salinity/SLR areas
- Extension experiences of DAE as adaptation
- Cyclone/storm surge specific adaptation measures
- Farmer's climate field school
- Traditional adaptive measures
- And some others.

3. Recommendations and follow up thoughts

From the experiences of administering of the local level training on climate change, some recommendations emerged and are outlined below for future considerations by the project and beyond. These are:

- It was emerged from the overall local level interaction that ***there has been a great demand for further training*** on climate change and adaptation issues in future. More trainings on wider issues of adaptation and more frequent trainings are also asked for.

- It was pointed out in several occasions that "one-day" trainings on climate change issues are useful but a longer term program of a ***"week-long training"*** would be very useful for the participants to get more hands on training and application of trainings in future. In this respect, a week long training or even two-week long training would give them more opportunities to design effective projects/initiatives for adaptation which they can follow up within their departments and sectors respectively after the training.

- It was emerged from the discussion that if a ***"Guidebook on Community Level Climate Change Adaptation"*** is developed in future then it could be very useful for them. A guidebook in Bangla with these types of issues of climate change and adaptation of science and society is recommended.

- From the experiences of the local level training on climate change and adaptation a training manual can be further developed and the existing resource book (FAO Case Study 9) can be ***further updated incorporating the coastal contexts*** into the guidebook or preparing a separate resource book altogether for coastal areas. This is quite important as the situation and the context of the Bangladesh coastal zone is quite different from the northern drought prone areas.

- For developing further widespread understanding of local level stakeholders some ***information and education related materials*** (i.e. paper based – billboards, posters, leaflets and audio-visual such as video/film etc.) relating to climate change and climate change adaptation can be developed and shared with the local level units/stakeholders.

- It is recommended that to share the training experiences of local level capacity building can be shared with the national level officials in Dhaka. A half-day ***central level sharing meeting*** can be organized in future. The meeting can be organized at DAE headquarters and central level DAE officials, NTWG members and other relevant national level stakeholders can be invited for this sharing meeting.

Annexes

Annex 1. Reflections of participation in the four trainings

Participants of "Pabna-round" training

Participants of "Khulna-round" training

Various other images of group-work and presentations


Training on
"Climate Change Adaptation in Agriculture and Allied Sectors"
22-23 October, 2008
Venue: HDTC, Daulatpur, KHULNA
Department of Agricultural Extension (DAE)
Food and Agriculture Organization of the United Nations (FAO)
Livelihood Adapt
Climate Change (LACC-II) Project
(Project No- BGD/01/004/01/99)











Thank





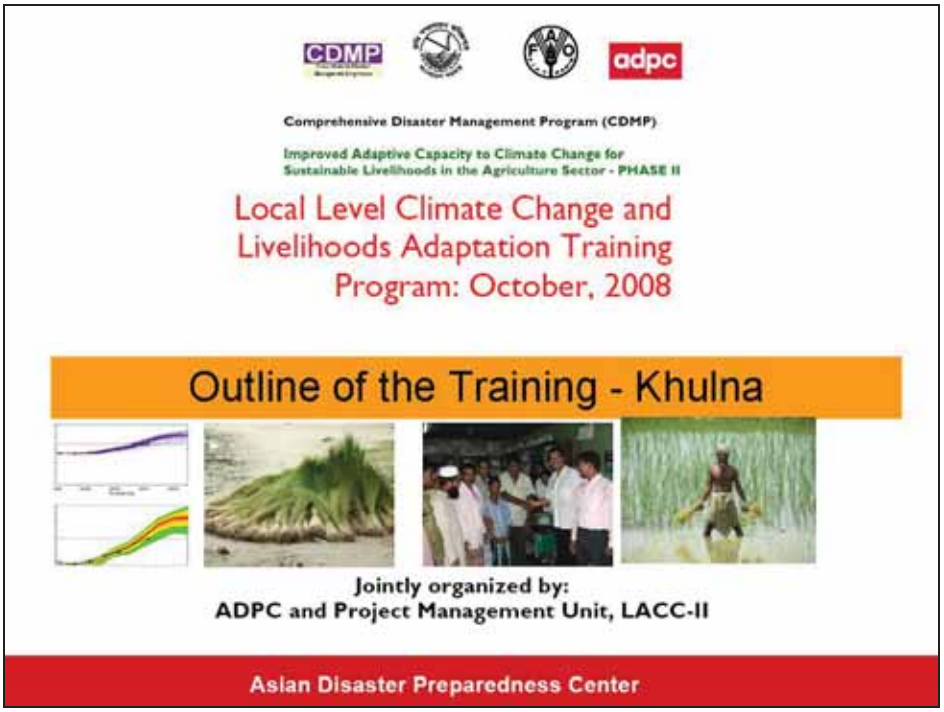



পরিবেশ বান্ধব কৃষির জন্য
আইপিএম


Annex 2: Training Modules (presentations and exercises)

Module '0'

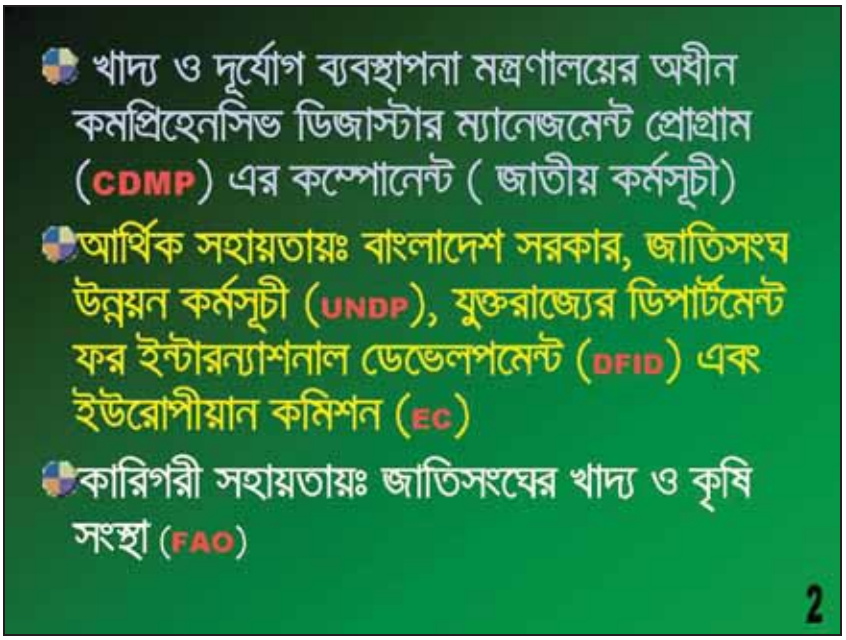
Item-M0a: Structure and outline of the training and training modules



Module	Timing	Session
Opening Session	8:30-9:30	• Opening Remarks: PMU,CDMP, National/local host] • LACC-II Project overview • Overview of CDMP • Structure and outline of training • Introduction to the participants & logistics briefing
Module One: (Climate change and DRM in Agriculture)	9:30-12:00	• **Ice breaker Exercise:** Observation on CC and its impact on agriculture (in card) • Climate Change Fundamentals
Module: Two: (Climate Forecast	12:00-13:00	• Weather Forecasting for Climate Risk Management • **Exercise:** Climate Forecast Applications at local level
	13:00-14:00	**Break/Prayer time/Lunch**
	14:00-15:00	• Climate Change Adaptation and Agriculture • **Group exercise:** Identification of sectoral impacts of climate change
Module: Three: (Climate Change Adaptation)	15:00-17:00	• **Mini talk(s) on CCA:** Innovative Agriculture Risk Management Approaches using IPM and other methods/ Participants presentation • **Group work and plenary:** Participant's evaluation of LACC-II Adaptation options
	17:30-17:45	**Closing remarks**

**Note: The outline was dynamically modified to remain flexible to the participants' type and need in various rounds.

Item M0b. Overview of the LACC project (in *Bangla*)



ল্যাক-১ এর প্রকল্পের পাইলট এলাকা ছিলঃ

চাঁপাই নবাবগঞ্জ ও নওগাঁ (উত্তর-পশ্চিম অঞ্চলের খরা প্রবণ জেলা)

২০০৫ সালে কাজ করেছে

ল্যাক-২ এর প্রকল্প এলাকাঃ

অঞ্চল	জেলা	উপজেলা	ল`াক প্রকল্প পর্যায়
উত্তর-পশ্চিমের খরা প্রবণ এলাকা	চাঁপাই নবাবগঞ্জ	নাচোল	প্রথম পর্যায় (ল্যাক-১) ও দ্বিতীয় পর্যায় (ল্যাক-২)
		গোমস্তাপুর	
	নওগাঁ	সাপাহার	
		পোরশা	
	নাটোর	লালপুর	
		বাগাতিপাড়া	
দক্ষিন -পশ্চিমের উপকূলীয় লবনাক্ত এলাকা	খুলনা	তেরখাদা	দ্বিতীয় পর্যায় (ল্যাক-২)
		দাকোপ	
	পিরোজপুর	ভান্ডারিয়া	
		নাজিরপুর	

3

ল্যাক-২ এর প্রকল্প এলাকা

অঞ্চল = ২

খরা প্রবণ এলাকা

উপকূলীয় লবনাক্ত এলাকা

জেলা = ৫

উপজেলা = ১০

প্রকল্পের মেয়াদ (ল্যাক-২)ঃ ফেব্রুয়ারী ২০০৮-জুন ২০০৯।

প্রকল্পের মূল উদ্দেশ্যঃ

* জলবায়ু পরিবর্তনের সাথে সাথে বিভিন্ন খাপ খাওয়ানোর কলা-কৌশল রপ্ত করা
* বিভিন্ন অভিযোজন (**Adaptation**) খাপ খাওয়ানোর ক্ষেত্রে যোগ্যতা বাড়ানো
* লক্ষ্য হলো গ্রামীণ দরিদ্র জনগোষ্ঠীর খাদ্য ও জীবন যাত্রার টেকসই নিরাপত্তা বিধান
* খরা প্রবণ ও উপকূলীয় অঞ্চলের জন্য উপযোগী কলা-কৌশল (কৃষি বিভিন্ন সেক্টর বিষয়ক ও অন্যান্য) সংযোজন, উন্নয়ন ও আরও শক্তিশালী করা

প্রকল্পের মূল উদ্দেশ্য

- সব পর্যায়ের অংশগ্রহণকারীদের দুর্যোগ ঝুঁকি হ্রাস ও জলবায়ু পরির্তন জনিত অভিযোজন বা খাপ খাওয়ানোর বিষয়ে প্রাতিষ্ঠানিক ও কারিগরী যোগ্যতা ও ক্ষমতা বৃদ্ধি করা।
- দীর্ঘস্থায়ীত্বের কথা বিবেচনা করে স্থানীয় জনগোষ্ঠীকে সাথে নিয়ে এবং তাদের অংশগ্রহণ নিশ্চিত করে মাঠ পর্যায়ে কার্যকরী দুর্যোগ ঝুঁকি হ্রাস ও জলবায়ু পরির্তন জনিত অভিযোজন কৌশল ও কার্যক্রম বাস্তবায়ন করা।
- প্রকল্পের কার্যক্রম বিস্তার, নবায়ন এবং সরকারের পরিকল্পনার মূল ধারায় সংযোজনের জন্য বিভিন্ন পর্যায়ে বিশেষত জেলা ও জাতীয় পর্যায়ে আলোচনা-পর্যালোচনা করা।

অভিযোজন (**Adaptation**)
(উত্তর-পশ্চিমের খরা প্রবণ এলাকা)




6

তৃনমূল পর্যায়ে সম্প্রসারণ কৌশল


Orientation meetings


Farmer field schools


Folk songs & dramas


Demonstration rally


Awareness raising


Exchange visits

প্রকল্প বাস্তবায়ন ও ব্যবস্থাপনাঃ

* কৃষি সম্প্রসারণ অধিদপ্তর-নেতৃত্বে
* এফএও (**FAO**)- নিয়মিত কারিগরী সহযোগীতা ও পরামর্শ প্রদান করছে।
- জাতীয় পর্যায়ঃ সাব কম্পোনেন্ট এ্যাডভাইজরি কমিটি (**SAC**) (বিভিন্ন সরকারী ও বেসরকারী বিভাগ ও সংস্থা)
- প্রকল্প ব্যবস্থাপন ইউনিট (**PMU**), কৃষি সম্প্রসারণ অধিদপ্তরের প্রধান কার্যালয় অবস্থিত
- নেতৃত্বেঃ সাব-কম্পোনেন্ট ম্যানেজার (ন্যাশনাল প্রজেক্ট ডাইরেক্টর) কৃষি মন্ত্রণালয় থেকে মনোনীত।
- প্রকল্পের সামগ্রিক ব্যবস্থাপনা ও বাস্তবায়নের জন্য দায়িত্বশীল থাকবেন।

* সার্বক্ষণিক সহযোগীতা করার জন্য আছেন কারিগরি কর্মকর্তা (কৃষি সম্প্রঃ অধিঃ নিয়োজিত)
* **FAO** এর পক্ষ থেকে আন্তর্জাতিক পরামর্শক (১জন) ও জাতীয় পরামর্শক (১ জন)

(কারিগরী বিষয়, প্রশিক্ষণ, প্রকল্পের উন্নয়ন, সম্প্রসারণ ও প্রয়োজনীয় বাস্তবায়নের জন্য দায়িত্বশীল)

<u>প্রকল্পে কারিগরী বিষয়ে পরামর্শ প্রক্রিয়া ও বাস্তবায়ন</u> :

* জাতীয় পর্যায়েঃ টেকনিক্যাল ইম্প্লিমেন্টেশন ওয়ার্কিং গ্রুপ (**NTIWG**)- নেতৃত্বেঃ পরিচালক সয়েজমিন উইং, কৃষি সম্প্রসারণ অধিদপ্তর।
* জেলা পর্যায়েঃ উপ-পরিচালক, প্রকল্প জেলা (পরামর্শ দেবেন)।
* উপজেলা পর্যায়েঃ টেকনিক্যাল ইম্প্লিমেন্টেশন ওয়ার্কিং গ্রুপ (**UTIWG**)- নেতৃত্বে উপজেলা কৃষি কর্মকর্তা।
* বাস্তবায়নে **SAAO**, প্রকল্পের মাঠ কর্মকর্তা (মনিটরিং)

Module 'One'

Item M1a: Ice breaker exercise with three questions

I

Ice-breaker: Questions

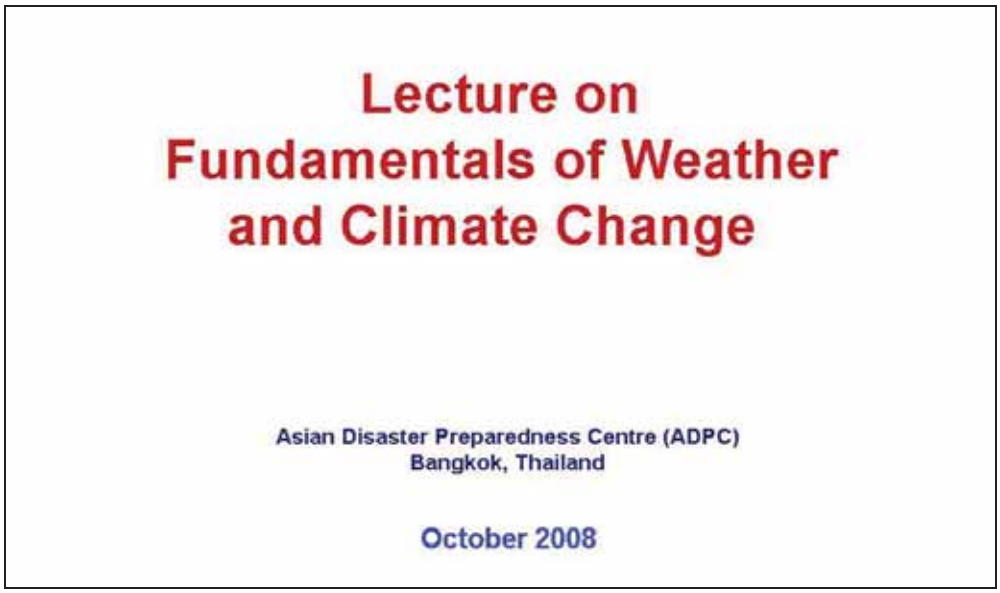
1. What do you mean by "Climate Change"?
2. Please identify some "indicators" of climate change
3. Please identify some "impacts" of climate change

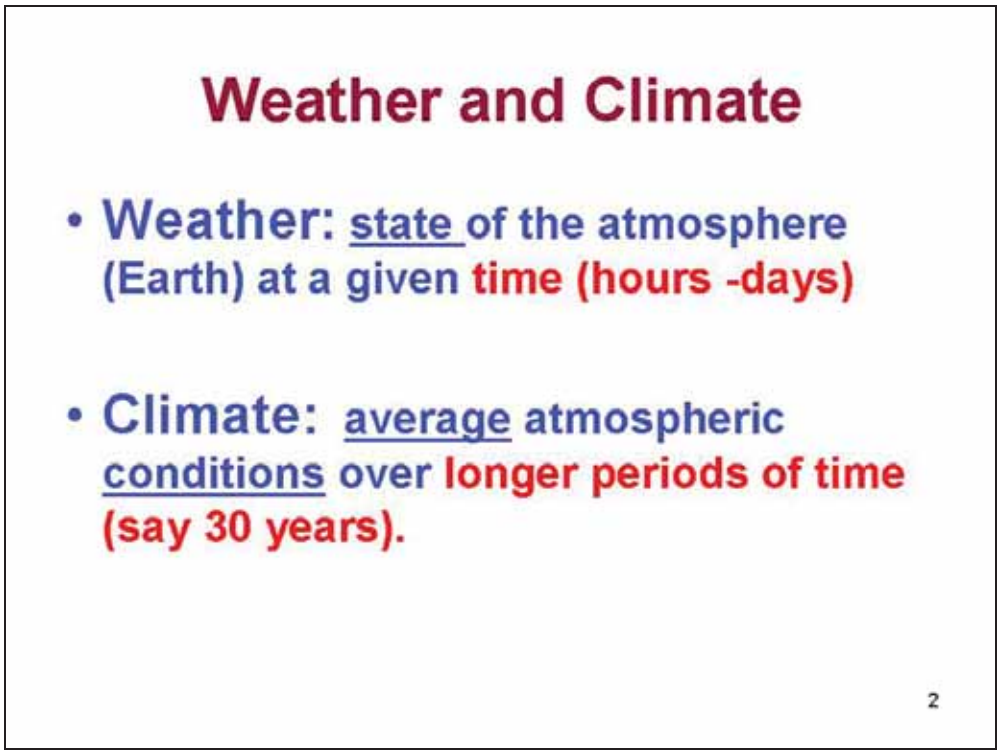
Defining Climate Change

"… any change in climate over time, whether due to natural variability or as a result of human activity (IPCC:2007).

… a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods (UNFCC)

Item M1b: Lecture on fundamentals of weather and climate science and change





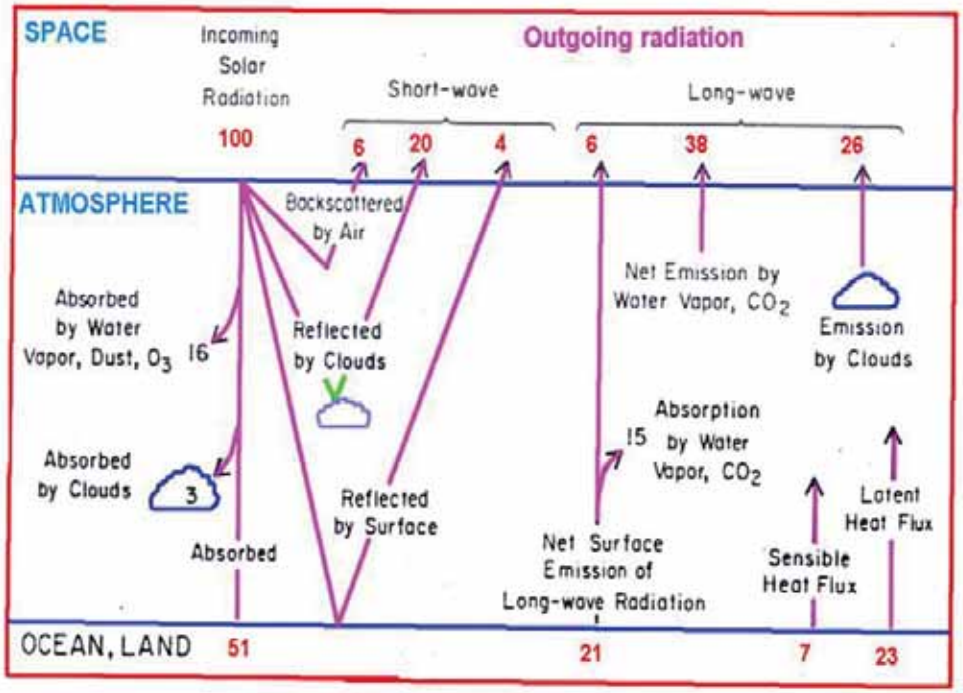
Variability in our Weather and Climate Systems

- Variation within hours to a few days – the weather
- Variation within a year

-- the season

- Variation between years – droughts and flood years
- Variation over longer time – climate change

Atmospheric Energy Balance



Schematic of the relative amounts of the various energy inputs and outputs in the earth/atmosphere system. [From data in NRC (1975)].

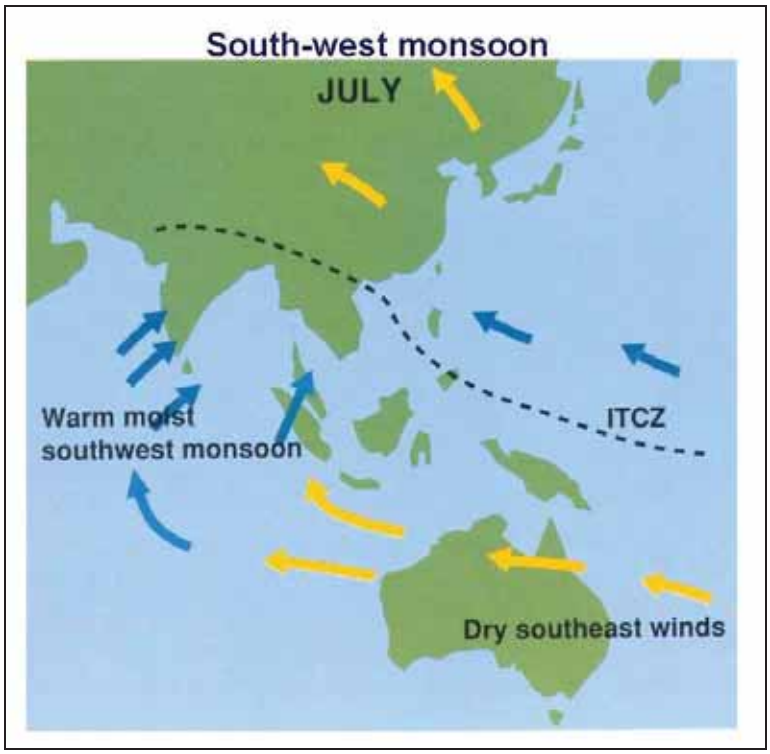
Type of forces in the Atmosphere

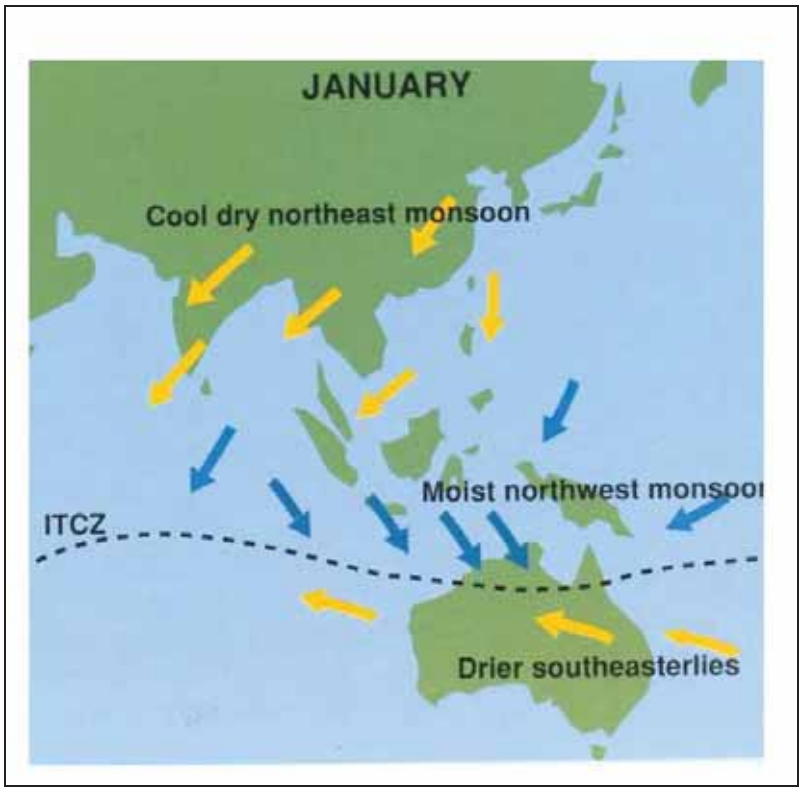
- Dynamical forces:
  - Fundamental force:
    - Pressure gradient
    - Gravitational
    - Frictional
  - Apparent force:
    - Coriolis
    - Centripetal
    - Centrifugal
- Physical force
    - Momentum flux
    - Sensible flux
    - Moisture flux
    - Radiation

5

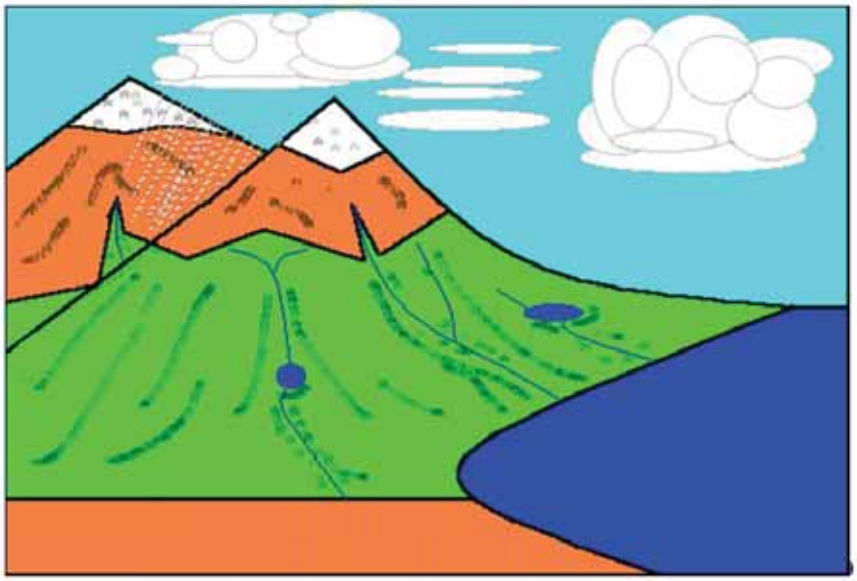
Positions of the ITCZ (Intertropical Convergence Zone) in January and July

6

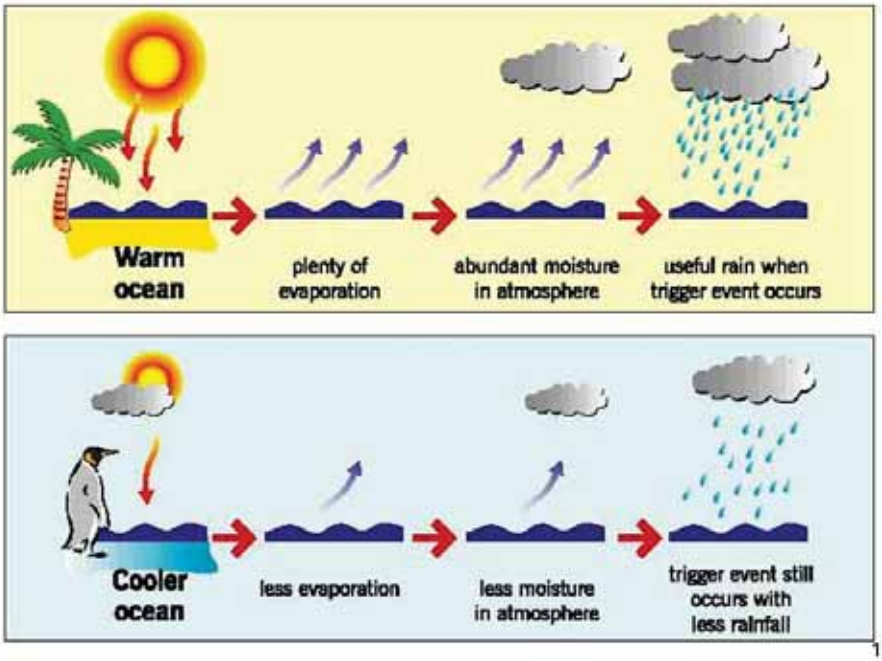

South-west monsoon
JULY
Warm moist
southwest monsoon
ITCZ
Dry southeast winds


JANUARY
Cool dry northeast monsoon
Moist northwest monsoon
ITCZ
Drier southeasterlies

Hydrological Cycle



How do ocean temperatures affect rainfall?

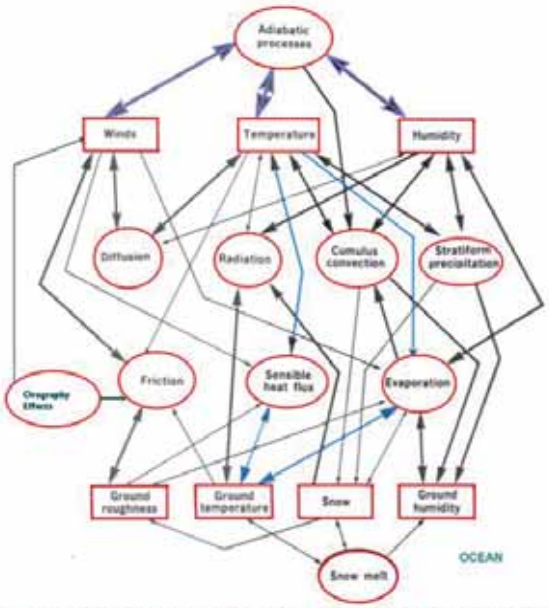


10

Different weather events with space and time scales

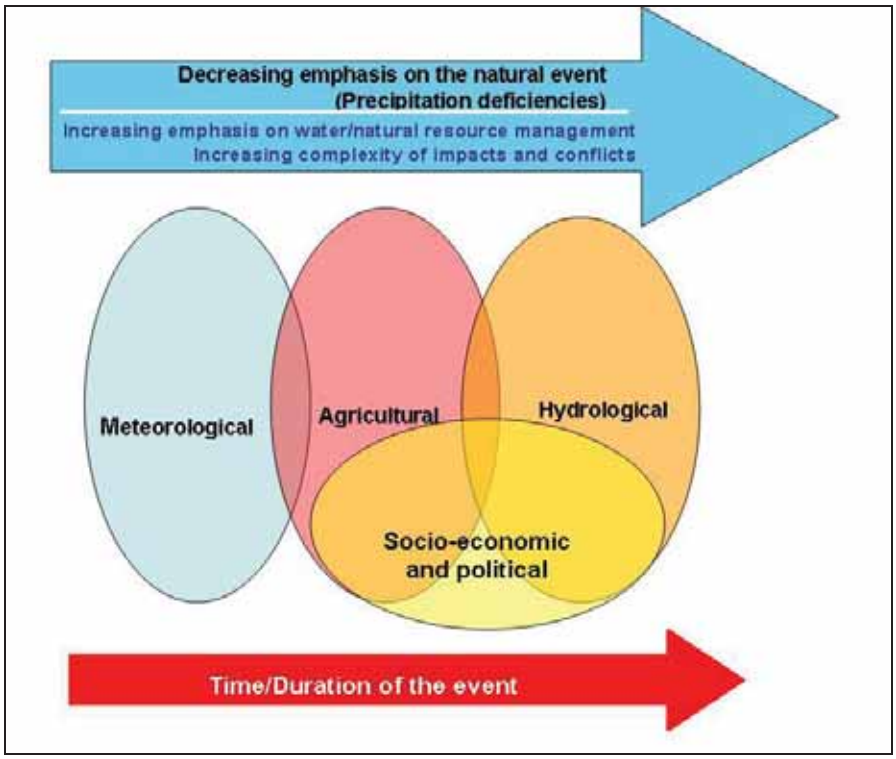
Disturbance	Scale	Duration
Extratropical Cyclone	500-2000 km	3-15 days
Cold front	500-2000 km	3-7 days
Anticyclone	500-2000 km	3-15 days
Warm front	300-2000 km	1-3 days
Hurricane	300-2000 km	1-7 days
Tropical Cyclone	300-1500 km	3-15 days
Tropical depression	300-1000 km	5-10 days
Dry front	200-1000 km	1-3 days
Midget typhoon	50-300 km	2-5 days
Meso height	10-500 km	3-12 h
Gust front	10-300 km	0.5-6 h
Mesocyclone	10-100 km	0.5-6 h
Downslope wind	10-100 km	2-12 h
Macrobrust	4-20 km	10-60 min
Microbrust	1-4 km	2-15 min
Tornado	30-3000 m	0.5-90 min
Suction vortex	5-50 m	5-60 s
Dust devil	1-100 m	0.2-15 min

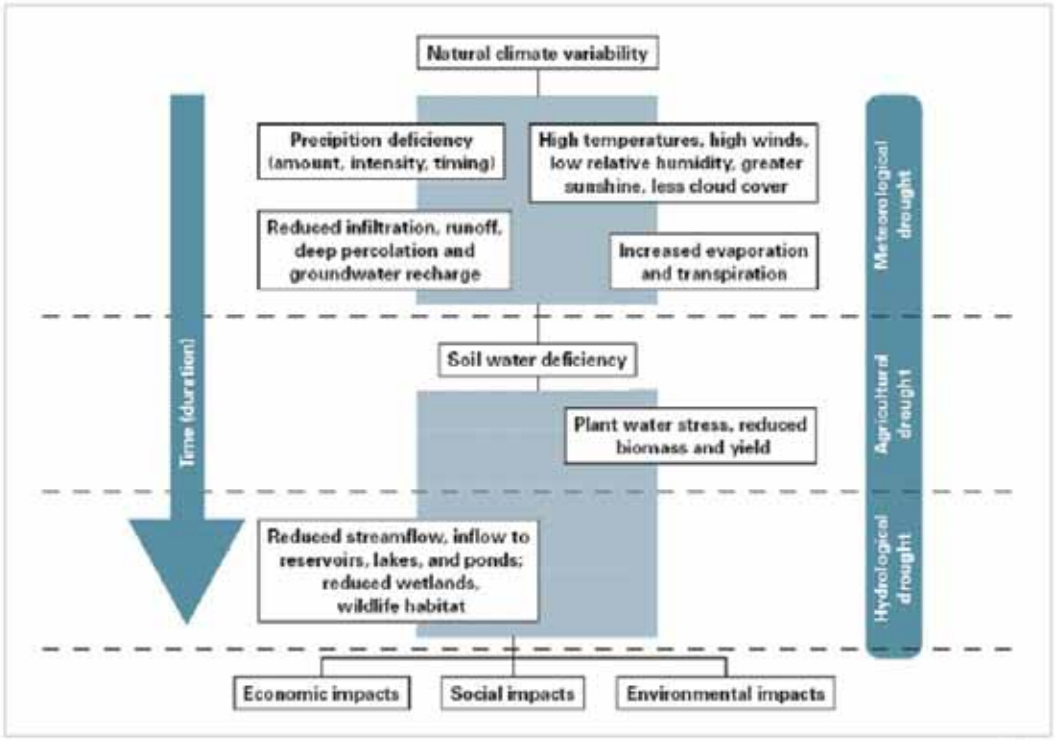
11

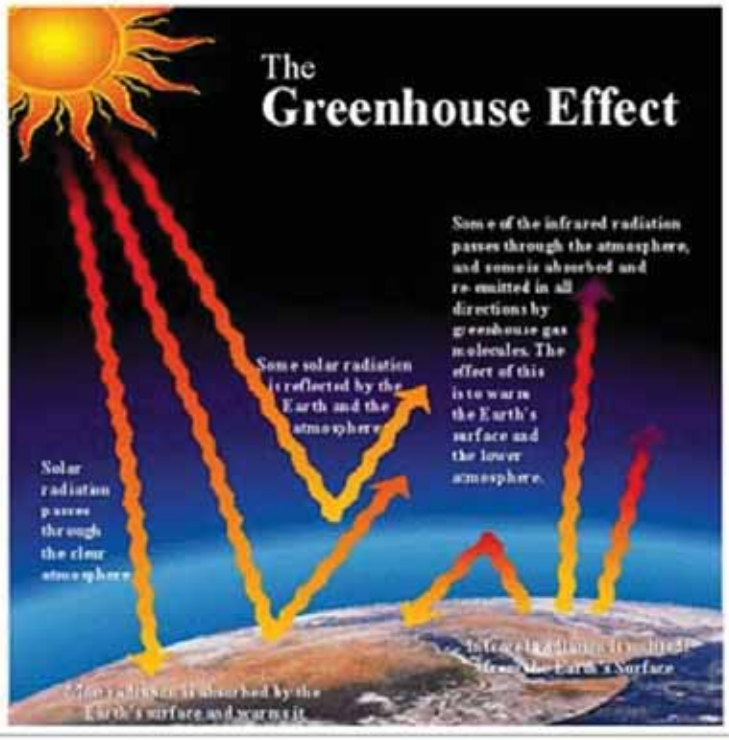


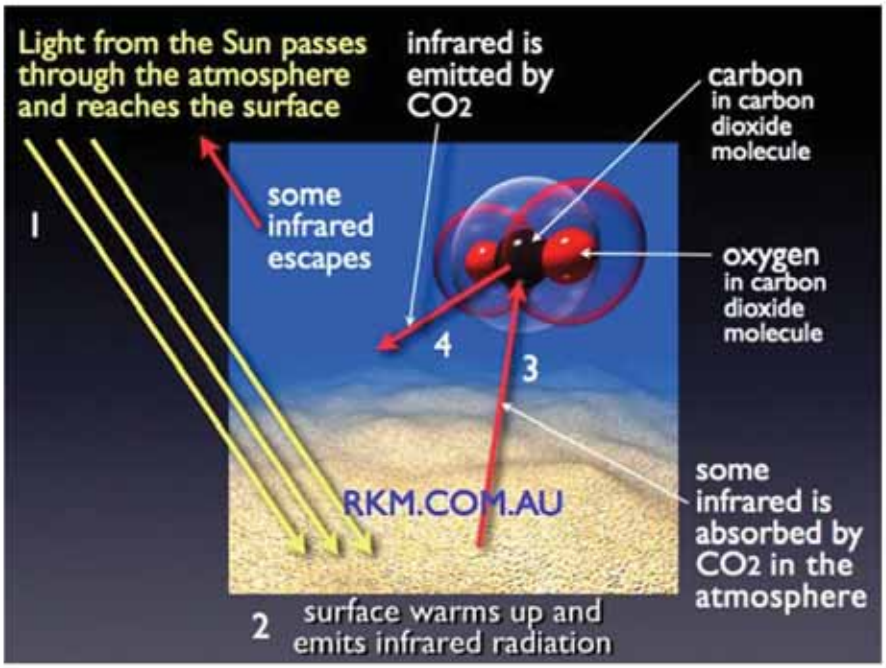
The thickness of the arrows represented qualitatively the importance of the interactions.
Any close loop indicates a feed-back phenomenon.
(ED: Temp → Evp → Ground Temp → Sen Heat Flux → Temp).
The physical processes and the feedback mechanisms to be incorporated in a numerical model.

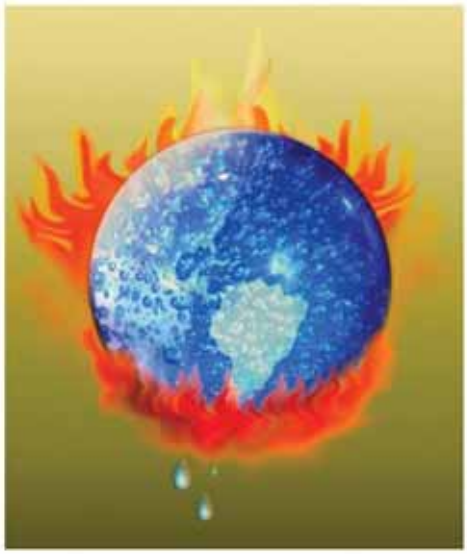
12


Decreasing emphasis on the natural event
(Precipitation deficiencies)
Increasing emphasis on water/natural resource management
Increasing complexity of impacts and conflicts
Meteorological
Agricultural
Hydrological
Socio-economic
and political
Time/Duration of the event

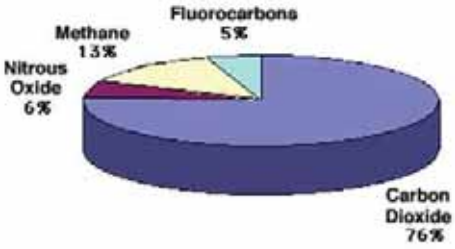

Natural climate variability
Precipitation deficiency (amount, intensity, timing)
High temperatures, high winds, low relative humidity, greater sunshine, less cloud cover
Reduced infiltration, runoff, deep percolation and groundwater recharge
Increased evaporation and transpiration
Soil water deficiency
Plant water stress, reduced biomass and yield
Reduced streamflow, inflow to reservoirs, lakes, and ponds; reduced wetlands, wildlife habitat
Time (duration)
Meteorological drought
Agricultural drought
Hydrological drought
Economic impacts
Social impacts
Environmental impacts

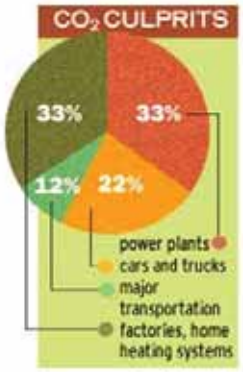

The
Greenhouse Effect
Some of the infrared radiation passes through the atmosphere, and some is absorbed and re-emitted in all directions by greenhouse gas molecules. The effect of this is to warm the Earth's surface and the lower atmosphere.
Some solar radiation is reflected by the Earth and the atmosphere
Solar radiation passes through the clear atmosphere
Some radiation is absorbed by the Earth's surface and warms it
15


Light from the Sun passes through the atmosphere and reaches the surface
infrared is emitted by CO2
carbon in carbon dioxide molecule
some infrared escapes
1
oxygen in carbon dioxide molecule
4
3
RKM.COM.AU
some infrared is absorbed by CO2 in the atmosphere
2
surface warms up and emits infrared radiation



17


Fluorocarbons
5%
Methane
13%
Nitrous
Oxide
6%
Carbon
Dioxide
76%


CO_2 CULPRITS
33%
33%
12%
22%
power plants
cars and trucks
major
transportation
factories, home
heating systems

18

Thanks

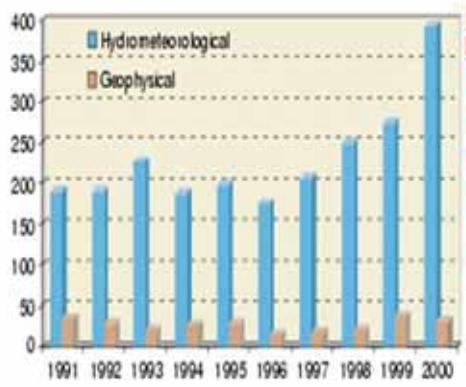
Item M1c: Lecture on Climate Forecast Applications and Exercise

Lecture and exercise on
Climate Forecast Applications

Number of Reported Disasters during 1991-2000

Geophysical Disasters:

Earthquakes
Avalanches
Land slides
Volcanic--eruption
Tsunami



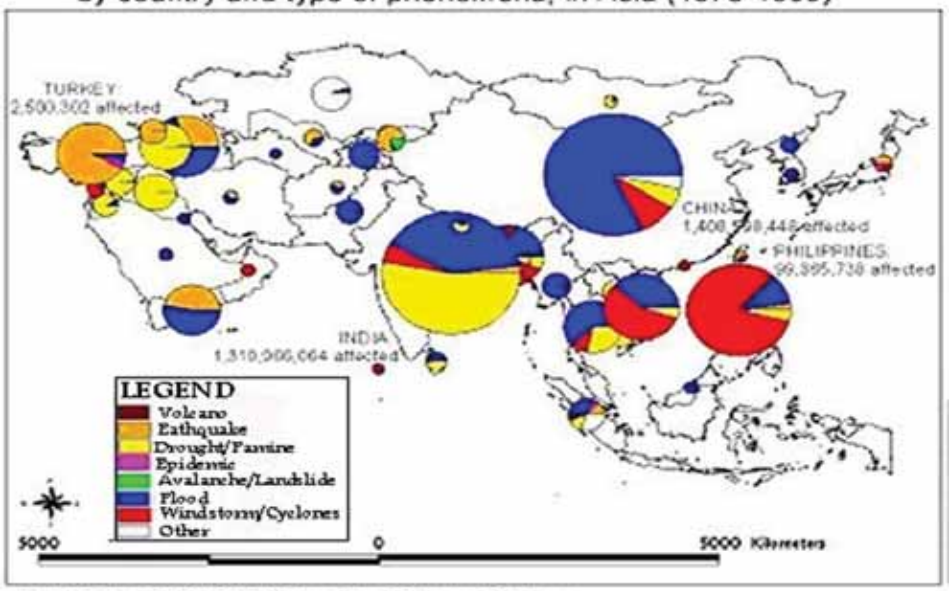
Hydrometeorological Disasters:

Cyclones
Flood
Drought
Tornadoes
Dust storms
Heat waves
Cold waves

More than 90% people killed by Natural Disasters are due to Meteorological and Hydrological Hazards

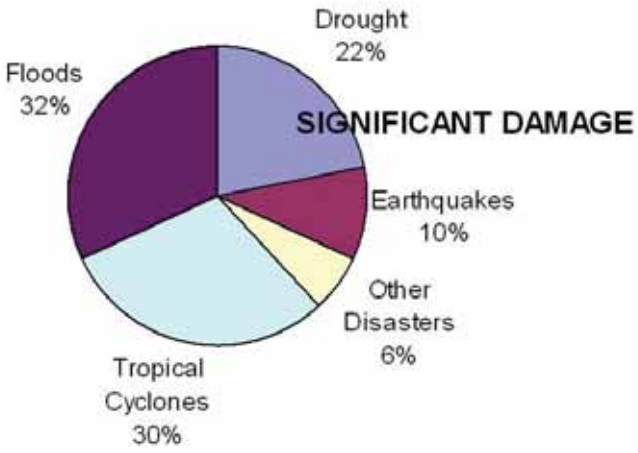
2

Distribution of people affected by natural disasters,
by country and type of phenomena, in Asia (1975-1999)



EM-DAT: The OFDA/CRED International Disaster Database
(http://www.cred.be ; email: cred@epid.ucl.ac.be)

MAJOR DISASTERS AROUND THE WORLD: 1963-2002



4

Major Hydro-Met. Hazards and main meteorological parameters

Major Meteorological Hazards	Parameters causing hazards	Predictability
Tropical Cyclones	Rainfall, wind, Storm surge	3 -5 days
River Floods	Rainfall, Soil Characteristics, Hydrology	5 -10 days
Flash floods	Rainfall, Soil Properties, Land Terrain (slope)	12–24 hours
Storm floods	Rainfall, wind speed, Bathy metre, Coastal topogrphy	3-5 days
Heavy rainfall	Rainfall, Hydrology	1 -3 days
Heat and Cold waves	Temperature, Wind	3-5 days
Droughts	Rainfall	1–3 months
Severe Thunderstorms and Tornadoes	Wind, Rainfall, Hail and Lightining	6-24 hours
Land Slides	Rainfall, Terrain characteristics	1- 2 days

5

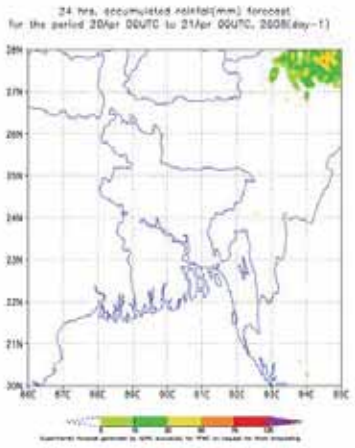
Weather Prediction Methods

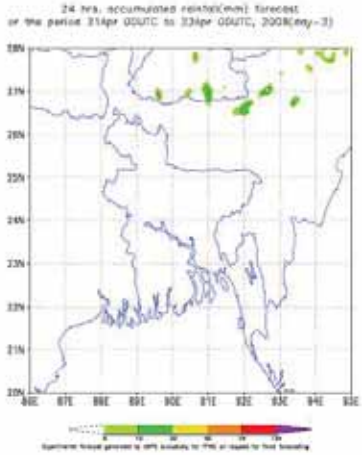
- Conventional Methods (Qualitative Methods)
- Numerical Weather Prediction (Quantitative Prediction)
- Statistical Prediction (Qualitative Prediction)

6

What is Weather and Climate Forecast?

Present → Arriving at the future state Of the Atmosphere → Future State





7

Methods of weather forecast

- **Practicing Methods :**
  - **Persistence :**
    - No change from current condition into a certain period
  - **Trend :**
    - The change of weather variables persists into a certain time ahead

    (e.g. warming trend based on the expectation that the movement of an approaching disturbance continues the same speed)

8

Forecast methods …*contd*..

– Analog (empirical) :

Anticipate what will happen on the basis of what happened in the past in a similar situation.

(Notion of weather types particularly useful for long range forecast)

9

Surface observations

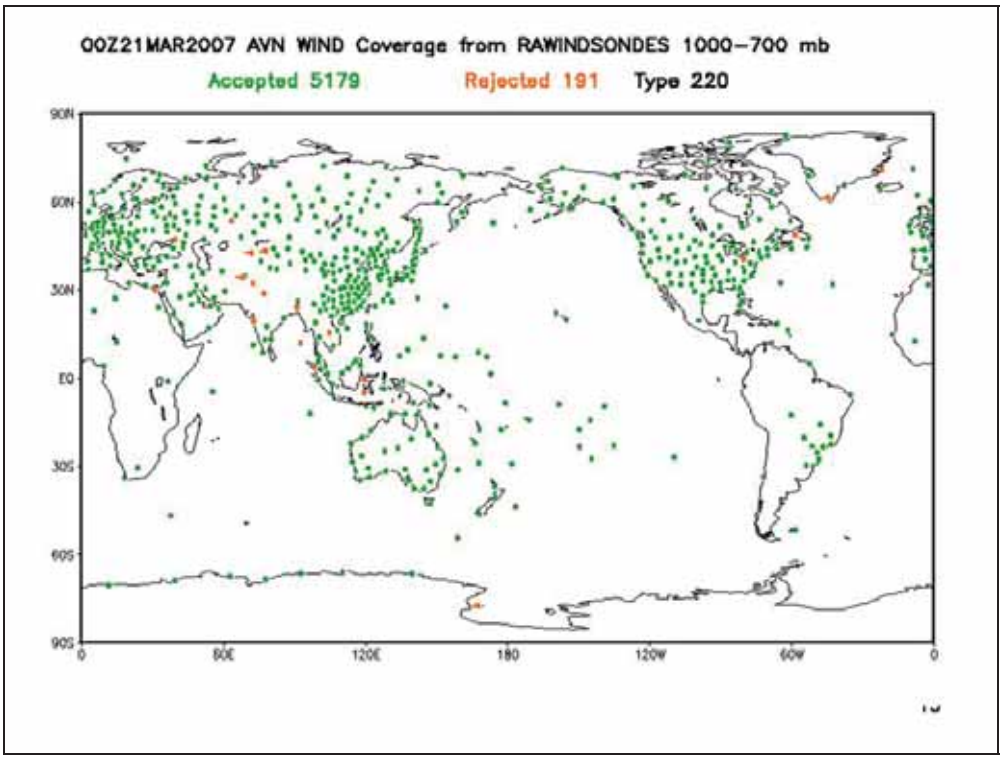
10

Upper air observations

11

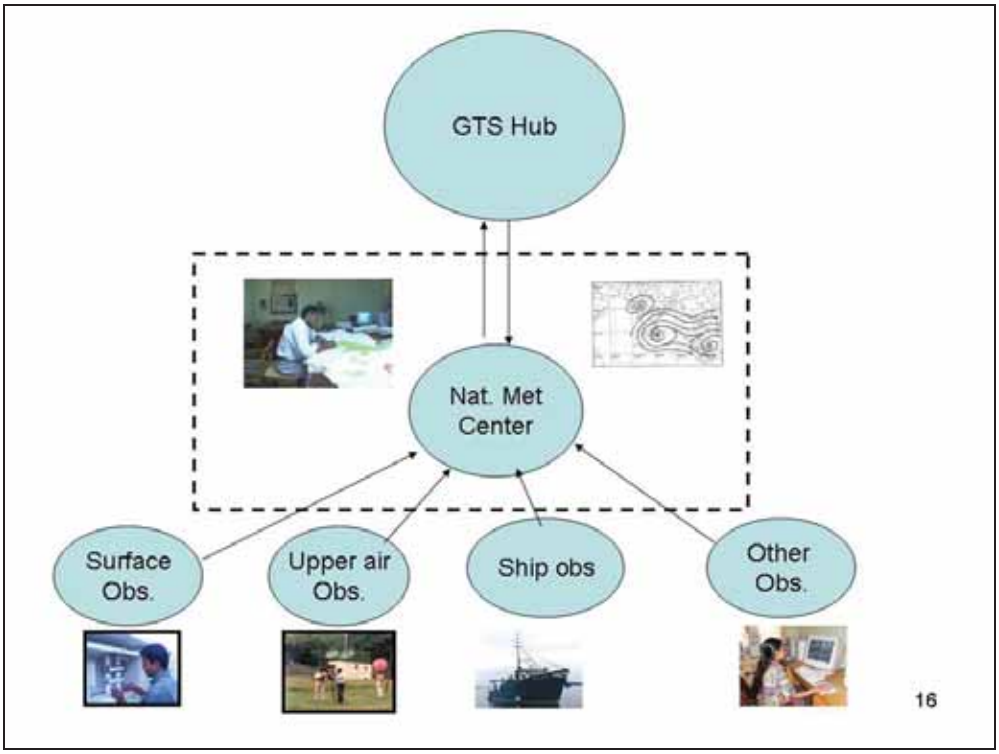
Ship observations

12

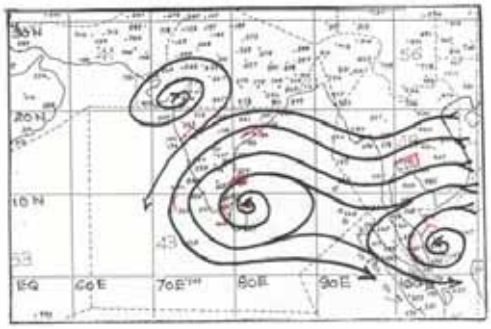

00Z21MAR2007 AVN WIND Coverage from RAWINDSONDES 1000-700 mb
Accepted 5179
Rejected 191
Type 220
90N
60N
30N
EQ
30S
60S
90S
0
60E
120E
180
120W
60W
0

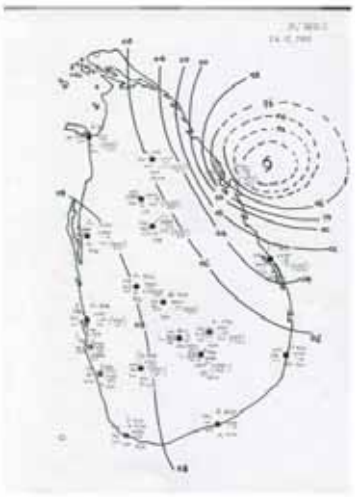
Satellite Receiving System for polar orbiting NOAA satellites

15



16





17

Qualitative Prediction

- Met. Data collection
- Transmitting to the NMC's
- Receiving the global data through GTS
- Plot data in standard charts
- Analyse the chart for possible weather events

18

Forecast Methods ….*contd..*

– Numerical Weather forecast (NWP)

mathematical model(s) that purportedly represents the atmospheric processes, starting with a given initial condition, use the model to calculate the future state of the atmosphere

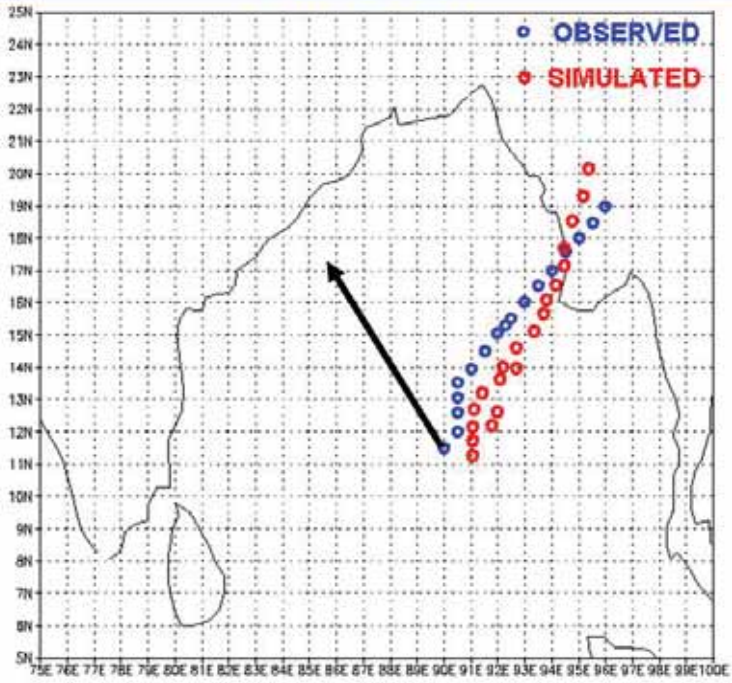
19

Is NWP Advantages over other Methods?

- Quantitative in Nature
- Specific to a location
- Specific to a time
- Past knowledge on state is not required

20

TRACK OF CYCLONE MALA (26 – 30 April 2006)



21

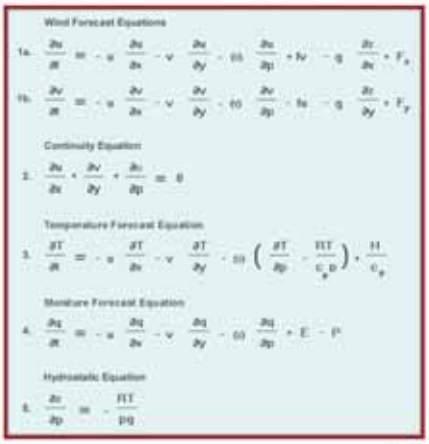
What all we require to run NWP Models?

- Mathematical Models

22

NWP Model

An NWP Model is a set of equations programmed in computer languages



23

Requirements for NWP Model

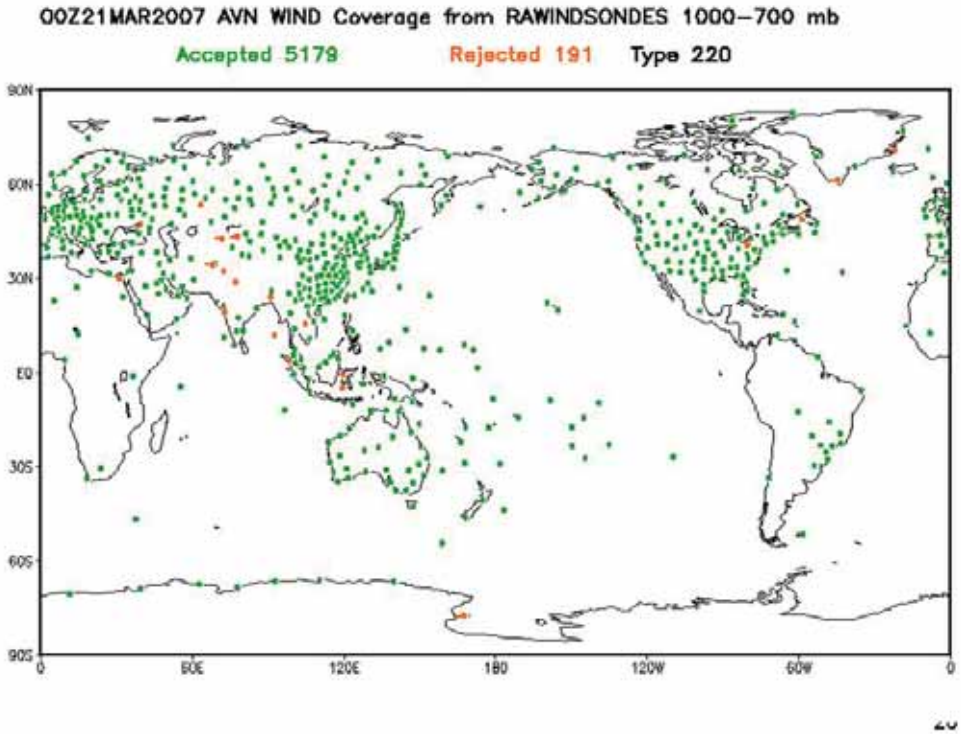
Computing System

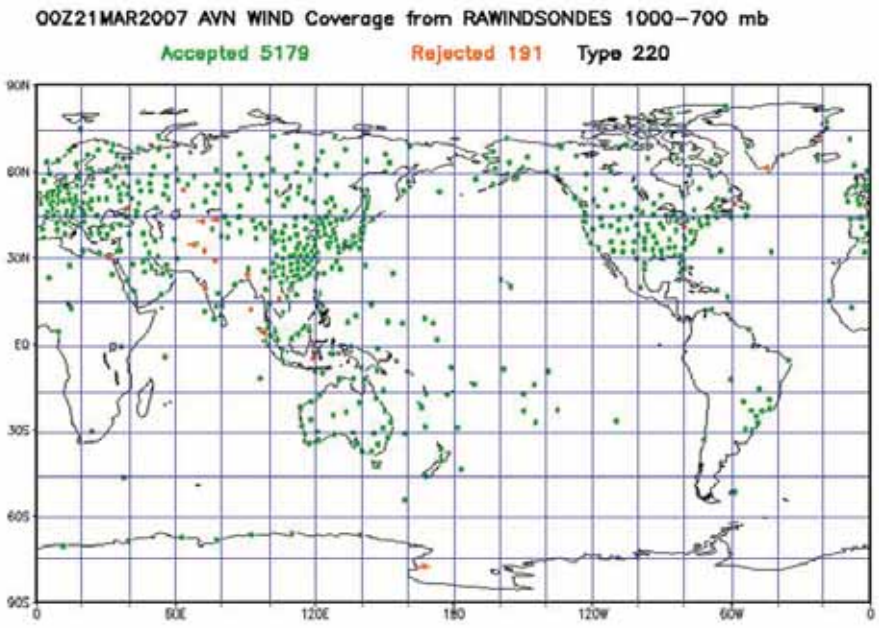
24

Requirements for an NWP Model

Initial and boundary conditions (Data)

25





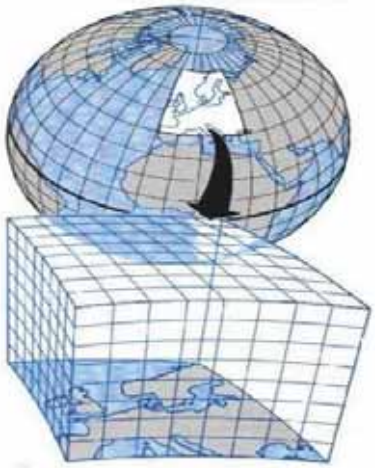
Model Grid in an NWP Model

Prognostic variables

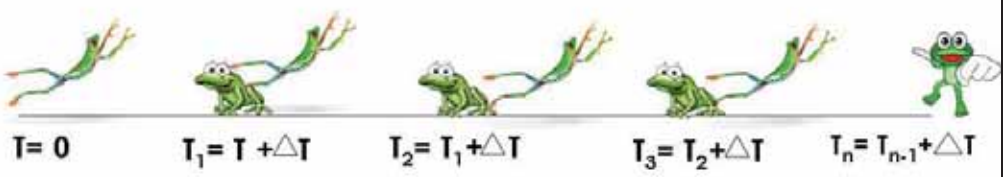
Diagnostic variables

Constants

Model levels



28



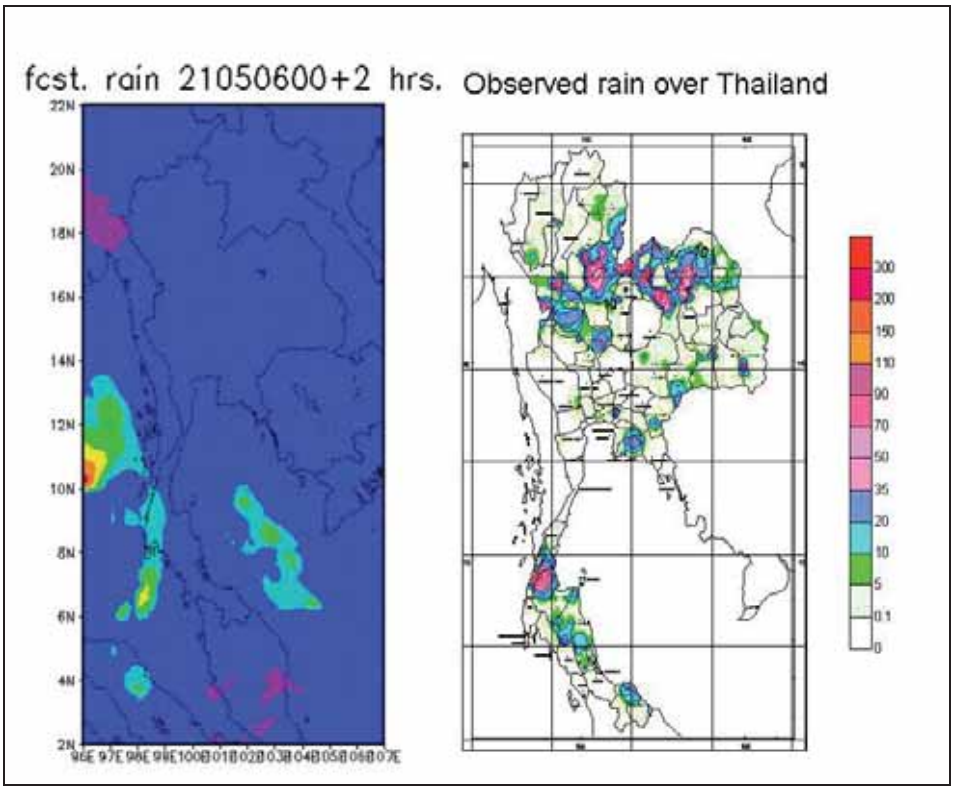
29

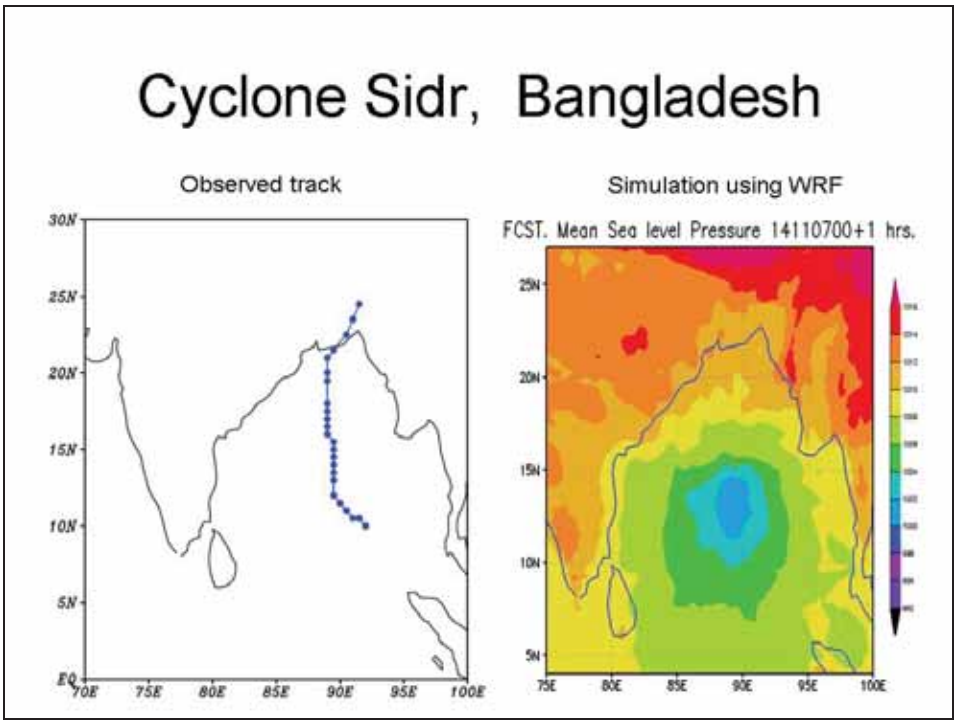
Types of Numerical Weather Predictions

- Short Range Forecasting

  (Valid upto 3 days)
  - Meso-scale weather events
  - More location specific forecast available
  - Cheap in computer time

30


fcst. rain 21050600+2 hrs.
Observed rain over Thailand
22N
20N
18N
16N
14N
12N
10N
8N
6N
4N
2N
300
200
150
100
90
70
50
35
20
10
5
0.1
0


Cyclone Sidr, Bangladesh
Observed track
Simulation using WRF
FCST. Mean Sea level Pressure 14110700+1 hrs.
30N
25N
20N
15N
10N
5N
EQ
70E
75E
80E
85E
90E
95E
100E
25N
20N
15N
10N
5N
75E
80E
85E
90E
95E
100E

- Medium Range Forecasting

(Valid upto one week)

- Generally Global in Nature
- Large Scale features are embeded
- Extended lead time of forecast
- Boundary conditions not required

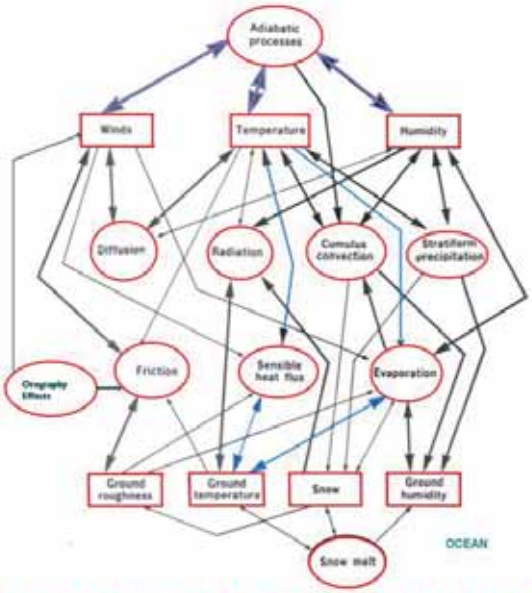
33

- Extended Range Forecasting

(Valid for a season)

- *Global in nature (regional Models are also used)*
- *Seasonal and Intra seasonal forecast is available*
- *Mean fields are available*

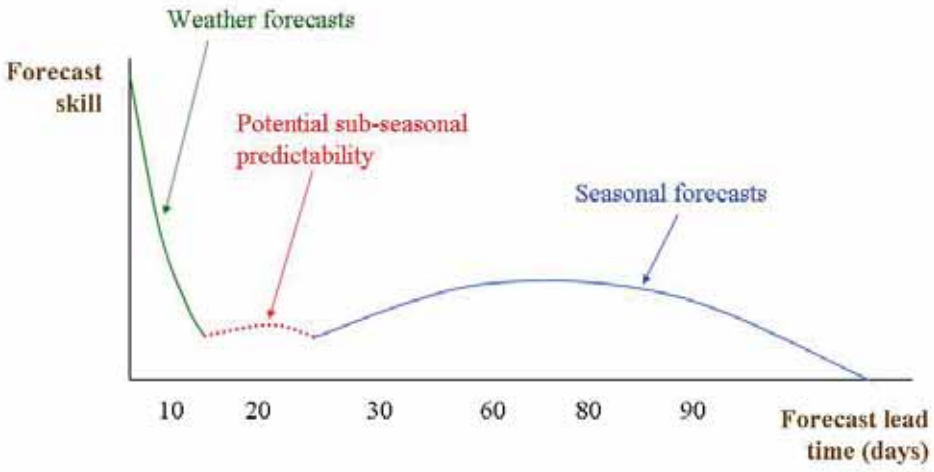
34



The thickness of the arrows represented qualitatively the importance of the interactions.
Any close loop indicates a feed-back phenomenon.
(ED: Temp → Evp → Ground Temp → Sen Heat Flux → Temp).
The physical processes and the feedback mechanisms to be incorporated in a numerical model.

35

A Schematic Diagram : Lead time and forecast skill



36

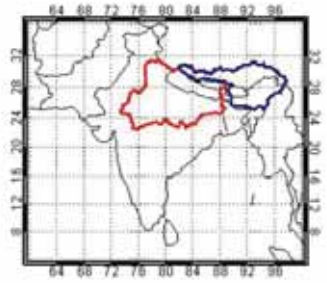
Climate Forecast Applications in Bangladesh

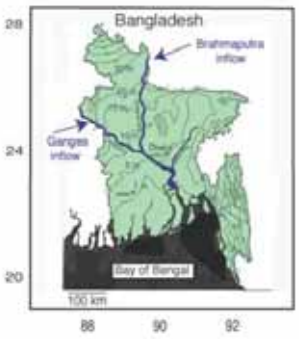
Short Term Forecast (1-10 days)

37

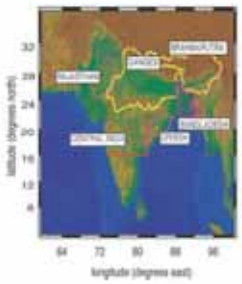
Challenge:

- Upstream data is not available from either the Ganges or the Brahmaputra.
- Only hydrological data available is river flow measured at boundaries of India and Bangladesh
- Forecast schemes have to assume that the Ganges and Brahmaputra are ungauged river basin





Background Techniques

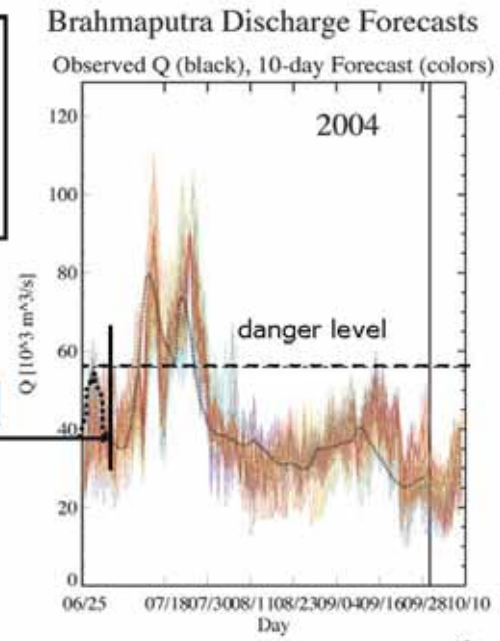


- To approach the problem of catchment precipitation forecasting, a nest of physical models are developed that depend on:
  - Satellite data
  - Forecasts from operational centers (e.g. ECMWF)
  - Statistical post-processing

39

Summary of 1-10 days forecasts for 2004

With data to here

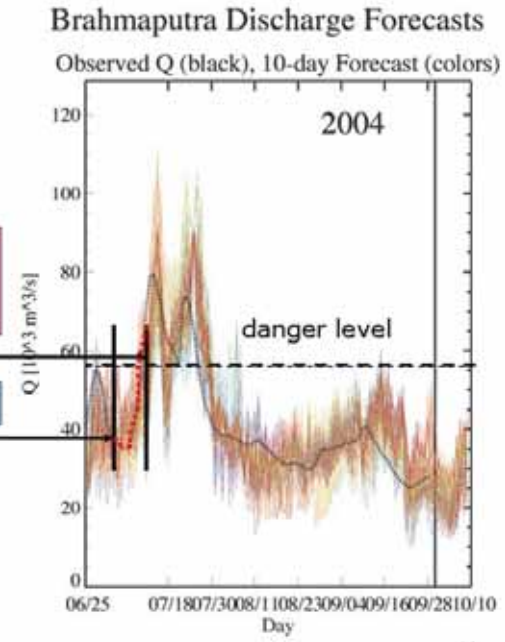


40

1-10 days (cont)

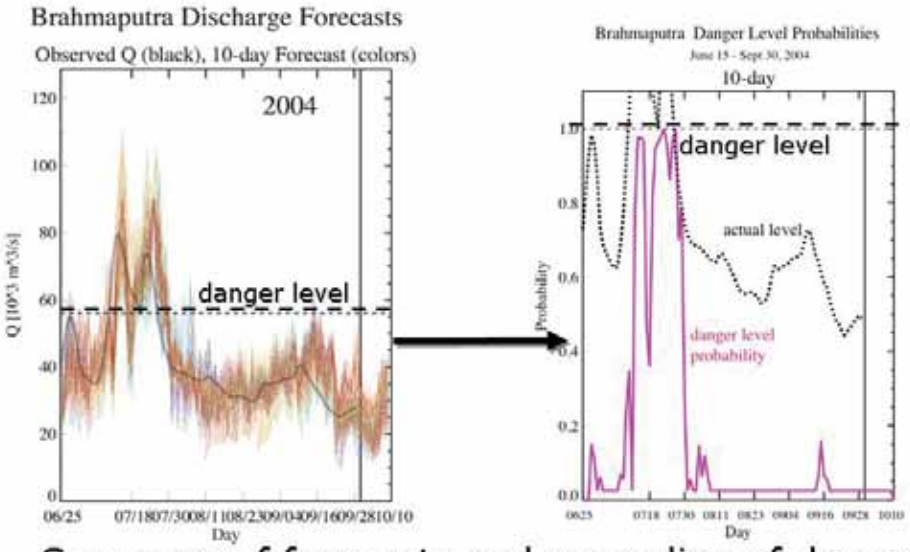
We forecast probability of danger flood level being exceeded 10 days later!

With data here



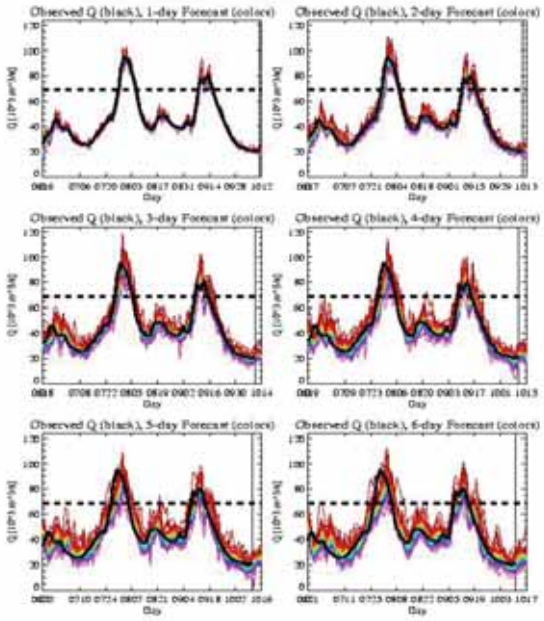
41

Short-term 10-day Operational Forecasts for Brahmaputra and Threshold Probabilities

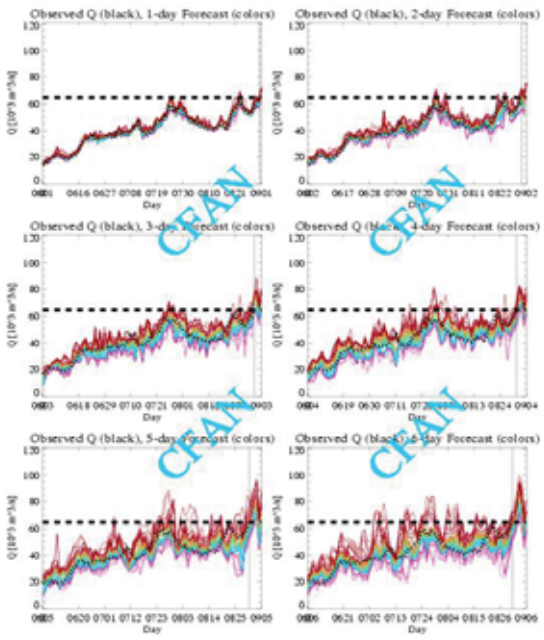


Summary of forecasts and exceeding of danger level

42

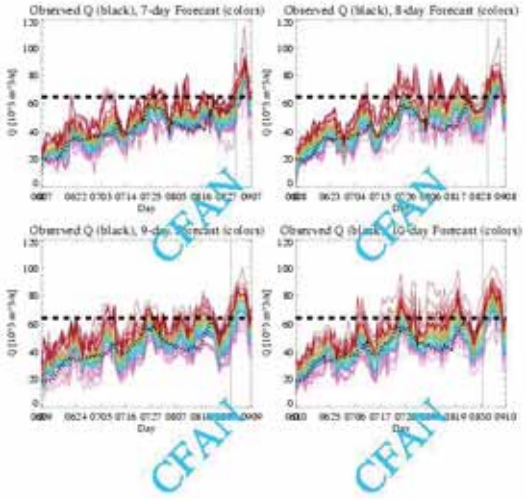

Multi-Model Brahmaputra Discharge Forecasts
1-6 day using ECMWF Precipitation Forecasts
Forecasts Initialized June 15, 2007 - October 11, 2007
Observed Q (black), 1-day Forecast (colors)
Observed Q (black), 2-day Forecast (colors)
Observed Q (black), 3-day Forecast (colors)
Observed Q (black), 4-day Forecast (colors)
Observed Q (black), 5-day Forecast (colors)
Observed Q (black), 6-day Forecast (colors)
Day

43


Multi-Model Brahmaputra Discharge Forecasts
1-6 day using ECMWF Precipitation Forecasts
Forecasts Initialized June 3 - August 31, 2008
Observed Q (black), 1-day Forecast (colors)
Observed Q (black), 2-day Forecast (colors)
Observed Q (black), 3-day Forecast (colors)
Observed Q (black), 4-day Forecast (colors)
Observed Q (black), 5-day Forecast (colors)
Observed Q (black), 6-day Forecast (colors)
Day
CFAN

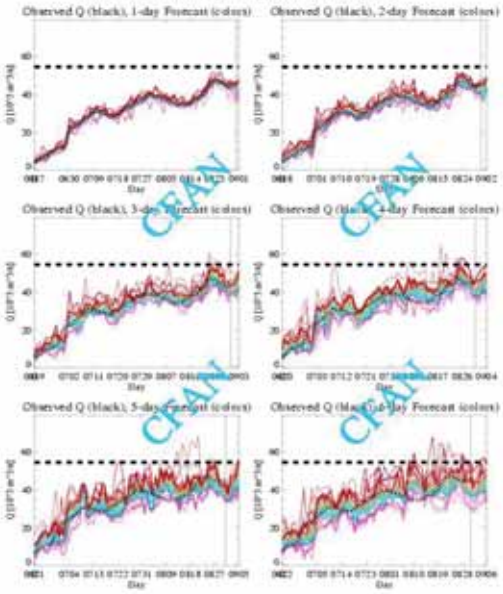
44

Multi-Model Brahmaputra Discharge Forecasts
7-10 day using ECMWF Precipitation Forecasts
Forecasts Initialized June 3 - August 31, 2008



45

Multi-Model Ganges Discharge Forecasts
1-6 day using ECMWF Precipitation Forecasts
Forecasts Initialized June 16 - August 31, 2008



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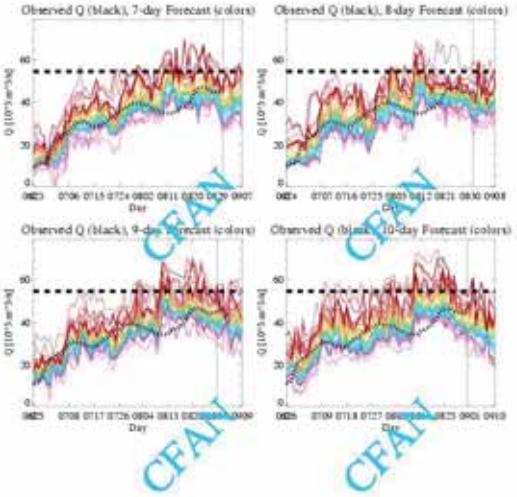
Multi-Model Ganges Discharge Forecasts

7-10 day using ECMWF Precipitation Forecasts

Forecasts Initialized June 16 - August 31, 2008



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Thanks

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Exercise:

Representative rainfall and temperature over district in Bangladesh are tabulated below for the period 1990 to 2005. From the data provided below find the following:
a) Normal rainfall for the period b) Draw the normal rainfall line in the figure given below c) Mark the rainfall and temperature each year in the chart and d) Find out the drought and flood years during those period from the graph.

Year	Rainfall (cm)	Temp(°C)
1990	202	27.0
1991	202	26.8
1992	234	24.2
1993	197	27.3
1994	164	29.3
1995	202	27.1
1996	221	26.3
1997	208	27.2..
1998	176	29.6
1999	195	26.4
2000	199	27.1
2001	202	27.2
2002	194	27.1
2003	196	26.9
2004	205	27.6
2005	224	25.1

Answers:

Answers

Normal rainfall: Flood years: Drought years:

Module 'Two'

Item M2a: Lecture on Climate Change Impacts and Adaptation

adpc

Climate Change Impacts and Adaptation

Atiq Kainan Ahmed
Social Scientist
Asian Disaster Preparedness Center
Email: atiqka@adpc.net

Outline

- Climate change and its impacts
- Impacts on Agriculture/Sectors
- Concept: Climate Change Adaptation
- Types and modes of adaptation

2

adpc

Defining Climate Change

"… any change in climate over time, whether due to natural variability or as a result of human activity (IPCC:2007).

… a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods (UNFCC)

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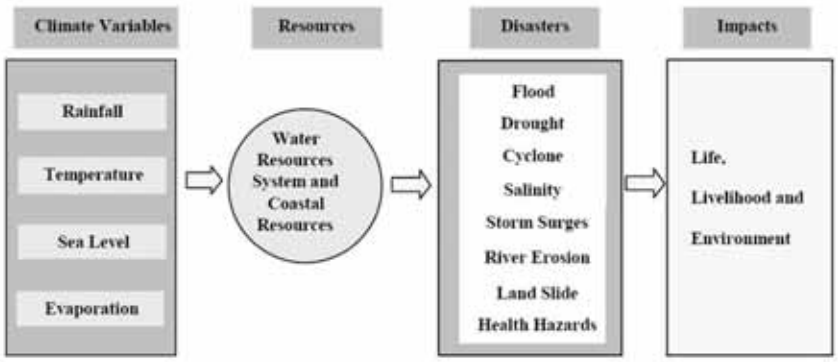
Year	Mean Temperature Change (°C)			Mean Precipitation Change (%)			Sea Level Rise		
	Annual	DJF	JJA	Annual	DJF	JJA	IPCC (Upper range)	SMRC	NAPA
2030	1.0	1.1	0.8	5	-2	6	14	18	14
2050	1.4	1.6	1.1	6	-5	8	32	30	32
2100	2.4	2.7	1.9	10	-10	12	88	60	88

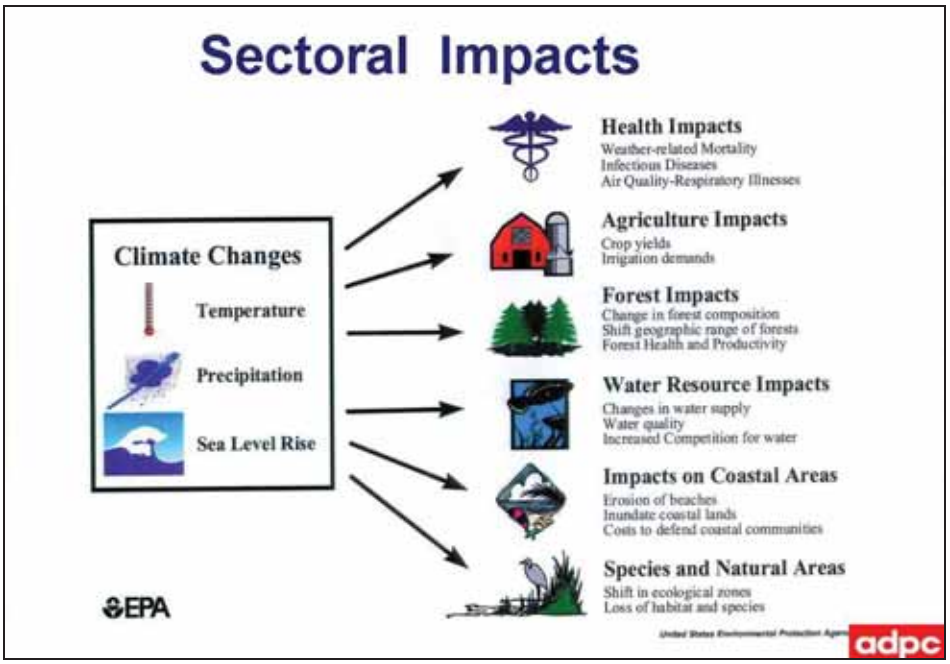
Note: DJF= December-January-February; JJA= June-July-August, SMRC= SAARC Meteorological Research Center *(Source: Adopted from IPCC 2001, OECD Report 2003)*

Impacts of Climate Change

- **physical impacts** (on ecosystems, infrastructure, humans)
- **social impacts** (on health, education, networks and family)
- **economic impacts** (costs for preparedness, costs for recovery, costs for addressing social and physical impacts)

CC and impacts



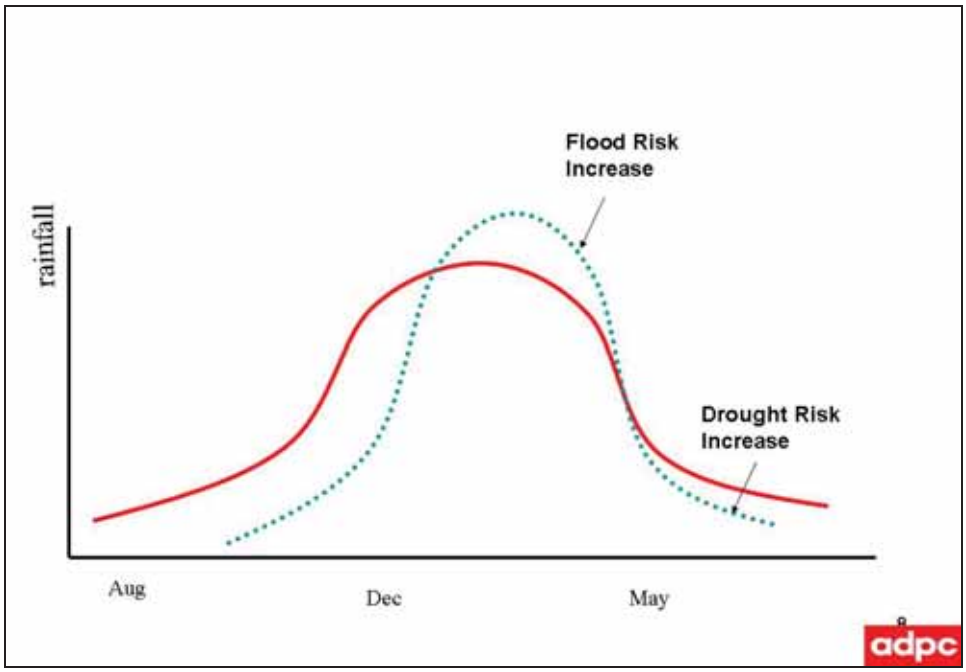


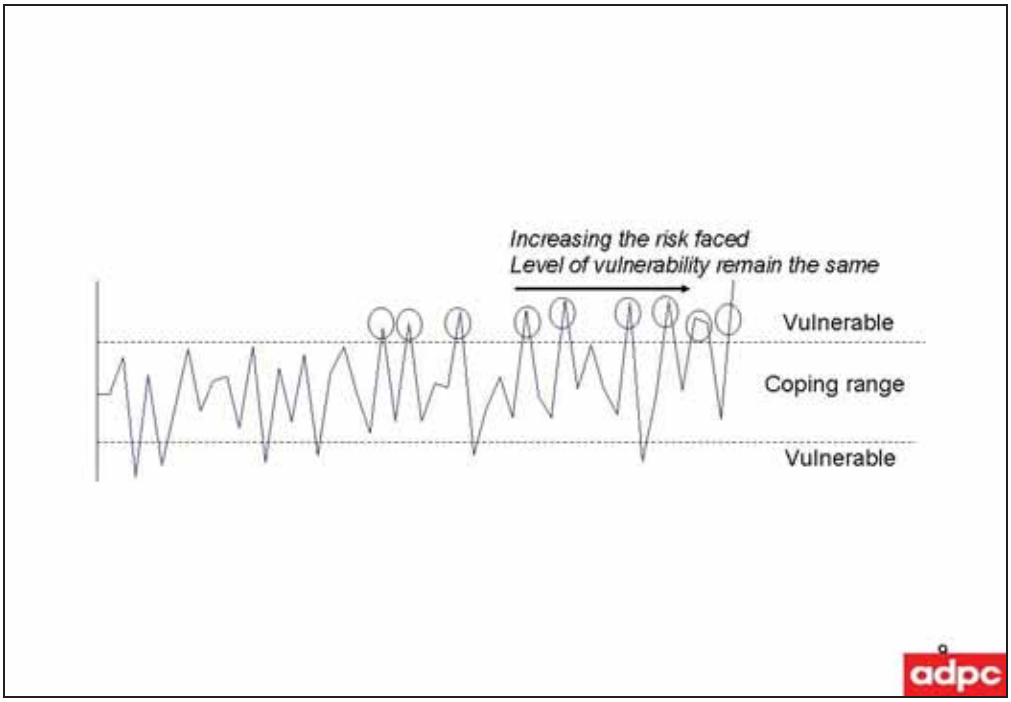
Why Adaptation?

- Climate change impacts become apparent
- Failing to reduce greenhouse gas emissions
- Responding to a changing climate requires adjustments and changes
- Sustainable development linkage

7

adpc


Flood Risk
Increase
rainfall
Drought Risk
Increase
Aug
Dec
May
adpc


Increasing the risk faced
Level of vulnerability remain the same
Vulnerable
Coping range
Vulnerable
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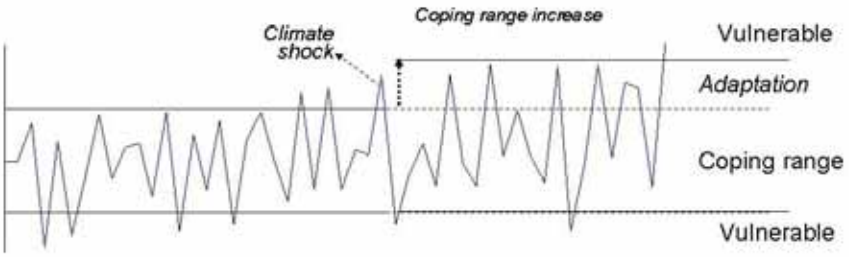
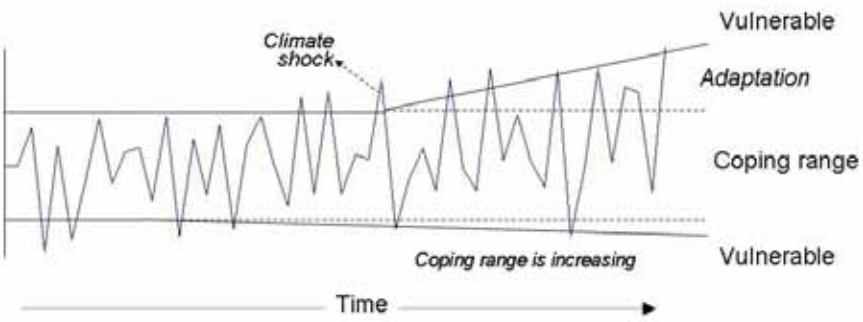
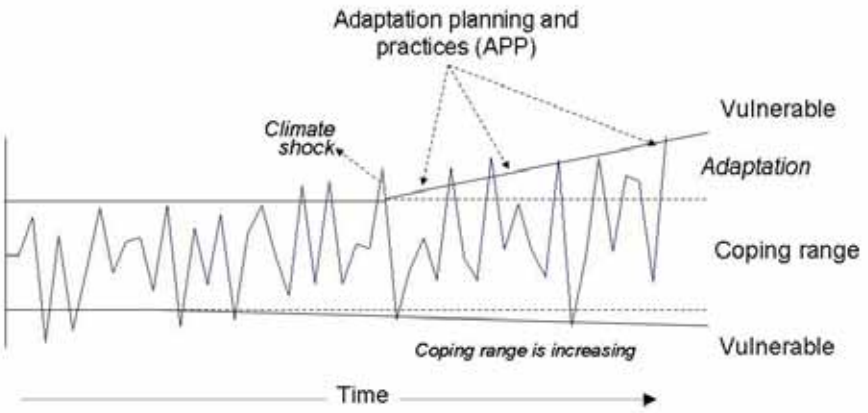

Coping range increase
Climate shock
Vulnerable
Adaptation
Coping range
Vulnerable


Climate shock
Vulnerable
Adaptation
Coping range
Coping range is increasing
Vulnerable
Time



So, what is CC "Adaptation"?

*Adaptation is the **adjustment** in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC:2007)*

"Adaptation" is possible adjustments (spontaneous or planned) of people, plants or ecosystems to climate change to reduce adverse impacts, to take advantage of opportunities or to cope with the consequences of climate change.

- A **process** of adjusting to changes in variables that influence e.g. human wellbeing & survival, ecosystems
- Takes place at **different levels**, with **different actors**, different levels of consciousness, purpose and timing

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Theoretically possible modes of adaptation

- Bear losses
- Share losses
- Modify threat
- Prevent effects
- Change use and
- Change location

		Anticipatory	Reactive
Natural Systems			· Changes in length of growing season · Changes in ecosystem composition · Wetland migration
Human Systems	Private	· Purchase of insurance · Construction of house on stilts · Redesign of oil rigs	· Changes in farm practices · Changes in insurance premiums · Purchase of air-conditioning
	Public	· Early-warning systems · New building codes, design standards · Incentives for relocation	· Compensatory payments, subsidies · Enforcement of building codes · Beach nourishment

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Practiced types of adaptation

- Serendipitous/unanticipated adaptation
- Climate-Proofing of Development Efforts
- Discrete Adaptation

(WRI: 2007)

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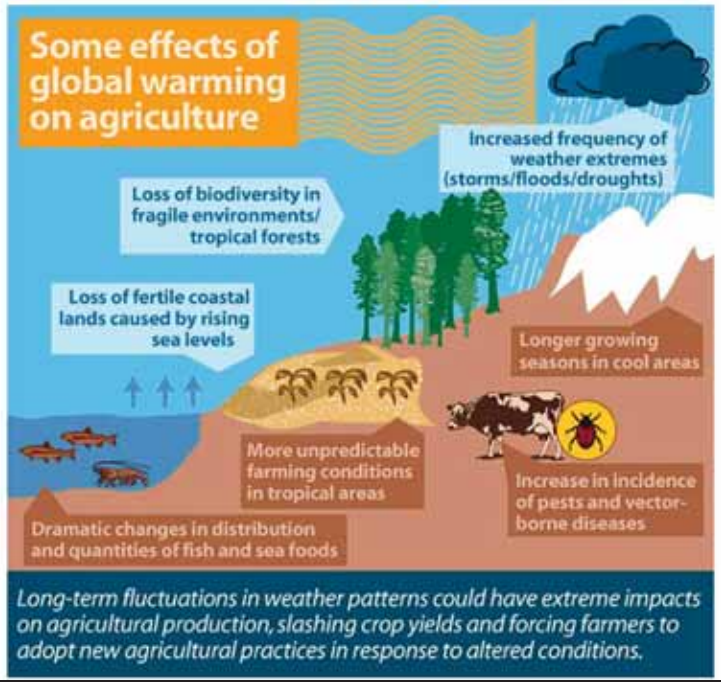

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Anticipated trends

- ***Changes in water resources demand and availability.*** Precipitation, evaporation, transpiration, etc., can all change. Flood control, drainage, and irrigation infrastructure will have to evolve with the changes.
- ***Greater risks for monoculture.***
- ***Changes in disease and pest ranges and severity.*** Changes in temperature, hydrologic regime, frost dates, etc., will affect disease and pest prevalence, and host susceptibility.
- ***Coastal inundation, saline groundwater intrusion, drainage congestion.*** As sea level rises, low-lying countries will be affected.

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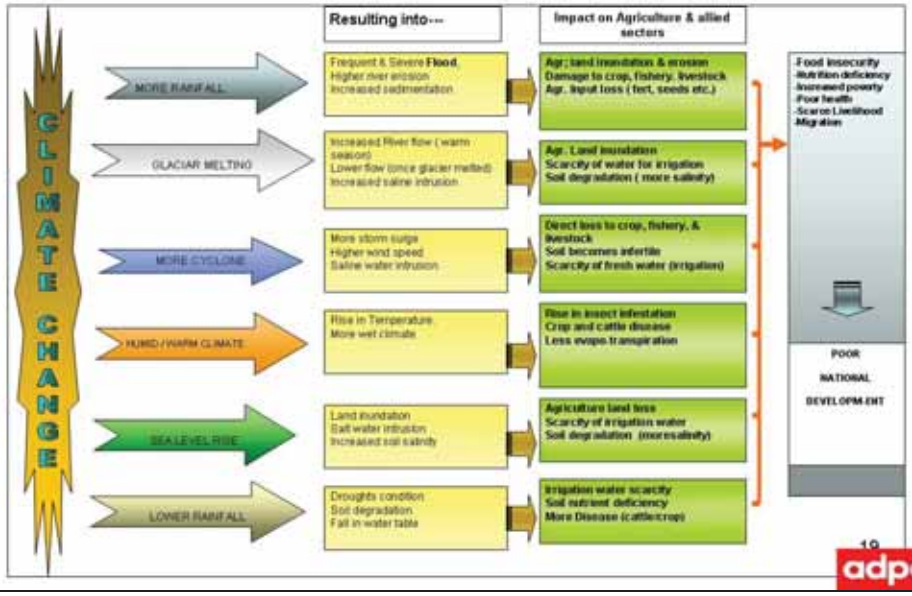
Impact on agriculture and allied sectors



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Impacts of coastal zone of BGD

Agents of Change / Primary Physical Effects		Salt-water Intrusion	Drainage Congestion	Coastal Morphology	Cyclone and Storm Surges
Climate change (temperature, precipitation, evapo-transpiration)		+	+	-	+++
Changes of upstream river discharge	Peak	-	++	+++	-
	Low	+++	-	-	-
Sea level rise		+++	+++	++	++
Subsidence		++	++	++	++

Source: Rahman, A., and Alam, M., 2004

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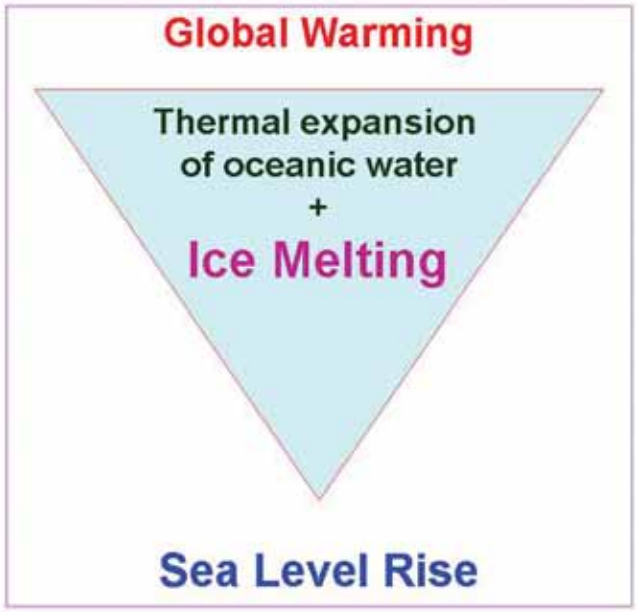

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Implications of SLR

- Sea level rise (SLR) will directly affect vast coastal area and flood plains of Bangladesh.
- 10 cm SLR – 2020 inundate 2% of the country
- 25 cm SLR – 2050 inundate 4 % of the country
- 1m SLR – 2100 about 17 % of the country

Twenty million people, engaged in salt/ shrimp production, fishery/ agriculture, and other businesses will be directly affected.

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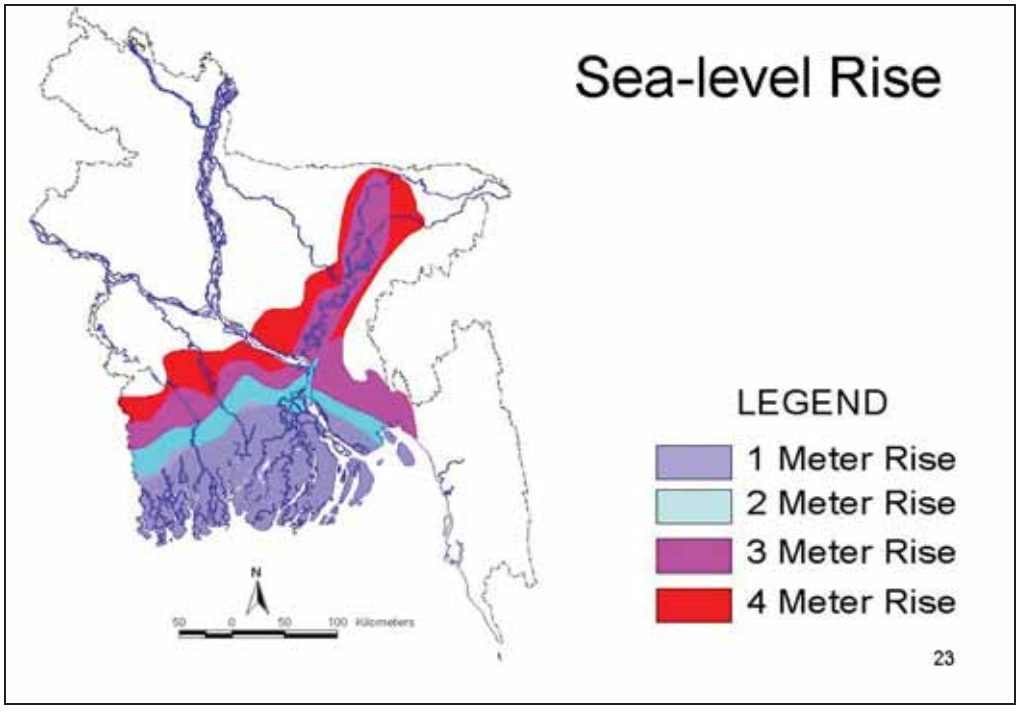
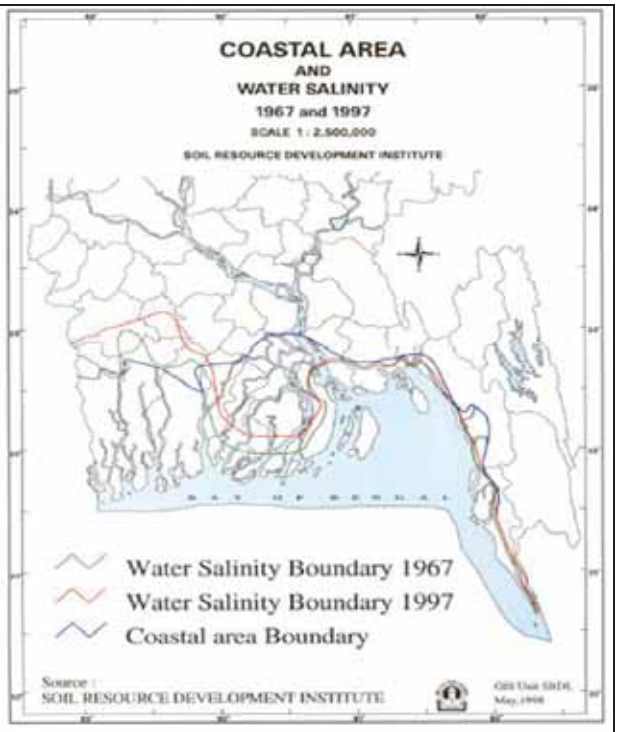
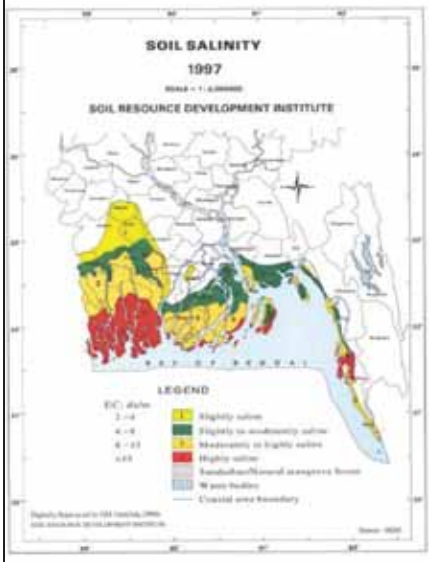
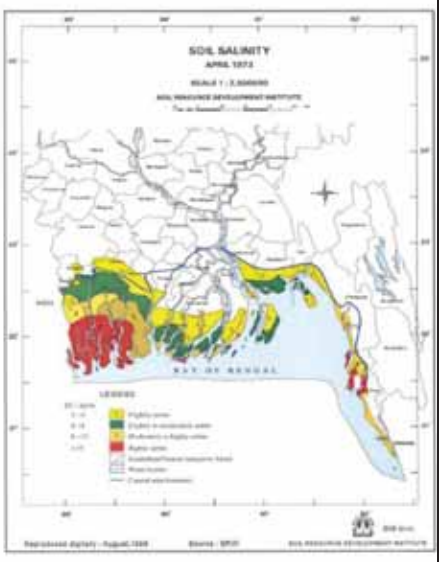


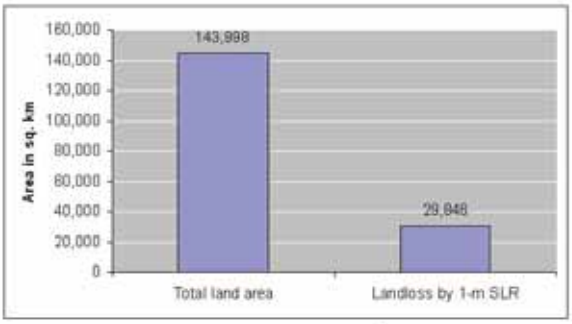
Water Salinity Intrusion



Soil Salinity Intrusion

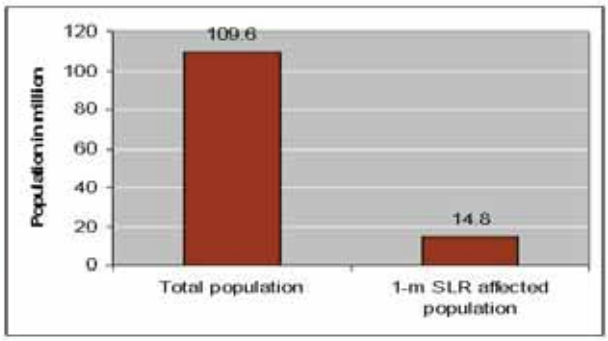






Land loss by 1-m SLR

Population affected by 1-m SLR



Impacts on basic needs- 1 Meter SLR Scenario

Physical Existence and Shelter:

- 29,846 sq. km. area of land will be lost
- 14.8 million people will be landless, losing their house

Food:

- SLR would flood agricultural lowlands and deltas decreasing food production
- Only salinity intrusion will reduce 0.2 million metric ton of rice production

Health:

- SLR will increase the risk of cholera and other diseases
- Accelerate flood intensity facilitating transmission of other gastrointestinal disease

Education:

- SLR will cause destruction of infrastructure including educational institutes

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Impacts on the Sundarbans

- 10 cm SLR will inundate 15% of the Sundarbans
- 25 cm SLR will inundate 40% of the Sundarbans
- 45 cm SLR will inundate 75% of the Sundarbans
- 60 cm SLR will inundate 100% of the Sundarbans
- 1 - M SLR will impact almost whole Sundarbans

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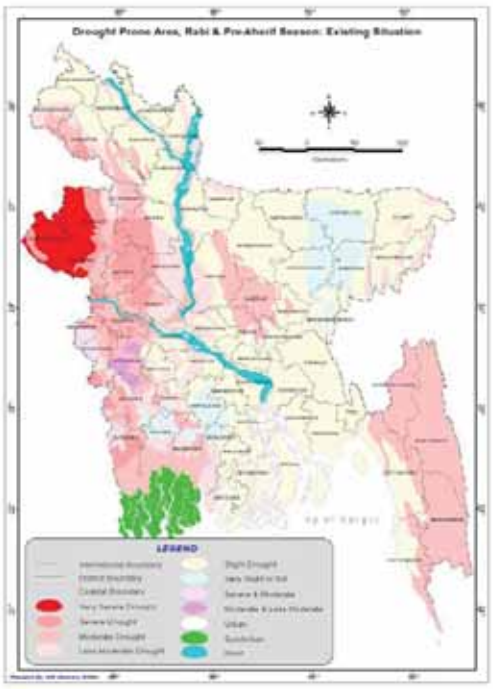

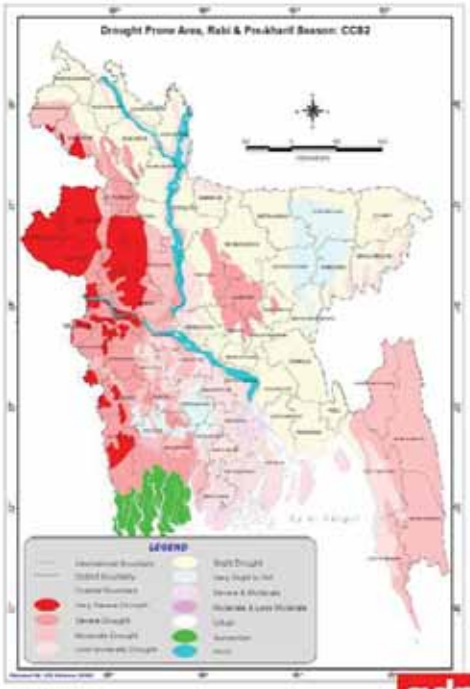

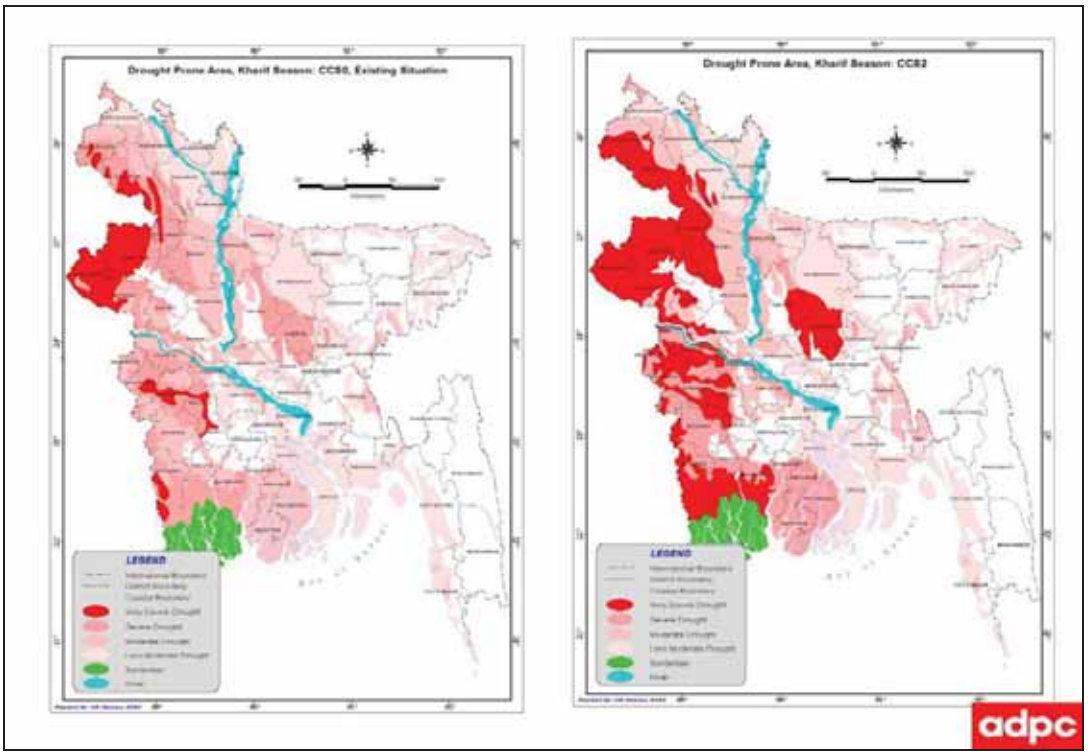

Limits or barriers to adaptation

- Physical and ecological limits
- Technological limits
- Financial barriers
- Informational and cognitive barriers
- Social and cultural barriers

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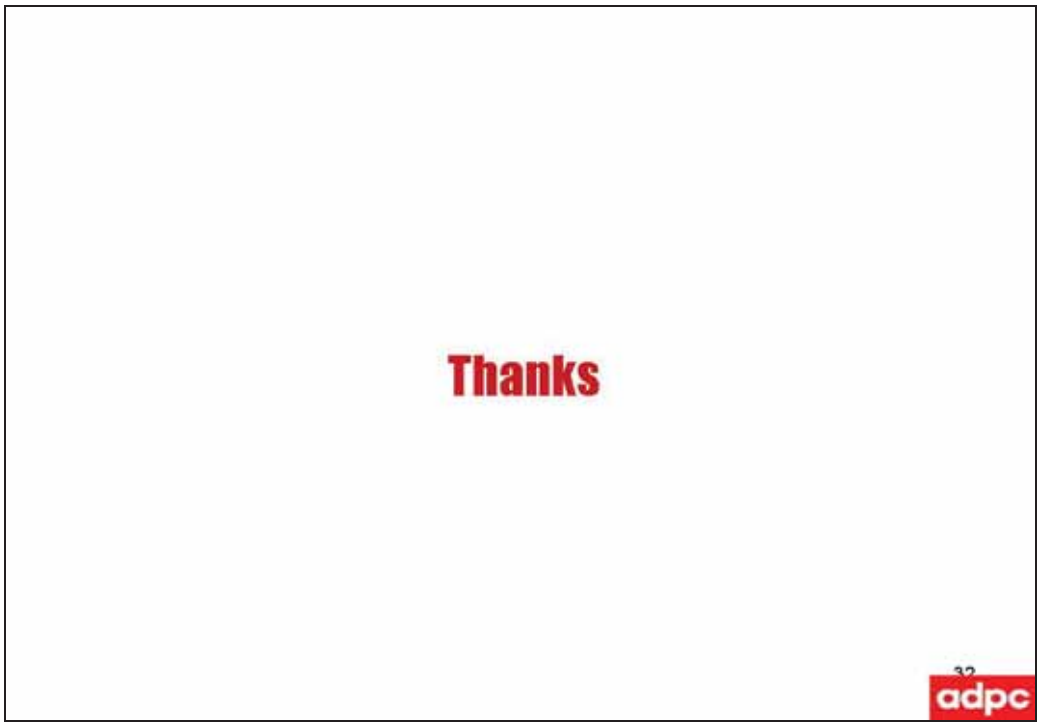
Thanks
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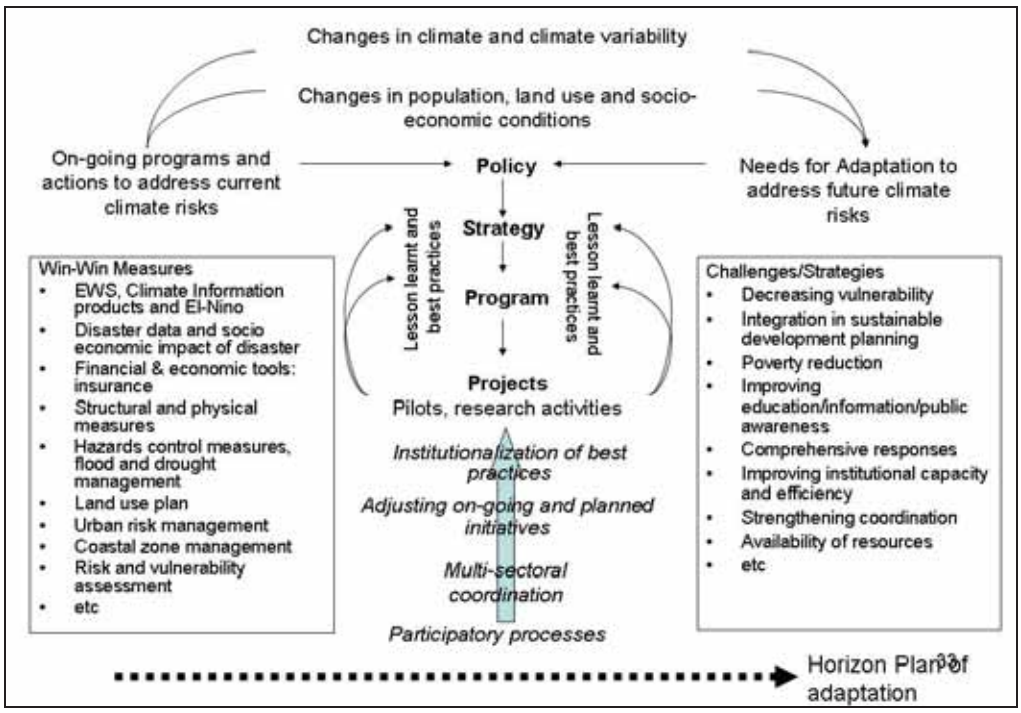
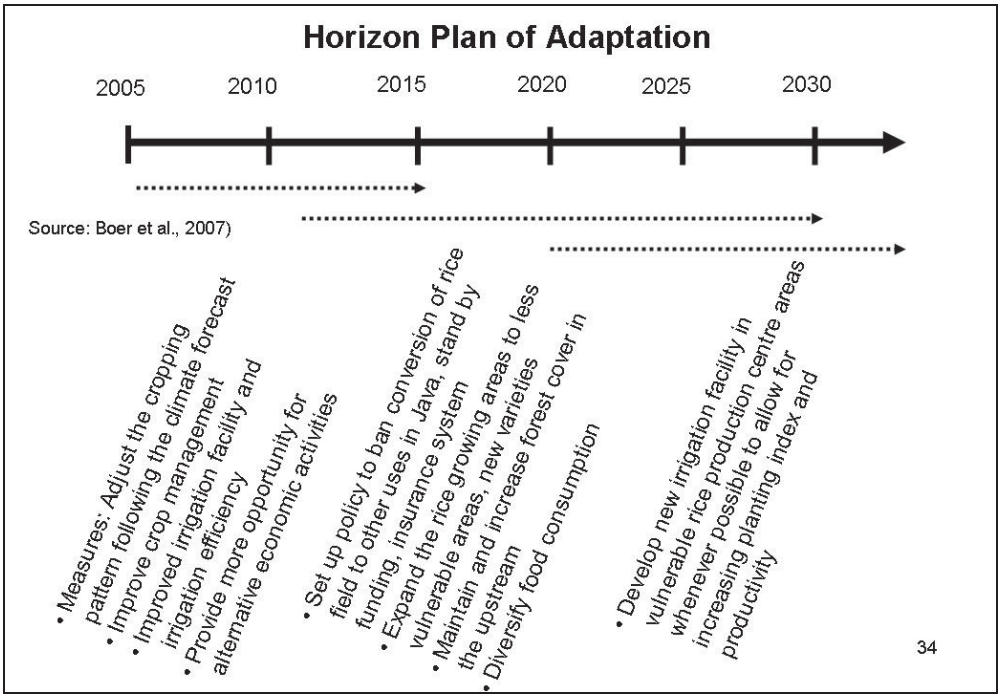
Some additional slides for sharing and information:





Other words that are often used:

- Adjustment
- Response
- Coping
- Risk Reduction
- Reducing vulnerability
- Development

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Terms to describe characteristics of systems pertinent to adaptation*

Sensitivity	Degree to which a system is affected by, or responsive to, climate stimuli
Susceptibility	Degree to which a system is open, liable or sensitive to climate stimuli (similar to sensitivity, with some connotations toward damage)
Vulnerability	Degree to which a system is susceptible to injury, damage, or harm (one part — detrimental — of sensitivity)
Impact Potential	Degree to which a system is sensitive or susceptible to climate stimuli
Stability	Degree to which a system is not easily moved or modified
Robustness	Strength; degree to which a system is not given to influence
Resilience	Degree to which a system rebounds, recoups or recovers from a stimulus
Resistance	Degree to which a system opposes or prevents an effect of a stimulus
Flexibility	Degree to which a system is pliable or compliant (similar to adaptability, but more absolute than relative)
Coping Ability	Degree to which a system can successfully grapple with a stimulus (similar to adaptability, but includes more than adaptive means of "grappling")
Responsiveness	Degree to which a system reacts to stimuli (broader than coping ability because responses need not be "successful")
Adaptive Capacity	The potential or capability of a system to adapt to (to alter to better suit) climatic stimuli
Adaptability	The ability, competency or capacity of a system to adapt to (to alter to better suit) climatic stimuli

Source: Smit et al. (2000) An Anatomy of Adaptation to Climate Change and Variability

Source: Smit *et al.* (1999) The Science of Adaptation: A Framework for Assessment

General Differentiating Concept or Attribute	Examples of Terms Used	
Purposefulness	autonomous spontaneous automatic natural passive	planned purposeful intentional policy active strategic
Timing	anticipatory proactive *ex ante*	responsive reactive *ex post*
Temporal Scope	short term tactical instantaneous contingency routine	long term strategic cumulative
Spatial Scope	localized	widespread
Function/Effects	retreat - accommodate - protect prevent - tolerate - spread - change - restore	
Form	structural - legal - institutional - regulatory - financial - technological	
Performance	cost - effectiveness - efficiency - implementability - equity	

Table 2. Bases for Differentiating Adaptations.

Item M2b: Group exercise on identification of sectoral impacts and adaptation

Group work: Sectoral Impacts and Adaptation

Sector: _____

Observed Impacts	Adaptation measures	Remarks

Module 'Three'

Item M3a: Exercise on Climate Change Adaptation and Evaluations

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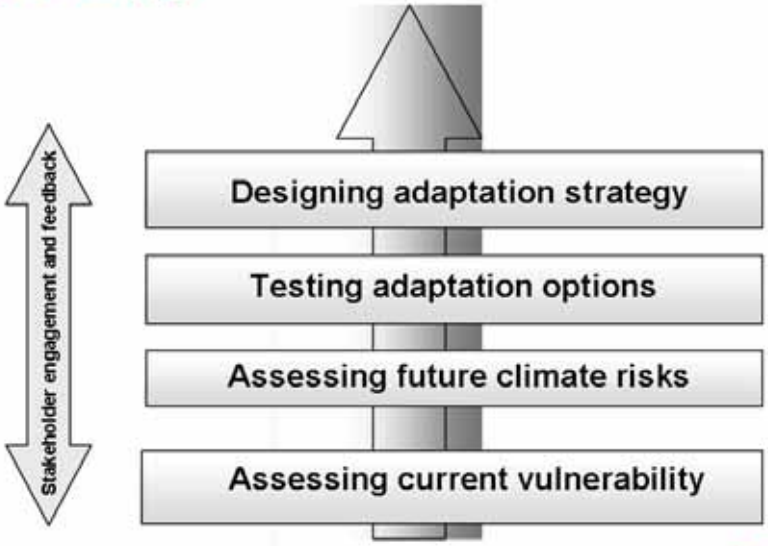
Adaptation Evaluations

Atiq Kainan Ahmed
Social Scientist
Asian Disaster Preparedness Center
Email: atiqka@adpc.net

Key strategy



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Criteria for evaluation

	Adaptation options/ measures	Rationale for considerations
Inclusion criteria	Climatic issues related measures	To consider the immediate and urgent issues of climate change
	Climate change and development related measures	To consider the mainstreaming and policy conformity issues
Exclusion criteria	Development only measures	These are not regular measures rather than climate change related.
	Non-climatic measures	These are not related to climate change vulnerabilities or reduction of it.

1. Climate issues related measure
2. Climate change and Development measure
3. Development only measure
4. Non-climatic measure

LACC Adaptation Options

Sl #	Name of the Adaptation Options
1	Seedbed method for T. *Aman* rice
2	Depth of transplanting for T. *Aman*
3	Weed control-reduce water seepage
4	Manual closing of soil cracks
5	Strengthening field bunds (Ail lifting)
6	Impact of water saturated soil condition on rice cultivation
7	Raise seedbed in the high land and prepare floating seedbed
8	Zero tillage potato cultivation and maize cultivation

LACC Adaptation Options

Sl #	Name of the Adaptation Options
9	Cultivation of local and HYV T. Aman rice to assess the comparative advantages of the varieties in the recurrent drought and saline condition
10	Cultivation of saline tolerant local and HYV *Boro* rice to assess the comparative advantages of the varieties in the recurrent saline problems in the coastal area
11	Excavation of mini-ponds
12	Excavation of canals
13	Re-excavation of traditional ponds
14	Re-excavation of khari canals (north-west)

LACC Adaptation Options

Sl #	Name of the Adaptation Options
15	Re-excavation of traditional canal and preserving fresh/sweet water in the canal by erecting mud bund/wall for subsequent irrigation
16	Canal re-excavation for supplementary irrigation (south-west)
17	Water Control Structures
18	Facilitate drainage by re-excavating the traditional canals
19	Installation of shallow and Deep Tube Wells
20	Supplemental Irrigation

LACC Adaptation Options

Sl #	Name of the Adaptation Options
21	System of Rice Intensification
22	Direct sown rice (drum seeder)
23	Drought resistant rice varieties
24	Green Manure – T.*Aman* system
25	*T. Aus* – Chini atap system
26	*T. aman* – Mustard/linseed system
27	*T. aman* – Chickpea
28	*T. aman* – Mung bean
29	Relay cropping of T. Aman with grass pea and mustard
30	Cultivation of pulse, oil, spices crops

LACC Adaptation Options

Sl #	Name of the Adaptation Options
31	Famine reserve crops
32	Jujube cultivation
33	Homestead vegetable gardening
34	Mulberry intercropping in rice
35	Fodder cultivation
36	Fish cultivation in mini ponds
37	Cottage industries
38	Manufacturing industries
39	Mini Nursery
40	Mixed Fruit Garden

LACC Adaptation Options

Sl #	Name of the Adaptation Options
41	Cultivation of Pigeon Pea (Arahar) in the Fallow Land
42	Boat garden
43	Indigenous fish culture in pond such as *Koi, shing, Rui, Katla* etc
44	*Pata* (Compartmentalization by bamboo mat in stagnant water) fish cultivation
45	Prawn (golda) culture in low land/ T. Aman rice field
46	Small pond Fish breeding practices
47	Cultivate saline tolerant fish
48	Protecting fish by putting-up fench/net around the pond

LACC Adaptation Options

Sl #	Name of the Adaptation Options
49	Vegetable cultivation at the boundary of shrimp/prawn field (*gher*)
50	Snail Cultivation in water lodged area
51	Goat rearing
52	Duck rearing
53	Drought resistant poultry (Cok) rearing
54	Cultivation of water lily in the water logged area
55	Flower cultivation
56	Mango cultivation
57	*Maize cultivation
58	*Papaya Cultivation

LACC Adaptation Options

Sl #	Name of the Adaptation Options
59	Community based biogas and tree planting
60	Improved stove
61	Seed storage for higher viability
62	Farm Yard Manure
63	Compost preparation
64	Cultivation of green manuring crops
65	Timber and fruit tree plantation in the roadside and in the homestead
66	Establishment of embankment to restrict saline water intrusion from the sea
67	Establishment/maintenance of embankment and sluice gate for saving crops from high tide and flood
68	Social mobilization for the Management of embankment and sluice gates through the water user groups in one union as pilot basis for growing rice and other crops as suitable to the area

Annex 3. Some relevant reference materials

Books and reports

Baas, S and Selvaraju, R (2007). Climate variability and change: Adaptation to drought in Bangladesh: A resource book and training guide
http://www.fao.org/nr/clim/abst/clim_070901_en.htm

ADPC (2005). Training modules for climate & flood forecast applications in agriculture. ADPC-FAO.
http://www.fao.org/sd/dim_pe4/pe4_060201_en.htm

FAO (2006). Livelihood Adaptation to Climate Variability and Change in Drought-Prone Bangladesh. FAO.
http://www.fao.org/sd/dim_pe4/pe4_061103_en.htm

Ahmed, AK and Chowdhury IA (2006). Study on livelihood systems assessment, vulnerable groups profiling and livelihood adaptation to climate hazard and long-term climate change in drought-prone areas of Northwestern Bangladesh. FAO.
http://www.fao.org/sd/dim_pe4/pe4_060701_en.htm

CEGIS (2005). Strengthening disaster risk management in the agricultural sector in Bangladesh. FAO.
http://www.fao.org/sd/dim_pe4/pe4_051201_en.htm

Relevant Websites:

FAO and Climate Change website
http://www.fao.org/climatechange/home/en/

FAO and Emergencies
http://www.fao.org/emergencies/current-focus/climate-change-adaptation/en/

FAO "Climpag" website
http://www.fao.org/nr/climpag/

Flood Forecasting and Warning Centre (FFWC), Bangladesh
http://www.ffwc.gov.bd/

Climate Forecast Applications Bangladesh (CFAB)
http://cfab.eas.gatech.edu/shortterm/home.html

Bangladesh Metrological Department
http://www.bdonline.com/bmd/

Barind Multipurpose Development Authority
http://www.bmda.gov.bd/

Ministry of Agriculture, Bangladesh website
http://www.moa.gov.bd/

Annex 4: List of participants in four training sessions

List of participants of two rounds of training for Junior Officers in Pabna and Khulna.

SL #	Name of participant	Name of Department / Organization	Tel./Cell No.	Zone	Date	Venue
1	Md. Azizul Islam	DAE, Bagatipara	1712441478	North	20 Oct., 2008	HDTC, Pabna
2	Md. A.Razzak	DAE, Bagatipara	01734-007681	North	21 Oct., 2008	HDTC, Pabna
3	Komol Kanti Kundu	DAE, Bagatipara	01717-331360	North	22 Oct., 2008	HDTC, Pabna
4	Md. Abdul Kuddus	DAE, Bagatipara	01718-878798	North	23 Oct., 2008	HDTC, Pabna
5	Md. Ashogor Ali	DAE, Lalpur	01715-715274	North	24 Oct., 2008	HDTC, Pabna
6	Md. Abdus Sattar	DAE, Lalpur, Natore	01718-28260	North	25 Oct., 2008	HDTC, Pabna
7	Md. Abu Ayube Ansari	DAE, Lalpur,Natore	01198-129334	North	26 Oct., 2008	HDTC, Pabna
8	Md. Monirul Islam	DAE, Sapahar	01916-557781	North	27 Oct., 2008	HDTC, Pabna
9	Shree Denesh Chondro Sarkar	DAE, Sapahar	01718-824622	North	28 Oct., 2008	HDTC, Pabna
10	Md. Ataur Rahman	DAE, Sapahar	01717-051566	North	29 Oct., 2008	HDTC, Pabna
11	Md. Abdul Mannan	Forester, Sapahar	01912- 935590	North	30 Oct., 2008	HDTC, Pabna
12	Md. Mainul Haque	DAE, Gomostopur	01712-392645	North	31 Oct., 2008	HDTC, Pabna
13	Md. Robiul Islam	DAE, Gomostopur	01718-878688	North	32 Oct., 2008	HDTC, Pabna
14	Md. Ibrahim Kholil	DAE, Gomostopur	01722-803550	North	33 Oct., 2008	HDTC, Pabna
15	Md. Humayun Kobir	DAE, Nachole	01712-986911	North	34 Oct., 2008	HDTC, Pabna
16	Md. Abul Hossain	DAE, Porsha	01719-613574	North	35 Oct., 2008	HDTC, Pabna
17	Md. Towhidul Islam	DAE,Porsha	01714-864841	North	36 Oct., 2008	HDTC, Pabna
18	Biddut K. Paul	FO(M),Bagatipara	01712-696152	North	37 Oct., 2008	HDTC, Pabna
19	Arif Jahangir	FO(M), Porsha,FAO	01713-247371	North	38 Oct., 2008	HDTC, Pabna
20	Elias Habib	FOM, Gomostapur	01711-333792	North	39 Oct., 2008	HDTC, Pabna
21	Md. Asadul Haque	FOM, Lalpur	01711-789380	North	40 Oct., 2008	HDTC, Pabna
22	Shah Md. Ashaduddowla	FOM, FAO, Nachole	01716-118116	North	41 Oct., 2008	HDTC, Pabna
23	Prodip Kumar Roy	FOM,FAO, Sapahar	01712-170591	North	42 Oct., 2008	HDTC, Pabna
24	Md. Aminul Islam	DAE, Nachole	01714-764522	North	43 Oct., 2008	HDTC, Pabna

SL #	Name of participant	Name of Department / Organization	Tel./Cell No.	Zone	Date	Venue
25	Md. Golam Morttuza	DAE, Nachole	01715-271425	North	44 Oct., 2008	HDTC, Pabna
26	Md. Ganiul Islam	DAE, Porsha	01718-701281	North	45 Oct., 2008	HDTC, Pabna
27	Md. Shoriful Islam	Forest Dep., Nachole	01716-155797	North	46 Oct., 2008	HDTC, Pabna
28	Md. Mahfuz Ashraf	FAO - LACC-II	1731242416	South	23 Oct., 2008	HDTC, Khulna
29	Md. Rafiqul Islam	FAO - LACC-II	1733019012	South	24 Oct., 2008	HDTC, Khulna
30	Dwipendra Chandra Sarkar	FAO - LACC-II	1730194621	South	25 Oct., 2008	HDTC, Khulna
31	Md. Mizanur Rahman	FAO - LACC-II	01721-936448	South	26 Oct., 2008	HDTC, Khulna
32	Zillur Rahman	DAE, Terokhada	1914987252	South	27 Oct., 2008	HDTC, Khulna
33	S.M. ……	DAE, Terokhada	1914667545	South	28 Oct., 2008	HDTC, Khulna
34	Sachindra Nath Das	DAE, Bhandaria	1716301916	South	29 Oct., 2008	HDTC, Khulna
35	Chitta Ranjan Gain	DAE, Bhandaria	1718043633	South	30 Oct., 2008	HDTC, Khulna
36	Md. Ala Uddin SK	DAE, Dacope	01717-614771	South	31 Oct., 2008	HDTC, Khulna
37	Das Bibhuti Ranjan	DAE,Dacope	01718-607117	South	32 Oct., 2008	HDTC, Khulna
38	Md. Kamal Hossain	DAE, Bhandaria	01736-200510	South	33 Oct., 2008	HDTC, Khulna
39	Md. Sultan Mahmud	DAE, Bhandaria	01714-801173	South	34 Oct., 2008	HDTC, Khulna
40	Md. Siddiqur Rahman	DAE.Nazirpur	01716-615235	South	35 Oct., 2008	HDTC, Khulna
41	Dhirendra Nath Sikder	DAE, Nazirpur	01715-350008	South	36 Oct., 2008	HDTC, Khulna
42	Nitish Chandra Bala	DAE, Nazirpur	01725-461126	South	37 Oct., 2008	HDTC, Khulna
43	Md. Habibur Rahman	DAE,Bhandaria	1724433663	South	38 Oct., 2008	HDTC, Khulna
44	Nirmal Krishna Biswas	DAE,Nazirpur	1710810317	South	39 Oct., 2008	HDTC, Khulna
45	Md. Babul Akter	DAE, Nazirpur	1912453719	South	40 Oct., 2008	HDTC, Khulna
46	SM. Ashrafuzzam	DAE,Terokhada	01710-120284	South	41 Oct., 2008	HDTC, Khulna
47	Md. Ekramul Haque	DAE, Tereokhada	01717-469932	South	42 Oct., 2008	HDTC, Khulna
48	Md. Younus Ali	DAE, Terokhada	1911803537	South	43 Oct., 2008	HDTC, Khulna
49	Bijan Kumar Roy	DAE,Dacope	01918-222709	South	44 Oct., 2008	HDTC, Khulna
50	Nikhil Chandra Biswas	DAE,Dacope	1715855975	South	45 Oct., 2008	HDTC, Khulna
51	Sadananda Mondal	DAE,Dacope	01915-018445	South	46 Oct., 2008	HDTC, Khulna

List of participants of two rounds of training for Senior Officers on 19th October 2008 in Pabna (Venue: HDTC, Tebunia Pabna)

S.L	Name & Designation of Participant	Name of Department / Organization	Tel./Cell No.
1.	Md. Abul Kalam Azad UAO	DAE, Nachole, Chapai nababganj	01716126185
2.	Md, Ohiduzzawali	DAE,Gomostapur	01711-378050
3.	Md.Sana Ullah Meah	D.D.A.E. Pabna	01732-062876
4.	Dr. Biplob Kumar Dey	V.S,Livestock Office,Nachole	01712537127
5.	Dr. Md. Abul Hossain	ULO.	01711789872
6.	Md. Abul Hashim SAE	Panasi,BADC,Bagatipara	01720-466616
7.	Md. Nowsher Ali. SAE	B.ADC. Panasi, Lalpur	01916-406376
8.	Md. Niaz Muddin	U.L.O. Lalpur	01712277902
9.	Md. Mahbubur Rahman	UFO, Gomastapur	01711784840
10.	Md. Alamgir Kabir	UFO, Porsha, Naogaon	01711-930972
11.	S. M. Azharul Islam, UFO	DOF, Sapahar	01716-937692
12.	Dr. Md. Salim Uddin ULO	U.L. Officer Sapahar, Naogaon	01718-290095
13.	Pratul Chandra Sarker	Uao, Parsha,Naogaon	01714941444
14.	A.B.M. Mostafizur Rahman	UAO,(DAE), Sapahar	01712987962
15.	Md. Mobosher Hossain	AFO-Lalpur Natore	01712-439184
16.	K.M. Abdul Halim	UFO, Bagatipara, Natore	01716-729576
17.	Subrata Kr, Sarker UAO	DAE, Bagati , Natore	01715-844689
18.	Md. Ehsanul Haque	DAE-Lalpur Natore	01715176139

List of participants of two rounds of training for Senior Officers on 22nd October 2008 in Khulna (Venue: HDTC, Khulna)

S.L	Name & Designation of participant	Name of Department / Organization	Tel./ Cell No.
1.	Kazi Anisuzzaman UAO	DAE	01711397721
2.	Gour Kanti Singha UAO	DAE, Terokhada	01715-094094
3.	Md. Habibulla, Forester	Upazilla, Forster Dacope	01716-681088
4.	Kazi Anisuzzaman UAO,	DAE, Dacope Khulna	01711397721
5.	Dr. Ataur Rahman Chowdhury	ULO Dacope	01818-372989
6.	Md. Saiful Islam, Forester	Dept. of Forest, Bhandaria	01722-278777
7.	Md. Khayrul Islam, FG	FD , Nazirpur	01719-975299
8.	Sanjida Haque E.O	Fisheries, Dacope	01919-858984
9.	Md. Zillur Rahman	UFO, Bhandaria	01720-201447
10.	G.M Salim	UFO, Nazirpur	01712-699215
11.	Md. Abu Sayed	SUFO,Terokhada	01712-661616
12.	Dr. Shishir Kumar Biswas	DLS, Terokhada	01712-156234
13.	Swapan Kumar Mandal	UAO,Bhandaria	01716-421838
14.	Ashit Kumar Saha	UAO,Nazirpur	01712-257061
15.	Dr. Dinesh Chandra Mazumder	ULO,Bhandaria	01718-148425
16.	F.M. Mostafa		01912-475622
17.	S. M Ferdous	Metro. Agri.. Officer DAE	01711-184475
18.	Md. Golam Hossain	DDAE, Khulna	811486/041
19.	Md. Obaidur Rahman	Forester,Terokhada	01712-923376
20.	Md. Mizanur Rahman	FO9M, FAO	01721-936448
21.	Md. Jafor		01912-447551