Linking Climate Change and Water Resources: impacts and responses

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Introduction:
The Intergovernmental Panel on Climate Change (IPCC)

- The leading international body for the assessment of climate change.
- Established in 1988 as a scientific body by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) under the auspices of the United Nations.
- Aims to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts.

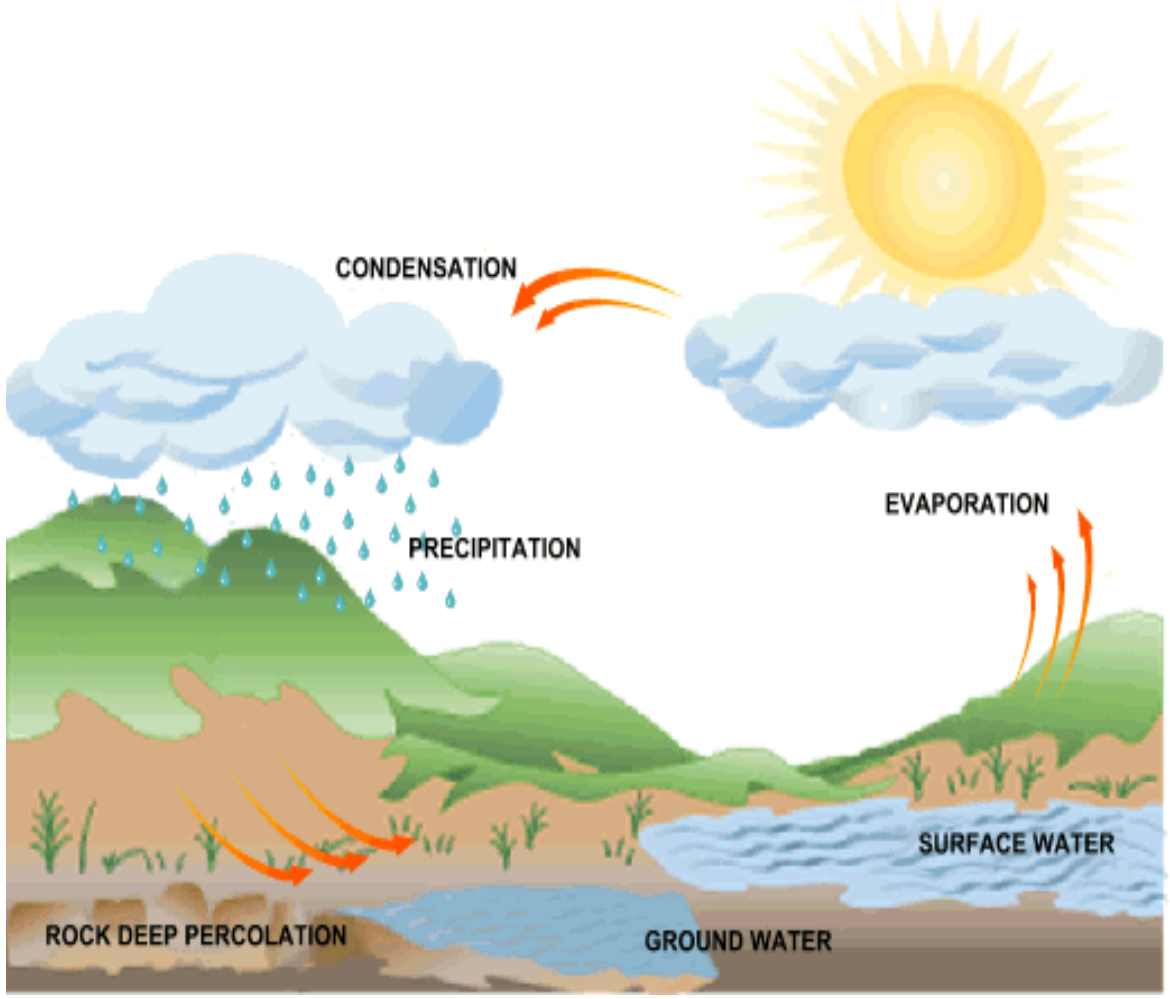
Introduction:
The Intergovernmental Panel on Climate Change (IPCC)

- Intergovernmental body open to all member countries of the United Nations (UN) and WMO. (195 members)
- Governments participate in the scientific review process and plenary Sessions, where main decisions about the work program are taken and reports are accepted, adopted and approved.
- Comprised of thousands of scientists who contribute on a voluntary basis as authors, contributors and reviewers.
- By endorsing the IPCC reports, governments acknowledge the authority of their scientific content.

Introduction

Changes in the hydrological cycle due to climate change can lead to diverse impacts and risks.

As a variable resource, water is the agent that delivers many of the impacts of climate change to society. Example to energy, agriculture, health and transport sectors.



Introduction

Observed and projected impacts of climate change on freshwater resources and their management are due mainly to increases in temperature and sea level, local changes in rainfall and changes in the variability of these quantities

The negative impacts of climate change on freshwater systems outweigh its benefits.

Anthropogenic (human induced) climate change is one of the many stressors of water resources

Drivers of Change for Freshwater Resources (Climatic)

- Precipitation and potential evaporation are the main climatic drivers
- During the 21st century surface temperature, which affects the water vapour capacity of the atmosphere, is projected to increase non-uniformly probably to about 1.5 times more over land than over oceans.
- Precipitation changes generally become statistically significant only when the temperature rises by 1.4ºC. (Mahlstein *et al* 2012)

Drivers of Change for Freshwater Resources (Non-Climatic)

In addition to climate change the future of freshwater systems will be impacted strongly by demographic, socioeconomic and technological changes including lifestyle changes. These will change both the exposure to hazard and requirements for water resources.

Human contributions such as water withdrawals , land use change and pollution make it difficult to link depleting (changing) water resources strictly to climate drivers.

Drivers of Change for Freshwater Resources (Non-Climatic)

- Changing land use for example through increasing urbanization could increase flood hazards and decrease groundwater recharge.
- Future agricultural land use for irrigation could severely impact freshwater availability for humans and ecosystems owing mainly to population and economic growth.
- The share of irrigation from groundwater is expected to increase in some areas owing to increased variability in surface water supply caused by climate change.

Extreme Hydrological Events (Floods and Droughts)

How will climate change affect the frequency of floods and droughts?

- The frequency of floods in small river basins is very likely to increase since the projected increase in intense rains is usually confined to smaller areas.
- By the end of the 21st century meteorological drought (less rainfall) and agricultural drought (drier soils) are projected to become longer, or more frequent or both in some areas.

Extreme Hydrological Events (Floods and Droughts)

- It is uncertain what these rainfall and soil moisture deficits could mean for prolonged reductions in stream flow and reservoirs, lakes and groundwater levels.
- The impacts of floods and droughts are projected to increase even when the hazard remains constant owing to increased exposure and vulnerability.
- Droughts have become more common, especially in the tropics and sub-tropics, since the 1970s.

How will the availability of water resources be affected by climate change?

- More frequent droughts due to climate change may challenge existing water management systems, together with an increase in population may place at risk even our domestic supply.
- Under climate change reliable surface water supply is expected to decrease due to increased variability of river flow due in turn to increased rainfall variability.
- Availability of water can also be reduced by negative impacts of climate change on water quality.

How should water management be modified in the face of climate change?

- Climate change poses a conceptual challenge to water managers by introducing uncertainty in future hydrological conditions.
- Long term planning (over several decades) is needed for a future that is highly uncertain.
- Familiar adaptive measures: rainwater harvesting, maintaining vegetative cover, planting trees in steeply sloping fields, improved pasture management, water reuse and more efficient soil and irrigation water management.
- Restoring and protecting freshwater habitats and managing natural floodplains are adaptive measures that are not usually part of the conventional catchment management practice.
- A flexible portfolio of solutions that produces benefits regardless of the impacts of climate change ("Low-regret" solution) is extremely valuable.

Responses- national systems and actors for managing the risks from climate extremes and disasters

- National systems are at the core of a country's capacity to meet the challenges of observed and projected trends in exposure, vulnerability and weather and climate extremes.
- Effective national systems comprise multiple actors from national, private sector, research bodies and civil society including community–based organizations each playing differential but complimentary roles to manage risks according to their accepted functions and capacities.

Water Resources Sector Response ('no regrets' and 'low regrets actions for current and future risks)

- Implement Integrated Water Resource Management (IWRM), national water efficiency, storage plans
- Effective surveillance, prediction, warning and emergency response systems
- Adequate funding, capacity for resilient water infrastructure and water resource management ; improved institutional arrangements, negotiations for water allocation, joint river basin management

Water Resources Sector Response ('no/low regrets options)- Preparing for climate change by reducing uncertainties.

- Develop prediction, climate projection, and early warning systems for flood events and low water flow conditions; research and downscaling for hydrological basins
- Multi-sectoral planning for water; selective decentralization of water resource management (e.g., catchments and river basins); joint river basin management (e.g., bi-national)

Responses- Reduce Risks from Future Climate Change

- National water policy frameworks, robust integrated and adaptive water resource management for adaptation to climate change
- Investments in hard and soft infrastructure considering changed climate; river restoration
- Improved weather, climate, hydrology-hydraulics, water quality forecasts for new conditions

Responses- Risk Transfer

- Public-private partnerships; Economics for water allocations beyond basic needs
- Mobilize financial resources and capacity for technology
- Insurance for infrastructure

Responses - Accept and deal with increased and unavoidable risk

- Enhance national preparedness and evacuation plans to address greater risks
- Enhance health infrastructure for more failures
- Alter transport, engineering; increases to temporary consumable water taking permits
- Enhance food , water distribution for emergencies, plan for alternate livelihoods

Responses- “Win-win” synergies for Greenhouse Gas reduction, adaptation, risk reduction and development benefits

Integrated and sustainable water efficiency and renewable hydro power for adaptation to climate change

Does climate change imply only bad news about water resources?

- The good news is very often ambiguous.
- Example: Water may become less scarce in regions that receive more precipitation, but more precipitation will probably increase flood risk; it may also raise the groundwater table which could lead to damage to building and foundations and other infrastructure or may lead to reduced agricultural productivity due to saturated soils or soil salinization.

Does climate change imply only bad news about water resources?

Example: Water and wastewater treatment yields better results under warmer conditions as chemical and biological reactions needed for treatment perform generally better at higher temperatures.

- Important point is that impacts do not become “good news” unless investments are made to exploit them.

Example: Where additional water is expected to become available , the infrastructure to capture that resource would need to be developed if not already in place.

Example: Technology transfer and development

Thanks for your attention!!!