

# **Water, Agriculture and Food security challenges under changing weather and climate threats**

**CBPS / UON ANNUAL  
RESEARCH WEEK  
14 - 16 OCTOBER 2020**

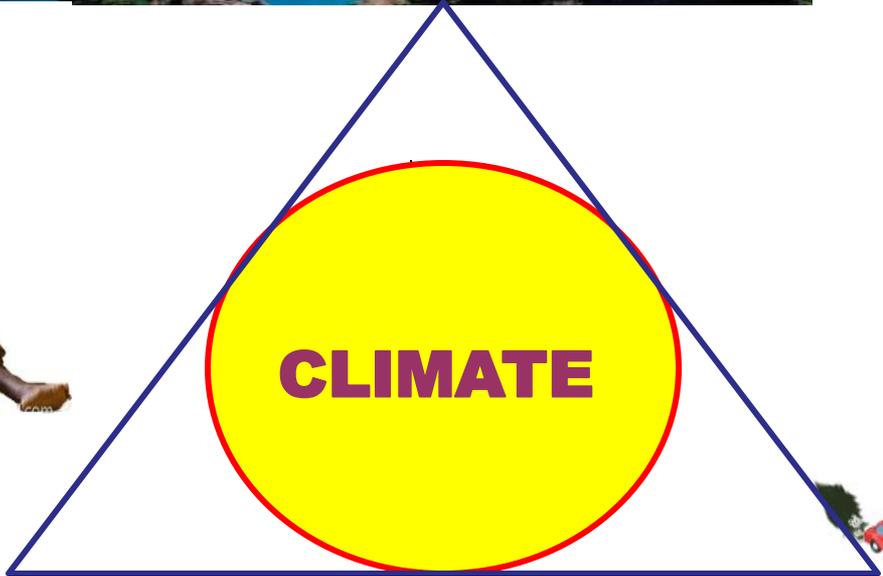
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# KEY PRESENTATION ISSUES

- 1. Sustainable Development under changing climate environment  
(Introduction)**
- 2. WEATHER / CLIMATE AND DEVELOPMENT NEXUS (focus Water resources, Agriculture , and Food security sustainability)**
- 3. THE CHANGING WEATHER AND CLIMATE AND THREATS**
- 4. Science / knowledge needs for Building climate resilient future**

**ENVIRONMENT**  
**ATMOSPHERE;**  
**HYDROSPHERE**  
**BIOSPHERE**  
**GEOSPHERE**



**SOCIETY,**  
basic livelihood  
, Population, Poverty

**ECONOMY**  
wealth, trade

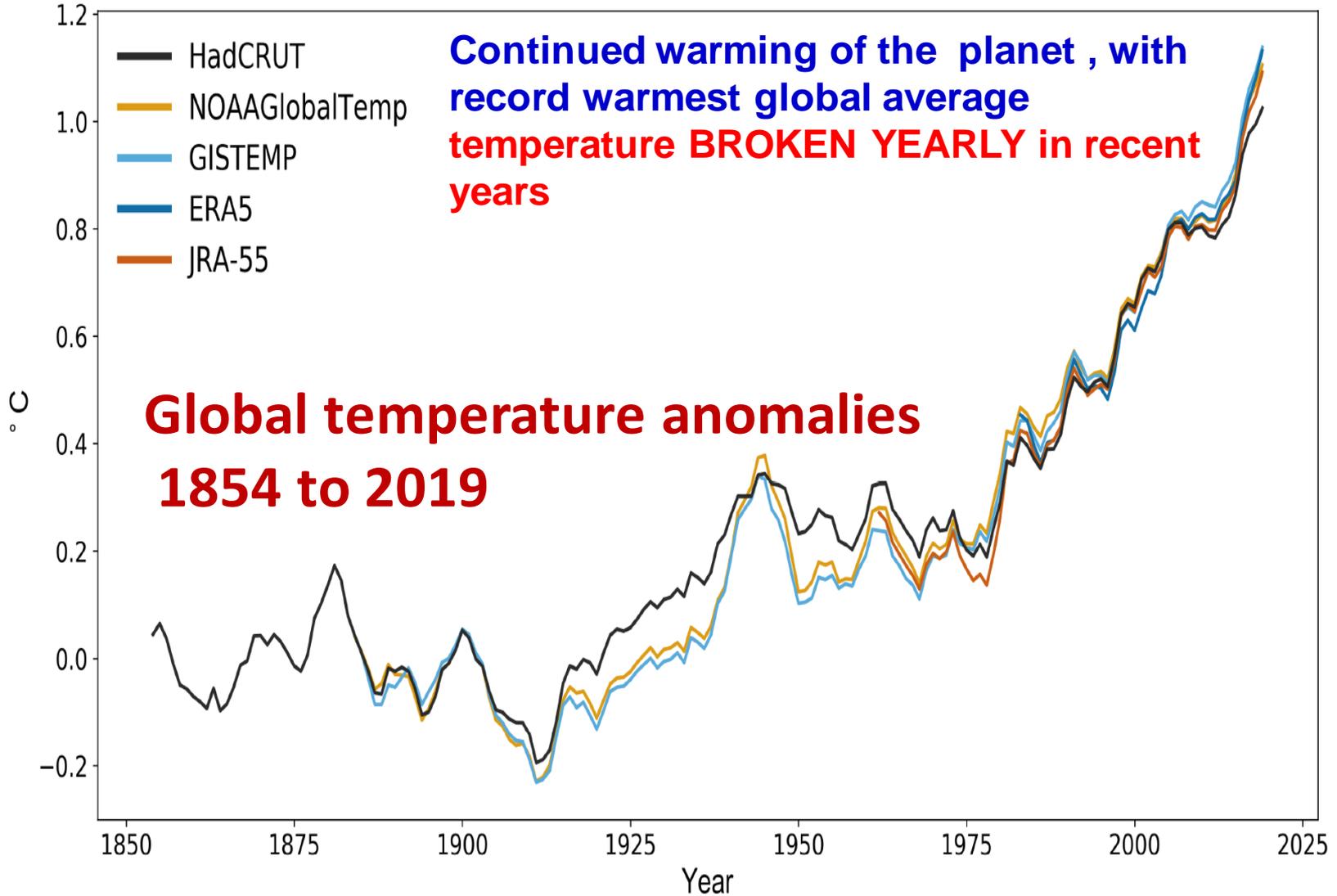
**CLIMATE AND DEVELOPMENT NEXUS**

# CLOSELY LINKED ISSUES

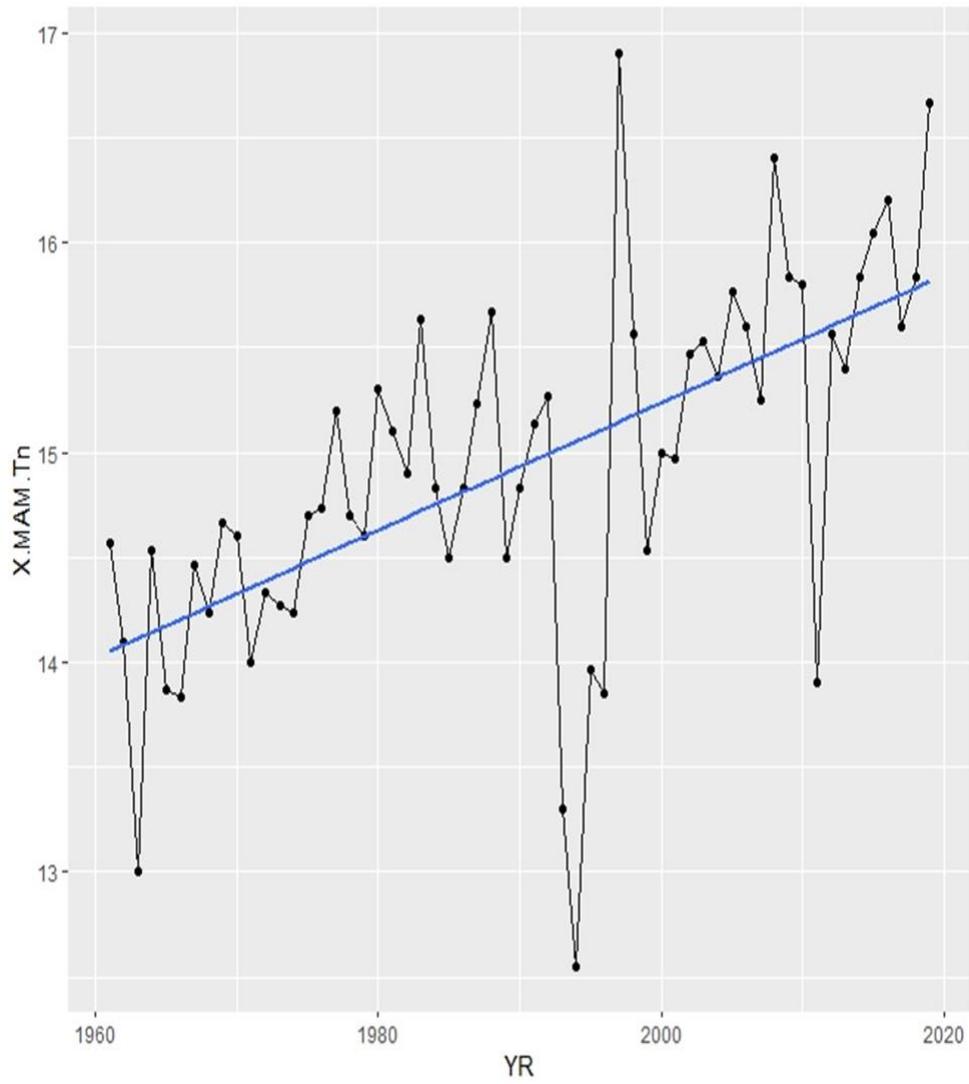
- **Population**
- **Economic development**
- **Energy production and energy consumption**
- **Technology**
- **Land use, etc.**
- **Policies: Emission control policies**
- **Impacts on planet earth Planet ( Planet earth is warming)**

# CHANGING WEATHER /CLIMATE

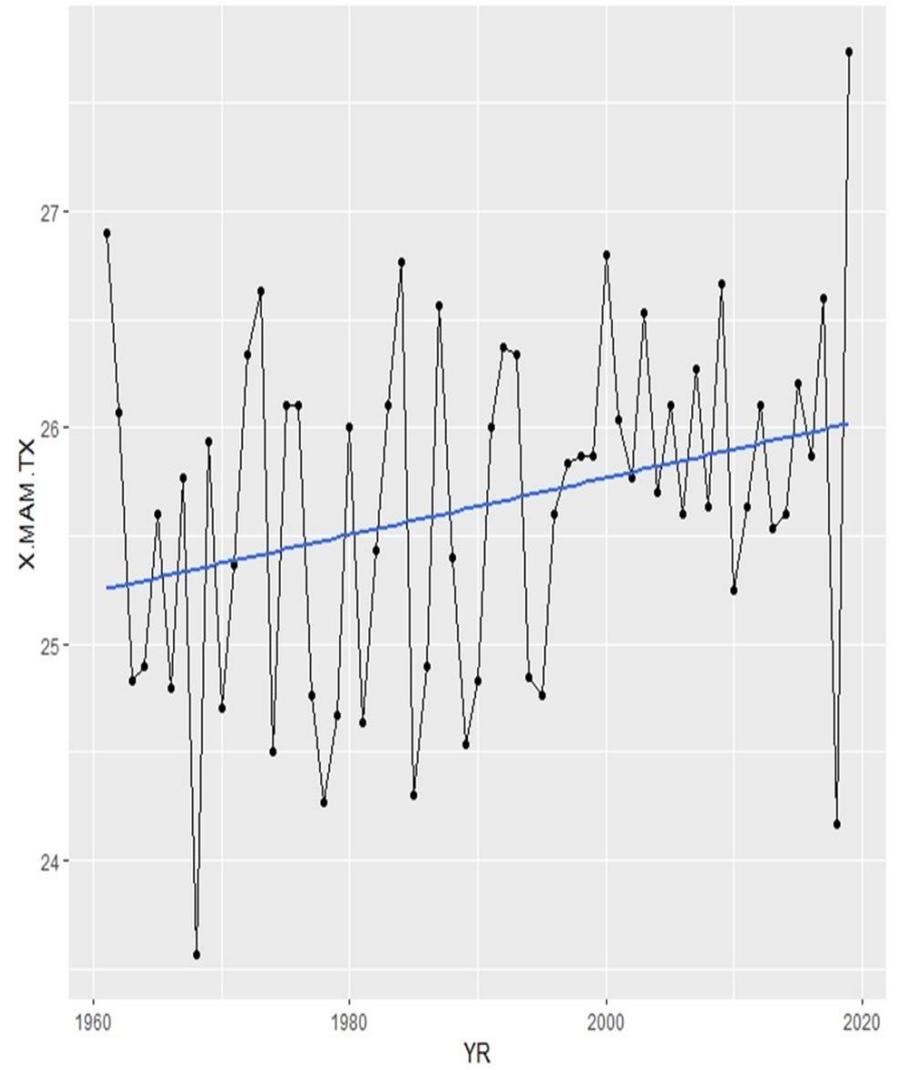
Global mean temperature difference from 1850-1900 ( ° C)

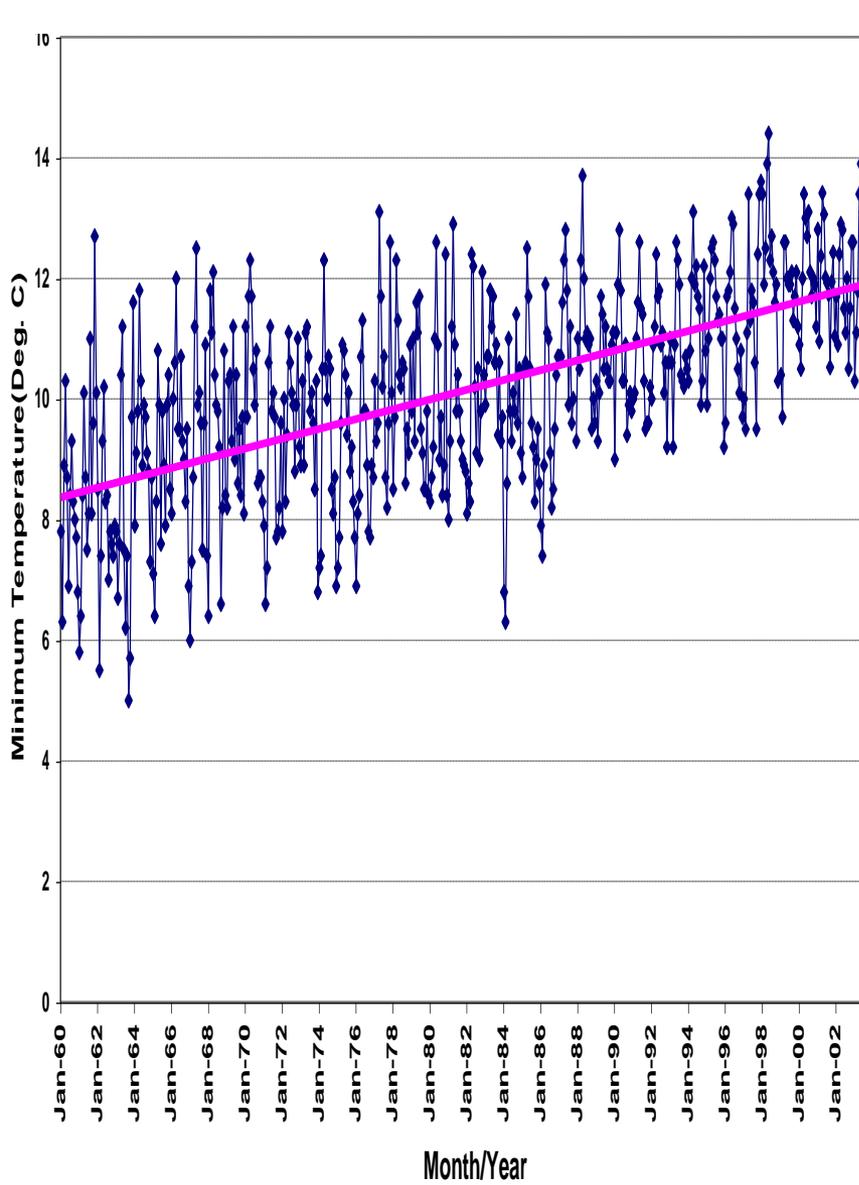


NAIROBI Tmin

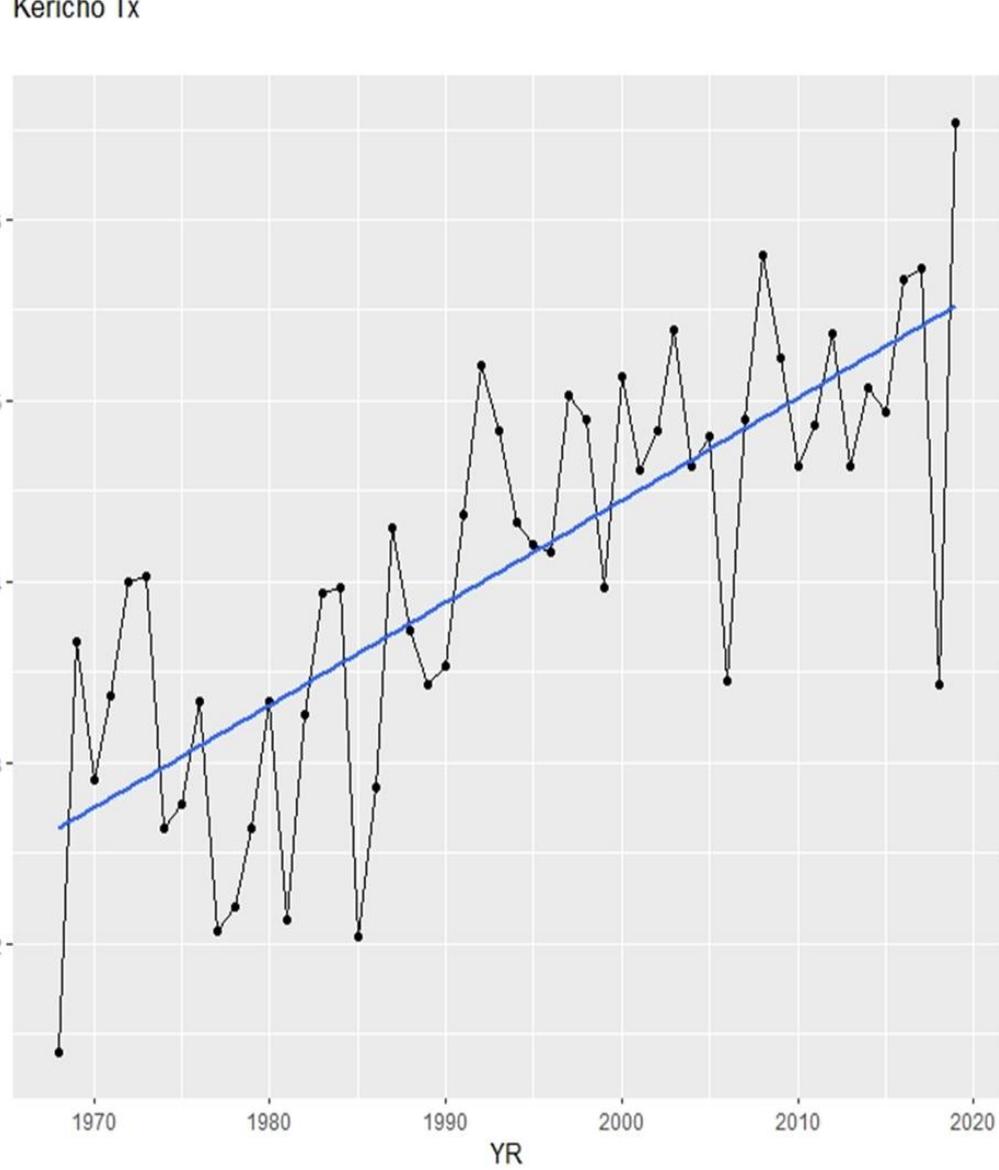


NAIROBI Tx





**MIN TEMP KERICHO**

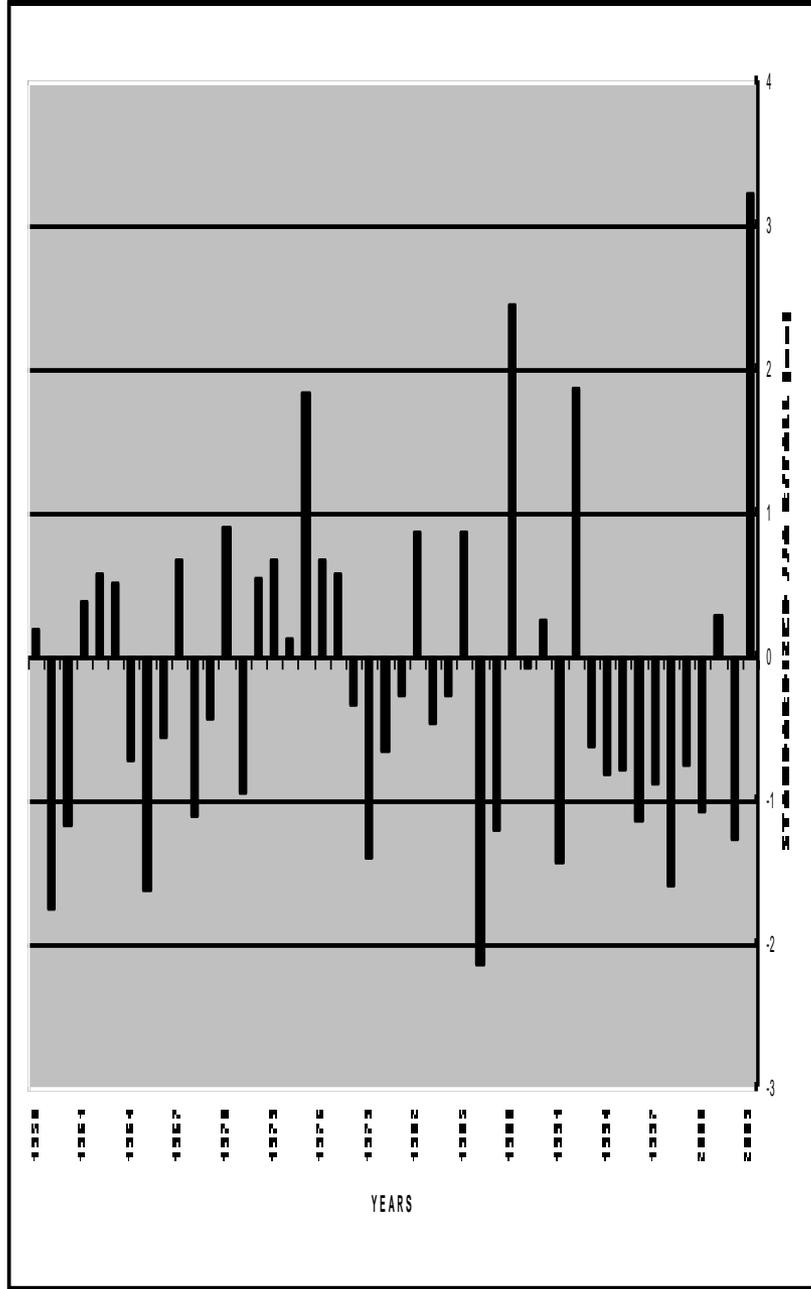


**Max Temp Kericho**

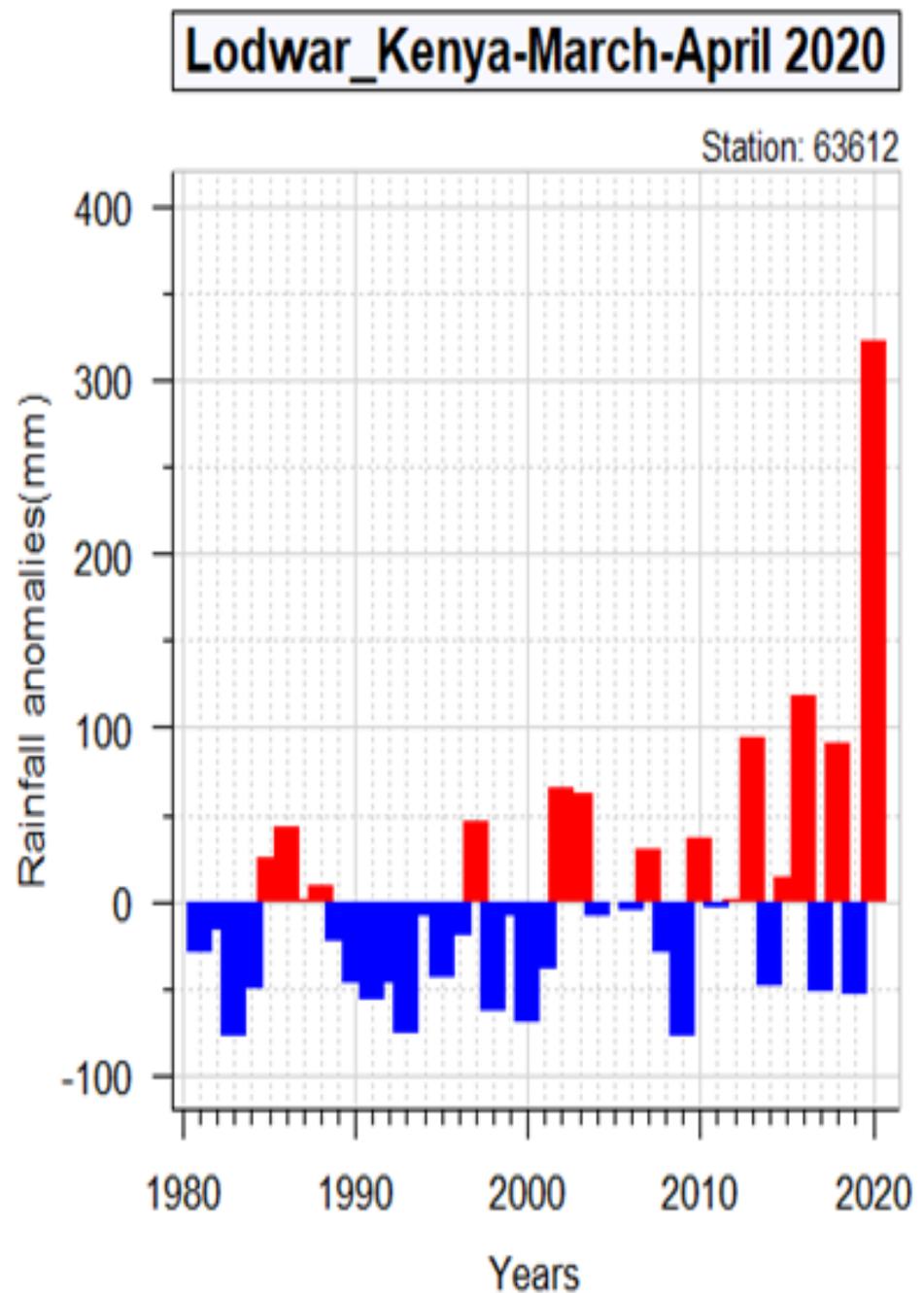
# Evidences of changing weather and climate

- **Rainfall patterns not homogenous**
- **Significant challenging rainfall trends**
- **Seasonal shifts, Onset, cessation, wet / dry days, etc.**
- **Weather / climate extremes**
  - **increased intensity / frequency**
  - **floods, drought**
  - **Cyclones**
  - **heat waves,**
  - **strong winds**

- **Dry / Wet spells**
- **Lake / Sea level rise**
- **Hailstorm**
- **Lightning and thunder**
- **Frost, other extremes**
- **The changing patterns are area specific**
- **Past / present weather / Climate changes impacts on Development Nexus**
- **Case of climate , water , agriculture and food security NEXUS**



**Kakamega OND rainfall**



# GLOBAL SUSTAINABLE DEVELOPMENT EFFORTS

**1. Agenda 21: 1992 Rio Earth Summit** : Action plan of the United Nations to promote sustainable development, in the 21<sup>st</sup> century (targeting 2030).- **No clear Goals, targets , indicators set**

(Three conventions were negotiated in Rio  
- UNFCCC, United Nations Framework Convention on Climate Change; UNCBD UN Convention on Biological Diversity, UNCCD- UN Convention to Combat Desertification)

**2. Millennium Development Goals (8) : Outcome from review of Agenda 21 in 2000** - Up dated of Agenda 21 , Had 8 Goals with 2015 as target end date

**CLIMATE RISKS** common factor for failures in meeting set targets

**3. Sustainable development Goals (SDGs) (17) – Came out of MDGs review in 2015)** First time to include Climate risks integration in the Goals and Target : based on **2015 Paris climate Agreement**

**UN Paris Climate Agreement requires development that keep**

- **Mean global warming below 1.5 – 2 degrees centigrade to avoid dangerous impacts of climate change on the planet earth**
- **First time critical and dangerous threshold was put on mean global climate warming**
- **GHGs emissions must to fall by about 45% from 2010 levels by 2030, reaching “net zero” around 2050**
- **1992 UNFCCC called for stabilizing of greenhouse gas concentrations to prevent human interference with global climate system (Developed countries to reduce and provide resources to developing countries to copes impacts of the changes )**
- **Paris AGREEMENT has introduced reduction of GHGs emission by all under Nationally Determined Contributions (NDCs) framework**

# APPROACHES SUSTAINABLE DEVELOPMENT UNDER CHANGING WEATHER / CLIMATE

- 1. ADAPTATION: Coping with current changes and adapting to the future including the new extremes**
- 2. MITIGATION : Stop GHGs Emissions (UNFCCC)**

## Some Science Questions

- How has weather / climate patterns changed in the past in Kenya
- Their impacts on Development
- **Adaptation:** What makes developing countries systems more vulnerable to climate risks?
- **Mitigation :** Do we have local knowledge for negotiations and reporting (NDCs)
- **Science support needs for building climate resilient / Smart national systems**

# CLIMATE CHANGE VIDENCES ARE FROM:

## 1. Data available from

- Meteorological instrumental records;
- Proxy climate data (Paleoclimate, ...)
- Remote sensing data eg space based observations  
(calibration challenges)
- Computer based MODELLING the past, present and future
- very LIMITED climate data especially at regional and local levels
- Non climate data may even be more difficult to get



**FLOODS**

# Drought



# Implications of variability and Climate Change

Africa, is one of the most vulnerable continents to climate variability and change.

## Climate Changes



Temperature



Precipitation



Sea Level Rise



## Health Impacts

Weather-related Mortality  
Infectious Diseases  
Air Quality-Respiratory Illnesses



## Agriculture Impacts

Crop Yields  
Irrigation Demands



## Forest Impacts

Forest composition  
Geographic range of forests  
Forest health and productivity



## Water Resource Impacts

Water supply  
Water quality  
Competition for water



## Impacts on Coastal Areas

Erosion of beaches  
Inundation of coastal lands  
Additional costs to protect coastal communities



## Species and Natural Areas

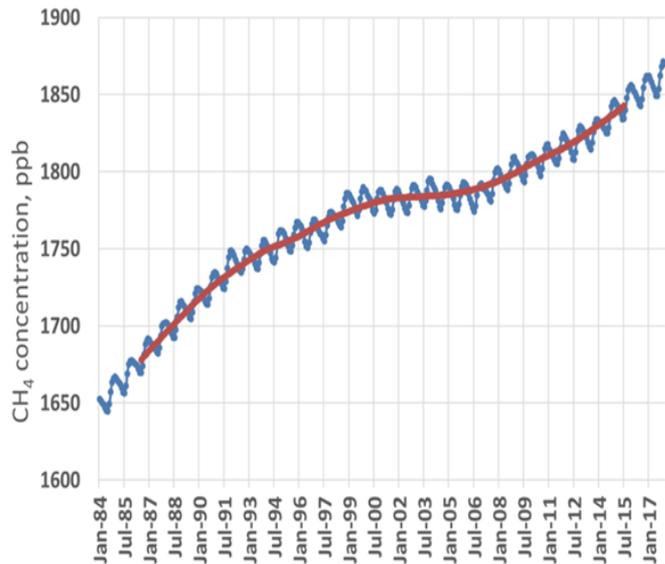
Loss of habitat and species

# THE CLIMATE WORLD TOMORROW

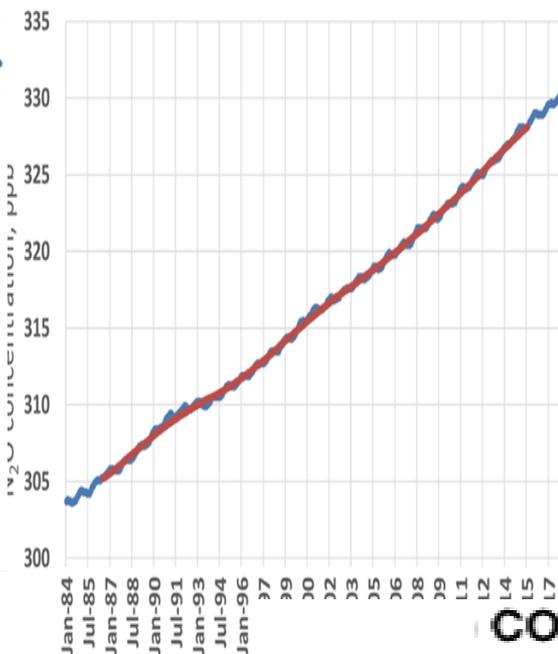
*Will also depend on:*

- **Population**
- **Economic development**
- **Energy production and energy consumption**
- **Technology**
- **Land use, etc.**
- **Policies: Emission control policies (UNFCCC):**

CH<sub>4</sub> concentration

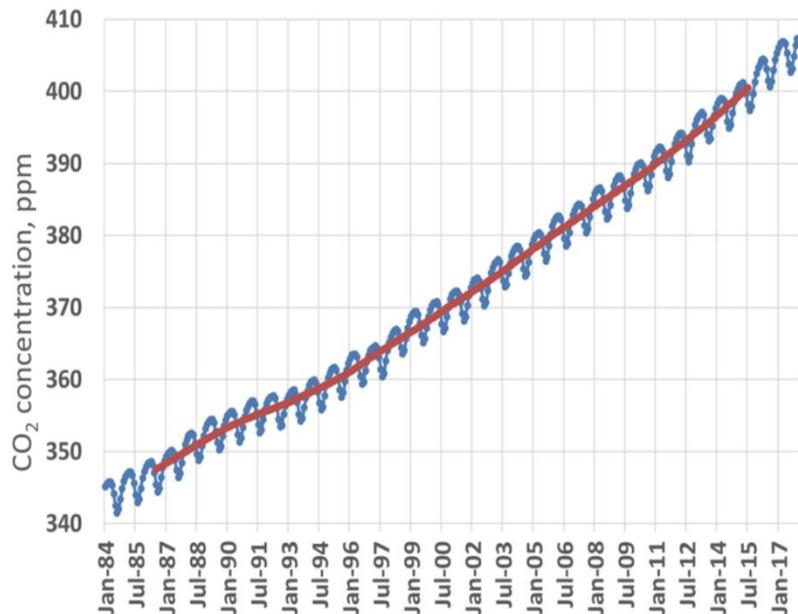


N<sub>2</sub>O concentration

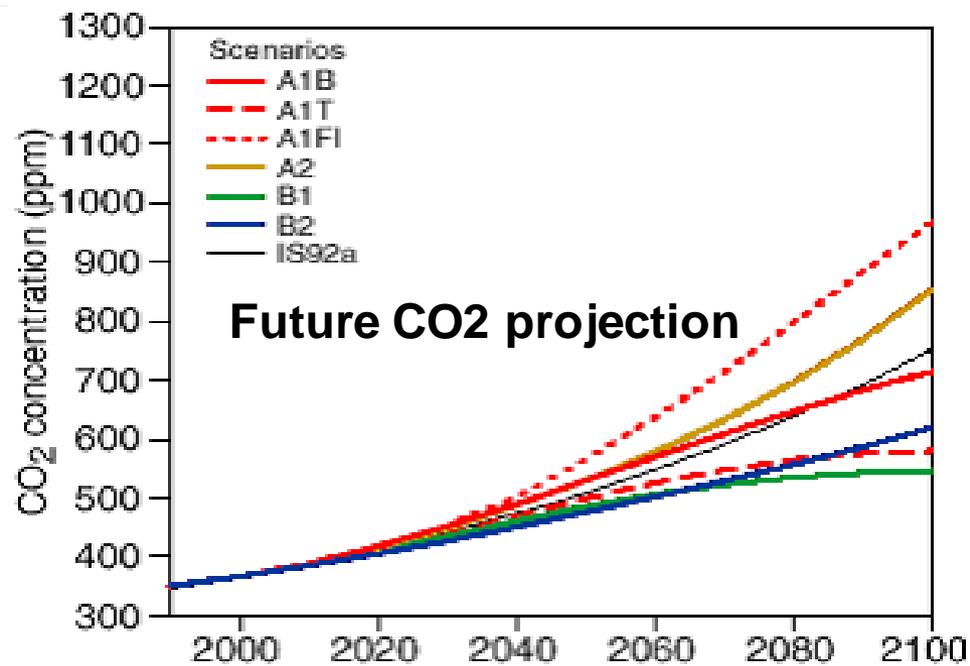


Increasing emissions of GHGs caused by human Activities, even with UNFCCC

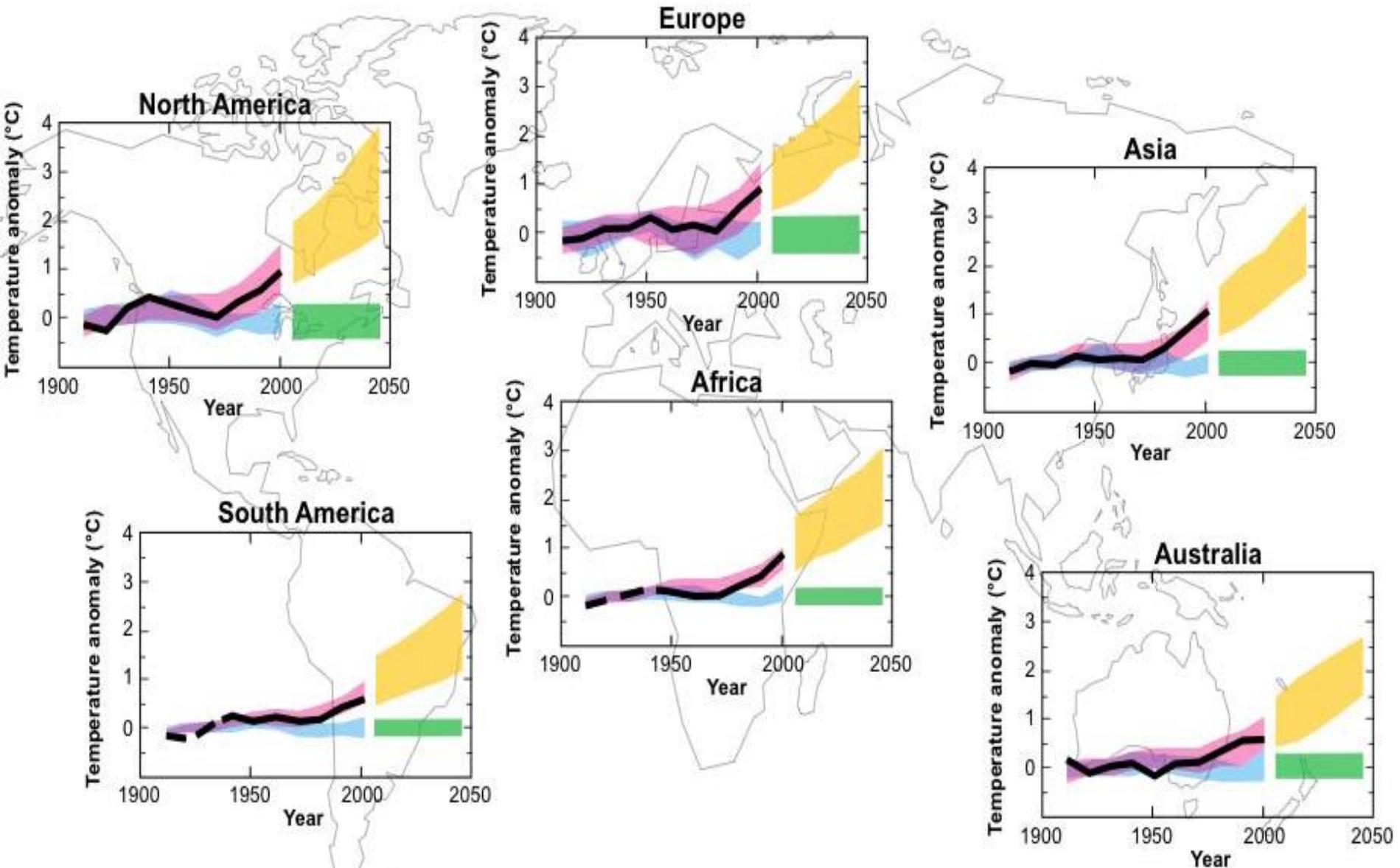
CO<sub>2</sub> concentration



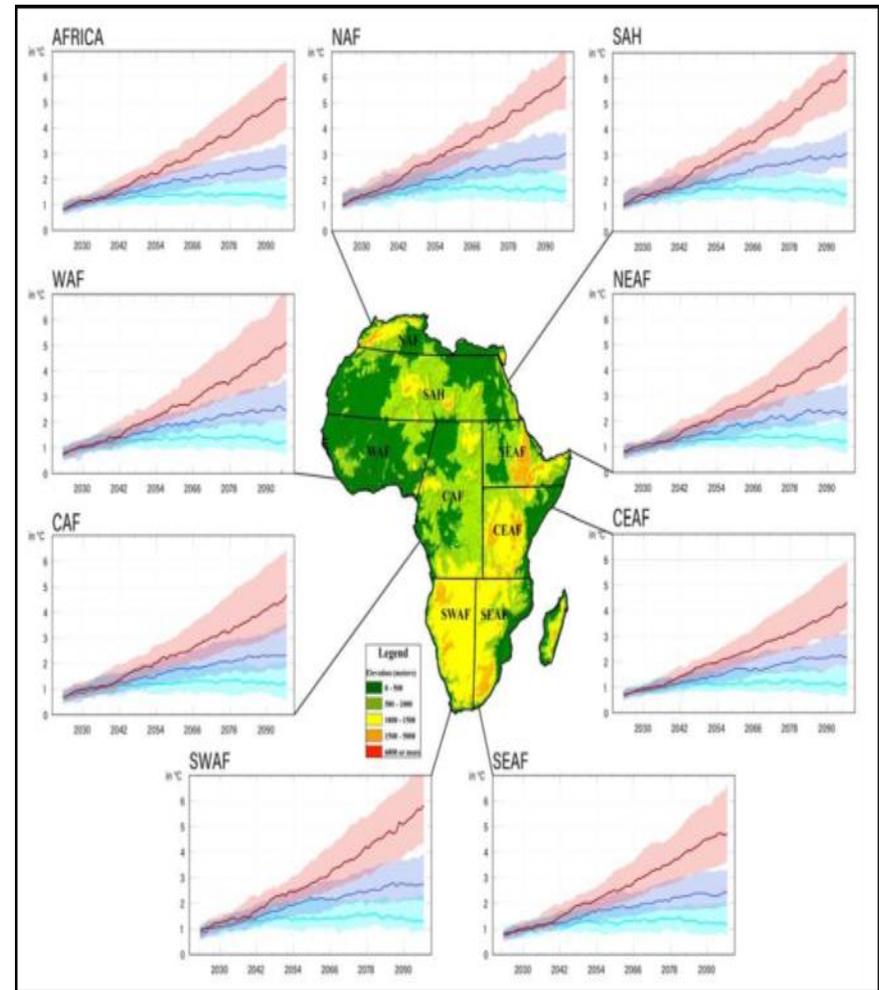
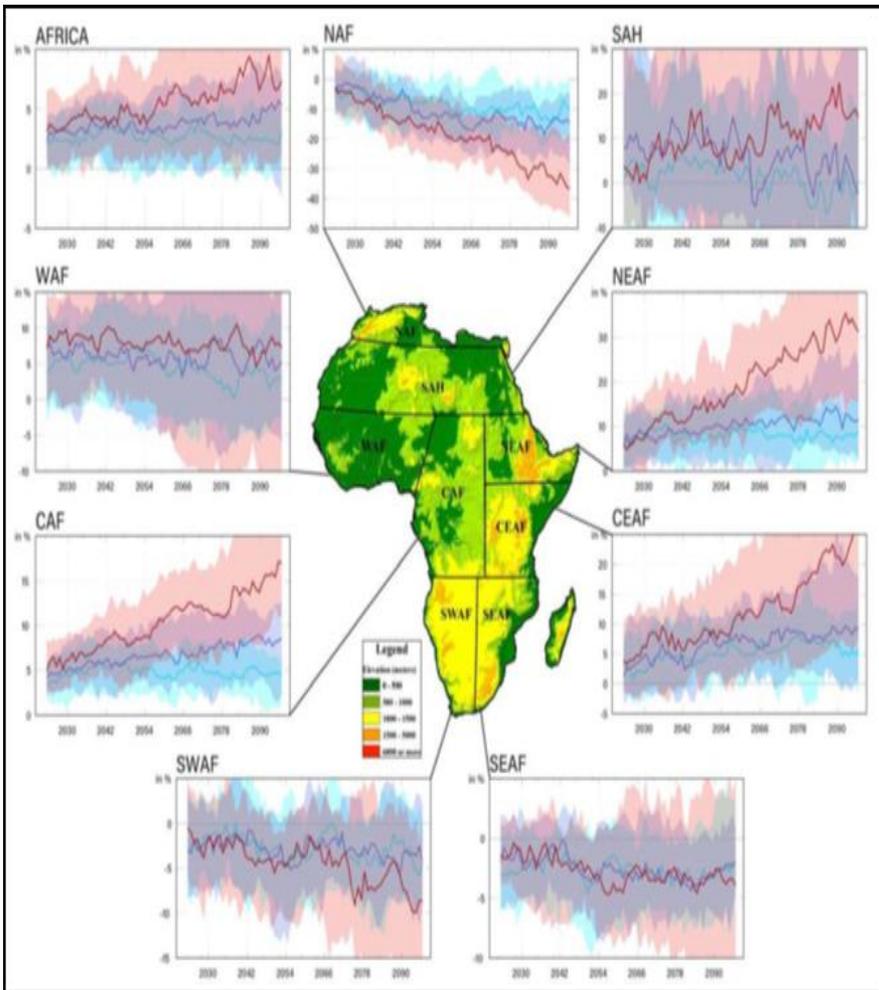
CO<sub>2</sub> concentrations



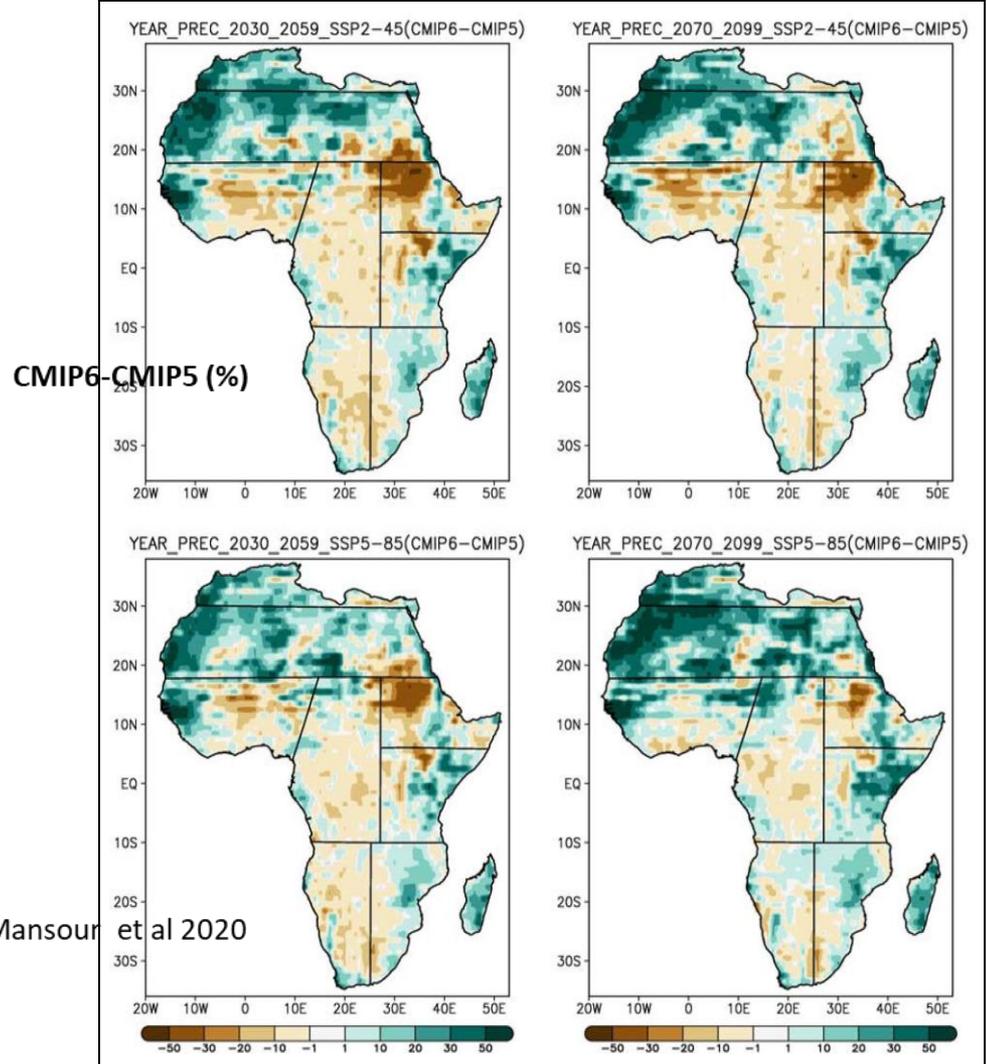
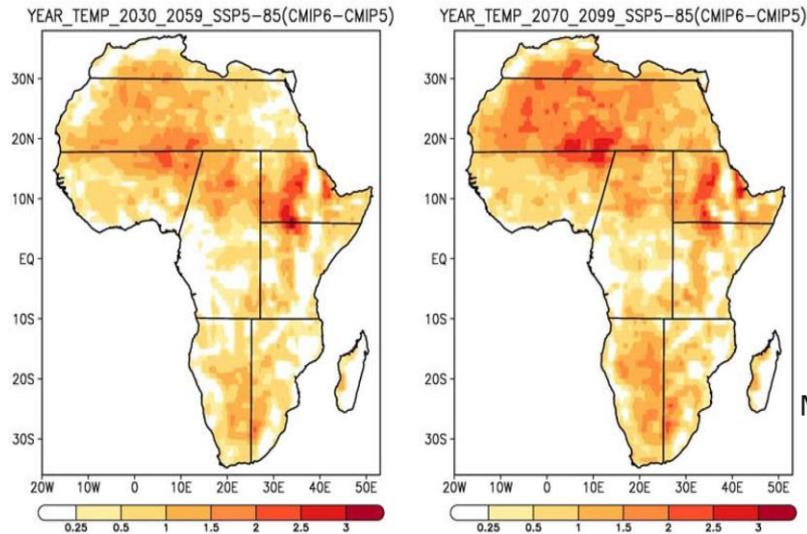
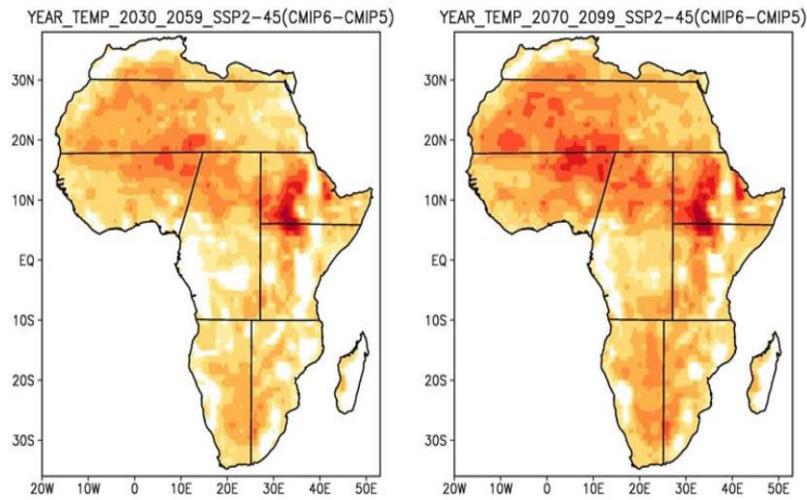
# PROJECTIONS OF FUTURE CHANGES IN CLIMATE



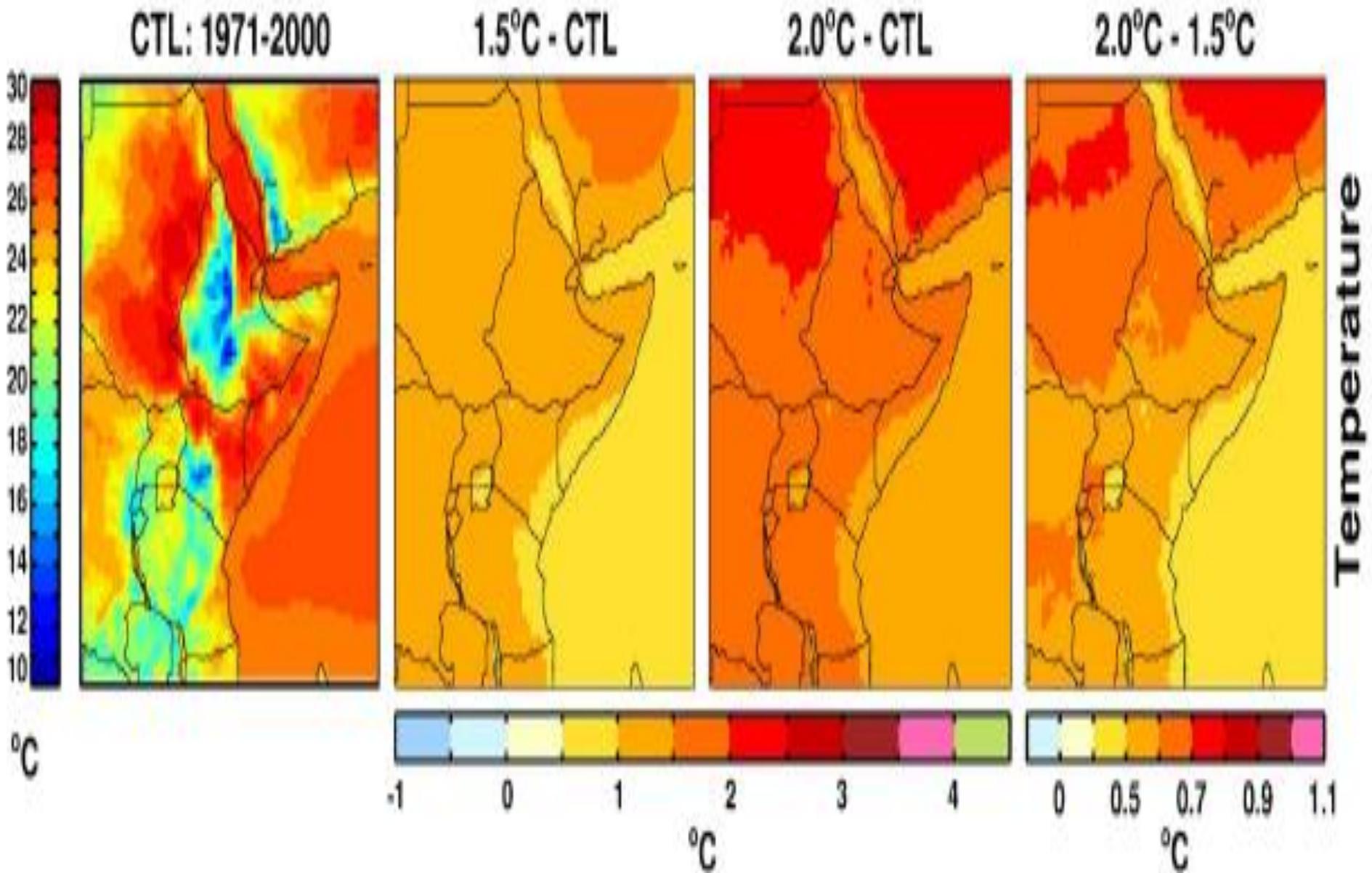
**THE FUTURE CLIMATE**



**Down scale of regional/local climate change patterns, projections of future rainfall and temperature for Africa , ar5**



**Limited knowledge of regional/ local climate change scenarios, up to 5 degrees Centigrade rise by end of the century (upper scenario)**



**Mean temperature compared to 1971-2000 baseline period**

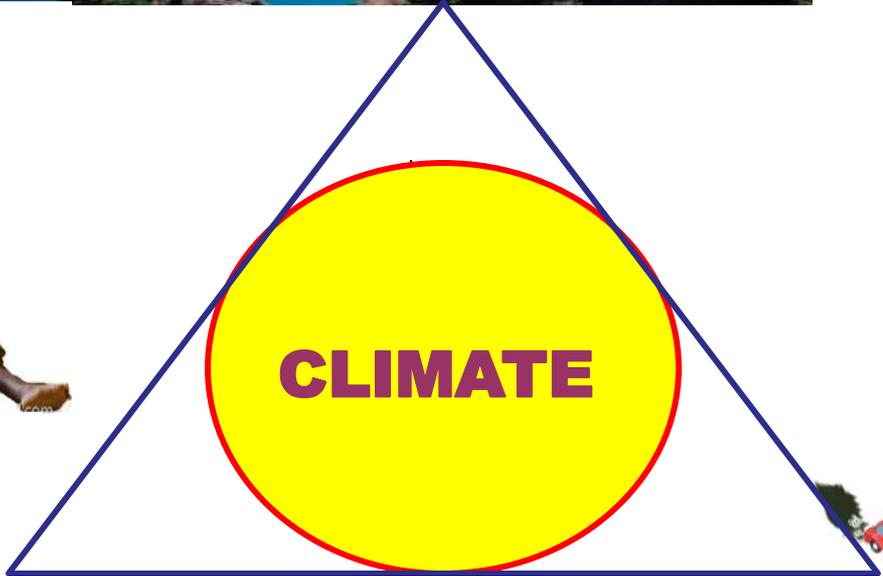
# PAST / PRESENT CLIMATE CHANGE IMPACTS ON DEVELOPMENT

- **Temperature increase is evident also at regional and local scale**
- **Warming is above the 1.5 - 2 degrees centigrade and may be above 5 degrees by end of the century over parts of Africa,**
- **Paris Agreement has 1.5 -2 degrees thresh hold for global mean**
- **Sustainable future for Kenya, Local science and Technology needed to support local adaptation needs and Mitigation**

# SCIENCE SUPPORT NEEDS FOR NATIONAL SUSTANIABLE DEVELOPMENT

- 1. National Adaptation strategy:** Support to the SDGs and Paris climate Agenda (keep Mean global warming below 1.5 – 2 degrees centigrade
  - What is the state of Kenyan past, present and future climate in each county
- 2. Mitigation : Nationally Determined Contributions (NDCs)** support to national reporting process
  - New and emerging areas research Geoengineering : Replacement of eroded planet earth parts

**ENVIRONMENT**  
**ATMOSPHERE;**  
**HYDROSPHERE**  
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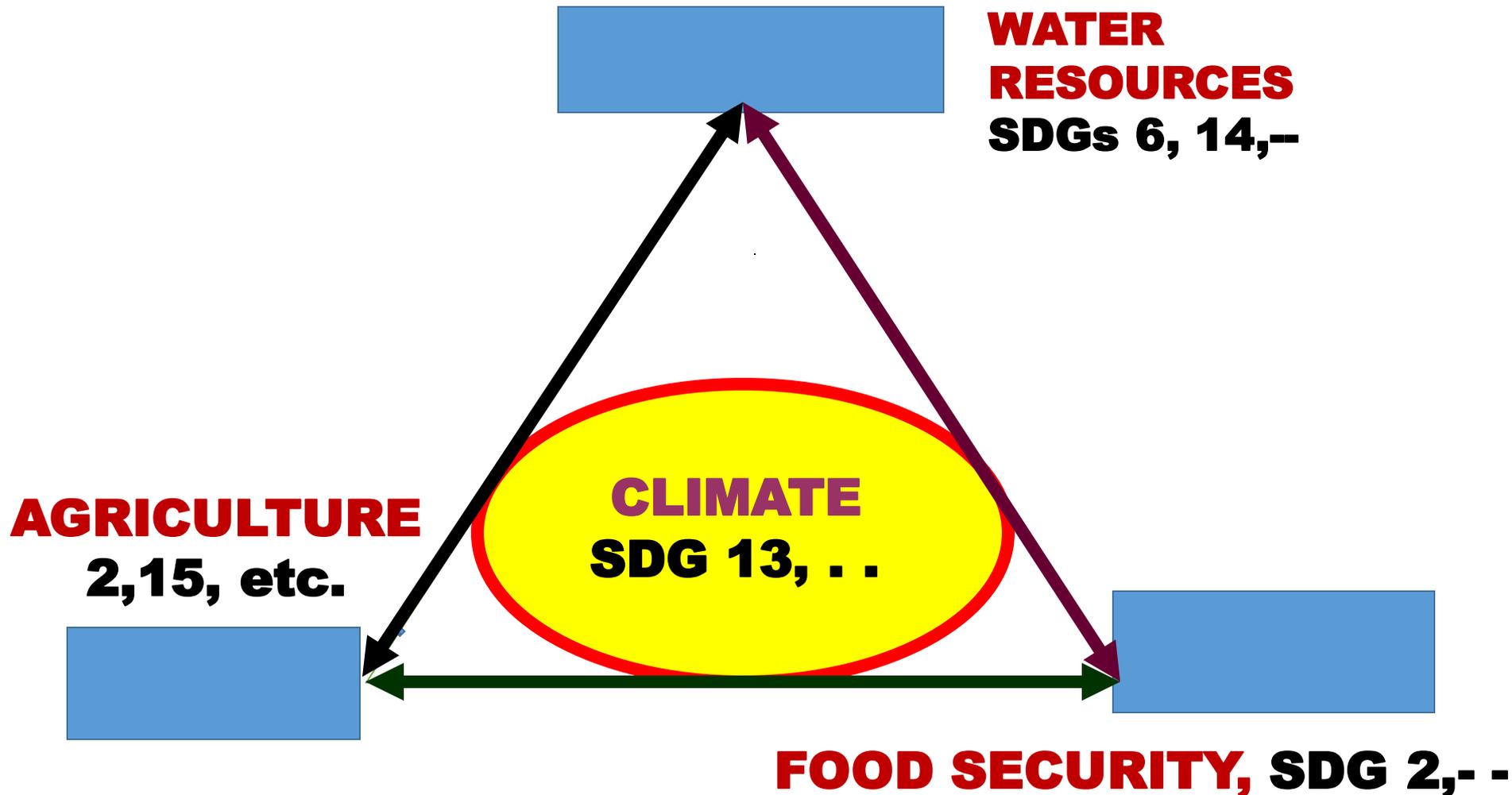


**SOCIETY,**  
basic livelihood  
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**ECONOMY**  
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**2. Multi disciplinary research**

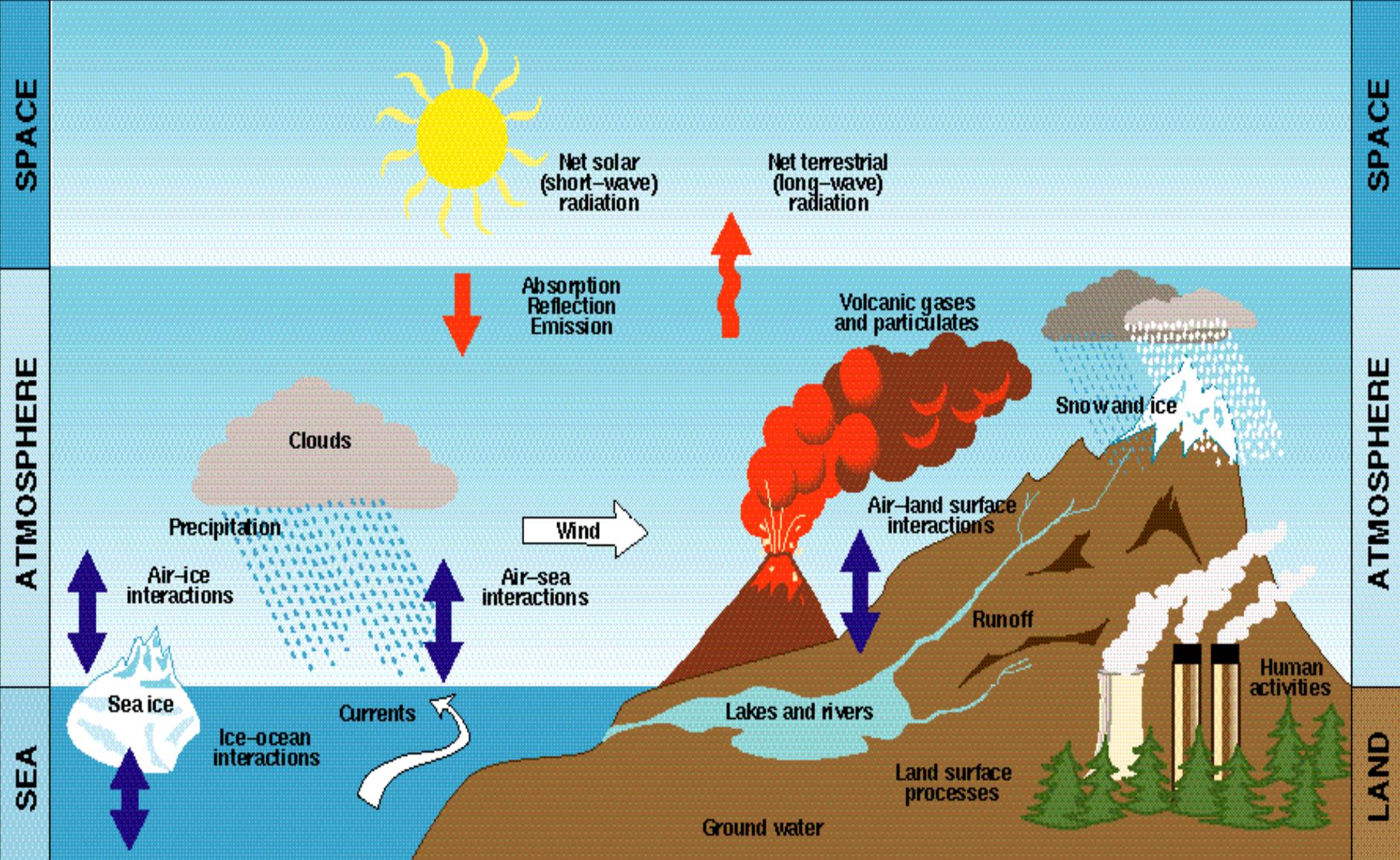
**Example: HOW WELL DO WE UNDERSTAND  
THE COMPLEX CLIMATE, WATER ,  
AGRICULTURE, FOOD SECURITY NEXUS  
(PAST AND PRESENT)**



**Water cycle related risks:** is important components of the planet earth and the associated Climate system: the atmosphere, hydrosphere, cryosphere, land surface and biosphere.

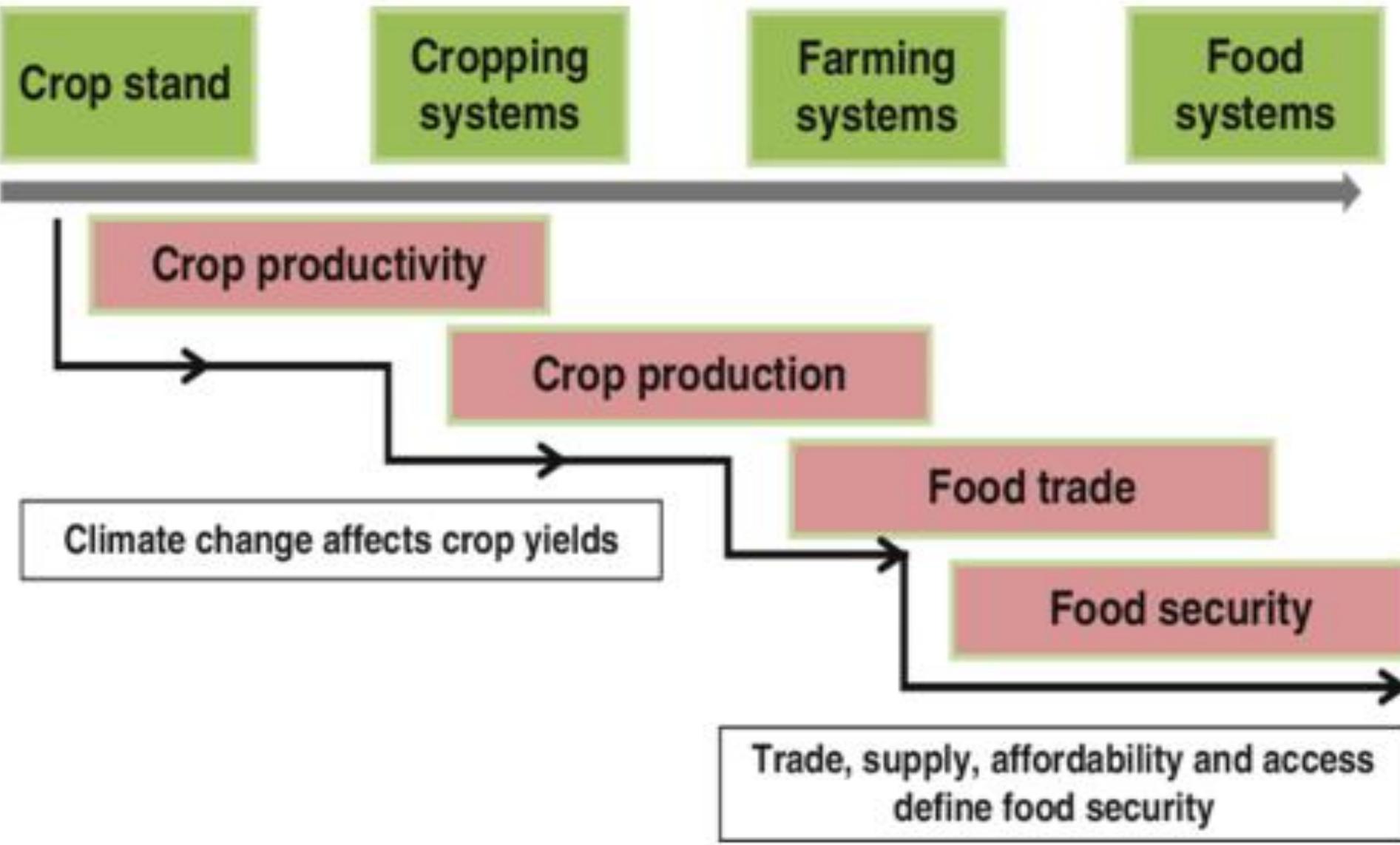
- **Climate RISKS influence world's freshwater resources in several aspects, such as freshwater availability, quality, and destructive potential.**
- **Hydrological extremes become more extreme**
- **sea / lake levels rising**
- **Water related diseases, etc**

# hydrological / Water cycle ( what do we know on past/present climate nexus)?



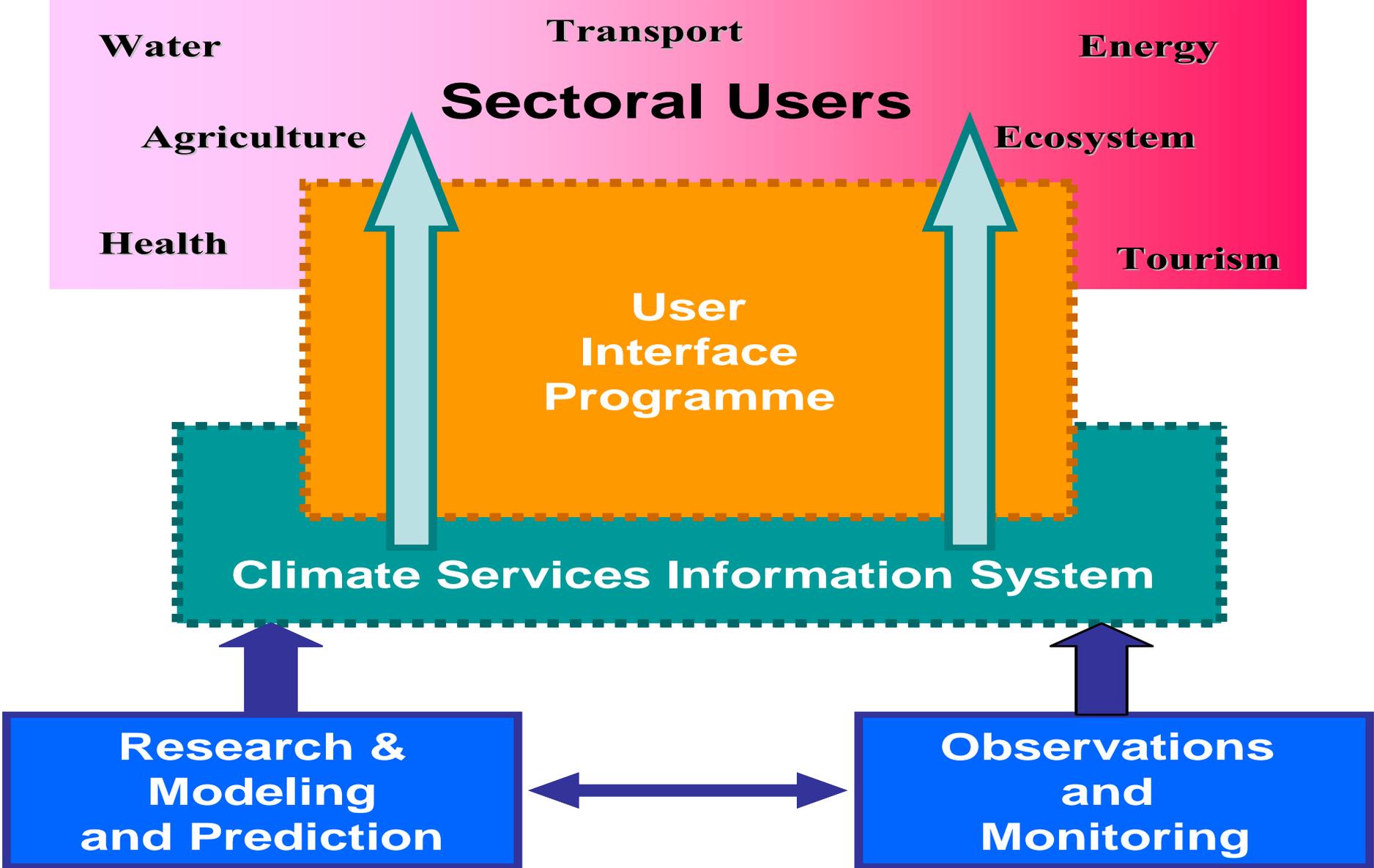
# **Agriculture / Food security systems and Climate Nexus (past / present)**

- . Food production and availability, access, quality, utilization, and stability of food systems**
- . Climate pests and diseases**
- . Agriculture and GHGs emissions**
- . Agriculture and climate change mitigation: reducing the risk of negative climate change from the agriculture sector (eg reducing emissions from deforestation and forest degradation – REDD and REDD+)**



**Past/ present Climate and Agriculture / Food security resources ( what do we know?)**

# CLIMATE SECTOR: INTERGRATED CLIMATE RESEARCH FO RISK REDCUTION (WMO/GFCS)



### **3. INFRASTRUCTURE**

- **Big Data and management, Computing, ICT , AI, management of big data , etc**

### **4. Modelling (Seamless modelling Capacity in Space / time / thematic)**

### **5. Relevant specialized Capacity**

**- Relevant capacity needs**

**- Mentioning Young scientists (Transition / New and emerging areas of science)**

**- specialized hardware and technicians**

### **6. Networking, collaboration and coordination**

- 7. Science Education /curriculum**
- 8. Advocacy , Awareness,  
Publications**
- 9. Resources**
- 10. Partnerships; Roles of Private  
sector, Public sector**
- 11. Above all , Policy framework  
(strategy and implementation  
programme)**
- 12. Take advantage of Opportunities**

# **SOME GLOBAL OPPORTUNITIES**

- **UN SDGs 2030**
- **Paris climate UNFCCC Agreement (Climate fund)**
- **Un Sector specific Frameworks e.g. Sendai Disaster Risk Reduction (DRR) Framework , and many others**
- **AU agenda 2063**
- **Regional RECs Agenda (IGAD, EAC, COMESA)**
- **PUBLIC SECTOR INSTITUTIONS**

# CONCLUSION

**SUSTAINABILITY OF DEVELOPMENT IN KENYA REQUIRES SPECIALIZED CAPACITY AND GOOD LOCAL KNOWLEDGE OF COMPLEX AND HIGHLY INTERACTIVE CLIMATE –DEVELOPMENT SYSTEMS THAT ARE INTERGRAL COMPONENTS THE TOTAL PLANET ERATH SYSTEMS WITH COMPLEX SPACE –TIME DIMENSIONS**

***I Thank You All***