Challenges for sustainability and climate resilience in West Africa. Towards long-term cooperation and implementation

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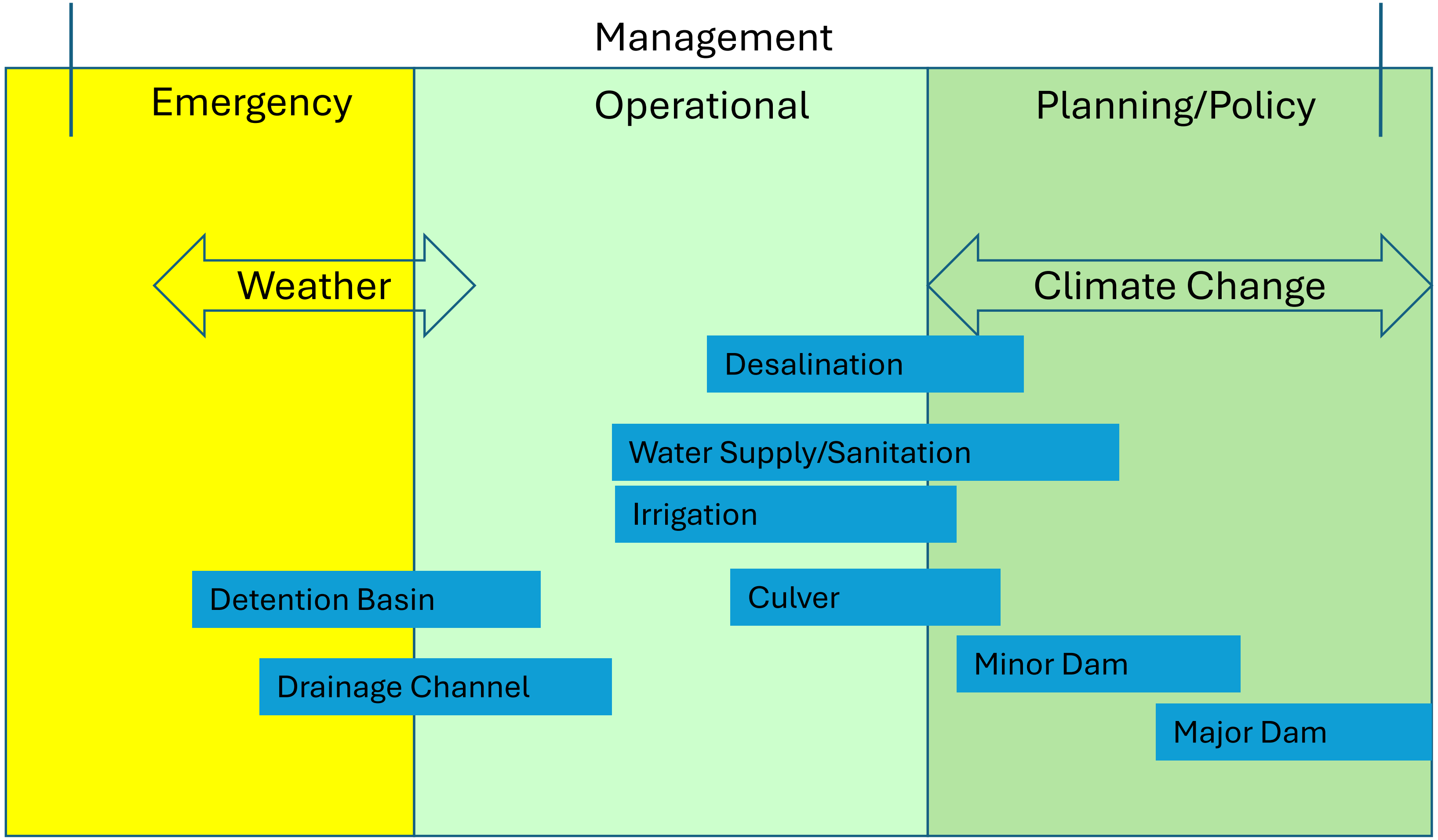
"CLIMATE IS WHAT YOU EXPECT AND WEATHER IS WHAT YOU GET"

Climate Resilience

- Climate resilience
  - Better able to anticipate, prepare for, and adapt to changing climate conditions and withstand, respond to, and recover-rapidly from disruptions
- Information – all time scales
  - Nowcasting
  - Weather (Synoptic)
  - Sub-seasonal
  - Seasonal
  - Climate Prediction (monthly, seasonal, annual, decadal)
  - Climate Change Projections
- Management scales
  - Emergency – weather information (e. g. Disaster Management)
  - Operational – weather and climate information
  - Planning/Policy – climate change information

Management scales in the context of Climate Change



Reproduced from UN Economic and Social Commission for Western Asia,

Decision-Making Across time scales

Begin monitoring mid-range
And short-range forecasts

Update contingency plans

Train volunteers

Sensitize communities

Enable early-warning systems

Continue monitoring
Short-time-scale forecasts

Mobilize assessment teams

Alert volunteers

Warn communities

Local preparation activities

Deploy assessment teams

Activate volunteers

Instruction to communities
to evacuate, if needed

Implementation (and cooperation)?

You want development?

Consult, cooperate, collaborate and coordinate

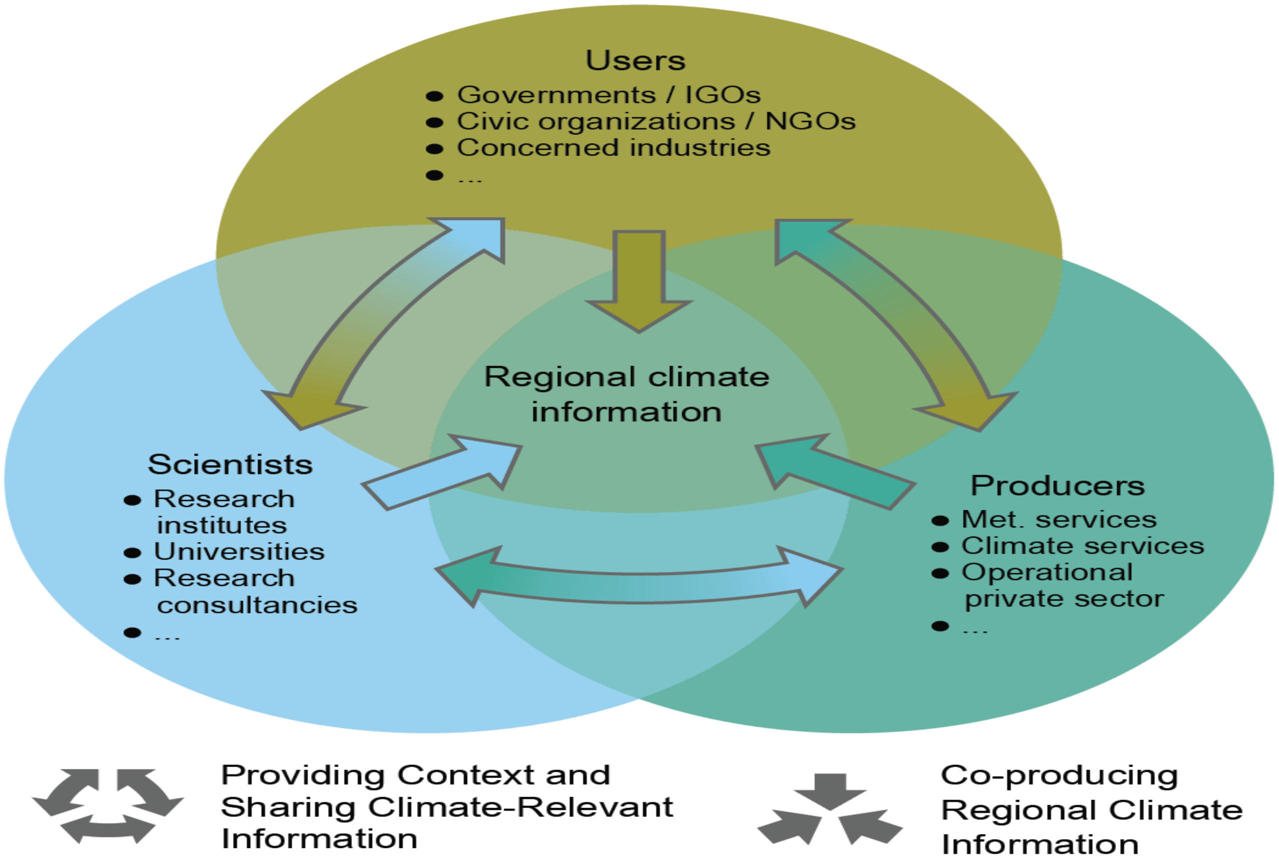
Climate Services

According to the World Meteorological Organization (WMO), climate services are the use and provision of climate information, data, and knowledge to help with decision-making

GFCS

Climate services involve the production, translation, transfer and use of climate knowledge and information for informed decision-making and climate-smart policy and planning.

Development of climate Information

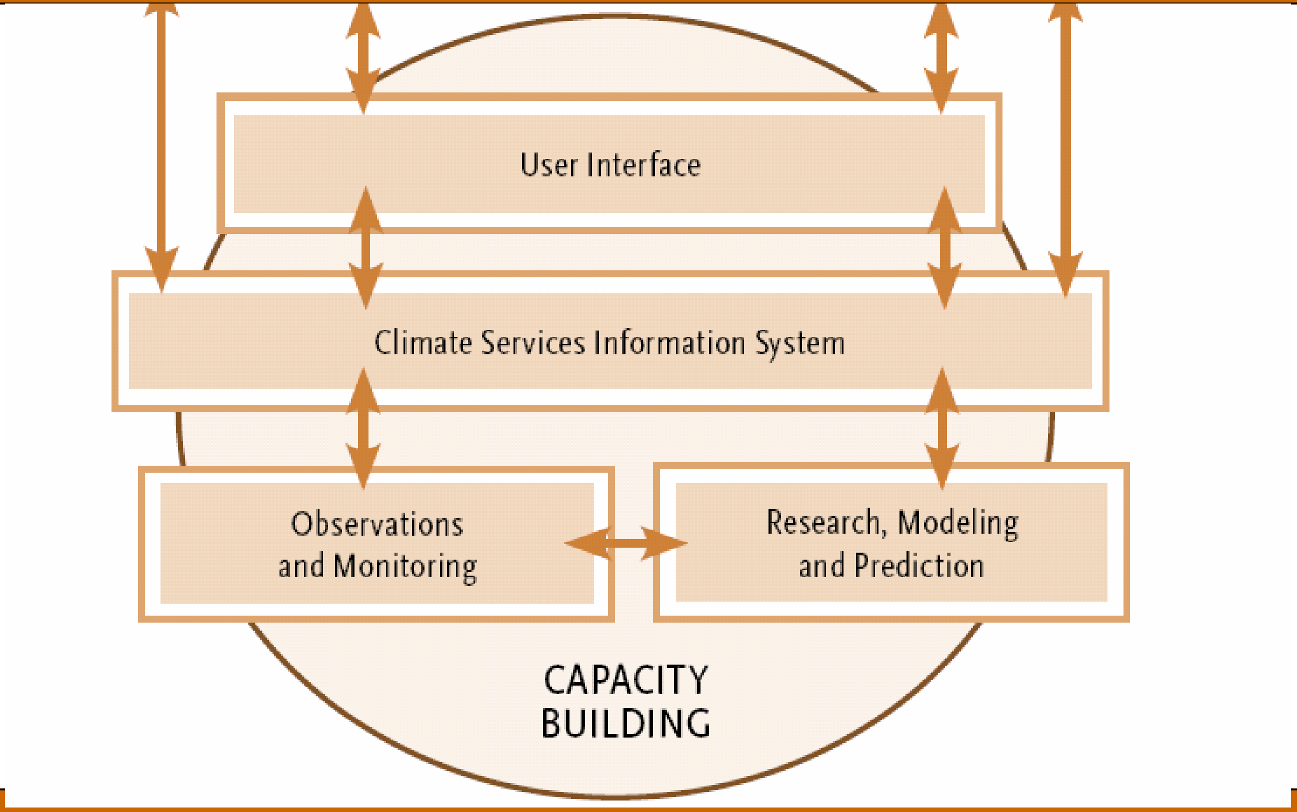


Effective regional climate information requires shared development of actionable information that engages all parties involved and the values that guide their engagement.

https://www.ipcc.ch/report/ar6/wg1/figures/chapter-10/figure-10-17/

Pillars of Global Framework for Climate Services (GFCS)

Provide Climate Services to national user groups:
ministries, prvate sector, local users



Strengthened through Capacity Building

Some thoughts about Sustainability

- Solutions
  - ➢Not sufficient to simply impose solutions which work in the Global North
- Provision of forecast from outside Africa
  - ➢Increasing the availability of inaccurate forecasts from NWP will not give people better early warnings.
- Sending more radars (or improving observation network)
  - ➢Sending more radars to Africa will have no impact unless there is investment in local capacity and capability to exploit them.
- Standards of Governance
  - ➢Donor or Funders should ensure standards of governance at the beginning of projects.

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- **Challenge 1**: *Scientific Gap*
  - Lack of understanding of the underlying science
  - Lack of sufficient scientific capacity and capability
  - **African ownership needed for community scale challenges**
  - Tropical weather systems not well studied compared to mid-latitude systems to support all aspects of operational weather prediction
  - Lack of proper understanding has led to poor representation in numerical weather and climate models, especially for rainfall
  - Insufficient scientific specialists and university programmes on the continent remain limited

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- **Incentive 1**: *Addressing scientific Gaps*
  - Required is investment in advanced quantitative and qualitative training in the core sciences –data analysis, weather and climate models
  - Need to support long-term scientific careers within Africa with adequate research infrastructure in the form of computing, models and data facilities.
  - Can be done by strengthening African research capability around existing centres of excellence with top-level scientific infrastructure **and a clear vision for growth**
  - International aid and development funding need to prioritize scientific centres of excellence and long-term African career paths in climate sciences.
  - The WASCAL example

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- **Challenge 2**: *Data gaps and data access*
  - ➢Need to improve past, present and future observations
  - ➢**Data rescue is needed for non-digitized data**
  - ➢**Use of the observation**: The observations are needed for improved scientific understanding – model verification, development and tunning, data assimilation, bias correction, development of statistical and **machine learning forecast approaches** to replace or complement model-based forecasts
  - ➢Lacks operational investment- Investing money is not enough. Needs tactical and strategic deployment of resources to support infrastructure on the basis of data collection
  - ➢Data access from the NMHSs is challenging.

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- **Incentive 2**: *Addressing data gaps and data access*
  - A coordinated African approach with support from the recent WMO Systematic Observations Financing Facility (SOFF) initiative, can be a new incentive for an African solution to an African challenge.
  - SOFF promotes reliable and accurate data collection – financial support is contingent on successful delivery of data to international servers, monitored long-term
  - SOFF encourages free exchange of data, by facilitating the delivery of data to open data repositories

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- **Challenge 3**: *Modelling and forecasting*
  - ➢Lack accuracy of models over Africa hinders weather and climate services delivery and leads to high uncertainty in the prediction of rain-bring deep convection over daily time scales
  - ➢Most weather and climate models developed in and for mid-latitudes => different strategies needed for running and exploitation for Africa.
  - ➢Poor performance of models for daily African rainfall – due to inherent chaos of convective systems and thus low predictability
  - ➢**Low predictability warrants use of ensemble strategies** (which need calibration with better observation)

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- **Challenge 3**: *Modelling and forecasting cont'd*
  - ➢Longer predictability at larger scales in the tropics implies statistical-dynamical modelling approaches (**including machine learning**) hold some promise are are windows of opportunity for flow-dependent forecasts that are not yet being exploited.
  - ➢**Advances in HPC and observing systems are lagging behind in Africa**
  - ➢Need to improve handling of tropical processes and weather systems in models, **advance ensemble modelling, apply convection-permitting models (CP) with an "African lens"**
  - ➢Improved models for African end users, require exploitation of real-time observational data through improved data assimilation, leading to benefits in climate analysis and in validating global models

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- **Challenge 3**: *Modelling and forecasting cont'd*
  - Lack of easy access to forecast products from global models with potential skill at sub-seasonal and short time scales (combined statistical-dynamical modeling including machine learning offers opportunity to improve skill of the data)
  - **There is the need for socio-economic and impact-based evaluation of models by Africans and should not be imposed from outside**.
  - Limitation on prediction of tropical convection due to chaotic atmospheric developments, necessitates improving ` ` nowcasting" of existing storms over Africa.
  - Need for improved cooperation between universities and NMHSs in both the global South and North.
  - **Need for Global North and Global South to co-design modelling solutions (including co-designing of NWP models in cloud-based computational platforms), to find the best balance between technical feasibility, sustainability and robustness on one side and sufficient acceptance, ownership and freedom of configuration on the other hand**.

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- **Incentive 3**: *Responding to Modelling and forecasting challenge*
  - ➢International donors have to ensure that African scientists have skills and facilities to **co-produce and deliver services that reach communities and stakeholders in countries**
  - ➢Centres of Excellence, in particular African universities and WMO Regional Training Centres (RTCs), can train large numbers of specialists to work across diverse countries and communities, as has been done by WASCAL.
  - ➢ Investments in HPC, NWP, Climate Modeling within a number of leading African Centres is required, **to build local capability, communities of expertise and ensure feedback** to Global Centres. **These benefit science globally and motivate African Scientists to continue their work in the region**.

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- **Challenge 4**: *Capacity building, knowledge management and communication*
  - Tackling challenges 1-3 within a few years will require strengthening management, governance and communication of regional activities, to increase **capacity and exploit learning across many stakeholders and projects.**
  - The scale of the challenge is global and across many disciplines with investments in early warnings and actors especially vital for saving lives, promoting economic development and reducing the cost of disaster responses in an African context
  - Although national and international coordination mechanisms and agencies exist, there are still too many examples where operational systems fail when agencies fail to cooperate.

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- **Challenge 4:** *Capacity building, knowledge management and communication cont'd*
  - ➢Need to enhance coordination for the optimal use of technology and optimal network of observing and communication systems, **including training a critical mass of human capacity to support these systems**.
  - ➢Existing coordination is provided by WMO, but the WMO can mostly only provide oversight to strategy due to lack of direct resources.
  - ➢Need for performance-based funding to strengthen coordination (as in the SOFF)
  - ➢Need to undertake capacity building within the framework of ``Training of Trainers (TOT)"
  - ➢Investments to support the transition from research to operations,
  - ➢Partnerships between universities, WMO RTCs and NMHSs that strengthen the provision of skills across the range of disciplines from physics, computational science through to social and economic sciences need to be part of the solution

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- **Challenge 4**: *Capacity building, knowledge management and communication cont'd*
  - **Need to address the reliance of the Global South on the Global north and the unequal dynamic between producers and users within the Global South**
  - Need to address the **low level of co-production** of climate services at regional and national levels within the Global South, which is reducing the uptake of climate information and its mainstreaming into decision-making processes
  - *Need to foster effective partnerships among actors in the Global South – requires knowledge exchange, capacity building and co-production- ACMAD, RCCs, Universities, WMO RTCs*.

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- **Challenge 4**: *Capacity building, knowledge management and communication cont'd*
  - ➢Need to promote innovation and job creation – sustainability is linked to this. Young students will be empowered to create new user-driven products and services.

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- **Incentive 4**: *Responding Capacity building, knowledge management and communication*
  - ➢Donors and programs need to insist on standards of governance for international coordination
  - ➢Motivate African leadership of projects with funding linked to successful outcomes.
  - ➢Possible co-production blueprint: WMO MHEWS best practice value chain: 1) Knowledge, 2) Forecasting, 3) Communication, 4)Preparedness and 5) Monitoring and Evaluation (including socio-economy)

Thank You for your attention.

Why a Framework for Climate Services?

- Present capabilities for providing climate services do not exploit all that we know about climate

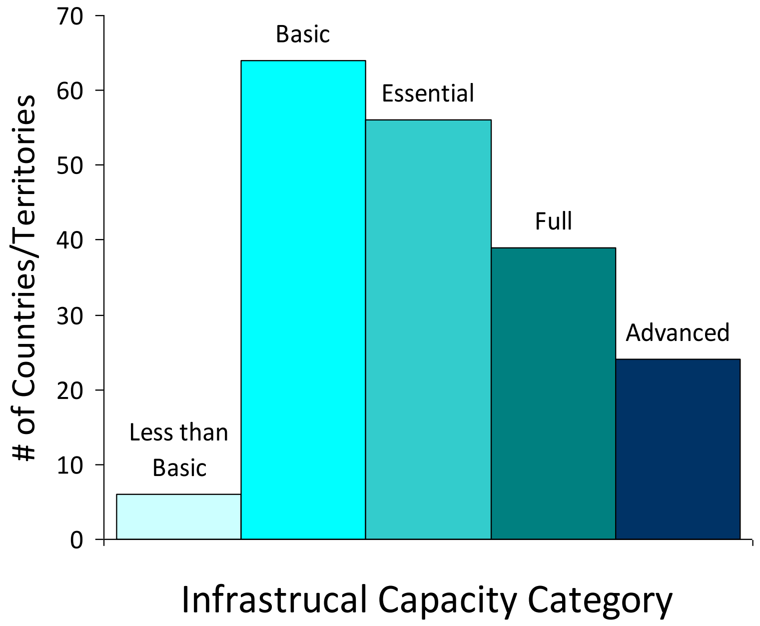
- Present capabilities fall far short of meeting current and future needs and delivering their full and potential benefits, especially in developing countries

A Framework for Climate Services will build on existing capacities and leverage these through coordination to address these shortcomings

Why a Framework for Climate Services?

- Many countries lack the infrastructural, technical, human and institutional capacities to provide high-quality climate services.

Infrastructural Capacities of Countries as of Aug 2010 to provide Basic, Essential, Full and Advanced Climate Services.



Some definitions

- Projection
  - It is a probabilistic statement that it is possible that something will happen in the future if certain conditions develop. In contrast to a prediction, a projection specifically allows for significant changes in the set of `boundary conditions' that might influence the prediction (Pielke, 2002).
  - The term ``projection" is used in two senses in the climate change literature. In general usage, a projection can be regarded as any description of the future and the pathway leading to it. However, a more specific interpretation has been attached to the term ``climate projection" by the IPCC when referring to model-derived estimates of future climate (IPCC, 2001).
- Prediction
  - It is a probabilistic statement that something will happen in the future based on conditions that are known today and assumptions about the physical processes that will determine these changes. A prediction is most influenced by the `initial conditions'. It is not dependent on unpredictable changes of other potentially influential factors that serve as `boundary conditions' (Pielke, 2002)
  - When a projection is designated ``most likely" it becomes a forecast or prediction. A forecast is often obtained using physically-based models, possibly a set of these, outputs of which can enable some level of confidence to be attached to projections (IPCC, 2001).
- Scenario
  - A scenario (includes all of the important direct and feedback effects on climate) is a realization out of an ensemble of possible simulations (Pielke, 2002).
  - A scenario is a coherent, internally consistent and plausible description of a possible future state of the world (IPCC, 1994). It is not a forecast; rather each scenario is one alternative image of how the future can unfold. A projection may serve as the raw material for a scenario, but scenarios often require additional information (e.g. about baseline conditions). A set of scenarios is often adopted to reflect, as well as possible, the range of uncertainty in projections. Other terms that have been used as synonyms for scenarios are ``characterisation", ``storyline" and ``construction" (IPCC, 2001).
- Baseline
  - The baseline (or reference) is any datum against which change is measured. It might be a ``current baseline", in which case it represents observable, present-day conditions. It might also be a ``future baseline", which is a projected future set of conditions excluding the driving factor of interest. Alternative interpretations of the reference conditions can give rise to multiple baselines (IPCC, 2001).
- Storyline
  - Terminology adopted when the Special Report on Emissions Scenarios (SRES) was published in 2000 (Nakicenovic et al., 2000)
  - A narrative description of a scenario (or a family of scenarios), highlighting the main scenario characteristics and dynamics, and the relationships between key driving forces (Carter, 2007).

- **Prediction**
- An estimate of how the natural climate will evolve in the future. Predictions are usually probabilistic because the climate system's future evolution is sensitive to initial conditions.
- **Projection**
- A model-derived estimate of future climate. Projections are based on assumptions about future socioeconomic and technological developments, which may or may not happen.
- **Forecast**
- A projection that is labeled as "most likely". Forecasts are often created using deterministic models, which can provide some confidence in the projections