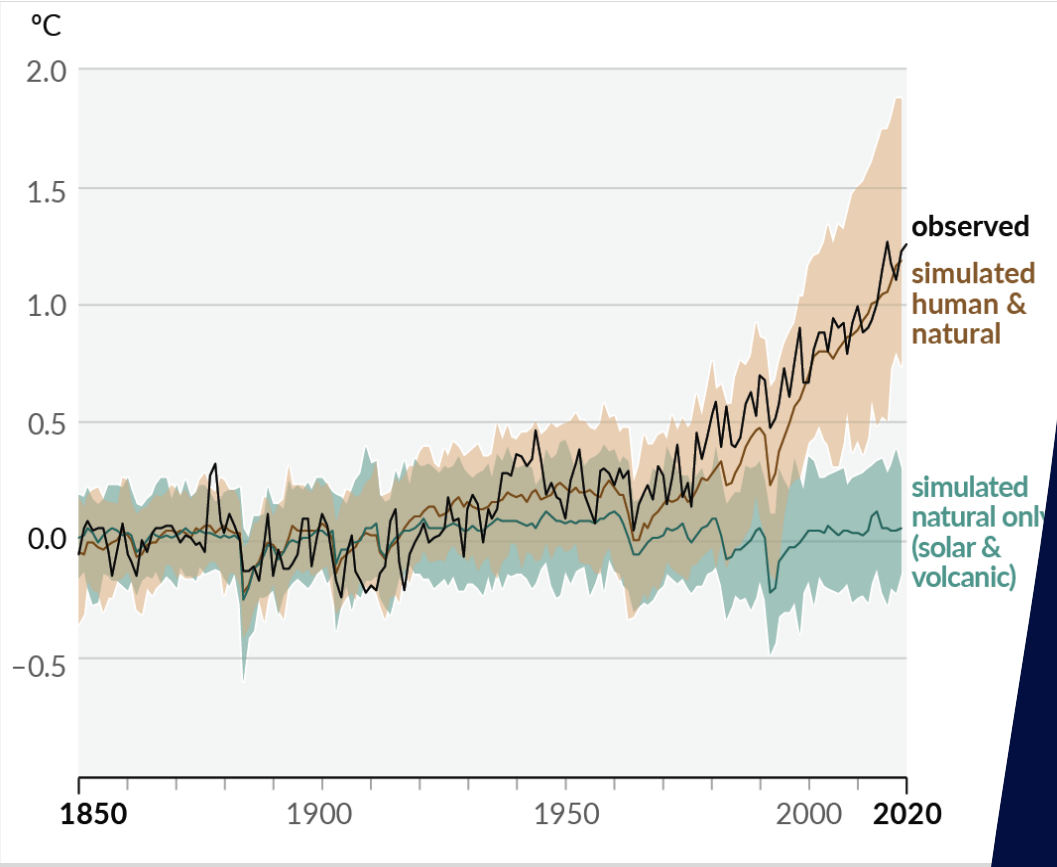
SUEZ AIR & CLIMAT FRANCE

From Climate Science to Adaptation Action: Case studies

Presented by Cassien Ndiaye, PhD

- **Climate Science Expert**
- **Climate Service Poject Manager**

25/03/2025



Changes in global surface temperature over the past 170 years (black line) relative to 1850–1900 and annually averaged, compared to Coupled Model Intercomparison Project Phase 6 (CMIP6) climate model simulations.

CONTEXT

"Climate change is accelerating, intensifying and becoming more widespread"

so remarks the Sixth Report of Working Group 1 of the Intergovernmental Panel on Climate Change published in August 2021 (IPCC,2021).

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Key climate hazards:

- Rising temperature
- Storms and flooding
- Drought

Climate change affects everyone, regardless of their sector of activity, and in diverse and varied ways.

*"**Climate change is a huge challenge**, but it can be brought in line if governments, businesses and individuals work together."*

Sir Richard Branson, Founder of Virgin Group

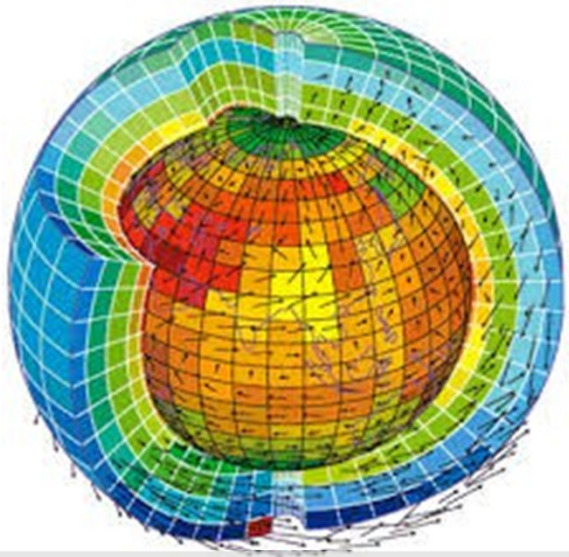
CLIMATE SERVICES FOR ADAPTING TO CLIMATE CHANGE

CLIMATE SERVICES FOR ADAPTING TO CLIMATE CHANGE

CLIMATE SERVICE… :

1. MODELLING OF CLIMATE CHANGE

Climate model



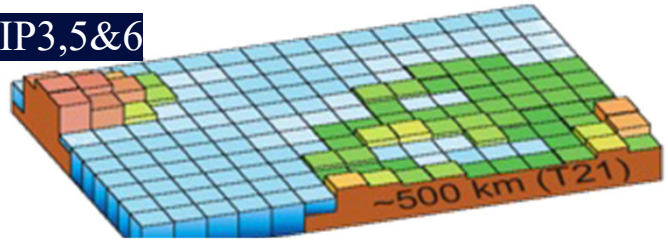
Developped by international modelling groups. For example, the IPSL-CM model by French Pierre-Simon Laplace Institute, CanESM5 by Canadian Centre for Climate Modelling, etc.

- ✓ Used in Coupled Model Intercomparison Projects (CMIPs) to carry out shared socioeconomic pathway (SSP) to assess present and future climate change.
- ✓ Used as a basis for the conclusions of the IPCC reports (e.g. AR5 and AR6).
- ✓ Sectors: Energy, gas, infrastructure, etc.

CLIMATE SERVICE… :

1. MODELLING OF CLIMATE CHANGE

CMIP3,5&6



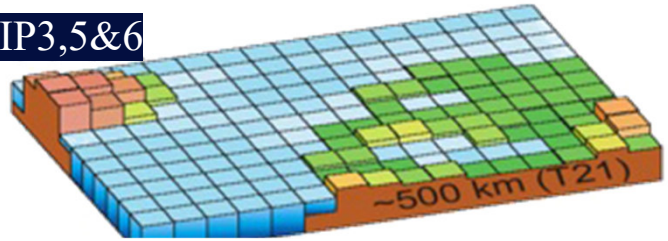
CMIP Version	Spatial resolution (°)	Spatial resolution(~km)
CMIP3 (2007)	1.4° à 5°	~150-500 km
CMIP5 (2013)	1° à 3°	~100-350 km
CMIP6 (2019)	0,7° à 2,5°	~80-300 km

- **Problems with CMIPs data for climate adaptation:**
  - Bias
  - Low spatial resolution, so lack of accurate climate information :
    - ✓ at city or neighbourhood scale,
    - ✓ at wind or solar farm scale,
    - ✓ etc.

CLIMATE SERVICE… :

1. MODELLING OF CLIMATE CHANGE

CMIP3,5&6

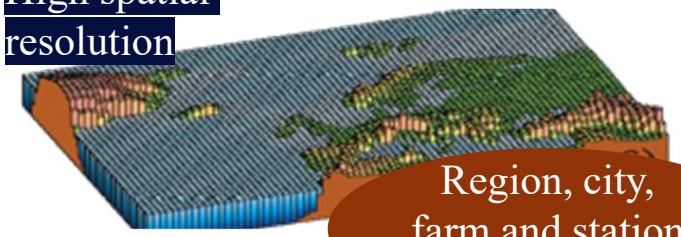


❖ **Problems with CMIPs data for climate adaptation:**

- Bias
- Low spatial resolution, so lack of accurate climate information :
  - ✓ at city or neighbourhood scale,
  - ✓ at wind or solar farm scale,
  - ✓ etc.

Why to increase the spatial resolution of models and data :

High spatial resolution



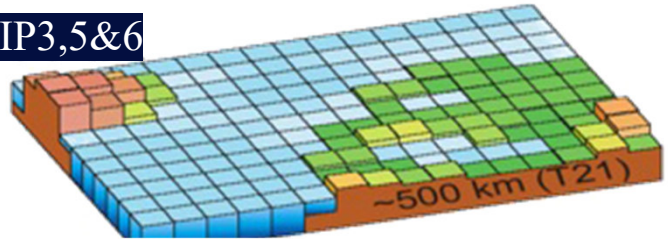
Region, city, farm and station scales

- to better take into account **topographic effects**;
- to solve some regional climate processes (regional wind, spatial structure of precipitation, small scale circulation, etc.).
- Local climate effect can be simulated more precisely, especially extreme events that are often related to small scale forcing.

CLIMATE SERVICE… :

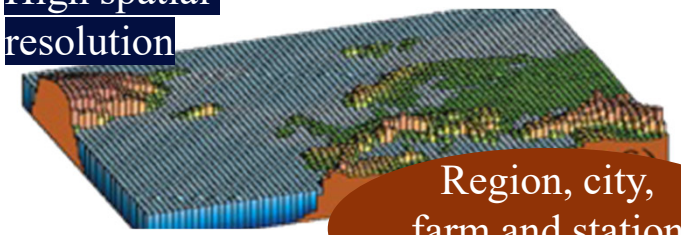
1. MODELLING OF CLIMATE CHANGE

CMIP3,5&6



How to increase
the spatial resolution:
Downscaling methods

High spatial resolution



Region, city, farm and station scales

Coarse atmospheric data
Precipitation, temperature, humidity, geopotential, wind, etc.

Dynamical downscaling (RCMs):

- GCMs to drive regional models (5-50km) determining atmosphere dynamics
- Requires a lot of computer time and resources => Limited applications

Statistical downscaling:

- Based on statistical relationships between large- and local-scale variables
- Low costs and rapid simulations applicable to any spatial resolution
- Uncertainties (results, propagation, etc)

Local variables (e.g., precip., temp.)
(small scale water cycle, impacts – crops, resources – etc.)

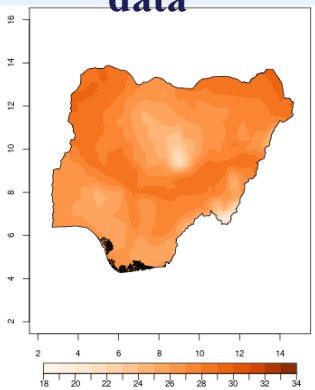
CLIMATE SERVICE… :

1. MODELLING OF CLIMATE CHANGE

Case study:

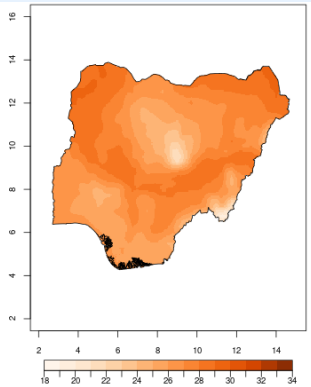
Development of high-resolution climate projection data for the National Adaptation Plan in Nigeria

Observed temperature data



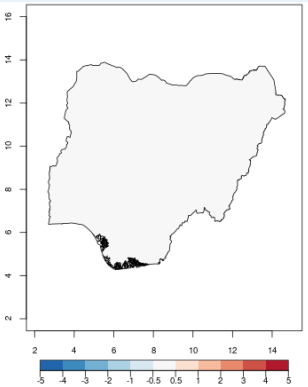
ERA5 observation data with 9km spatial resolution is used as a reference.

Downscaled CMIP6 models



After applying statistical downscaling method to CMIP6 data with 9km spatial resolution.

Bias= Models - Observation



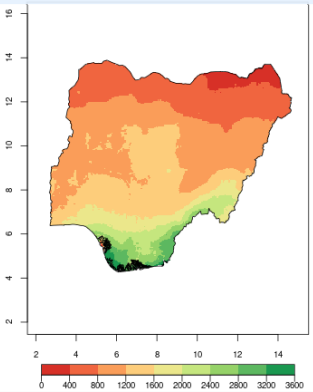
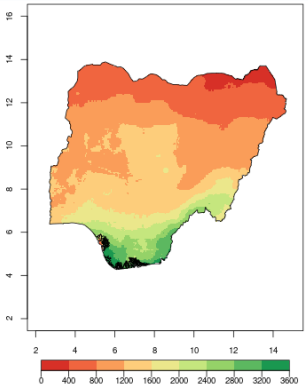
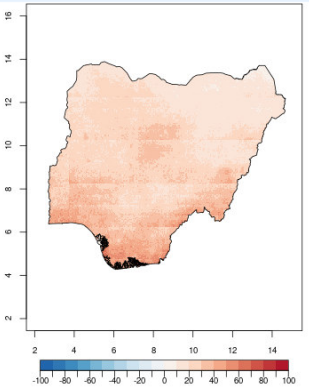
The downscaling method not only increases the spatial resolution, but also corrects almost all of the model bias in temperature.

CLIMATE SERVICE… :

1. MODELLING OF CLIMATE CHANGE

Case study:

Development of high-resolution climate projection data for the National Adaptation Plan in Nigeria

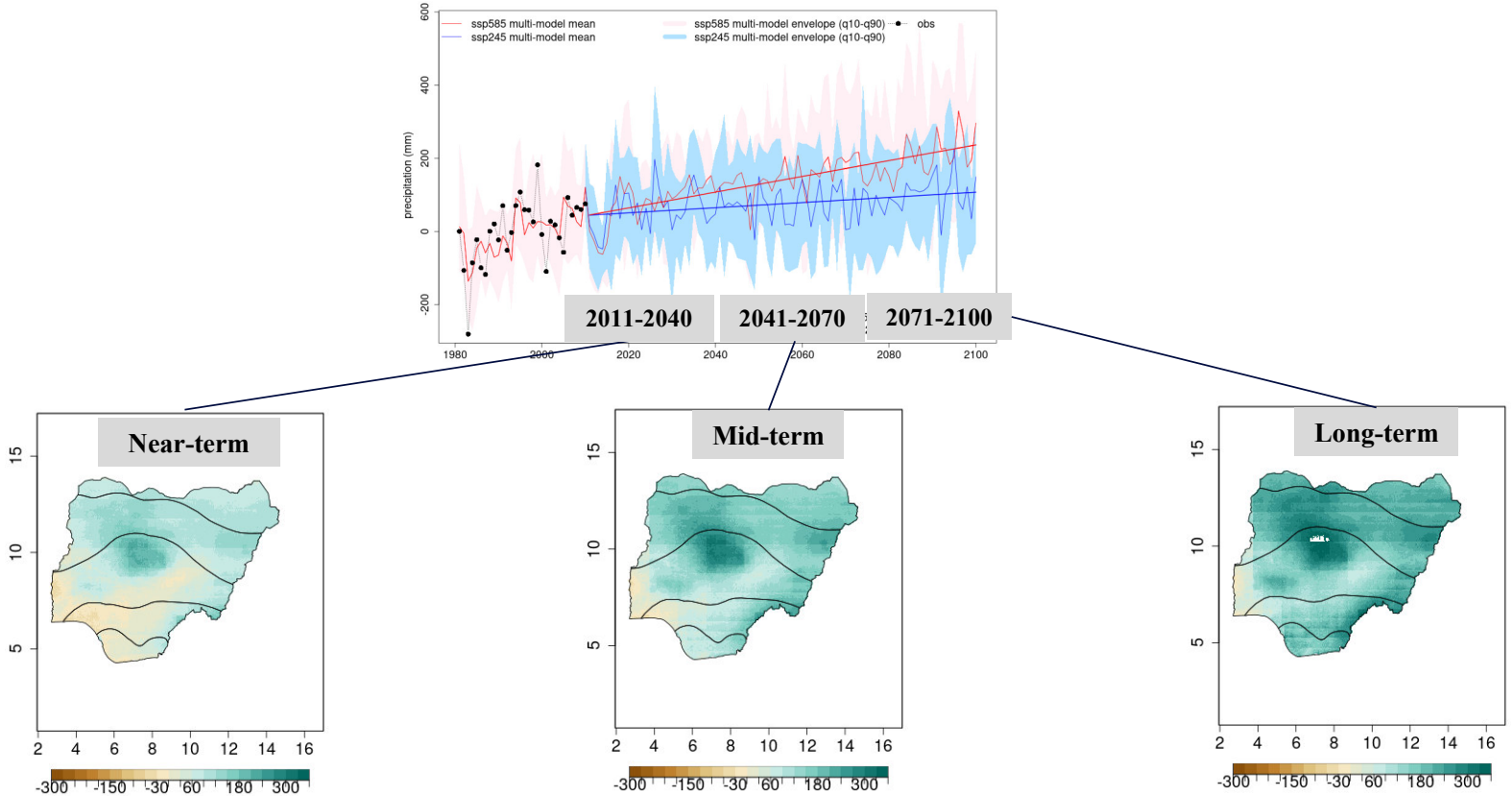
Observed rainfall data	Downscaled CMIP6 models	Bias= Models - Observation
		
CHIRPS observation data with 5km spatial resolution is used as a reference.	After applying statistical downscaling method to CMIP6 data with 5km spatial resolution.	The downscaling method not only increases the spatial resolution, but also drastically reduces the model bias in precipitation.

CLIMATE SERVICE… :

1. MODELLING OF CLIMATE CHANGE

Case study:

Development of high-resolution climate projection data for the National Adaptation Plan in Nigeria



CLIMATE SERVICES FOR ADAPTING TO CLIMATE CHANGE

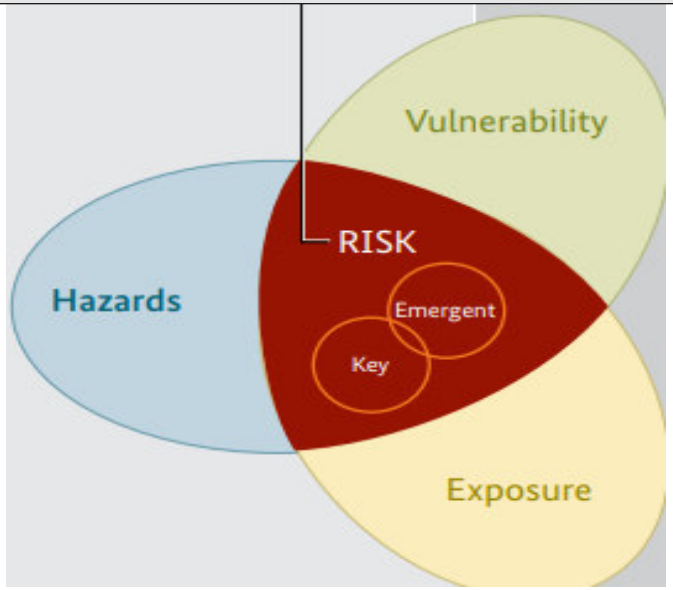
CLIMATE SERVICE… :
2. CLIMATE RISK ASSESSMENT

Climate Risk Assessment is the process of identifying, analysing, and managing potential impacts of climate change on region, neighbourhood, city, farm, various sectors, etc.

Why is it important?

- Economic and societal impacts.
- Risks to infrastructure and businesses.
- Need for proactive adaptation strategies.

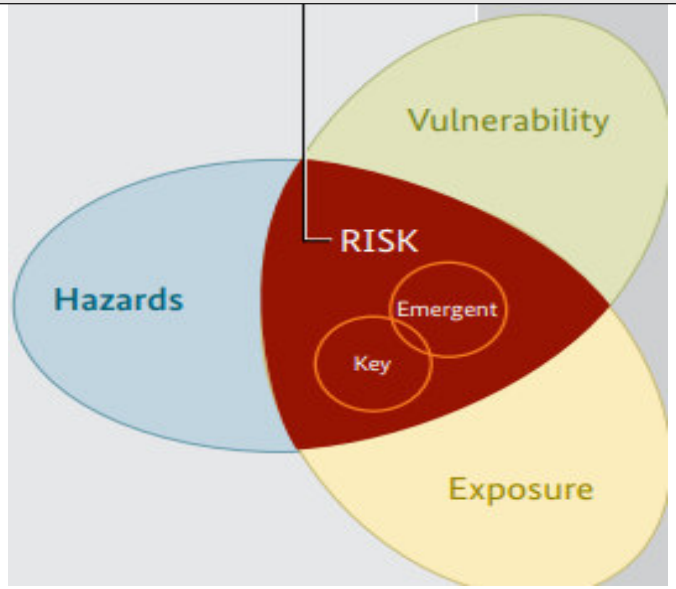
Risk = climate hazard x vulnerability x exposure



- Multi-sectoral approach (water, agriculture, forestry, infrastructure, health, tourism);
- Multi-dimensional (local, regional, national).

CLIMATE SERVICE… :
2. CLIMATE RISK ASSESSMENT

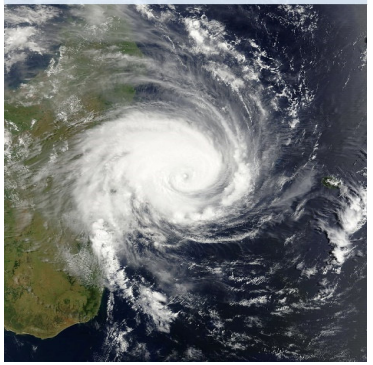
Risk = climate hazard x vulnerability x exposure



Climate hazard

Rising temperature

Heavy rainfall and Strom



Sea level rise

Floods

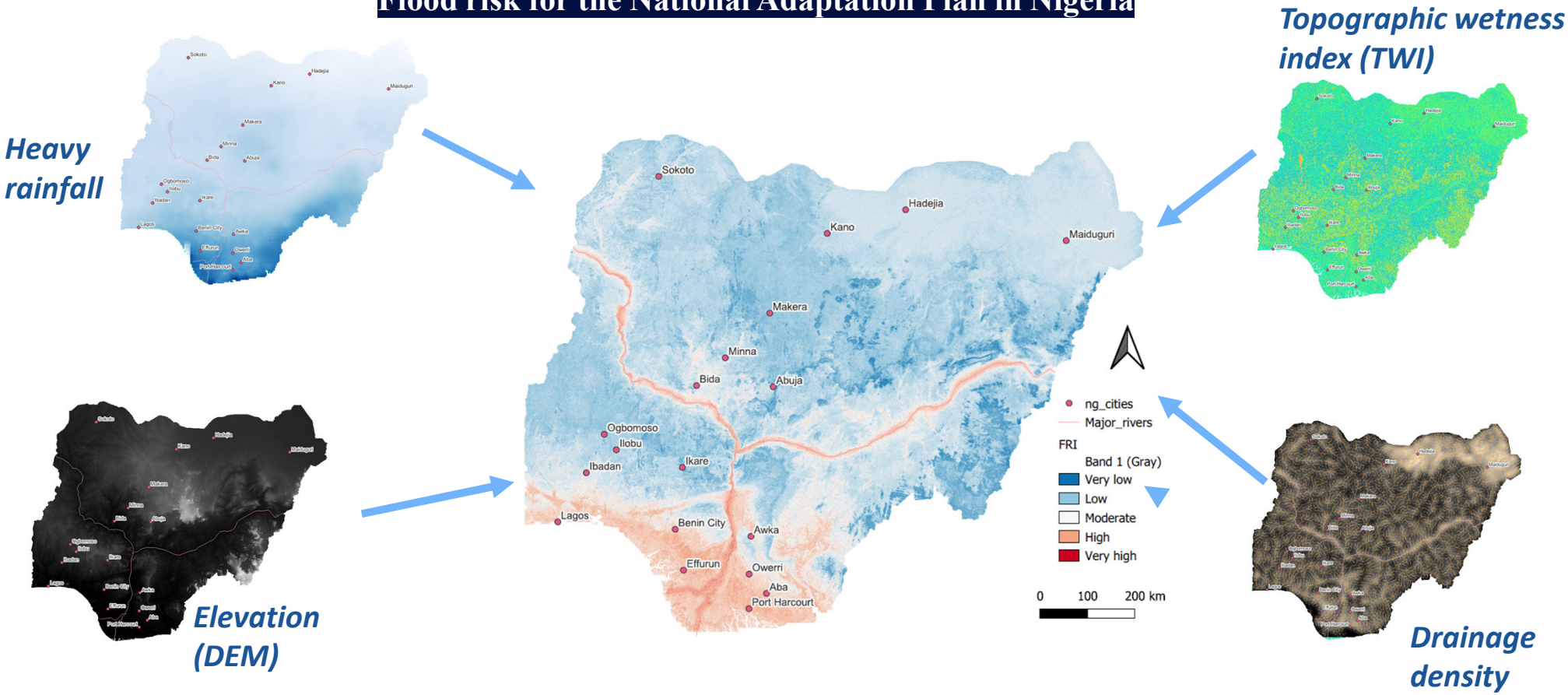
Droughts

CLIMATE SERVICE… :

2. CLIMATE RISK ASSESSMENT

Case study:

Flood risk for the National Adaptation Plan in Nigeria



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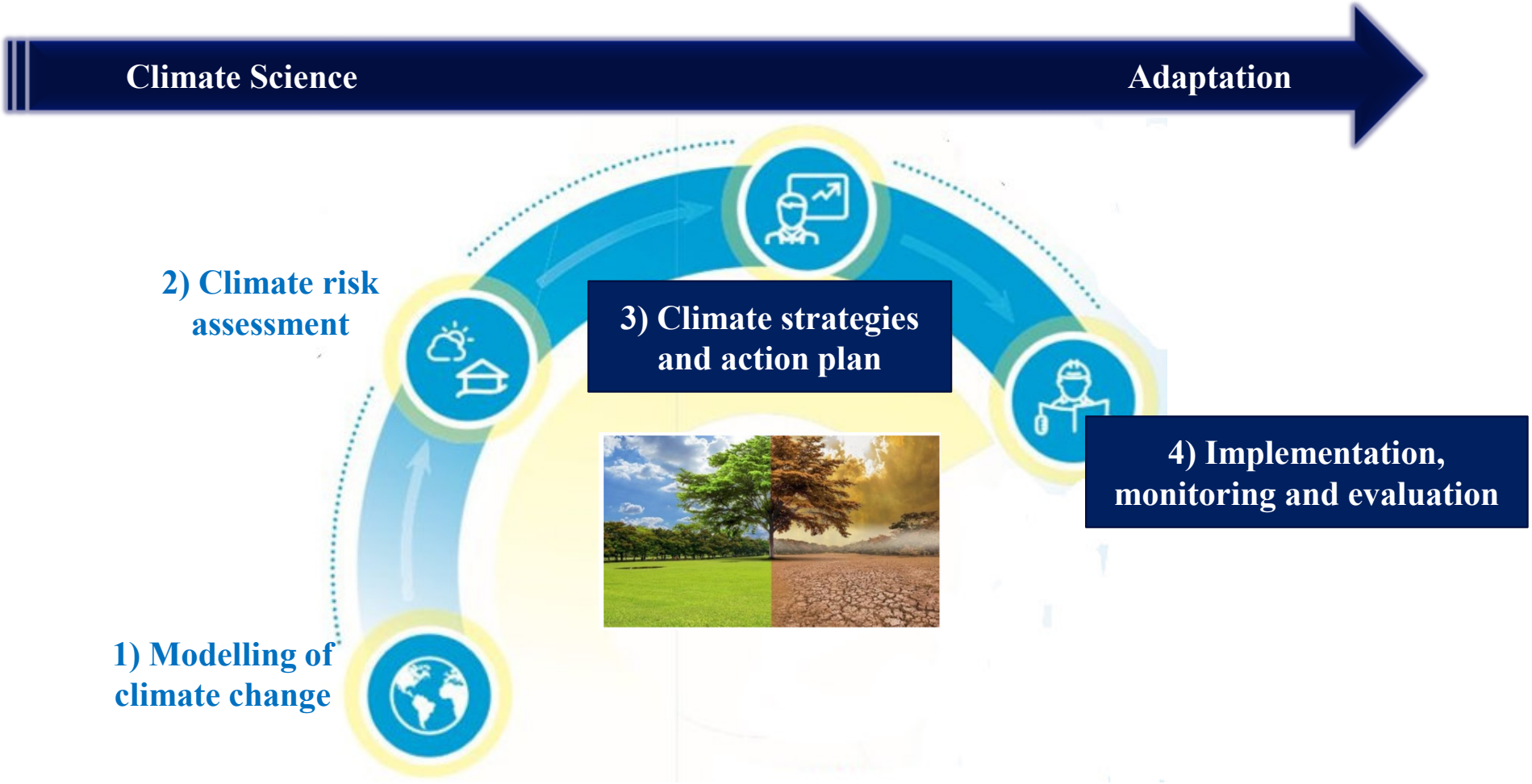


CLIMATE SERVICE… :
3. CLIMATE STRATEGIES AND ACTION PLAN

A Climate Strategy and Action Plan outlines measures to adapt to climate change effects.

Why is it important?

- Reduces environmental impact.
- Ensures sustainability and resilience.
- Aligns with global climate goals (e.g., Paris Agreement).

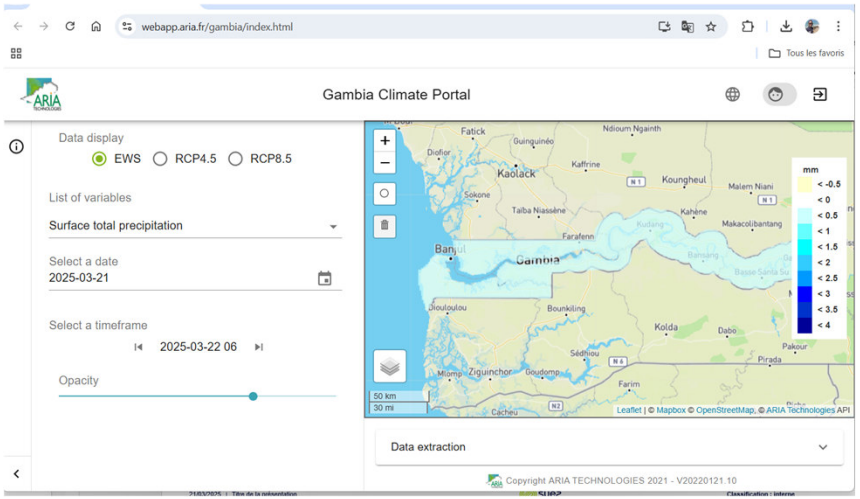
Adaptation Strategies (Coping with climate effects):

- Resilient infrastructure and flood defences
- Early warning systems for extreme weather
- Water conservation and sustainable agriculture

CLIMATE SERVICE… :
3. CLIMATE STRATEGIES AND 4. IMPLEMENTATION

Climate Risk Mapping Tool

Early Warning System



- Facilitate the monitoring of adaptation progress by sector officials.
- Strengthen adaptation planning priorities and progress reporting.
- Provide communities with vital information.

CLIMATE SERVICES FOR ADAPTING TO CLIMATE CHANGE

Pays :

France, Jordan, Eswatini, Angola, Gambia, Malawi, Eswatini, Maldives,…

Sectors :

Agriculture, Fisheries, Energy, gas Infrastructure

🌍 "ADAPT TODAY, THRIVE TOMORROW." 🌱

THANKS!

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