2015 UNFCCC FELLOWSHIP EXPERIENCE WITH A FOCUS ON CLIMATE DATA – A CASE STUDY FOR TRINIDAD AND TOBAGO

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Presentation outline

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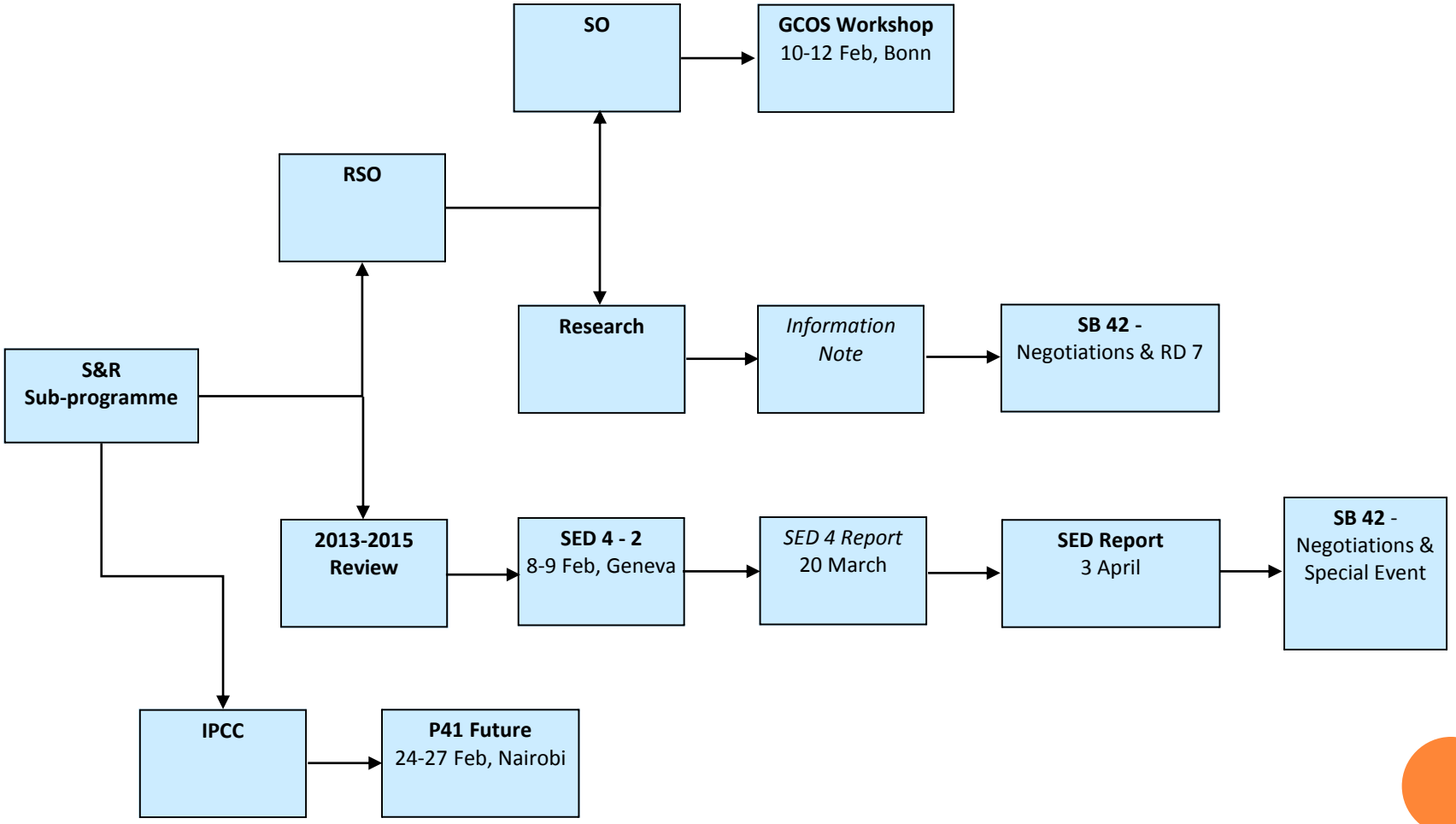
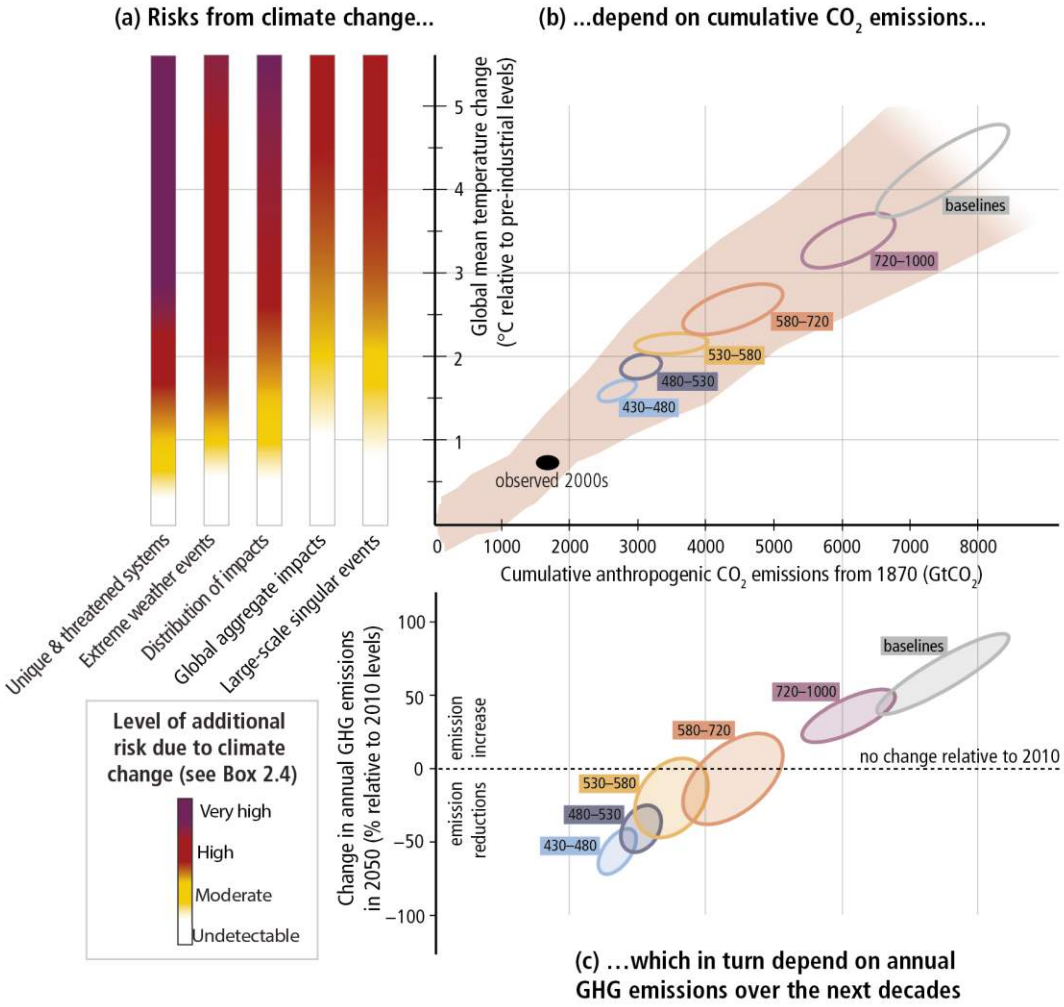
- Acknowledgements

S&R WORK FLOW DURING FELLOWSHIP



Climate change risks from cumulative CO_2 emissions



(*Source: IPCC AR5 Synthesis Report*)

Aim of case study

Aim:

- To determine the status of data used in informing climate change adaptation programmes within Trinidad and Tobago for the purposes of identifying gaps and making recommendations for greater efficiency based on guidelines and standards by the UNFCCC and their collaborating systematic observation bodies.

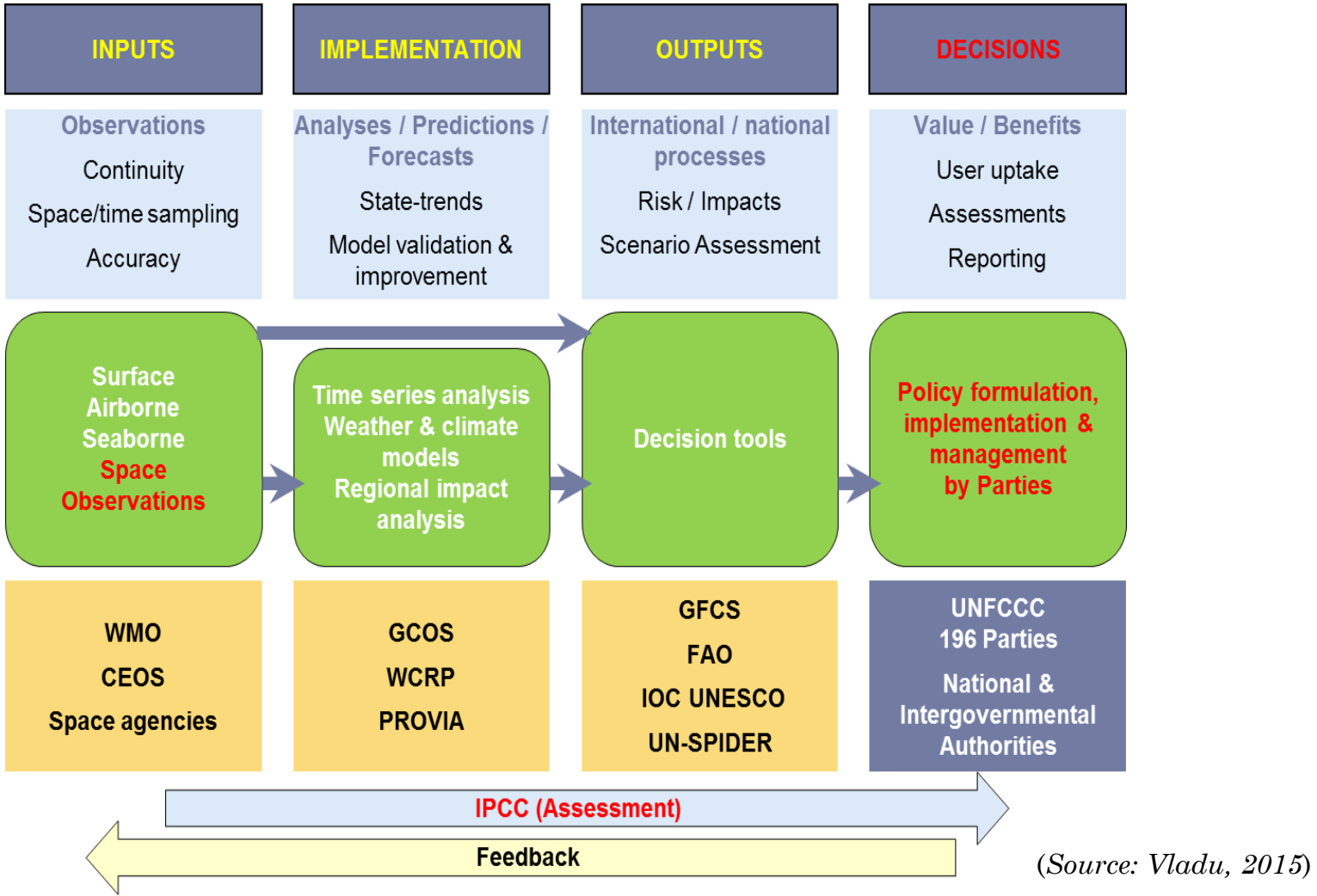
Key Questions:

- How are systematic observations/projections and other data being used to inform climate change decision-making?
- Are the climate data needs of Trinidad and Tobago being sufficiently met?
- How best can gaps in climate data be addressed for Trinidad and Tobago?

Overview of climate data

- Climate information and prediction enables better management of the risks associated with climate variability and adaptation.
- Current availability and quality of climate observations and impacts data to support adaptation appear to be inadequate for large parts of the globe (Pulwarty, 2015).
- The economic value of advanced climate observing systems is dramatically larger than their cost (Wielicki et al, 2013).

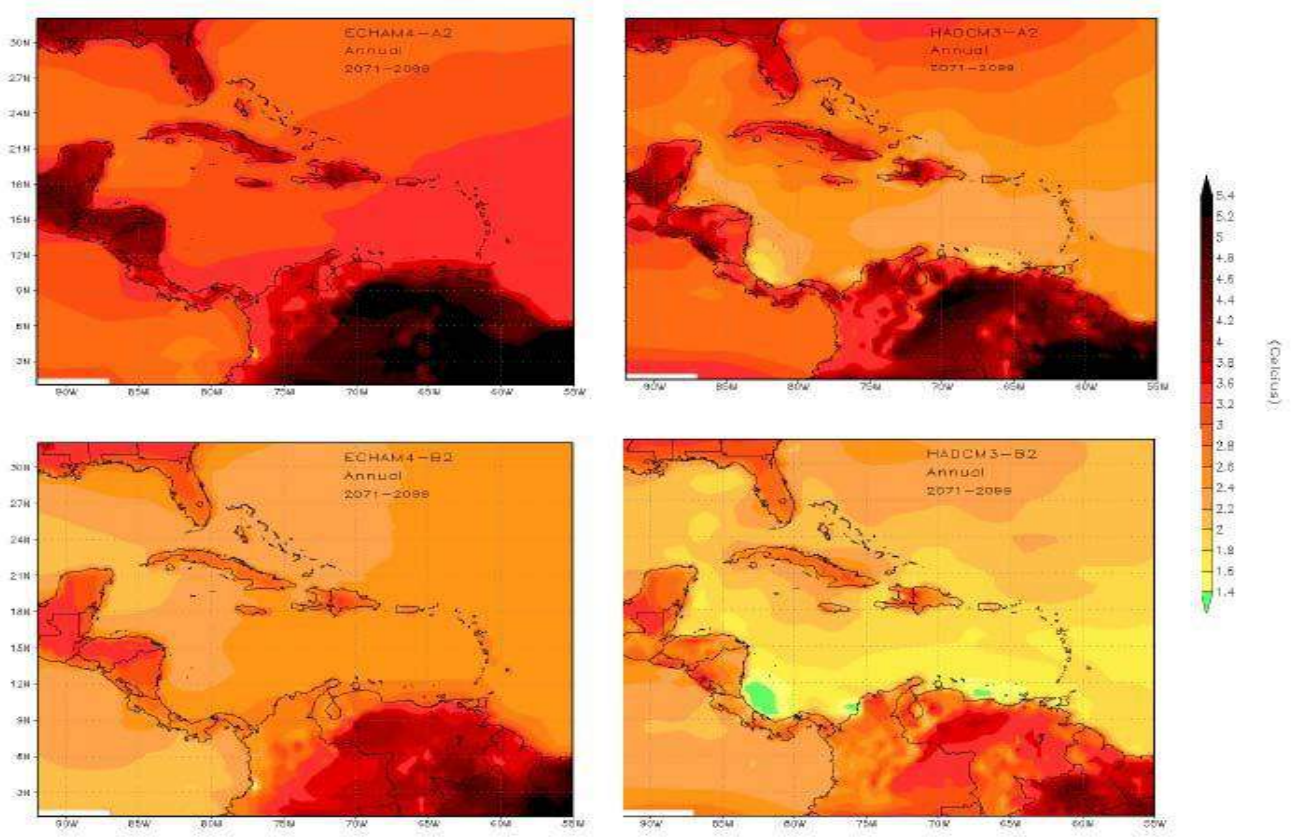
- According to articles 4.1(g) and 5, Parties are required to promote and cooperate in systematic observation of the climate system, including through support to existing international programmes and networks.



(*Source: Vladu, 2015*)

Climate change situation for T&T

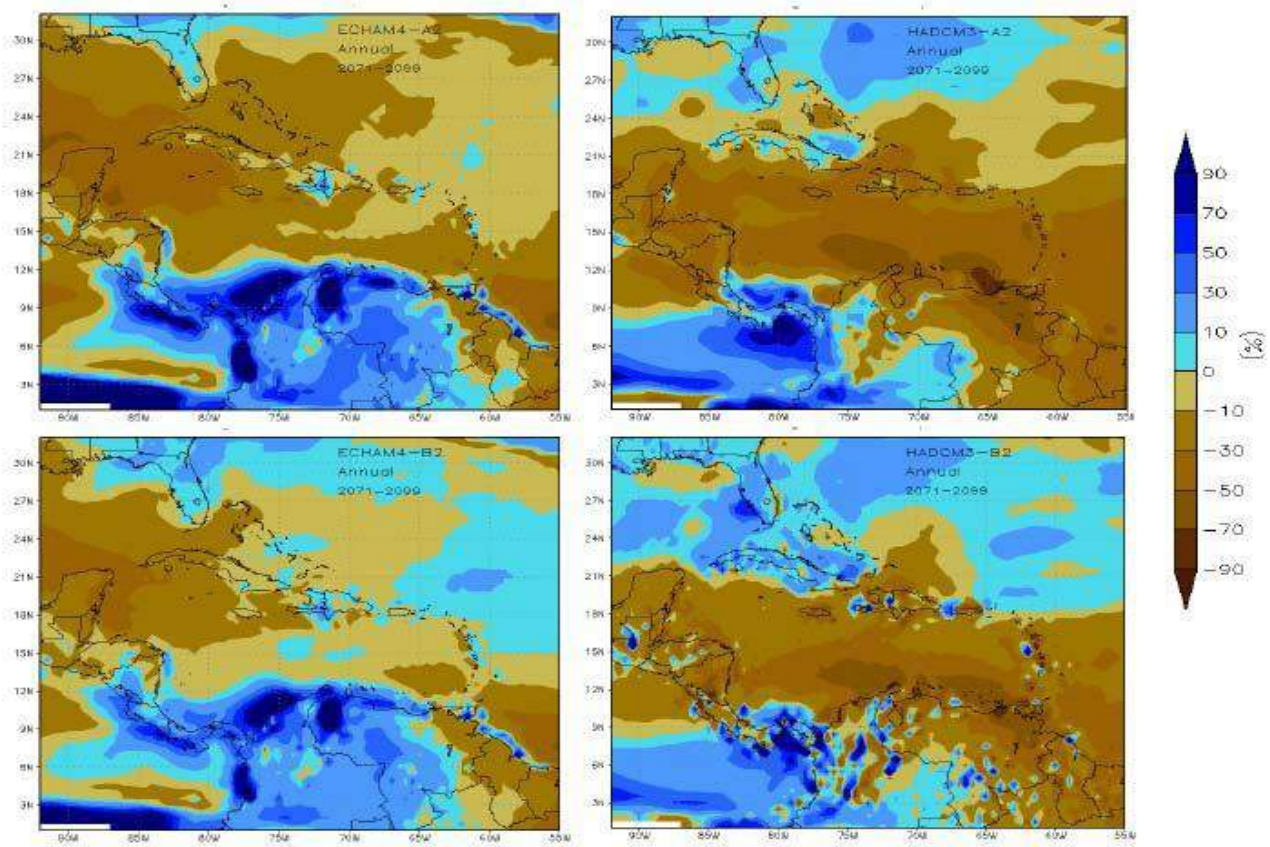
- T&T are among 51 SIDS that are especially vulnerable to the effects of climate change.
- Observed temperature changes in Caribbean reflect global trends - more warm days and warm nights; fewer cool days and cool nights (1°C to 4°C warming is projected by the end of the century)



Temperature projections for Caribbean, from 2071 – 2099 (*Source*: Nurse, 2015)

Climate change situation for T&T

- Mean annual rainfall over the Caribbean, from 1900-2000, showed a consistent decline by around 0.18 mm yr-1 and a 25-30% decrease in rainfall is projected before the end of century.



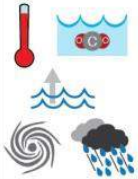
Precipitation projections for Caribbean, from 2071 – 2099 (*Source: Nurse, 2015*)

CLIMATE RISKS FOR T&T

Small Islands

Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation
Loss of livelihoods, coastal settlements, infrastructure, ecosystem services, and economic stability (*high confidence*) [29.6, 29.8, Figure 29-4]	• Significant potential exists for adaptation in islands, but additional external resources and technologies will enhance response. • Maintenance and enhancement of ecosystem functions and services and of water and food security • Efficacy of traditional community coping strategies is expected to be substantially reduced in the future.		Present Near term (2030–2040) Long term (2080–2100) 2°C / 4°C	Very low – Medium – Very high
The interaction of rising global mean sea level in the 21st century with high-water-level events will threaten low-lying coastal areas (*high confidence*) [29.4, Table 29-1; WGI AR5 13.5, Table 13.5]	• High ratio of coastal area to land mass will make adaptation a significant financial and resource challenge for islands. • Adaptation options include maintenance and restoration of coastal landforms and ecosystems, improved management of soils and freshwater resources, and appropriate building codes and settlement patterns.		Present Near term (2030–2040) Long term (2080–2100) 2°C / 4°C	Very low – Medium – Very high

The Ocean

Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation
Distributional shift in fish and invertebrate species, and decrease in fisheries catch potential at low latitudes, e.g., in equatorial upwelling and coastal boundary systems and sub-tropical gyres (*high confidence*) [6.3, 30.5-6, Tables 6-6 and 30-3, Box CC-MB]	• Evolutionary adaptation potential of fish and invertebrate species to warming is limited as indicated by their changes in distribution to maintain temperatures. • Human adaptation options: Large-scale translocation of industrial fishing activities following the regional decreases (low latitude) vs. possibly transient increases (high latitude) in catch potential; Flexible management that can react to variability and change; Improvement of fish resilience to thermal stress by reducing other stressors such as pollution and eutrophication; Expansion of sustainable aquaculture and the development of alternative livelihoods in some regions.		Present Near term (2030–2040) Long term (2080–2100) 2°C / 4°C	Very low – Medium – Very high
Reduced biodiversity, fisheries abundance, and coastal protection by coral reefs due to heat-induced mass coral bleaching and mortality increases, exacerbated by ocean acidification, e.g., in coastal boundary systems and sub-tropical gyres (*high confidence*) [5.4, 6.4, 30.3, 30.5-6, Tables 6-6 and 30-3, Box CC-CR]	• Evidence of rapid evolution by corals is very limited. Some corals may migrate to higher latitudes, but entire reef systems are not expected to be able to track the high rates of temperature shifts. • Human adaptation options are limited to reducing other stresses, mainly by enhancing water quality, and limiting pressures from tourism and fishing. These options will delay human impacts of climate change by a few decades, but their efficacy will be severely reduced as thermal stress increases.		Present Near term (2030–2040) Long term (2080–2100) 2°C / 4°C	Very low – Medium – Very high
Coastal inundation and habitat loss due to sea level rise, extreme events, changes in precipitation, and reduced ecological resilience, e.g., in coastal boundary systems and sub-tropical gyres (*medium* to *high confidence*) [5.5, 30.5-6, Tables 6-6 and 30-3, Box CC-CR]	• Human adaptation options are limited to reducing other stresses, mainly by reducing pollution and limiting pressures from tourism, fishing, physical destruction, and unsustainable aquaculture. • Reducing deforestation and increasing reforestation of river catchments and coastal areas to retain sediments and nutrients • Increased mangrove, coral reef, and seagrass protection, and restoration to protect numerous ecosystem goods and services such as coastal protection, tourist value, and fish habitat		Present Near term (2030–2040) Long term (2080–2100) 2°C / 4°C	Very low – Medium – Very high

(*Source: IPCC AR5 - WGII SPM*)

Climate data situation for T&T

- Documented issues with data production and sharing in T&T:
  - Data production done in isolation - data duplication and repetition of errors
  - Limited, incomplete and/or dated spatial data; lack of data standards; ownership, law and policy issues; and reluctance to share

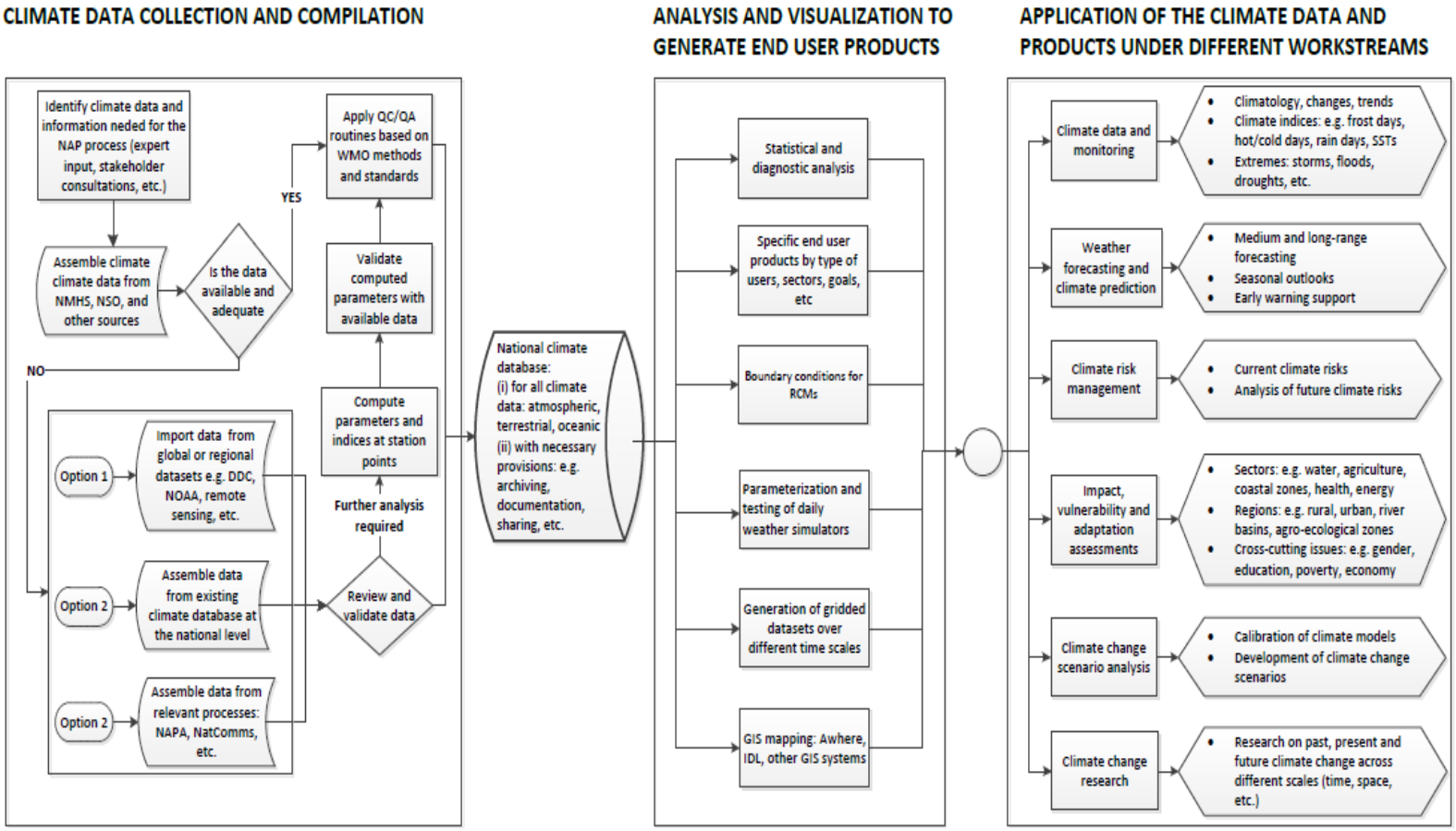
- Recent initiatives for improved data efficiency:
  - National Spatial Database Infrastructure (NSDI)
  - National Consultation on Climate Services (NSC) and National Climate Outlook Forum (NCOF)

NAP GUIDELINES FOR DATA

- Enhanced action on adaptation should be based on and guided by the best available science, traditional and indigenous knowledge, and gender-sensitive approaches, with a view to integrating adaptation into relevant social, economic and environmental policies and actions.
- The four elements of the NAP process:

Element D: **Reporting, Monitoring and Review**	**Element A:** **Lay the Groundwork and Address Gaps**
Element C: Implementation Strategies	**Element B:** Preparatory Elements

KEY ASPECTS OF DATA AND SO UNDER THE NAP



Notes:

1. A list of essential climate variables is available at <https://www.wmo.int/pages/prog/gcos/index.php?name=EssentialClimateVariables>.
2. Acronyms: NMHS = national meteorological and hydrological services; NSO = national statistics offices; QC = quality control; QA = quality assurance; GIS = geographical information system; IDL = international data library; NOAA = National Oceanic and Atmospheric Association; GSOD = Global Summary of the Day.
3. Options 1, 2 and 3 under climate data collection and compilation are not exclusive to each other.
4. Information on the NAP process, the NAPs, guidelines and other additional information is available at <unfccc.int/nap>.

(*Source: LDC Expert Group, 2015*)

KEY MESSAGES FROM THE NAP EXPO 2015

- Data is the basis for informing climate change studies.
- Many data gaps exist in developing countries, these include:
  - Poor organization of historical records and the need for digitization of such data (indicated by country representatives for Malawi, Maldives and Peru).
  - Insufficient meteorological stations and/ or poorly maintained meteorological stations.
  - Lack of expertise in analysis of climate data (indicated by country representative for Malawi).
  - Lack of inclusion of all stakeholders in the data collection process - socioeconomic data lacking.
  - Lack of sectoral coordination/ duplication of data.
  - Restricted data sharing.
  - Lack of political will and support for efficient data collection strategies.
  - Lack of understanding of the economic value derived from outcomes of data analysis in developing countries.
  - Lack of understanding of integration of indigenous data into national processes.
  - Financial limitations - insufficient funding and prolonged financial processes.
- Downscaling data enhances detail and accuracy of the scenarios.
- Indigenous knowledge enables addressing of data gaps on the ground. UNESCO can provide guidance.
- Link between data producer and user should be strong and clearly communicated.
- Best practice examples of data collection and management to guide other country members of NAP. CCCCC noted as a good example.
- Monitoring and evaluation plans - critical component to be considered at the beginning of the NAP process.

Case study approach

- Review of literature on international guidelines and relating to current regional and local data situation.
- Liaisons with relevant local and regional experts.
- Compilation of data collected, analysis of findings and recommendations to gaps and/or inefficiencies observed.

Data Sources:

Data Type	Details	Data Source
Primary Data		
Geospatial data	Information on the local organizations that can provide data relevant to climate studies and information on the status of the NSDI for Trinidad and Tobago.	Dr. Bheshem Ramlal, Head of the Department of Geomatics Engineering and Land Management, the University of the West Indies (UWI)
Weather and climate data	Information on the local meteorological services, the stations that provide climate data and supply global climate databases.	Mrs. Arlene Aaron-Morrison, Climatologist at the Trinidad and Tobago Meteorological Service
Sea level rise data	Information on existing local and regional stations.	Prof. John Agard, Head of the Department of Life Sciences, Faculty of Science and Technology, UWI; and member of the IPCC
Regional data portals	Information on regional climate data and climate projections and processes required in regional downscaling of data.	Timo Baur, Clearinghouse Manager/ Information Systems Advisor, CCCCC
The local example: GoLo CarSce	Information on the project and its sources of data	Prof. John Agard, Team Leader of the GoLo CarSce Project *(secondary data via the project website)*
Secondary Data		
Weather and climate data; Global data portals	Global datasets	Internet search
Scenario data	Global climate change scenario data	IPCC's Data Distribution Centre website
Socio-economic and sectoral data	Information on the climate data situation for the country and the gaps	Internet search; Country reports
International climate data situation and guidelines	Information on the international standards based on UNFCCC agreements	UNFCCC and GCOS website; and the NAP Technical Guidelines

Findings - general sources of climate data in T&T

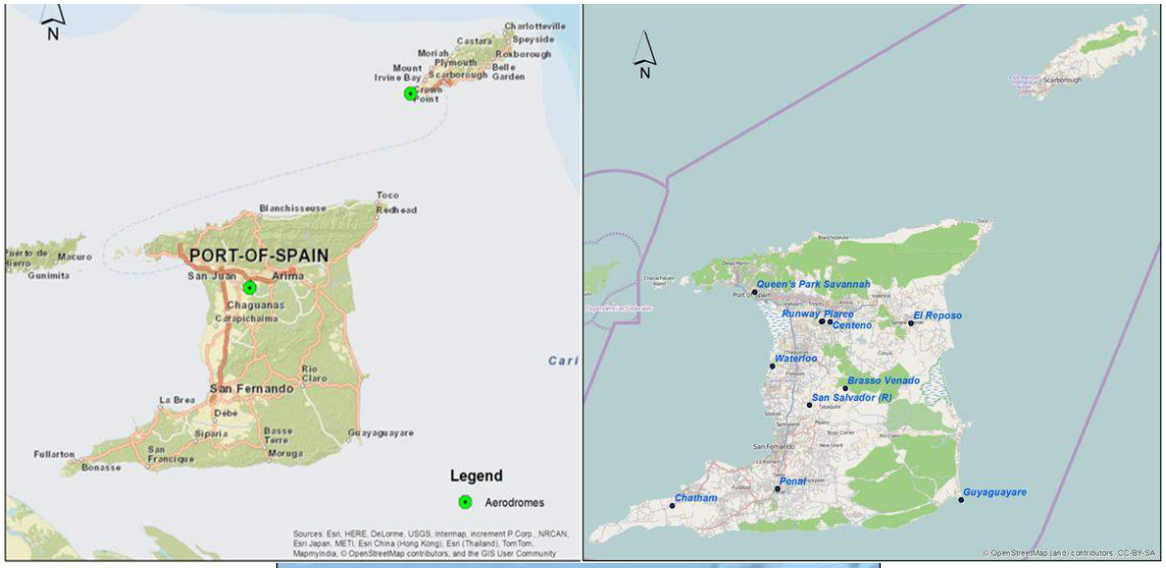
- Systematic Observations - geospatial data; weather and climate data; sea level rise data and scenarios; and information portals.

Geospatial Data - administrative lands, boundaries; topography; land use, land cover, slope, soils and basins.

- Data sources: The Lands and Surveys Division; Town and Country Planning Division; Soils Division, Ministry of Food Production; The Water Resources Agency
- Issues: limited, incomplete and/or dated spatial data; duplication of data; lack of data standards; ownership, law and policy issues; and reluctance to share

General sources of climate data in T&T

Weather and Climate Data



Location of TTMS synoptic stations and AWS stations, responsible for weather forecasts and early warnings
- 2 synoptic weather & climatology stations (Piarco & Crown Point)
-7 AWS weather stations (Brasso Venado, Caroni, Centeno, Chatham, El Reposo, Penal and Guayaguayare)
(*Source: TTMS*)

Location of WASA's rain gauges - 76 rain gauges which are utilized for climatological forecasts and research.
(*Source: TTMS*)

General sources of climate data in T&T

Sea Level Rise Data and Scenarios

- Outdated and improperly maintained SRL monitors located at Caroni and Nariva Swamp.
- More advanced and reliable SLR station installed by NOAA off the coast of Puerto Rico.
- Downscaled SLR scenarios through global data portals.

General sources of climate data in T&T

Global Portals

- Kononklijk Netherlands Meteorological Institute (KNMI) Climate Explorer

http://climexp.knmi.nl/plot_atlas_form.py?id=someone@somewhere

- The Global Observing Systems Information Center (GOSIC)

http://www.wmo.int/pages/prog/gcos/index.php?name=ObservingSystemsandData

- IPCC Data Distribution Centre (DDC)

http://www.ipcc-data.org/sim/gcm_monthly/SRES_AR4/index.html>

- Global Historical Climatology Network (GHCN)

http://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/global-historical-climatology-network-ghcn

- The World Bank Group – Climate Change Knowledge Portal

http://sdwebx.worldbank.org/climateportal/index.cfm?page=country_historical_climate&ThisRegion=Latin America&ThisCCode=TTO

- United Nations Development Programme (UNDP) Climate Change Country Profile – Trinidad and Tobago

http://www.geog.ox.ac.uk/research/climate/projects/undp-cp/

- Coordinated Regional Climate Downscaling Experiment (CORDEX)

http://www.cordex.org/

- WorldClim (weather and climate data)

http://www.worldclim.org/

- University of East Anglia – Climate Research Unit (weather and climate data)

http://www.cru.uea.ac.uk/data

General sources of climate data in T&T

Regional Portal

- The Caribbean Community Climate Change Centre (CCCCC) Clearinghouse - projected temperature and rainfall data from various downscaled models until 2100, for Caribbean.

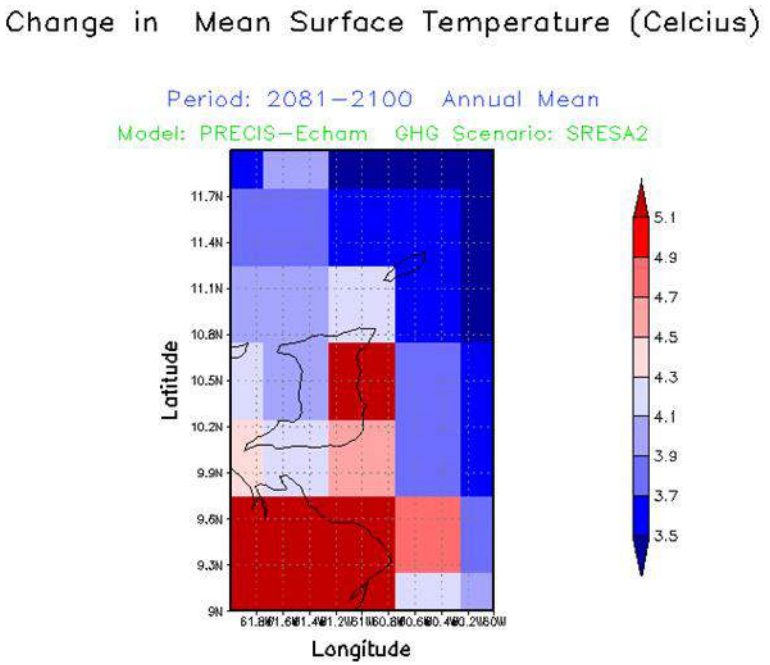
http://clearinghouse.caribbeanclimate.bz/?db_type=Climate%20Model&country=&collection=null&s=&sector=&topic=

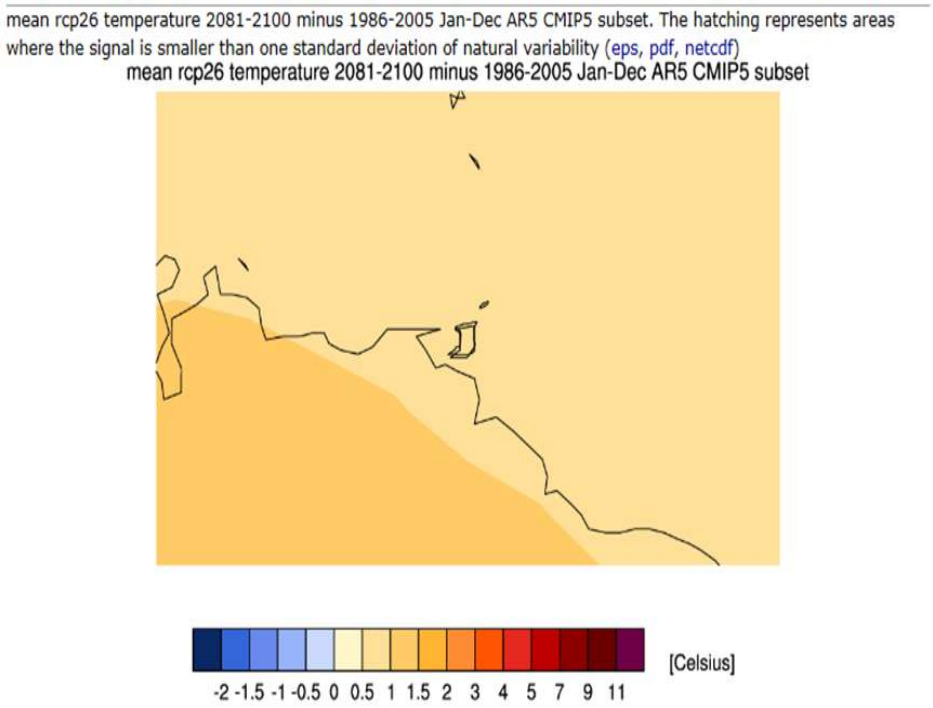
- Models created from PRECIS downscaling system of UK's Met Office's Hadley Centre – ECHAM5 and ERA-Interim.
- Methodology in line with international best practices.
- Resolution of Global Models - 300km^2 /

  Resolution of CCCCC Clearinghouse - 50 km^2
- 25km^2 resolution is currently being developed based on the newer WRF Model that supports the analysis of RCP scenarios adopted by IPCC AR5 – soon to be available through CARIWIG tool.
- Involved in relevant international global projects such as CORDEX to better guide downscaling efforts – with the aim of downscaling to 3km^2.

General sources of climate data in T&T

Comparison of CCCCC model projections for mean surface temperature and KNMI Climate Explorer global model projection for near-surface temperature, for Trinidad and Tobago from 2081-2100.





General sources of climate data in T&T

- Socio-Economic Data
- Population, economic development, technology and natural resources.
- Characterizes the vulnerability and adaptive capacity of social and economic systems.
- Data required for 2014 study by IDB, entitled "Understanding the Economics of Climate Adaptation in Trinidad and Tobago":

Variables	**Data Source(s)**	**Availability**
Demographic Data		
Population by parish	Central Statistical Office	Available
Density by parish	Central Statistical Office	Available
Economic Data		
Gross Domestic Product (GDP)	Central Statistical Office; Central Bank	Available
Sector's share of GDP	Central Bank	Available
Inflation rate	Central Statistical Office; Central Bank	Available
Exchange rate	Central Bank	Available
Production in each sector	Government of the Republic of Trinidad and Tobago (GORTT) Ministries	Available
Economic loss to the economy from extreme weather events	International Emergency Disasters Database	Available
Economic loss by sector from extreme weather events	GORTT Ministries	Unavailable
GIS maps of location of major infrastructure	Ministry of Planning and the Economy	Unknown

Conclusions

- Sectors projected to be impacted most include agriculture, health, human settlements, coastal zones, water resources, energy.
- Infrastructure exists to provide climate data.
- SO intertwined on the national, regional and global levels
- Data gaps observed:
  - Insufficient data coverage – limited functional weather stations.
  - No official data protection and sharing policy.
  - No official data rescue strategy.
  - Data incompatibility and poor quality data.
- Although internationally coordinated solutions exist e.g. through GCOS – international databases have high data requirements.

RECOMMENDATIONS

- **Data rescue** of historical or incomplete data and **improved data coverage**.
- The **development, maintenance and support of data protection** and **data sharing policies**.
- **Collaborative mechanisms** and **coordination** among different agencies on a national, regional and international scale.
- **Enhancement** and **better overall coordination** of **capacity building** for climate data specialists.
- Ensuring that climate studies are **guided by the best available science** as indicated in the NAP, including considerations for **traditional and indigenous knowledge** in contributing to data needs.
- **Improving regional downscaling** of global data models.
- An **integrated national approach** to climate data management.

Acknowledgements

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