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Overview of the challenges and opportunities for linking climate science to policy and practice

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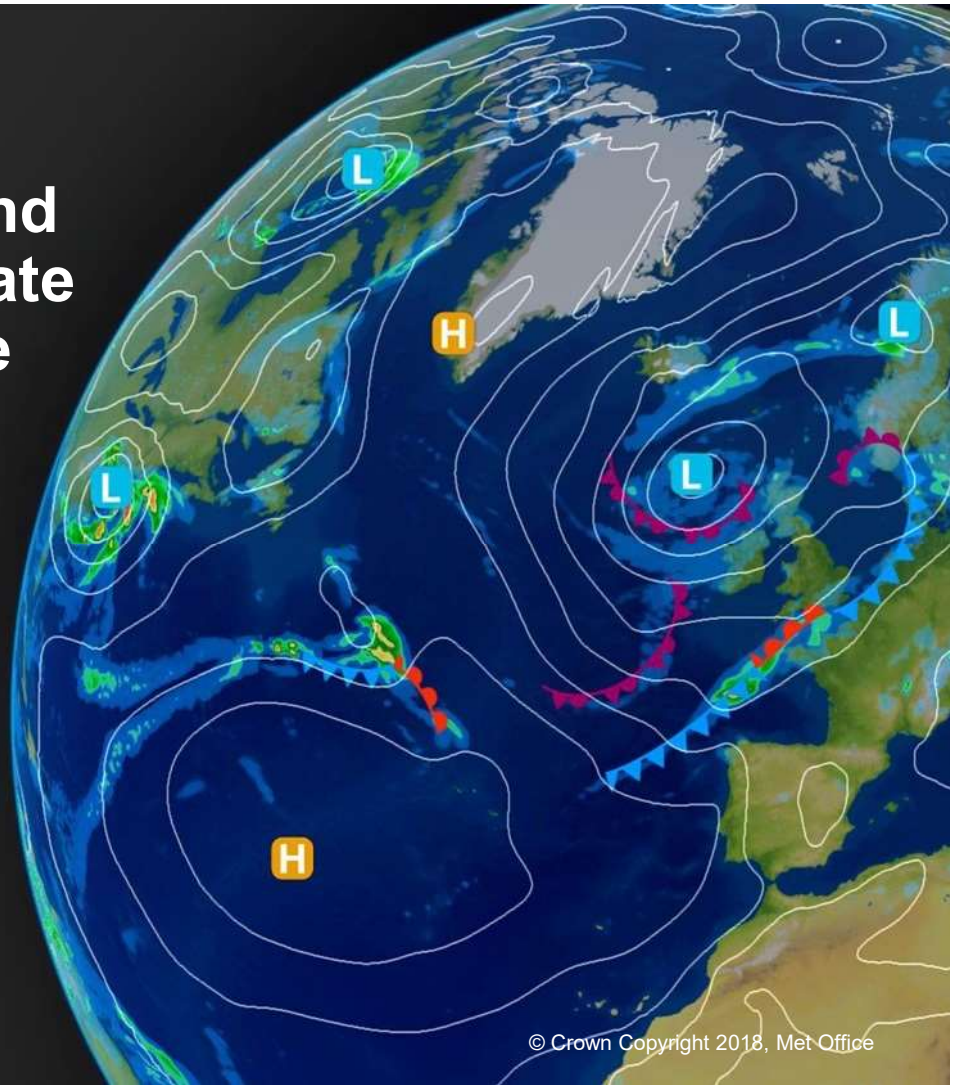
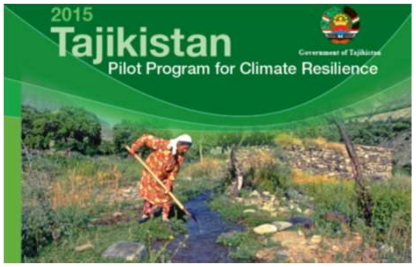
Pilot Program for Climate Resilience
Knowledge Sharing on Adaptation and Resilience, Manila

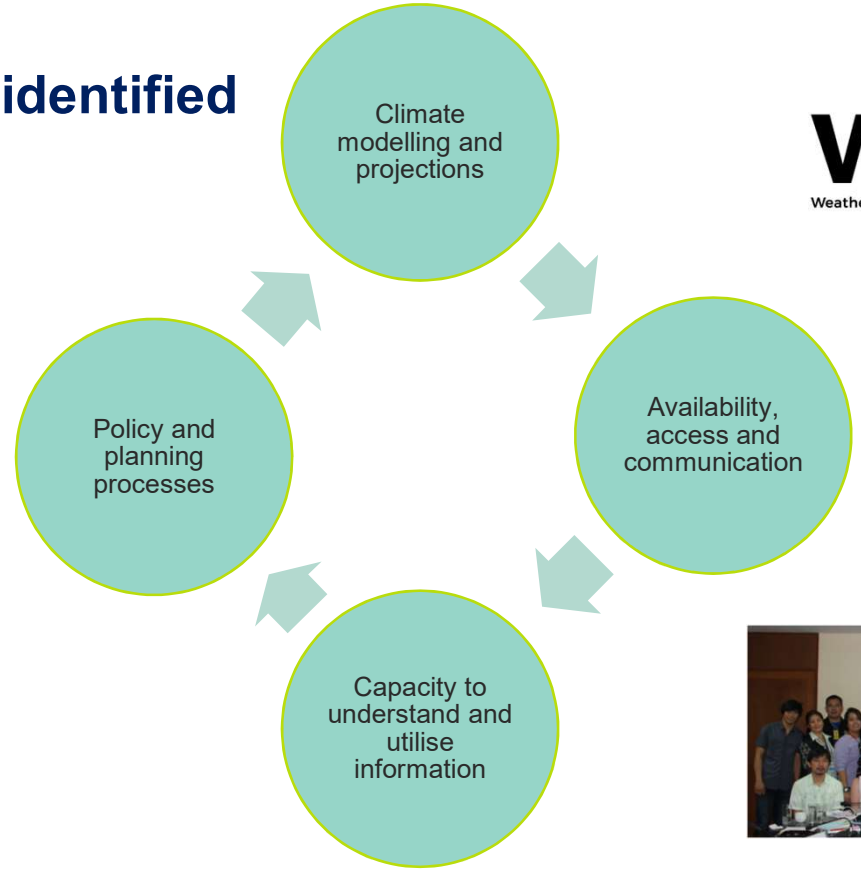
21st May 2018



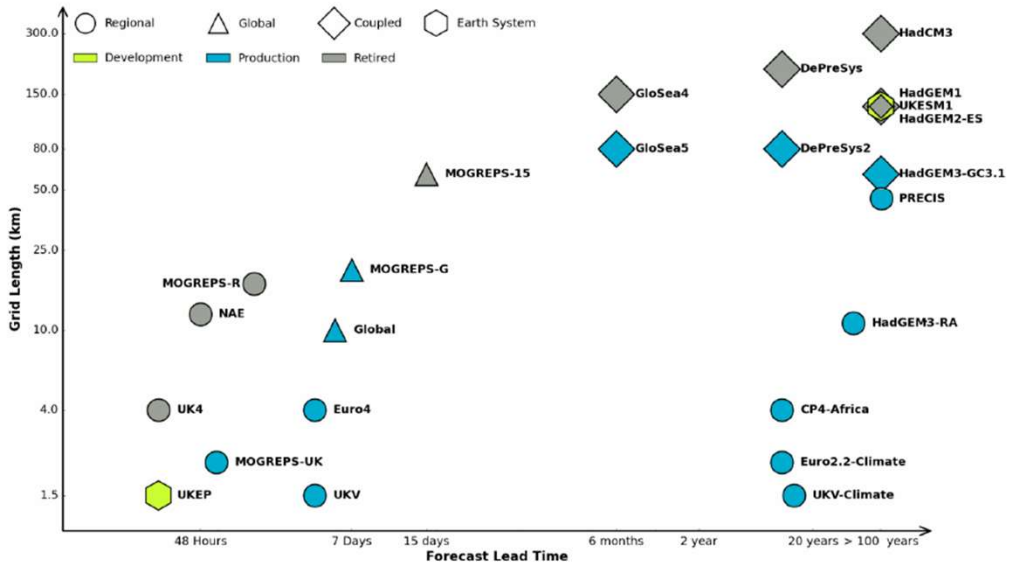
Challenges for linking climate science to policy

Broad themes identified





Climate modelling and projections



Multiple models, providers and uncertainty

Scale and domain choice

Biases and errors

Limited information on impacts

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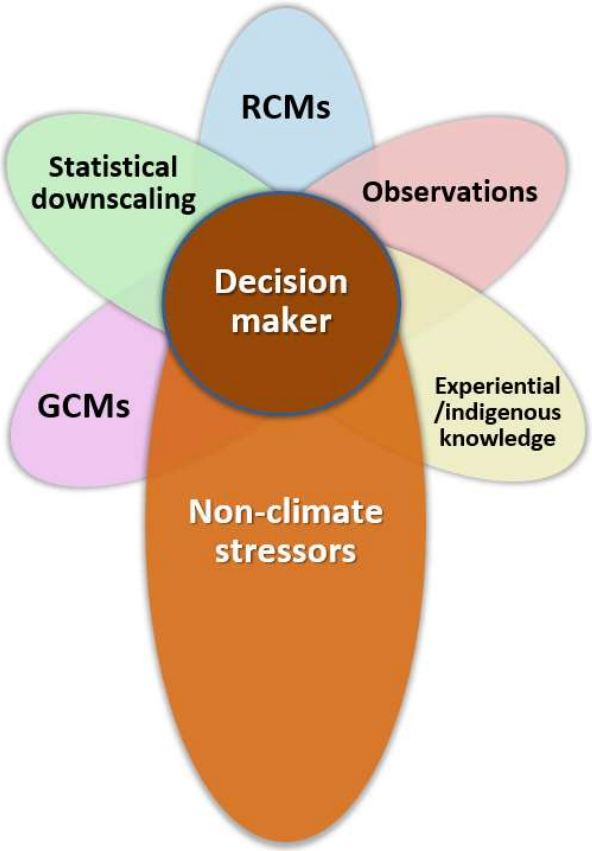
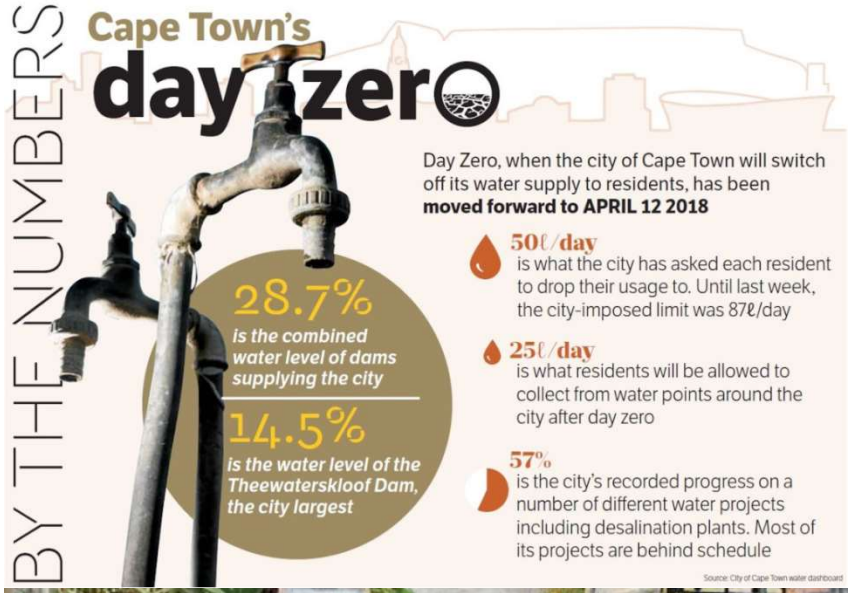
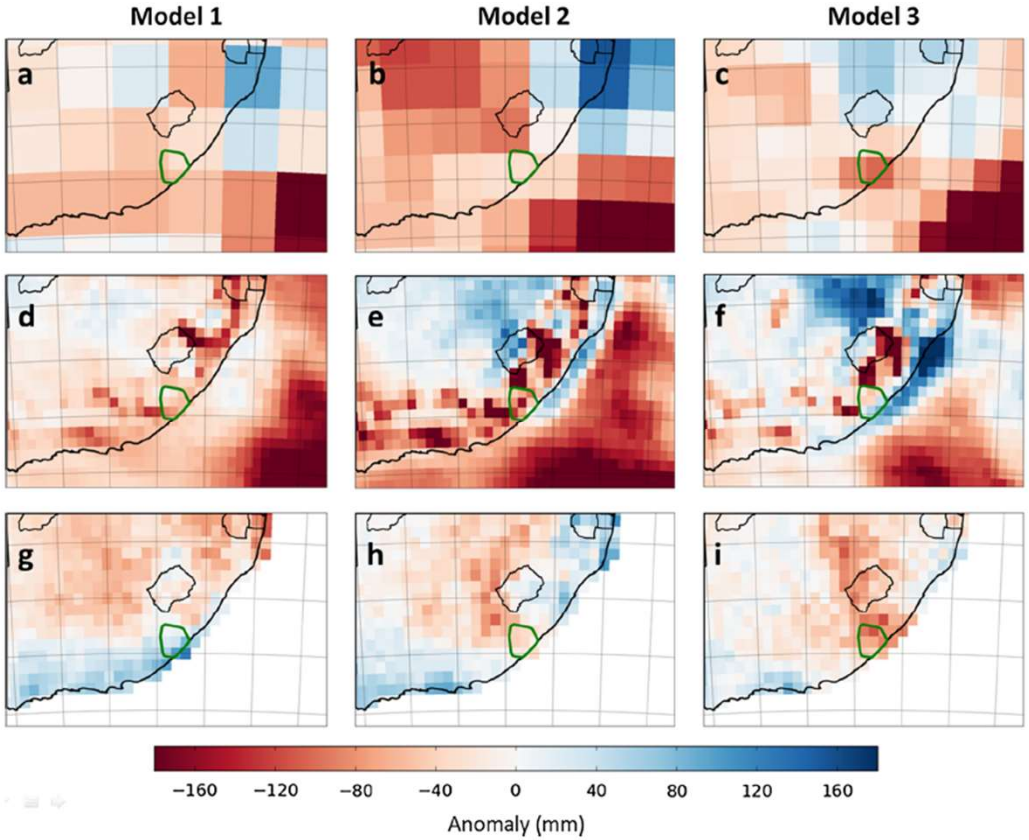


The decision maker's dilemma: Expected to…

- Assess skill
- Understand confidence
- Consider uncertainty
- Accommodate scale dependency
- Reconcile contradictions
- Find trust amidst competing climate services

…whilst dealing with multiple other issues and constraints





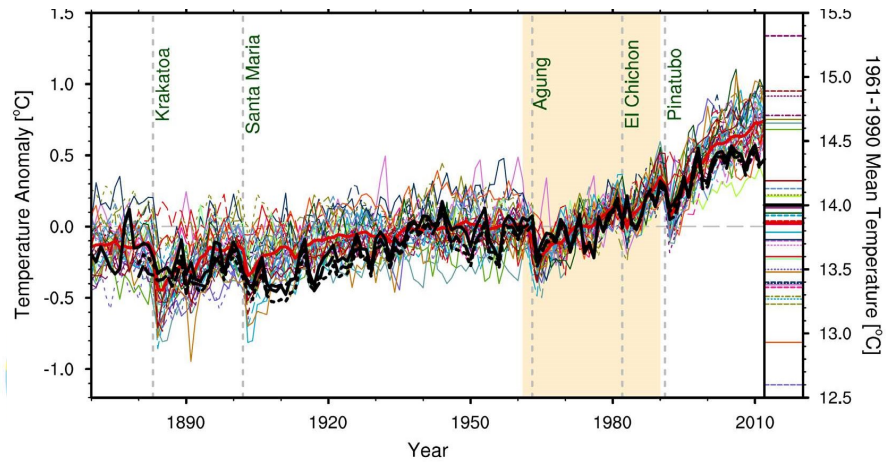
"These contradictions are probably the single biggest factor undermining the confidence in regional and local scale projections."
(Hewitson et al 2013)

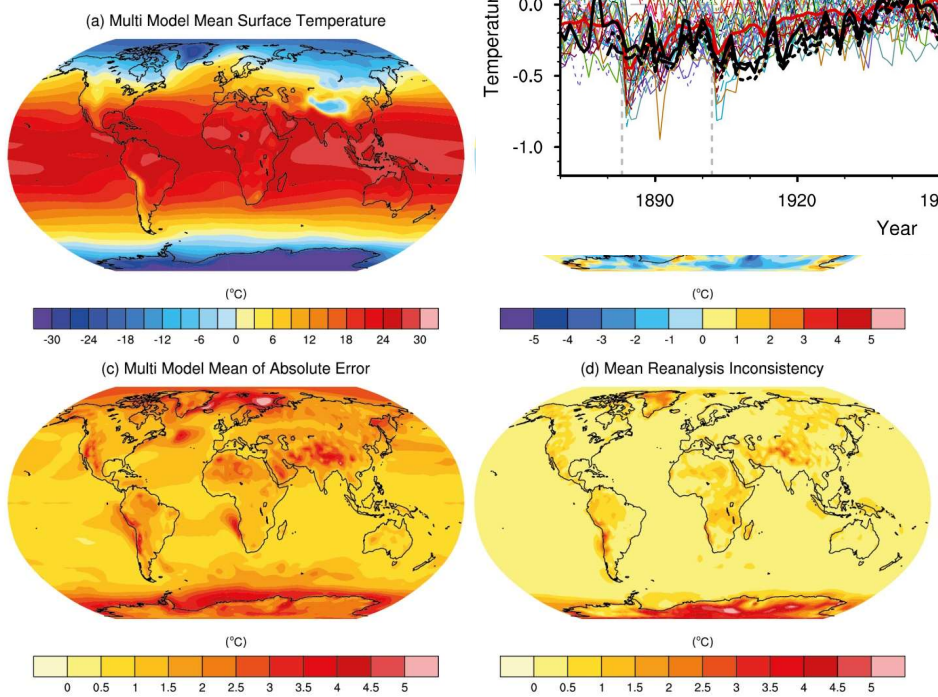
How good are climate models?

From IPCC AR5…

"Models reproduce observed continental-scale surface temperature patterns and trends over many decades, including the more rapid warming since the mid-20th century and the cooling immediately following large volcanic eruptions (*very high confidence*)"

"… though systematic errors of several degrees are found in some regions, particularly over high topography, near the ice edge in the North Atlantic and over regions of ocean upwelling near the equator"





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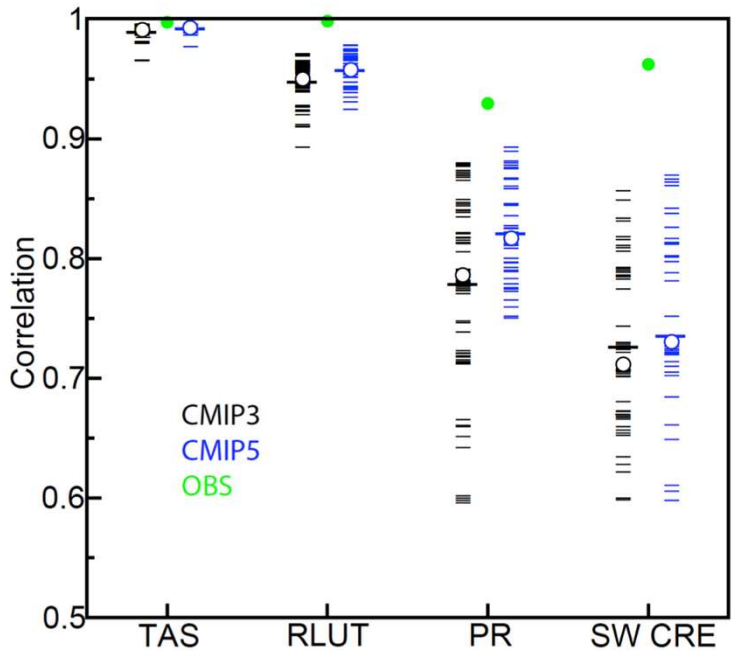
Are Models improving?

From IPCC AR5…

Annual mean global pattern correlations between models and observations



- Many examples of incremental improvements since CMIP3
- Improvement not uniform, but little/no evidence of performance deterioration

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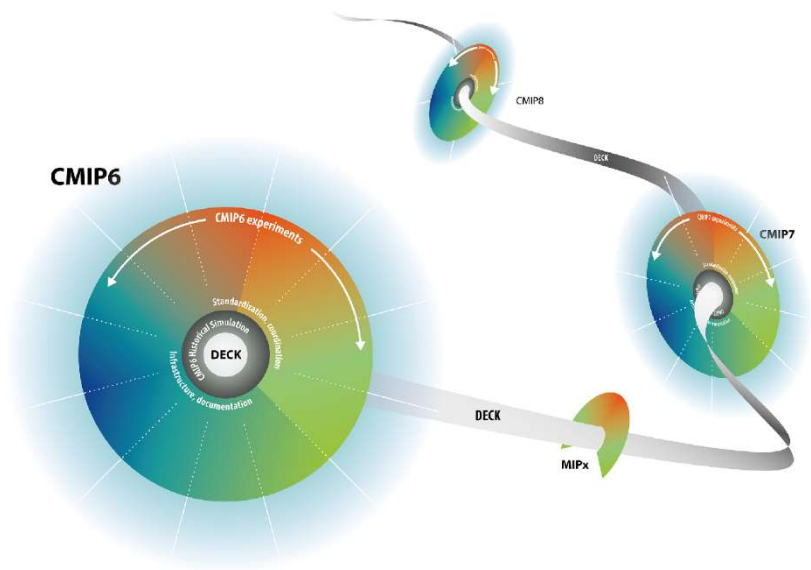
What is CMIP6?

- Latest round of WCRP's ***Coupled model inter-comparison project***
- Basis for climate research under the World Climate Research Programme (WCRP)
- Sets standards and specifies experimental protocols
- >30 groups globally, improved climate assessments, underpins IPCC and negotiations
- Better understand climate impacts e.g. agriculture, human living conditions, ocean biogeochemistry
- CMIP6 provides higher resolutions and analyses additional processes



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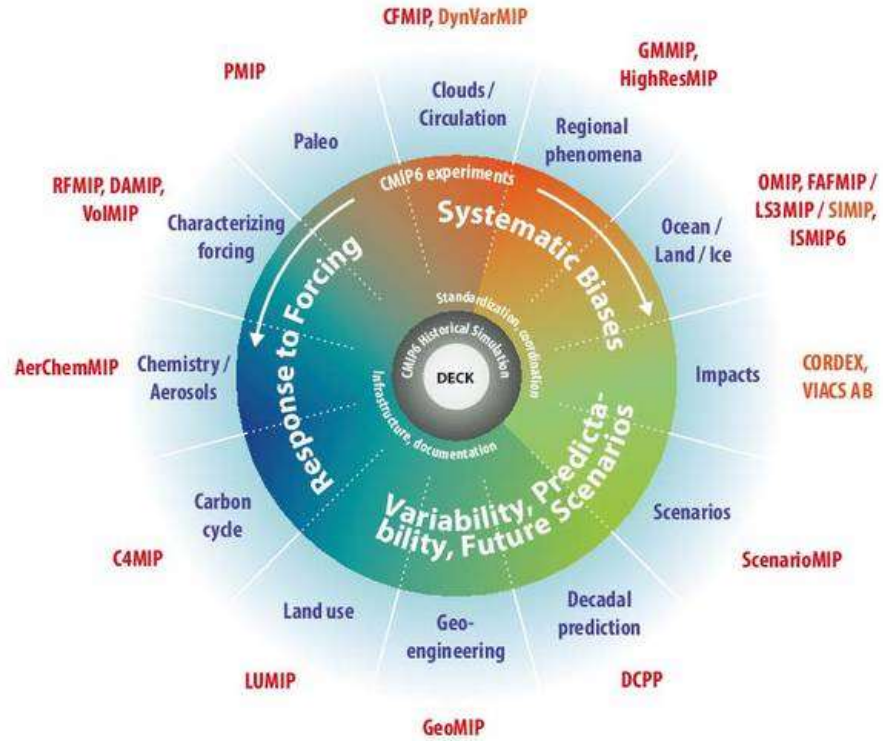
CMIP6

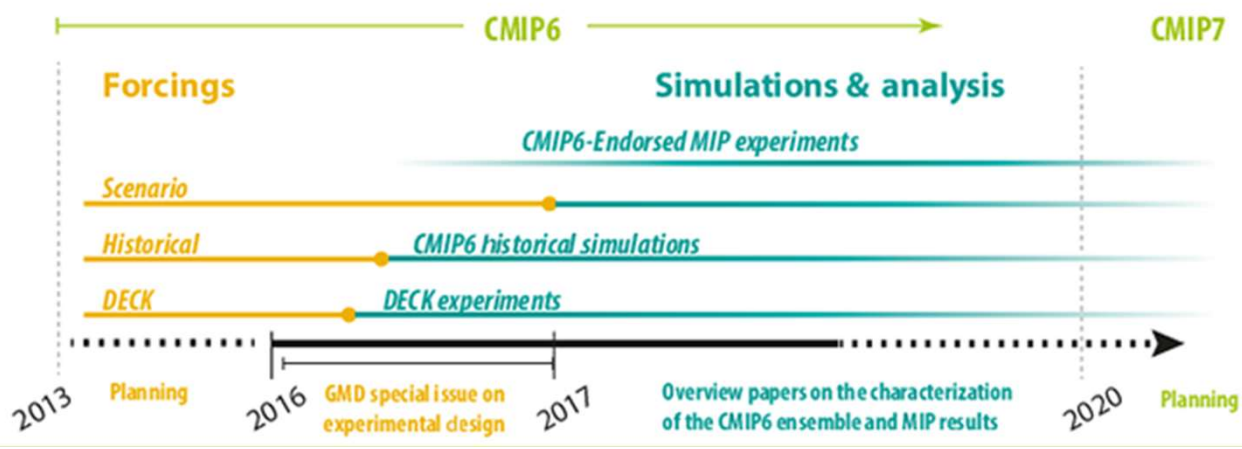
- Multiple models run a *common set of experiment protocols*
  - small set of fundamental (***DECK***) experiments
  - twenty model intercomparison projects (***MIP***s)

- Output from each experiment converted into standard format
  - labelled with metadata (institution, model, experiment…)
  - submitted to Earth System Grid Federation

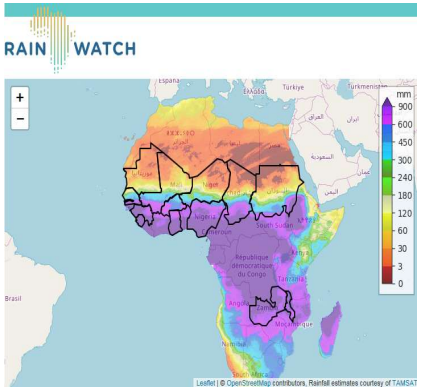


CMIP6 in the UK

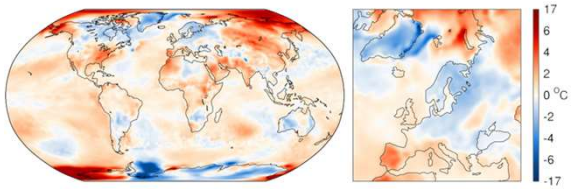
- Participation by UK climate scientists
  - NERC, UK academia, Met Office (& international partners: KMA, NIWA ...)
- UK contributing to all MIPs using three models:
  - HadGEM3-GC31-LL, HadGEM3-GC31-MM, UKESM1
  - DECK runs have begun for all models
  - each MIP uses one model
    - depending on its science aims

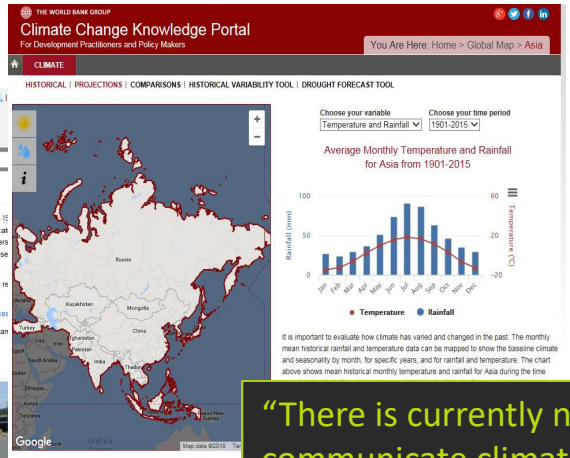


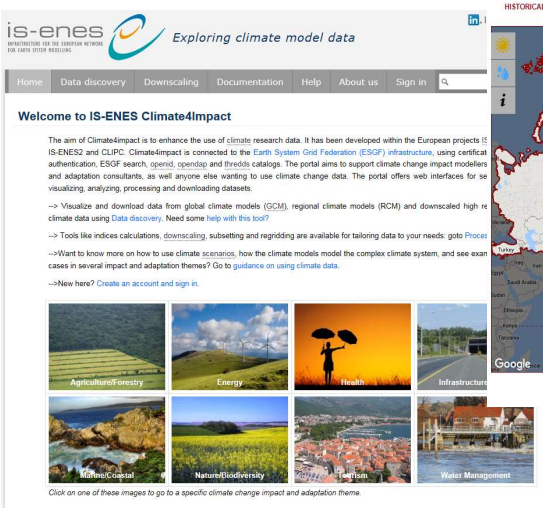
Information availability and access



C3S







Mandating providers and roles

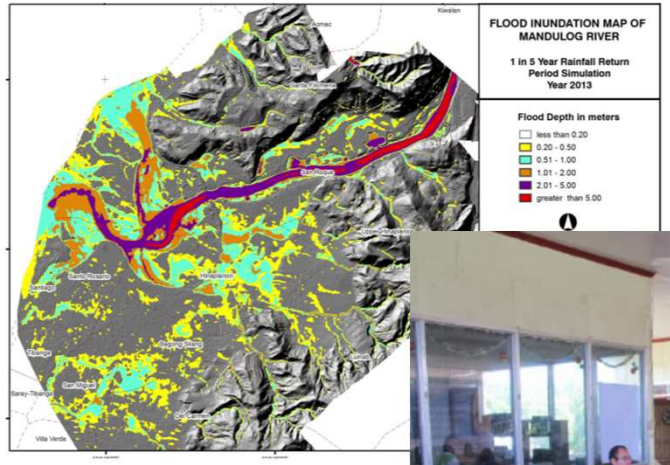
Data sharing and access

Ownership and sustainability

Lack of systematic evaluation

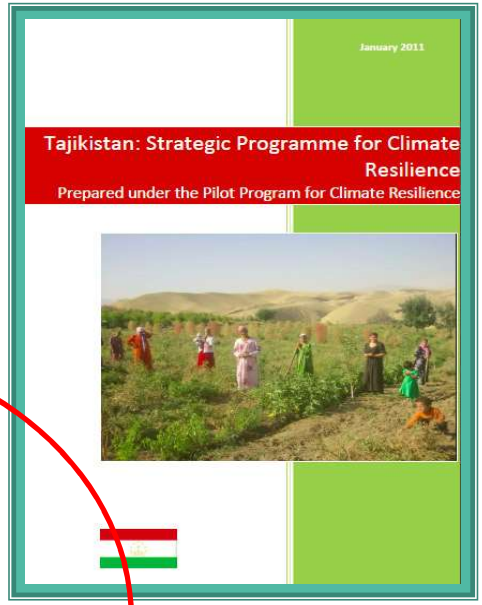
"There is currently no consensus on how to combine, compare and communicate climate change information produced from different models and methods (Tebaldi and Knutti 2007, Knutti et al. 2010)."

Capacity to understand and utilise information



- Scientifically driven information production
- Government capacity to utilise
- Issues around end user uptake
- Provision of “actionable” climate information
- Communication approaches

PPCR in Tajikistan



Improvement of Weather, Climate and Hydrological Service Delivery (WB)

Technical Assistance for Building Capacity for Climate Resilience (ADB)

Building Climate Resilience in the Pyanj River Basin (ADB)

Enhancing the Climate Resilience of the Energy Sector (EBRD)

Environmental Land Management and Rural Livelihoods (WB)

CLIMADAPT Climate Resilience Financing Facility (EBRD)

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Regional perspective

Country capacity for weather and climate services in South Asia

Country Status	National capacity
India	• Currently providing regional services from several national centres and strong infrastructure in place for providing weather and climate services nationally and to the region as a whole. • Strong R&D capability with planned project work to improve risk based weather forecasts and seasonal forecast services.
Bangladesh	• Capacity to provide essential national services to agro-meteorology, aviation and hydrological services and some centres provide flood warnings. Good advances in cyclone warning. • Strong R&D capability and a major WB programme 'Bangladesh Weather and Climate Services Regional Project' aims to strengthen capacity and improve access to services
Pakistan	• Reasonable national capacity to provide essential services with major investments planned to improve hydro-meteorological capacity and networks • R&D capability with expertise in NWP, pollen forecasting, and climate change impacts assessments and adaptation strategies
Nepal	• Basic infrastructure for weather and climate forecast. No national mechanism for sharing climate data • The World Bank 'Building Resilience to Climate Related Hazards' aims to enhance government capacity and networks for weather and climate services
Myanmar	• Basic infrastructure for weather and climate forecast. No national mechanism for sharing climate data • Several large modernisation programmes are in place including WB AIRBM project that is improving modernising meteorological and hydrological services
Afghanistan	• Less than basic operational capacity for weather and climate services, and has very basic interaction outside of aviation. • There is a strong need for modernisation and donors are working towards this.

Policy, planning and investment processes

International policy and agreements

Planning and investment timescales

Donor coordination

Lack of tools and guidance

Building capacity to improve resilience to weather and climate extremes in the Philippines

A DFID funded project in partnership with PAGASA (Philippine Atmospheric, Geophysical and Astronomical Services Administration)

Typhoon Haiyan, Nov 2013

Key components:

1. Assessment of current climate risk information in the Philippines
2. Generation of downscaled climate model simulations
3. Provision of decision-relevant information on future typhoon risks
4. Regional sea level rise projections for the Philippines
5. Pilot studies to improve the uptake of climate information
6. Enabling roadmap to improve the current situation

	Climate Model Simulations				
	1	2	3	4	5
Change in tropical cyclone frequency	↓	↓	—	—	↓
Change in tropical cyclone intensity	—	↑	↑	↑	↑

Projected changes to tropical cyclones affecting the Philippines by the mid-21st century (RCP8.5). Black /grey arrows show significant /insignificant changes, and a dash indicates no change.

taken from "Information Brief" for policy -makers

http://www.metoffice.gov.uk/research/applied/international-development/philippines

Pilot study engagement

PRECIS installation

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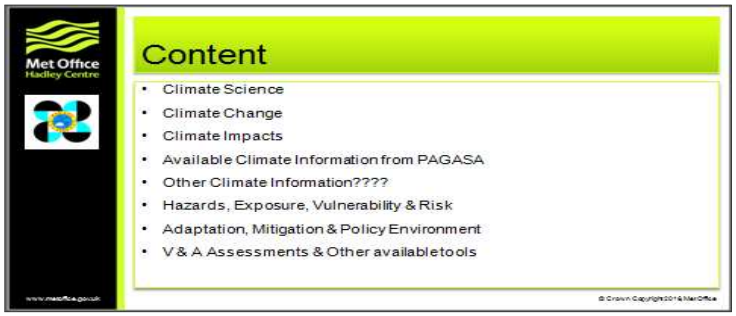
Integrating climate information into local level government planning



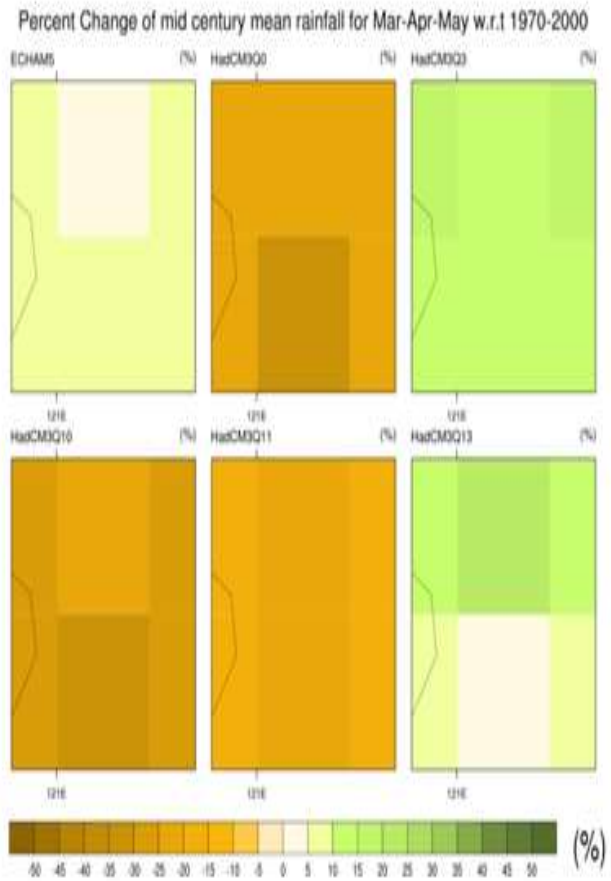
I. Climate Orientation Pack **(Train the Trainers)**

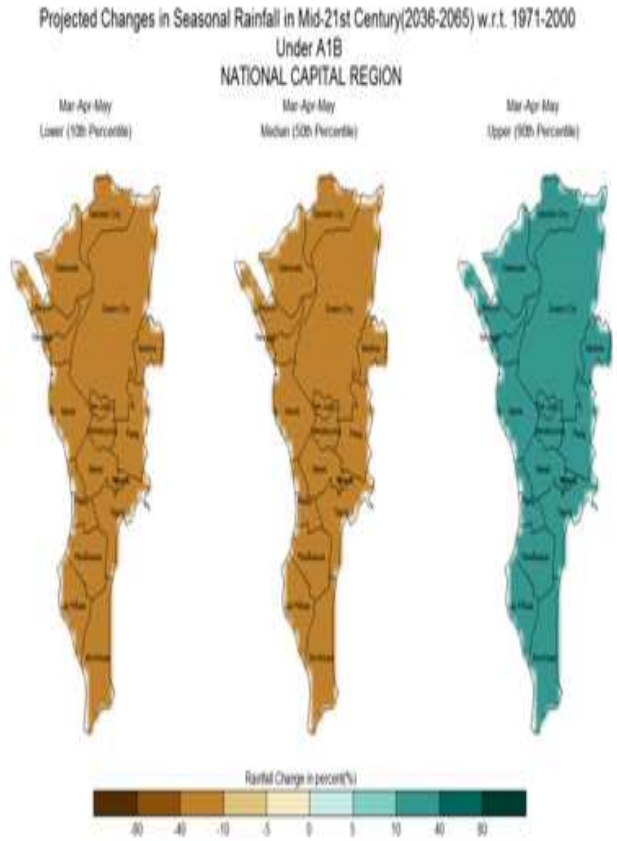
II. **Co-produced** Climate information

III. Climate Information and Risk Analysis Matrix

IV. Guidance to support integrating Climate Information in Local Planning

Projected changes in the seasonal rainfall for Dry/Hot season March-April-May under an A1B Scenario





Projected Change in Seasonal Rainfall in Mid-21st Century(2036-2065) for Metro Manila

December-January-February (DJF) Observed Baseline (1971-2000) = 107.5 mm

SCENARIO	Range	PROJECTED CHANGE		Projected Seasonal Rainfall Amount (mm)	Potential Impacts	Proposed Solutions
		PERCENT (%)	Rainfall amount in mm			
Low Emission RCP45	Upper (90th percentile)	97.2	104.5	219.8		
	Median (50th percentile)	17.7	19.0	127.9		
	Lower (10th percentile)	-3.5	-3.8	103.4		
Medium-Range Emission AIB	Upper (90th percentile)	27.5	29.6	139.3		
	Median (50th percentile)	-19.1	-20.6	85.4		
	Lower (10th percentile)	-46.9	-50.4	53.3		
High Emission RCP85	Upper (90th percentile)	57.6	61.9	174.1		
	Median (50th percentile)	21.0	22.5	131.7		
	Lower (10th percentile)	2.6	2.8	110.5		

Case Study - Mainstreaming Climate Information in County Government Planning Processes in Kenya

AIM: Improve the extent to which climate information is routinely and systematically used to inform planning decisions at the county level over the long term.

Challenge:

- Prepare 5 year County Integrated Develop Plans (CIDPs)
- Establishing targets and implementation
- Improving the incorporation of climate information

Solution:

- Stakeholder development and consultations
- Collaboration with county planners
- Needs assessment
- Capacity building

Conclusion:

- Production of Climate smart CIDPs
- Built and strengthened relations with County Government Administration
- Created awareness of climate information and impacts, and the need for mainstreaming

- Gaps in understanding the providers and users of the information
- Access to information
- Lack of decision making tools
- Limited experience

- Common understanding across the project
- Secure political buy-in
- Understand the capacity and willingness of planners to mainstream climate information
- Gain a sense of ownership by the participants
- Appreciation of the importance of developing 'climate smart' CIDPs
- Imparted knowledge and skills on climate information and climate service provision

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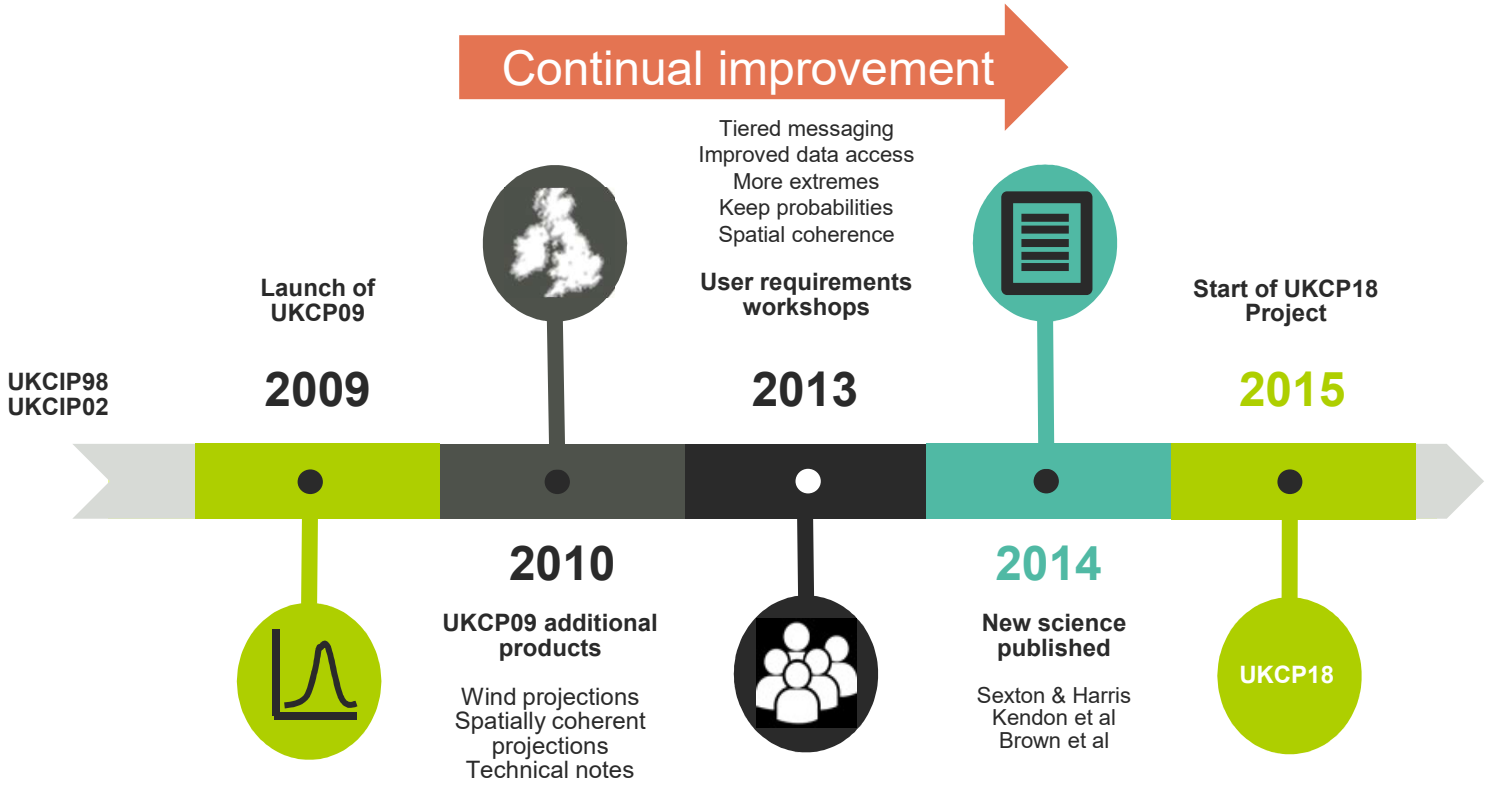
UK Climate Projections



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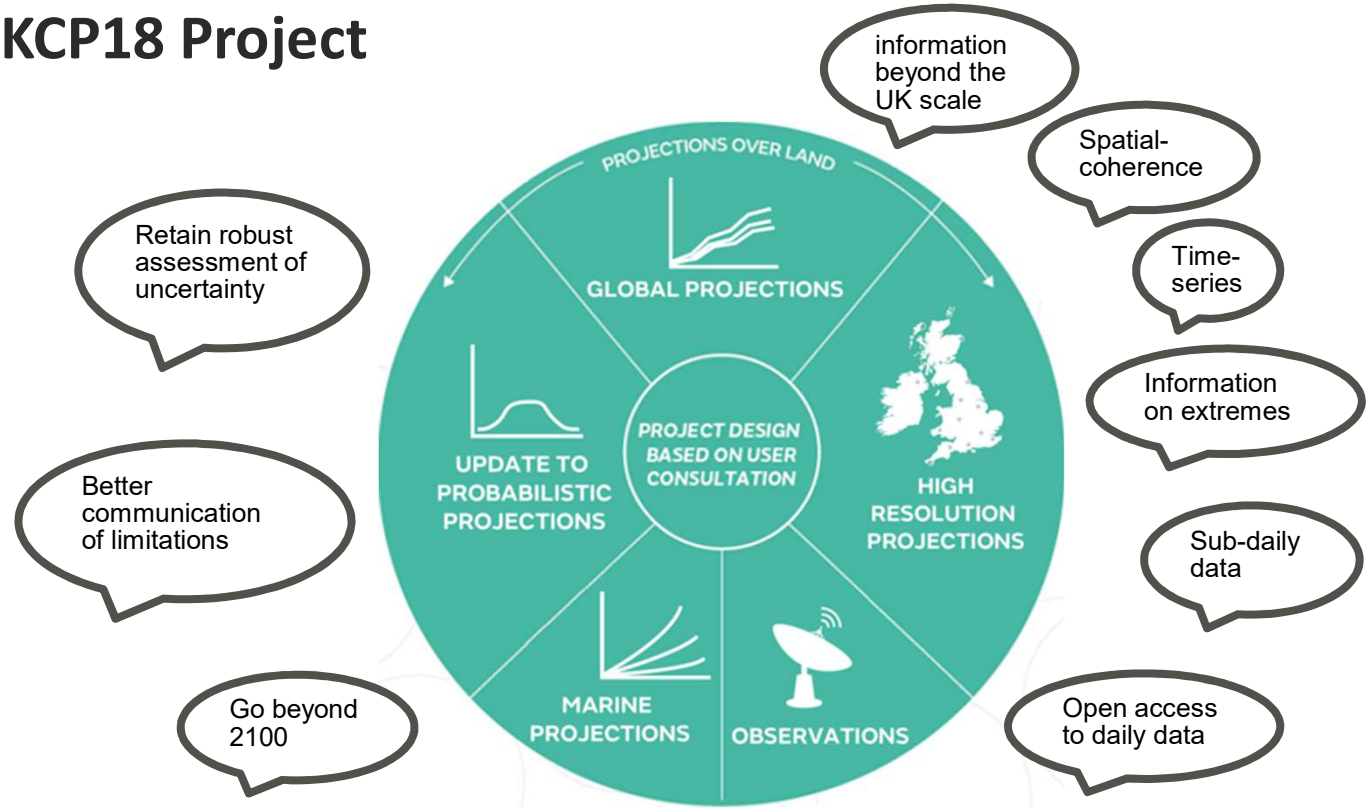
UKCP18 Project



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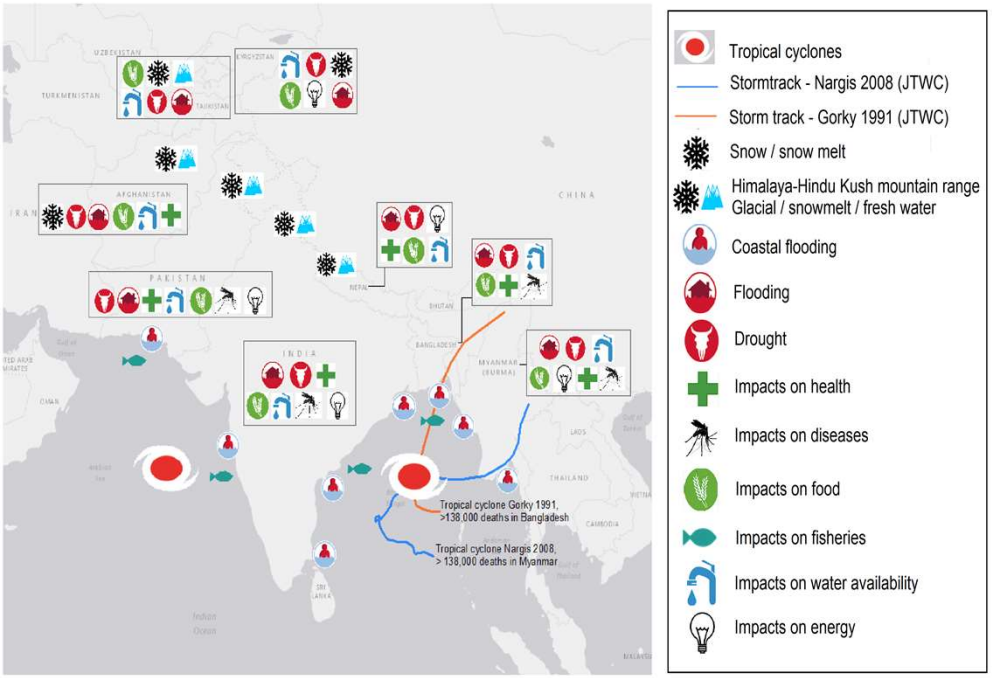
Summary

Modelling & projections	Access & communication	Capacity to utilise	Policy & planning process
CMIP6	Producer / User interactions	Co-production approaches	Emerging frameworks
Novel approaches emerging	Increasing examples of tailored products.	Train the Trainer	Increasing examples demonstrating benefits
Observations and monitoring ($)	Private sector opportunities	New tools and approaches	Climate Policy Integration (and DRR)

Asia – Regional Resilience to a Changing Climate (ARRCC) programme

- The four-year programme, starting in 2018, aims to strengthen weather forecasting systems across Asia
- DFID, Met Office, World Bank partnership
- Deliver new technologies and innovative approaches to help vulnerable communities use weather warnings and forecasts to better prepare for climate-related shocks



Department for International Development

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Thanks for listening

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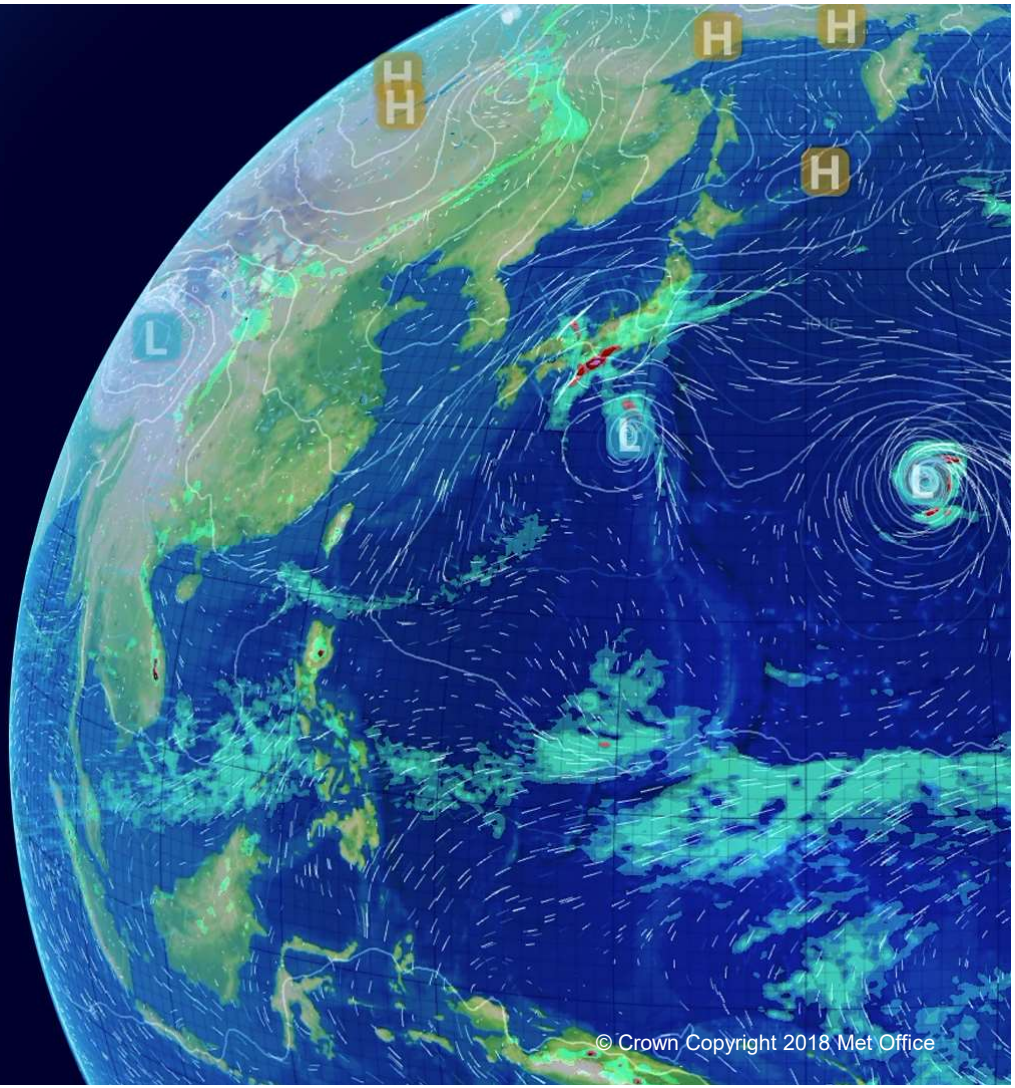
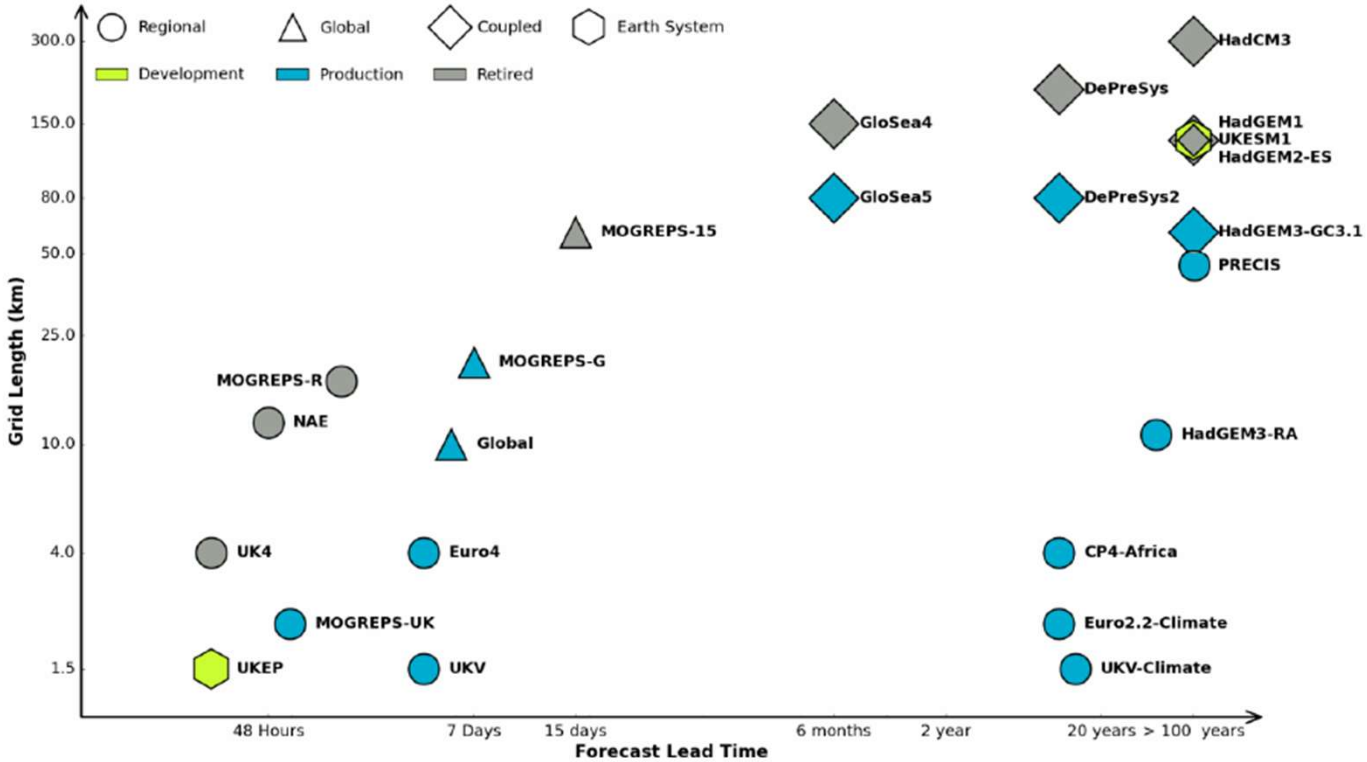


Climate modelling and projections



Decision Support Systems for Climate Policy & Practice

Climate Investment Funds, PPCR, Knowledge Sharing Event Manila, May 21, 2018

Rupa Mukerji
Director, Advisory Services
HELVETAS
Switzerland

Content of the Presentation

1. Normative approach to decision making

2. How climate related decision making may differ

3. Dealing with uncertainties

4. What is a good climate decision?

5. Decision Support Systems

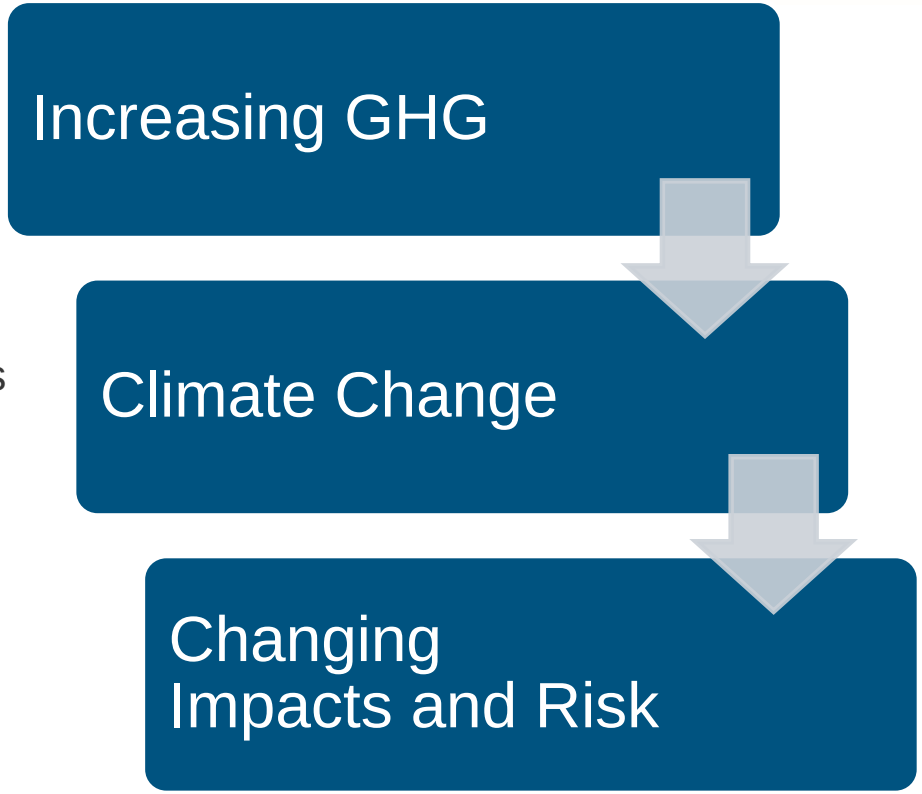
The Normative Framework

Decision making under CC largely modelled on the scientific understanding of cause-effect process

- Does not adequately address diverse contexts within which CC decisions made
- Neglects existing decision making processes
- Overlooks many cultural and behavioral aspects of decision making

Factors that affect decision making processes:

- Decisions made within broader societal and cultural environment
- Varied knowledge levels
- Who makes and who implements
- Values, purpose, goals
- Available resources, including time



Case of Louisiana

Faces serious problems of land loss

Damage to fishery

Risk of storm surge in New Orleans

Port handles 20% of US oil and gas

Previous efforts at coastal zone protection stymied by competing jurisdiction, climate skepticism, conflicting interests.

After hurricane Katarina state started:

New coastal planning effort with extensive decision support

Network of research institutions engaged

33 member multi-stakeholder group

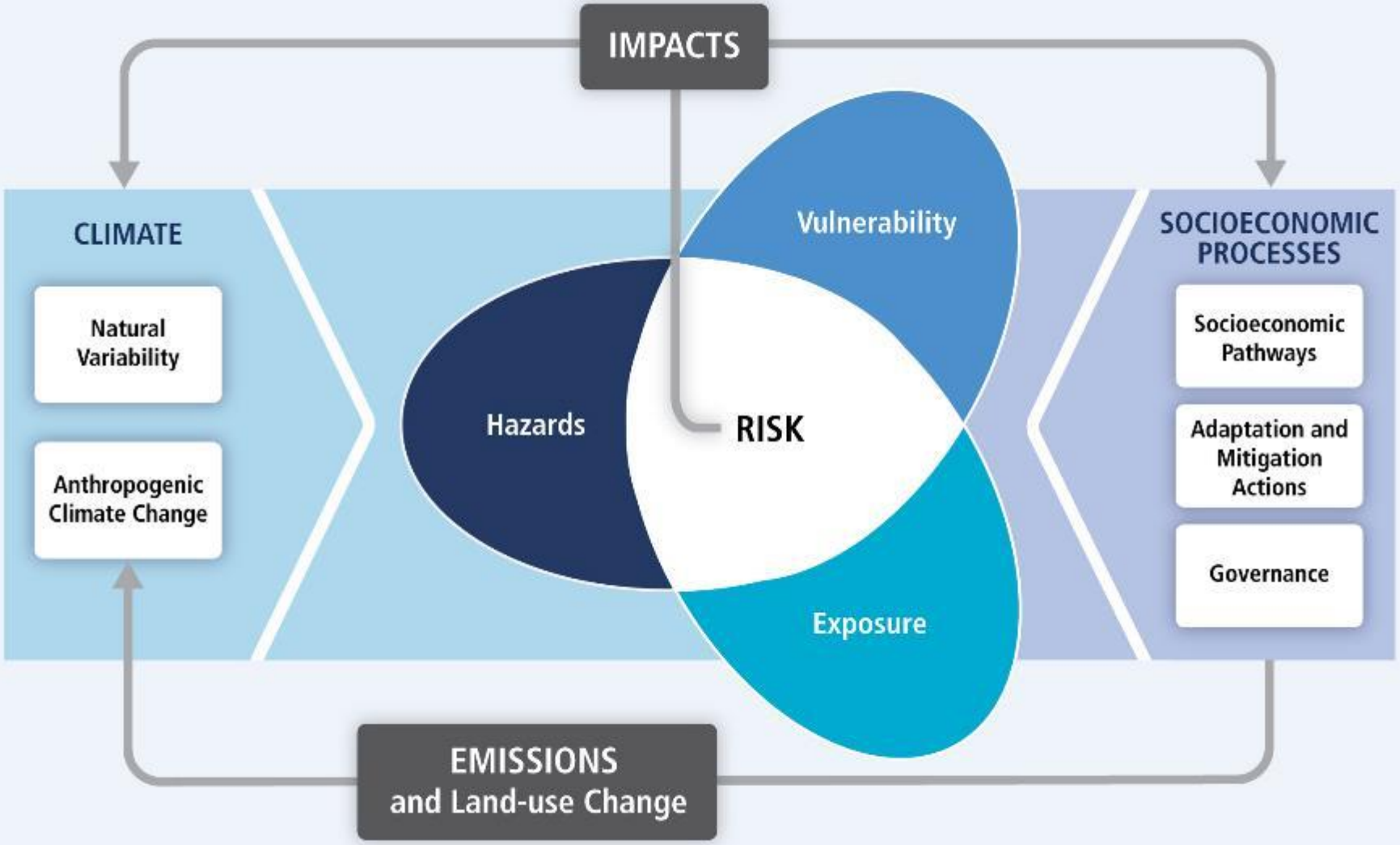
Workshops over 2 yrs

A future flood risk model developed

A multi-attribution planning tool developed

Resulting masterplan passed unanimously!

Vulnerability and Risks



Key Risks & Climate Drivers: L America

HELVETAS Swiss Intercooperation

Climate-related drivers of impacts

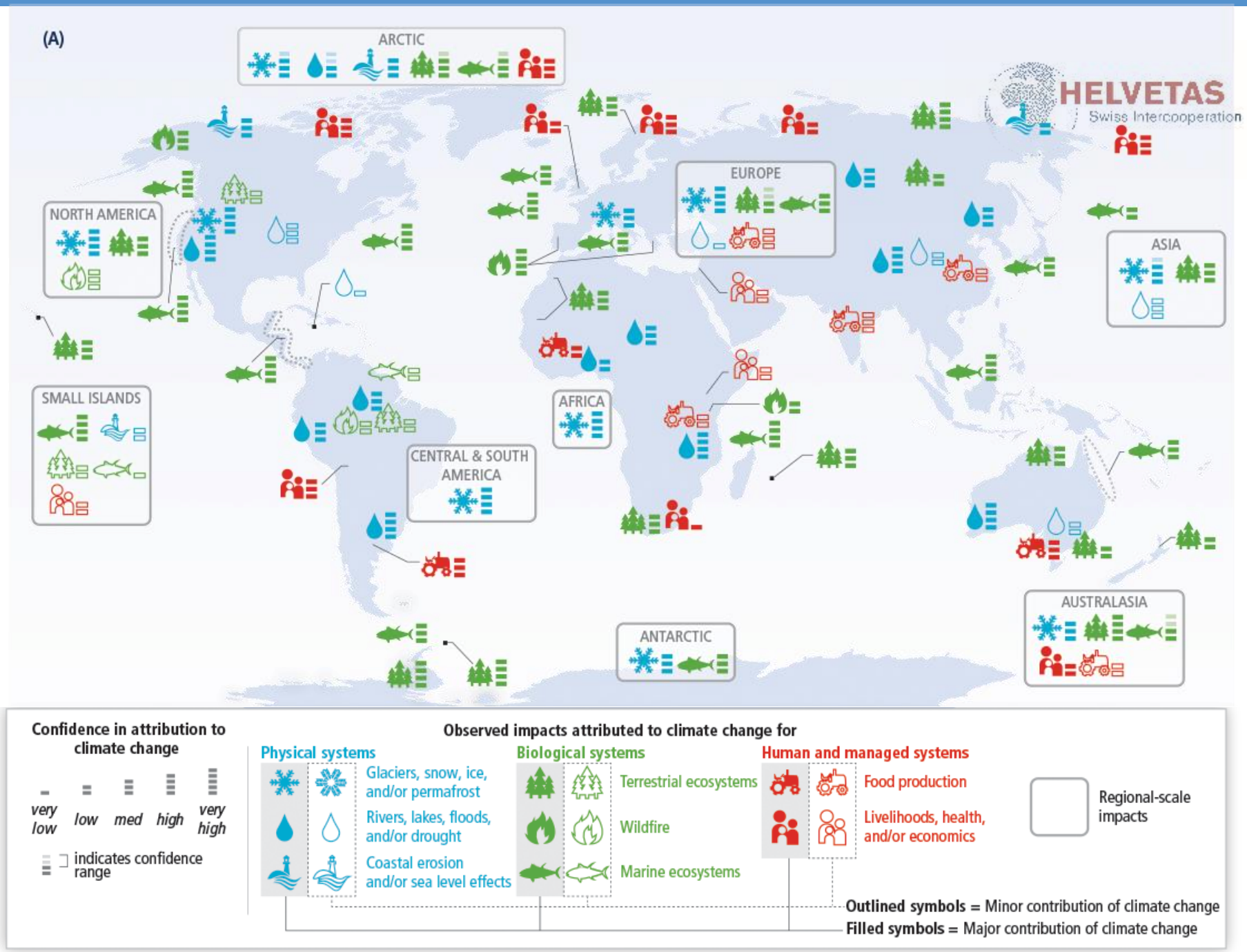
Warming trend | Extreme temperature | Drying trend | Extreme precipitation | Precipitation | Snow cover | Damaging cyclone | Sea level | Ocean acidification | Carbon dioxide fertilization

Level of risk & potential for adaptation

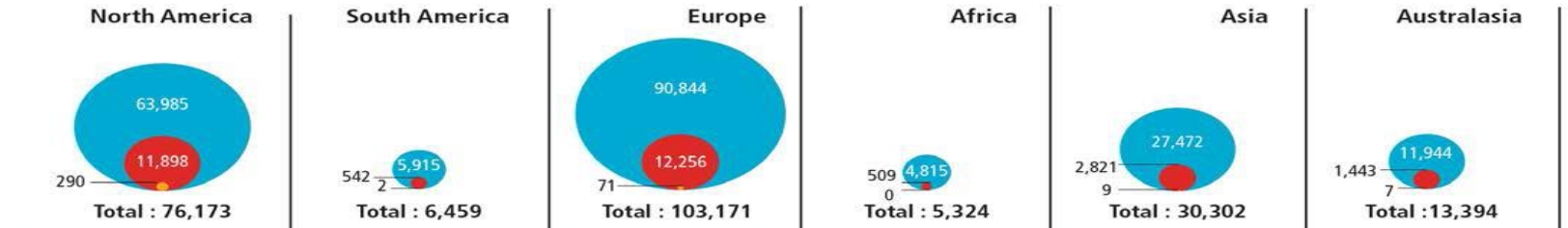
Potential for additional adaptation to reduce risk

Risk level with **high** adaptation — Risk level with **current** adaptation

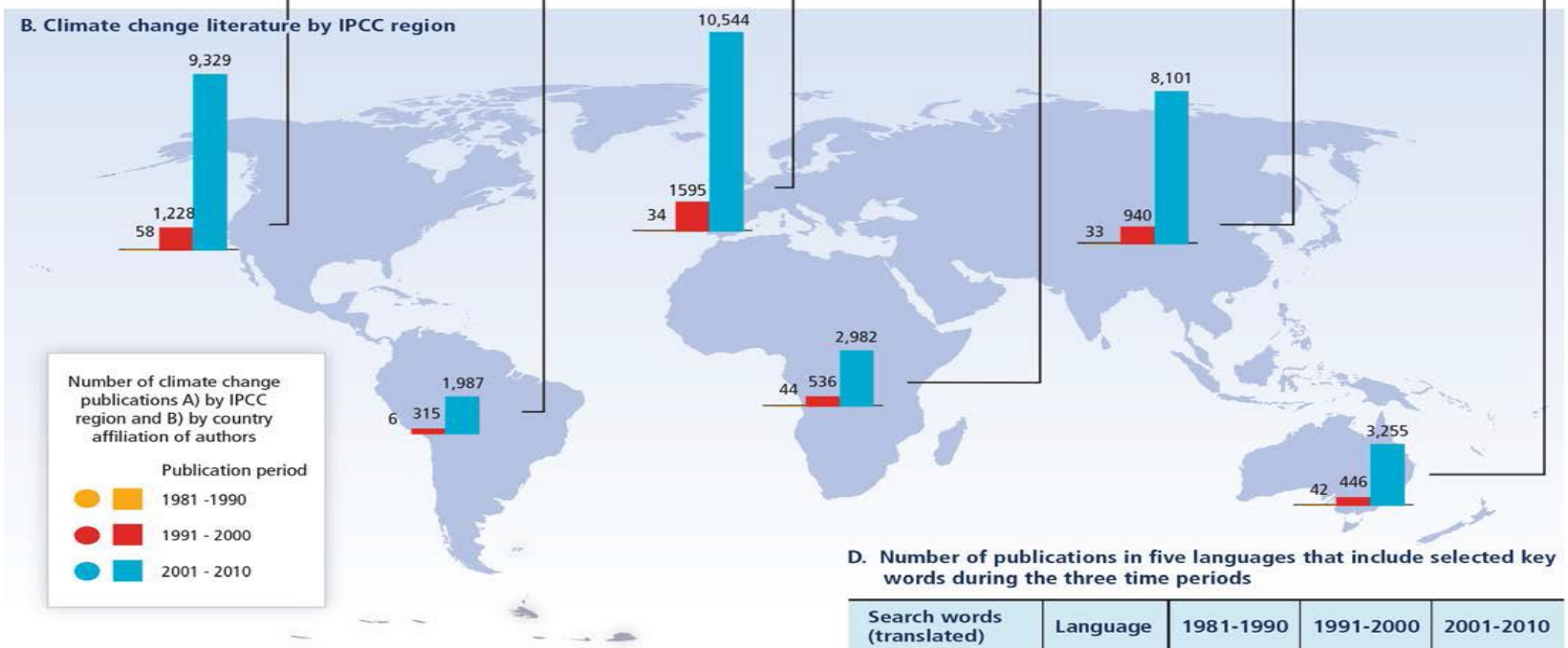
Key risk	Adaptation issues & prospects	Climatic drivers	Timeframe	Risk & potential for adaptation (Very low – Medium – Very high)
Water availability in semi-arid and glacier-melt-dependent regions and Central America; flooding and landslides in urban and rural areas due to extreme precipitation (*high confidence*) [27.3]	• Integrated water resource management • Urban and rural flood management (including infrastructure), early warning systems, better weather and runoff forecasts, and infectious disease control		Present Near-term (2030-2040) Long-term (2080-2100) 2°C Long-term (2080-2100) 4°C	
Decreased food production and food quality (*medium confidence*) [27.3]	• Development of new crop varieties more adapted to climate change (temperature and drought) • Offsetting of human and animal health impacts of reduced food quality • Offsetting of economic impacts of land-use change • Strengthening traditional indigenous knowledge systems and practices		Present Near-term (2030-2040) Long-term (2080-2100) 2°C Long-term (2080-2100) 4°C	
Spread of vector-borne diseases in altitude and latitude (*high confidence*) [27.3]	• Development of early warning systems for disease control and mitigation based on climatic and other relevant inputs. Many factors augment vulnerability. • Establishing programs to extend basic public health services		Present Near-term (2030-2040) Long-term (2080-2100) 2°C Long-term (2080-2100) 4°C	not available not available


(A)
ARCTIC
HELVETAS
Swiss Intercooperation
NORTH AMERICA
EUROPE
ASIA
SMALL ISLANDS
AFRICA
CENTRAL & SOUTH AMERICA
AUSTRALASIA
ANTARCTIC
Confidence in attribution to climate change
very low
low
med
high
very high
indicates confidence range
Observed impacts attributed to climate change for
Physical systems
Glaciers, snow, ice, and/or permafrost
Rivers, lakes, floods, and/or drought
Coastal erosion and/or sea level effects
Biological systems
Terrestrial ecosystems
Wildfire
Marine ecosystems
Human and managed systems
Food production
Livelihoods, health, and/or economics
Regional-scale impacts
Outlined symbols = Minor contribution of climate change
Filled symbols = Major contribution of climate change

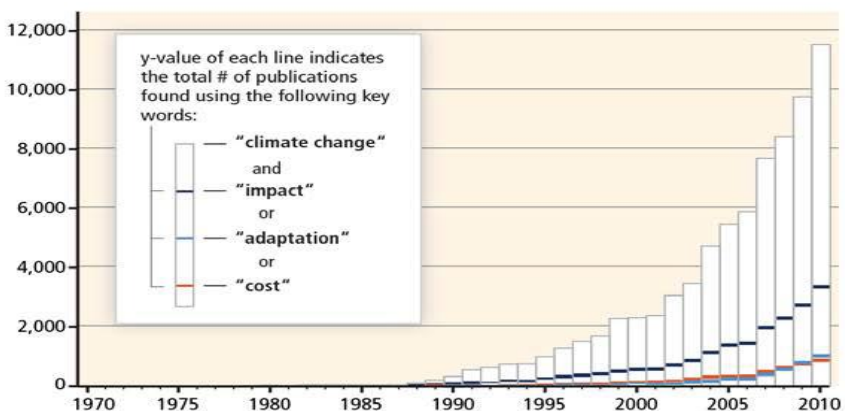
A. Author affiliation



B. Climate change literature by IPCC region



C. Climate change literature in English, total and for selected topics (1970-2010)



D. Number of publications in five languages that include selected key words during the three time periods

Search words (translated)	Language	1981-1990	1991-2000	2001-2010
"climate change"	English	990	12,686	61,485
	Chinese	1,454	6,353	22,008
	French	1	108	815
	Russian	67	210	1,443
	Spanish	3	82	1,381
"climate change" and "impacts"	English	232	3,001	16,218
	Chinese	133	515	1,780
	French	0	1	95
	Russian	0	72	403
	Spanish	0	7	103
"climate change" and "adaptation"	English	14	373	3,661
	Chinese	6	58	321
	French	0	7	110
	Russian	0	7	44
	Spanish	0	5	103
"climate change" and "cost"	English	24	699	4,099
	Chinese	1	22	162
	French	0	7	36
	Russian	0	1	24
	Spanish	0	2	11

Epistemological constructs of Risks

1. Idealized risk: The conceptual framing of the risk at hand

2. Calculated risk: product of a model based on a mix of historical/ observed and theoretical information

3. Perceived risk: The subjective judgement people make about an idealized risk.

They combine to form socially constructed risk.

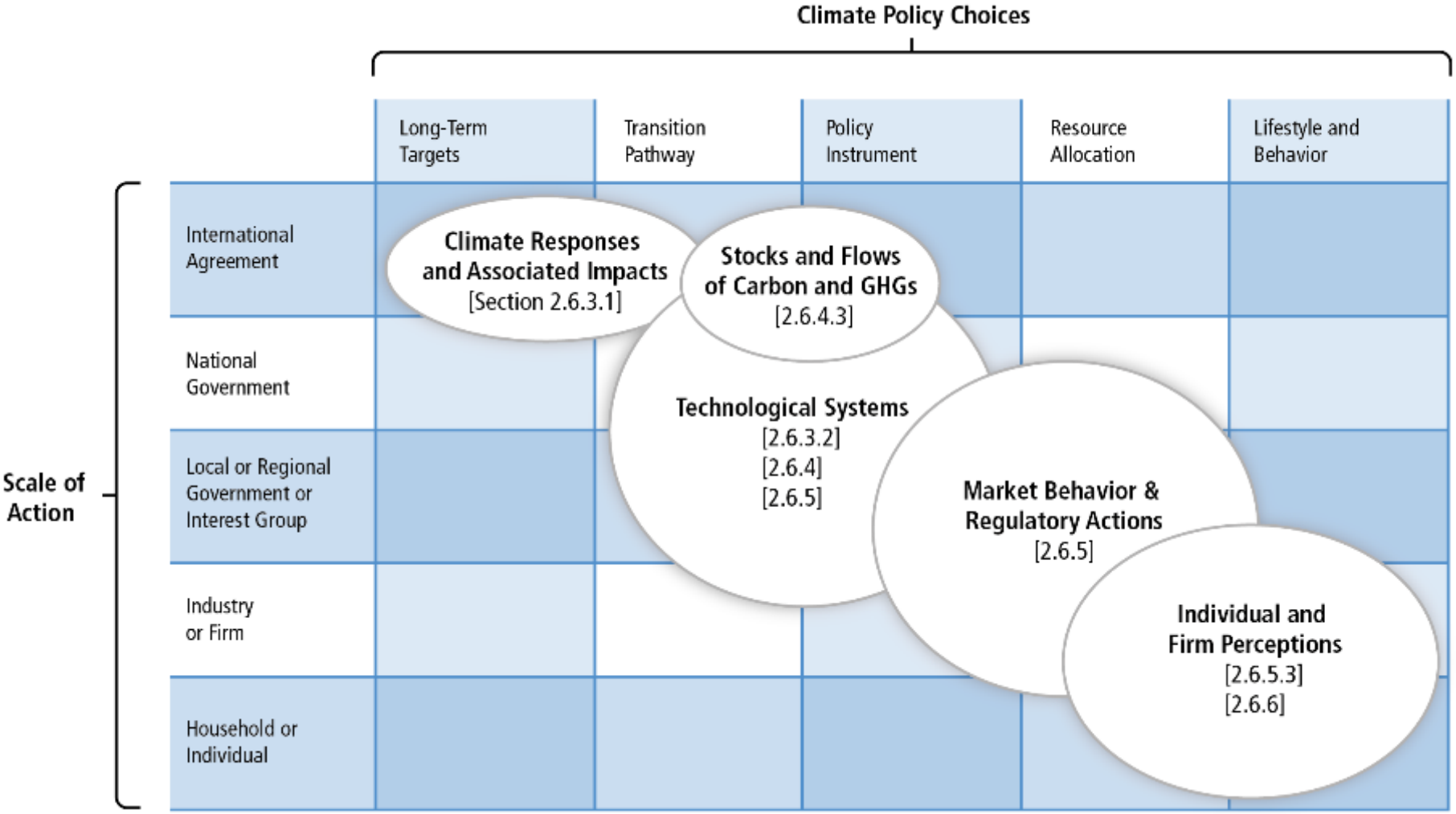
Media, opinion leaders plays an important role shaping our perception of risk!

Types of Risks and Characteristics of Decision Making

HELVETAS
Swiss Intercooperation

Characteristics of decision making	Simple risk	Complicated risk	Complex risk
Methodology	Linear, cause and effect	Top down and/or bottom up, iterative	Iterative and/or adaptive, ongoing and systemic
Approach	Analytic and technical	Collaborative process with technical input	Process driven. Frame and model multiple drivers and valued outcomes
Stakeholder strategy	Communication	Collaboration	Deliberation, creating shared understanding and ownership
Mental models	Common model	Negotiated and shared	Contested initially and negotiated over project
Values and outcomes	Widely accepted	Negotiated over project by user perspectives and calculated risk	Contested initially and negotiated over project
Monitoring	Straightforward	With review and trigger points	As real-time as possible, adaptive with management feedback and trigger points

Levels of decision making and climate policy choices



What constitutes a good climate decision?

No universal criteria exists, but..

- Good decisions emerge from processes in which people are explicit about their goals
- Consider a range of alternative options
- Use the best available science to understand the potential consequences of their action
- Carefully consider the trade-offs
- Assess the decision from a wide range of views and vantages
- Follow agreed rules and norms that add to the legitimacy of the decision

It requires:

Information on climate, its impacts and potential risks and vulnerabilities

Dialogue between users and specialists on how a task can be best undertaken

Facilitation by knowledge brokers and Boundary organizations

Good scientific and technical information alone is rarely sufficient to result in better decisions.

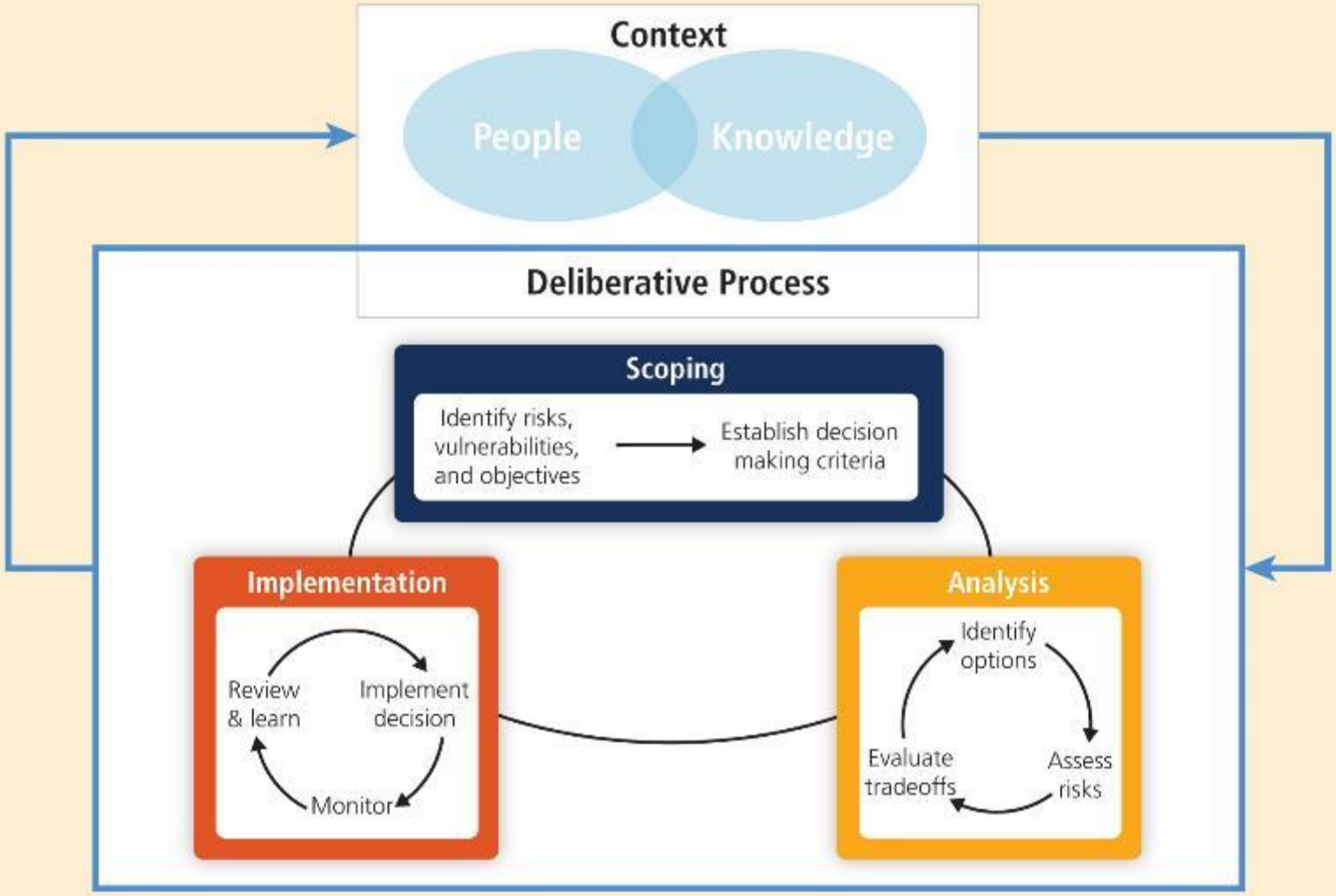
Aspects that distinguish climate change from other decision making processes are:

→ Long time scale involved

→ Pervasive impact of resulting risks

→ Deep uncertainties attached to many of these risks

Iterative Risk Management



Is climate change decision making different?

Commonalities with other decisions concerning long term, high consequence issues:

- Usefulness of a board risk framework
- Need to consider uncertain projections of various bio physical and socioeconomic conditions.

Differences:

- Climate change includes longer time horizons
- Affects a boarder range of human and earth systems
- Has specific tipping points and may lead to irreversible outcomes
- The realization that future climate may differ significantly from previous experience is relatively new for many affected sectors

Decision Support

Begins with user's needs and not scientific research priorities

Emphasizes process over products

Incorporates systems that link users and producers of information

Build connections across disciplines

Seek institutional stability

Incorporate learning -> flexibility, adaptability and learning form experience

Multi-stakeholder processes

1. Reduces information uncertainty
2. Reduces normative uncertainty
3. Helps to build consensus on criteria for M&E
4. Can empower stakeholders to influence adaptation and take appropriate actions themselves
5. Can reduce conflicts and build synergies between adaptation activities of different stakeholders
6. Can improve the likely fairness, social justice and legitimacy of adaptation decisions and actions

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Thank you!

“”From disaster to climate science to national planning: Learning from Haiyan”.

Thelma A. Cinco

Assistant Weather Services Chief, CAD, PAGASA

Philippine Atmospheric, Geophysical and Astronomical Services Administration

*Email: telacebes@yahoo.com

Knowledge Sharing on Adaptation and Resilience in PPCR Countries, ADB, Manila May 21-24, 2018

PAGASA
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Outline

- Enhance warning and advisories of PAGASA
- New Climate projections using RCP4.5 & RCP8.5
- Communicating Climate projections: Climate Risk Analysis Matrix (CLIRAM)
- Integrating Climate information to local planning LCCAP and the Risk Resiliency and Sustainability Program

What went wrong in Typhoon Haiyan ("Yolanda")?
Why do good forecast result in poor response?

On November 08, 2013 – 5:00 AM, Typhoon "YOLANDA" has made Landfall over Guiuan, Samar with max. sustained winds of 235 kph and gustiness of 275 kph moving WNW at 39 kph. 6300 individuals were reported dead, 28,689 injured and 1,061

- Accurate warnings on Yolanda's tracks and intensity and reasonably accurate estimate of storm surge height were issued by PAGASA

- Many of the deaths were caused by the storm surge that resulted from the strong wind.

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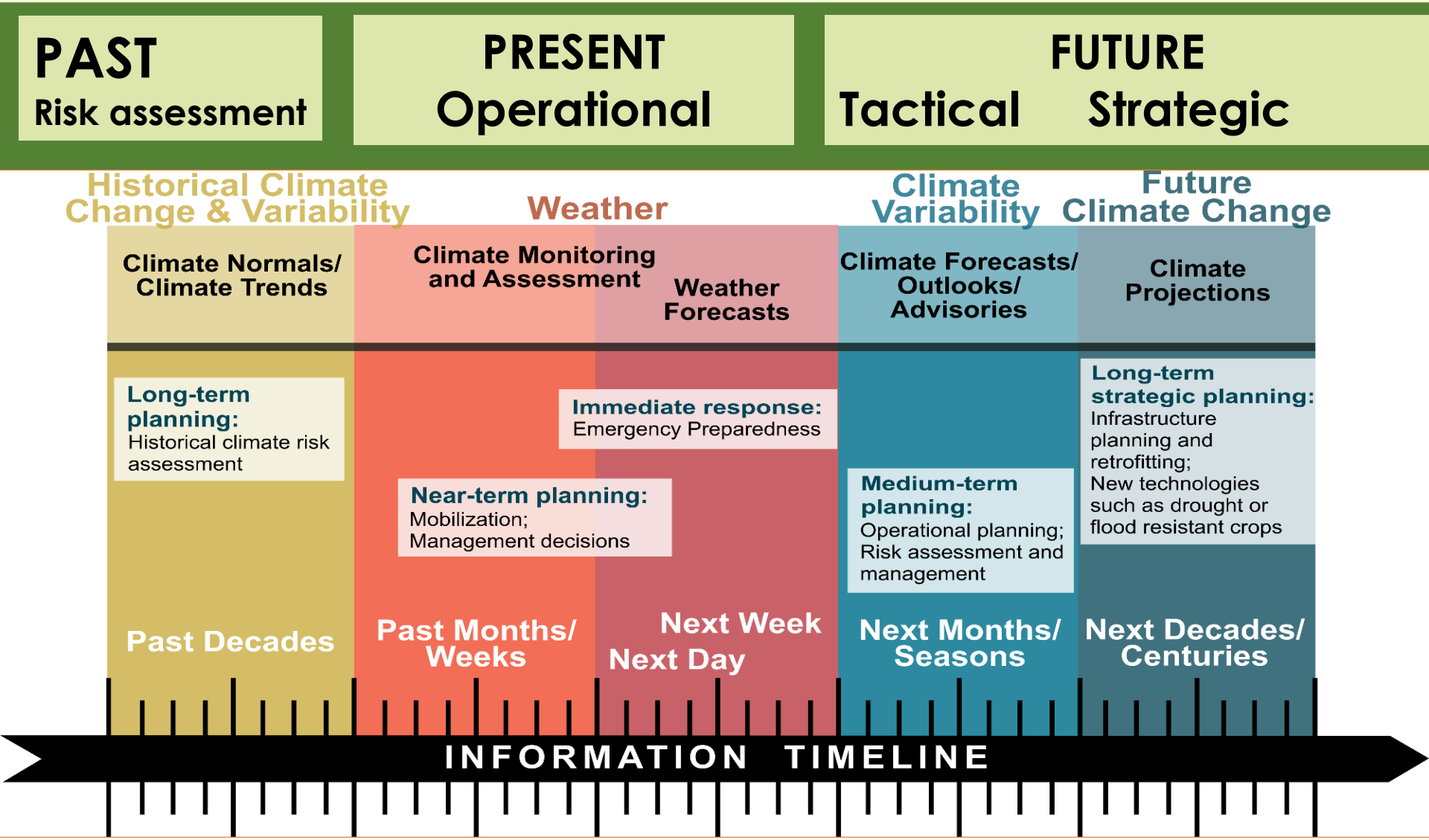
Weather and climate information being provided by PAGASA



PAGASA's enhanced warnings and advisories

FORECASTING

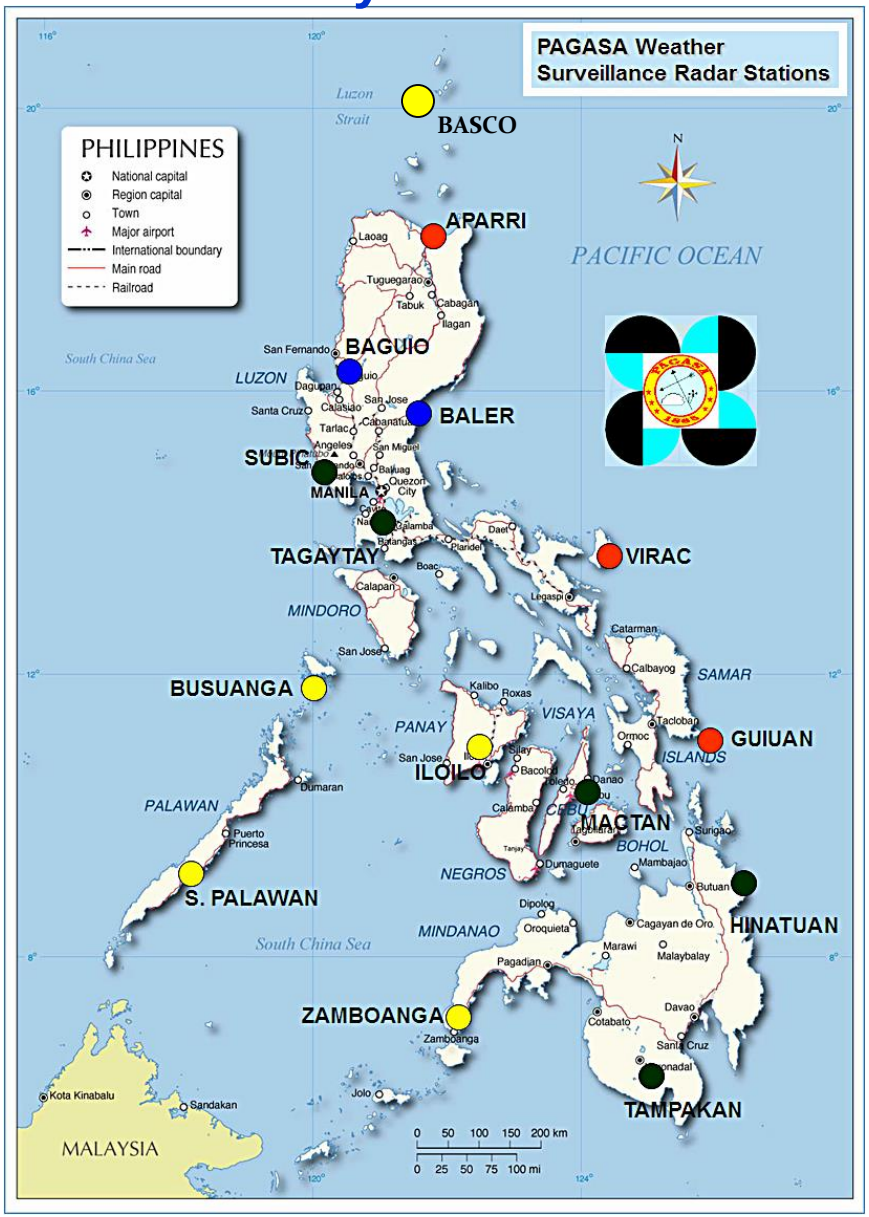
PAGASA offers Weather Forecasts to different stakeholders on a daily basis to informed decision making;

Introduced the color-coded warning categories:

- ***Alert/Advisory/Warning relating to specific hazard thresholds and lead-times***
- ***Standardized content of message***
- ***Warnings disseminated to NDRRMC/OCD, media, LGUs, general public.***

Towards Impact Base forecasting

Radar Network that covers the whole country



No.	RADAR STATION	STATUS
1	APARRI	OPERATIONAL
2	BAGUIO	OPERATIONAL
3	BALER	FOR REPLACEMENT
4	SUBIC	OPERATIONAL
5	TAGAYTAY	OPERATIONAL
6	VIRAC	FOR REHABILITATION
7	GUIUAN	OPERATIONAL
8	MACTAN	OPERATIONAL
9	HINATUAN	OPERATIONAL
10	TAMPAKAN	OPERATIONAL
11	BASCO	FOR REPLACEMENT
12	ILOILO	OPERATIONAL
13	PALAWAN	OPERATIONAL
14	ZAMBOANGA	OPERATIONAL
15	BUSUANGA	2018
16	BOHOL	2019
17	DAET	2018
18	AGNO	2019
19	MASBATE	2019
20	LAOANG	2019

Enhancement of Early Warning Service
Color-coded Warning System

Hazards	Signal/Warning
Heavy Rainfall	
Thunderstorm	
Tropical Cyclone	
Floods	Flood Advisory/Bulletin
Storm Surge	Severe Weather Bulletin/Storm Surge Bulletin
Gale	Gale Warning
Seasonal Climate Outlook	El Nino Advisory/La Nina Advisory

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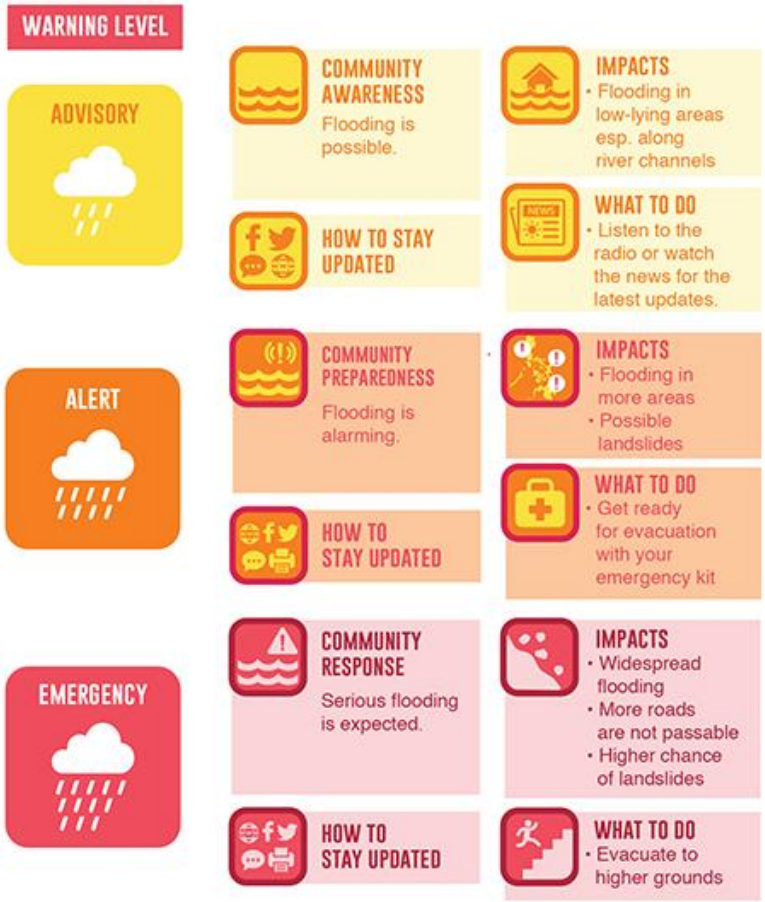
Enhancement of Early Warning Service
Color-coded Warning System

HEAVY RAINFALL WARNING SYSTEM (HR-WS)

- For rainfall events of long duration (can last days or weeks) and widespread rain
- Usually caused by tropical cyclones, monsoons, etc.
- Covers a larger area



Enhancement of Early Warning Service
Color-coded Warning System

WHAT IS A TROPICAL CYCLONE?

- AN INTENSE LOW PRESSURE SYSTEM OF AT LEAST 30 KPH MAXIMUM SUSTAINED WINDS
- ALSO KNOWN AS "BAGYO"

DID YOU KNOW

About 20 tropical cyclones enter the Philippine Area of Responsibility (PAR) each year.

90% of these affect the country.

IMPACTS

Damage to buildings and settlements caused by strong winds

Casualties from storm surge, inland flooding and landslide

CLASSIFICATION OF TROPICAL CYCLONES

A tropical cyclone is classified according to its strength and grouped according to the maximum sustained winds near the center.

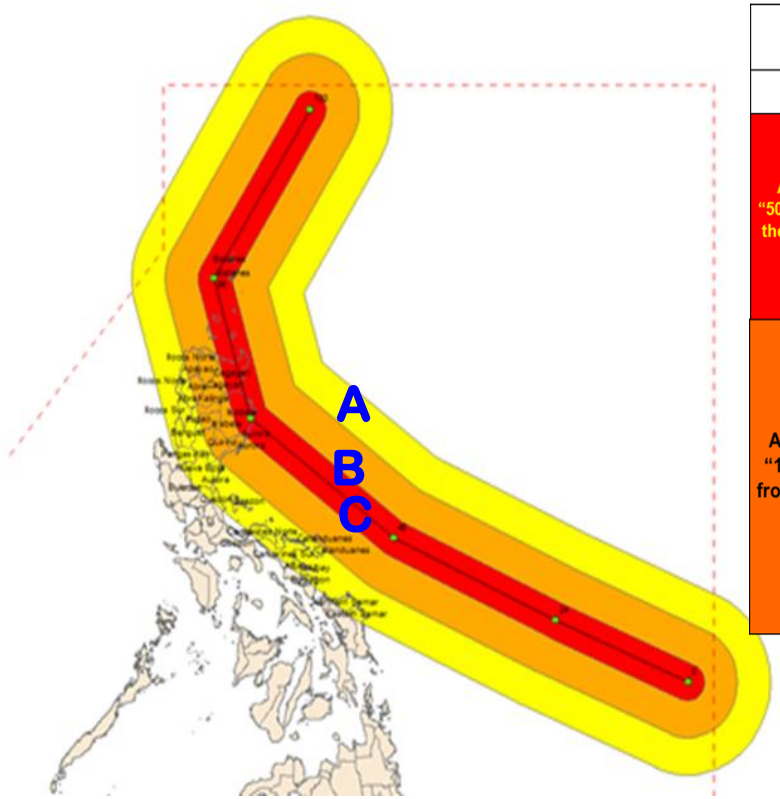
TROPICAL DEPRESSION	TROPICAL STORM	SEVERE TROPICAL STORM	TYPHOON	SUPER TYPHOON
61 KPH OR LESS	62-88 KPH	89-117 KPH	118-220 KPH	MORE THAN 220 KPH

BASIC TROPICAL CYCLONE STRUCTURE

TROPICAL CYCLONE WARNING SYSTEM SIGNALS (TCWS)

	TCWS NO. 1	TCWS NO. 2	TCWS NO. 3	TCWS NO. 4	TCWS NO. 5
WIND IMPACT	No damage to very light damage	Light to moderate damage	Moderate to heavy damage	Heavy to very heavy damage	Very heavy and widespread damage, phenomenal
LEAD TIME *since first issuance*	Expect the impact of 30-60 kph winds in 36 hours	Expect the impact of 61-120 kph winds in 24 hours	Expect the impact of 121-170 kph winds in 18 hours	Expect the impact of 171-220 kph winds in 12 hours	Expect the impact of more than 220 kph winds in 12 hours
OPEN SEA CONDITION / WAVE HEIGHT	1.25-4.0 meters	4.1-14.0 meters	more than 14.0 meters	more than 14.0 meters	more than 14.0 meters
		Storm surge is possible along coastal areas	Storm surge is possible along coastal areas	Storm surge of 2-3 meters is possible along coastal areas	Storm surge of more than 3 meters is possible along coastal areas
WHAT TO DO	• Check the stability of your home and reinforce it if necessary. • Tune in to the radio for weather news. • Monitor PAGASA's latest Severe Weather Bulletin.	• Stock up on food, water and batteries for wireless radios and flashlights. • Stay inside a concrete structure. • Make sure cell phones are fully charged.	• Evacuate from low-lying areas to higher ground. • Get updated on the latest tropical cyclone development. • Everybody is advised to stay in safe and sturdy houses. • Stay away from coasts and riverbanks.	• Stay in safe houses or evacuation centers. • Cancel travels and outdoor activities. • Keep listening to news about the typhoon.	• Cancel travels and outdoor activities. • Stay in safe houses or evacuation centers.

Pre-disaster risk assessment



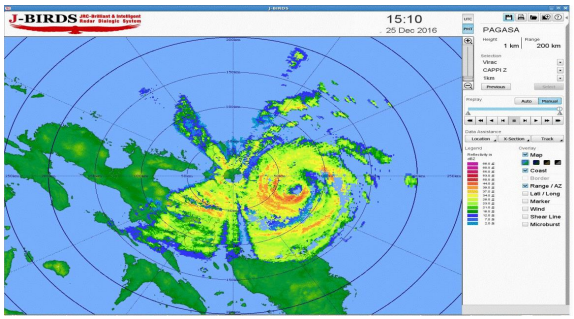
8 AM MAY 7, 2015 POTENTIAL RISK AREAS FOR TY DODONG (NOUL)		
AREAS AFFECTED	PROVINCES	POTENTIAL IMPACTS DUE TO SEVERE WIND
ALERT LEVEL "50KM Radius from the forecast track"	Aurora Batanes Cagayan Isabela	❖ Storm Surge of up to 2 meters high over coastal areas ❖ Heavy damage to agriculture ❖ Some large trees uprooted ❖ Majority of nipa and cogon houses unroofed or destroyed considerable damage to structures of light to medium construction ❖ Moderate to heavy disruption of electrical power and communication services ❖ Travel by land, sea and air is dangerous
ALERT LEVEL "150KM Radius from the forecast track"	Abra Apayao Catanduanes Ifugao Ilocos Norte Kalinga Mountain Province Nueva Vizcaya Quirino	❖ Moderate damage to agriculture ❖ Rice and corn adversely affected ❖ Few large trees uprooted ❖ Large number of nipa and cogon houses partially or totally unroofed ❖ Some old galvanized iron roofing may roll off ❖ Travel by all types of sea vessels is risky

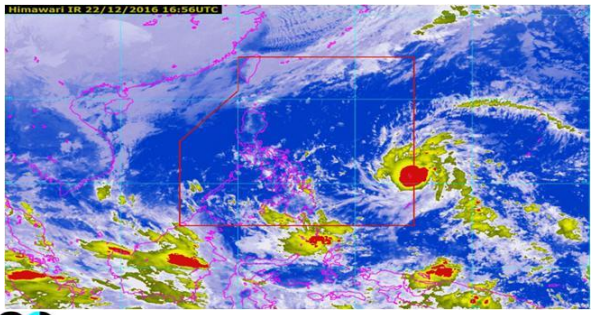
EARLY ACTION!!!

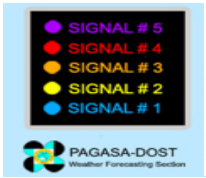
Color coded TC warning still under development

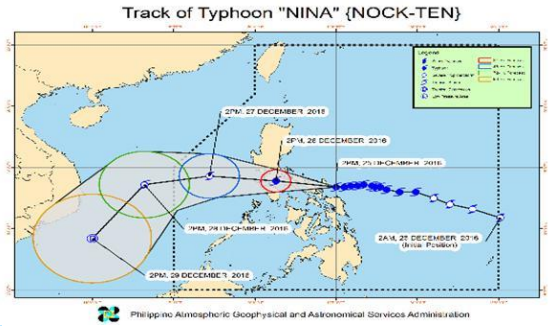
Typhoon "Nina"(Nock-Ten) Update

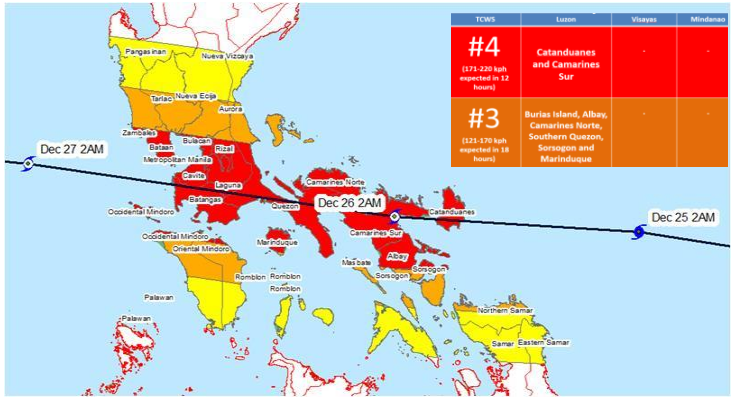
- 5PM, 25 December 2016











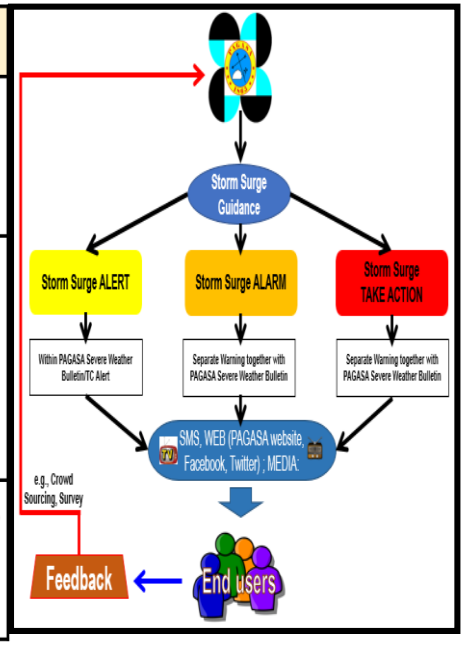
Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA)

PAGASA New Initiatives

- **Impact-Based Storm Surge Warning System**

	NO ACTION REQUIRED Evacuation NOT necessary.
	Storm Surge is POSSIBLE – BE AWARE Get READY. Stay away from the coast or beach.
	Storm Surge is EXPECTED – BE PREPARED Conditions could be Life Threatening. Follow evacuation guidance from local authorities when required.
	Significant THREAT TO LIFE – TAKE ACTION Catastrophic. MANDATORY EVACUATION is enforced.

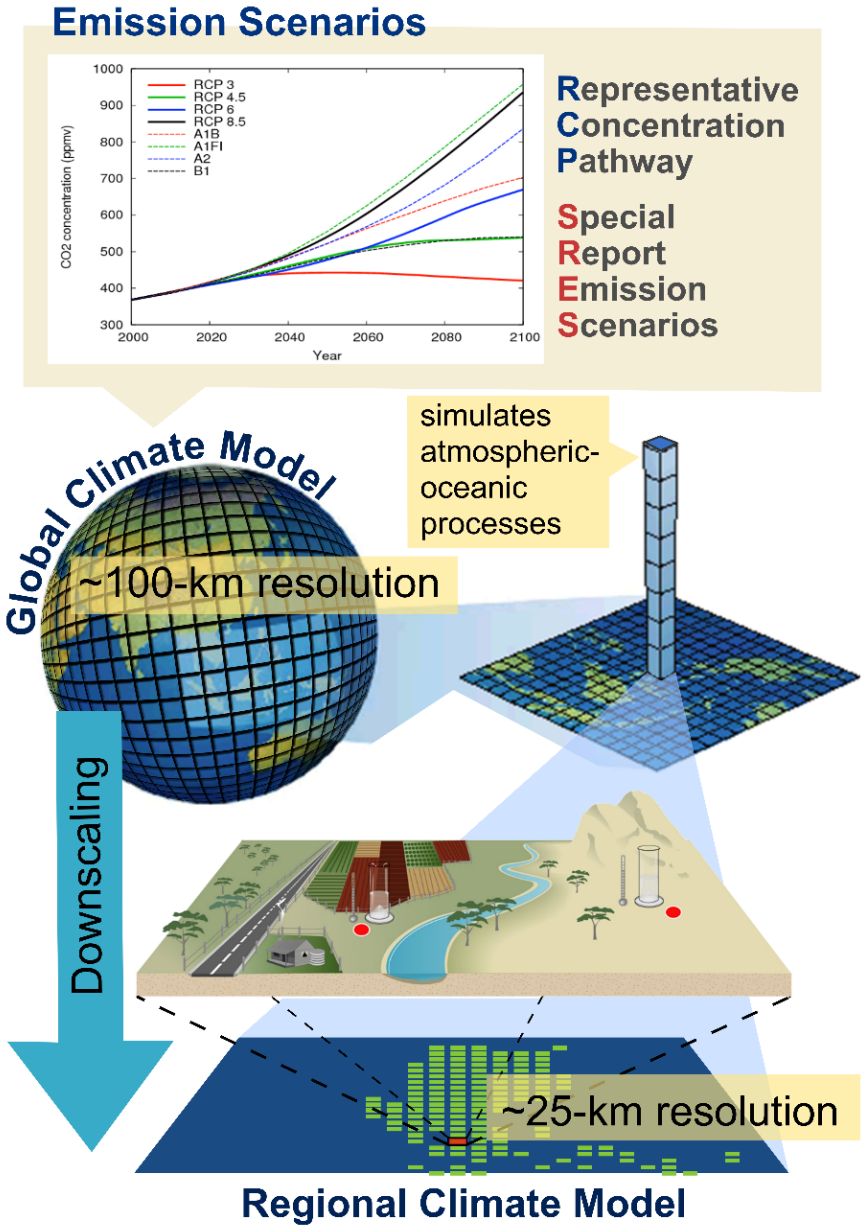
Storm Surge Warning Levels	Expected Impact/ Damage	Advice/ Action to be Taken
ALERT (ADVISORY)	Low to moderate risk storm surge may occur and is expected to impact coastal communities within 48 hours.	Storm surge is POSSIBLE – BE AWARE Stay away from the coast or beach. Preparedness measure should be carried out.
ALARM (WATCH)	High to very high risk storm surge may occur and is expected to impact coastal communities within 36 hours.	Storm surge is EXPECTED – BE PREPARED Conditions could become life threatening. All marine activities should be cancelled. Follow evacuation guidance from local authorities when required.
TAKE ACTION (WARNING)	Severe damage to coastal communities may occur due to storm surge that is expected to impact within 24 hours; or is already happening.	Significant THREAT TO LIFE – TAKE ACTION Catastrophic. Mandatory evacuation is enforced.



*Still in Research phase and subject to feedback from stakeholders/users

The new Climate projections for the Philippines?

The process of generating downscaled climate projection by using Regional Climate Model (RCM)



RCMs used by PAGASA:

1. PRECIS
2. CCAMCCAM (CSIRO)
3. RegCM4
4. HadGEM3-RA(UK-Met Office)

Number of Model member in the ensemble:
12 model members – RCP8.5
7 model-members – RCP4.5

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Climate Scenario	Downscaling Model	Driving GCM	Resolution	Available Time Period
A1B (Millennium Development Goals-2011)	PRECIS	HadCM3Q0	25km	1971-2099
A1B (Southeast Asia Climate Analysis and Modeling-2014)	PRECIS	ECHAM5	25km	1971-2000 2030-2059 2070-2099
		HadCM3Q0		
		HadCM3Q3		
		HadCM3Q10		
		HadCM3Q11		
		HadCM3Q13		
RCP 4.5	PRECIS	HadGEM2-ES	25km	1971-2099
	CCAM	ACCESS1.0	10kmin Vietnam, 25kms around the Philippines	
		CNRM-CM5		
		CCSM4		
		GFDL-CM3		
		MPI-ESM-LR		
		NorESM1-M		
RCP 8.5	CCAM(PH)	CNRM-CM5	25km	1971-2099
	PRECIS	HadGEM2-ES		
	RegCM4			
	HadGEM3-RA	CNRM-CM5	12km	1971-2000 2036-2065
		HadGEM2-ES		1971-2000 2036-2065
		MRI-CGCM3		1971-2000 2036-2065 2069-2099
	CCAM	ACCESS1.0	10kmin Vietnam, 25 kmaround the Philippines	1971-2099
		CNRM-CM5		
		CCSM4		
		GFDL-ESM2M		
		MPI-ESM-LR		
		NorESM1-M		

List of utilized

GCMs and RCMs

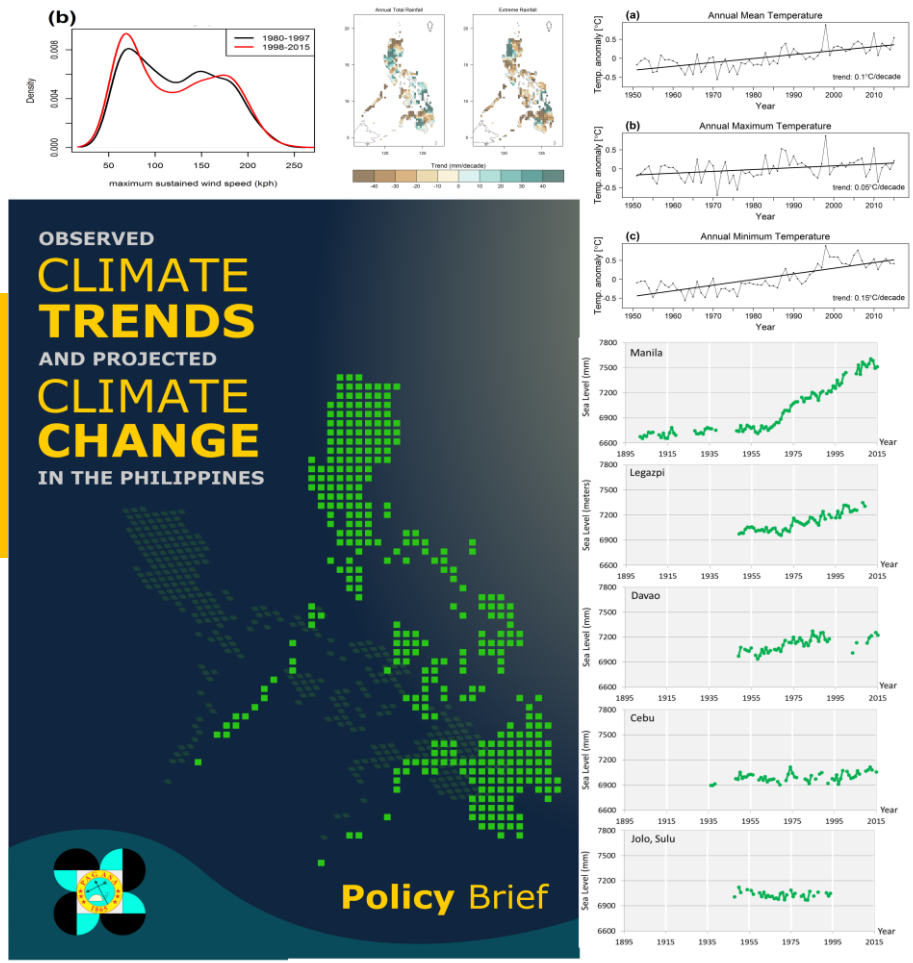
to generate high-resolution climate projections for the Philippines.

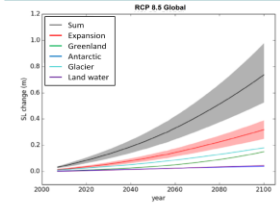
RCMs used by:

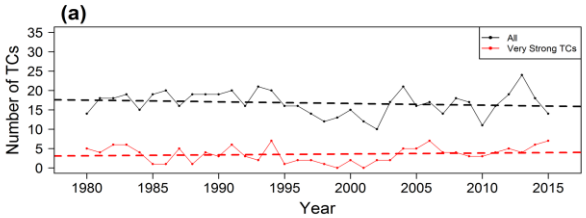
- PRECIS
- CCAM (CSIRO)
- RegCM4
- HadGEM3-RA(UK –Met office)

Number of Model ensemble:
Single model – A1B
SEACAM -6 members – A!B
12 model members – RCP8.5
7 model members – RCP4.5

The latest climate change report for the Philippines







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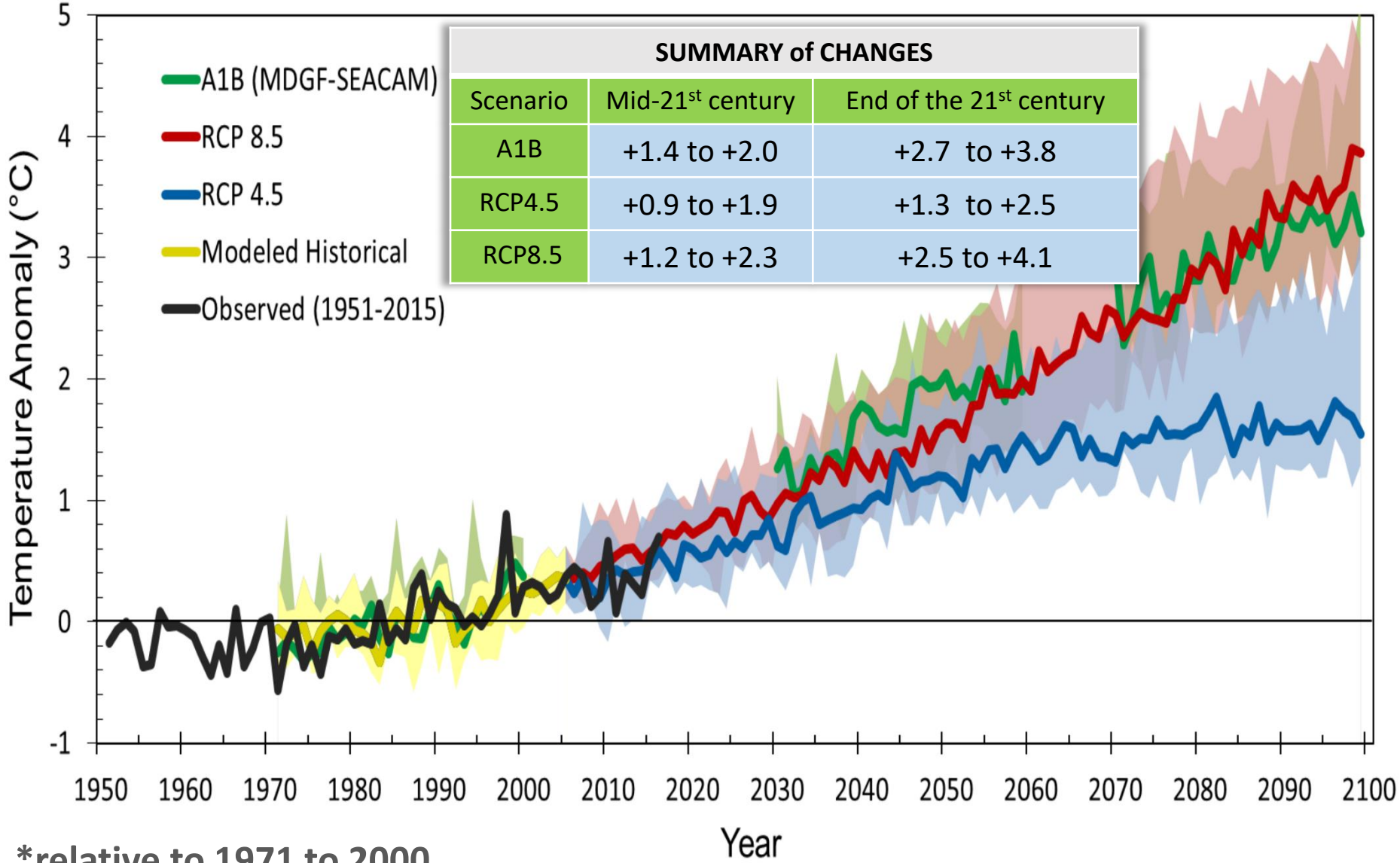
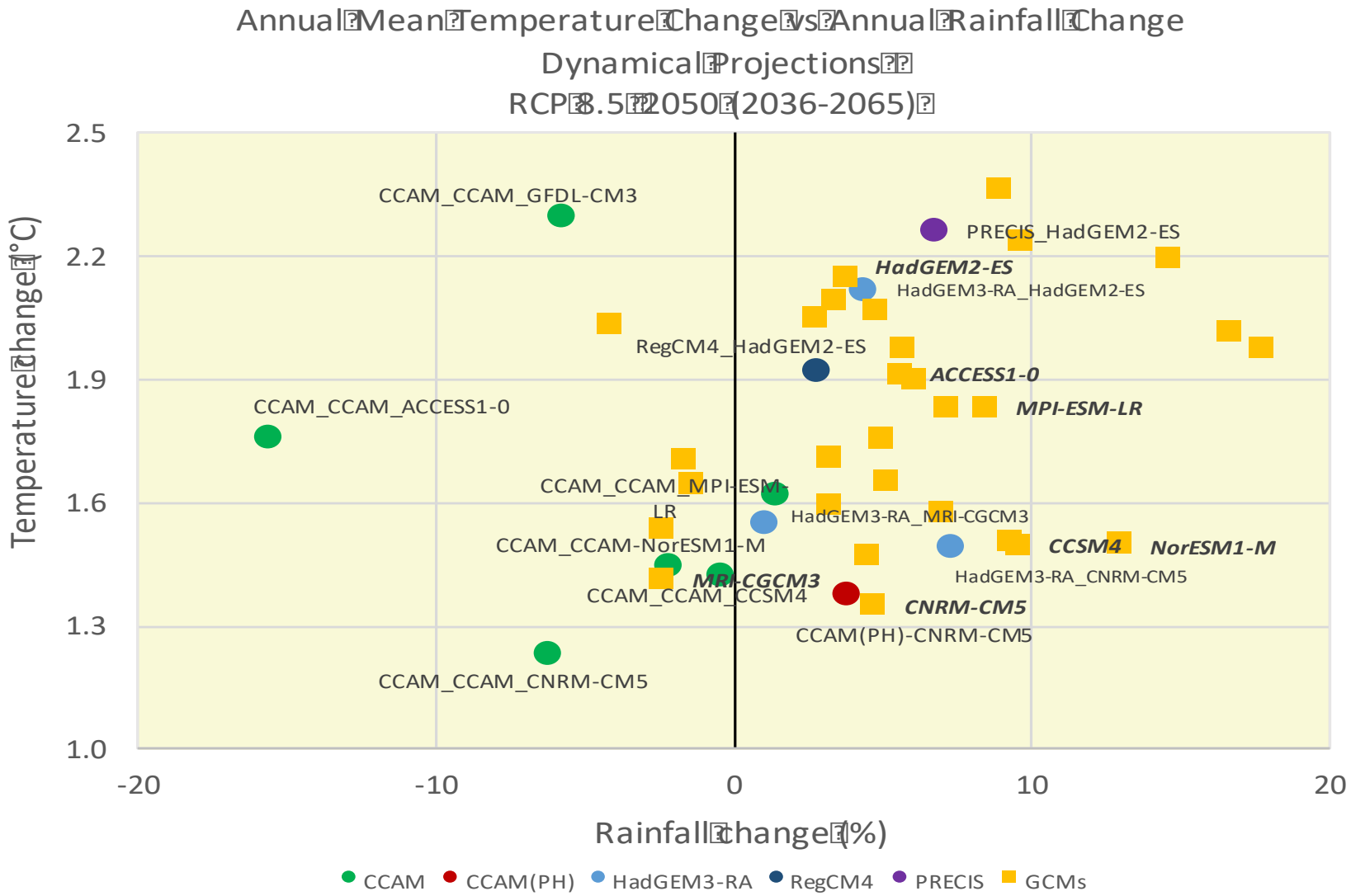
Projected Annual Mean Temperature Change*



SUMMARY of CHANGES		
Scenario	Mid-21st century	End of the 21st century
A1B	+1.4 to +2.0	+2.7 to +3.8
RCP4.5	+0.9 to +1.9	+1.3 to +2.5
RCP8.5	+1.2 to +2.3	+2.5 to +4.1

*relative to 1971 to 2000



Providing future climate projections using multiple models and methods: insights from the Philippines

Joseph Daron[1], Ian Macadam[1], Hideki Kanamaru[2], Thelma Cinco[3], Jack Katzfey[4], Claire Scannell[1], Richard Jones[1], Marcelino Villafuerte II[3], Faye Cruz[5], Gemma Narisma[5,6], Rafaela Jane Delfino[7], Rodel Lasco[7], John Manalo[3], Emma Ares[3], Ana Liza Solis[3], Rosalina de Guzman[3], Joseph Basconcillo[3], and Fredolin Tangang[8]*

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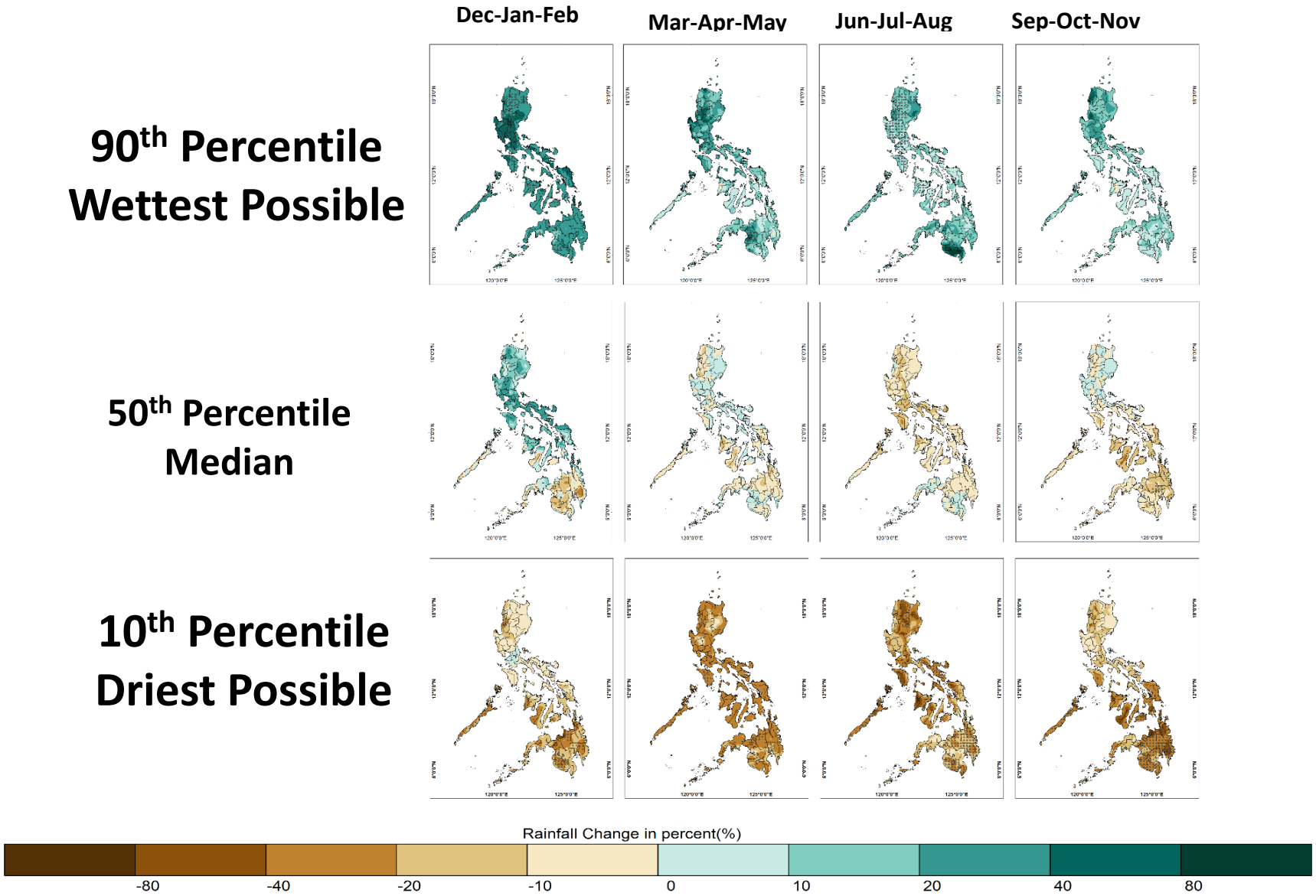
Projected changes in seasonal total rainfall by the Mid-21st Century (2036-2065) based on RCP8.5 scenario



Projected future change in tropical cyclones to affect the Philippines

	Climate Model Simulations				
	1	2	3	4	5
Change in tropical cyclone frequency	↓	↓	–	–	↓
Change in tropical cyclone intensity	–	↑	↑	↑	↑

Source: Daron et al. 2016, DFID project, UK- Met-office report

Communicating Climate projections **Cli**mate **R**isk **A**nalysis **M**atrix (CLIRAM)

Climate **R**isk **A**nalysis **M**atrix CLIRAM

Projected Changes in Seasonal Rainfall in the Mid-21 Century (2036-2065) for Eastern Samar relative to 1971-2000

Season	Scenario	Range*	Projected Change		Projected Seasonal Rainfall Amount (mm)	Information about patterns of Change	Potential Impacts	Adaptation Option
			Percent (%)	Rainfall amount (mm)				
December-January-February (DJF) Observed baseline = 987 mm	Moderate Emission (RCP4.5)	Lower Bound	-4.2	-41.1	945.9			
		Median	1.3	12.5	999.5			
		Upper Bound	45.0	444.4	1431.4			
	High Emission (RCP8.5)	Lower Bound	-7.9	-77.8	909.2			
		Median	13.7	135.2	1122.2			
		Upper Bound	43.6	430.8	1417.8			
March-April-May (MAM) Observed baseline = 464 mm	Moderate Emission (RCP4.5)	Lower Bound	-2.6	-12.1	452.0			
		Median	1.8	8.2	472.3			
		Upper Bound	17.4	80.8	544.9			
	High Emission (RCP8.5)	Lower Bound	5.8	26.8	490.9			
		Median	1.1	5.3	469.4			
		Upper Bound	13.0	60.3	524.4			
June-July-August (JJA) Observed baseline = 560 mm	Moderate Emission (RCP4.5)	Lower Bound	-6.7	-37.5	522.3			
		Median	-1.1	-6.0	553.8			
		Upper Bound	8.3	46.4	606.2			
	High Emission (RCP8.5)	Lower Bound	-14.0	-78.3	481.5			
		Median	-0.6	-3.2	556.6			
		Upper Bound	9.7	54.6	614.4			
September-October-November (SON) Observed baseline = 871 mm	Moderate Emission (RCP4.5)	Lower Bound	-20.1	-174.9	696.5			
		Median	-16.6	-144.7	726.7			
		Upper Bound	-3.8	-33.4	838.0			
	High Emission (RCP8.5)	Lower Bound	-22.0	-191.3	680.1			
		Median	-9.3	-81.3	790.1			
		Upper Bound	4.7	40.7	912.1			

* upper: 90th percentile; median: 50th percentile; lower: 10th percentile

Example of a filled-up CLIRAM for Agriculture sectors in Salcedo

CLIRAM: Projected Changes in Seasonal Rainfall in the Mid-21st Century (2036-2065) for Eastern Samar relative to 1971-20

Season	Scenario	Range*	Projected Change		Projected Seasonal Rainfall Amou	Information about patterns of change	Agriculture	
			Percent (%)	Rainfall amou (mm)			Potential Impacts	Adaptation Option
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7	Col 8	Col 9
December-January-Februar (DJF) Observed baseline = 987 mm	Moderate Emission (RCP 4.5)	Lower Bound	-4.2	-41.1	945.9	Minimal to no change	Same vulenrability to the present	•Extend cover/greenhouse style of planted cr •Plant water resistant varieties, raise beds, tra planting sites •Provide good farm drainage, by construction irrigation canals to divert excess surface run-o •Practice cut&carry, provide permanent shelt livestock •Use flood tolerant/water resistant varieties/drought tolerant varieties •Conduct Climate Field School to make farme more resilient to climate adversities •Provide EWS for agriculture •Provide insurance to farmers
		Median	1.3	12.5	999.5	Minimal to no change		
		Upper Bound	45.0	444.4	1431.4	The highest possible future rainfall change durir Northeast (NE) Monsoon or Amihan shows an ir of 45%. This increase could be detrimental to so sectors of the community, as this season corres to the wettest months over the region.	•Farm Flooding, Crops ruined (e.g. wash out of planted cassava 6-8 months growing period) •Pest & Disease Infestation •Increased Cost of lodging animals & crops •Decrease in yield/production	
	High Emission (RCP 8.5)	Lower Bound	-7.9	-77.8	909.2	Minimal to no change	Same vulenrability to the present	
		Median	13.7	135.2	1122.2	Minimal increase		
		Upper Bound	43.6	430.8	1417.8	The highest possible future rainfall change durir Northeast (NE) Monsoon or Amihan shows an ir of 44%. This increase could be detrimental to so sectors of the community, as this season corres to the wettest months over the region.	•Farm Flooding, Crops ruined (e.g. wash out of planted cassava 6-8 m growing period) •Pest & Disease Infestation •Increased Cost of lodging animal crops •Decrease in yield/production	

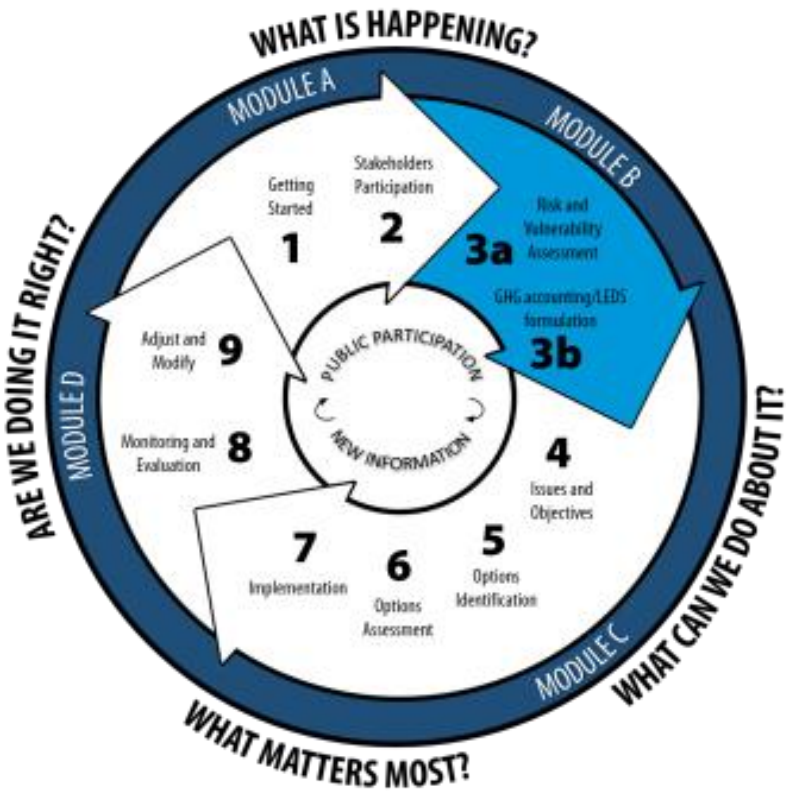
PAGASA

Source: DFID project 2016, UK Met office

Integrating Climate Change Information into national and local government Planning

Integrating Climate Change Information to local planning

Enhance Local Climate Change Adaptation Plan



Source: Local Government Academy (LGA,DILG)
Enhanced LCCAP Guide Book 3

Step 3	LCCAP
Component A: Climate Change Vulnerability and Risk Assessment	***Key Questions:*** *1. Vulnerabilities, Risks, and Opportunities of climate change in communities* *2. Types of climate-related and natural hazards* *3. Issues that need to be addressed,* ***4. Location of climate change issues and hazards- current and are projected to happen (illustration/mapping)*** *5. Summary description on type of climate related hazards and issues will the LGU face in the future?* *6. Analysis report on why and when should action be initiated*

Sharing the information to various end users through the conduct of Trainor's Training (ToT)

RISK RESILIENCY AND SUSTAINABILITY PROGRAM
PHILIPPINES' STRATEGIC PROGRAM FOR CLIMATE RESILIENCE

Risk Resiliency Program

Objective: Strengthen the resiliency of natural ecosystems and the adaptive capacity of vulnerable groups and communities to short and long term risks and disasters particularly in the 18 MRBs

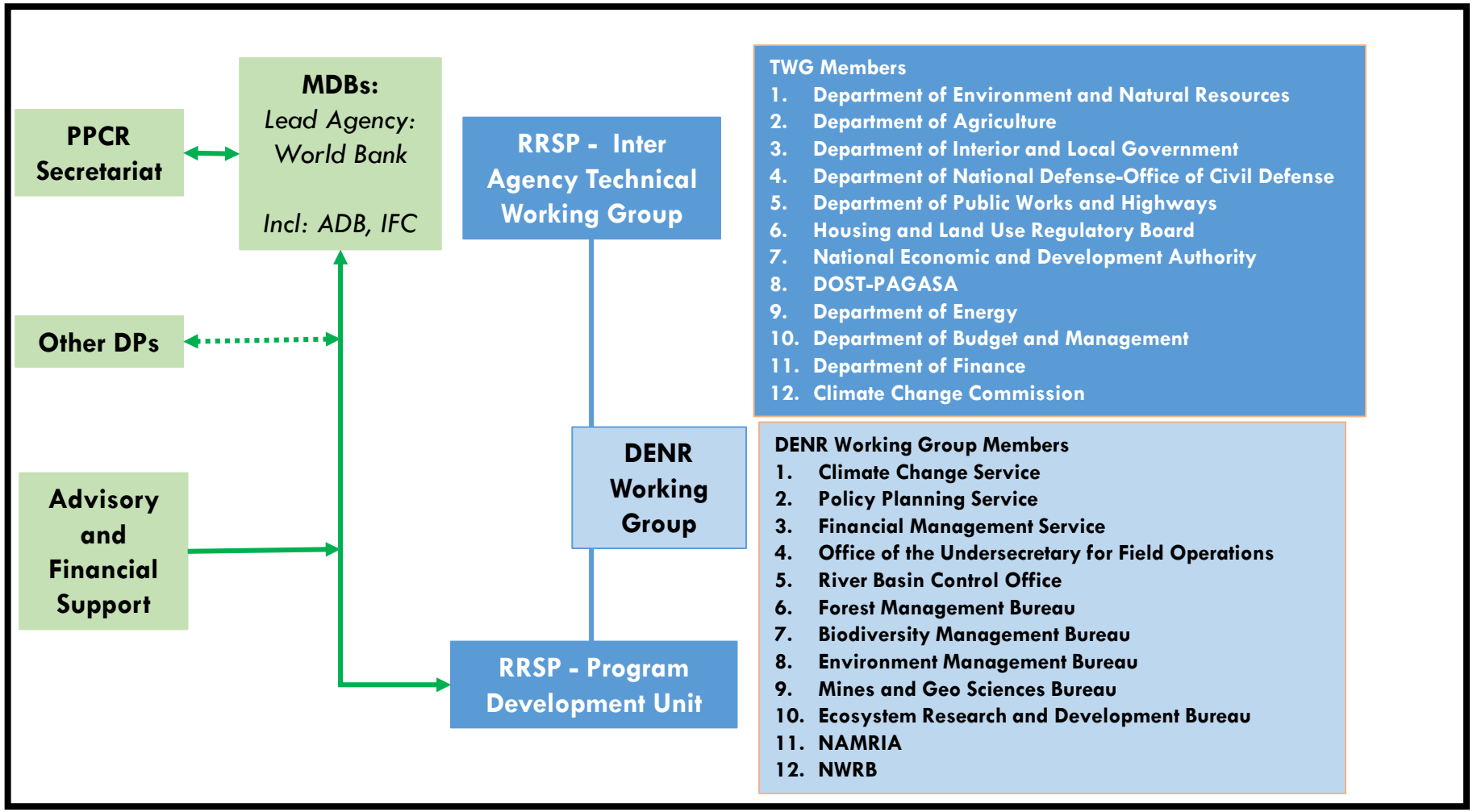
Cluster Program **Outcome 1** Enhanced resiliency of natural systems	Cluster Program **Outcome 2** Improved environmental quality for cleaner and healthier environment	Cluster Program **Outcome 3** Improved adaptive capacity of communities

Risk Resiliency Program (RRP) as the convergence budgeting program of the Cabinet Cluster on Climate Change Adaptation, Mitigation and Disaster Risk Reduction (CCAM-DRR**CCAM-DRR**

Source: DENR,Cabinet Cluster on Climate Change Adaptation, Mitigation and Disaster Risk Reduction (CCAM-DRR)

Payong PAGASA

CCAM-DRR
Cabinet Cluster



For **them**, we all need to **work together.**

Source:Climate Change Commission

Acknowledgements

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Thank you! ☺

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What are the key challenges in communicating Climate Change Projections?

- Users need know how to translate projected changes into impacts to the various socio-economic sectors to informed policy decisions and adaptation plans

- Users need climate projection expressed in return periods or probabilities to do the climate adjusted hazard maps

- Need higher resolution(5km) for provinces not covered in the 25Km

BANGLADESH

Linking Climate Science to Climate Policy and Practice

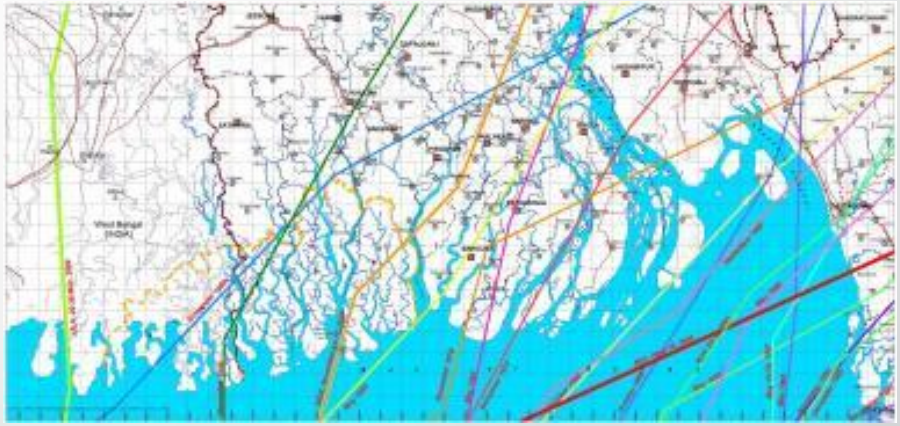
Ministry of Environment & Forests and
Ministry of Finance
Government of the People's Republic of Bangladesh

May 2018
Manila, Philippines

Highly Vulnerable to Climate Change

Bangladesh is categorized as the most climate vulnerable country in the world (Harmeling, 2012).

- Entire coastline vulnerable.
- 65% of the country is less than 5 meters above sea level, increasing susceptibility to floods, storm surges, and sea level rise.
- A low lying delta, farmlands are susceptible to daily and seasonal flooding.
- About 21% of current population of 160 million live below the poverty line.
- Increasing frequency and intensity of natural climate related disasters including cyclone (Severe tropical cyclone every 3 years on avg.) and salt water intrusion.



Simulation of Historical Cyclones

Major Cyclones: Bangladesh Coast (1965-2017)

Month/Year	Maximum Wind speed (km/hr)	Storm Surge height (m)	Death Toll
May 11, 1965	161	3.7-7.6	19,279
November 12, 1970	224	6.0-10.0	300,000
April 30, 1991	225	6.0-7.6	138,882
November 15, 2007 (Sidr)	223	3.5-6.0	3,363
May 23, 2009 (Aila)	92	--	190
May 16, 2013 (Mahasen)	95	--	24
May 2016 (Roanu)	83	1.2	26
May 2017 (Mora)	135	--	6

Source: Bangladesh Meteorological Department (BMD) 2017 and Government of Bangladesh (GoB) 2008

Country Context

- Cyclone Sidr (2007) killed over 3,000 people, and caused an economic loss of US$1.7 billion, as well as consecutive monsoon floods which caused damage of US$1.1 billion.

- For 2010 it was estimated that the loss of life attributed solely to climate change was 15,000 (DARA, 2012).

- These major disasters prompted debate about the link to climate change, followed by efforts to tackle long-term adverse climate change impacts.

Country Context

The key challenges in tackling climate change are

- Food security, social protection and health
- Comprehensive disaster management
- Infrastructure development
- Research and knowledge management
- Mitigation and low carbon development
- Capacity building and institutional development.

Bangladesh's growing vulnerability to climate change makes it a suitable candidate for PPCR finance.

PPCR in Bangladesh

PPCR Leveraging Potential

- The PPCR is leveraging substantial climate financing from the World Bank, ADB, and other bilateral and multilateral development agencies.
- A total of US$95.4 million of PPCR support (US$ 45.4 million grant and US$ 50 million concessional loan) has attracted US$ 523.4 in co-financing from WB, ADB, KFW (Germany), IFAD, and GoB with possible additional support from other partners.

Specific Investments (Projects)

Geographical Focus: Coastal Zone of Bangladesh

Investment Project 1: Coastal Embankment Improvement Project Phase-I

Investment Project 2: Coastal Towns Infrastructure Improvement Project

Investment Project 3: Coastal Climate Resilient Infrastructure Project

PPCR Interventions

Investment Project 1: Coastal Embankment Improvement Project (CEIP) Phase-I

Objective: The project development objectives are to

(a) increase the area protected in selected polders from tidal flooding and frequent storm surges, which are expected to worsen due to climate change;
(b) improve agricultural production by reducing saline water intrusion in selected polders; and
(c) improve the Government of Bangladesh's capacity to respond promptly and effectively to an eligible crisis or emergency.

Responsible MDB: The World Bank

Total Project Financing: US$ 400 million (IDA Credit: US$ 375 million + PPCR Grant: US$ 25 million)

Implementing Agency: Bangladesh Water Development Board (BWDB)

Project Components:

A. Rehabilitation and improvement of Polders
B. Implementation of social and environmental management framework and plans
C. Construction supervision, project monitoring and evaluation and coastal zone monitoring
D. Project management, technical assistance, training and strategic studies
E. Contingent emergency response

PPCR Interventions

Investment Project 1: Coastal Embankment Improvement Project (CEIP) Phase-I

Key Results:

- **17 Polders** will be rehabilitated to protect against tidal flooding and storm surge in **6 coastal districts.**
- **760,000** people will be supported by the PPCR to cope with the effects of climate change.
- **380,000** females will be supported by the PPCR to cope with the effects of climate change.
- About **8.5 million people** will be benefitted from agricultural development, employment, and increased food security.
- A **Comprehensive Analysis** will be undertaken to better understand the coastal dynamics to increase climate resilience in the coastal area.

PPCR Interventions

Investment Project 1: Coastal Embankment Improvement Project (CEIP) Phase-I

Use of Climate data and Climate Projections in Project Design:

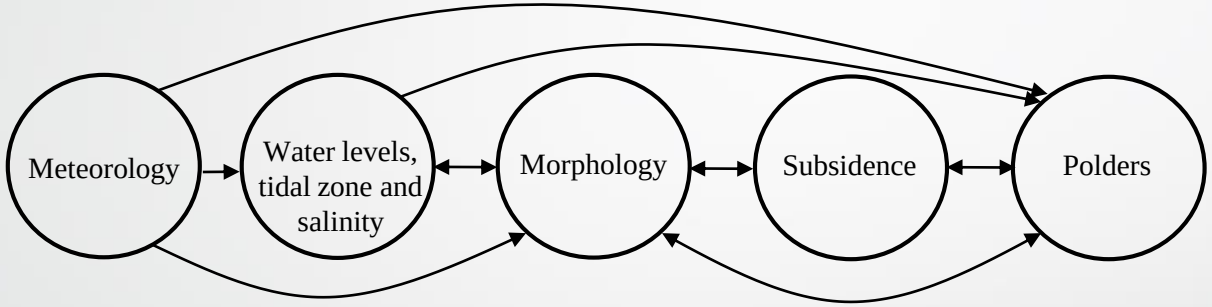
- **Stimulation of 19 well documented major cyclones** (that have occurred from 1960 to 2009) under the maximum tide level.
- **Spatio-temporal hydrodynamic cyclone and storm surge model** of the Bay of Bengal for different return periods (i.e., 10, 25, 50 and 100 years).
- **Precipitation:** A 20 percent increase in extreme precipitation by 2050.
- **Sea Level Rise**: 0.5m SLR by 2050 assuming a liner progression over time for the 1.0 m SLR by 2100.
- **Land Subsidence:** A potential subsidence of land by 9.55 mm per year as per the measurement of Dhaka University.
- **Cyclone Intensification:** An increase of 10 percent tropical cyclone intensities for a rise in sea surface temperature of 2°C.

PPCR Interventions

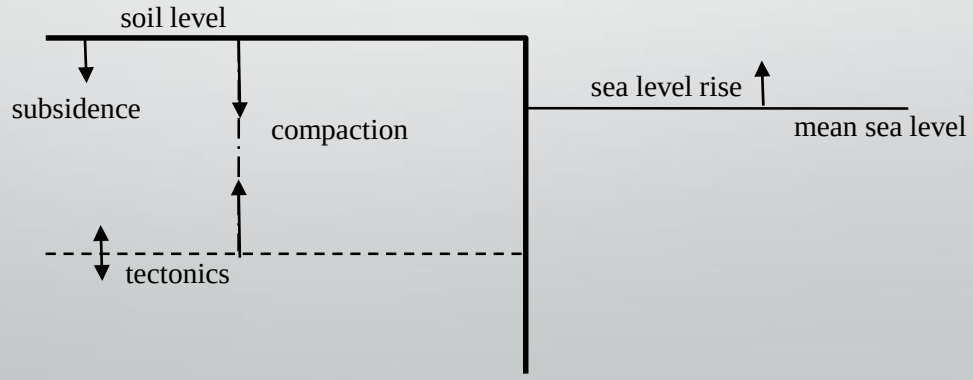
Investment Project 1: Coastal Embankment Improvement Project (CEIP) Phase-I

Use of Climate data and Climate Projections in Project Design: Long Term Monitoring, Research and Analysis of Bangladesh Coastal Zone (Sustainable Polders Adapted to Coastal Dynamics)

Create a framework for polder design, based on understanding of the long term and large scale dynamics of the delta.



Relations between physical processes and polders



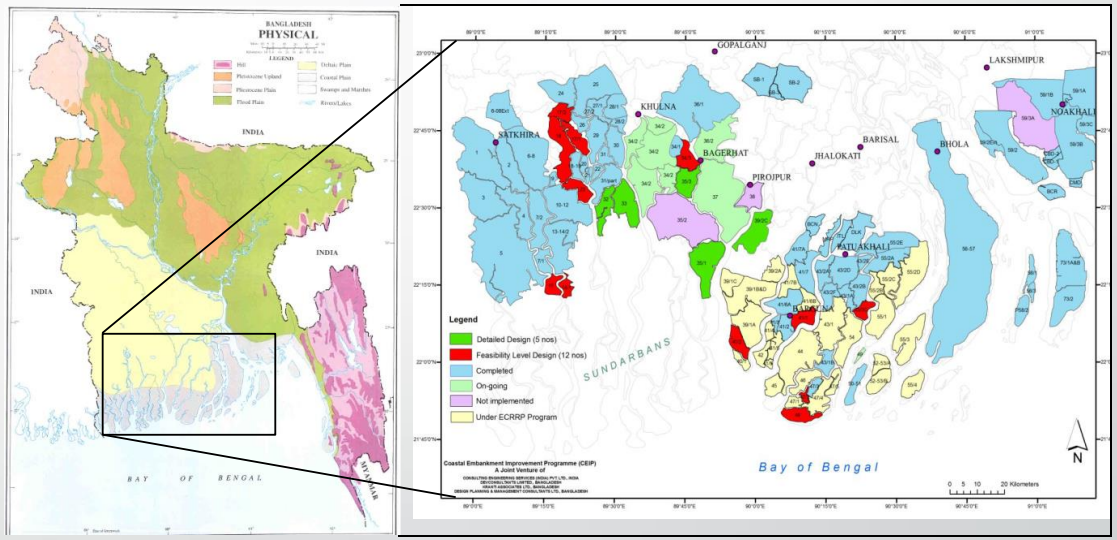
Key elements of subsidence

PPCR Interventions

Investment Project 1: Coastal Embankment Improvement Project (CEIP) Phase-I

Use of Climate data and Climate Projections in Project Design:

- Present an **overview of values of relevant parameters** at locations in the polder area, now and in the future, as boundary conditions for polder design and management.
- Ability to **evolve and be responsive** to institutional capacities and **climate vulnerability**.
- **Develop a long term investment plan for Polders** based on climate data and projections.
- **Build the analytical foundation and technical capacity** of BWDB & partners to engage in data driven decision making on tidal flood, storm surges and drought hazards in the coastal region of Bangladesh.



Coastal zone of Bangladesh and Polders in CEIP-I Project

PPCR Interventions – cont'd

Investment Project 2: Coastal Towns Infrastructure Improvement Project

Objective: The project will strengthen climate resilience and disaster preparedness in eight vulnerable coastal pourashavas (secondary towns) of Bangladesh. The project takes a holistic and integrated approach to urban development and will

(i) provide climate-resilient municipal infrastructure; and
(ii) strengthen institutional capacity, local governance, and public awareness for improved urban planning and service delivery considering climate change and disaster risks. Key infrastructure investments include (a) drainage; (b) water supply;
(iii) sanitation;
(iv) cyclone shelters; and
(v) other municipal infrastructure including emergency access roads and bridges, solid waste management, bus terminals, slum improvements, boat landings, and markets. Investments will benefit the poor and women.

Responsible MDB: Asian Development Bank

Total Project Financing: Total $117.1m: PPCR: $40.4 (30 m concessional loan+ $10.4 m grant); ADB: $ 52m; Government of Bangladesh: $23.1m and BMGF: $1.6m

Implementing Agency: Local Government Engineering Department (LGED)

PPCR Interventions – cont'd

Investment Project 2: Coastal Towns Environmental Infrastructure Project

Use of Climate data and Climate Projections in Project Design:

- Local Level Climate Resilience Vulnerability Assessment for selection and designing of Infrastructure Subprojects

1 Selection of 11 coastal districts from 19 based on Government's Coastal Dev. Strategy (2006) and SPCR, 2010)

2 Screening and ranking of 36 coastal towns located in 11 vulnerable districts

3 Basic Eligibility Criteria for Screening
- Population
- Population Density
- Funding from different sources in last 5 years

4 Vulnerability ranking Criteria
- Distance from coast and/or major river estuary
- Poverty
- Salinity intrusion and river water quality
- Availability of protective embankment

PPCR Interventions – cont'd

Investment Project 2: Coastal Towns Infrastructure Improvement Project

Use of Climate data and Climate Projections in Project Design:

- Master Plan for the municipalities/ townships are being updated incorporating climate data and climate projections.

Town Vision and Master Plan

1	2	3	4
Rapid Urban CC Assessment (RUCCA)	Climate Resilient Integrated Urban Plan (CRIUP)	Identification of Infra. Subprojects to Strengthen Resilience	Detailed Engineering Design (DED)

- Infrastructures is designed considering climate change projections for the year 2040.

- Depending on the type of infrastructure, the incremental adaptation costs ranged from around 15%-30%.

PPCR Interventions – cont'd

Investment Project 3: Coastal Climate Resilient Infrastructure Project

Objective: The Climate Resilient Infrastructure Improvement in Coastal Zone Project will improve livelihoods in the rural coastal districts vulnerable to climate variability and change.

Responsible MDB: Asian Development Bank

Expected Outputs:

- Improved road connectivity
- Improved market services
- Enhanced climate change adaptation capacity

Total Project Financing: Total $150.00 m: PPCR fund: $30.0 m ($10.0 m grant+$20.0 m concessional loan): ADB: $20.0 m; KfW: $8.8m; IFAD: $60.0 m; and Government of Bangladesh: $31.2m.

Implementing Agency: Local Government Engineering Department (LGED)

PPCR Interventions – cont'd

Investment Project 3: Coastal Climate Resilient Infrastructure Project

Use of Climate data and Climate Projections in Project Design:

- By 2050, climate change impact could make an additional 14% of the country extremely vulnerable to flooding and dislocate more than 35 million people in the coastal districts.
- Vulnerable rural infrastructure as a result of sea level rise, increased wet season rainfall; increased annual temperatures and increased frequency of severe cyclones.
- Low-lying river char areas where crop intensity is low (some areas produce only one crop per year) due to climate change.
- Culmination of these impacts will be a rapid deterioration of rural infrastructure.
- Climate-proofing of rural infrastructure (enhancing longevity and sustainability) in 12 rural coastal districts vulnerable to climate change.

Overall Expectations

Improved quality of life in the coastal zone as well as transformed development that is climate resilient

- Increased resilience of coastal infrastructure to climate induced seasonal and natural disasters.
- Reduced water and soil salinity and improvements in agricultural and fisheries production.
- Improved capacity of BWDB/ LGED to manage and coordinate investments in and knowledge on climate resilient initiatives.
- Improved leveraging of public financing for climate resilient development.

Using Climate Data and Projections in Project Design

Barriers:

To improve and manage the Coastal Zone of Bangladesh successfully in the coming decades, it is important to have a clear understanding the climate data and projections as well as the ever changing boundary conditions due to the dynamics of the environment.

Issues	**Questions**
(River) floods & storm surges	Where and when are the largest problems with these issues now? How well do we understand these issues?
Drought & salinity	
Erosion & sedimentation (morphology)	Is there a clear trend and what are the drivers?
Compaction & tectonics (subsidence)	What will the situation be 25, 50 or 100 years from now?

Using Climate Data and Projections in Project Design

Opportunities:

- Knowledge exchange and collaboration across BWDB, LGED and other relevant stakeholders will build ownership and support for the planning and investment selection process.
- Regional collaboration and South-South Knowledge exchange: Leveraging lesson learned in using climate data and projections from large scale investments in Bangladesh will be beneficial for countries vulnerable to climate changes.
- Approaches for integration of climate risk and resilience into development policies and increased capacity to integrate climate resilience into Bangladesh's disaster risk management strategies.
- Scaled-up climate resilient investments linked and leveraged funds at scale through formal MDB collaboration in agriculture, coastal defense, water supply, connectivity; housing.
- Shaping investment plans and priorities based on their experiences and evidence with current climate variability and impacts.
- Enhancing resilience for urban climate impacts such as flooding/ water logging in Dhaka.

PPCR Interventions – cont'd

Investment Project 4: Climate Resilient Agriculture and Food Security

Responsible MDB: IFC

Expected Outputs:

- Increase farmer and agribusiness firm revenues through adoption of sustainable climate-smart agriculture technologies and practices;
- Demonstrate business model for climate-smart agriculture technologies, products and services

Total Project Financing: $ 13.1 Million ($ 100.00 project preparation grant, $3 million advisory services, $10 million concessional loan)

Implementing Agency: : Private sector (Agribusinesses, financial institutions/intermediaries)

Using Climate Data and Projections in Project Design

Progress:

•The projects pilot phase ended in August 2017 where a total of 9000 farmers were trained on CSAgri-practices based on 12 CSA developed.

•Cooperation Agreement signed with Supreme ltd for 30,000 Farmers to be benefited through 850 events on climate smart agri-practices. Activities to begin in May 2018.

•5 training programs on Harvest & Post-Harvest, Business Edge Training Program, Production Training, six demonstration plots and a farmers field day organized by Seba Ltd for their potato supply in South activities.

•17 Small and Growing Businesses (SGBs) were selected and completed a rigorous 3-week long boot camp as part of the ScaleUP Bangladesh accelerator project with BetterStories Ltd.

•mPower has purchased AWS device and will have it set up by May 2018. They have also set up a Farmers Query System (FQS) across 3 districts Barisal, Khulna, Shatkhira, 1200 farmers have been registered.

Using Climate Data and Projections in Project Design

Challenges:

•Developing a commercially viable model in polder areas is challenging due to remoteness, scalability, and new technologies under pilot.

•Companies hesitant to penetrate high risk markets with low farmer awareness.

•Overall lack of knowledge on climate change adaptation, resilience, and climate smart agriculture amongst private sector and farming communities.

PPCR Interventions – cont'd

Investment Project 5: Feasibility Study on Climate Resilient Housing for Low-Income Communities (Technical Assistance)

Responsible MDB: IFC

Expected Outputs:

- Develop a pilot program for building climate resilient and individually owned houses to supplement traditional cyclone shelters;
- Establish a viable business model to induce private sector involvement in the lower income housing market; and
- Safe, yet affordable, shelter that can reduce pressure on existing cyclone shelters, outcomes include a study and training for selected financial institutions and real estate developers

Total Project Financing: $0.4 million

Implementing Agency: N/A

Using Climate Data and Projections in Project Design

Progress:

•Feasibility study on climate resilient housing finance completed in Nepal and Bangladesh

•Basic climate resilient housing microfinance model designed for Bangladesh

• Market scoping completed and agreement signed with pilot partner, BRAC MFI.

Using Climate Data and Projections in Project Design

Status:

•Procurement process for relevant experts (engineering expert, housing loan expert, market research expert) in climate resilient housing finance is currently ongoing.

• Targeting and market selection in southern coastal regions is currently ongoing.

Questions?
Comments?
Thank you!

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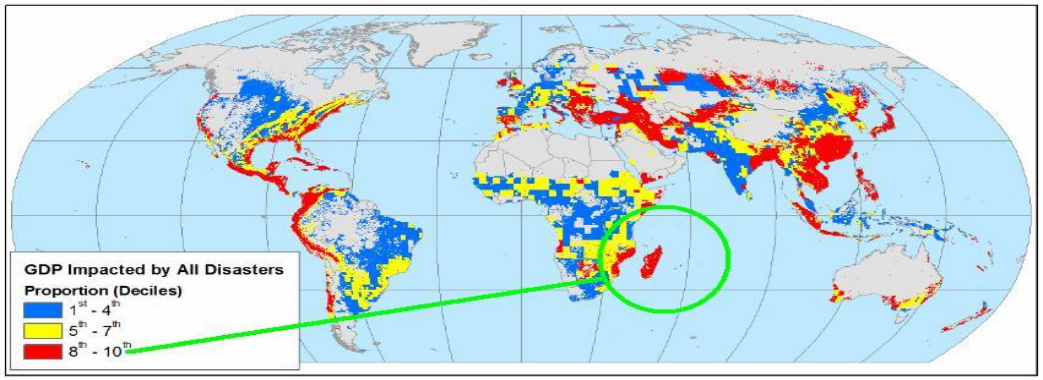
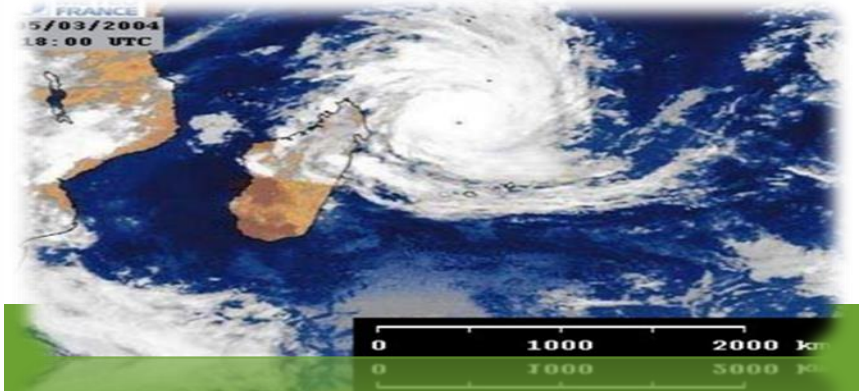
CELLULE DE PREVENTION ET GESTION DES URGENCES
CPGU
PRIMATURE

FORTHCOMING PPCR COUNTRIES MEETING Manila 21-24 mai 2018

Multiple uses of climate information and hydro-met forecasting systems in climate resilient Program SPCR in Madagascar.

Presented by Brigadier General Mamy Razakanaivo





MADAGASCAR:
A HOT-SPOT MULTI-RISK COUNTRY

- Madagascar is one of the **most vulnerable countries to extreme weather event**s (rank 8th in the global Climate Risk Index and 4thamongst African countries),
- On average by **3-4 cyclones a year,** hit Madagascar. Thus, he is ranked amongst the top ten countries worldwide with the highest mortality risk index associated with cyclone.
- **Flooding is widespread throughout the country and most commonl**y occurs after cyclones or tropical storms.
- During the last two decades, **6 major drought events** were recorded that affected at least 2.5 million persons in the semi-arid deep-south region.
- **Locust invasions affect the southern and western region** of Madagascar during the rainy season
- **100 million US$ worth of damage** is caused by each cyclone event and flooding.
- **20% of Territory and coastal areas is at risk** and 25% of the population lives in zones at risk of natural disasters.
- **70 % of disasters are climate related** and cause widespread crop damage.

The Case of 2017 -2018: cyclone and drought

Impact of cyclone AVA (Cat.2) January 2018

- 51 dead and 22 missing persons,
- 161.328 disaster victims/homeless
- 2.345 damaged houses and 512 damaged schools
- **Economic losses: US $ 195 million, about 2 %t of GDP**

Impact of cyclone Enawo (Cat.4) February 2017

- 81 dead and 18 missing persons,
- 433,985 disaster victims/homeless
- 40520 damaged houses and 1500 damaged schools
- **Economic losses : US $ 415 million, about 4 %t of GDP**

Population affected of drought crisis (episodes of El Niño) : 2016

- 665,000 : severe food insecurity
- 475,000 : moderately food insecurity,
- Total : 1,140,000 people in food condition insecurity

Overview of damage and loss

Major impacts climate-related

.

- **CYCLONES:** 3–4/y hitting East coast worse. Due to climate change their intensity and frequency are projected to increase.
- **FLOODS (AND LANDSLIDES):** Strong storms and tropical cyclones, coupled with increasing deforestation and poor land use practices lead to extensively damaging floods across the country
- **DROUGHTS:** Droughts rapidly lead to water shortages and crop loss and pose a severe threat to rural households' food security. Prolonged droughts observed in recent years, particularly in southern Madagascar.
- **SEA LEVEL RISE:** Projected to increase exponentially in 2100. Associated to SLR, coastal erosion threatens vital infrastructures and unique ecosystems in Madagascar. Salinization of water and land is aggravating food insecurity
- **LOCUST PLAGUES:** Increased climate variability could be favoring locust plagues. In 2012 a plague left 60 per cent of the Malagasy population at risk of
- **Coastal erosion**

Sectoral Vulnerabilities

- **INFRASTRUCTURE**: Over $100 M/year loss in infrastructure mostly due to tropical cyclones (85%) and floods (13%).
- **TOURISM**: in 2016 the island experienced a 20% increase of tourists landing but with extreme weather events on the increase, the incipient development of tourism infrastructure is at risk
- **URBAN**: In a rapid urbanization process, with unfit land-use planning, informal settlements in risk- prone areas proliferate and vulnerability to climate impacts in urban settings magnify. Antananarivo and its large metropolitan area
- **COASTAL MANAGEMENT**: Climate change is a multiplying factor of the challenges to public health: flood episodes can rapidly translate into food insecurity crisis due to crop loss, diarrhea or cholera outbreaks and other water and vector-borne diseases
- **NATURAL RESOURCES**: Fisheries' stock, forests, biodiversity, water resources, etc. affected by extreme weather and slow onset events.
- **AGRICULTURE**: 25% of GDP and 80% of employment. Water access and soil fertility effected by climate impacts.

CLIMATE INVESTMENT FUNDS

Guiding principles for SPCR

Spatial Resilience

- Acknowledgement of the particular challenges of different regions in the country
- E.g.: Grand Sud (rural and coastal context) and Greater Tana (large urban area)

Sectoral Resilience

- Addressing sector-specific vulnerabilities
- Focus on key sectors: the agriculture/ livestock/fisheries sector, water and sanitation sector, and other

Communities Resilience

- Applying a community-based adaptation approach to all interventions
- Focus on the most vulnerable: e.g. female-led house-holds, informal dwellers

Infrastructure Resilience

- Ensuring the climate-proofing of public investments and the adoption of risk-aware building codes
- Focus on critical infrastructure, e.g.: flood control, water supply, connectivity…

inancial esilience

- Approaching the vulnerability of public finances to climate shocks
- Promoting financial protection instruments: CATDDO, agricultural insurance, access to credit of most vulnerable, etc.

Selection criteria for SPCR investments

- Alignment with **development/climate priorities**
- Impact on **poverty reduction**
- Impact on **climate resilience**
- Cross-sectoral synergies/**co-benefits** Cross-sectoral trade offs/**coherence** **Value** for money
- **Readiness**
- **Scale-up** potential Social **inclusiveness**
- the most vulnerable first while building communities' resilience
- Innovative adaptation measures will be piloted and; where possible up-scaled (green urban infrastructure, Contribute to NAP process and seek synergies)
- Triggering transformational change

SPCR Programme Phase 1 and Phase 2

PILLAR 1

TECHNICAL ASSISTANCE

To strengthen the institutional and technical capacity of the GoM to mainstream climate change resilience into key economic sectors, and to improve the evidentiary basis for future development policy and planning, with a view to establishing the enabling environment for the implementation of the SPCR.

- **Improving the Understanding of Climate Risks and their Gender Implications**
- **Strengthening the Institutional Framework**
- **Knowledge Management**
- **Enhancing the Coordination Efforts to Mainstream Climate Resilience**

DEVELOPMENT POLICY OPERATION

To promote the mainstreaming of climate resilience in policy

PILLAR 2

PROJECT 1
Strengthening of National Hydro-Met Systems & Services

To (i) enhance the weather, climate and hydrological information and monitoring networks and early warning systems, and (ii) strengthen the capacity of hydro-met institutions to collect and data analysis, and provide quality and timely climate-weather services.

PROJECT 2
Enhancing Climate Resilience of Urban Communities and Infrastructure in Greater Antananarivo and Selected Municipalities in

To improve living conditions of the por in selected low-income neighborhoods of Greater Antananarivo through enhancing basic service delivery and flood resilience; and to strengthen the Government`s capacity for integrated urban management and effective response to eligible crises and emergencies.

PROJECT 3
Strengthening Climate Resilience of Coastal Cities

To strengthen the resilience of coastal cities to natural hazards and climate risk and strengthen the municipal and community capacities to effectively respond to their impacts.

PROJECT 4
Climate-proofing Social Infrastructure and Regional Development in the "Grqnd Sud"

To build climate resilience by scaling up social protection efforts, rehabilitating selected lifeline infrastructure and strengthening livelihood diversification of selected communities in the Grand Sud.

PROJECT 5
Enhancing Climate-Resilience Agricultural Production, Food Security and Nutrition in the "Grand Sud"

To promote shared economic growth based on the drivers of growth and local livelihoods and reduce poverty and vulnerability zoned.

PROJECT 6
Biodiversity and Ecotourism Promotion

To preserve biodiversity, develop ecotourism to accelerate economic growth, improve the conditions of communities living on the periphery of protected areas, promote the emergence of a local private sector that invests in green growth, and increase the resilience of biodiversity to climate change.

Phase 1: Strengthening the enabling environment

Objective: Strengthen institutional and technical capacities of the GoM to manage and mainstream climate risks into development policies, plans and programmes in key sectors.

- **COMPONENT 1** Enhancing the understanding of climate risks and implications (« vulnerability studies », needs-based technical assistance)
- **COMPONENT 2** Strengthen institutional and policy frameworks for climate resilience (institutional coordination, capacity development, reinforcing regulatory frameworks, development of fiscal protection instruments)
- **COMPONENT 3** Knowledge management
- **COMPONENT 4** Support to program implementation, coordination,

Geographical scope: National

Estimated cost: $1,5 million CIF grant for preparation of PPCR phase 2

Expected Advantages and Outcomes

- Receiving emergency warnings of heavy rainfall and thunderstorms in time to mitigate damage. (Flood forecasting improvement, Large-scale drought)
- Forecasts in Madagascar will be provided at higher resolution and will be tuned to the requirements of the economic sectors.
- collect and populate a representative climate dataset that will help the next generation to identify emerging anomalies.
- Forecasts provided to Madagascar from external sources will improve as more data makes its way to external modelers.
- Weather information will be made available to Madagascar's farmers and fishermen, promoting gradual but steady productivity improvements
- Enhanced hydro-met Information and monitoring Strengthened capacity of hydro-met institutions to collect, generate and analyze reliable hydro-met data, and provide quality and timely hydro-meteological services.

SPCR Phase 2: the investment projects

1. Investment project 1: Strengthen **HYDROMET** services, Indicative cost: US$ 25 million
2. Investment project 2: Building resilience of INFRASTRUCTURE and COMMUNITIES in Greater Antananarivo, Indicative cost: USD 100 million
3. Investment project 3: Strengthen **resilience of COASTAL** cities, **Indicative cost: US$ 80 million**
4. Investment project 4: Climate-proof **SOCIAL INFRASTRUCTURE** in Grand Sud region **Indicative cost: US$ 70 million**
5. Investment project 5: Strengthen climate r**esilience of AGRICULTURAL production**, food security and nutrition in the Grand Sud Indicative cost: US$ 135 million
6. Investment project 6 : Preserve biodiversity through **ECOTOURISM ,** Indicative cost: US$ 25 million

Strengthening Hydromet Services

Objective: Strengthen institutional capacities to collect, analyse and manage hydro-meteorological information in a timely and user-oriented manner.

- **COMPONENT 1** Reinforce the hydro-met stations' network for data collection and climate surveillance
- **COMPONENT 2** Strengthen hydro-met forecast systems and service delivery
- **COMPONENT 3** Strengthen the technical capacities for climate modelling, forecasts and early warning systems
- **COMPONENT 4** Project management, knowledge management and M&E

Geographical scope: National and regional coverage

Estimated cost: $25 million

CIF CLIMATE INVESTMENT FUNDS

Use of the data produced through this Strengthening Hydro met Services project

- The relevant and reliable climate data inform end-users and decision makers so as ensure that climate-resilience measures can effectively be integrated into the country´s development plans.
- During project preparation, links between projects will be further explored and developed in order to highlight multi-sectoral dimensions. (Ongoing project Building resilience in Greater Antananarivo and in **the South** region)
- Improved vulnerability studies to enhance decision making on adaptation measures
- The use of weather and water information will be facilitated by mechanisms such as : map rooms, sectorial exchanges, open access to databases, and will be informative and helpful for the formulation of the feasibility studies and implementation of the other projects in this SPCR.
- Improved community for preparedness after receiving threat & alert notices from early warning systems (for cyclone or flood) supporting timely during extreme events
- This climate information is an essential public good witch is expected to complete the National Adaptation Planning (NAP) formulation's process and make efficient its delivered master document
- This climate data is expected to use for upscaling the profil and mapping of risk for building an effective Resilence (drought,…)
- These data are used in the framework of the development of construction standards for critical and key infrastructures that are resistant to climatic hazards.
- Weather information will be made available to Madagascar's farmers and fishermen, promoting gradual but steady productivity improvements (by improving the efficacity of community decision making on crop calendar and knowledge favorable times for fishing compared to wave, swell and strong wing forecasts)

The barriers to achieve this component of the SPCR

The barriers and threat:

- **Lack of investment from the donners:**
  - context of uncertainty about the financial support of the Climate Investment Funds (CIF),
  - Difficulty for exploring potential sources of co-finance for the investment projects needs to conceived within its strategy with others donners (GCF)
  - the ability of the Government to mobilize international (and/or domestic) resources to trigger implementation
- Lack of Lobbing and mobilization of financial resource / communication of SPCR
- Political stability,
- Education, connectivity, sustainable use of natural capital… and climate change
- Insufficient ownership and spirit of appropriation by the beneficiary agency

Lesson learned on previous project:

- low capacity of DGM and insufficient technical staff in terms of fieldworkers to maintain equipment and its monitoring, so, the next project need to more focus on how to improve local monitoring.
- Vandalism and security of monitoring equipment and observation station

=> The availability, sustainability and operability of the existing and new infrastructure : weather stations, agro-meteorological stations, hydro-meteorological systems.

Opportunity from SPCR

- Political Commitment with Climate Change as national priority
- Alignment with existing plans/policies and especially with the Madagascar NAP in process
- Opportunity to reduce the poverty, poor rural female-headed families of particular concern (lack of access)
- Convergence and Combined efforts on Risk and Disaster Reduction and Adaptation to Climate Change leading Madagascar towards resilience

Investment plan's financial summary

Investments (in million US$)	MDB	PPCR request	PPG	Co-financing GCF	WB	AfDB	Other
Enhancing enabling environment (Phase 1)	WB	**1,5 (grant)**					
1. Strengthening Hydro-Met Services	WB	**25**	1	tbd			
2. Enhancing Climate Resilience of Urban Communities and Infrastructure in GA	**WB**	**30**			**70 (IDA)**		
3. Strengthening Climate Resilience of Coastal Cities	WB	**30**	2				50 tbd
4. Climate-proofing Social Protection Infrastructure in "Grand Sud"	**WB**	**20**	2		**50 (IDA)**		
5. Enhancing Climate- Resilient Agricultural Production/ Food Security in the "Grand Sud"	**AfDB**	**35**				100 tbd	
6. Biodiversity and ecotourism promotion	**AfDB**	**25**					
	Total	**166,5**	5		120	100 tbd	50 tbd

Thank you for your attention

"The development of Madagascar is fully dependent on its climate resilience. Ensuring the former through the latter is our generation's mandate"

Brigadier General Mamy Razakanaivo
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CPGU PRIMATURE

WORLD BANK GROUP

AFRICAN DEVELOPMENT BANK GROUP

CLIMATE INVESTMENT FUNDS

Sustainable Livelihood and Resilience Building in Latin America and the Caribbean: *Technology and Innovation to support the Blue Economy*

Asha Singh, PhD

Presentation to
World Bank PPCR Pilot Country Meeting
Manila, Philippines
21-05-2018

Environmental Governance Consulting

Latin America and The Caribbean – The Context

Latin America and The Caribbean – The Realities

Growing Population

Economies of scale

Poverty and Inequalities

Dwindling Options on Land

Latin America and The Caribbean – The Context

Blue Frontier

Ocean Economy

Transport
- Shipping
- Trade

Energy
- Renewables
- Oil & Gas

Seafood
- Fisheries
- Aquaculture

Biotechnology
- Pharmaceutical

Minerals
- Mining

Coastal Corridor
- Tourism
- Infrastructure

Provisioning services
- Blue Carbon
- Carbon Capture and Storage
- Protection

Environmental Governance Consulting

Climate Change and the Challenges

Ocean Acidification

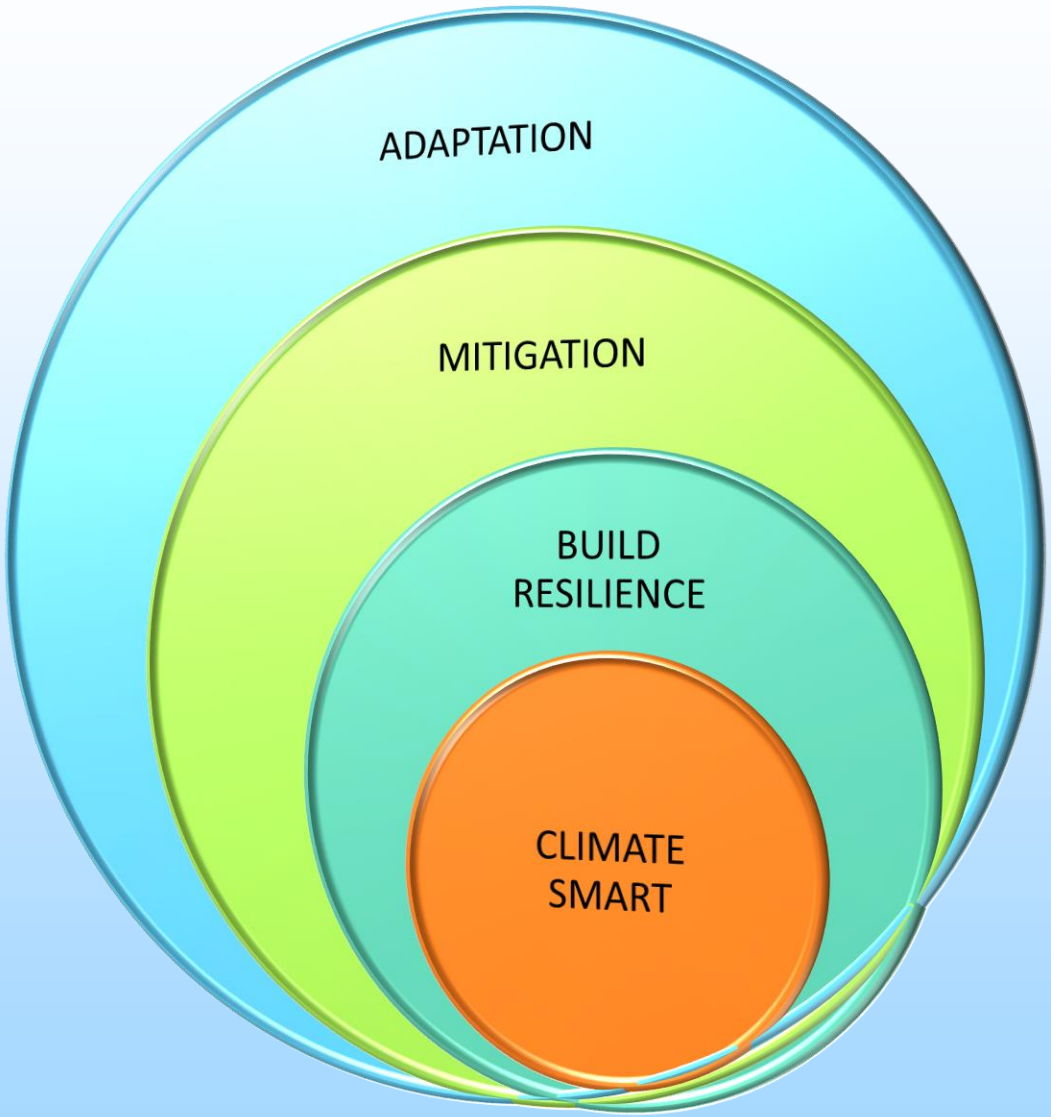
Temperature

System Change

Disasters

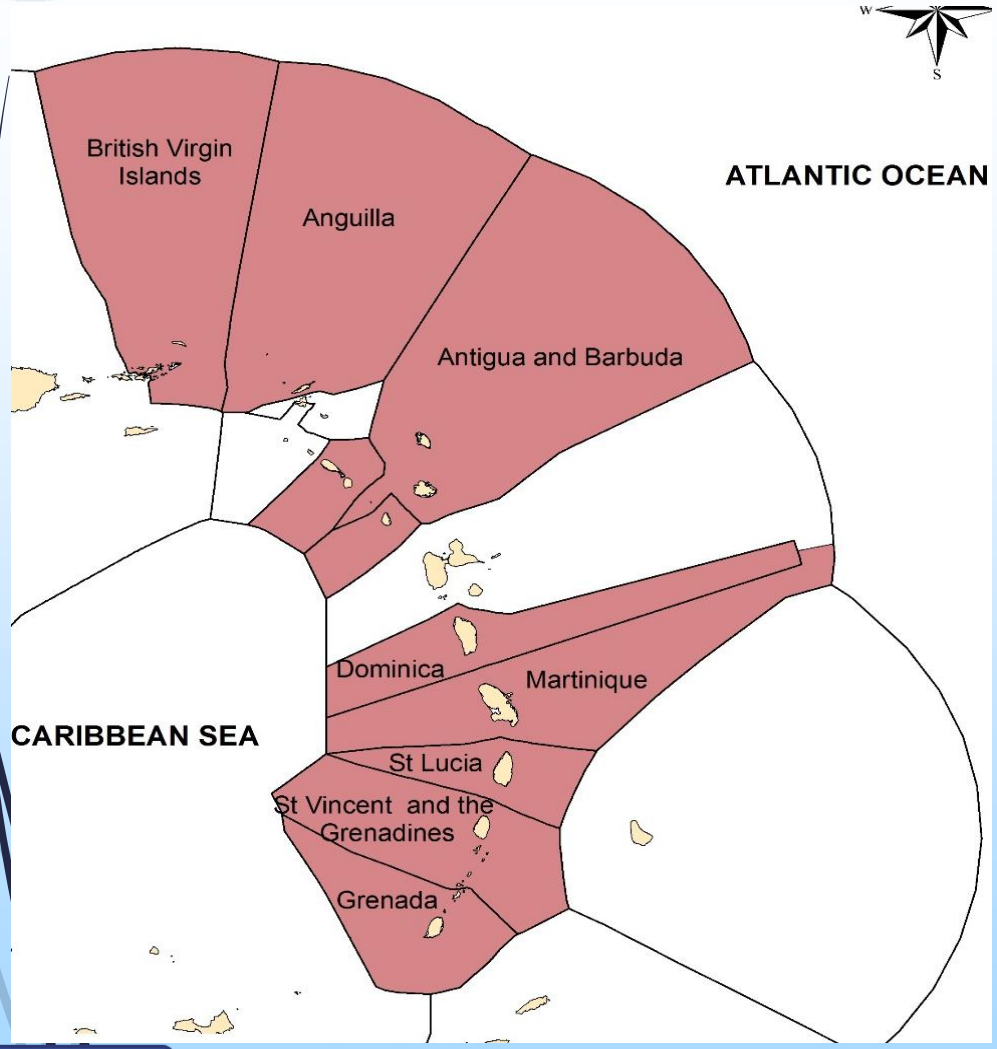
Global warming

Climate Change and Climate Resilience



Innovation & Technology

Innovation and Technology: Energy- Climate Nexus in SIDS



Energy Input: Largely dependent on fossil fuels

Source : Imported

Economic Activity: tourism

Cost : 20-23/night --- 4.6 kw/h 38-40 us cents

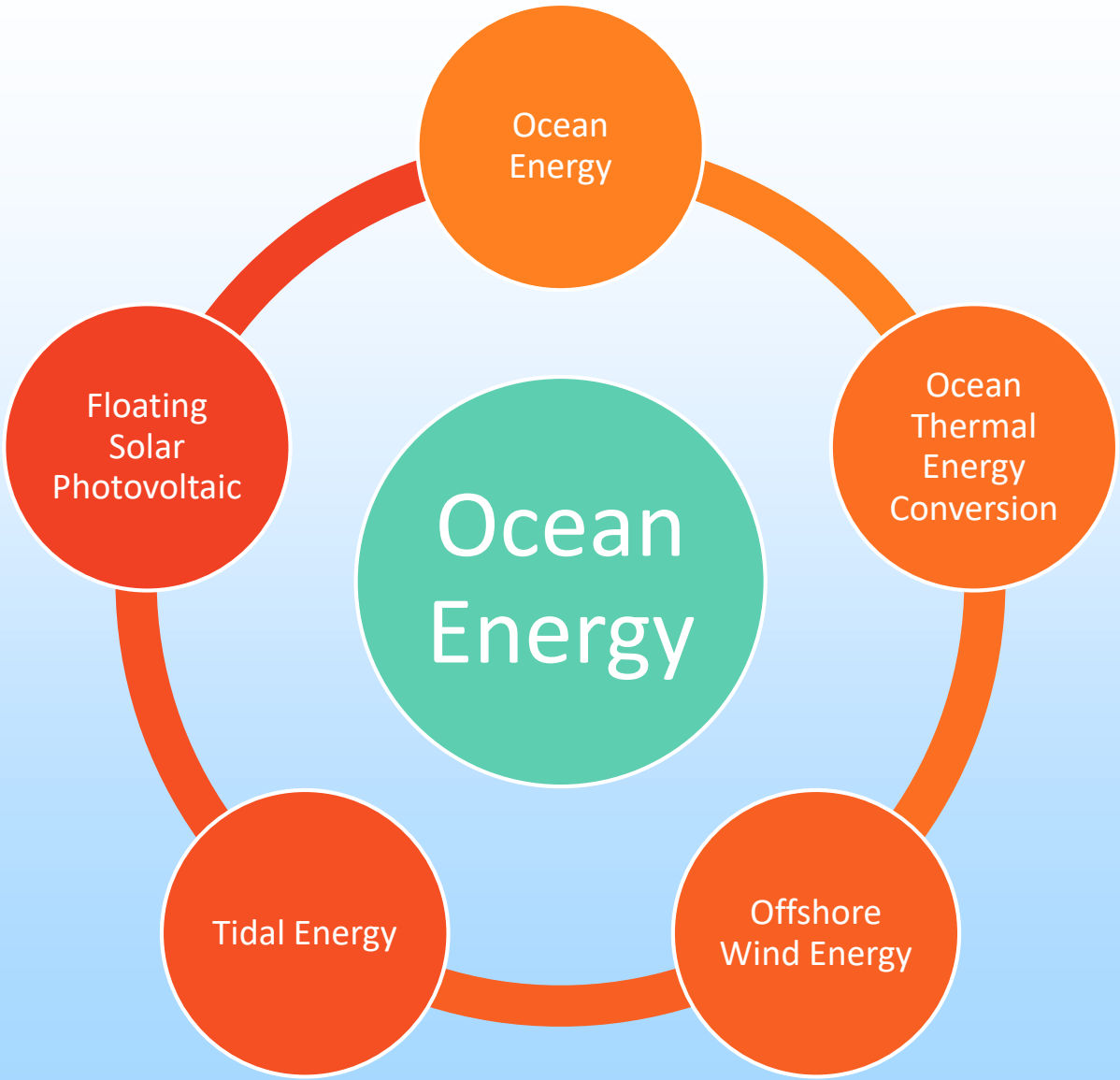
Consumer : Poverty

Reality: tariffs among the highest

Response: Renewable Options

Source: Singh A. and J. Ephrim (2016)

Innovation and Technology: Energy- Climate Change Nexus in SIDS



Environmental Governance Consulting

Making Innovation and Technology a reality

- Encourage diversification and advance and Indigenous technology
- turn issues into opportunities
- Collaborate to grow

Environmental Governance Consulting

Effective Platforming

- Collaborate among agencies to foster connectivity

Regional Mechanisms

- Regional mechanism to promote blue growth and incorporate climate change

Mechanisms

- Governance FRAMEWORK

transformation

Environmental Governance Consulting

PILOT PROGRAMME FOR CLIMATE RESILIENCE

Enhancing Climate Resilience of the Coastal Resources and Communities (ECR) Project

SAMOA'S EXPERIENCE

PPCR Pilot Country Meeting
May 21- 24, 2018
ADB, Manila, the Philippines

Jean T Viliamu
Climate Resilience Investment & Coordination Division
Ministry of Finance
jean.viliamu@mof.gov.ws

Contents

- Samoa’s SPCR
- Background of ECR
- Achievements
- Challenges
- Lessons Learnt

Samoa's SPCR/CRIP

Investment Project 1

Enhancing the Climate Resilience of the West Coast Road (WCR)

Implemented by Land Transport Authority

- USD15million

Investment Project 2

Enhancing the Climate Resilience of the Coastal Resources and Communities (ECR)

Implemented by Ministry of Natural Resources and Environment

- USD14.6million

CIF CLIMATE INVESTMENT FUNDS

Background

Total Funding – Investment Project 2= USD $14.6million

Focal Point- Ministry of Finance

Implementing Agency –Ministry of Natural Resources and Environment

Development Objective
To support communities in Samoa become more resilient to climate variability and change

Project Aims
To develop and implement immediate and urgent activities to:

i. assist the population of Samoa in adapting to climate variability and climate change;
ii. protect people's lives and livelihoods, coastal and inland infrastructure, and the environment;
iii. increase awareness of climate change impacts and adaptation activities in communities, civil society and local government.

Progress overview

PHASE I

October 2010 – September 2012

PHASE II

2013 -2014

Project Implementation

2015 - 2016

PMS
LIDAR
Procurement of Technical Assistance

2017 TO DATE

Review and Update CIM Plans completed

Village Level Subprojects Implementation

District Level Subprojects started

Project Preparation

Achievements

- Stakeholder engagement
- Procurement of the LiDAR
- Review and Update of CIM Plans completed
- 80% of village level subprojects implemented and completed
- Implementation of district level subprojects
- Strengthened capacity of line ministries
- Increased understanding of CSOs and communities on CC

Challenges

- Very limited capacity in country
- Timely inputs from consultants for the CIM Plans
- Quality of Funding proposal submitted were not fully compliant and had to be restructured and revised
- Weak ownership of project design processes by line ministries

Lessons Learnt

- Coordination across multiple Sectors
- Assessing vulnerability to climate risks
- High level support and stakeholder engagement
- Implementation arrangements clearly defining roles of relevant stakeholders and line agencies
- Lessons on Monitoring & Reporting

FAAFETAI LAVA..!