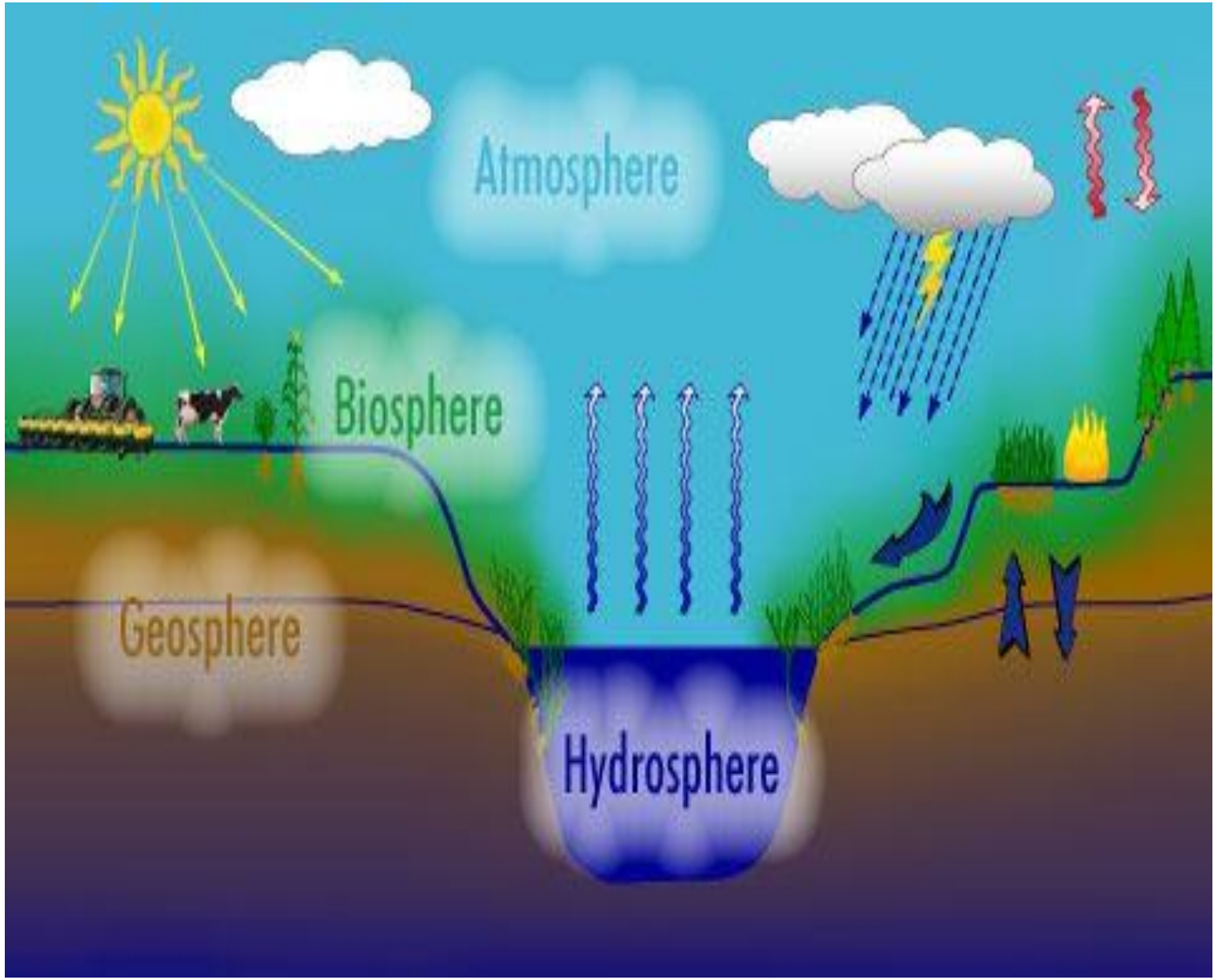
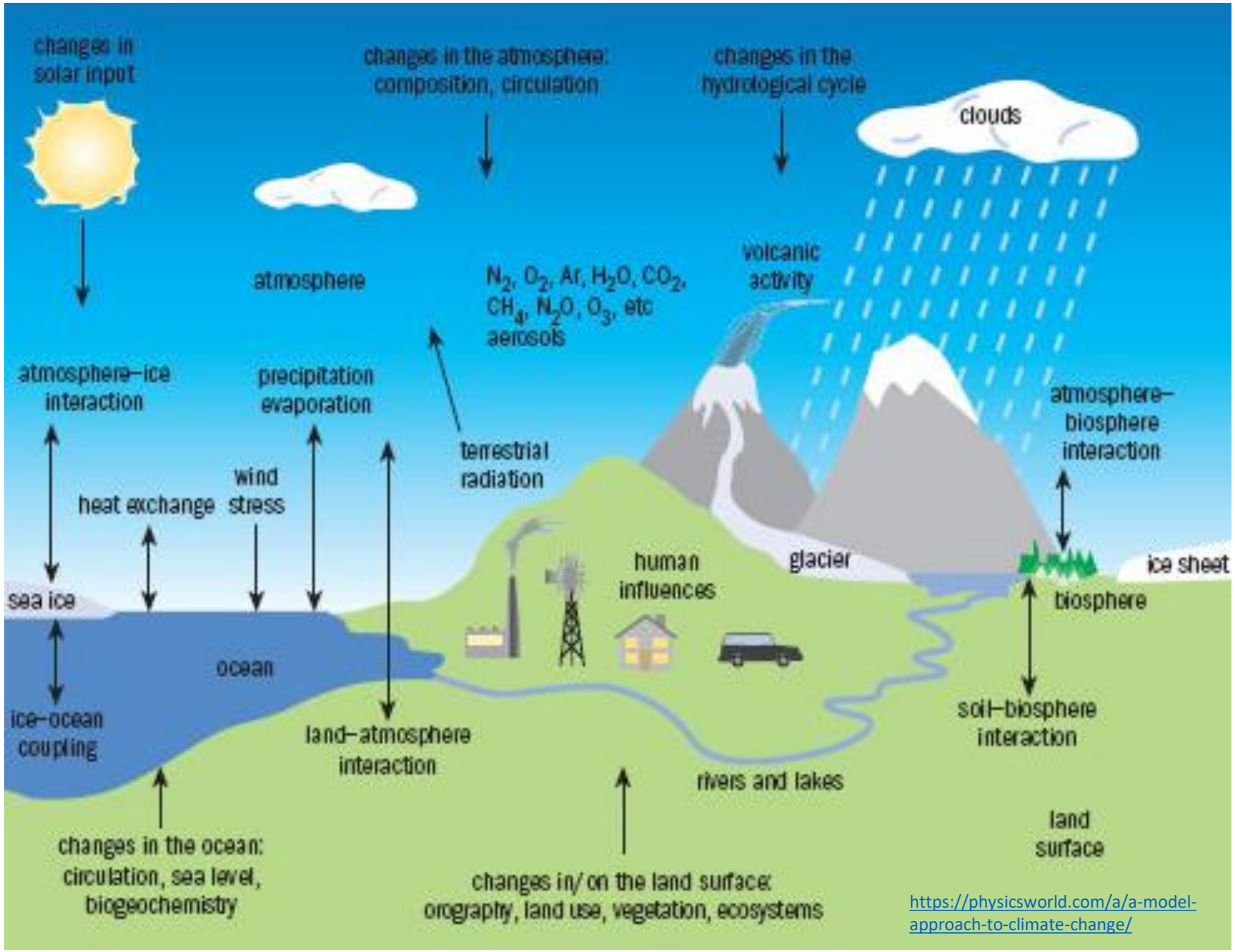
Climate change adaptation and housing

Jessica Dator-Bercilla, Christian Aid with inputs from
Coastal Cities at Risk Philippines
Manila Observatory
Christian Aid partners – COPE-Bicol, Tao Piilipinas
Donna Mitzi Lagdameo, IFRC
Malu Erni , National Resilience Council

Our Earth and the Climate

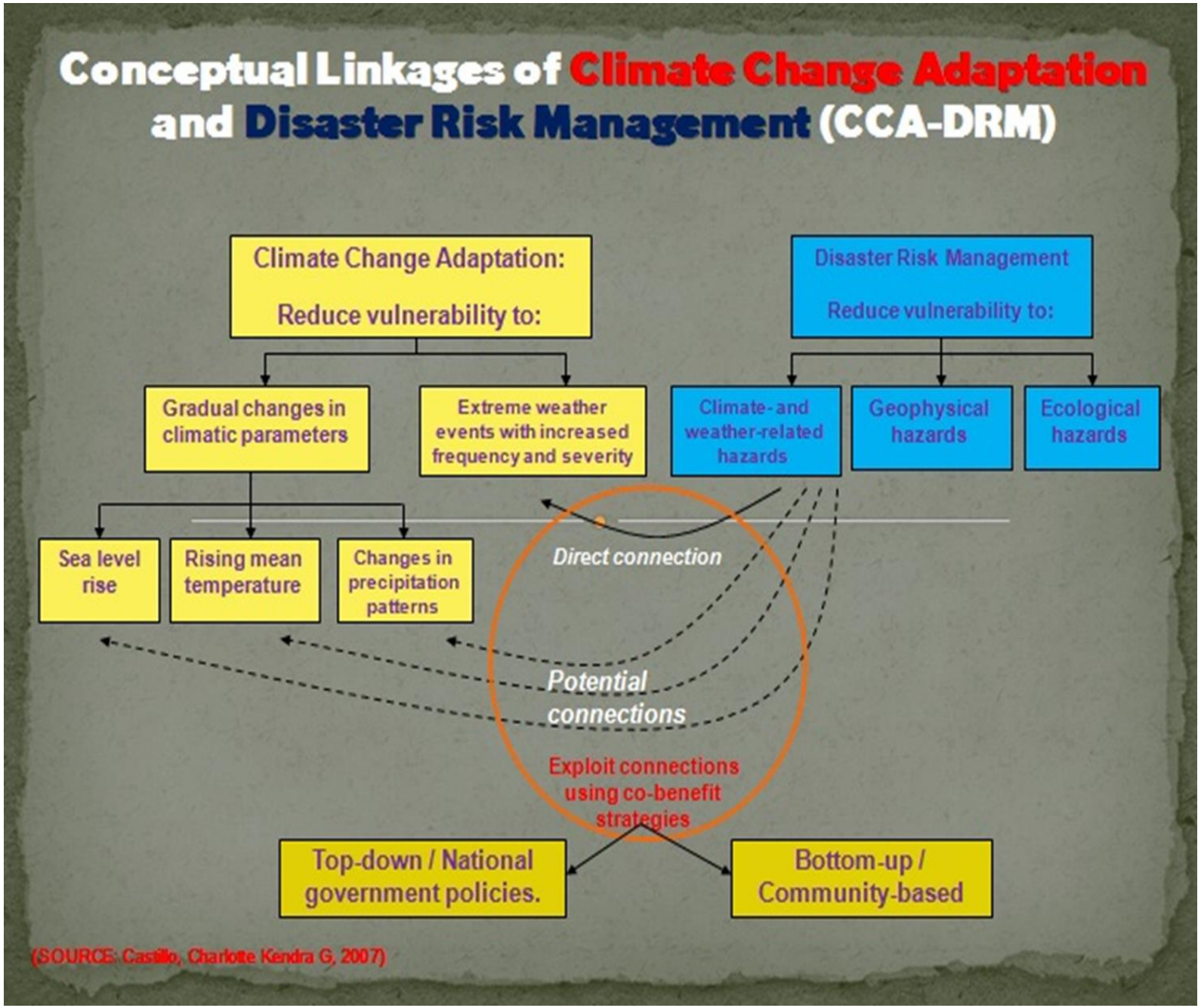


CLIMATE SYSTEM AND CLIMATE CHANGE



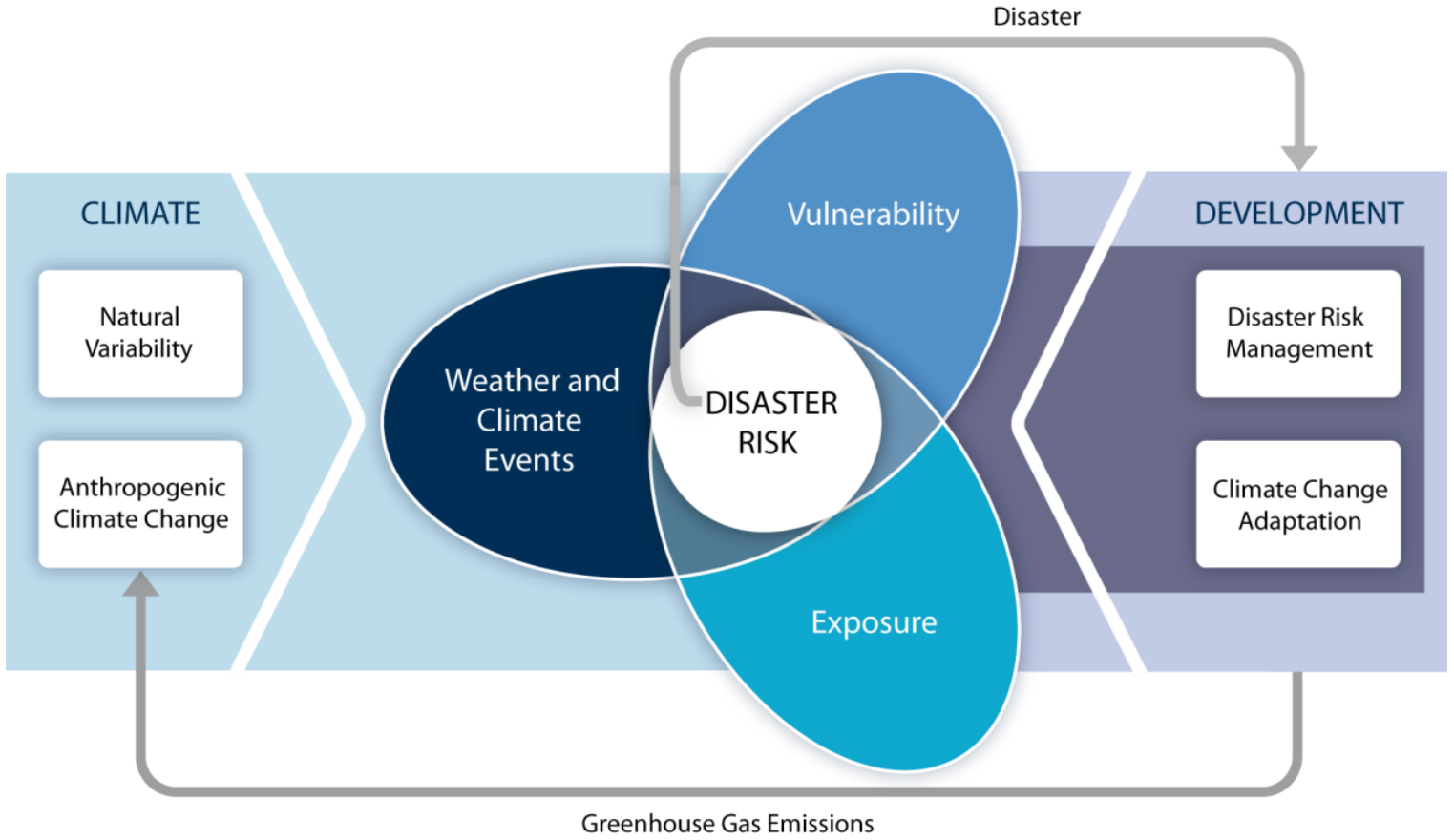
https://physicsworld.com/a/a-model-approach-to-climate-change/

The CCA-DRR link



Climate Change and our Disaster Risks

IPCC, 2011



GCOS Essential Climate Variables

esa

The Essential Climate Variables

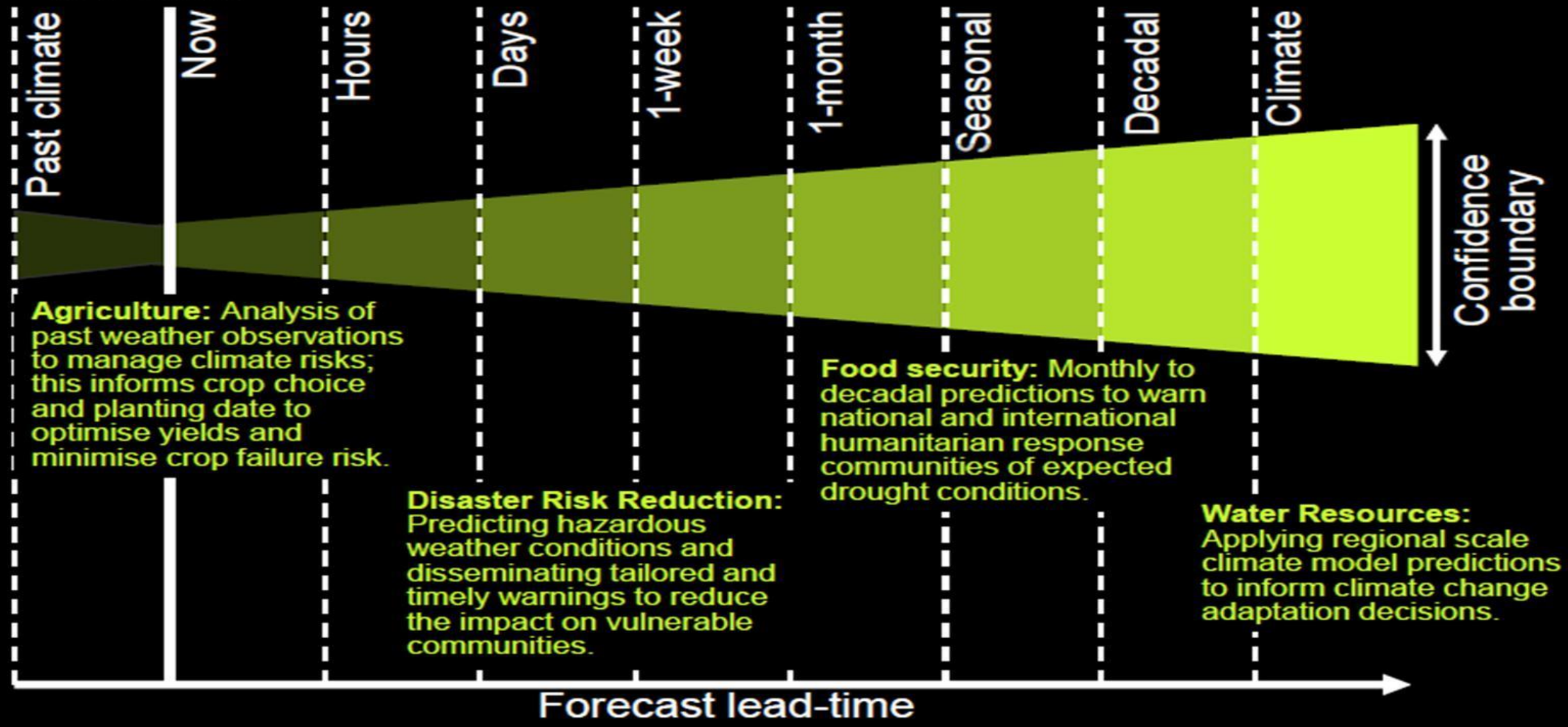
Domain	Essential Climate Variables	
Atmospheric (over land, sea and ice)	Surface:	Air temperature, **precipitation**, air pressure, surface radiation budget, wind speed and direction, water vapour.
	Upper air:	**Earth radiation budget (including solar irradiance), upper air temperature (including MSU radiances), wind speed and direction, water vapour, cloud properties.**
	Composition:	**Carbon dioxide**, methane, **ozone**, other long-lived greenhouse gases, **aerosol properties**.
Oceanic	Surface:	**Sea surface temperature**, sea surface salinity, **sea level, sea state, sea ice**, currents, **ocean colour (for biological activity)**, carbon dioxide partial pressure.
	Sub-surface:	Temperature, **salinity**, currents, nutrients, carbon, ocean tracers, phytoplankton.
Terrestrial	River discharge, water use, ground water, **lake levels, snow cover, glaciers and ice caps**, permafrost and seasonally-frozen ground, **albedo, land cover (including vegetation type), fraction of absorbed photosynthetically active radiation (fAPAR), leaf area index (LAI), biomass, fire disturbance, soil moisture.**	

GCOS
GLOBAL CLIMATE OBSERVING SYSTEM

CEOS
Committee on Earth Observation Satellites

Prediction on all timescales

Supporting decision making for international development



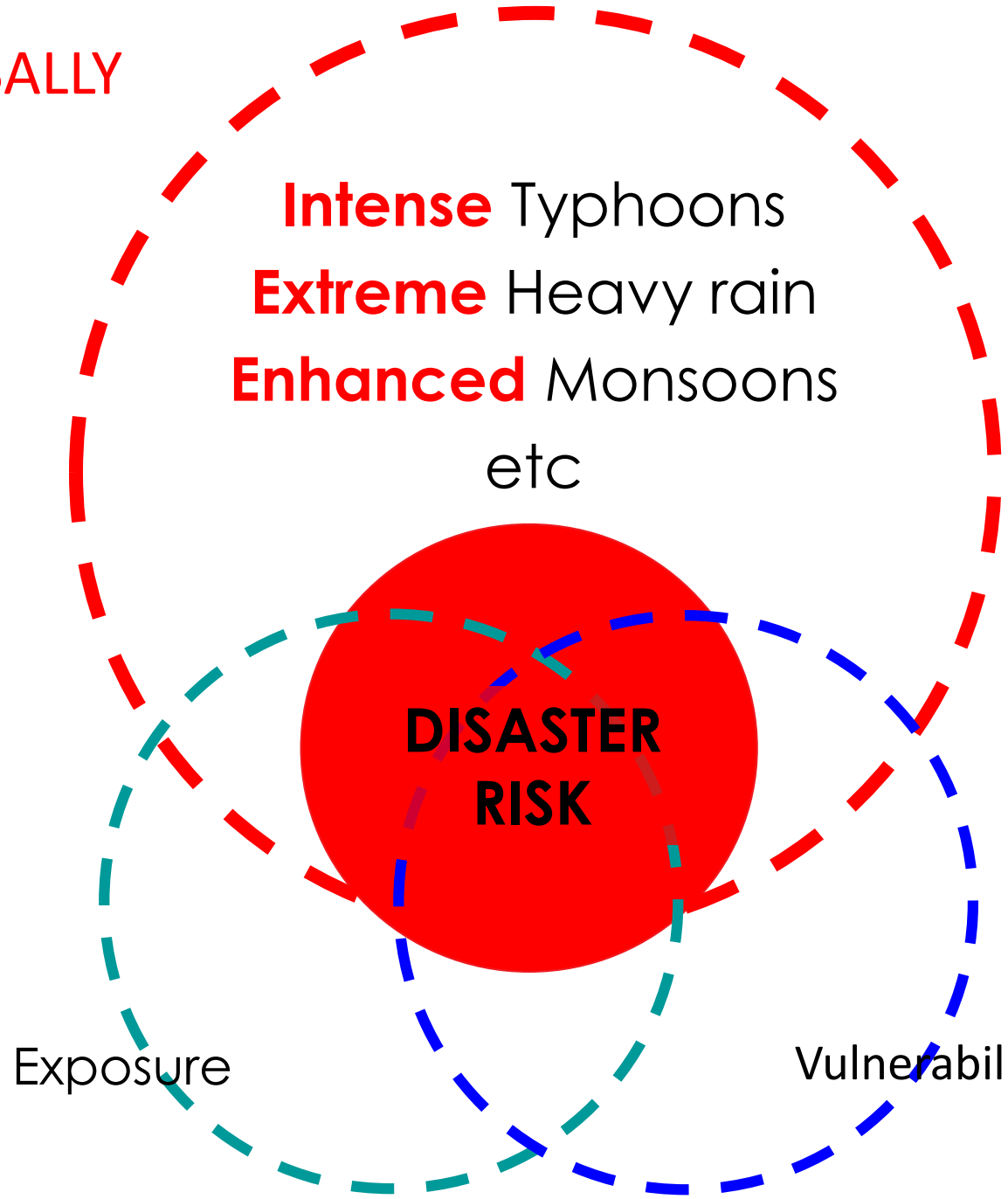
Agriculture: Analysis of past weather observations to manage climate risks; this informs crop choice and planting date to optimise yields and minimise crop failure risk.

Disaster Risk Reduction: Predicting hazardous weather conditions and disseminating tailored and timely warnings to reduce the impact on vulnerable communities.

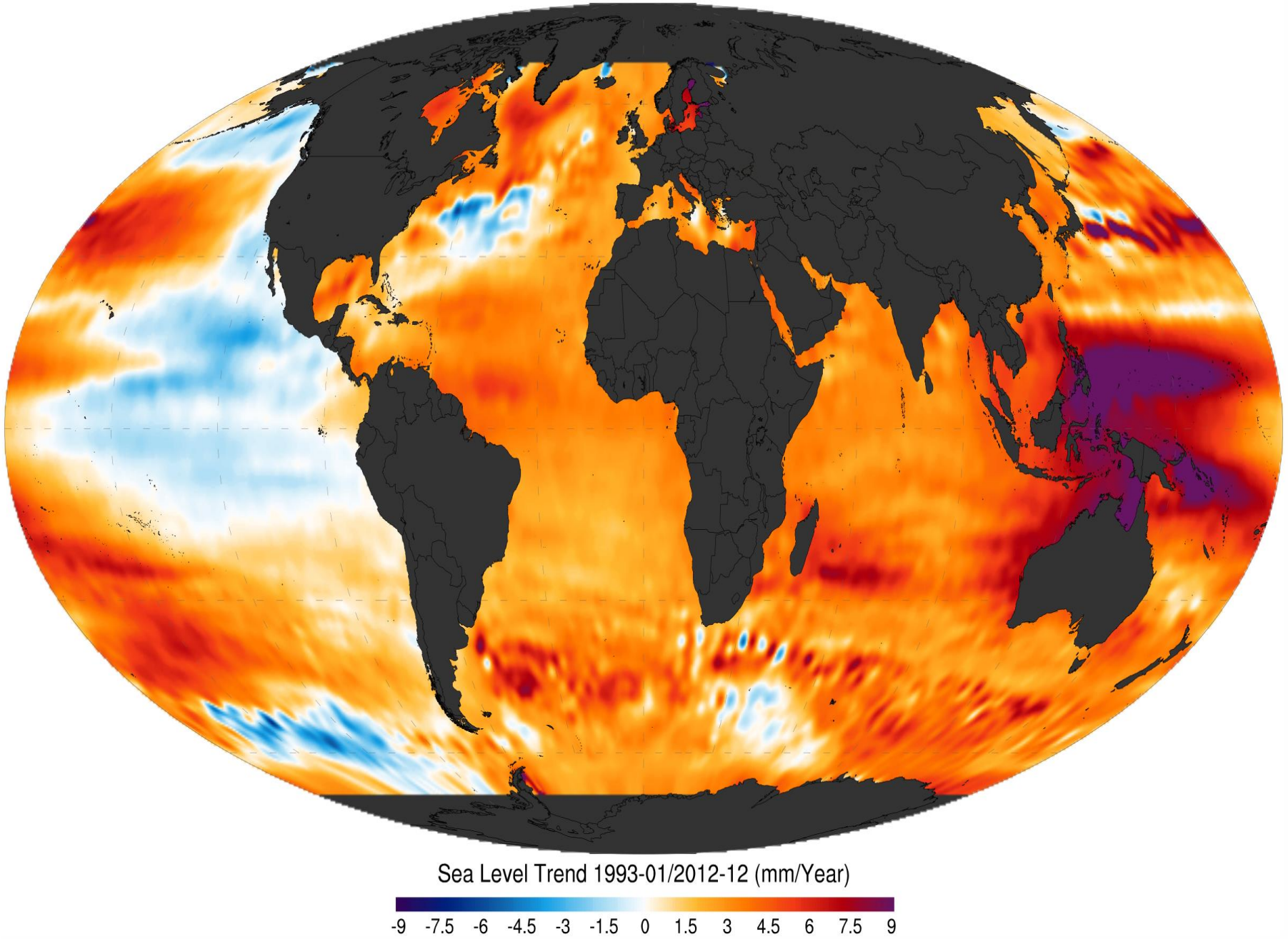
Food security: Monthly to decadal predictions to warn national and international humanitarian response communities of expected drought conditions.

Water Resources: Applying regional scale climate model predictions to inform climate change adaptation decisions.

IN A GLOBALLY WARMER WORLD

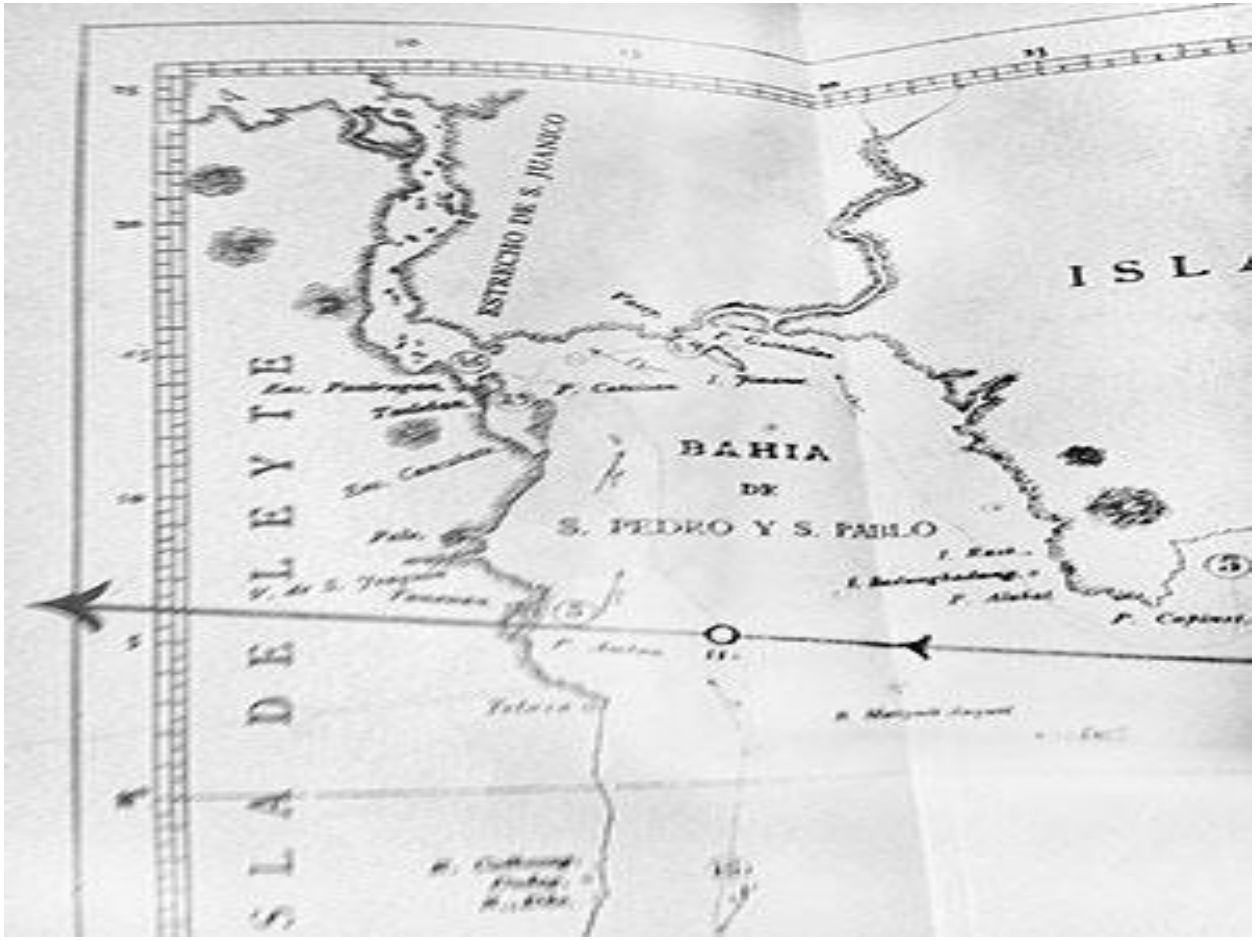


Dr. Gemma Narisma,
Manila Observatory


Sea Level Trend 1993-01/2012-12 (mm/Year)
-9 -7.5 -6 -4.5 -3 -1.5 0 1.5 3 4.5 6 7.5 9

Source: NOAA

Throwback 1897



"El Baguio de Samar y Leyte, 12-13 de Octubre de 1897" by P. Jose Algue, S.J. were published by the Observatorio de Manila, Dirigido por los Padres de la Compañia de Jesus. Foto-tipografia de J. Marty. Manila: 1898. From the Emilia A. Lotilla Book Collection.)

Throwback 1897

THE BARRIER MINER, WEDNESDAY, JANUARY 12, 1898.

INTERCOLONIAL NEWS.

A NEW YORK PARSON.

A NOVEL MOUNTAIN RAILWAY.

A TERRIBLE CASE OF ECZEMA

Ayer's Sarsaparilla

TYPHOON AND TIDAL WAVE IN THE PHILLIPINES.

7000 Lives Lost.

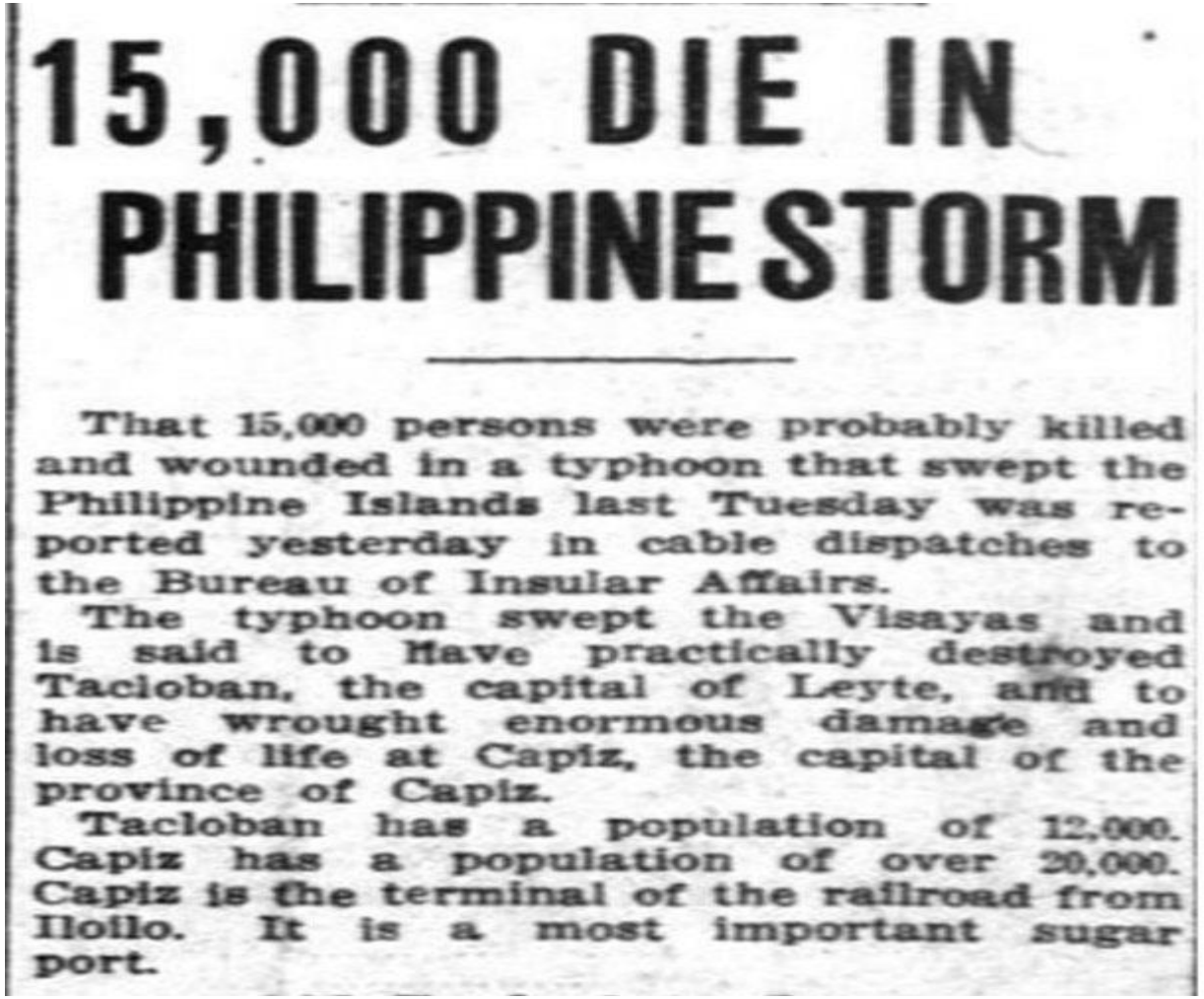
MAIL advices, brought by the steamer Gaelic from Chinese and other ports in the Far East, contain details of the fearful destruction wrought in the Phillipine Islands by the typhoon and tidal wave during October. It is estimated that 400 Europeans and 6000 natives lost their lives, many being drowned by the rush of water, while others were killed by the violence of the wind. Several towns have been swept or blown away. The hurricane first struck the Bay of Santa Paula, and devastated the district lying to the south of it. No communication with the neighborhood was possible for two days. The hurricane reached Leyte on October 12, and striking Tacloban, the capital, with terrific force, reduced it to ruins in less than half an hour. The bodies of 126 Europeans have been recovered from the fallen buildings. Four hundred natives were buried in the ruins. A score of small trading vessels and two Sydney traders were wrecked on the southern coast, and their crews drowned. At Gamos the sea swept inland for a mile, destroying property worth seven million dollars, and many natives lost their lives. The Government prison at Tacloban was wrecked, and of the 200 rebels therein half succeeded in making their escape. The town of Herain was swept away by flood, and its 5000 inhabitants are missing. The small station of Weera, near Loog, is also gone, while in Loog itself only three houses are left standing. Thousands of natives are roaming about the devastated province seeking food and medical attendance. In many cases the corpses were mutilated as though they had fallen in battle, and the expressions of their faces were most agonising.

- October 1897 typhoon landed very near Guiuan in Samar, proceeded to Tanauan, Palo and Tacloban in Leyte, struck northern Cebu and northern Panay (then the province of Capiz which included the present-day province of Aklan) and exited just south of Mindoro island

Raphael Lotilla in http://www.rappler.com/move-ph/issues/disasters/typhoon-yolanda/44062-leyte-1897-typhoon

The Barrier Miner, January 1898
In http://noypistuff.blogspot.com/2013/11/philippine-typhoon-left-7000-dead-in.html

Throwback 1912



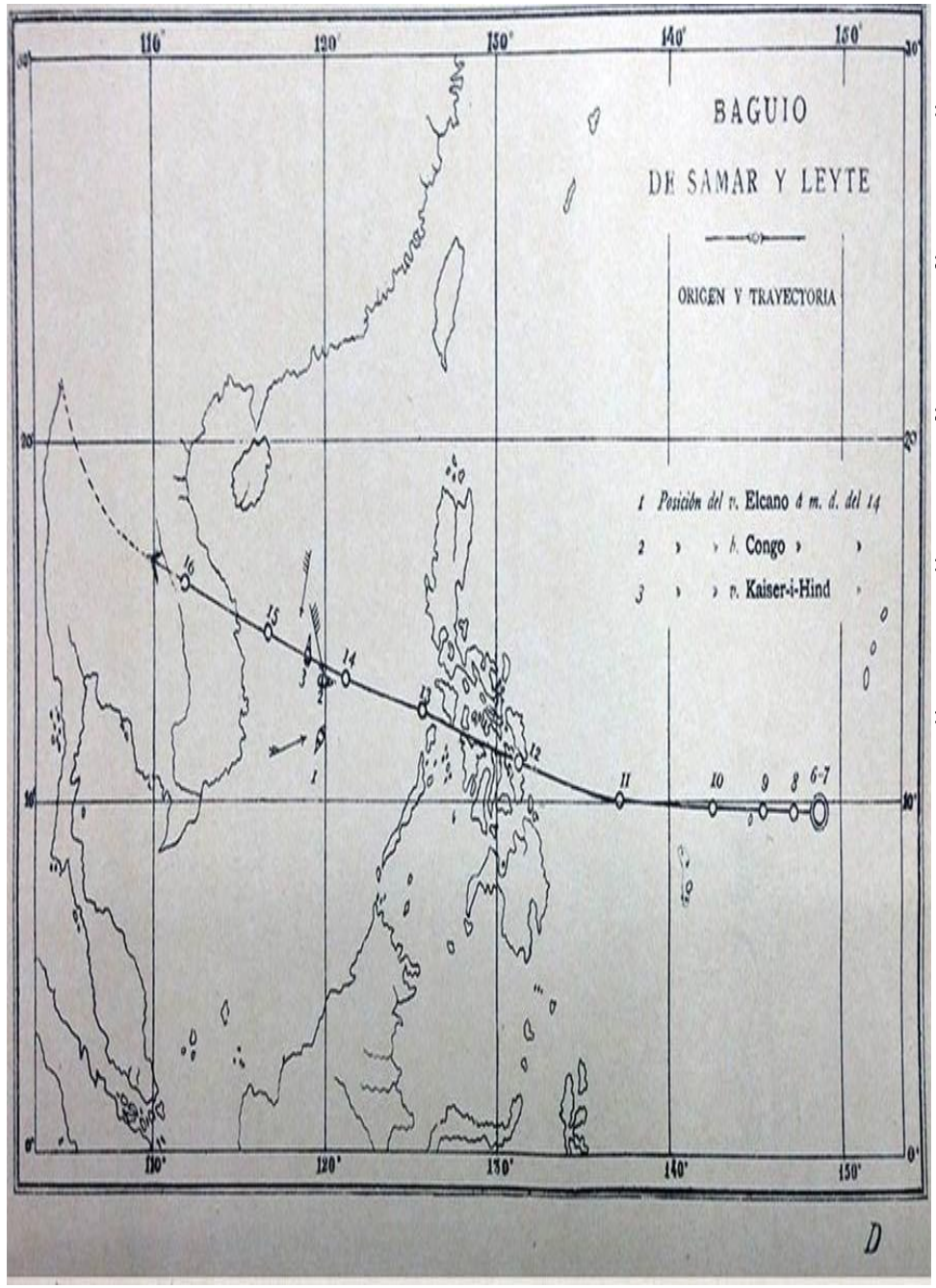
15,000 DIE IN PHILIPPINE STORM

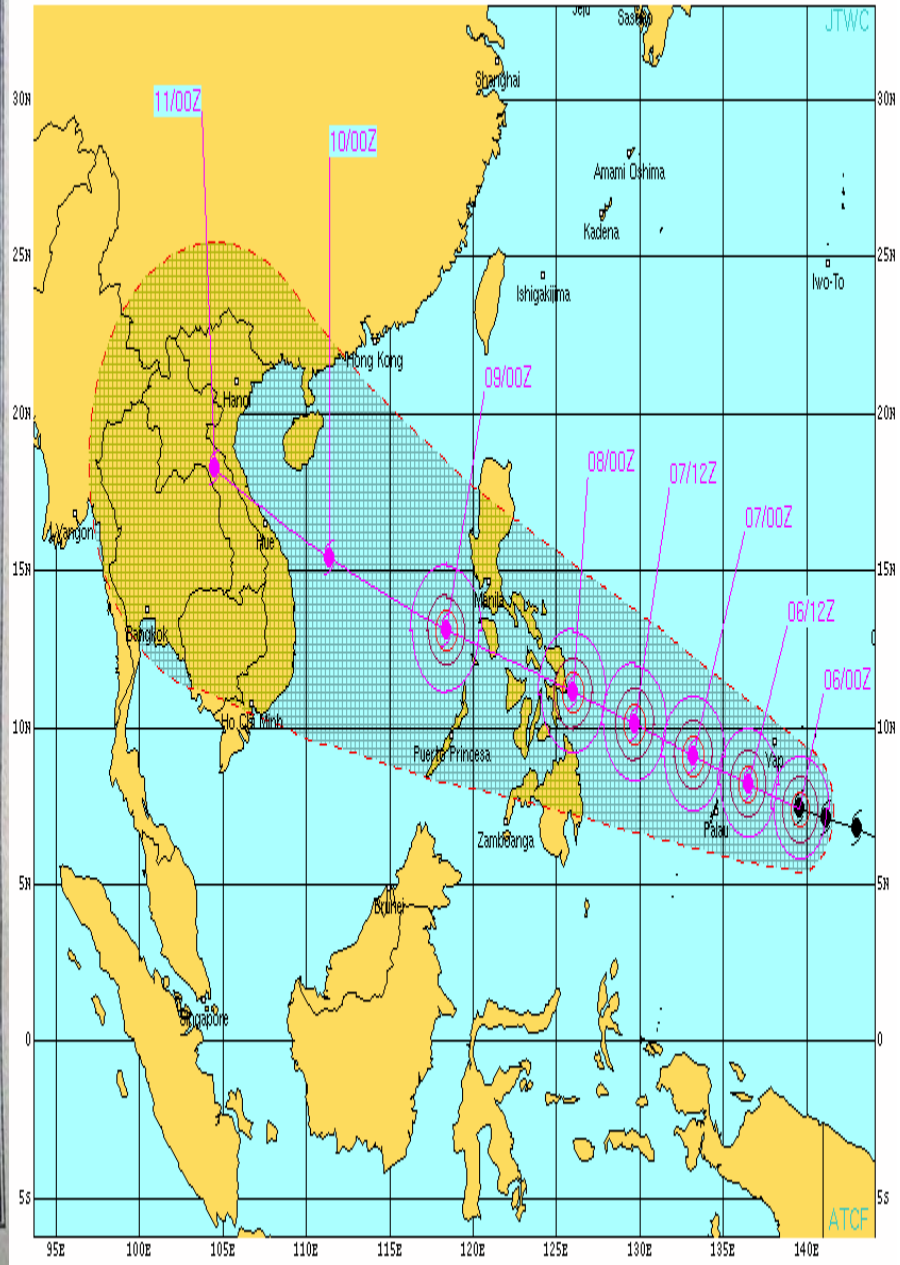
That 15,000 persons were probably killed and wounded in a typhoon that swept the Philippine Islands last Tuesday was reported yesterday in cable dispatches to the Bureau of Insular Affairs.

The typhoon swept the Visayas and is said to have practically destroyed Tacloban, the capital of Leyte, and to have wrought enormous damage and loss of life at Capiz, the capital of the province of Capiz.

Tacloban has a population of 12,000. Capiz has a population of over 20,000. Capiz is the terminal of the railroad from Iloilo. It is a most important sugar port.

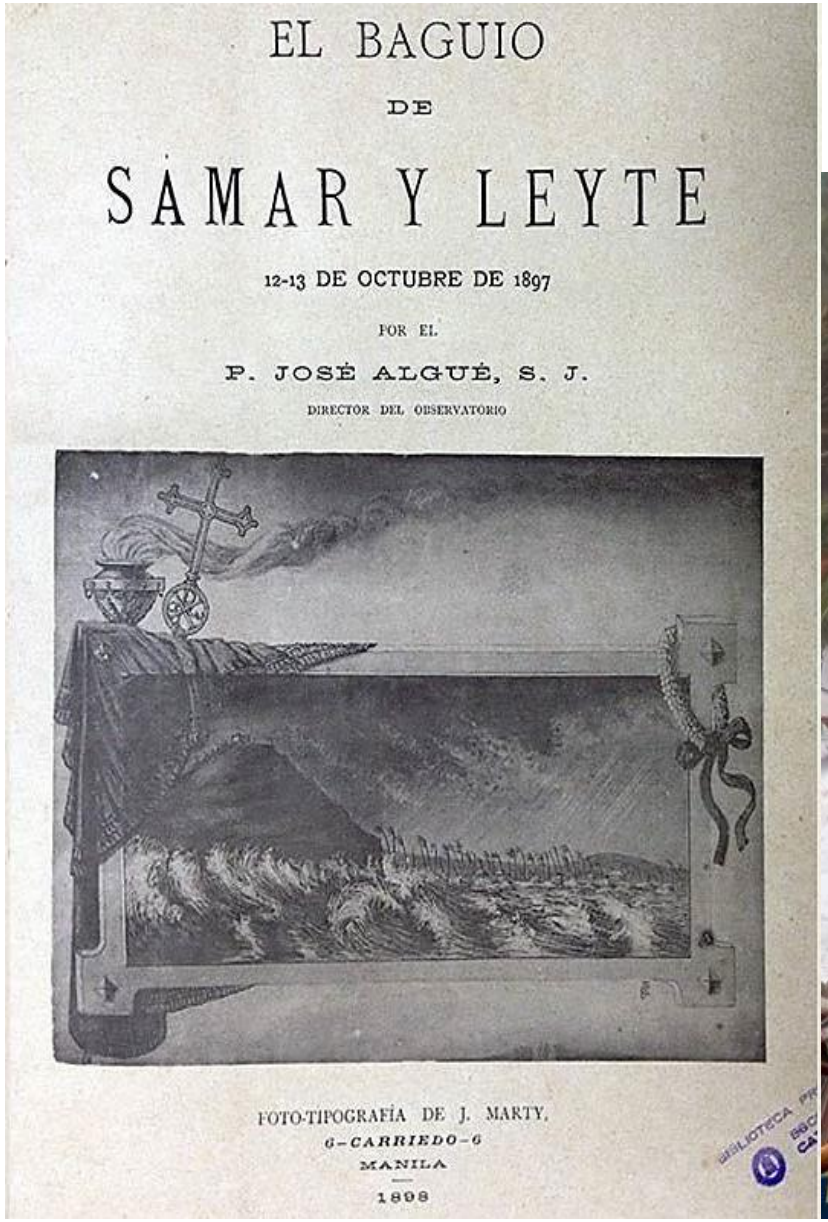
Washington Herald, November 1912
http://www.westernpacificweather.com/2013/11/19/15300-tacloban-wrecked-by-typhoon-before-haiyan/





Super Typhoon 31W (Haiyan) Warning #12 Issued at 06/0300Z, warning graphic issued by the US Navy Joint Typhoon Warning Center.

Dr. Mahar Lagmay



EL BAGUIO

DE

SAMAR Y LEYTE

12-13 DE OCTUBRE DE 1897

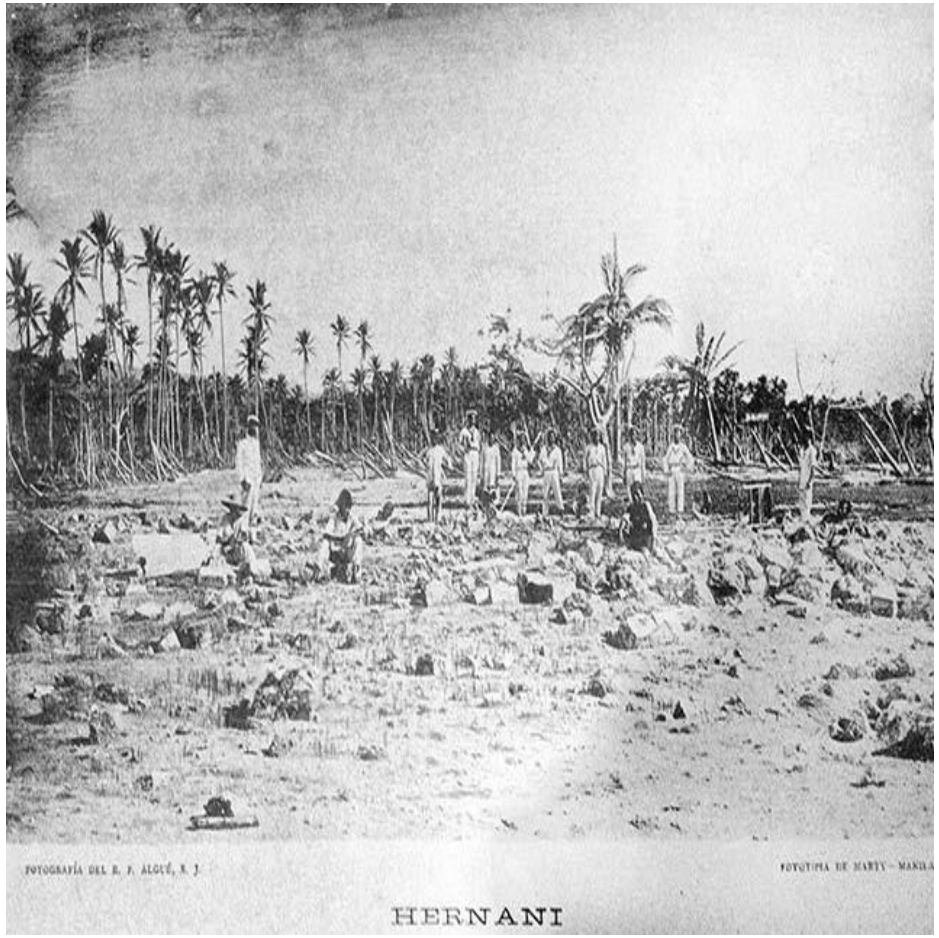
POR EL

P. JOSÉ ALGUÉ, S. J.

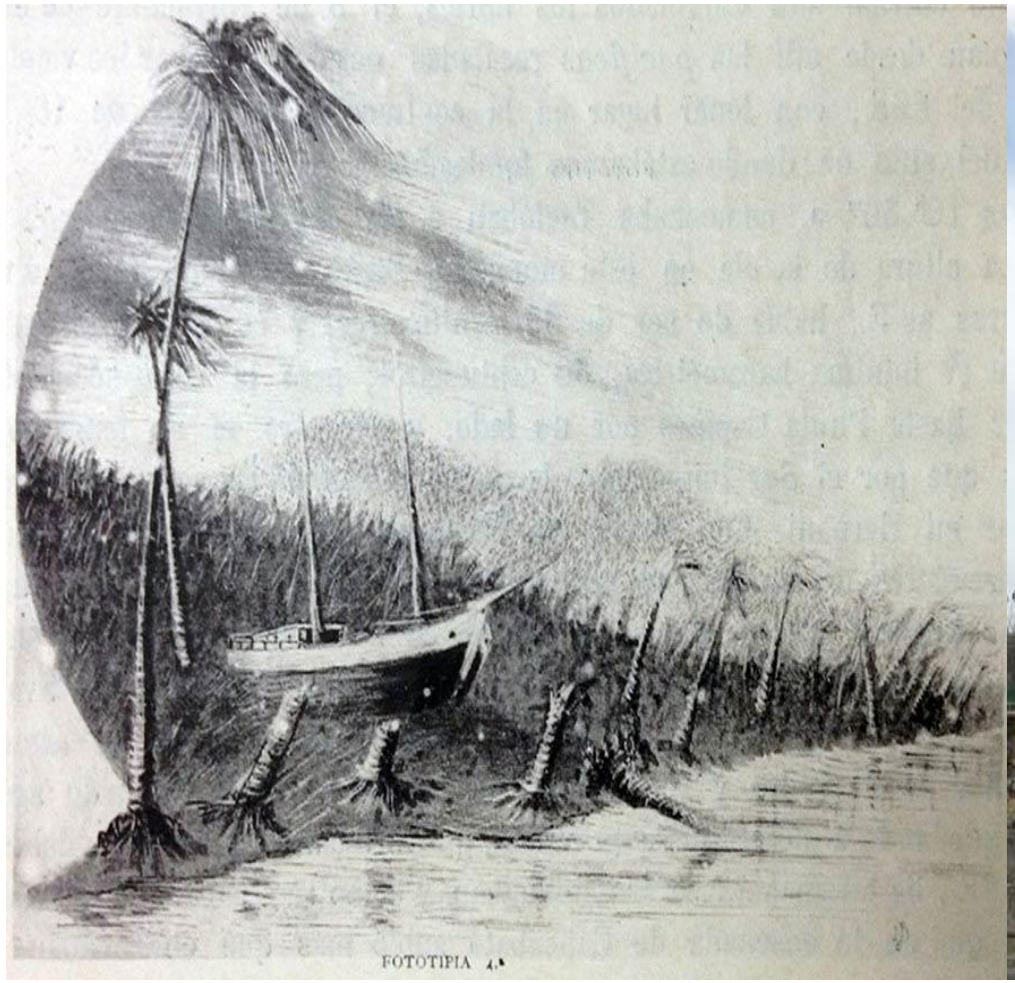
DIRECTOR DEL OBSERVATORIO

FOTO-TIPOGRAFÍA DE J. MARTY,
6-CARRIEDO-6
MANILA
1898

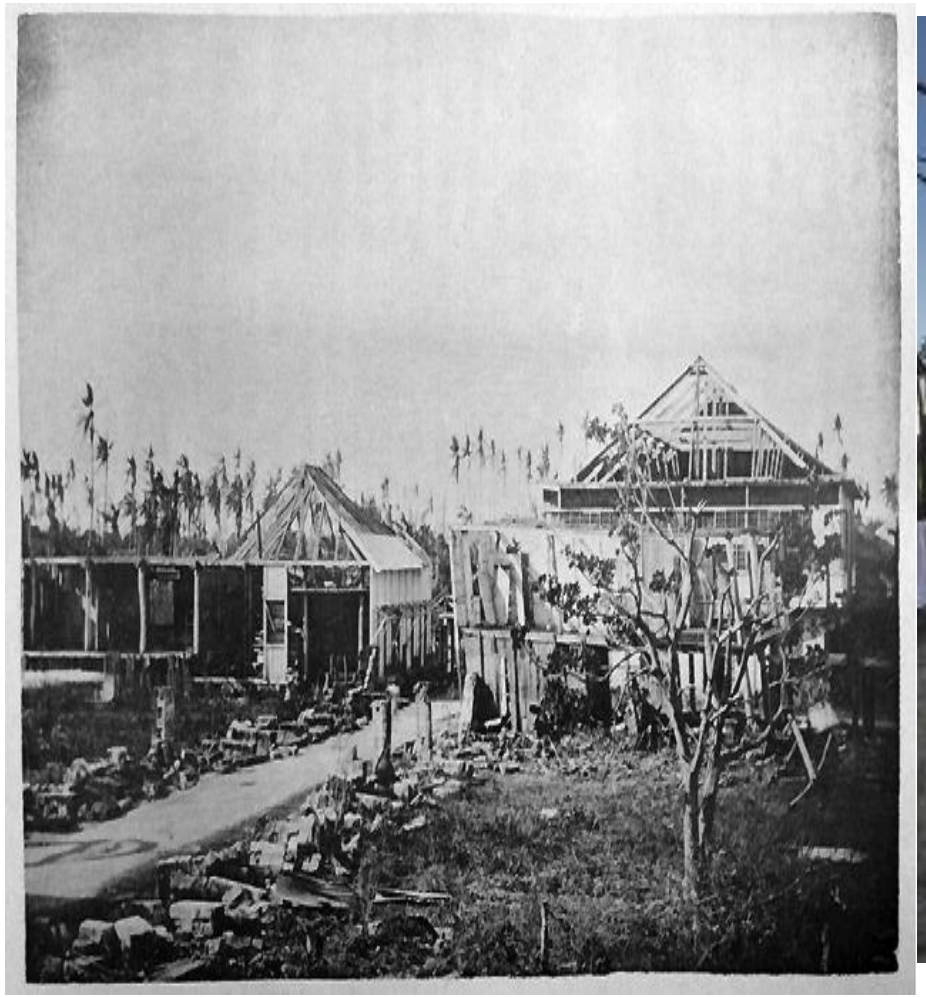
http://stormsurge2010.blogspot.com/2013/11/haiyans-surge-may-have-been-highest-in.html



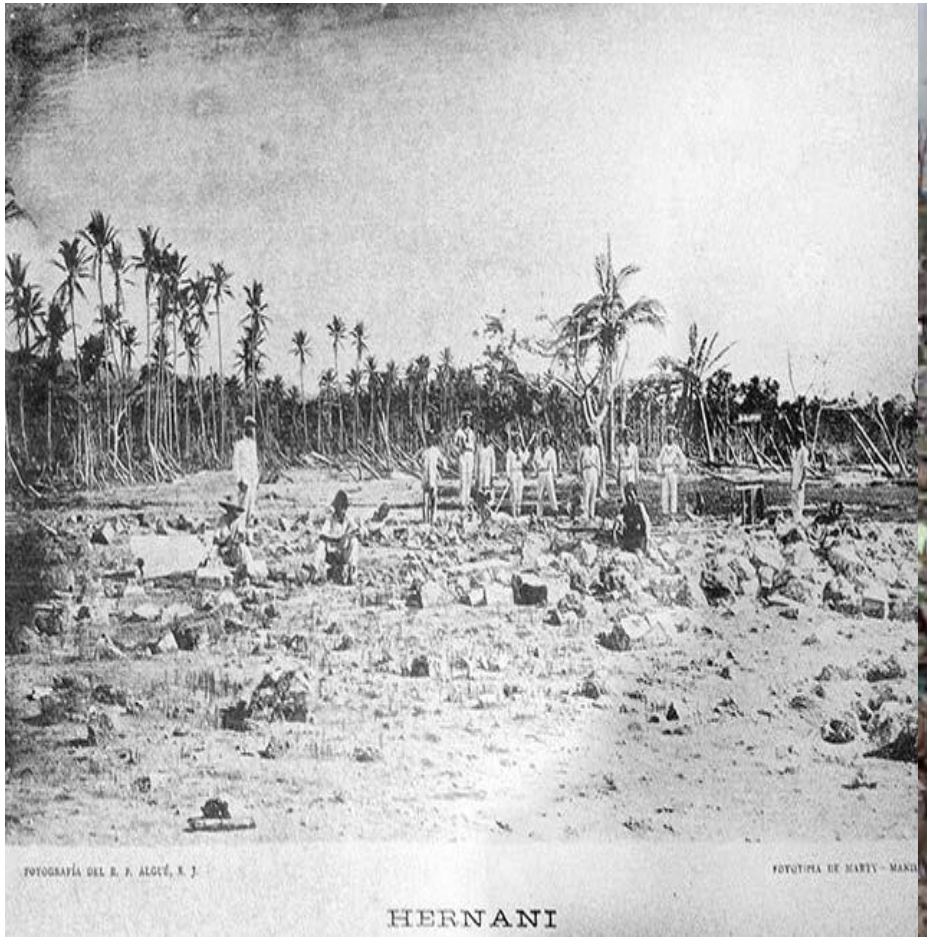
http://www.eenews.net/stories/1059990425/print



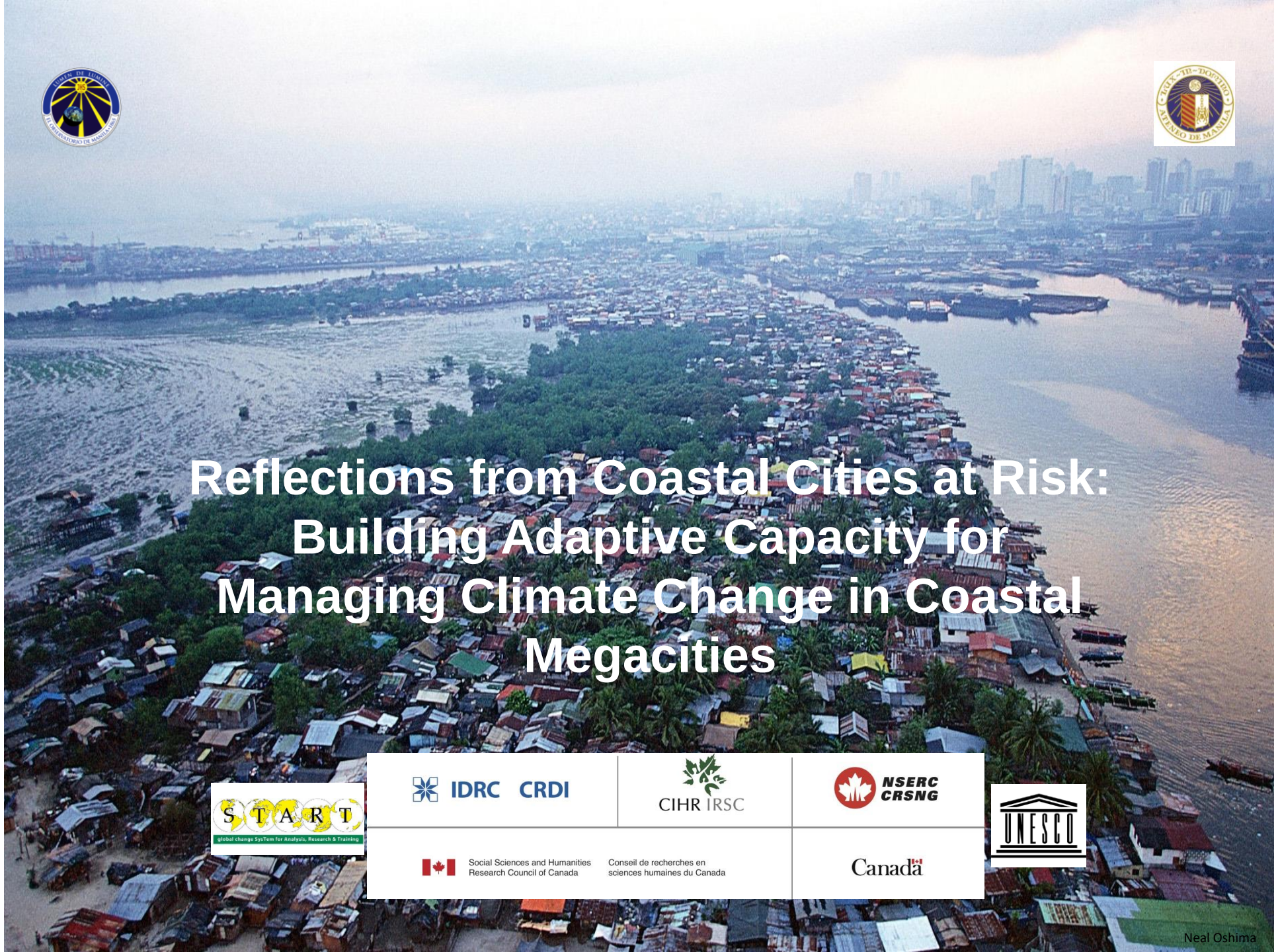
http://stormsurge2010.blogspot.com/



http://www.gmanetwork.com/news/story/335673/scitech/science/a-history-of-storms-1890s-newspaper-reveals-devastating-leyte-typhoon



http://stormsurge2010.blogspot.com/2013/11/the-water-was-as-high-as-coconut-tree.html



Reflections from Coastal Cities at Risk: Building Adaptive Capacity for Managing Climate Change in Coastal Megacities

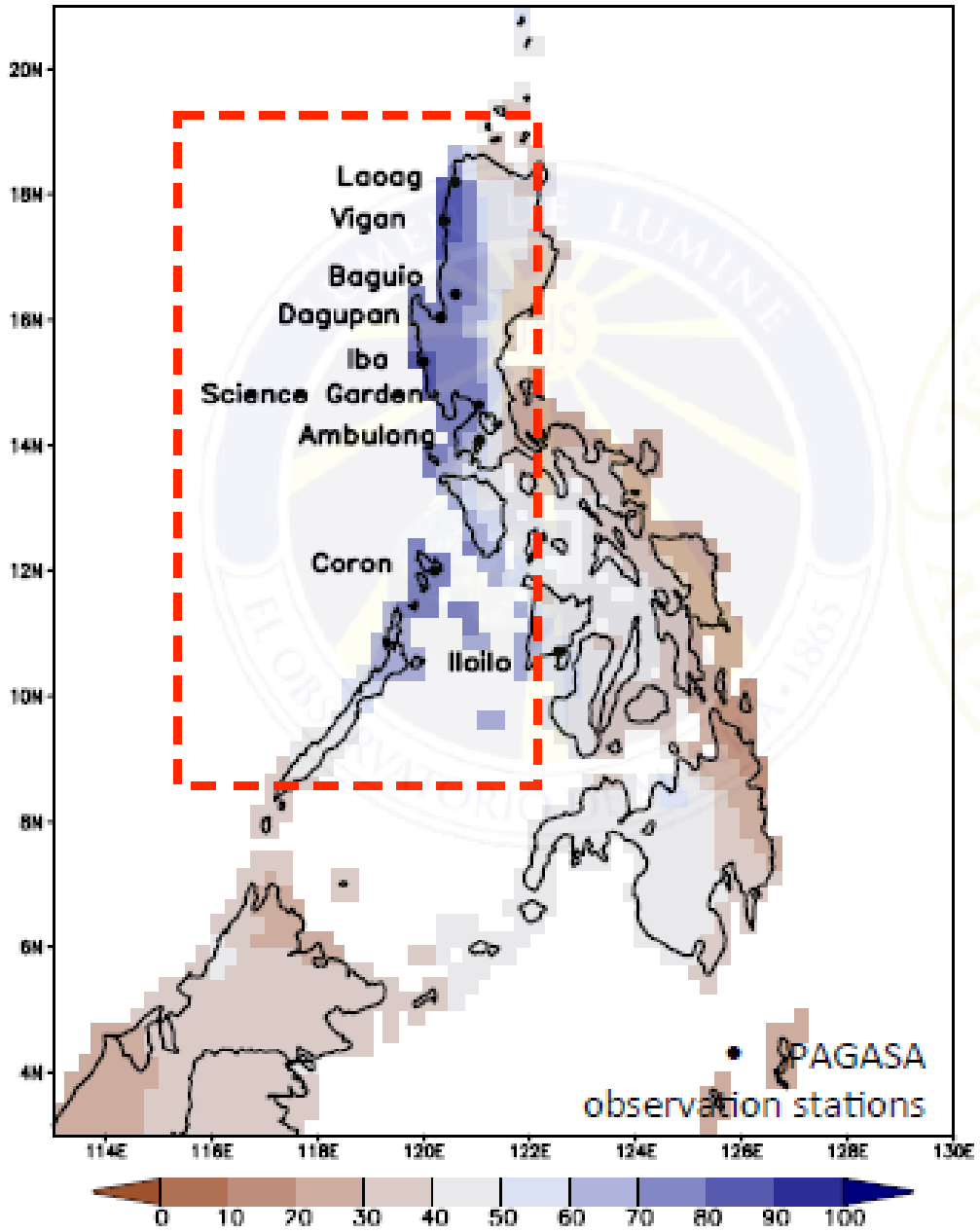
Neal Oshima

The Women and Men of CCAR (Philippines)

- Antonia Yulo-Loyzaga
- Dr. Emma Porio
- Dr. Gemma Narisma
- Dr. Celine Vicente
- Dr. Kendra Gotangco
- Dr Fernando Siringan
- Dr. Posa Perez
- Dr. Raul Clarete
- Dr. Philip Arnold Tuano
- Dr. John Wong
- FORIN Team
- Jessica Dator- Bercilla
- Julie Dado and Monica Ortiz
- Emil Gozo,Justin See, John Paul Dalupang, Liz del Castillo, JoEd Perez
- Raul Dayawon, Patricia Sanchez, Richie Antonio

IDRC CRDI
CIHR IRSC
NSERC CRSNG
UNESCO
START
global change SysTem for Analysis, Research & Training
Social Sciences and Humanities Research Council of Canada
Conseil de recherches en sciences humaines du Canada
Canada

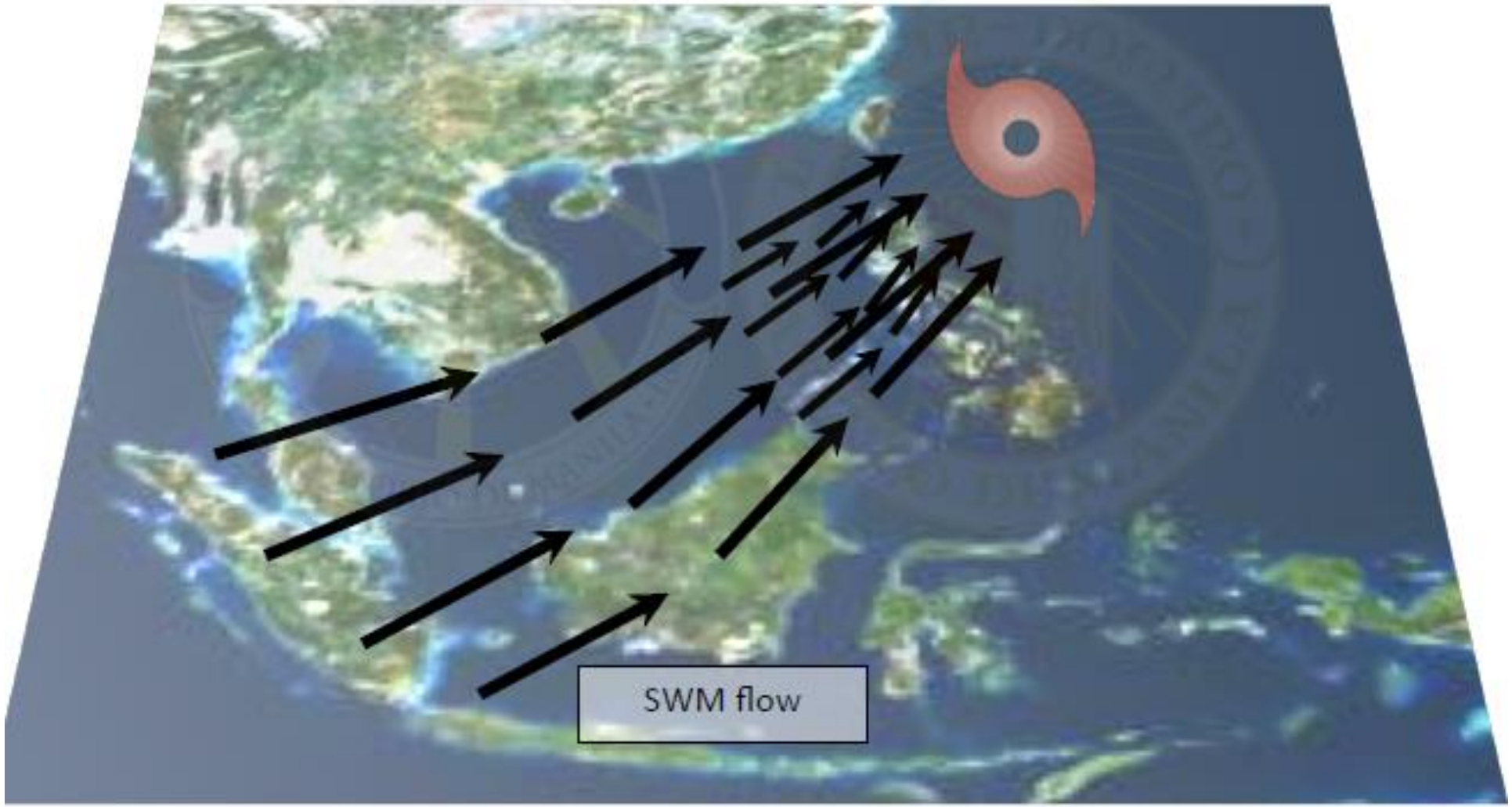
% RAINFALL DURING SWM



- 50-80% of annual rainfall occurs in June-Sept during Southwest Monsoon Season (SWM) in most regions in the west
- Water for agriculture, energy and, domestic use
- Changes in rainfall (climatological average or extremes) will impact livelihood, food security and economic stability

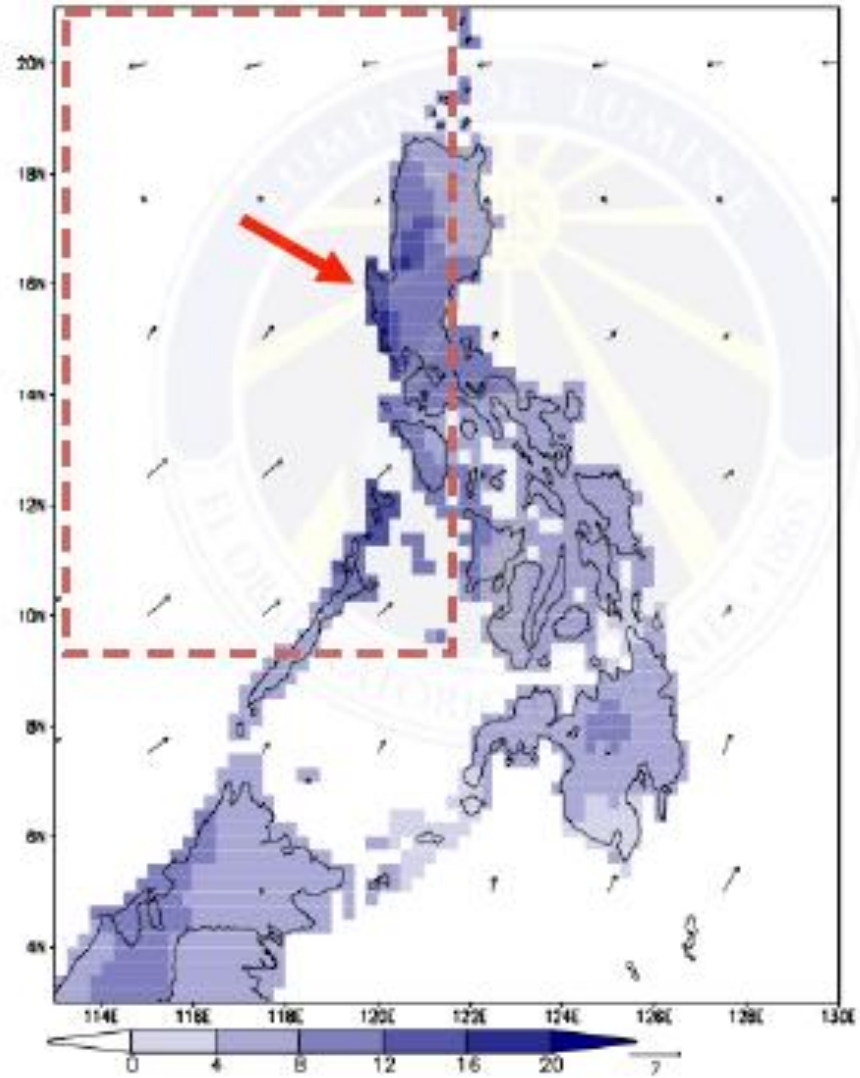
Data: Aphrodite

Tropical Cyclone - ENHANCED SWM

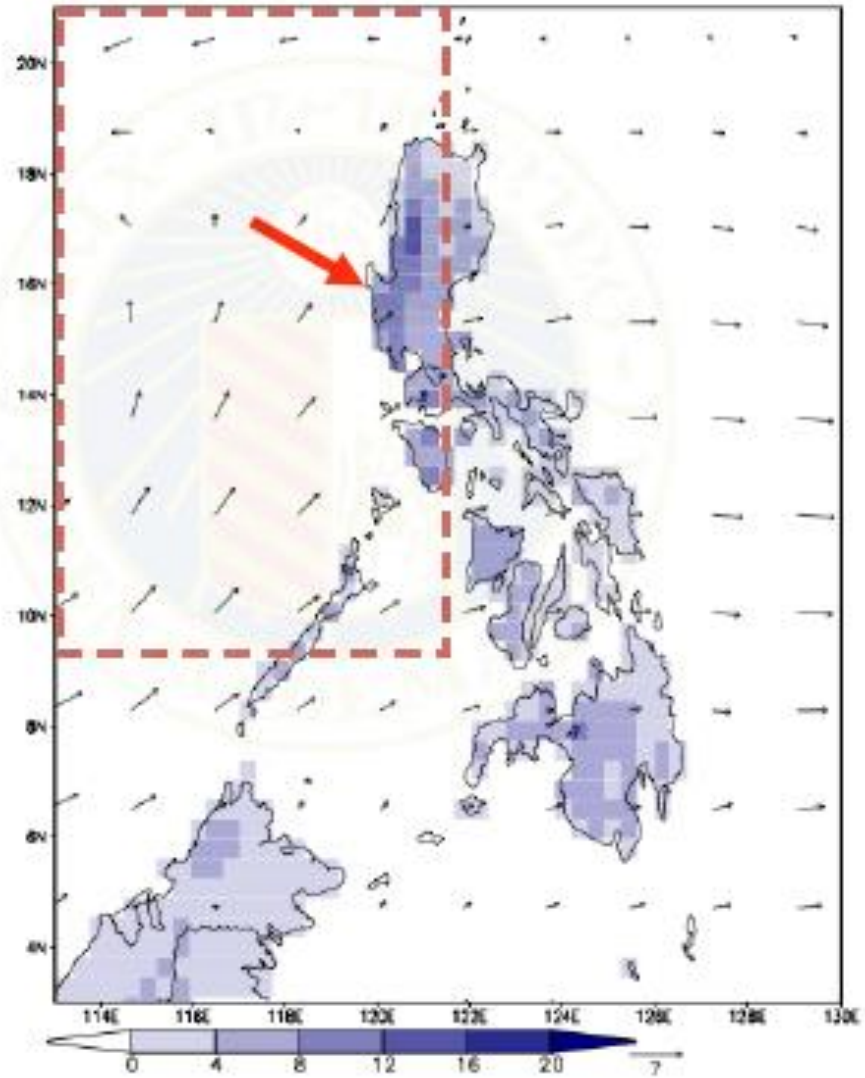


RESULTS: Wind, Rain Pattern Validation

SEPT (OBSERVED)

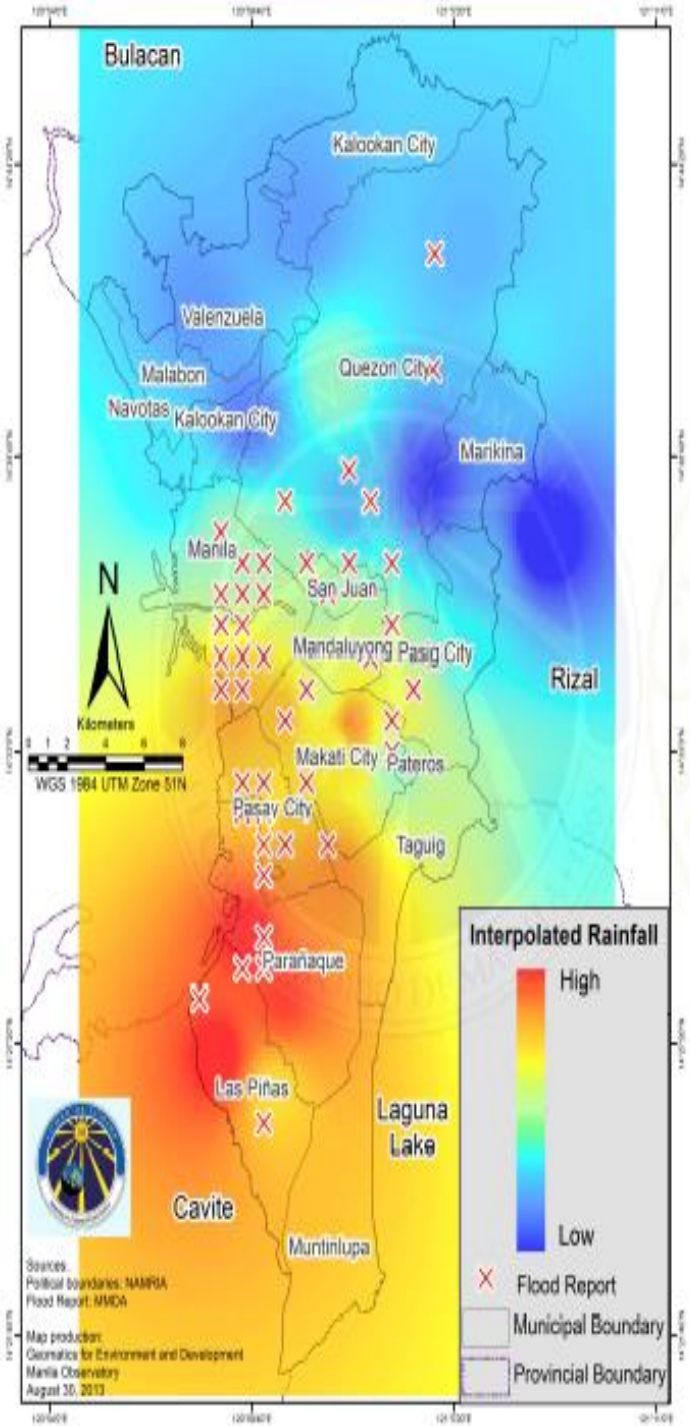


SEPT(MODEL)

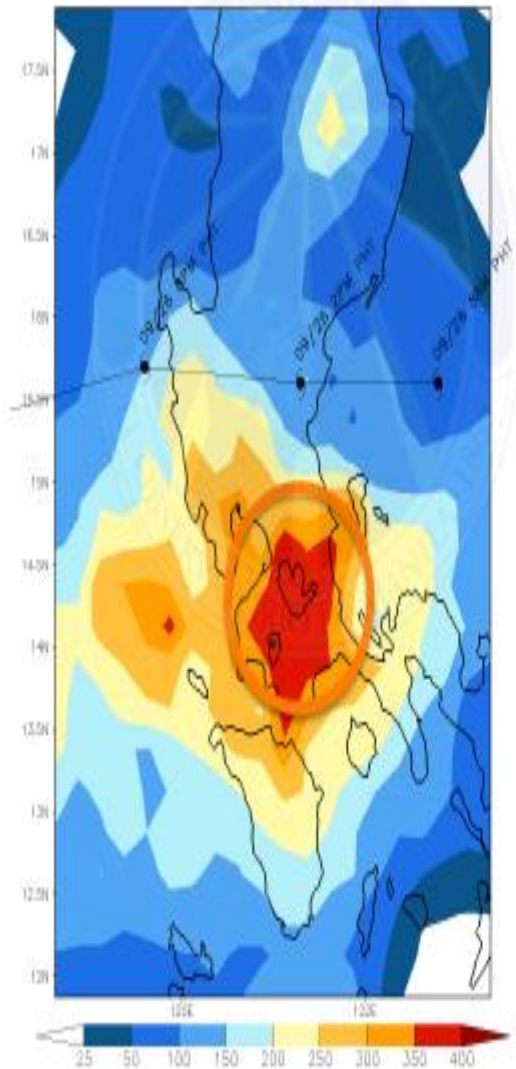


Accumulated rainfall and Typhoon track

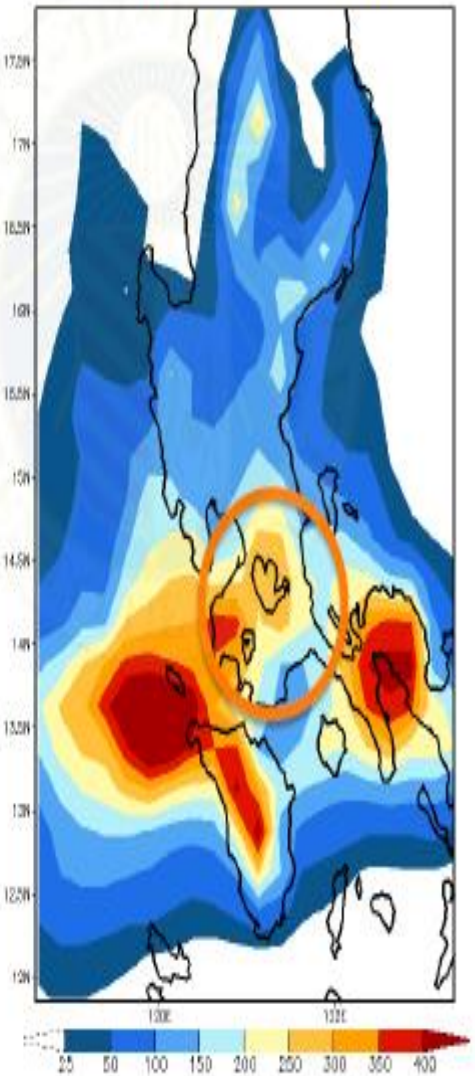
from 25 Sept 2009 8 PM to 27 Sept 2009 2 AM PHT

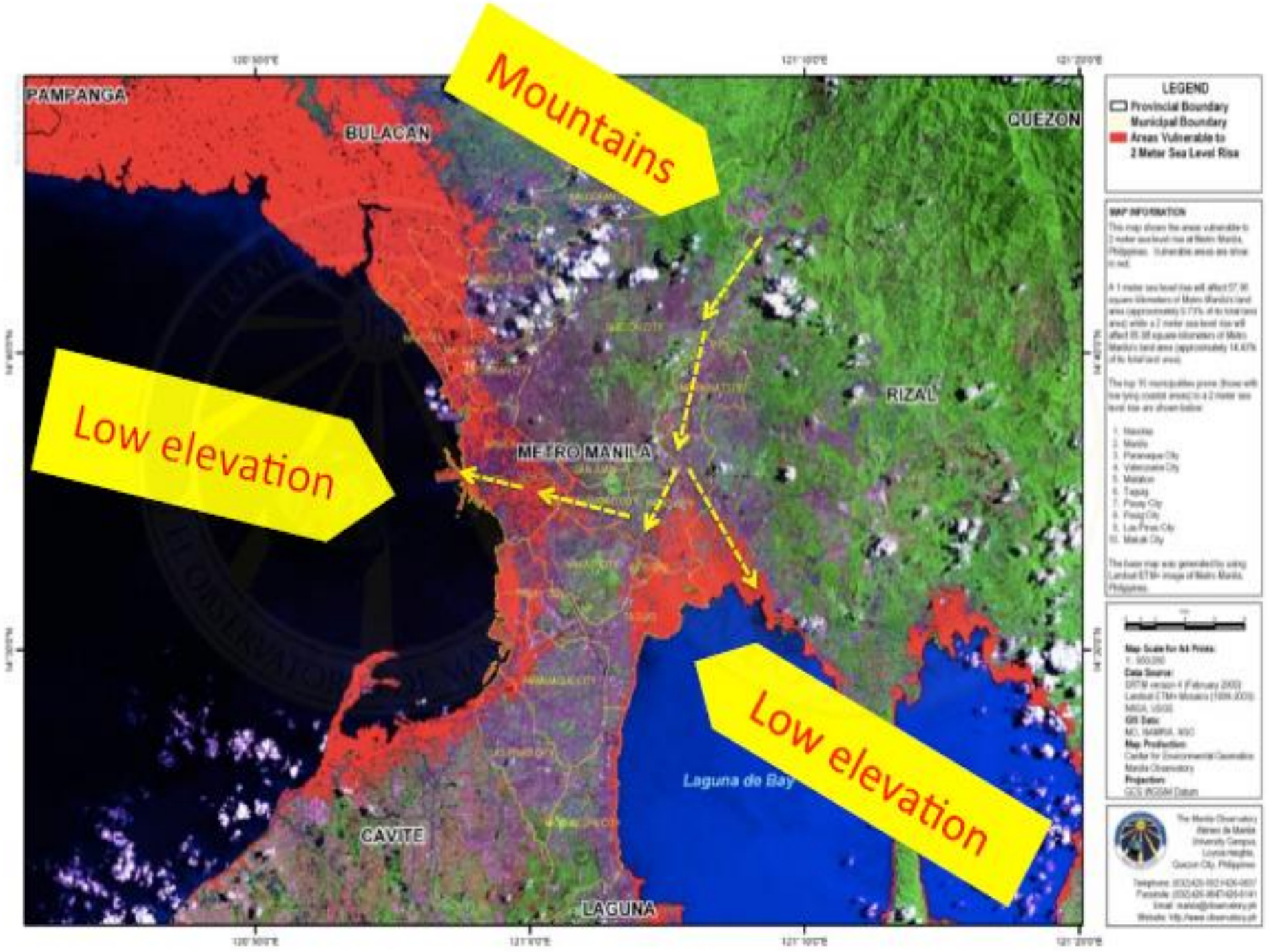


Observed



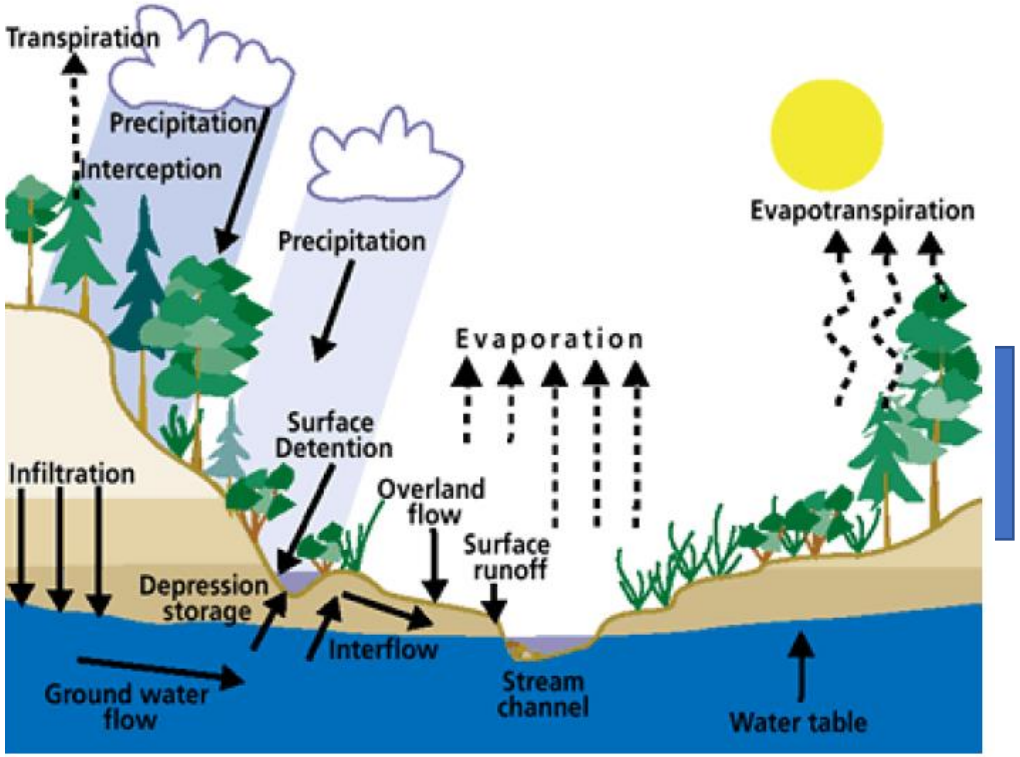
WRF Model




Mountains
Low elevation
Low elevation
PAMPANGA
BULACAN
QUEZON
RIZAL
METRO MANILA
CAVITE
LAGUNA
Laguna de Bay
LEGEND
Provincial Boundary
Municipal Boundary
Areas Vulnerable to 2 Meter Sea Level Rise
MAP INFORMATION

Controls to Flow Characteristics (Chorley, 1969)

- Controls to Flow
  - Transient
    - Rainfall Amount
    - Duration
    - Intensity
    - Spatial Distribution
    - Direction
    - Antecedent soil moisture



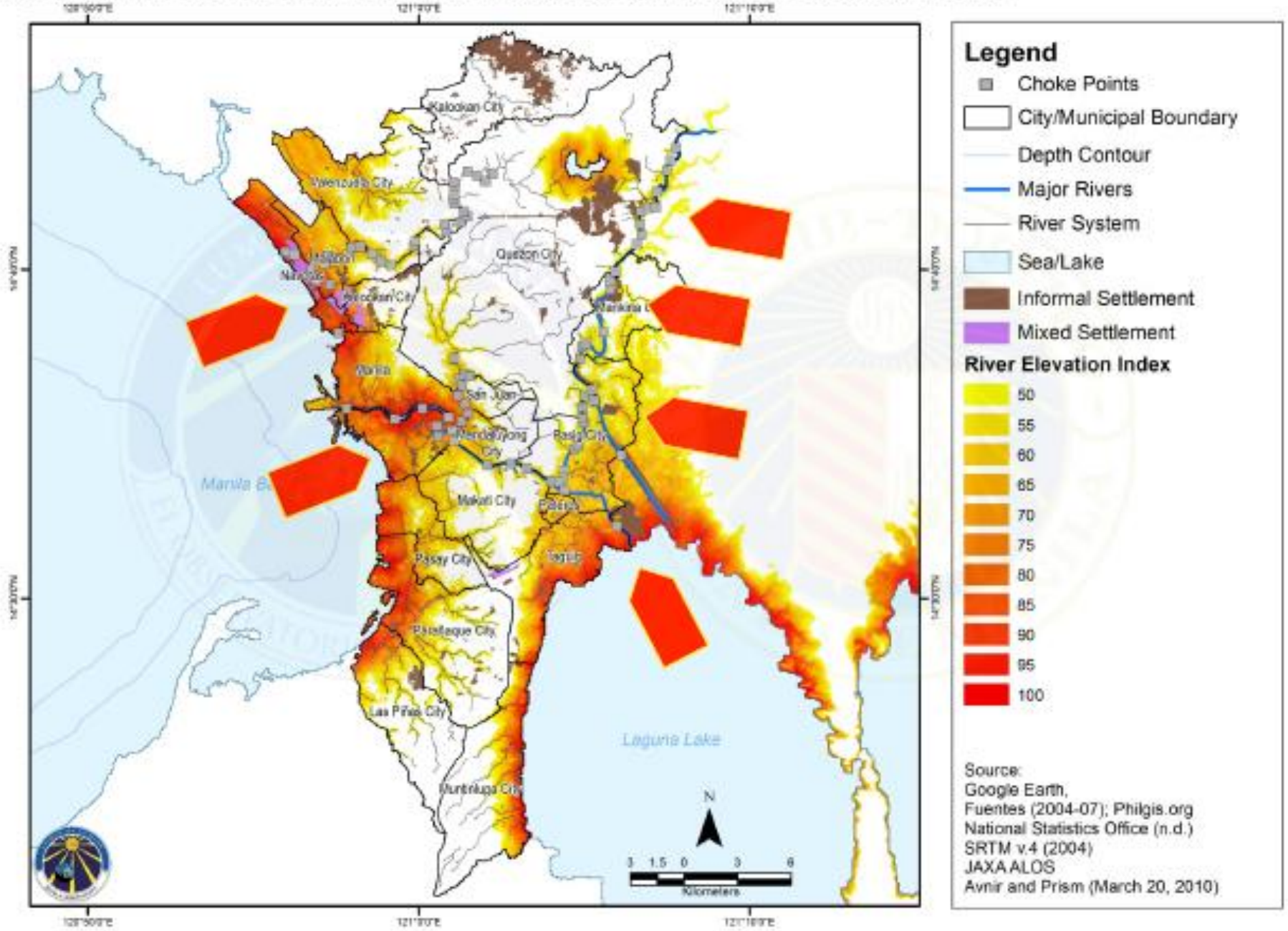
CHOKE POINTS

SLIDE COURTESY OF DR. SIRINGAN, UP MSI

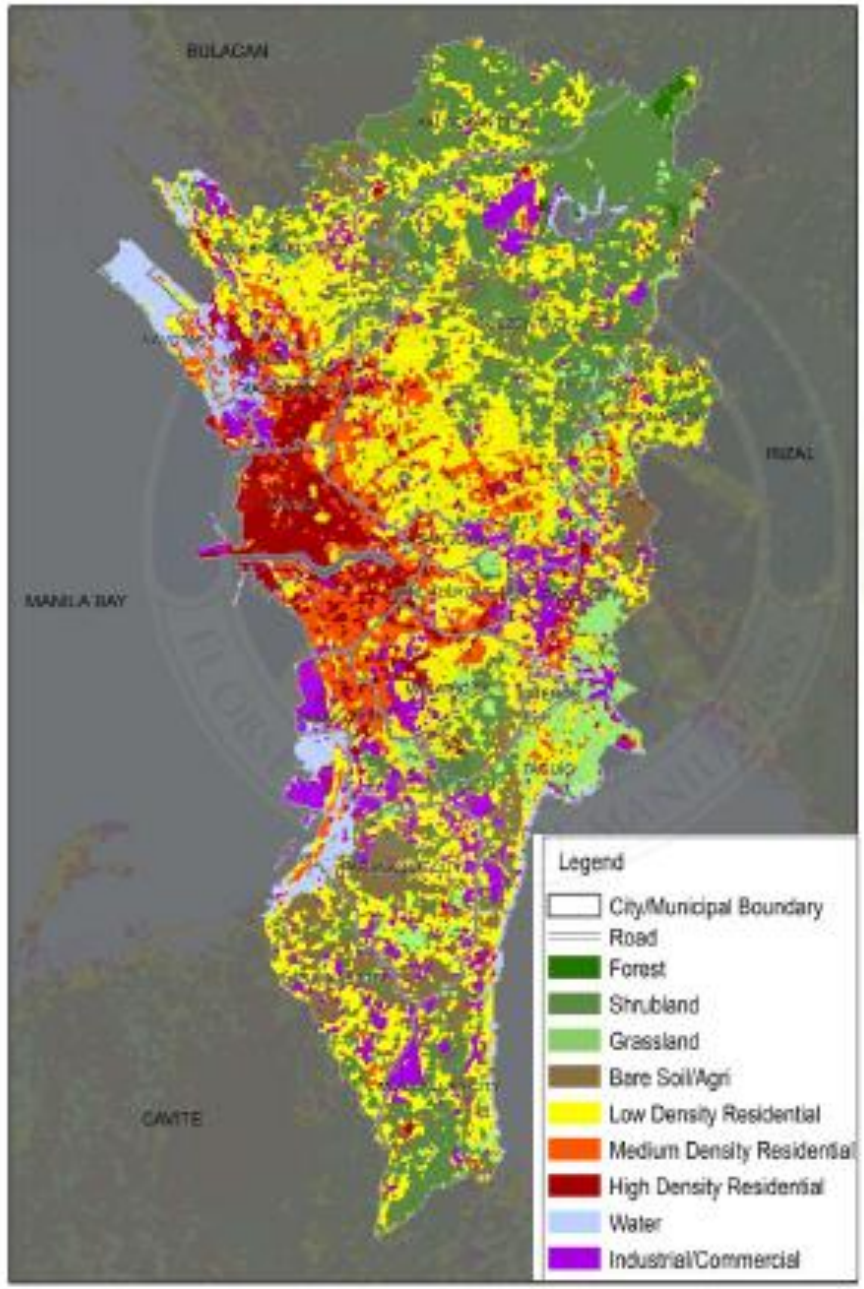
Metro Manila River Constriction Points

Slide courtesy of Dr. Ando Siringan, UP MSI

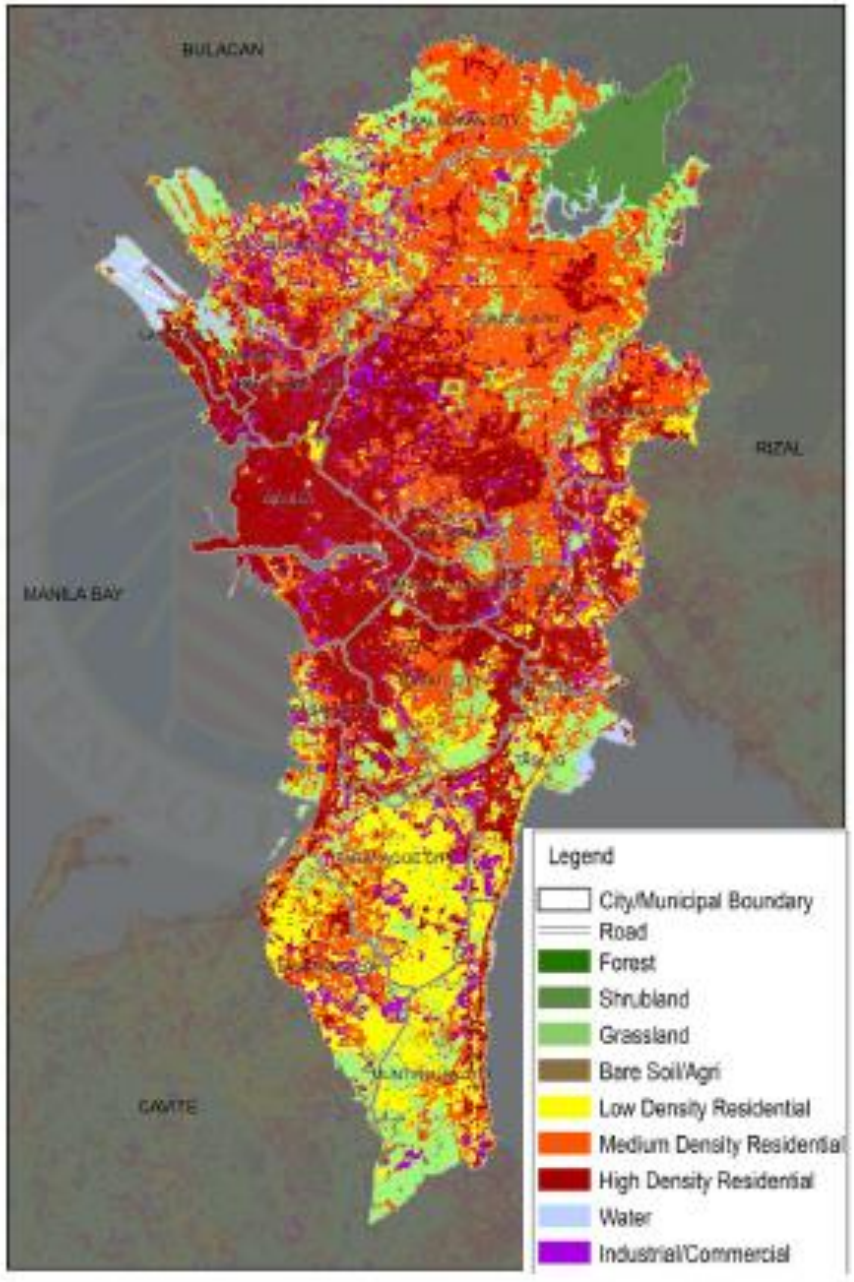
Metro Manila Choke Points, River Elevation Index and Informal Settlements (2010)



1979


BULACAN
RIZAL
MANILA BAY
CAVITE
Legend
City/Municipal Boundary
Road
Forest
Shrubland
Grassland
Bare Soil/Agri
Low Density Residential
Medium Density Residential
High Density Residential
Water
Industrial/Commercial

2009


BULACAN
RIZAL
MANILA BAY
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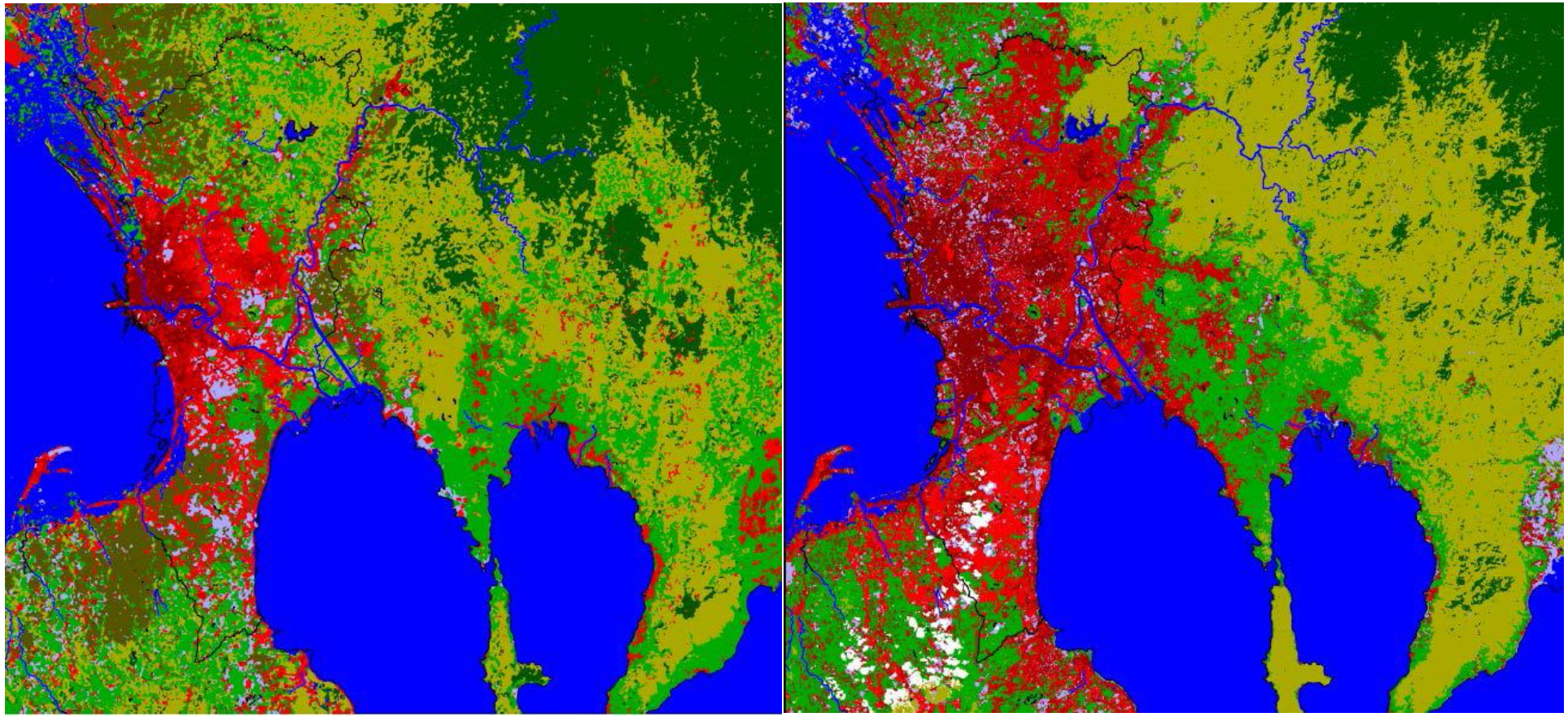
City/Municipal Boundary
Road
Forest
Shrubland
Grassland
Bare Soil/Agri
Low Density Residential
Medium Density Residential
High Density Residential
Water
Industrial/Commercial

Control experiment (1972)

Land cover change experiment (2009)



Forest
Shrubland
Grassland
Bare Soil
Low-Density Residential
High-Density Residential
Water
Industrial
No Data

Geomatics for Environment and Development, Manila Observatory

Landsat based land cover scenarios

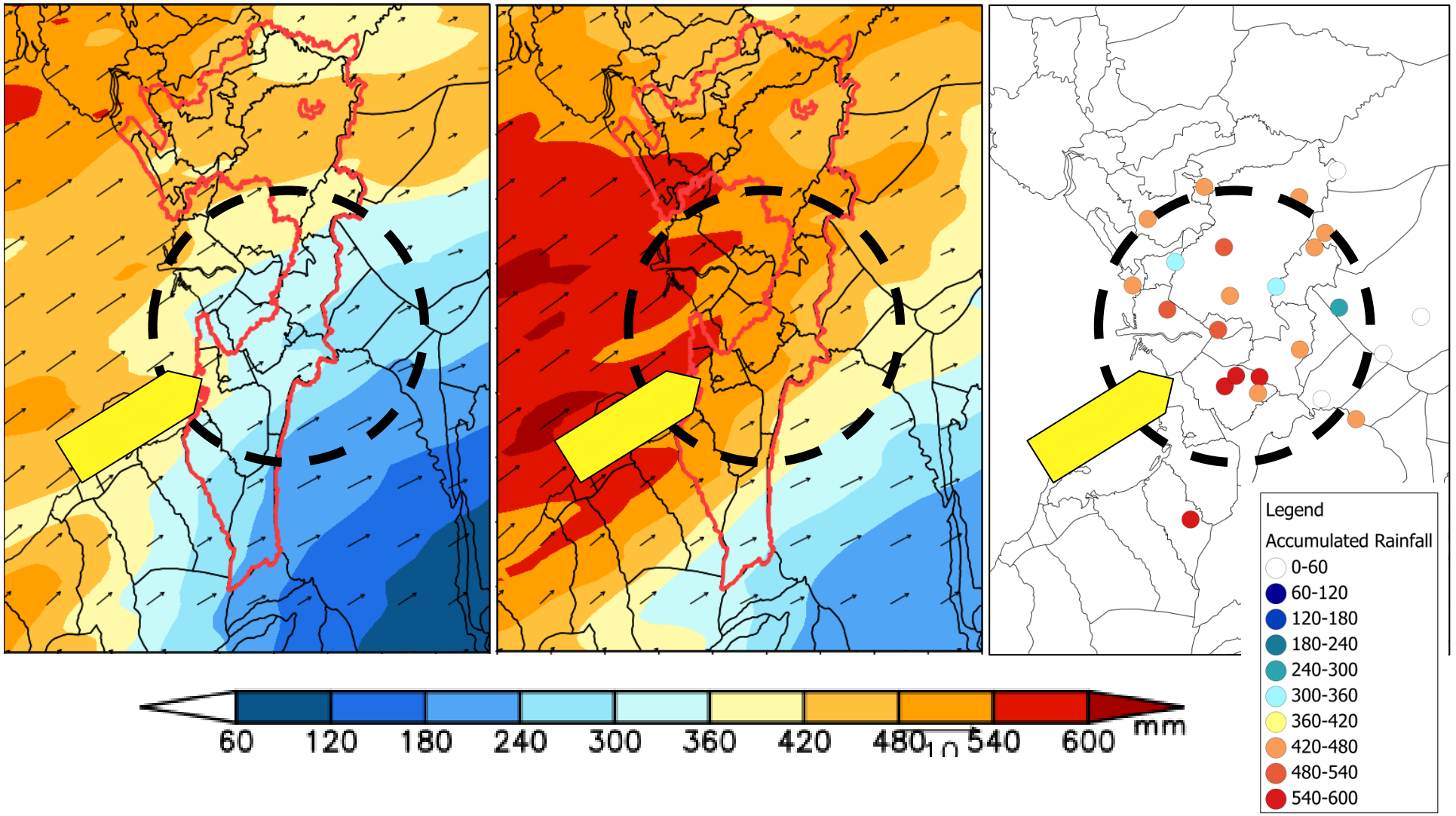
5-Day Accumulated Rainfall

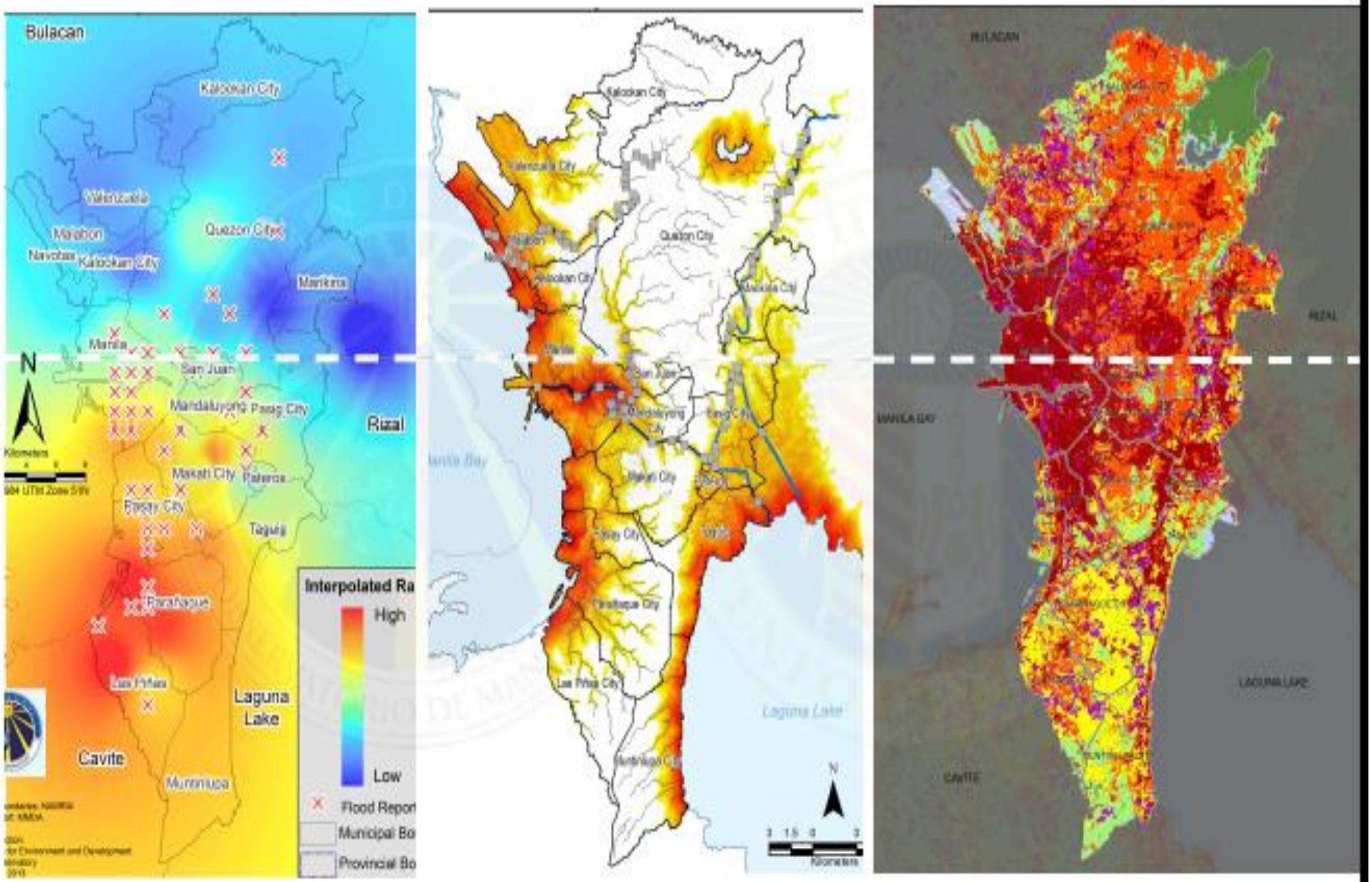
(17Aug – 22Aug 2013)

PAST

PRESENT

OBSERVED




Bulacan
Kalookan City
Valenzuela
Malabon
Navotas
Kalookan City
Quezon City
Marikina
Manila
San Juan
Mandaluyong
Pasig City
Rizal
Makati City
Pateros
Taguig
Parañaque
Las Piñas
Laguna Lake
Cavite
Muntinlupa
N
Kilometers
Interpolated Ra
High
Low
Flood Repor
Municipal Bo
Provincial Bo
Valenzuela City
Quezon City
Marikina City
Manila
San Juan
Mandaluyong City
Pasig City
Makati City
Taguig City
Parañaque City
Las Piñas City
Muntinlupa City
Laguna Lake
BULACAN
RIZAL
MANILA BAY
LAGUNA LAKE
CAVITE

Slide source: Dr. Fernando Siringan, UPMSI

Slide source: Dr. Fernando Siringan, UPMSI

Slide source: Dr. Fernando Siringan, UPMSI

10 new insights from climate science
Future Earth, 2018

Extreme weather events are now clearly attributable to climate change

Growing climate impacts show risks of critical tipping points

Every half degree matters: Large difference in impacts between 1.5°C and 2°C degrees of warming

New understanding of the acceleration of sea level rise and its future

Managing plants and soil: a prerequisite for meeting the Paris Agreement

Options to remove CO2 from the atmosphere are limited

Major socio-technical transformations needed to meet the 1.5°C target

Stronger policy measures would reduce climate risks

Transformation of food systems needed for global health and reduced greenhouse gas emissions

Benefits for global health by addressing climate change

Observed and Projected Temperature Anomaly in the Philippines

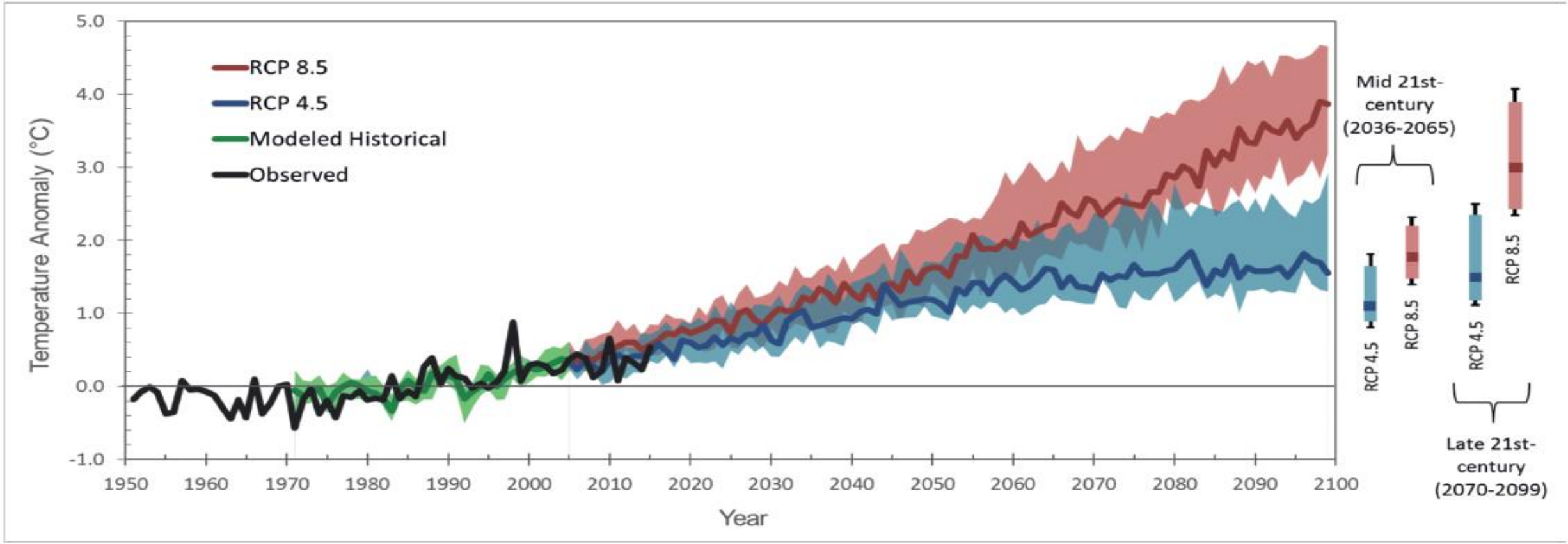


Figure 2. Time series of projected annual-mean temperature anomalies in the Philippines. Anomaly values were taken relative to the 1971–2000 baseline period. Shadings indicate the inter-model range. For comparison, the observed values from 1951 to 2015 are included (thick black line). The bars correspond to the 10th, 50th and 90th percentiles; while the whiskers correspond to the minimum and maximum projected temperature anomaly values by the mid- and end of the 21st century.

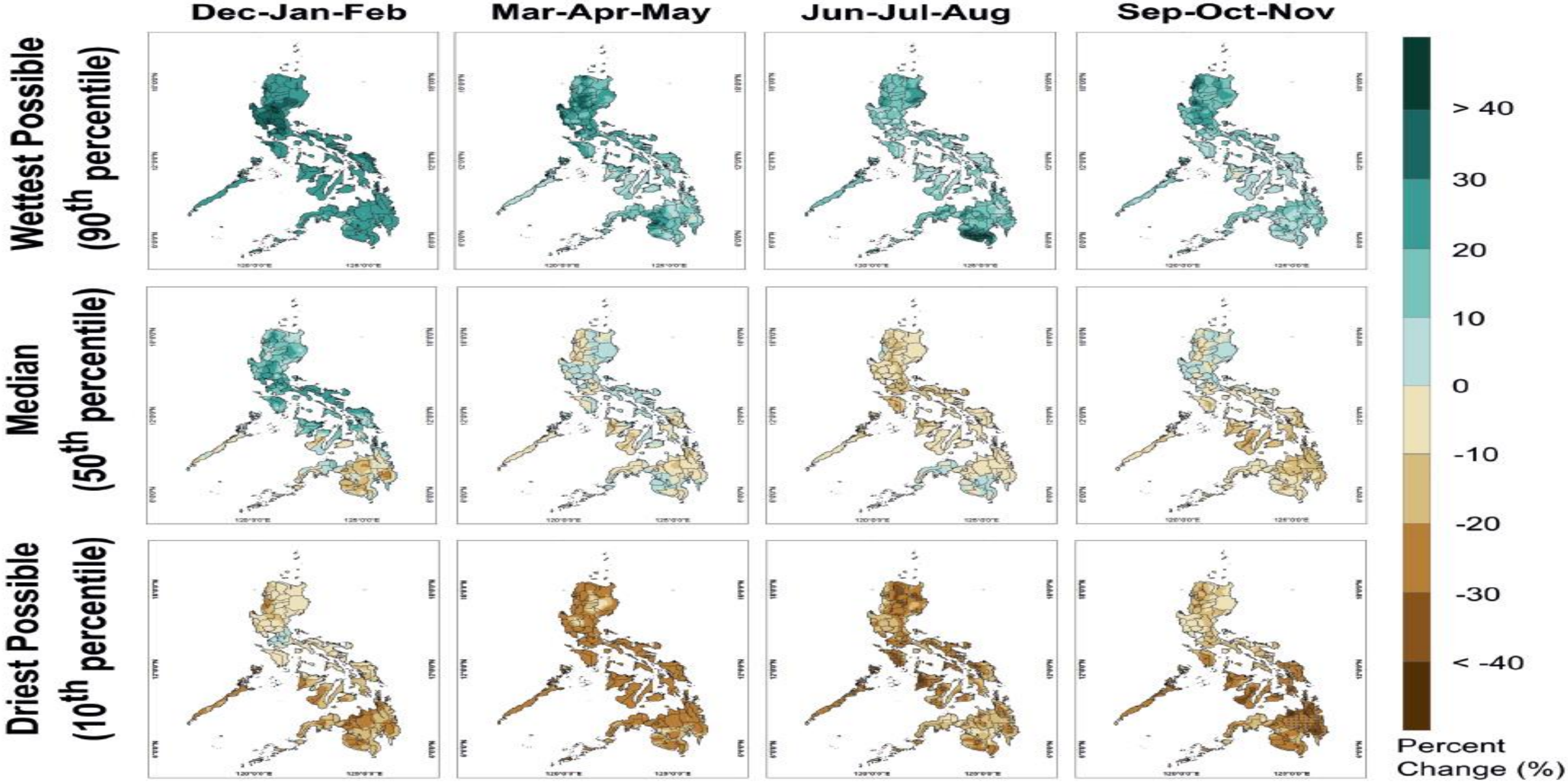


Figure 6. Projected change in seasonal total rainfall in the Philippines for the mid-21st century (2036–2065) relative to the baseline period of 1971–2000. The wettest possible change represents the 90th percentile of the projections, 50th percentile is the median or usual change, and 10th percentile is driest possible change; these were computed from the 12-member high emission scenario (RCP8.5) RCM ensemble. Dotted areas denote that the change beyond natural variability (i.e. ±1 standard deviation of the baseline period).

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

Figure 8. Projected changes in tropical cyclones affecting the Philippines by the mid-21st century assuming high emission scenario (RCP8.5). Black arrows indicate significant changes, grey arrows indicate insignificant changes, and a dash indicates no change. Taken from [5].

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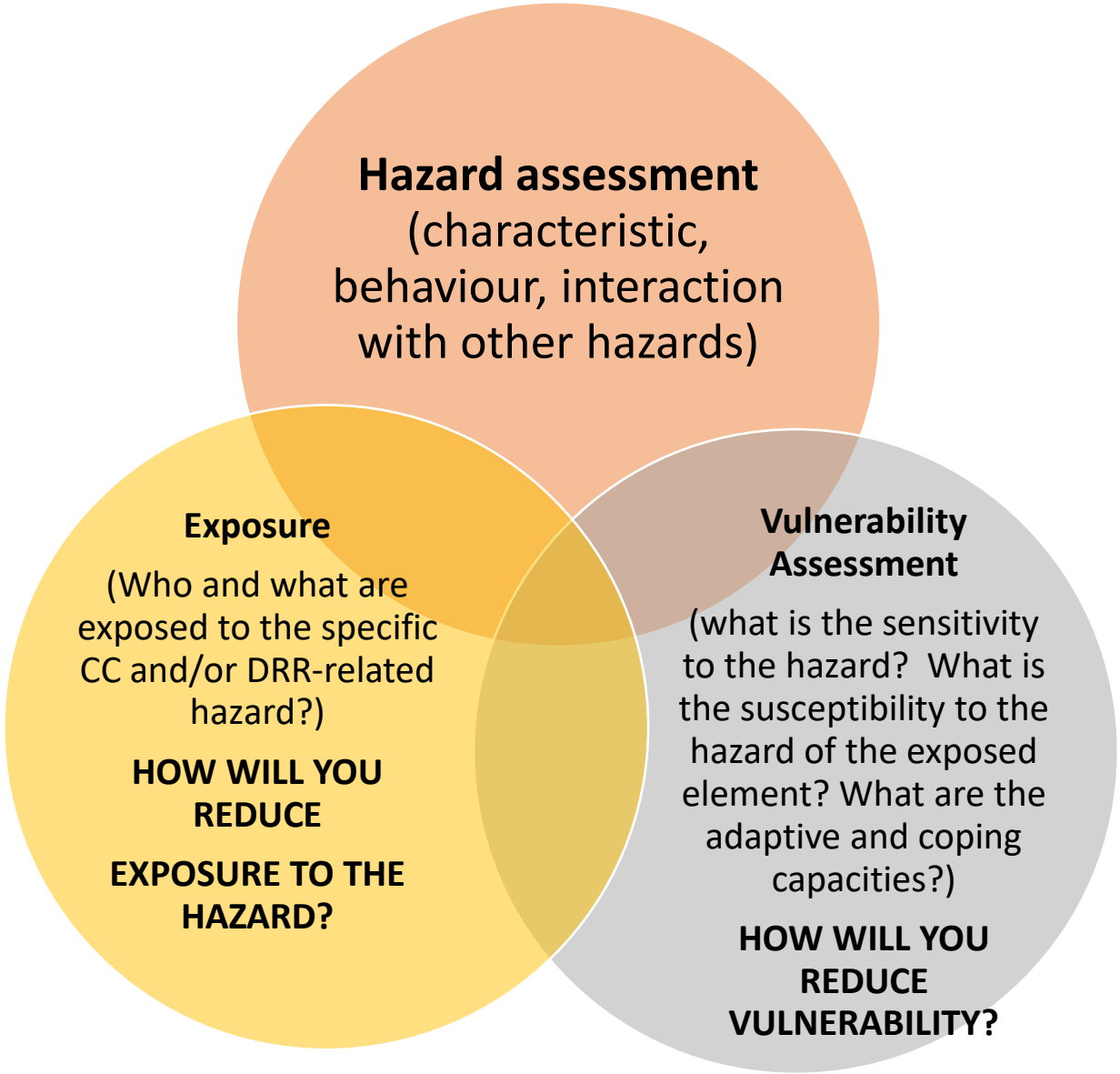
Benefits for global health by addressing climate change

Assessing Risks



Resilience

IPCC, SREX

- The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions.

UNISDR, 2017

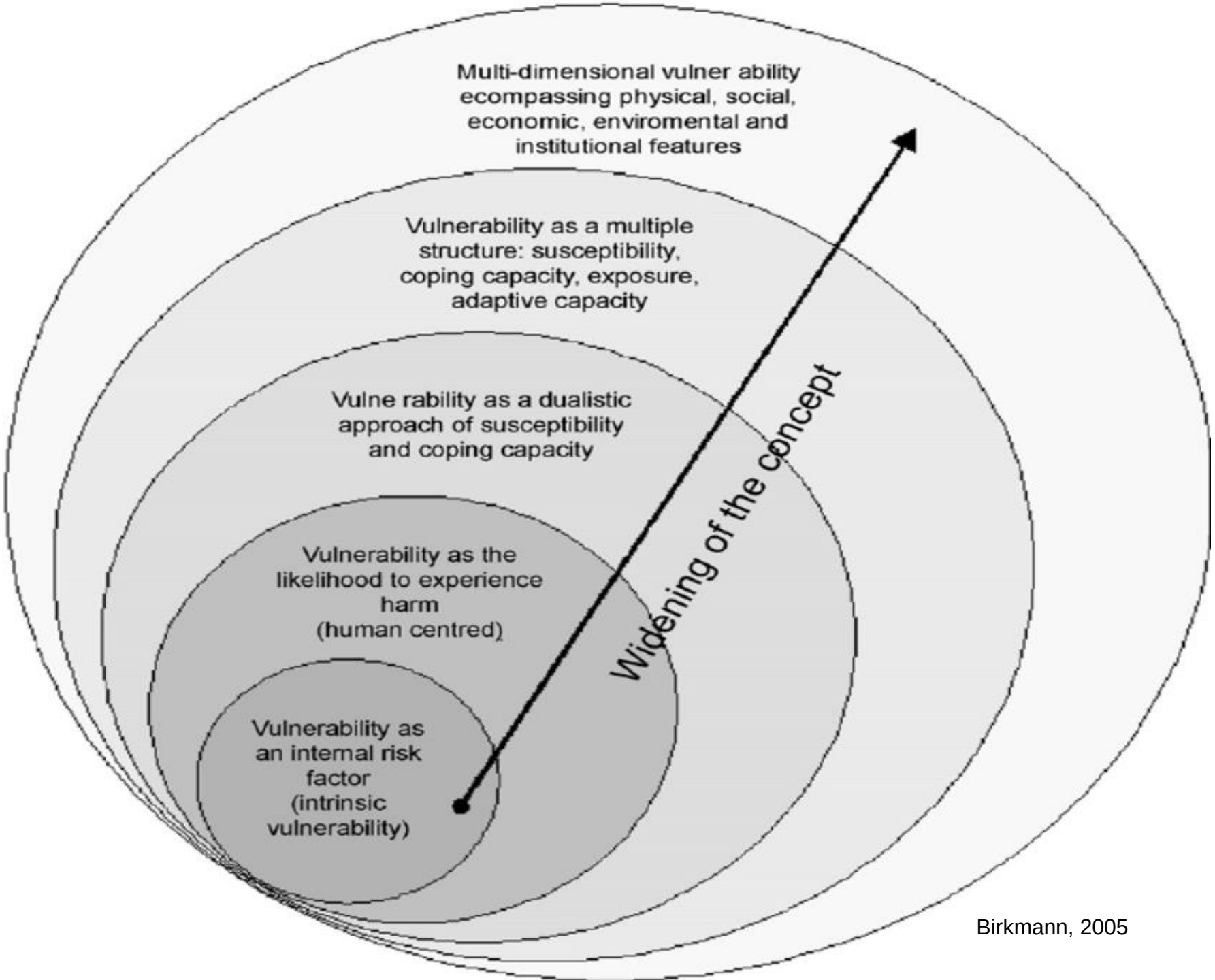
- The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management.

IPCC, AR5

- The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation. {WGII, III

Understanding exposure and vulnerabilities

actalliance



Birkmann, 2005

Photo: https://www.worldbank.org/en/news/feature/2016/11/15/a-new-plan-to-support-action-on-climate-change-in-the-arab-world

Meeting the challenge of Climate Change with Socio-Economic, Environment, Political Co-Benefits

Climate Resilient Development Pathways

- Strengthen SD and efforts to eradicate poverty; ambitious mitigation and adaptation
- Equity and social justice are core elements of the societal and systems transitions and transformations required

IPCC

https://news.stanford.edu/2016/04/13/scientists-suggest-appealing-human-psychology-create-solutions-climate-change/

Adaptation: synergies and trade-offs

Synergies from adapting to 1.5°C

- Reducing vulnerability of human and natural systems -> food, water, disaster risks, health, poverty, inequality, ecosystem services

- Trade-offs, if interventions poorly designed and implemented

Intensifying agriculture, expanding urban infrastructure - > greenhouse gas emissions, water use, social and gender inequality, undermine health and natural ecosystems

Photo: A woman gathers water from an Ikhttart irrigation system in the Tighfrt oasis (left). An herb plot planted by women in the Ferkla region. EMMA BRYCE/YALE E360

Suggested pathways

- Adaptation options that also mitigate emissions -> synergies and cost savings
- Increasing investment in physical and social infrastructure key enabling condition -> societal resilience, adaptive capacity

IPCC

https://ccafs.cgiar.org/blog/climate-change-food-security-and-refugee-crisis-connecting-dots-avoid-future-tragedy#.XTe1o-gzbIU

Mitigation: synergies and trade-offs

- Economies that are highly dependent on fossil fuels: Mitigation creates risks for sustainable development --- Diversified economy and energy sector
- Redistribution policies to protect the poor and vulnerable can resolve trade-offs for a range of SDGs
- Investment needs for such complementary policies are only a small fraction of the overall mitigation investments

IPCC

Mitigation: Enabling Conditions

- Strengthened multi-level governance and institutions
- Strengthened policy tools
- Technological innovation
- Changes in lifestyle and behaviour : Net-effect depends on pace, magnitude, portfolio, management of mitigation --- least trade-offs in pathways with **low energy demand, low material consumption, low-emissions diet**
- Transfer and mobilisation of finance

IPCC

https://blogs.worldbank.org/water/game-changing-water-solutions-middle-east-and-north-africa

Examining Dimensions of Resilient Housing

RESILIENT LOCAL GOVERNMENT SYSTEMS SCORECARD

VERSION 1.0

NATIONAL RESILIENCE COUNCIL

PREPARE

Leadership and Governance Competencies in Resilient Local Government Systems	Pillars of the Local Government Systems											
	HUMAN DEVELOPMENT			LOCAL ECONOMY			INFRASTRUCTURE			ENVIRONMENT		
	Health	Education	Social Protection	Livelihood	MSMEs	Large Businesses	Housing	Buildings	Lifelines	Ecosystem	Socio-ecosystem	Pollution Management and Resource Use
OWNERSHIP Personal vision for resilience Strategic and systems thinking for resiliency Problem-solving and decision-making for resiliency **CO-OWNERSHIP** Leads the internal stakeholders towards resiliency Leads external stakeholders towards resiliency **CO-CREATION** Innovate for resilience	Functional Local Health Board (LHB)	Functional Local School Board (LSB)	Functional Local Social Protection Team/SPT (province; city/ municipality; barangay levels)	Presence of data inventory on informal economy	Presence of data inventory on MSMEs	Tax incentives on DRR related investments based on CDRA to include new construction	CDRA-based inventory and classification of residential housing (including man-made hazards)	CDRA-based inventory and classification of public and private buildings	CDRA-based inventory and audit of assets (related to financial, logistics, transport, power, fuel, energy, gensets, water and sanitation, telcos, food, health)	Ecological characterization	Easy access to climate scenarios for hazard events	Comply with existing policies governing resource use and pollution management
	Presence of Disaster Risk Reduction and Management in Health (DRRM-H) Plan	Compliance of SDRRM Team with the CSSMT indicators related to Preparedness, Prevention and Mitigation	Establish DSWD Social Protection Programs	Livelihood opportunities assessment	Integrate science-based supply chain vulnerability assessment	Prioritize science-based public-private partnerships (PPP)/Joint projects	Network of accessible resilient evacuation centers and temporary shelters	Harmonize and comply with codes and standards (building code, fire code, etc.) for a preventive maintenance program for assets	CDRA-based audit of infrastructure (roads, bridges, seaports, airports)	Science-based risk assessment i.e. Climate and Disaster Risk Assessment (CDRA) (formal and ethnology-based) for locally managed and rehabilitated ecosystems	Participate in protection and rehabilitation of nationally/ locally managed ecosystems	
		Support compliance of higher education institutions with DRRM Requirements of CHED in the NSTP pertaining to Prepare DRRM Theme	Comply with Social Protection Requirements of Seal of Good Local Governance (SGLG)	Capability building on financial literacy, CDRA, etc.	Formulate Business Continuity Management (BCM)	Implement data management and recovery initiatives		Build an emergency plan	Early Warning Systems Continuity plans for the provision of critical services (related to financial, logistics, transport, power, fuel, energy, gensets, water and sanitation, telcos, food, health services, security, peace and order)		Participate in the process and implementation of the EIA and IEE	

ADAPT

Leadership and Governance Competencies in Resilient Local Government Systems	Pillars of the Local Government Systems											
	HUMAN DEVELOPMENT			LOCAL ECONOMY			INFRASTRUCTURE			ENVIRONMENT		
	Health	Education	Social Protection	Livelihood	MSMEs	Large Businesses	Housing	Buildings	Lifelines	Ecosystem	Socio-ecosystem	Pollution Management and Resource Use
OWNERSHIP Personal vision for resilience Strategic and systems thinking for resiliency Problem-solving and decision-making for resiliency	Functional Local Health Board (LHB)	LGU-managed adaptive measures to complement adaptive strategies of SDRRM Plan (in relation to the Ensuring Education Continuity component of the Plan which touches on Thematic Areas 3) Response, and 4) Rehabilitation and Recovery)	LGU-managed SP Program through the SPTeam on promotive interventions in the context of DSWD 4 core social protection programs and responses: labor market interventions, social insurance, social welfare and social safety nets	Implement Business Registry and Business Permit Licensing systems	MSME database via external Hard Drives (HD)	Risk sensitive and science-based Infrastructure investments aligned with local and national plans	Retrofit and rebuild houses to be more resilient	Presence of enforced guidelines on the redesign, retrofitting of infrastructure enforced	Retrofit and upgrade disaster resilient facilities	Institutionalize resiliency leadership	Incorporate rapid and slow onset natural & human-induced risk considerations in local sectoral and development plans	Regulate resource use and pollution
CO-OWNERSHIP Leads the internal stakeholders towards resiliency Leads external stakeholders towards resiliency	DRRM-H Plan has ordinances/ policies/ protocols and funds for its Adaptation Strategies (pertains to 3rd Thematic Area of Response and 4th Thematic Area of Rehabilitation and Recovery)	Support compliance of SDRRM Team with the CSSMT indicators pertaining to response and adaptation	Comply with Accessibility Law in evacuation centers and temporary shelters and related SGLG requirements	Facilitate access to sources of funds (financial and livelihood assistance or risk transfer programming)	Establish disaster recovery funds and risk transfer tools	Institutionalize pre-agreements among large businesses, NGOs, and LGUs	Design and implement housing alternatives and innovative solutions for informal and formal exposed and vulnerable sectors (i.e, in-city relocation with inclusive mobility)	Rehabilitate, retrofit and strengthen buildings and structures based on assessment	Formalize pre-agreements with service providers	Risk-sensitive investment in ecosystem well-being	Enhance organizational capacities to protect socio-ecological systems	
CO-CREATION Innovate for resilience		Support compliance of higher education institutions with DRRM Requirements of CHED in the NSTP pertaining to Adapt DRRM theme	Comply with GAD requirements of SGLG	Transfer knowledge on science-based hydro-meteorological, geo-morphological risk mapping	Mandatory review of BCM	Integrate data back-up through data servers	Site acquisition and preparation for resettlement and relocation	Formalize pre-agreements/ protocols with various sectors	Coordinate continuity plans for immediate and inclusive access to critical services		Utilize climate funding for mitigation and adaptation in the AIP	

TRANSFORM

Leadership and Governance Competencies in Resilient Local Government Systems	Pillars of the Local Government Systems											
	HUMAN DEVELOPMENT			LOCAL ECONOMY			INFRASTRUCTURE			ENVIRONMENT		
	Health	Education	Social Protection	Livelihood	MSMEs	Large Businesses	Housing	Buildings	Lifelines	Ecosystem	Socio-ecosystem	Pollution Management and Resource Use
OWNERSHIP Personal vision for resilience Strategic and systems thinking for resiliency Problem-solving and decision-making for resiliency	Functional LHB with established partnerships for transformative (beyond Thematic area 4/Recovery and Rehabilitation with pursuit of change in systems, structures and bouncing forward rather than just back) strategies of DRRM-H Plan	LGU-managed transformative measures to complement transformative (beyond Thematic Area 4/Recovery and Rehabilitation with pursuit of change in systems, structures and bouncing forward rather than just back) strategies of SDRRM Plan	LGU-managed SP Program through the SPTeam on transformative interventions in the context of 3 of the 4 DSWD defined core social protection programs and responses: Labor Market Interventions, Social Insurance and Social Welfare	Operational One Stop Shop for social services delivery	Database management investment in infrastructure or i-cloud technology	Invest more in disaster resilient infrastructure with insurance	Comprehensive Insurance Coverage	Enforce risk sensitive and harmonized codes and standards (fire, building, subdivision code and zoning, and use, and environmental standards or other relevant regulations).	Localize strategic network of services (transport, water, ICT, energy) with the supporting social infrastructure	Guarantee ecosystem health through the deputation of the LGUs on the enforcement of environmental laws subject to the guidance of existing national policies	Formulate and implement localized science based strategies addressing ecosystem vulnerabilities for the NDC	Provide rehabilitation program for degraded ecosystems
CO-OWNERSHIP Leads the internal stakeholders towards resiliency Leads external stakeholders towards resiliency	Institutionalize operations of Resilient Service Delivery Network (SDN)	Support compliance of SDRRM Team with CSSMT indicators pertaining to recovery, rehabilitation and transformation		Transition from informal to formal economy	Retrofit existing MSMEs infrastructure with insurance	Promote safety compliant and risk-sensitive ease of doing business	Provide access to safe and affordable housing (e.g. usufruct vs ownership) with livelihood and adequate facilities	Institutionalize public-private partnerships	Risk-sensitive investment in the systematic maintenance and upgrade of critical services	Sustain ecosystem service delivery through the stablishment of integrated and co-beneficial protected ecosystem network	Promote investments and partnerships in adaptation and low-carbon development with the private sector and other stakeholders	Enact an energy efficient policy in the local government
CO-CREATION Innovate for resilience		Support compliance of higher education institutions with DRRM Requirements of CHED in the NSTP pertaining to Transform DRRM Theme		Available LGU Database Management System	Institutionalize partnerships among MSMEs, LGUs, and GFIs	24/7 data servers operational	Permanent resettlement and relocation	Invest in risk-sensitive insurance, preventive maintenance and upgrade of critical services	Interoperability of technological systems			
							Invest in risk-sensitive redevelopment or renewal plan	Risk-sensitive renewal plan	Risk-sensitive renewal plan			

Addressing dimensions of vulnerability for resilience in housing: the Case of COPE-Bicol, Tao Pilipinas

- Whose concept of resilience should prevail? -- participatory design process amid climate and other-related hazards
- Addressing inequality for decision-making: Restoring the power to decide and innovate
- The value of social capital: does the house facilitate empowering social relations --- housing is beyond structure

IFRC: URBAN RESILIENCE

- https://www.climatecentre.org/downloads/modules/training_downloads/2e%20IFRC%20Building%20urban%20resilience-%20A%20guide%20for%20Red%20Cross%20and%20Red%20Crescent%20engagement%20and%20contribution.pdf