Climatology in Support of Climate Risk Management

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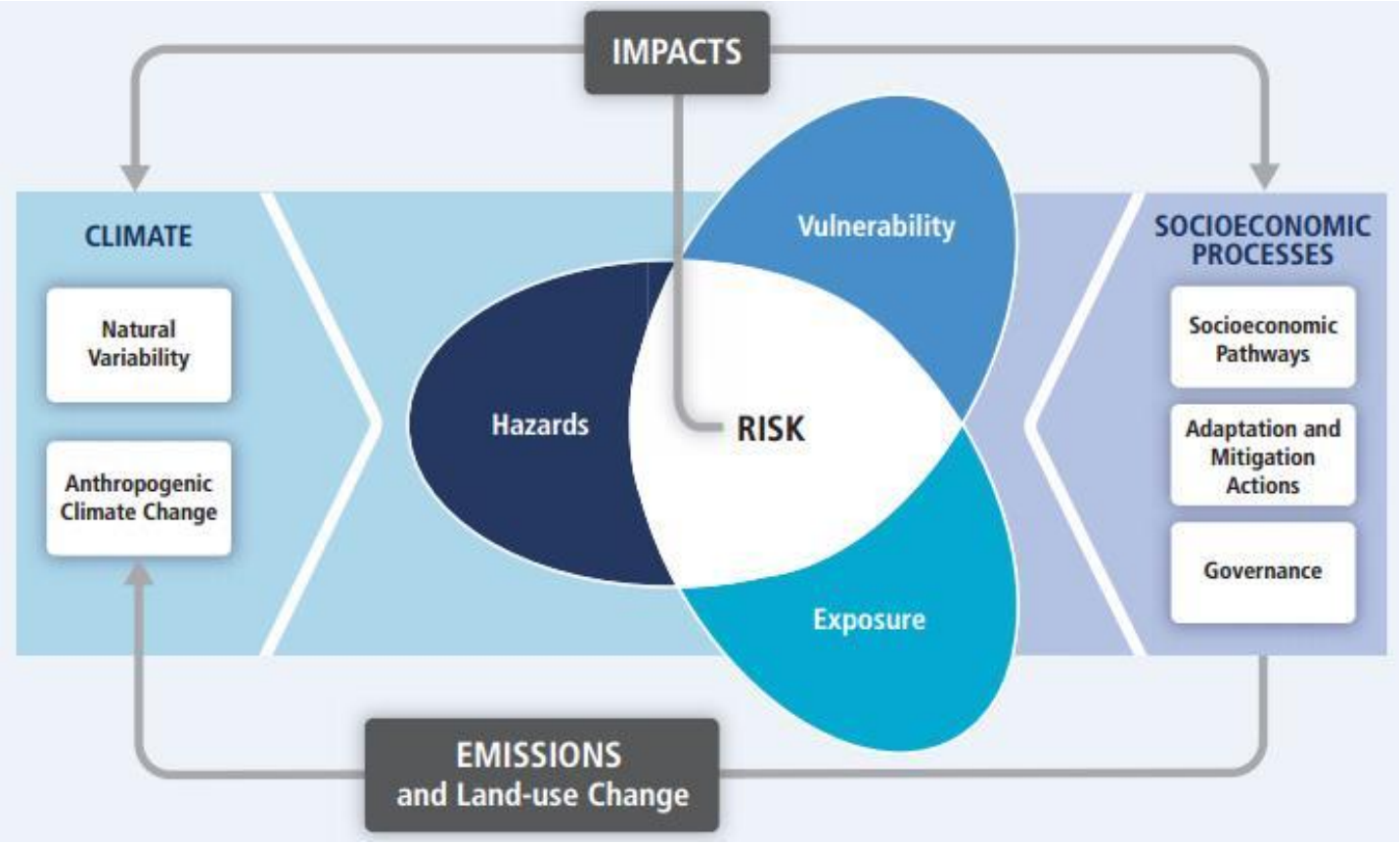
Climatology

- Study and analysis of the working of the climate system
- Interested in the boundary conditions that control weather systems and climate events (hydrosphere, cryosphere, biosphere, land surface)
- Climate data collection
- Focus on physical characteristics and causes of climate events at a range of spatial and temporal scales
- Increasingly concerned with impacts of climate events, especially the pathways to impact
- Goal is to produce ‘actionable knowledge’ or ‘useable science’, especially in relation to a range of climate-related risks

IPCC Framing of Risk



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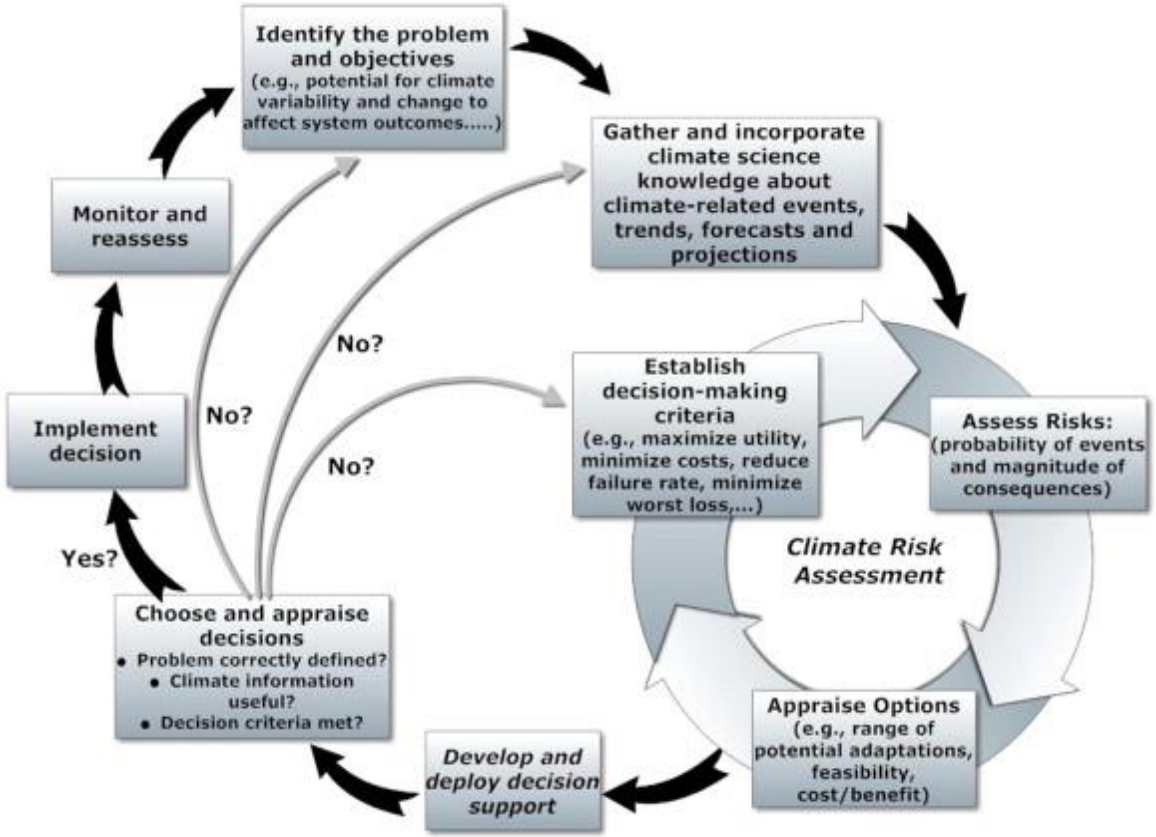
Climate Risk Management (CRM) Defined

Travis and Bates (2014): CRM “a process for incorporating knowledge and information about climate-related events, trends, forecasts and projections, into decision making to increase or maintain benefits and reduce potential harm or losses. It is a multidisciplinary activity that calls for an integrated consideration of socioeconomic and environmental issues”

Travis WR and Bates B (2014) What is climate risk management? Climate Risk Management 1: 1-4.

Climate Risk Planning Cycle: Climatology Input at all Stages



Generic Steps in Risk Management

1. Identify, characterize, and assess threats
2. Assess the vulnerability of critical assets to specific threats
3. Determine the risk (i.e. the expected consequences of specific types of attacks on specific assets)
4. Identify ways to reduce those risks
5. Prioritize risk reduction measures based on a strategy

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Source: Travis WR and Bates B (2014) What is climate risk management? Climate Risk Management 1: 1-4.

CRM: Successful Elements

- Demand driven and problem focused approach
- An effective policy framework
- High quality climate data and information
- Appropriate climate services – capacity and capability
- Effective communication between stakeholder groups
- User-friendly decision-support tools and methods that show how climate variables will affect specific outcomes (e.g. crop productivity, health, energy, water)
- Sufficient resources to allow decision makers to use information effectively.
- In turn, these require
  - Full stakeholder participation
  - Communication channels and links between stakeholder groups
  - Functioning media aware of, and able to perform, their role
  - Capacity building at different levels, including extension/outreach services
  - Responsive and integrated climate research

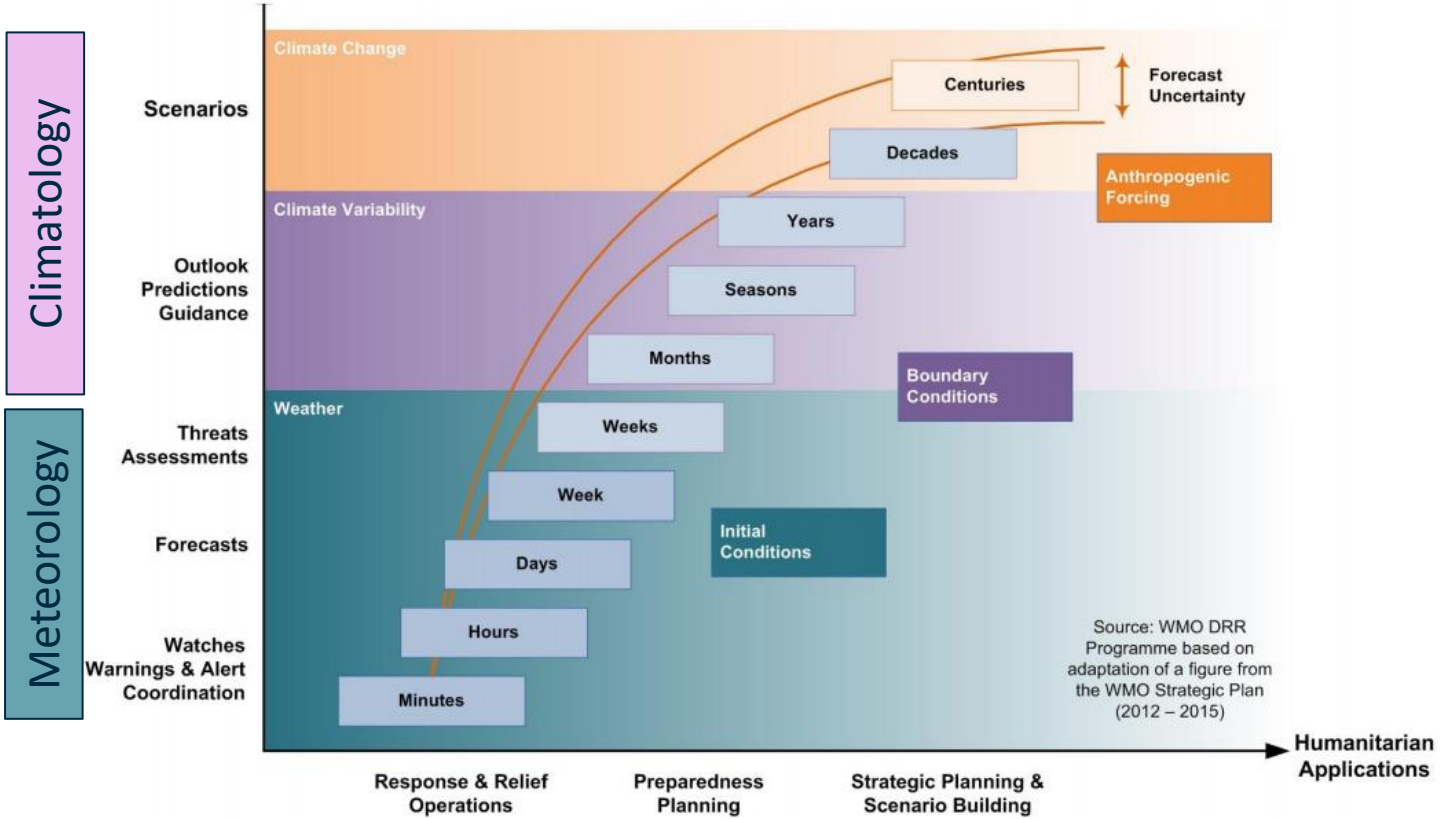
Some Lessons From CRM Projects

- Climate information is most effective when integrated into decision-making frameworks
- Reducing climate-related risks requires multi-level stakeholder coordination and communication
- Climate information must be credible if it is to be used in decision making
- Reinforcing and sustaining climate observation networks is essential if the full potential of climate information for decision making is to be realized
- Information and communications technologies, the media, and extension services are vital components of improved information systems
- Economic analysis of the value of climate services is lacking

Climate Information for CRM

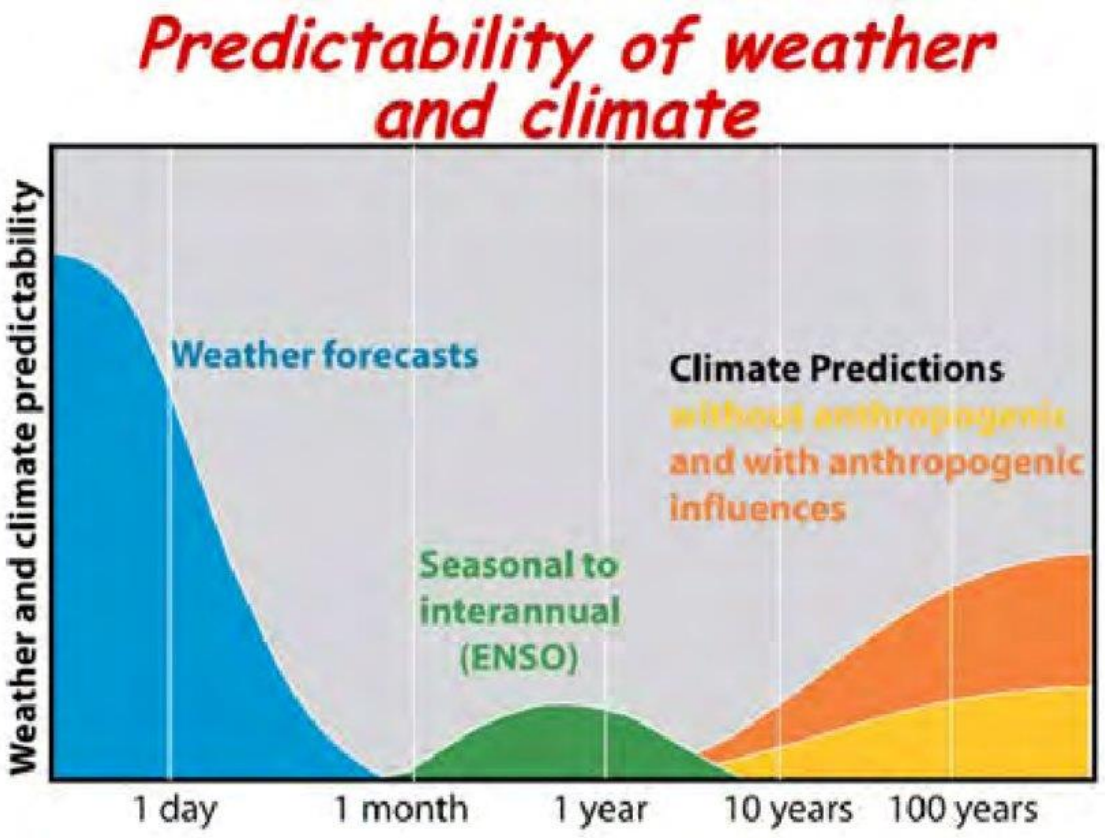
- Historical data:
  - climate statistics
  - analyse trends
  - set a context for current data,
  - quantification of variability and extremes
  - analysis of modes of variability
- Real-time data: aid short-term predictions of the consequences of specific weather events
  - heavy rainfall → flooding
  - blocking → heatwaves
- Climate forecasts/predictions:
  - long-term weather forecasts,
  - sub-seasonal to seasonal forecasts (S2S),
  - decadal (10–30 year)
  - long-term climate change projections

Climate Information Time Scales



Source: https://www.newsecuritybeat.org/2015/10/climate-data-critical-fragile-conflict-affected-states-heres/

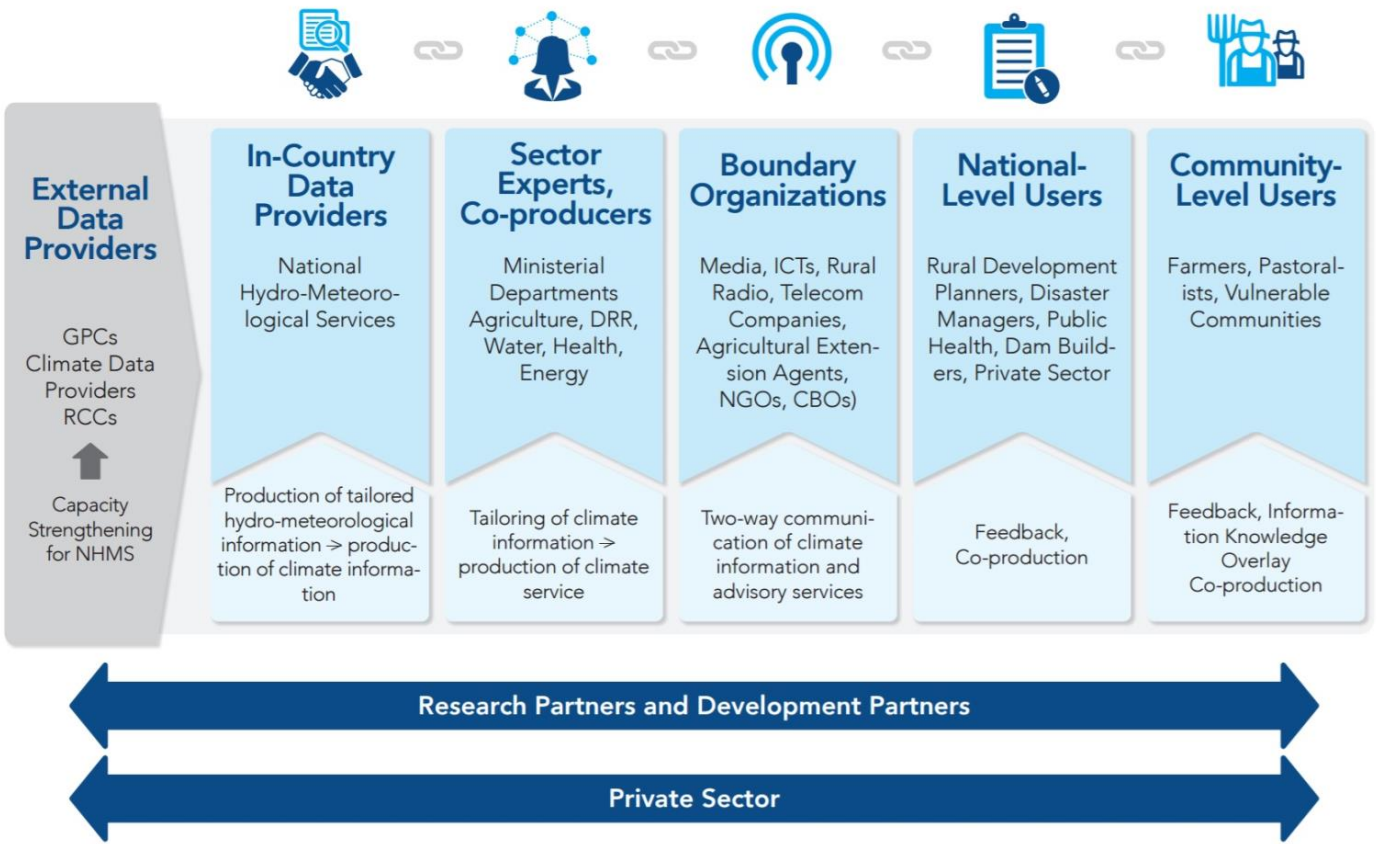
Credibility



https://www.researchgate.net/figure/Predictability-of-weather-and-climate-models-high-on-the-short-time-scales-and-in-the_fig1_51992235

Climate Information is Great

Value Chain Linking Climate Knowledge to Action



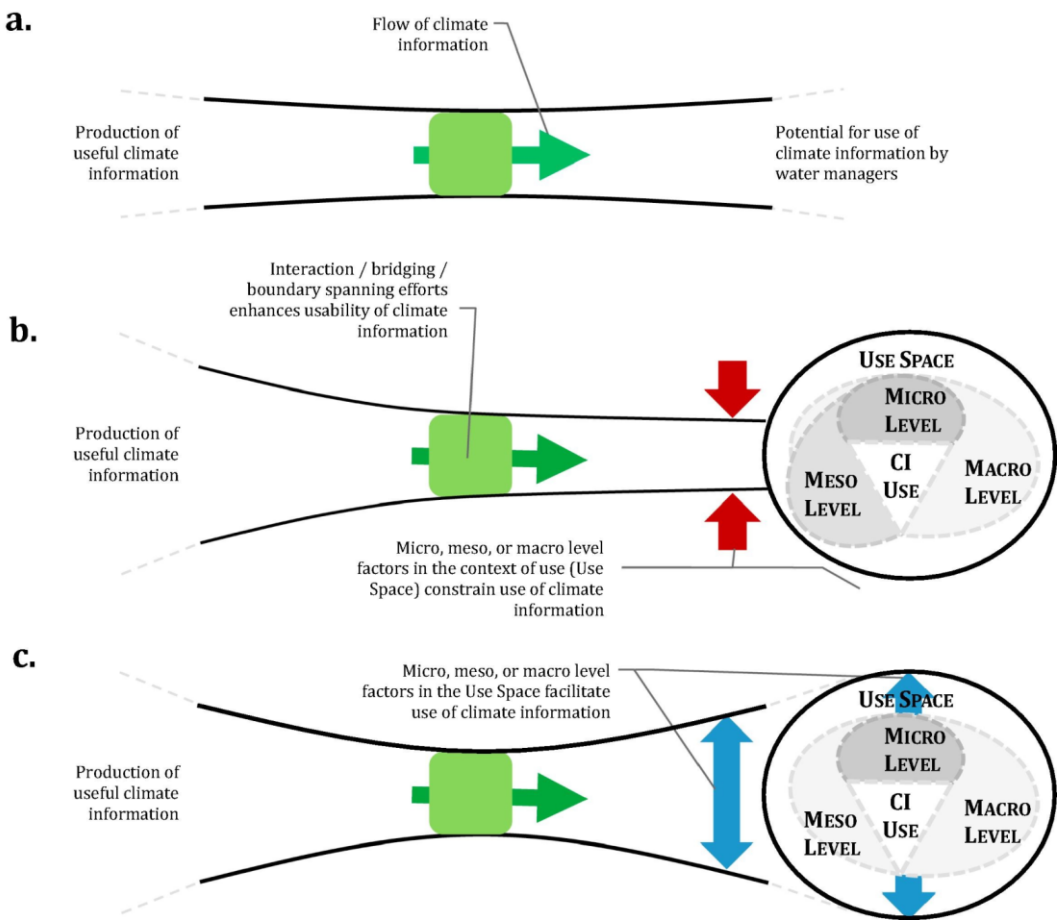
Source: https://www.wmo.int/gfcs/saly-coordination-workshop

Drivers of and barriers to climate information (CI) use at the micro to macro levels

	Micro level factors	Meso level factors	Macro level factors
Drivers of CI use	Feeling at risk or experiencing climate-related risks Valuing research and scientific collaborations. Having CI related educational background.· Perceived responsibility. More recently employed and working on the front lines	In the public eye and accountable. Organizational leadership and a culture of innovation.· A focus on long-term planning.· Having a flexible decision making process· Believing climate issue (e.g. heat) is a problem and a priority for the organization.· Larger risk management organizations with technical and human capacity	State elected leaders' direct or indirect actions· Local elected boards and council members supportive actions·· National level policy (e.g. HHAPs, building codes etc).
Barriers to CI use	Scepticism or politicization of climate-related risks. Lack of perceived responsibility. Longer tenure employee working higher up in the organizational hierarchy or only working part-time	Not in the public eye or not accountable More conservative organization with measured approach to innovation A focus on long-term planning that creates path dependency. Inflexible decision making process Believing climate issue is not a priority Smaller risk management organizations without sufficient technical and human capacity·	State elected leaders' direct or indirect actions· Local elected boards and council members unsupportive Politicization of climate issue Little support of/progress with climate research informed policy negotiations

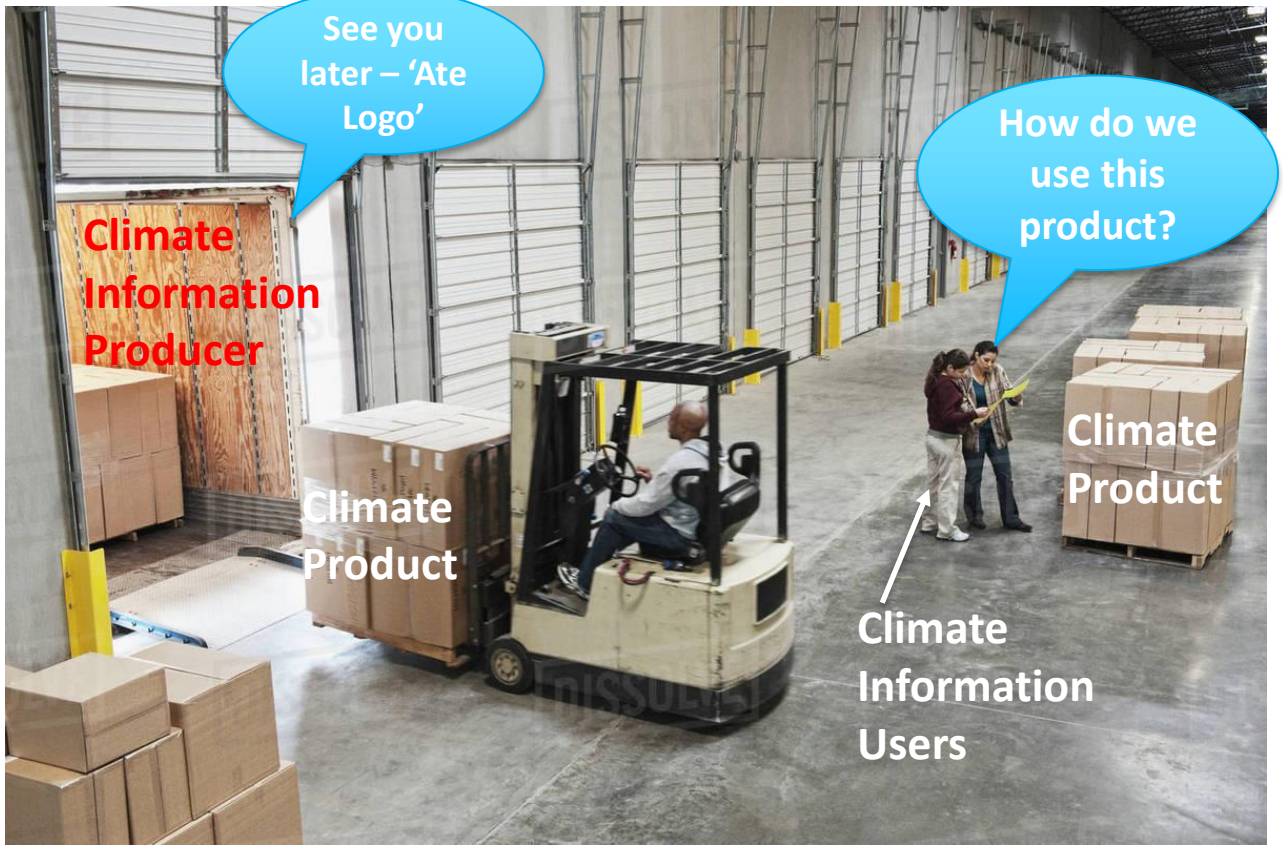
Source (modified from) : Flagg and Kirchoff (2018) Climate Risk Management, Volume 20, 2018, Pages 1-10

A conceptual model for bridging the knowledge-action gap



Source: Flagg and Kirchoff (2018) Climate Risk Management, Volume 20, 2018, Pages 1-10

Provision of Climate Information – Avoid the 'Loading Dock' Approach



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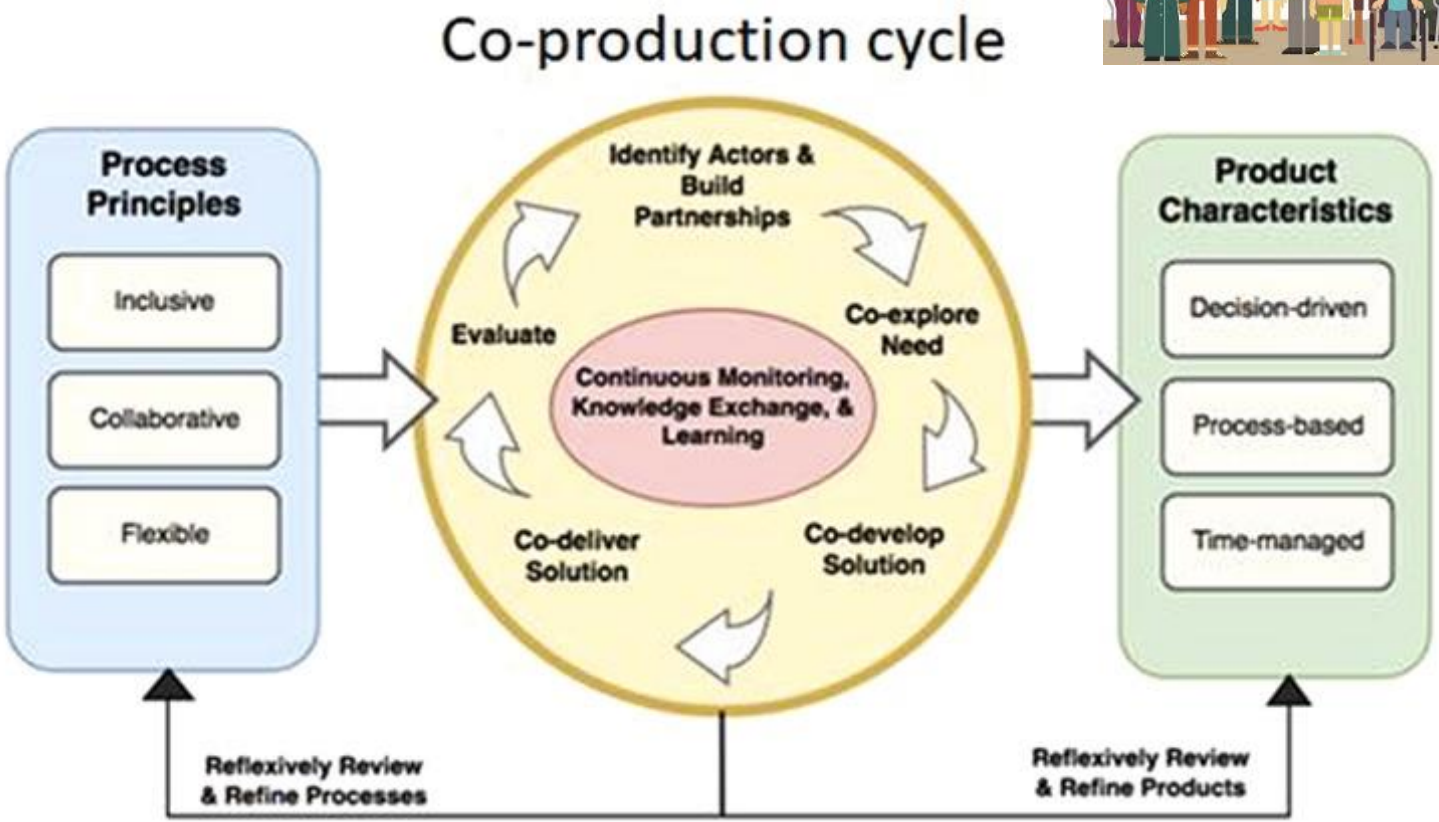
A Co-Production Approach



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Source: https://futureclimateafrica.org/resource/what-can-climate-services-learn-from-theory-and-practice-of-co-production/

Climate Information for Risk Management

ENSO and Health in South Pacific Island Countries: The Case of Diarrhoea

(exploratory study of potential use of climate information)

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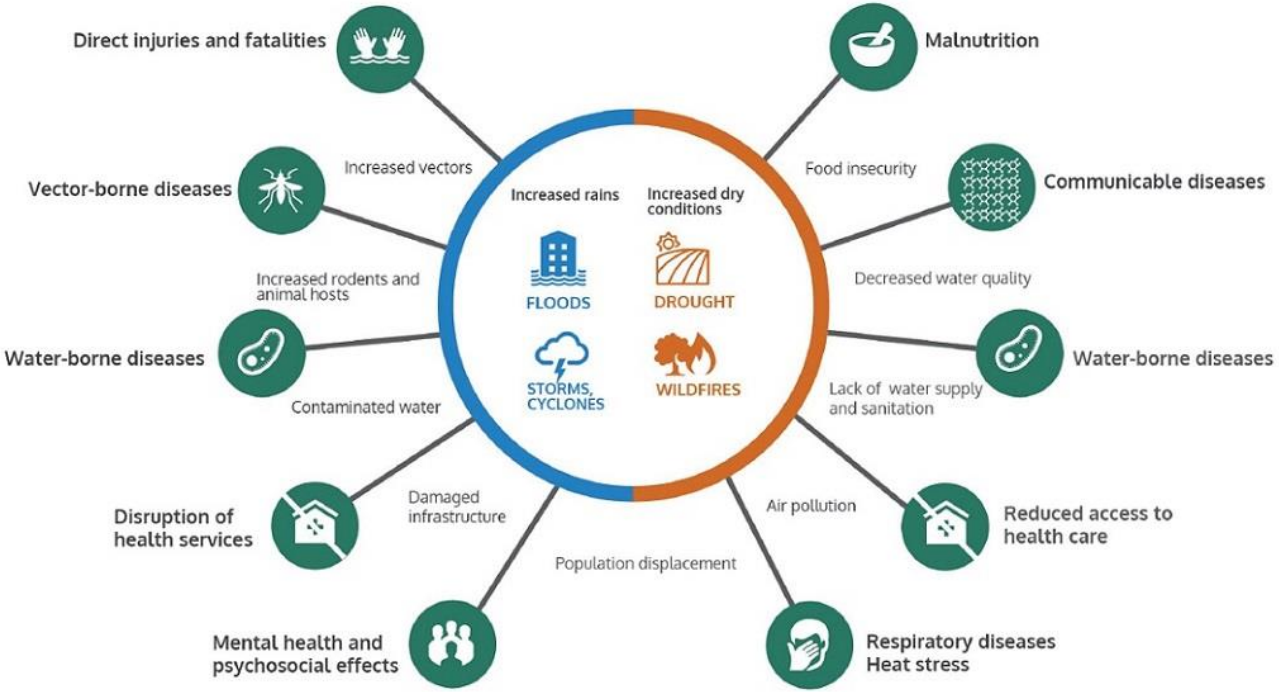
HEIGHTENED EL NIÑO-RELATED HEALTH RISKS



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http://www.who.int/hac/crises/el-nino/22january2015/en/

ENSO and Health in Pacific Island Countries (PIC) 2015-2016

- WHO reported in January 2016 extreme drought and acute water shortages were affecting 4.7 million people in the south west Pacific
- Impacts on food availability and water quantity and quality in Vanuatu, Fiji, Solomon Islands, Samoa, and Tonga
- WHO posited that diarrhoeal disease is likely to increase due to the scarcity of potable water compounded by poor water infrastructure.
- **This formed the motivation for this exploratory study**

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Conceptual Links Between Climate and Diarrhoea

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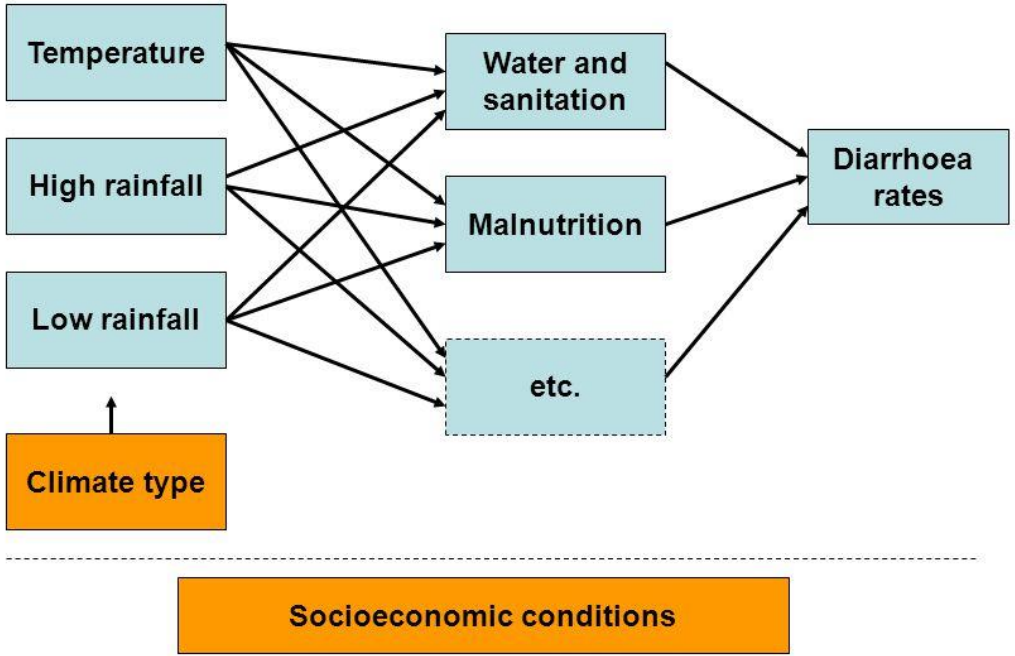
Diarrhoea and average weather



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Source: http://slideplayer.com/slide/4806022/ S Lloyd LSHTM

Data and Methods

Climate data

- Rainfall and temperature fields extracted from ERA-Interim reanalysis (http://www.ecmwf.int/en/research/climate-reanalysis/era-interim)
- El Nino multivariate index from NOAA (https://www.esrl.noaa.gov/psd/enso/mei/)

Health Data

Weekly surveillance data from Pacific Syndromic Surveillance System (PSSS) (2010 – 2016)

PSSS reports fours syndromes: acute fever and rash (AFR), influenza-like illness(ILI), diarrhoea and prolonged fever (PR)

Data Processing and Analysis

All climate and health data converted to monthly values with monthly standardised departures calculated

Correlation analysis between climate and health variables

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Study Countries

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PSSS – Weekly Report for Four Syndromes

Pacific Syndromic Surveillance -- weekly report

Year: 2016 Week: 18 ending on 8 May 2016

Country / Area	Date of report	Number of sites reporting	Acute fever and rash Sudden onset of fever with acute nonblistering rash	Diarrhoea 3 or more loose or watery stools in 24 hrs	Influenza-like illness Sudden onset of fever, plus cough and/or sore throat	Prolonged fever Any fever lasting 3 days or longer
American Samoa	11 May 2016	1	2	14	313	4
Cook Islands	11 May 2016	13	0	4	3	0
Federated States of Micronesia	12 May 2016	3	0	45	215	2
Fiji	11 May 2016	10	33	286	409	31
French Polynesia	12 May 2016	12	4	22	16	4
Guam	10 May 2016	1		0	3	
Kiribati	11 May 2016	3	2	95	367	40
Marshall Islands	12 May 2016	2	1	4	19	1
Nauru						
New Caledonia	10 May 2016	1		5	21	
New Zealand	12 May 2016	100				
Niue	12 May 2016	1	0	6	11	0
Northern Mariana Islands	12 May 2016	7	0	1	26	0
Palau						
Papua New Guinea						
Pitcairn Islands						
Samoa						
Solomon Islands	12 May 2016	8	1	128	194	42
Tokelau	12 May 2016	2	0	0	3	0
Tonga						
Tuvalu						
Vanuatu	11 May 2016	10	1	130	191	7
Wallis & Futuna						

Countries are asked to email their weekly reports to **surveillance.sp@wpro.who.int**

A red underlined entry indicates that the number of cases is above the threshold of 90% of historical values.

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2015-16 ENSO in Context

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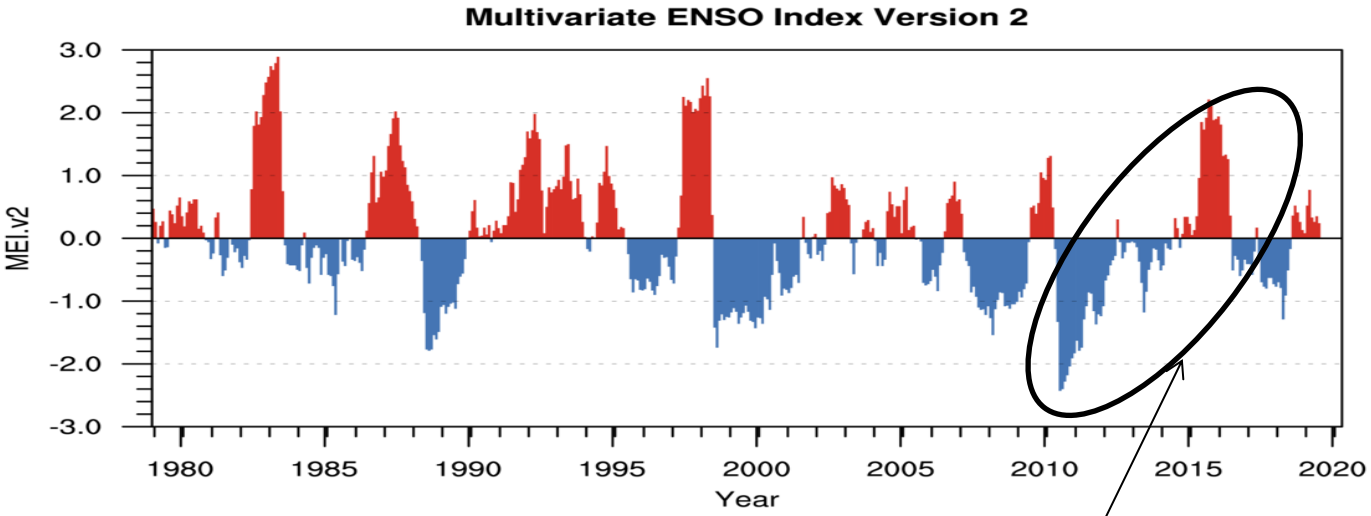
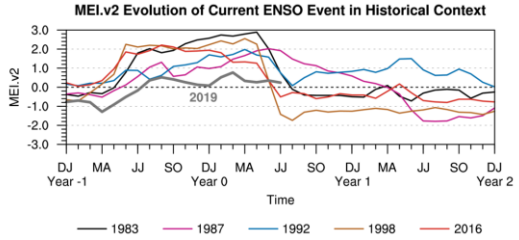
Multivariate ENSO Index (MEI) 1950 - 2019

Multivariate ENSO Index (MEI) composed of six variables are: sea-level pressure (P), zonal (U) and meridional (V) components of the surface wind, sea surface temperature (S), surface air temperature (A), and total cloudiness fraction





Period of Analysis
2010 - 2016

Source: https://www.esrl.noaa.gov/psd/enso/mei/

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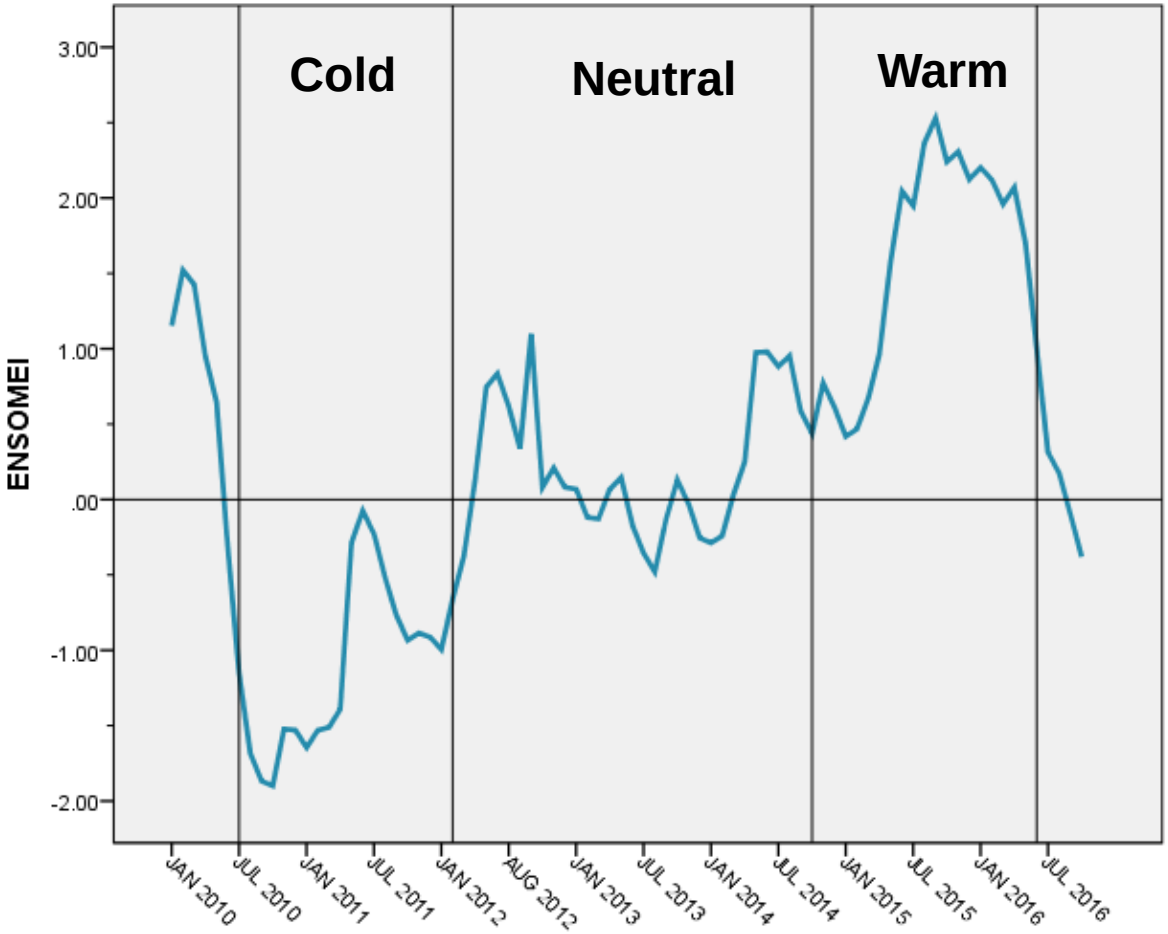
‘Cold’ and ‘Warm’ Episodes 2010 - 2016



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2015-16 ENSO Impacts on Rainfall

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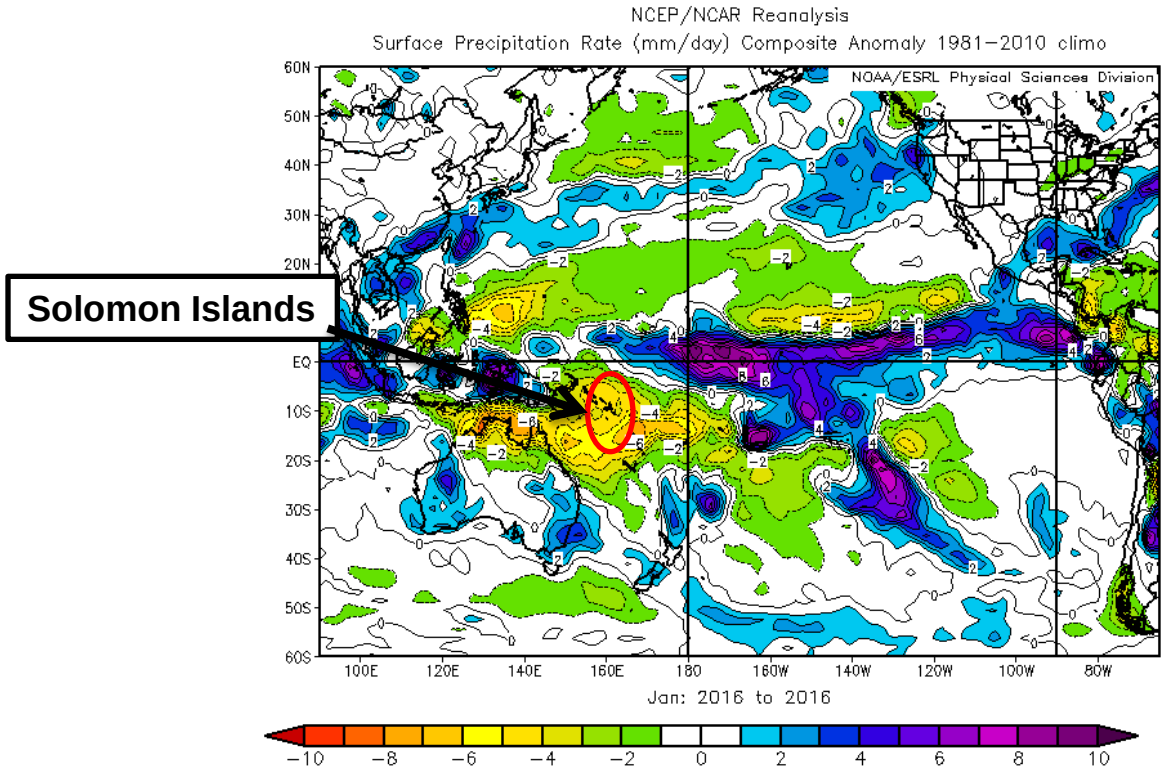
January 2016 Precipitation Rate Anomalies (mm/day) based on 1981 – 2010 Climatology



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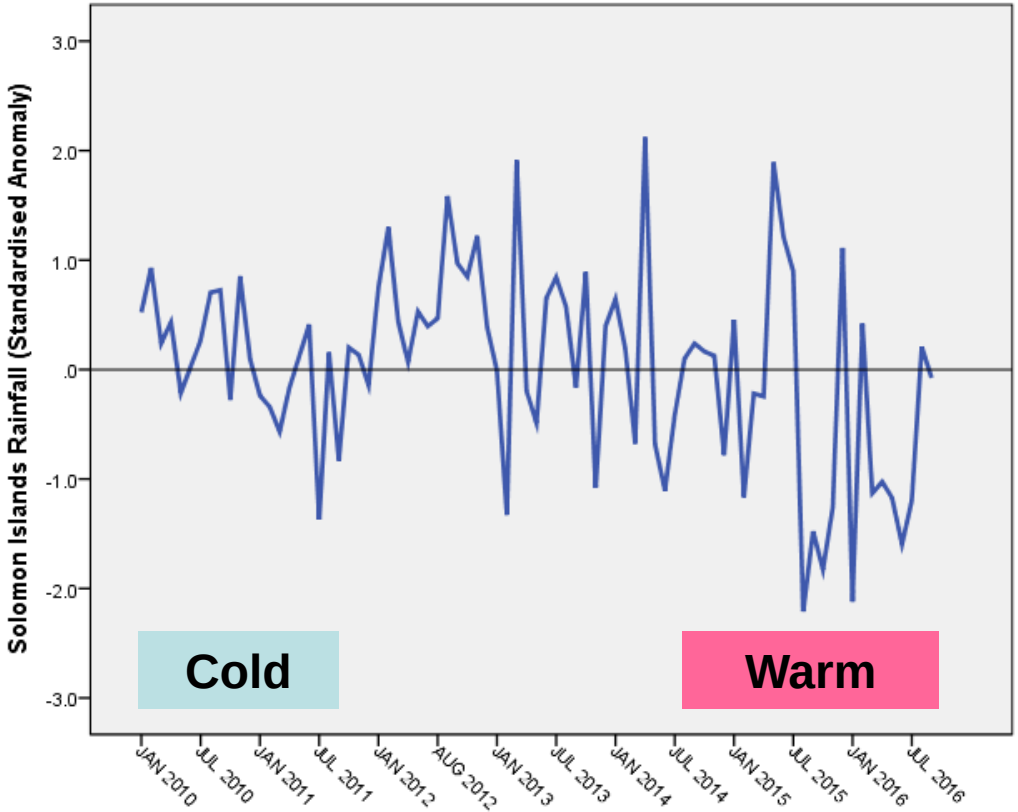
Source: 20th Century Reanalysis V2 data provided by the NOAA/OAR/ESRL PSD, Boulder, Colorado, USA, from their Web site at http://www.esrl.noaa.gov/psd/

Solomon Islands Rainfall



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ENSO Rainfall Associations
Solomon Islands

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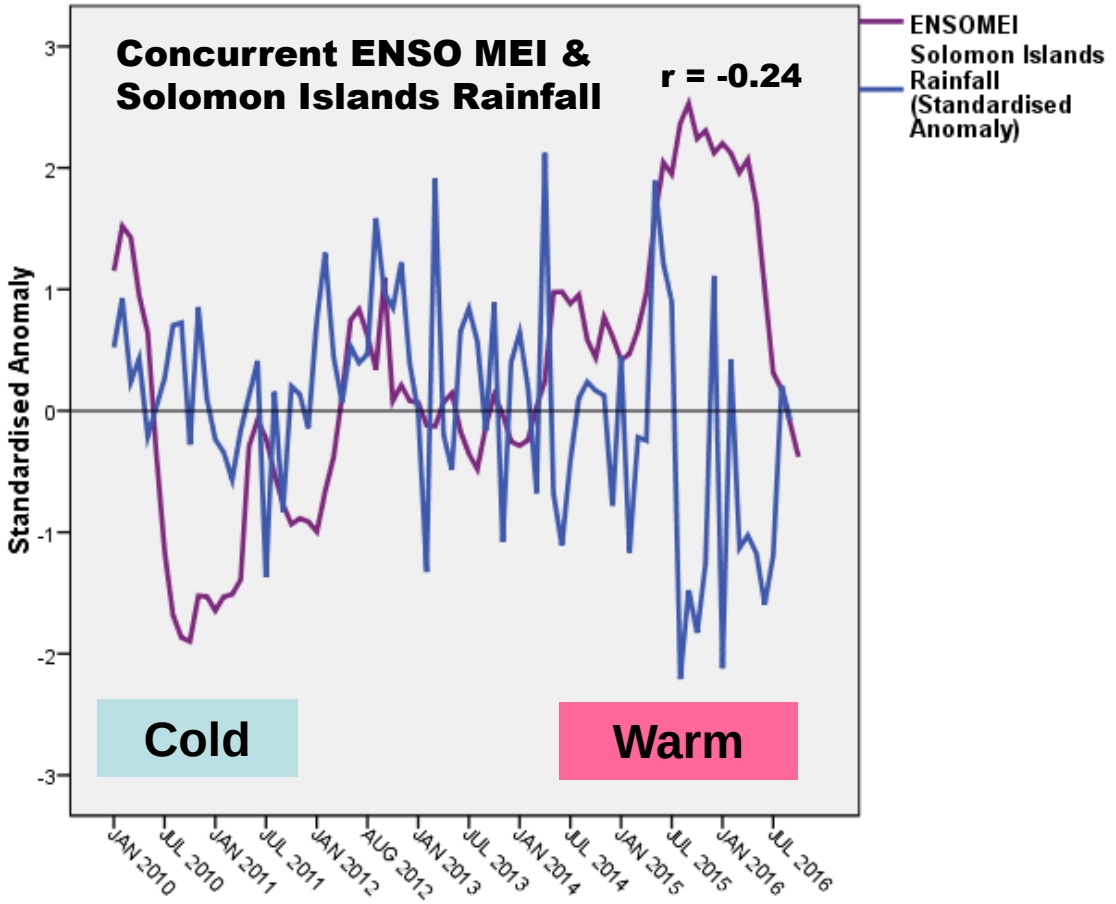

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Rainfall, ENSO MEI & Diarrhoea Associations Solomon Islands

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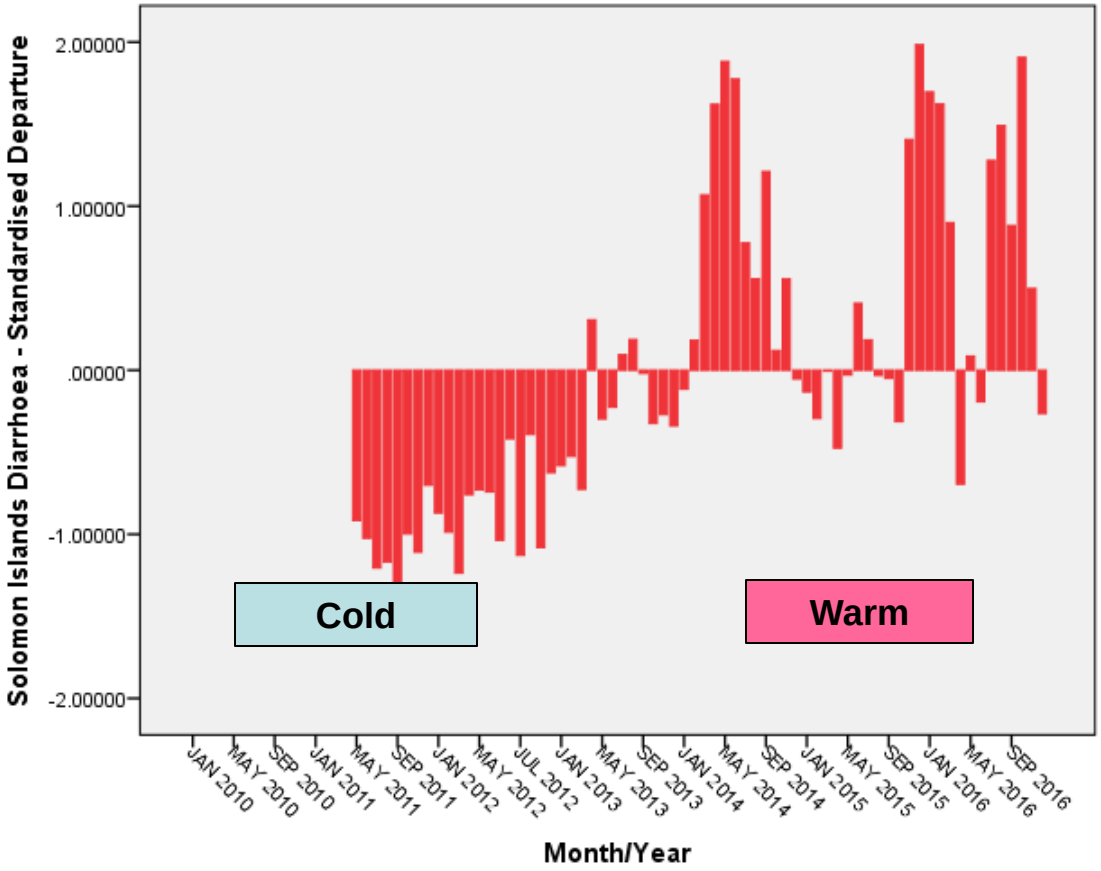
Solomon Islands Diarrhoea



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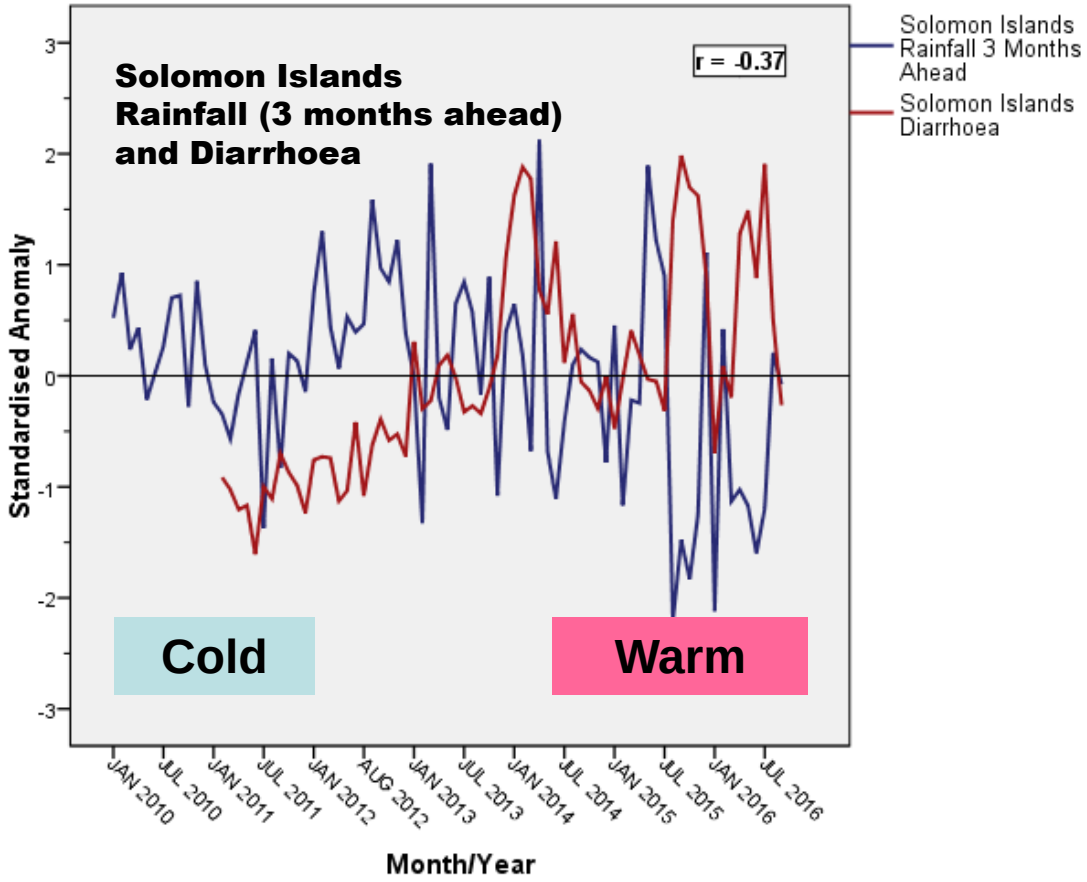

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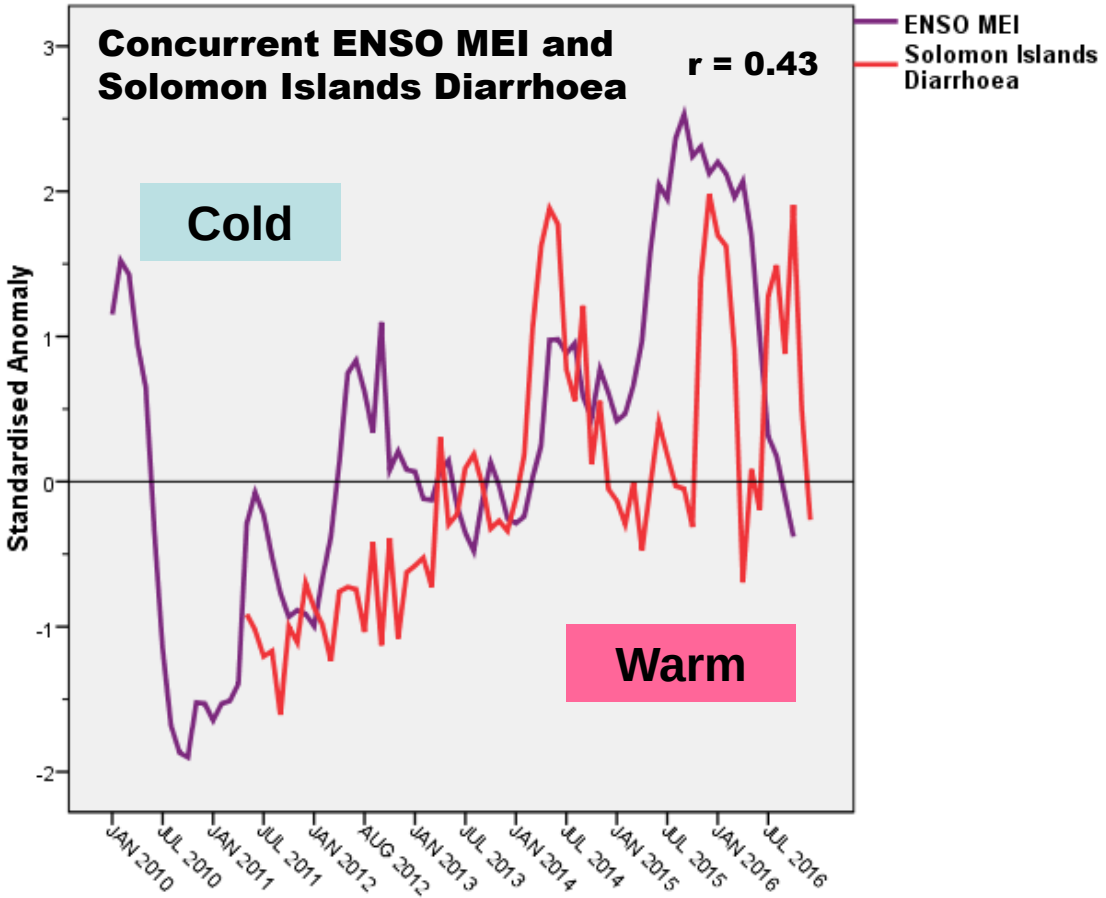

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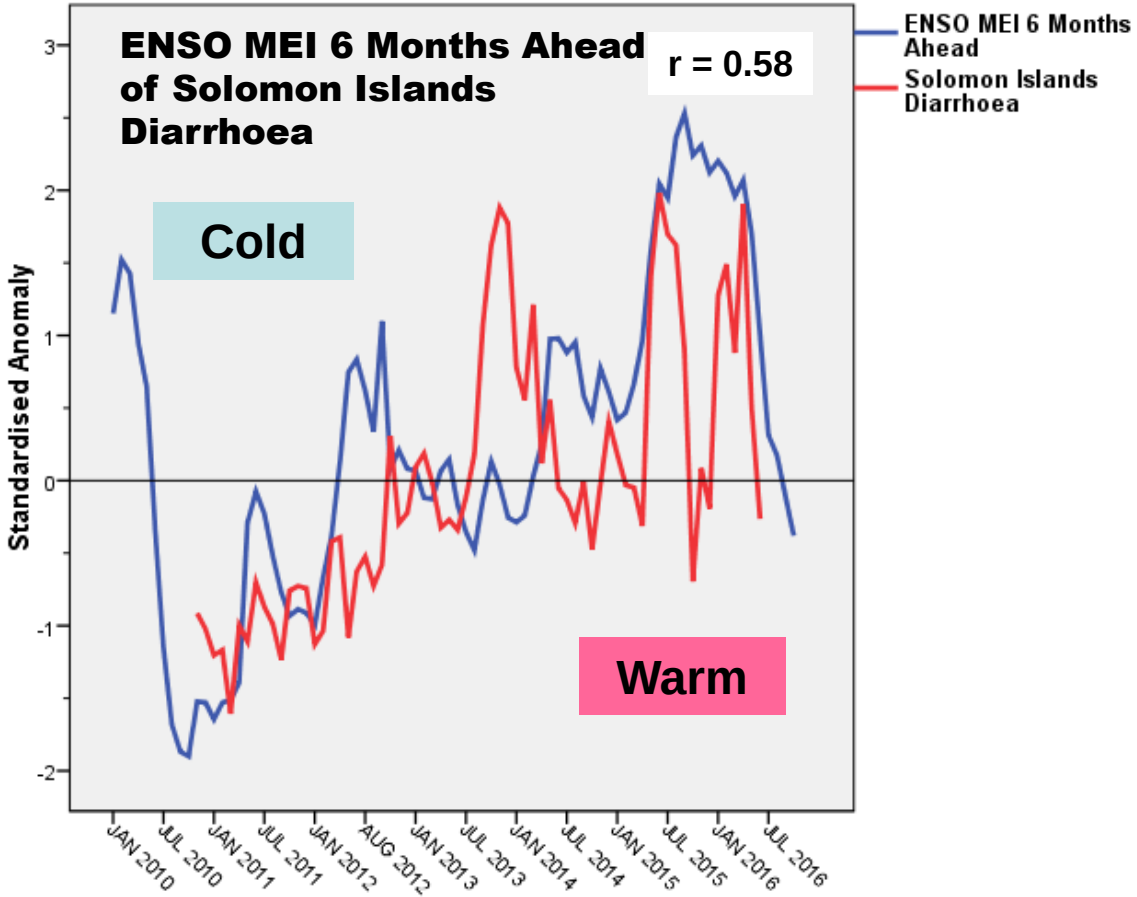

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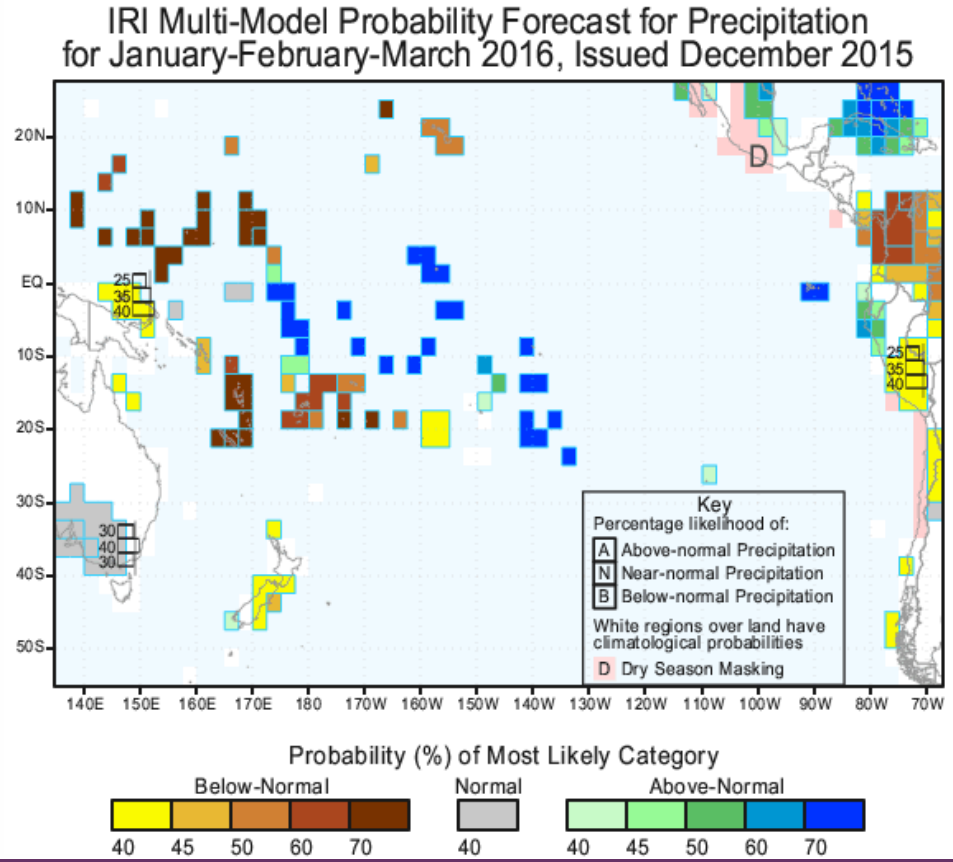
IRI Pacific Islands Rainfall Probability Forecast for January – March, 2016 (Issued December 2015)



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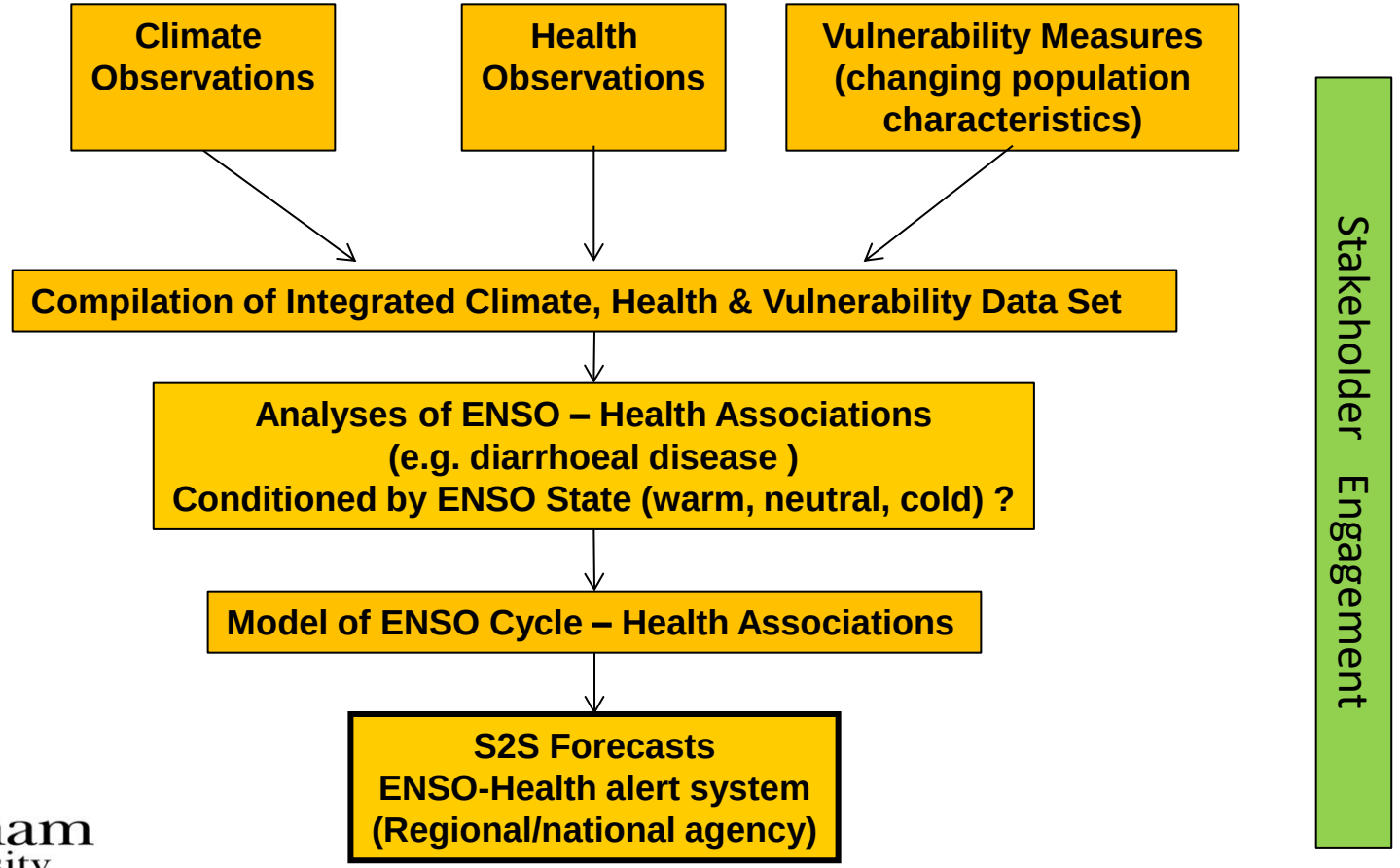
Development of ENSO – Health Alert System to Increase Resilience



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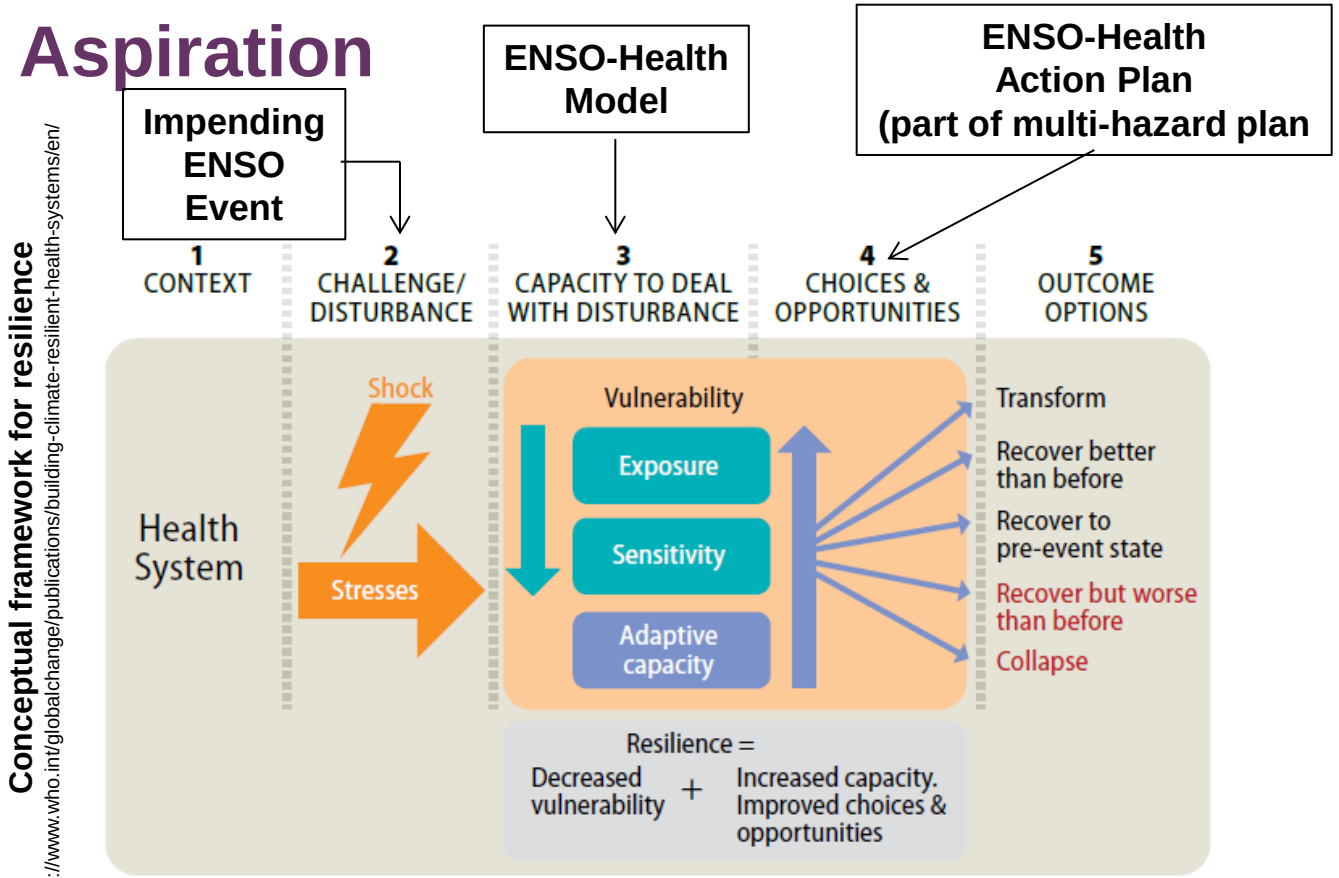
Aspiration



Conceptual framework for resilience
http://www.who.int/globalchange/publications/building-climate-resilient-health-systems/en/

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To Conclude

- Climatology is central to climate risk management (CRM) and can provide input at all stages of the climate risk planning cycle
- For ‘successful’ CRM, provision of climate information to decision makers is not enough – strong stakeholder/end-user engagement and a ‘co-production’ approach is necessary
- The so-called ‘loading dock’ approach must be avoided
- In the Pacific region ENSO plays a key role in determining a range of climate-related impacts on society, including health
- Understand ENSO (climate) impacts on health offers the opportunity for putting in place a climate risk management system in order to increase resilience in Pacific Island Country health systems
- We need integrated climate and health observing and analysis systems that will allow the generation of climate information for the management of the health risks arising from climate events such as ENSO

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