



# Resilient Atoll Nations in Productive Oceans

27–29 August 2019 • Kurumba Resort, Male', Maldives



## Hazard to Risk Analysis with purpose

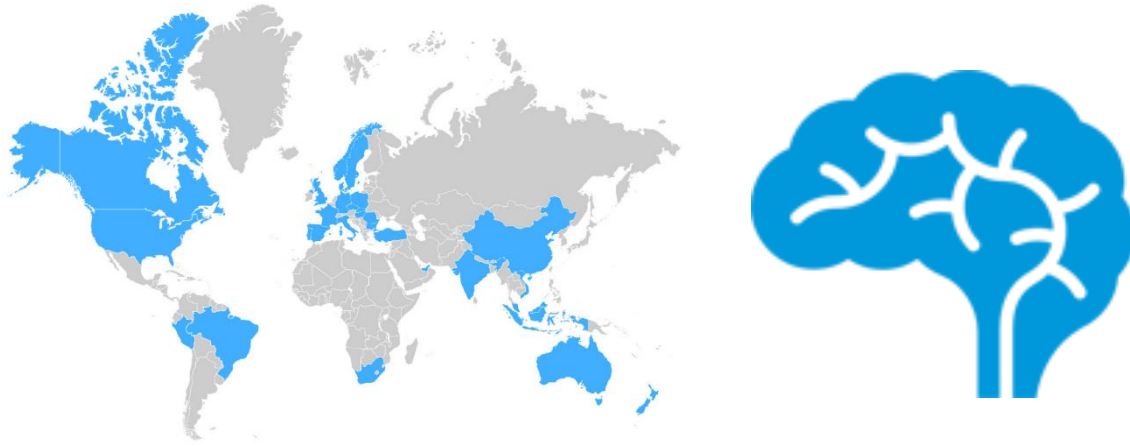
### Atoll Adaptation Knowledge Sessions

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28 Aug 2019

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**We are a research based  
specialist consultancy**

*changing*  
**DHI strives to solve the world's toughest challenges in water environments**



Rivers



Reservoirs



Oceans



Coastlines



Cities



Factories

and we are **committed to**



Water  
sufficiency



Food  
security



Sustainable  
cities



Efficient  
infrastructure



Climate  
adaptation



Environmental  
protection

## HAZARD

*How intense,  
extensive, and  
frequent?*



RISK

## EXPOSURE

*What and where?*

- People
- Infrastructure
- Economic production

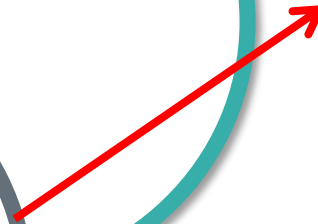


## HAZARD

*How intense,  
extensive, and  
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**RISK**



## EXPOSURE

*What and where?*

- People
- Infrastructure
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## RISK

## HAZARD

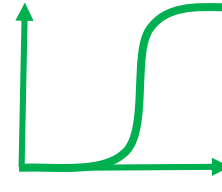
*How intense, extensive, and frequent?*



## VULNERABILITY

*How fragile and how does it respond?*

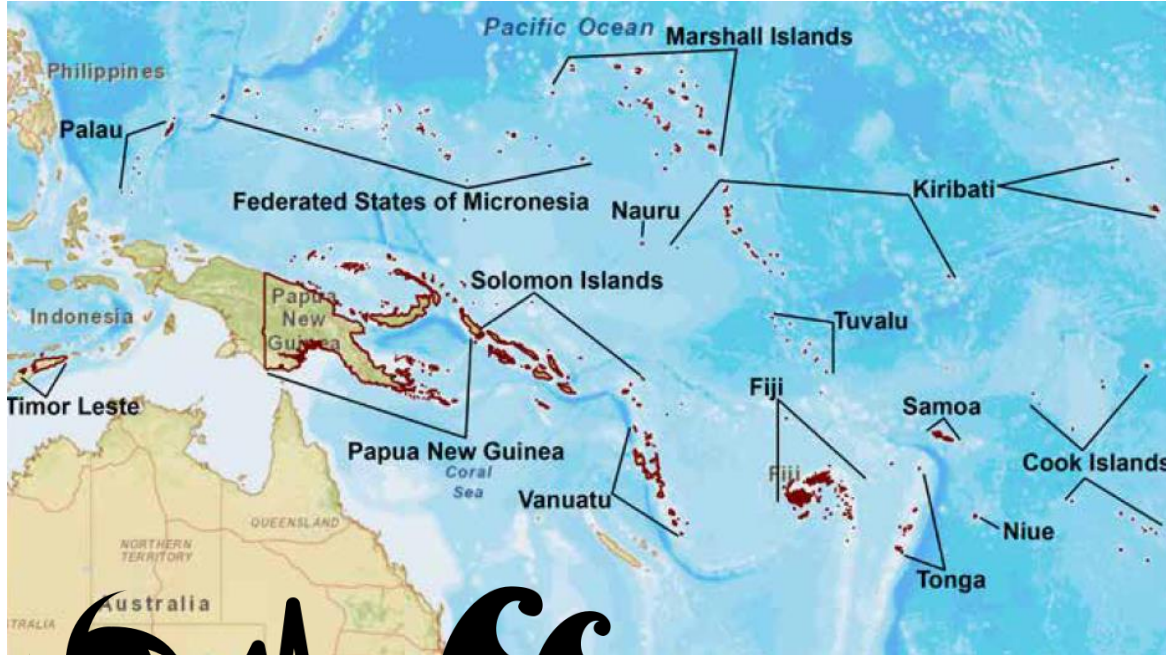
- People
- Infrastructure
- Economic production



From regional risk assessment...

...to local risk adaptation

# Pacific Catastrophe Risk Assessment and Financing Initiative



- First parametric catastrophe risk transfer transaction in the Pacific region
- Multi-Hazards

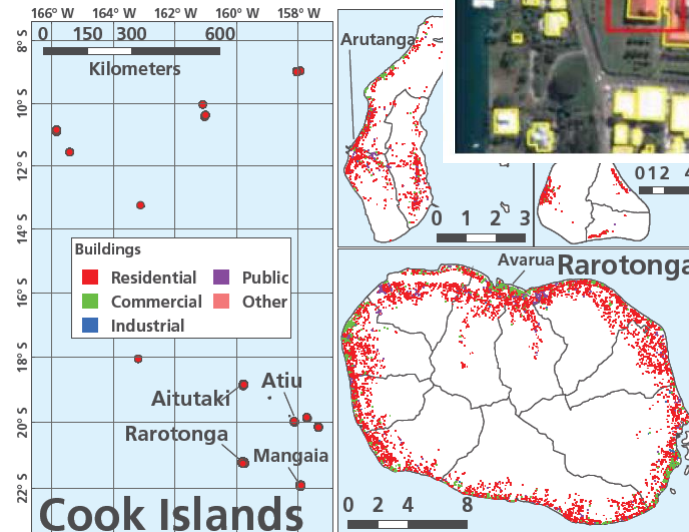
Source: PCRAFI



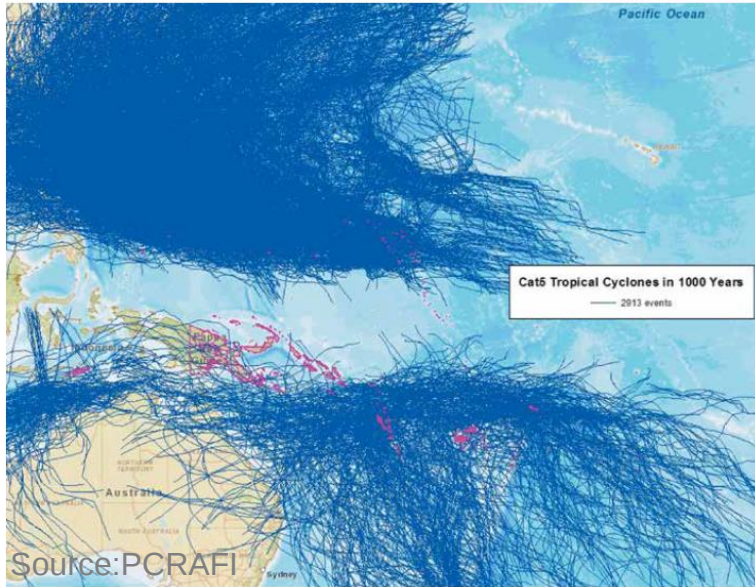
# PacRIS – Information platform the Pacific

## Exposure/Vulnerability database

- Assets and population mapping
- Classification and typologies
- Vulnerabilities
- Replacement costs



# Probabilistic hazard models for regional loss analysis



Very large catalogue of synthetic events:

- Preserve regional correlations
- Capture diversity of realization
- Capture most unlikely scenarios

Can imply:

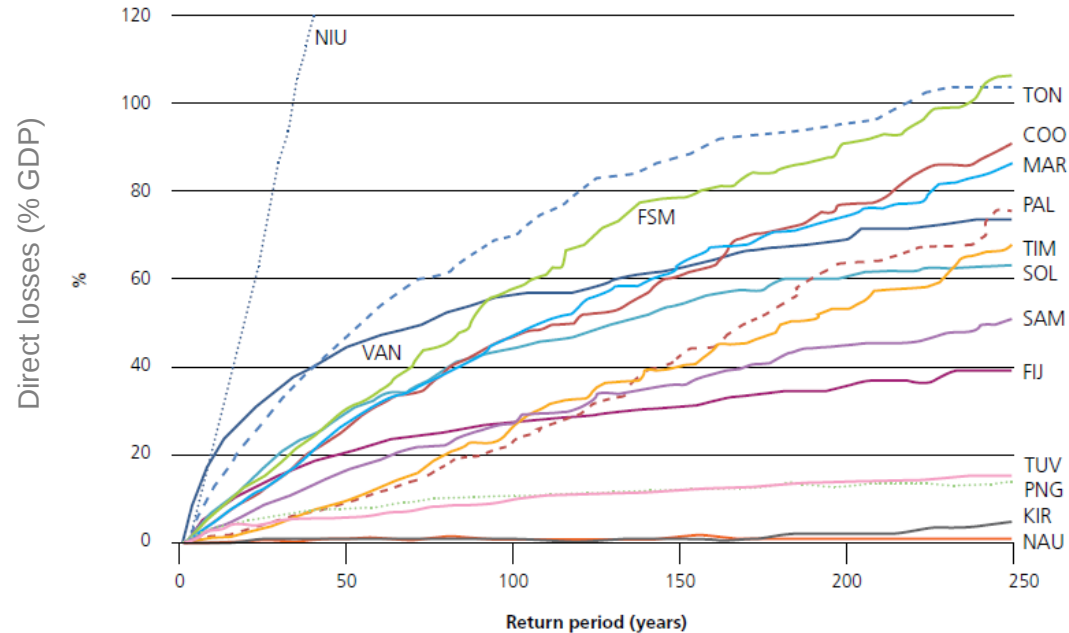
- simplified models
- coarser resolution

Catalogue of  
**simulated/synthetic** CAT5  
tropical cyclones over a **1,000**  
years of activity

HAZARD  
How intense,  
extensive, and  
frequent?



# Quantitative risk evaluation for risk transfer

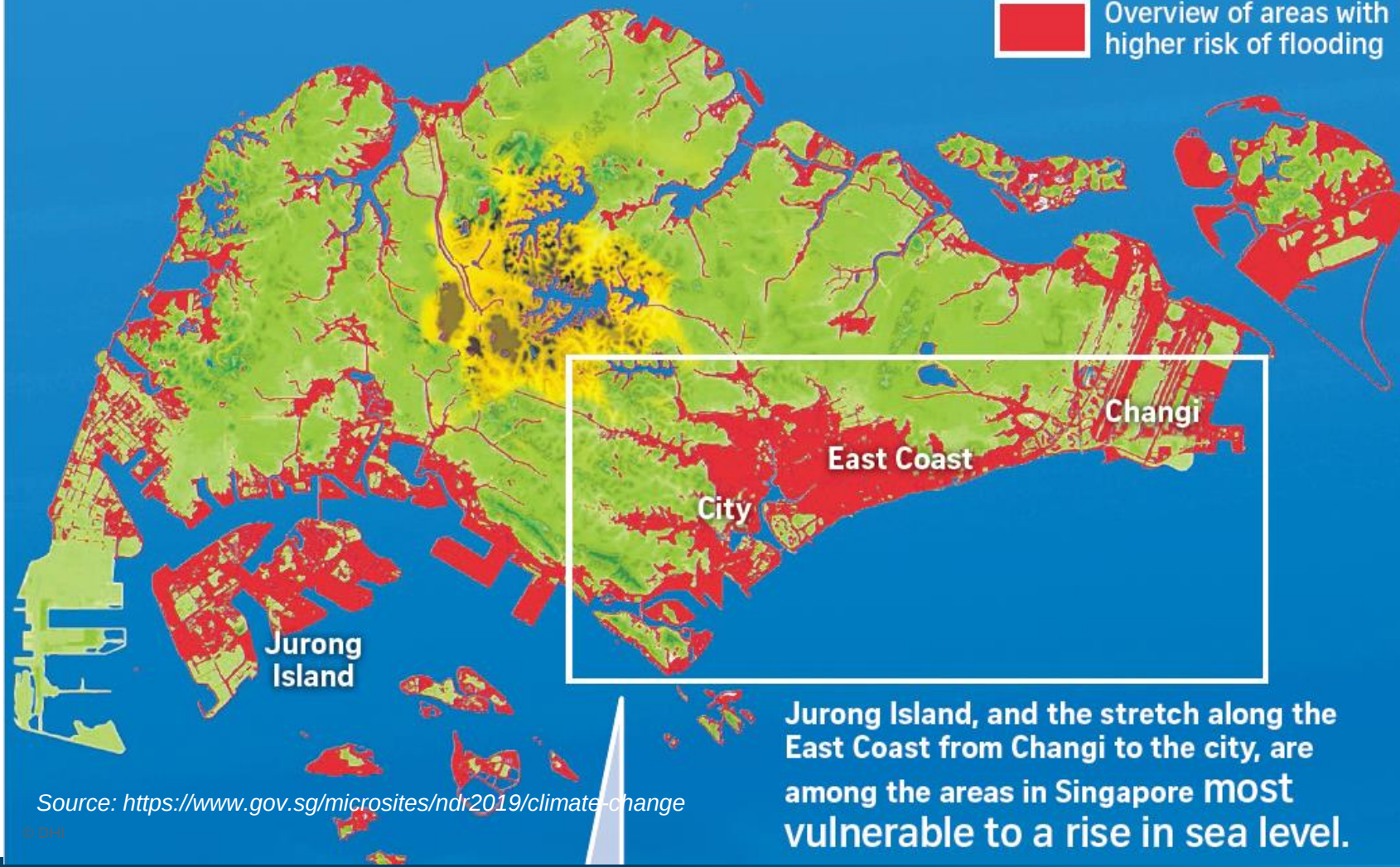


PIC Disaster Risk Profile –  
Exceedance Probability of GDP loss per country (Source: PCRAFI)

# PCRAFI – Possible applications of the Risk Assessment

- Post Disaster Response Capacity and Disaster Risk Financing  Underpin the development of other insurance products
- Post-Disaster Assistance and Assessment
- Baseline information for Climate Change Risk studies
- (Disaster Risk Reduction and Urban/Infrastructure Spatial Planning) Can be too coarse for localised analysis and solutions

 Overview of areas with higher risk of flooding



Source: <https://www.gov.sg/microsites/ndr2019/climate-change>

Jurong Island, and the stretch along the East Coast from Changi to the city, are among the areas in Singapore **most vulnerable** to a rise in sea level.

# Singapore pours \$10m into research of rising sea levels

Minister for the Environment and Water Resources  
Masagos Zulkifli, 17 Jul 2019

Around \$100 billion or more may be needed over the long term to protect Singapore against rising sea levels...

- PM Lee Hsien Long, 18 Aug 2019

# Singapore's National Framework for Coastal Adaptation



Source: National Climate Change Strategy 2012

- to provide actionable information for the present

**Detailed high resolution risk modelling**

- to accommodate both future needs and the latest science

**Technologies for testing options (simplified risk modelling) and cost benefit analysis**

**...up to 2100**

# Coastal Adaptation Decision Support System

Where

- must the interventions be located?

When

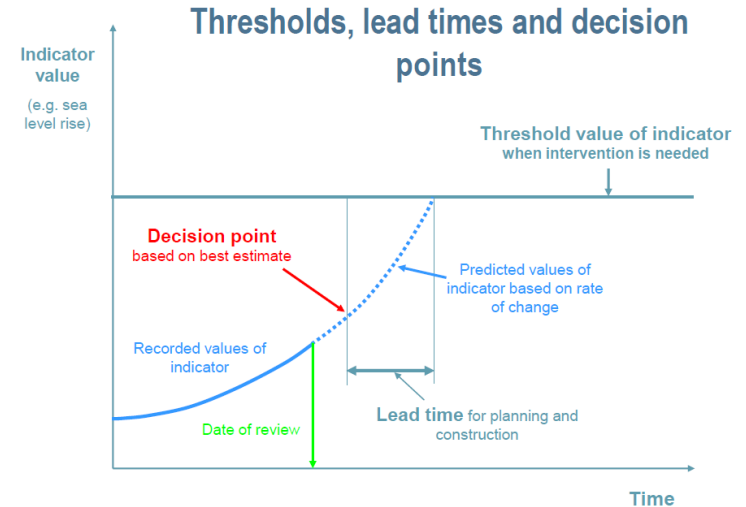
- must the interventions be in effect by?

How

- high/large must the interventions be?

What

- interventions must be put in place?



# Final remarks

- Hazard to risks: assessment with purpose
- Work with uncertainty
- Mainstreaming risk information in decisions is a challenge