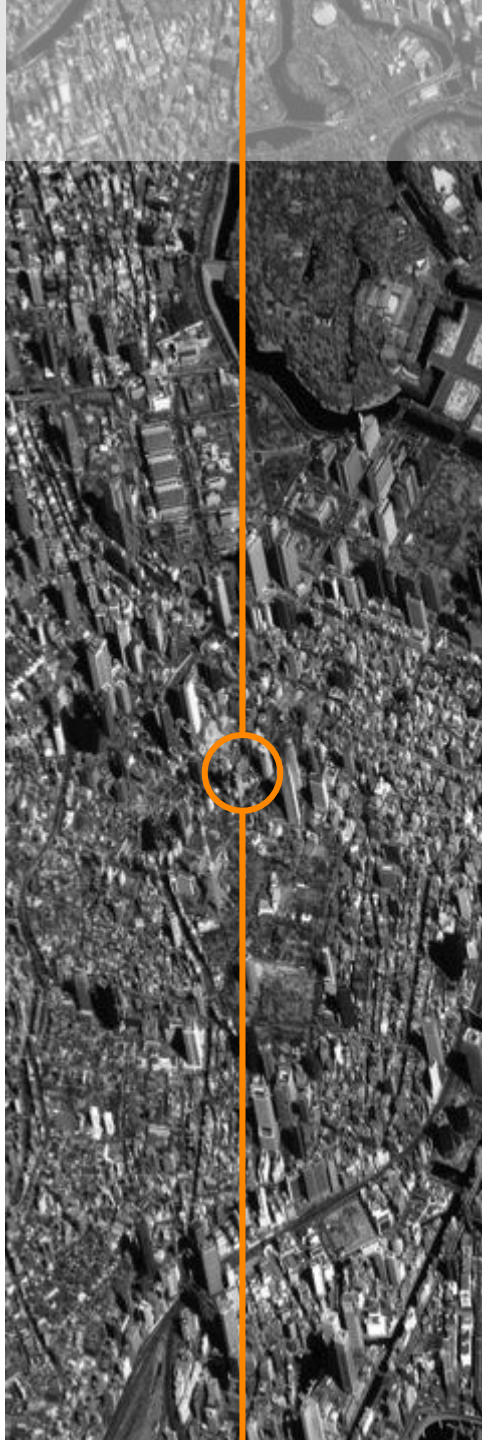
RESTEC

Agenda Item 16.2
Methodologies to evaluate climate change impacts on storm surge/storm wave hazards in SIDS



Tsugito Nagano
Remote Sensing Technology Center of Japan (RESTEC)

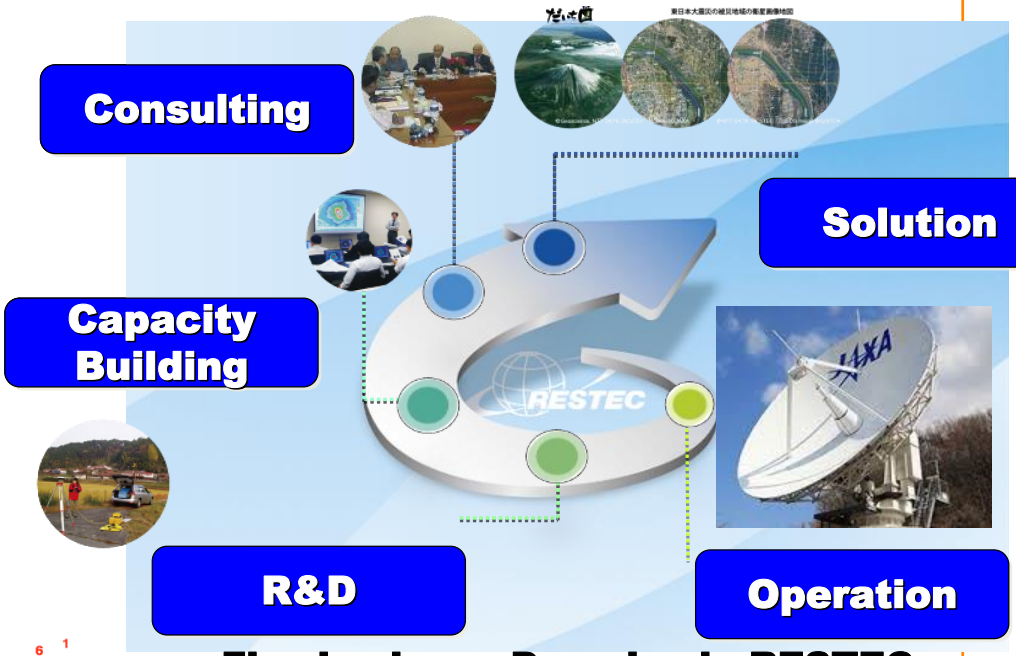
REmote Sensing TEchnology Center of Japan

The core organization for satellite-based remote sensing technologies in Japan

More than 40 years, RESTEC works for EO missions mainly entrusted by the Japan Aerospace Exploration Agency (JAXA)

Capacity Development;

More than 4,000 trainees from 55 countries



Five business Domains in RESTEC

Nowadays, focusing on "developing solutions"

- **not limited to satellite**
- **not limited to R&D**
- **ex) paddy field, drought/flood, land subsidence. vessels tracking etc..**

Ministry of the Environment Japan (MOEJ) Project

“Developing methodology to evaluate climate change impact in Small Island States” (JFY 2015-2017)

環境省

Ministry of the Environment

Government of Japan

RESTEC

東京大学 THE UNIVERSITY OF TOKYO

KANAZAWA UNIVERSITY

BroadBand Tower, Inc.

organized by Remote Sensing Technology Center of Japan (RESTEC)
in association with
the University of Tokyo, KANAZAWA University and Broad Band Tower Inc.

Project overview

1. Systems development (Prototype)
Evaluate the long-term hazard of Storm Surge/Storm Wave caused by TC with developing the 3D hazard map system as prototype.
Target : Fiji, Vanuatu and Samoa

2. Networking
Disseminate Japan's methodology and systems for climate change adaptation in SIDSs

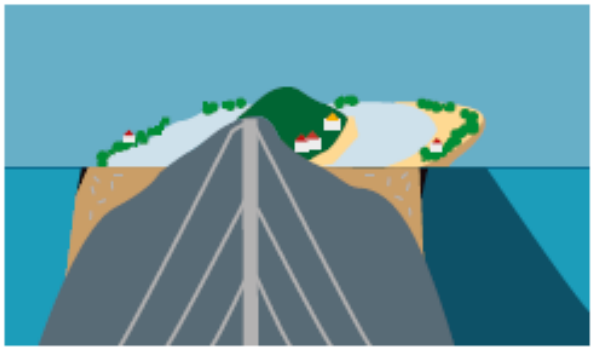
3. Workshops
Conduct regional workshops (Fiji, Vanuatu and Samoa)

Challenge: How to prepare the hazard by TC with considering various topographic condition in each

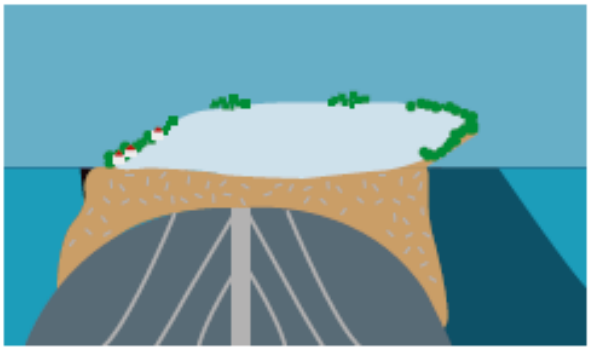
Tanna, Vanuatu – *volcanic raised island*

St. Lucia

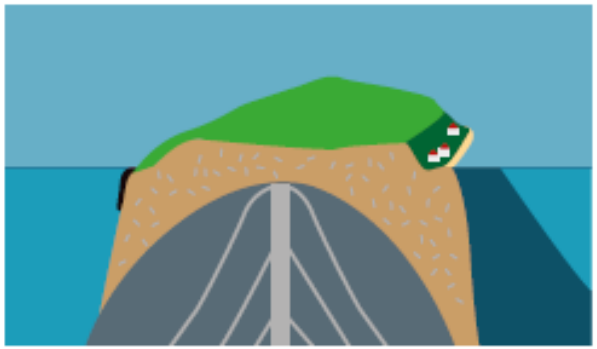
Rodrigues, Mauritius



Aitutaki, Cook Islands



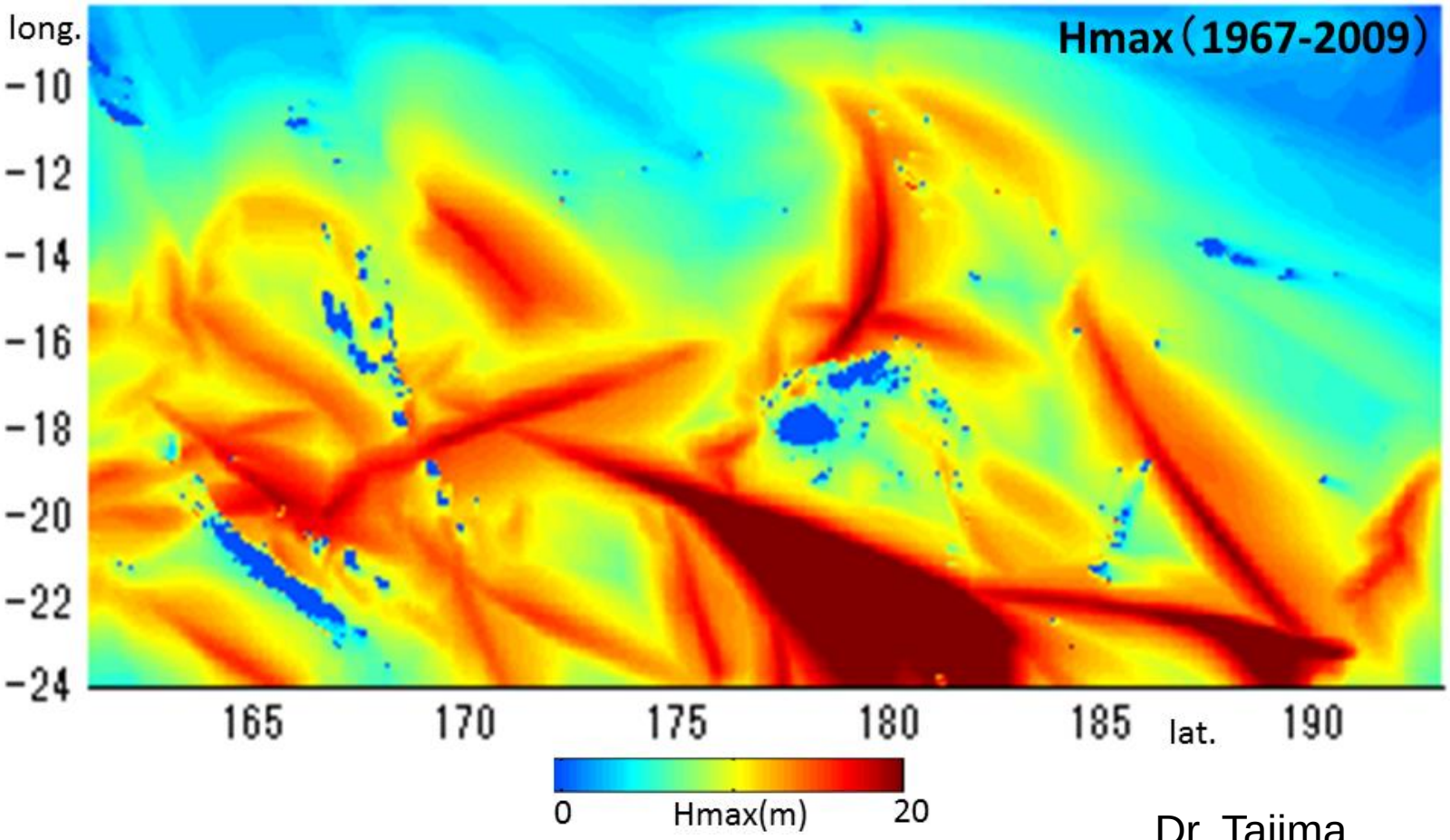
Tarawa, Kiribati – *atoll*



Nauru – *raised limestone island*

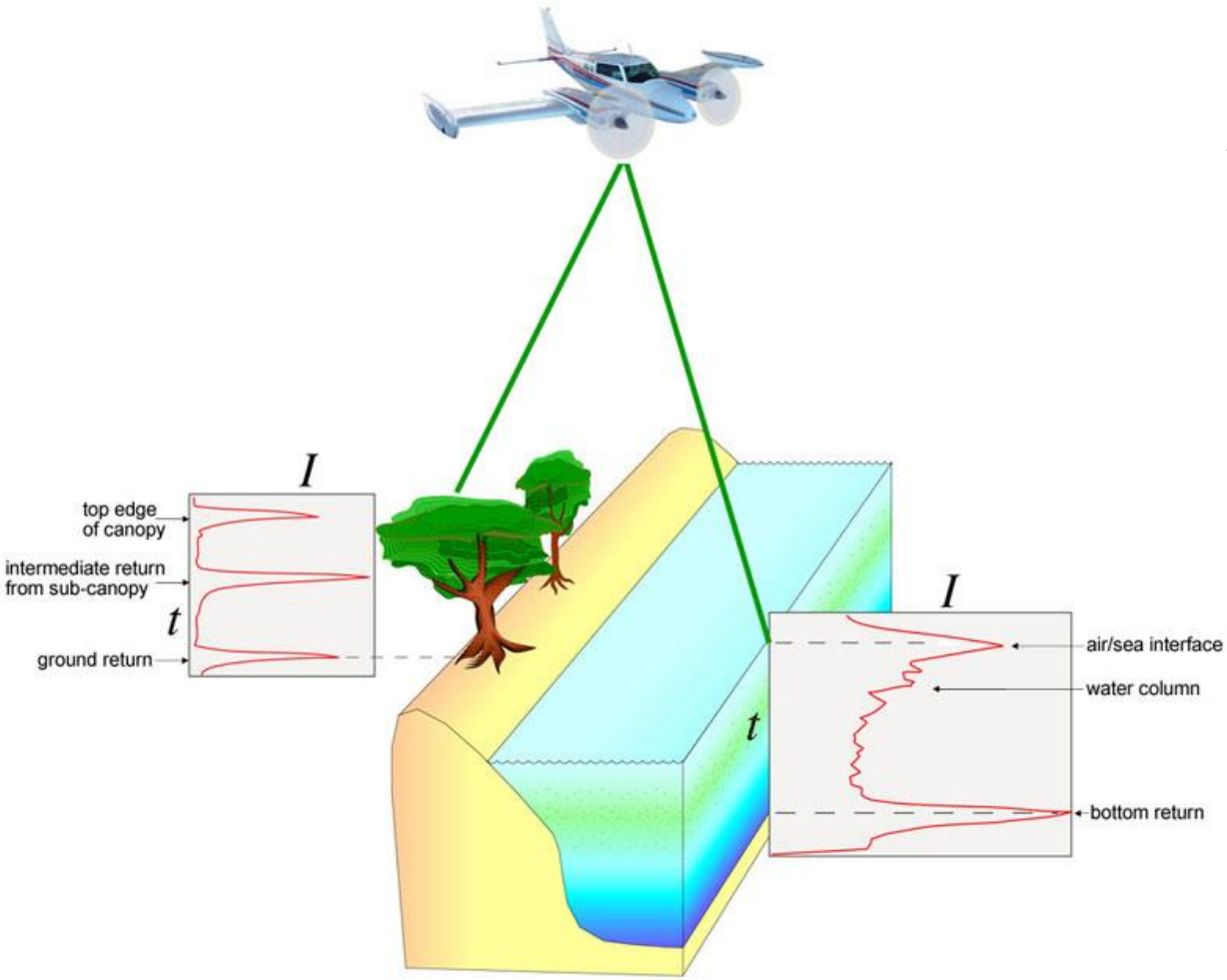
http://cdkn.org/wp-content/uploads/2014/08/CDKN_IPCC_Whats_in_it_for_SIDS.pdf

Challenge: how to identify the hazards led by TC with considering the climate change scenarios?



Dr. Tajima

Challenge : How to assess hazards as a whole country scale with reasonable cost?

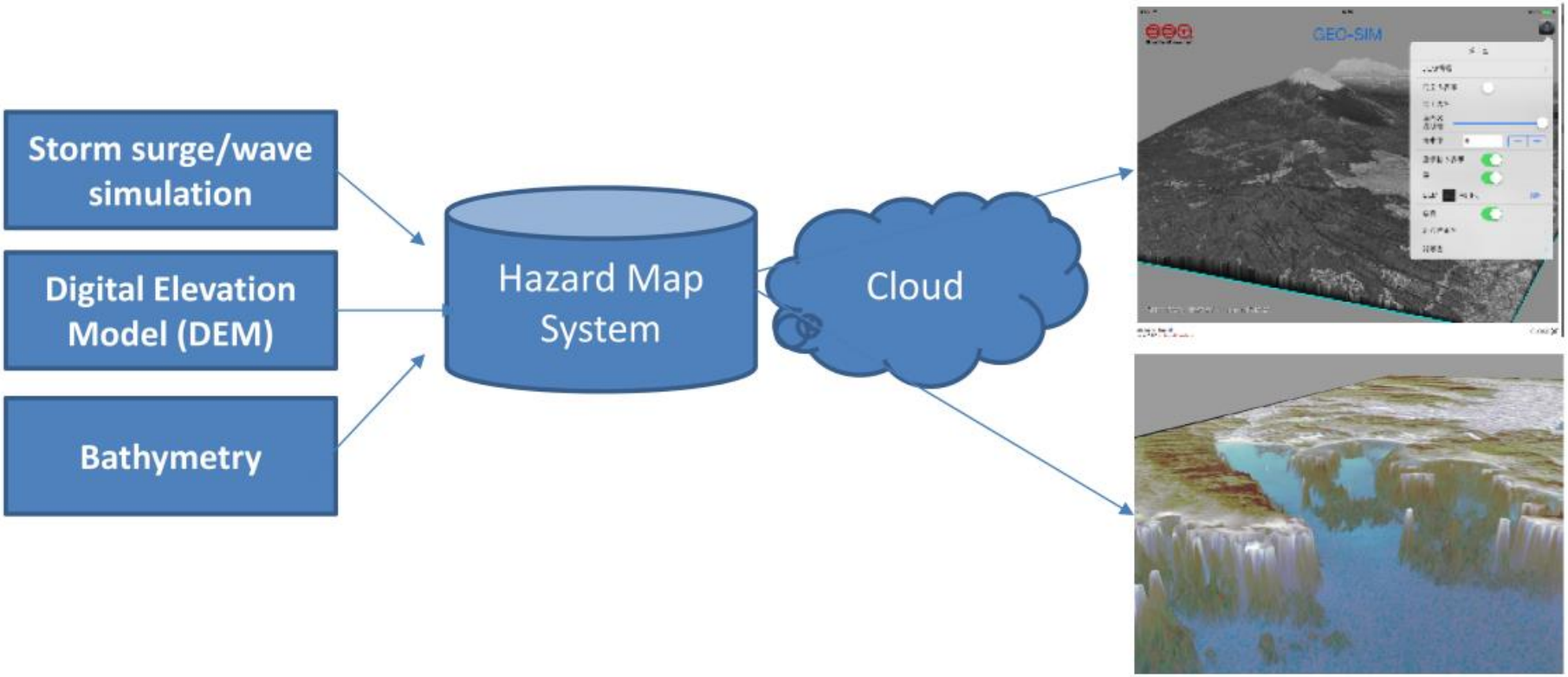


Airborne LiDAR can acquire precise information for mapping.

However... the cost for observation is not low.

1500-2000 euro / km^2 (SHOM, 2012)

Systems Overview (Original Concept)



Key technology;
3D Hazard Map (trial version : Efate, Vanuatu)

Nominal

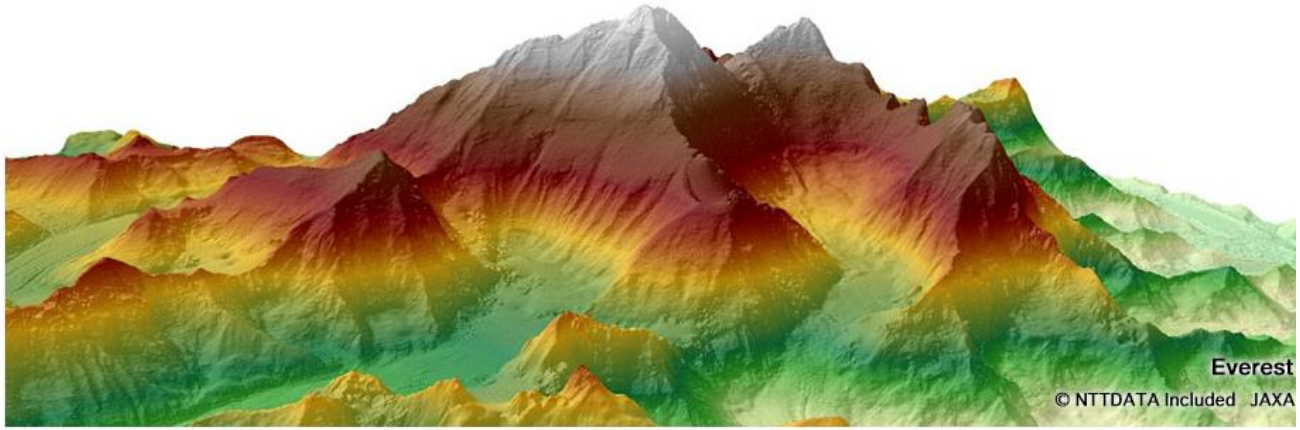
Inundated

Key Technology :
Satellite based Digital Surface Model (DSM)

AW3D

THE WORLD'S FIRST 3D GLOBAL MAP WITH 5M RESOLUTION

AW3D: Global High-resolution 3D Map



NTT DATA

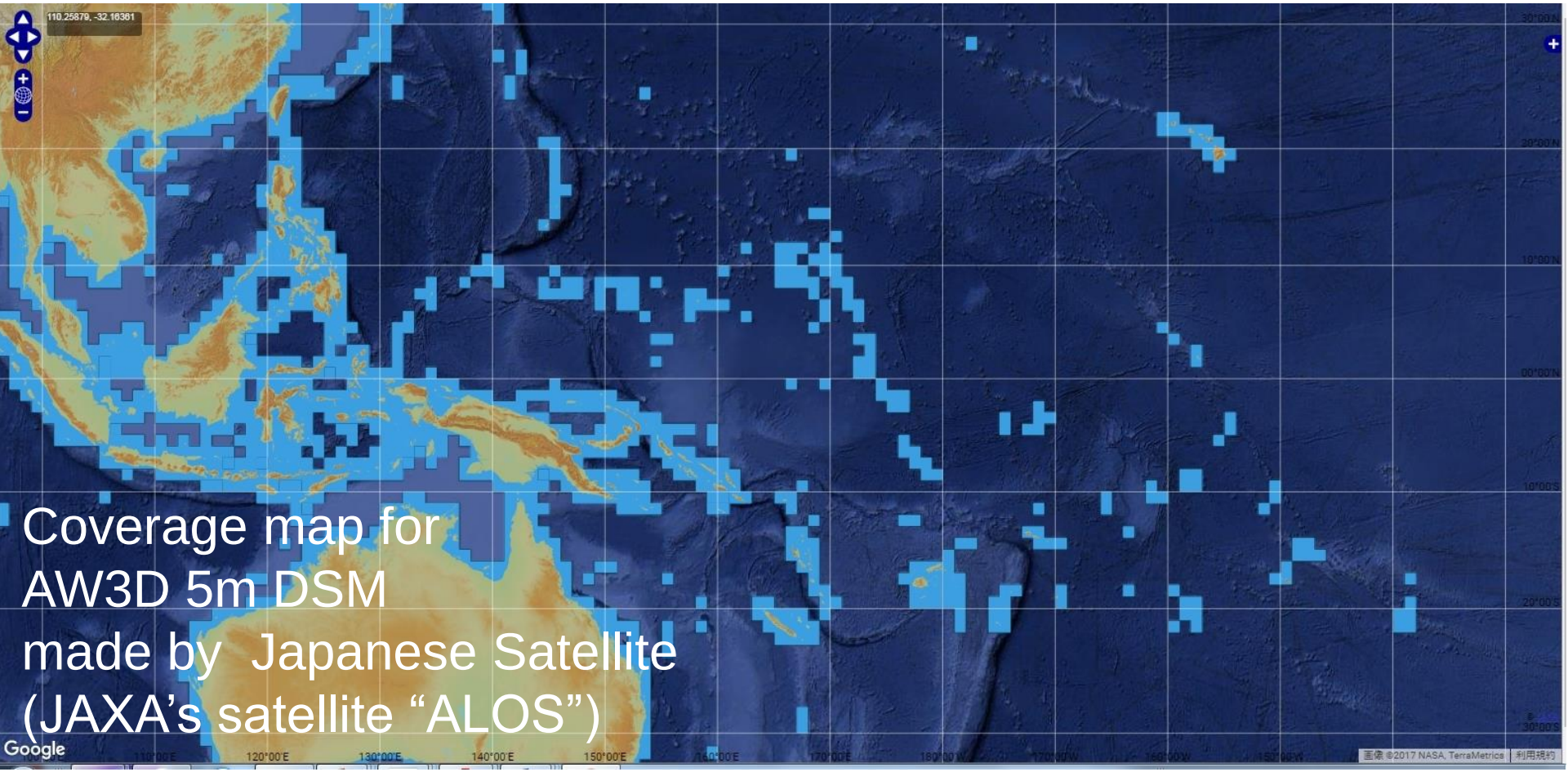
RESTEC

ALOS
Advanced Land Observing Satellite

※JAXA陸域観測技術衛星「だいち（ALOS）」

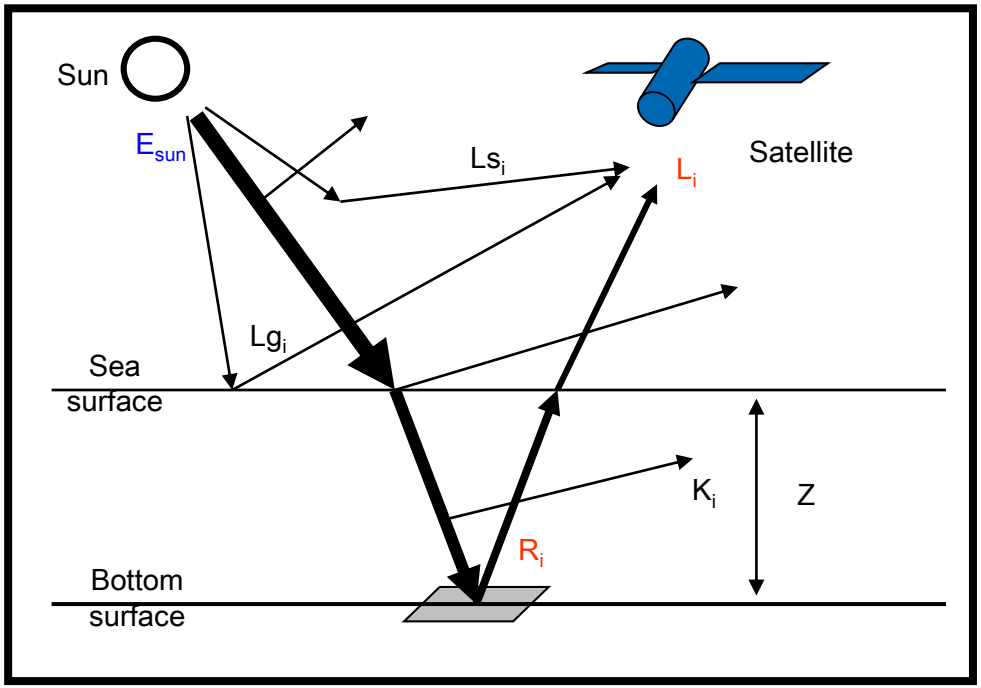
DigitalGlobe

Key Technology :
Satellite based Digital Elevation Model (DSM)



Coverage map for
AW3D 5m DSM
made by Japanese Satellite
(JAXA's satellite "ALOS")

Key Technology :
Satellite Derived Bathymetry (SDB)



- Z: Depth
- L:radiance recorded by satellite sensor
- i: band number
- R: sea bottom reflectance
- La: Coefficient about Sun irradiance and transmittance in atmosphere
- K: Diffuse attenuation coefficient
- F: Geometric factor
- Ls: radiance scatted in atmosphere and sea surface
- Lg: radiance of sunglint effect

Radiance model in coastal water

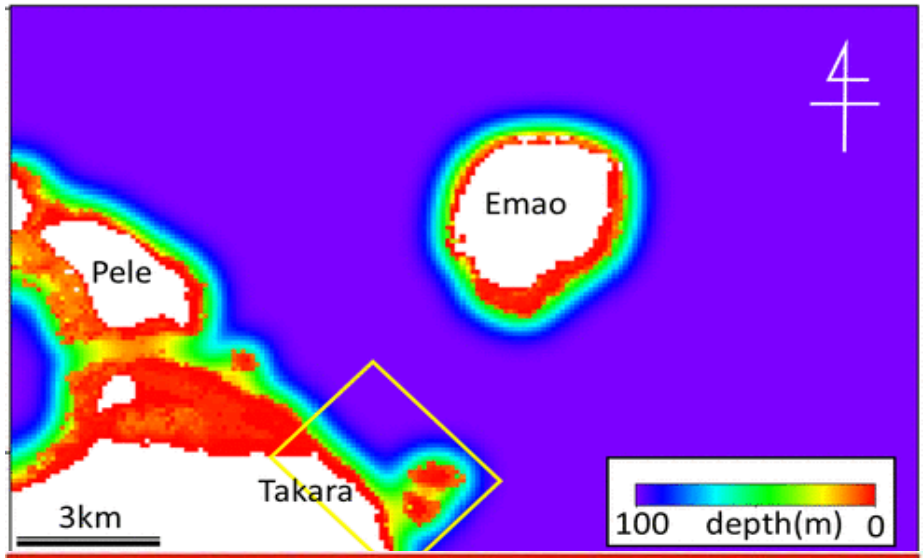
$$L_i = La_i \cdot R_i \cdot \exp(-K_i \cdot F \cdot Z) + Ls_i + Lg_i \ (W/m^2/sr/\mu m)$$

Depth estimation model by Lyzenga (1978)

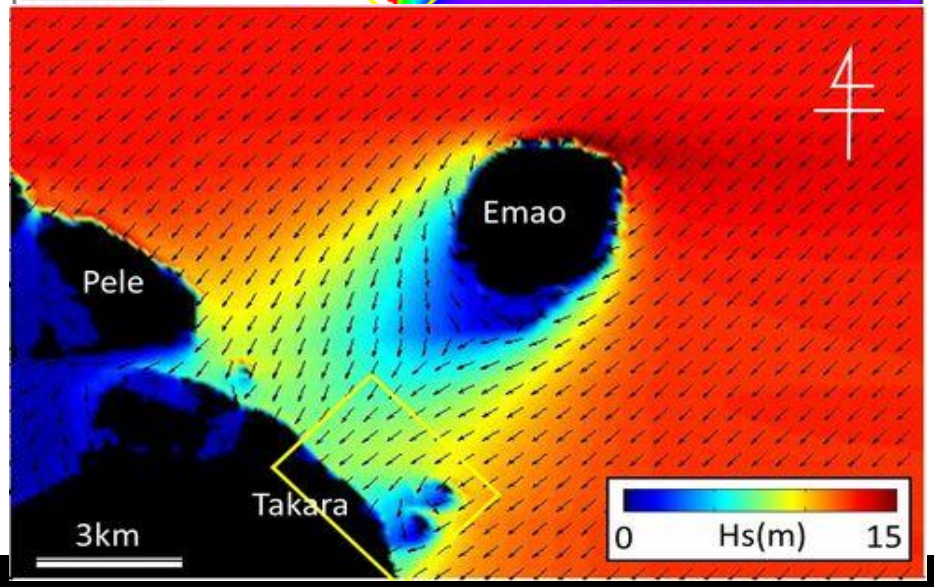
$$Z = \beta_0 + \sum_{i=1}^{N} \beta_i X_i \qquad (X_i = \ln(L_i - Lsi - Lgi))$$

Following the increase of N (number of bands), accuracy also increases

Key Technology :
Computing simulation for wave height / direction



←Estimated water depth by SDB at Takara Bay, Efate island, Vanuatu

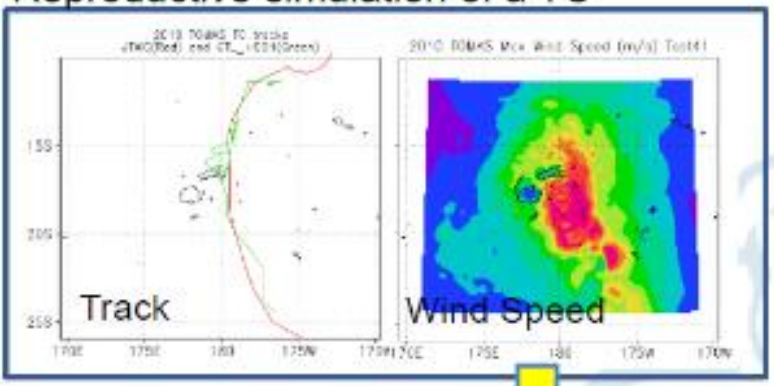


←Simulation to reproduce wave height and direction condition at TC Pam case (by University of Tokyo)

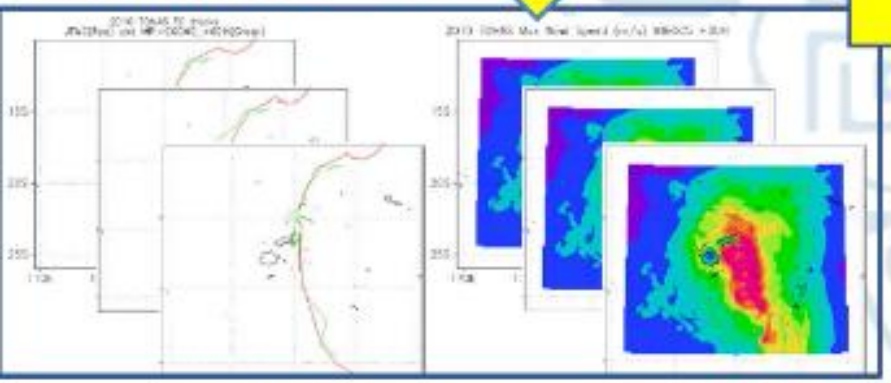
Key Technology :
Applying Climate Change Scenario

Framework for worst case simulation

Reproductive simulation of a TC

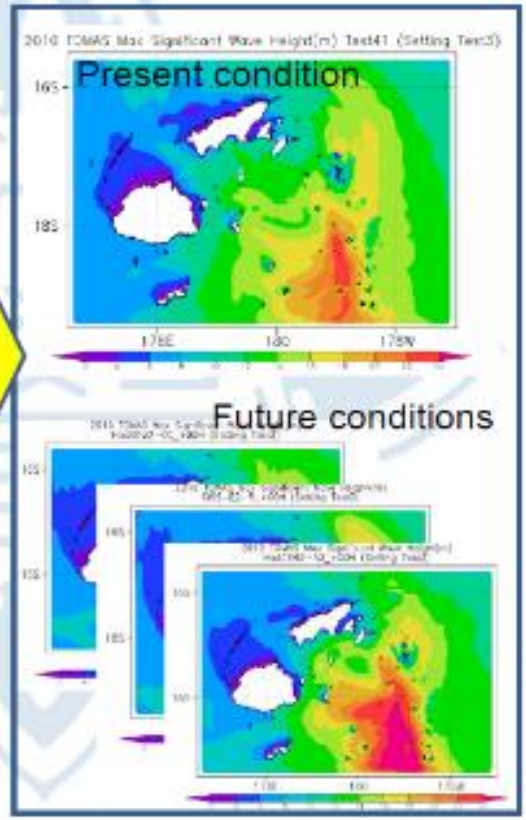


Future variations of a TC



Using multiple AOGMs, climate scenarios

Wave simulation with present/future conditions



The contents will be developed with;

3 scenarios

- RCP 2.6
- RCP 4.5
- RCP 8.5

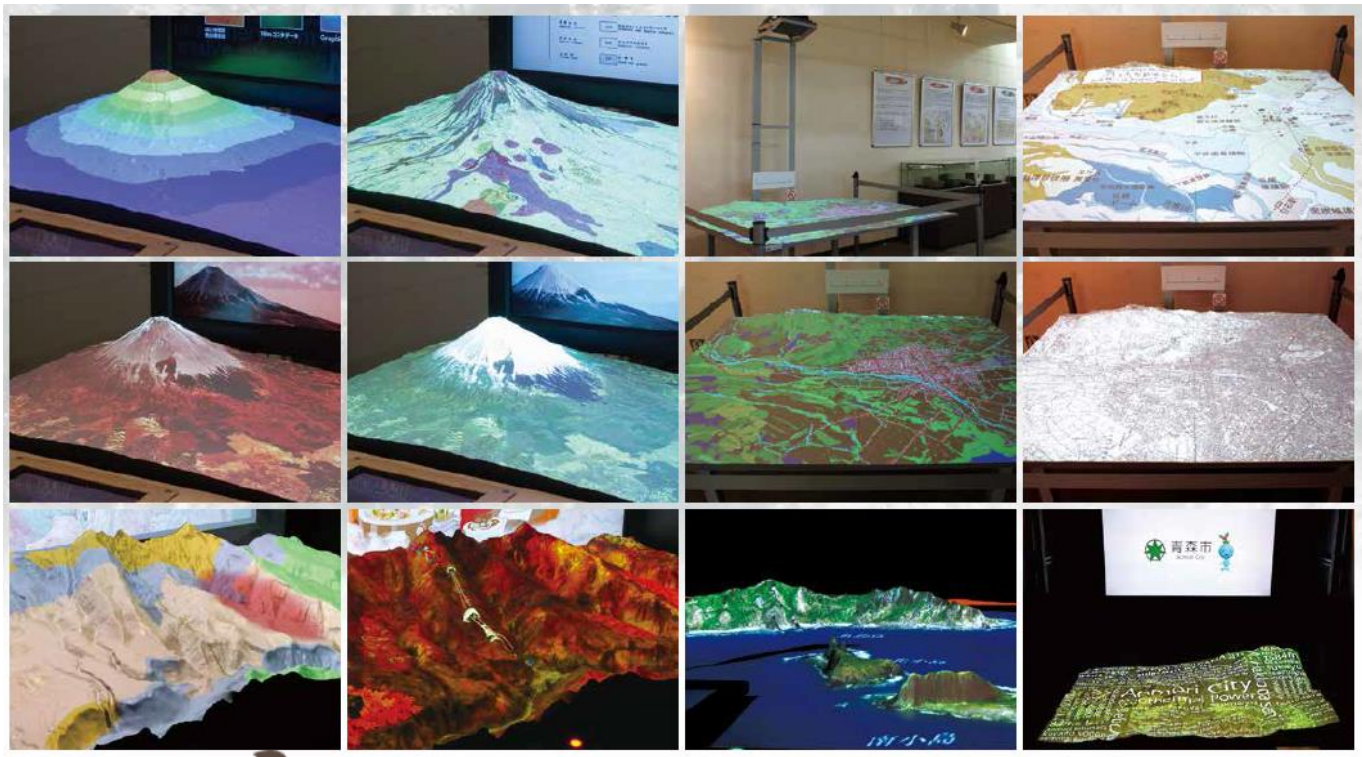
3 return period

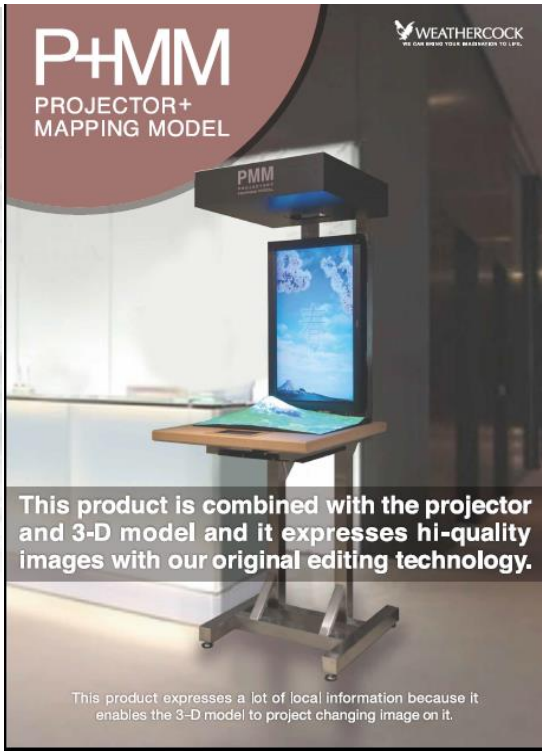
- 30 years
- 50 years
- 100 Years

(by Kanazawa Univ.)

For Dissemination:

Develop “real” 3D map with projected hazard information





COP23 FIJI

UN CLIMATE CHANGE CONFERENCE

BONN 2017

The demonstration system with hazard map for Suva, Fiji will be displayed at Japan pavilion at COP23 meeting

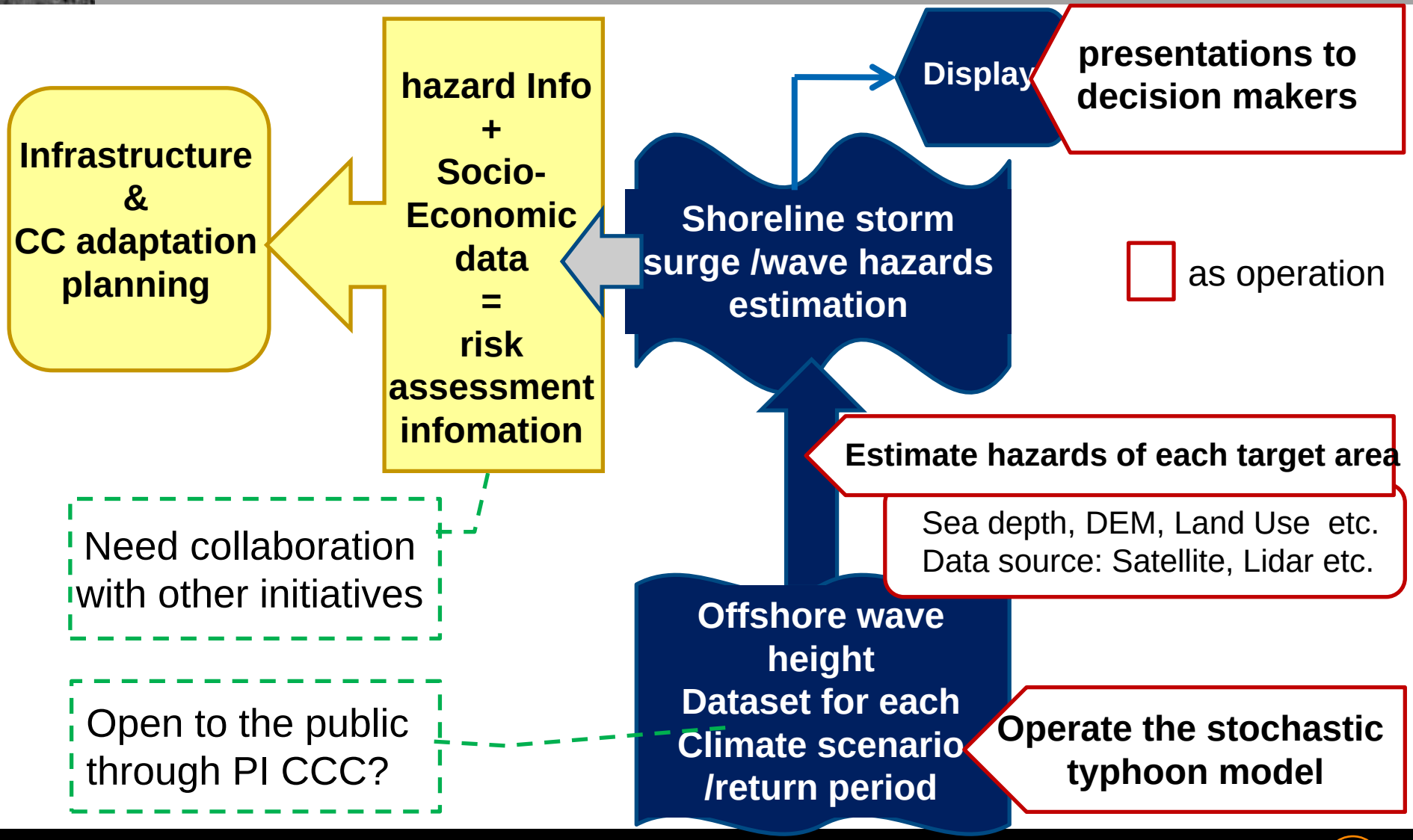
Regional workshops

Upcoming workshops;

25 Sep 2017 Fiji (Suva)

TBD 2018 Samoa (Apia)

Methodology (Summary)



For regional collaboration...

- The goal of the project is developing methodology to design the sustainable hazard mapping system for SIDs.
- And through the networking activities, we recognize a lots of regional DRR / CCA initiatives are on going in this region.
- The unique point of our project is focusing on hazard assessment purely – no function for risk assessment.
- We can contribute to other initiatives in the South Pacific as the provider of hazard information.
- We are preparing for future proposal to scale up for all South Pacific Islands countries.

Recommendation

The Meeting is invited to:

- Note through RESTEC and its partners considerable progress has been made on the implementation of the project.

- Recommend that additional resources will be needed to upscale the project and replicate the project in other countries.

- Note that additional resources will be need to upscale the project in other countries