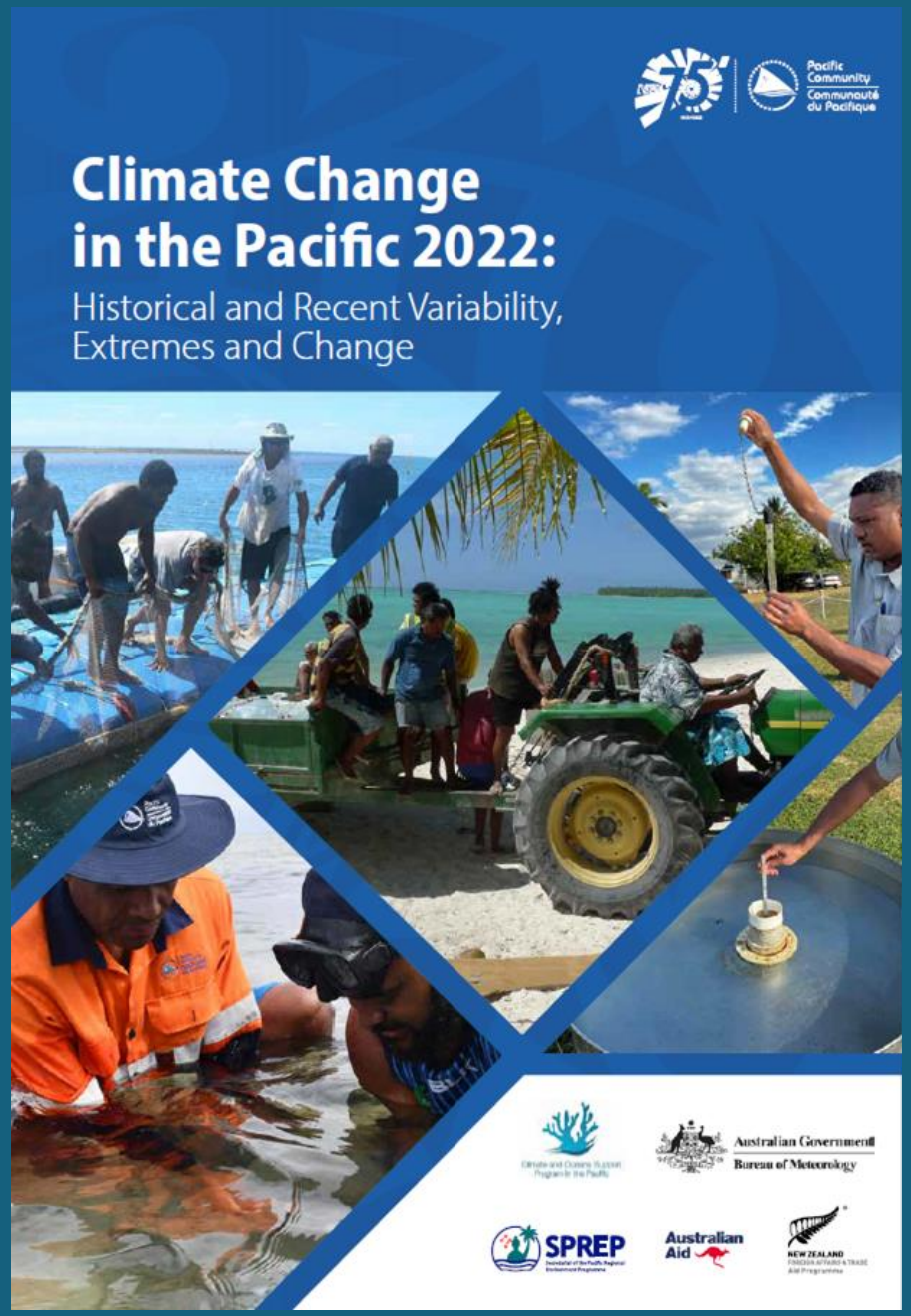
STRENGTHENING EARLY WARNING CAPACITY AS AN ADAPTATION SOLUTION TO SEA LEVEL RISE CASE STUDY: COASTAL INUNDATION TUVALU

CLIMATE AWARENESS WORKSHOP
Feb 19-22 Wellington, NZ

By: **Zulfikar Begg,** Cristina Izaguirre, Antonio Hermosa, Herve Damlamian, Litea Biukoto



Background

- Peer-review regional technical climate science report containing country scale historical climate and ocean variability and trends information
- Update of country scale information presented in the PCCSP *Climate Change in the Pacific: Scientific Assessment and New Research, Volume 2, Country Reports* (2011) and PACCSAP Program *Climate Variability, Extremes and Change in the Western Tropical Pacific: New Science and Updated Country Reports* (2014)
- Country specific chapters for COSPPac partner countries or territories. Each chapter has a similar look and feel
- Country chapters designed to be standalone reports

Early Warning for ALL

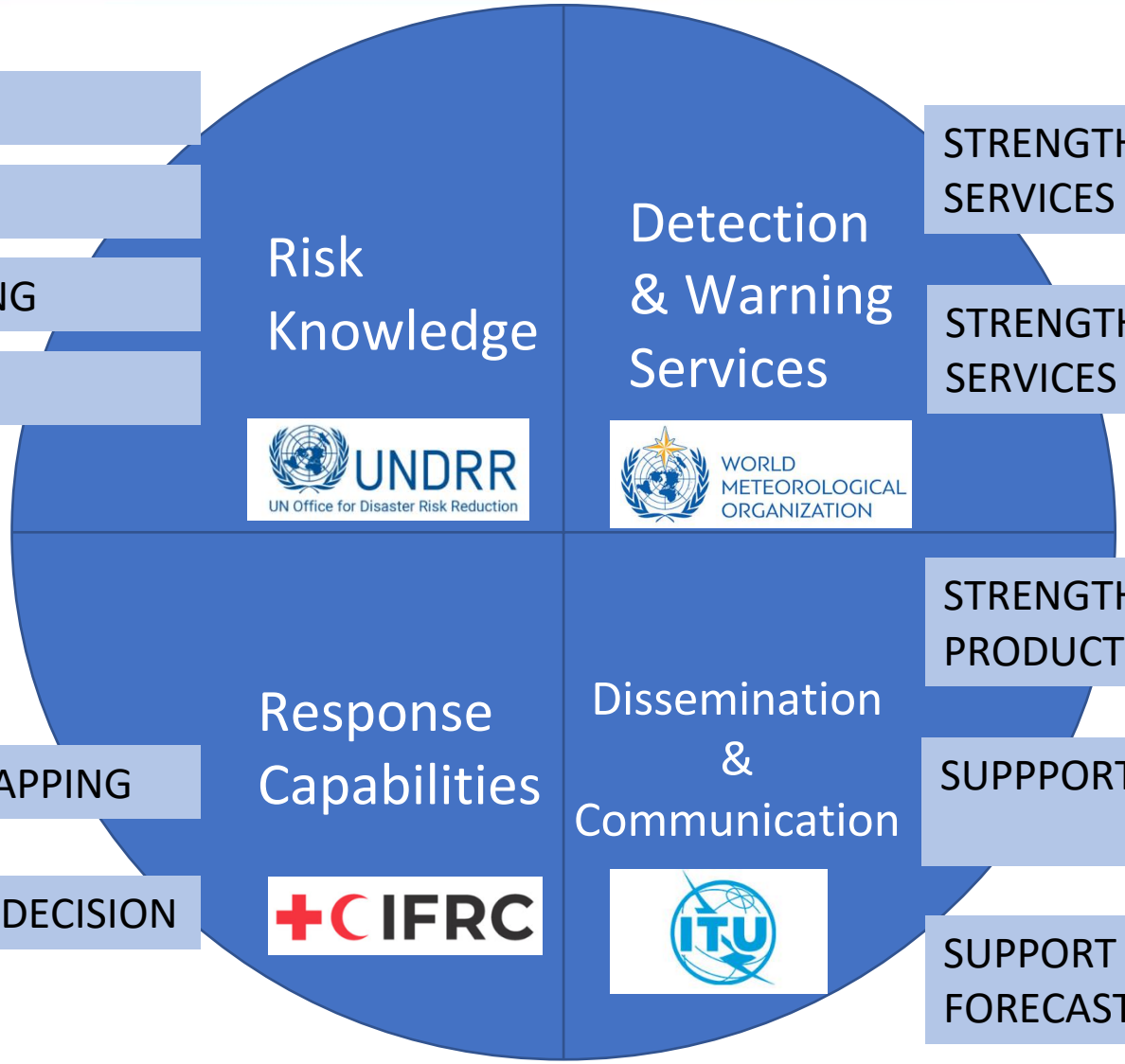
"People in Africa, South Asia, South and Central America, and the inhabitants of small island states are **15 times more likely to die** from climate disasters. These disasters displace three times more people than war. And the situation is getting worse." António Guterres UN Secretary General, COP27

UN Secretary-General launched in March 2022, the Early Warnings for All initiative which called for every person on Earth to be protected by early warning systems by 2027

The *Executive Action Plan for the Early Warnings for All initiative*, calls for initial new targeted investments of $ 3.1 billion between 2023 and 2027, equivalent to a cost of just 50 cents per person per year.

Early Warning Coverage is **worst for developing countries on the front lines of climate change**, namely the world's Least Developed Countries (LDCs) and **Small Island Developing States (SIDS).**

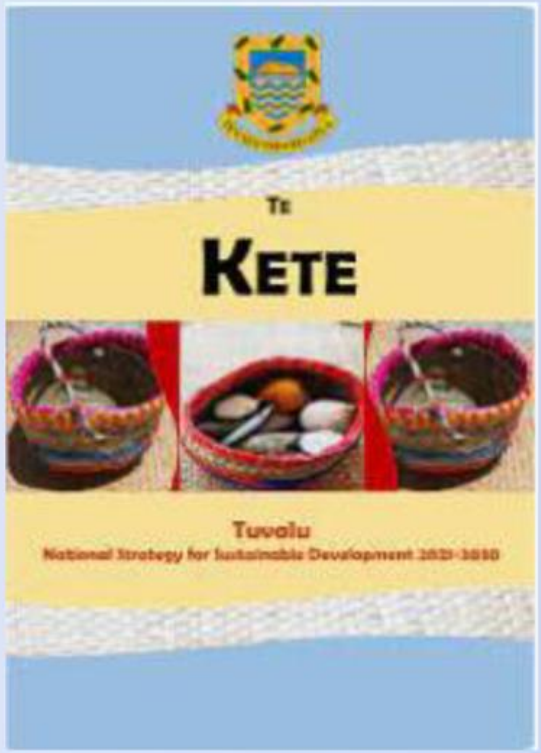
4 Pillars of EWS



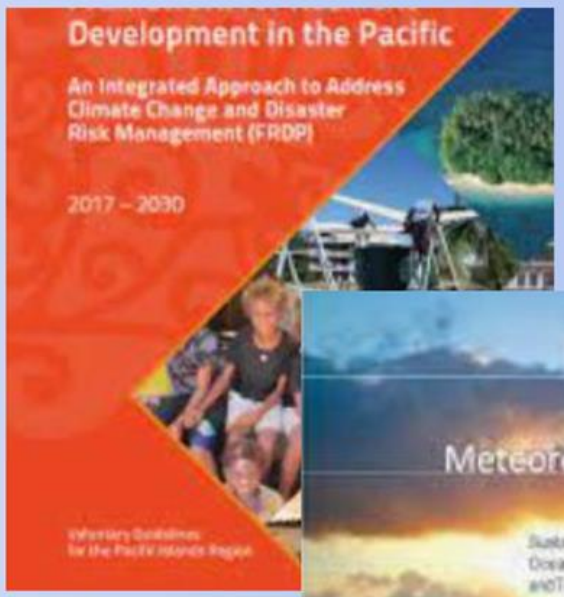
- HAZARD ASSESSMENT
- RISK ASSESSMENT
- COASTAL RISK MONITORING
- SUPPORT PDNA EFFORT
- STRENGTHEN OCEAN PREDICTION SERVICES
- STRENGTHEN OCEAN MONITORING SERVICES
- STRENGTHEN ACCESS TO OCEAN PRODUCTS
- SUPPPORT USER CENTERED PRODUCTS
- SUPPORT TOWARDS IMPACT-BASED FORECAST
- SUPPORT EVACUATION MAPPING
- SUPPORT RISK INFORMED DECISION

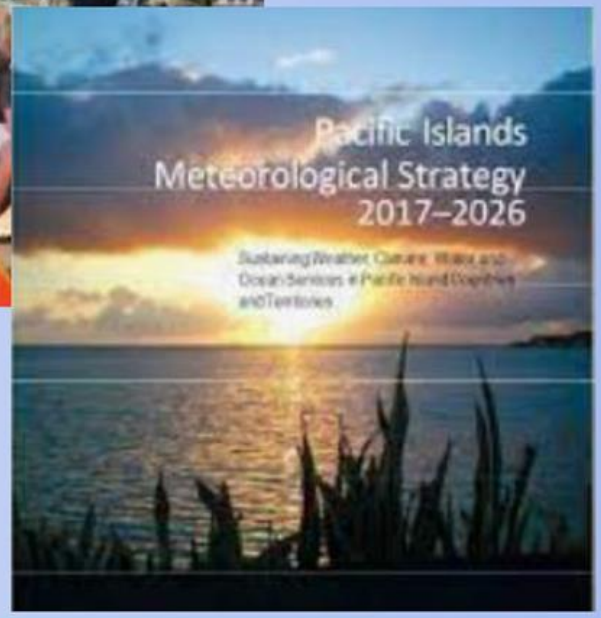
A GLOBAL, REGIONAL AND NATIONAL DEVELOPMENT STRATEGY…

National

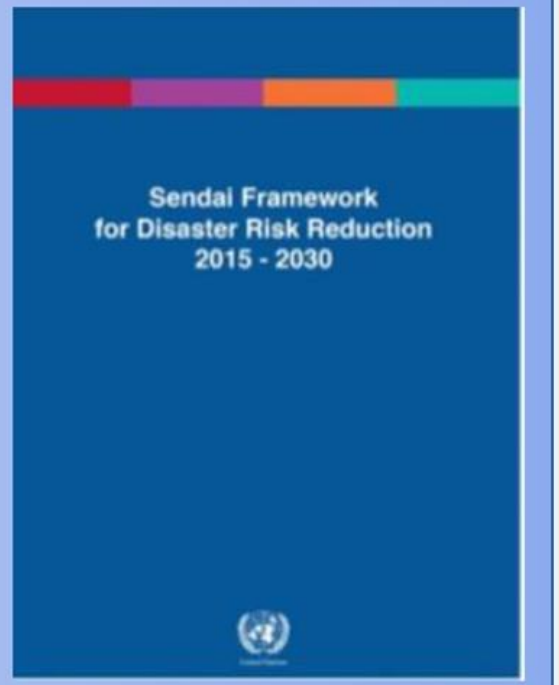


Regional

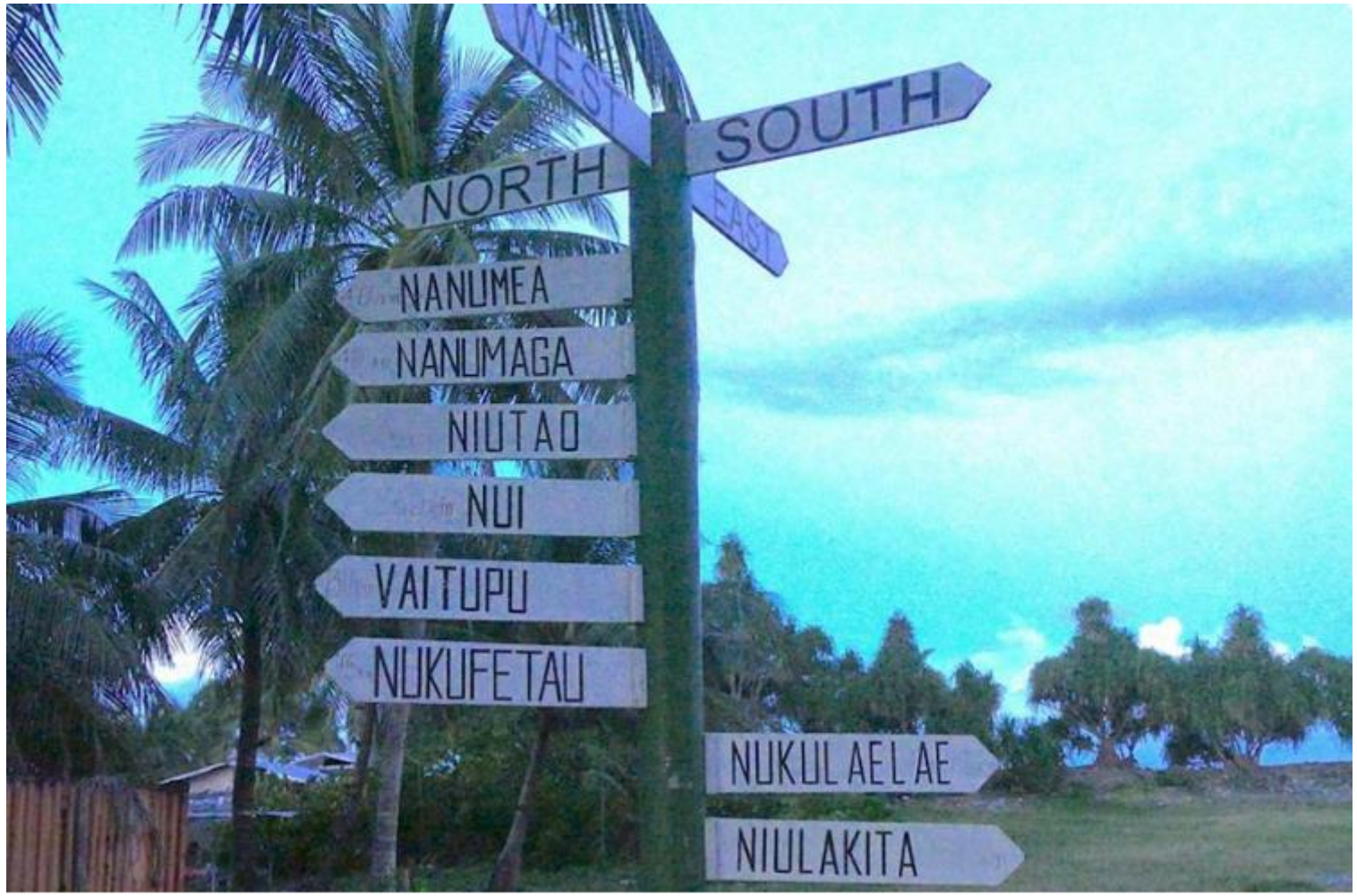




International



Strengthening EW Capacity in Tuvalu



Source: TCAP

Supporting state of the art baseline data collection

Pacific Community
Communauté du Pacifique

index mundi

Tuvalu Geography Profile

Elevation extremes

highest point: unnamed location 5 m

lowest point: Pacific Ocean 0 m

mean elevation: 2 m

Sea Level Rise: Some Implications for Tuvalu

JAMES LEWIS*
Datum International, 101 High Street, Marshfield, Nr Chippenham, SN14 SLT, UK

The entire atoll chain extends over 700 km of ocean, but the total national land area is only 24 km^2. The largest single island is 5 km^2; the highest point of all islands is 4.5 m above mean sea level and most land areas are appreciably

Tuvalu: country data and statistics (worlddata.info)

u is an archipelago in the Pacific about 3700 km away from the Australian mainland. The dwarf state has a total area of only 26 km² (10 mi²) and a coastline of 24 km (14.9 mi). This land area is about 0.8 times the size of Manhattan. In terms of area, Tuvalu is thus the third smallest country in Oceania after Tokelau and Tuvalu and the eighth smallest country worldwide. With 454 inhabitants per km², it is also one of the most densely populated countries.

The highest elevation (Funafuti) reaches only 5 meters. The archipelago consists of 9 islands. Tuvalu has no direct neighbours. The distance between New York City and the Capital Funafuti is about 12,060 km (7,494 mi).

COP23 FIJI
UN CLIMATE CHANGE CONFERENCE
BONN 2017-18

Tuvalu

CURRENT FORECAST: TUVALU AND A

Rising sea levels and creeping tides routinely engulf the remote Pacific island group, degrading its shoreline, eroding its natural ecosystems and threatening the nation's very existence.

• **The country, in brief.** Home to some 11,000 inhabitants, Tuvalu consists of three islands and six low-lying atolls scattered across the middle of the Pacific Ocean. The nation's highest points reach 4.5 metres (14.8 feet) above sea level. Tuvalu's outer islands are largely isolated, hindering communication and making it difficult to provide essential supplies in the face of or following weather-related destruction.

How can we support sound risk informed adaptation solution and long term strategy without the most basic information about the islands?

Symbol Hunt | NATIONAL SYMBOLS → | COMPARE | SEARCH | COUNTRIES

Home » Australia/Oceania » Tuvalu » Average Elevation

AVERAGE ELEVATION ABOVE SEA LEVEL OF TUVALU IS 4.6 M

King Tide was defined and discussed by Lin et al. (2014) as the average island elevation.

Sea Level Rise in Tuvalu

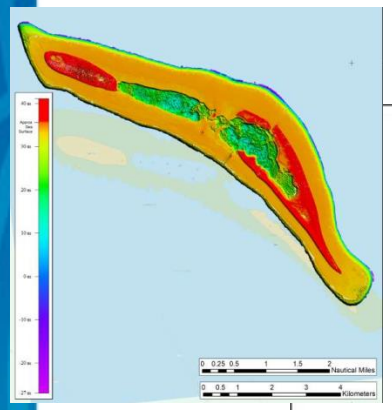
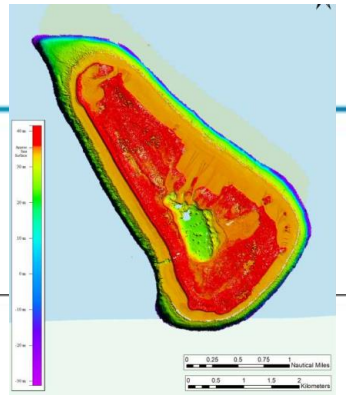
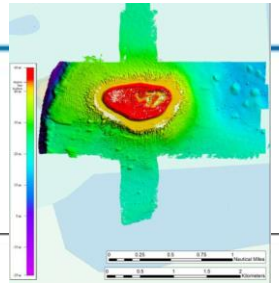
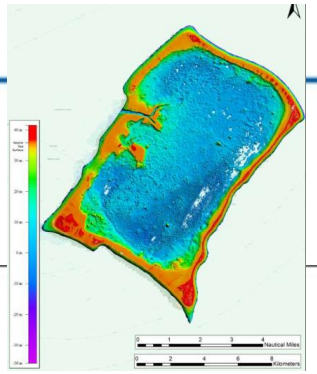
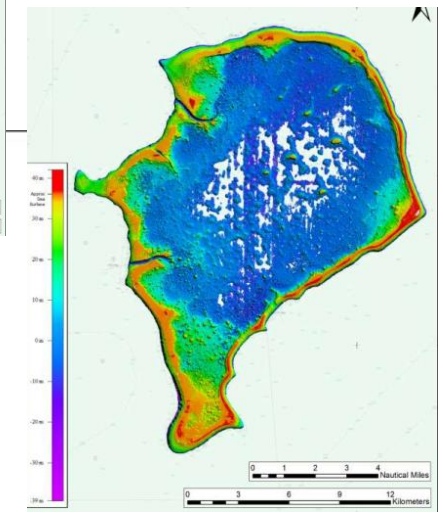
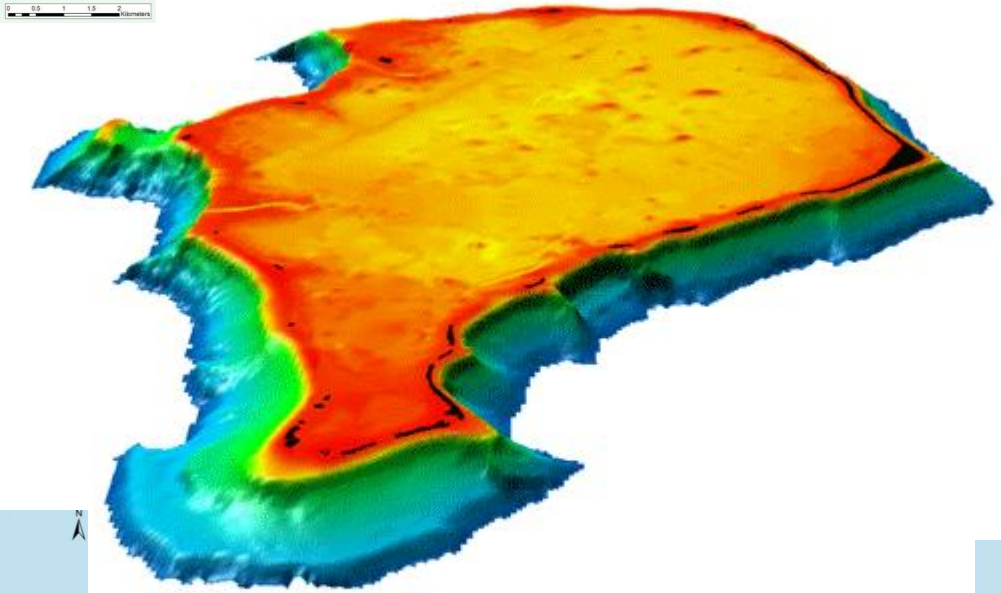
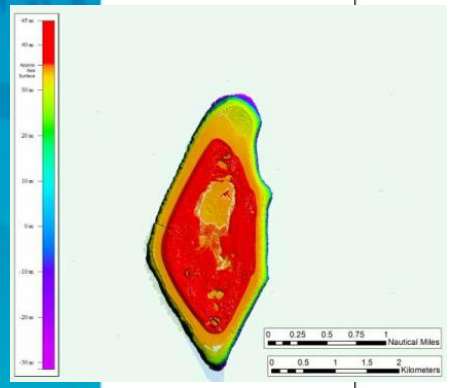
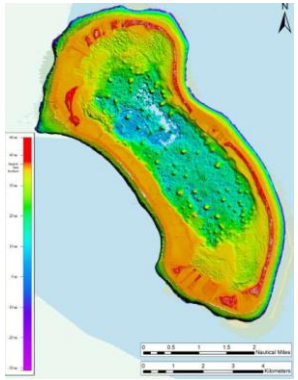
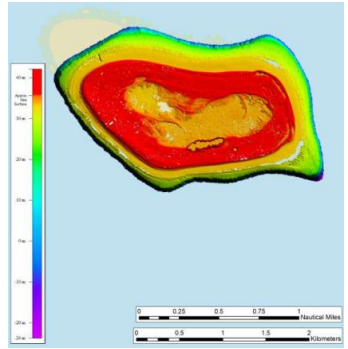
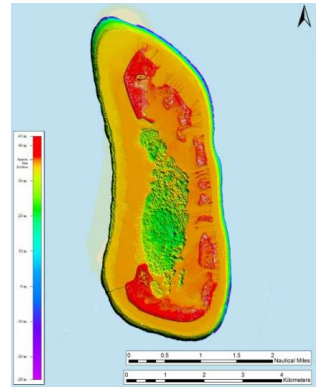
Show affiliations

Lin, C. C. ; Ho, C. R. ; Cheng, Y. H.

Most people, especially for Pacific Islanders, are aware of the sea level change which may caused by many factors, but no of them has deeper sensation of flooding than Tuvaluan. Tuvalu, a coral country, consists of nine low-lying islands in the central Pacific between the latitudes of 5 and 10 degrees south, has the average elevation of 2 meters (South Pacific Sea Level and Climate Monitoring Project, SPSLCMP report, 2006) up to sea level. Meanwhile, the maximum sea level recorded was 3.44m on

SUPPORTING STATE OF THE ART BASELINE DATA COLLECTION

Pacific Community
Communauté du Pacifique

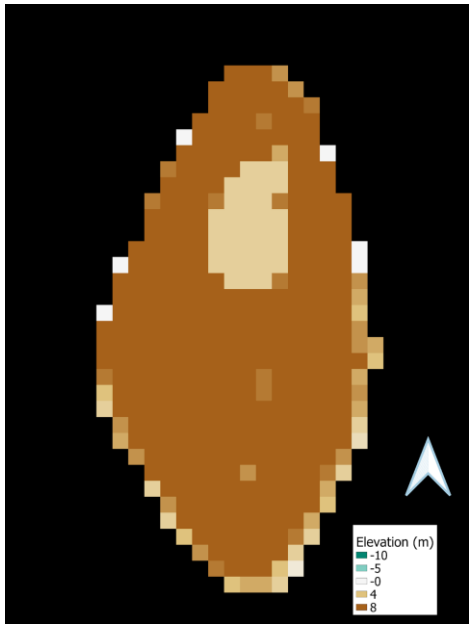











Simple Lidar DEM Analysis

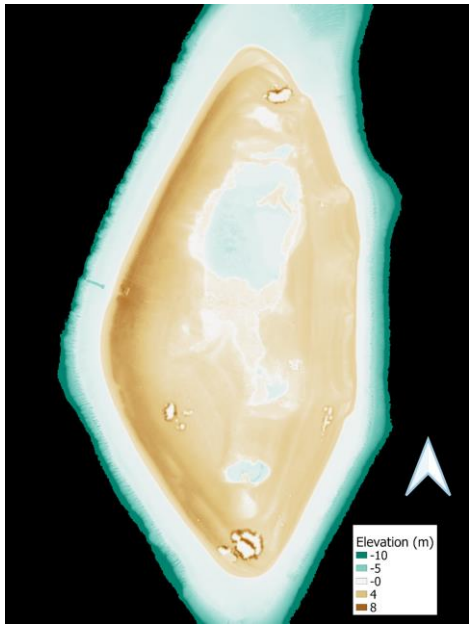
	Max. Elevation	Mean elevation (land above MSL)	Mean elevation (land above MHWS)	Land area above MHWS
Funafuti	6.93 m	1.469 m	1.929 m	2.83 km^2
Nanumea	6.71 m	1.956 m	2.174 m	3.47 km^2
Nanumanga	10.48 m	2.517 m	2.803 m	2.49km^2
Nukulaelae	10.48 m	1.139 m	1.866 m	1.89 km^2
Vaitupu	7.68 m	1.740 m	2.140 m	4.97 km^2
Nukufetau	5.81 m	1.436 m	1.881 m	3.09 km^2
Niulakita	6.54 m	3.254 m	3.557 m	0.42 km^2
Niu	8.37 m	0.963 m	1.994 m	4.29 km^2
Niutao	8.67 m	2.438 m	3.039 m	1.87 km^2
Overall	**10.48 m**	**1.54 m**	**2.20 m**	**25.33 km^2**

Benefit in investing in high quality baseline data for Tuvalu

DEM Comparison for Nanumaga



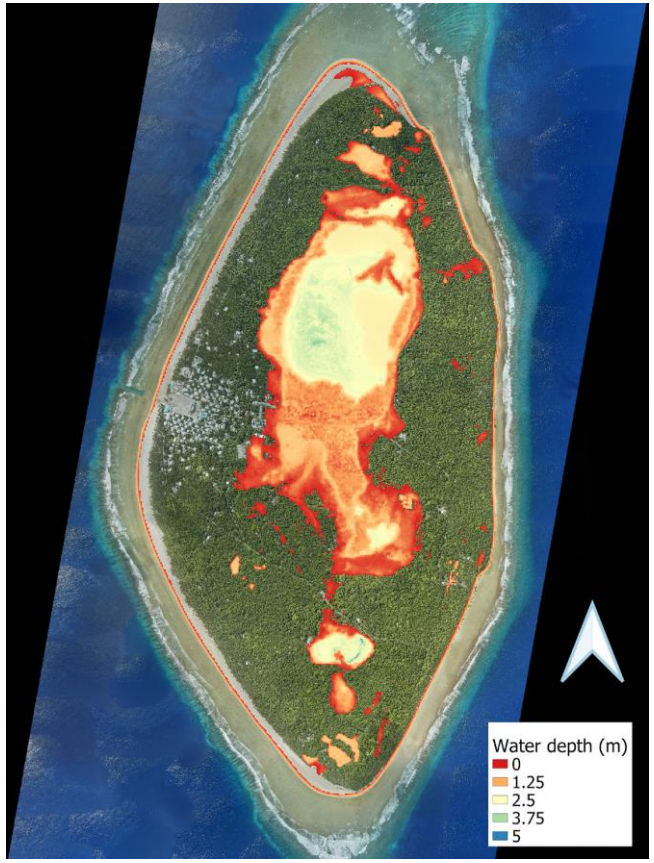
Best Available Topography before TCAP (SRTM)



TCAP LiDAR dataset

Tuvalu	SRTM	Lidar
Mean elevation	9.2 m	1.55 m
Maximum elevation	27 m	10.48 m

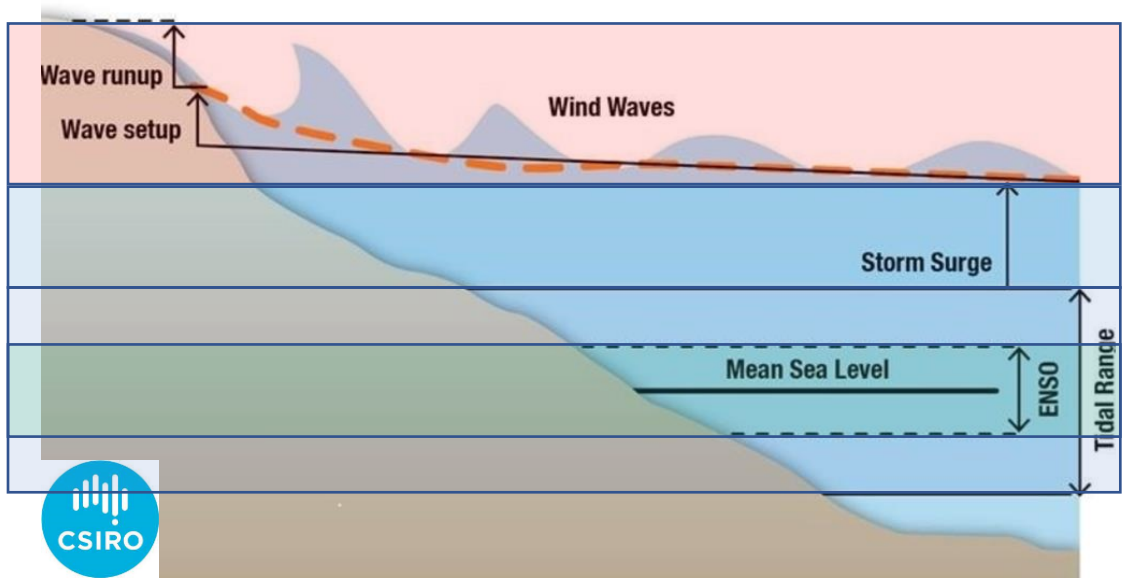
Comparison using simple inundation mapping (Bathtub modelling)
Scenario: High tide + SLR (2100, SSP5 -8.5)



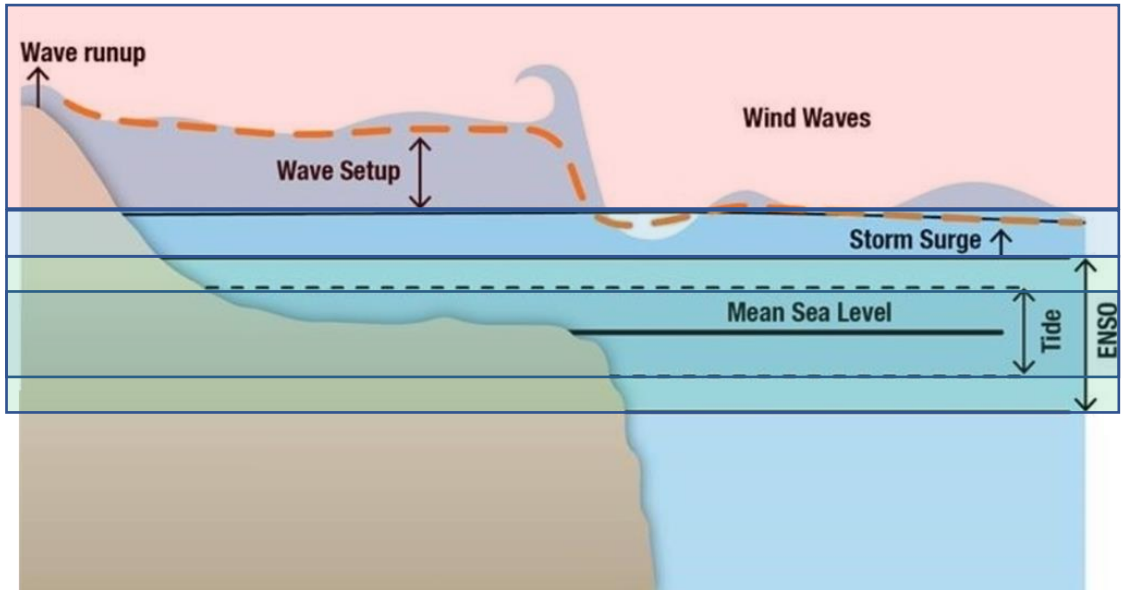
Coastal inundation

Pacific Community
Communauté du Pacifique

Smooth continental shelf

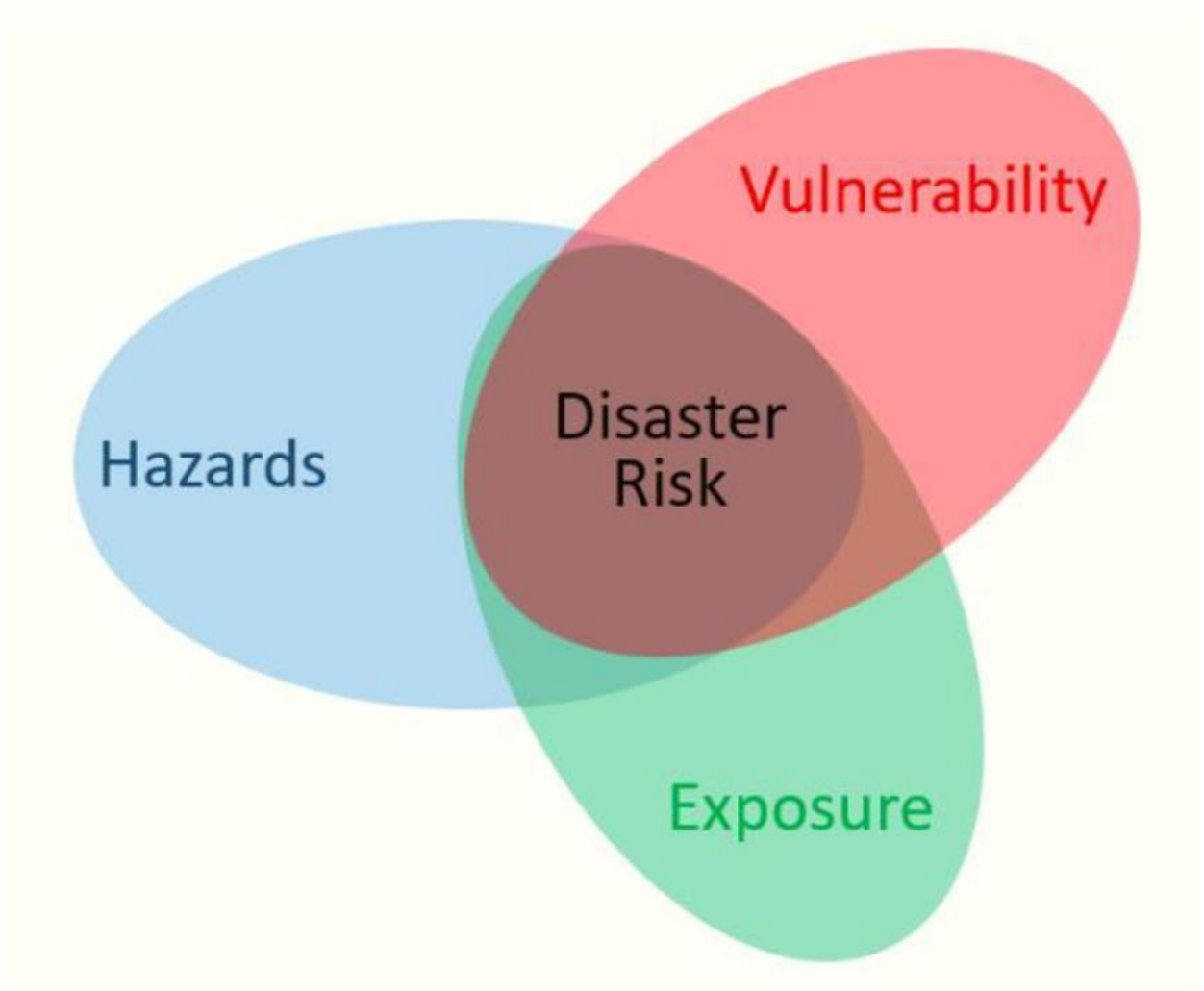


Reef fronted island



Waves dominate coastal inundation in reef fronted island

Risk Knowledge

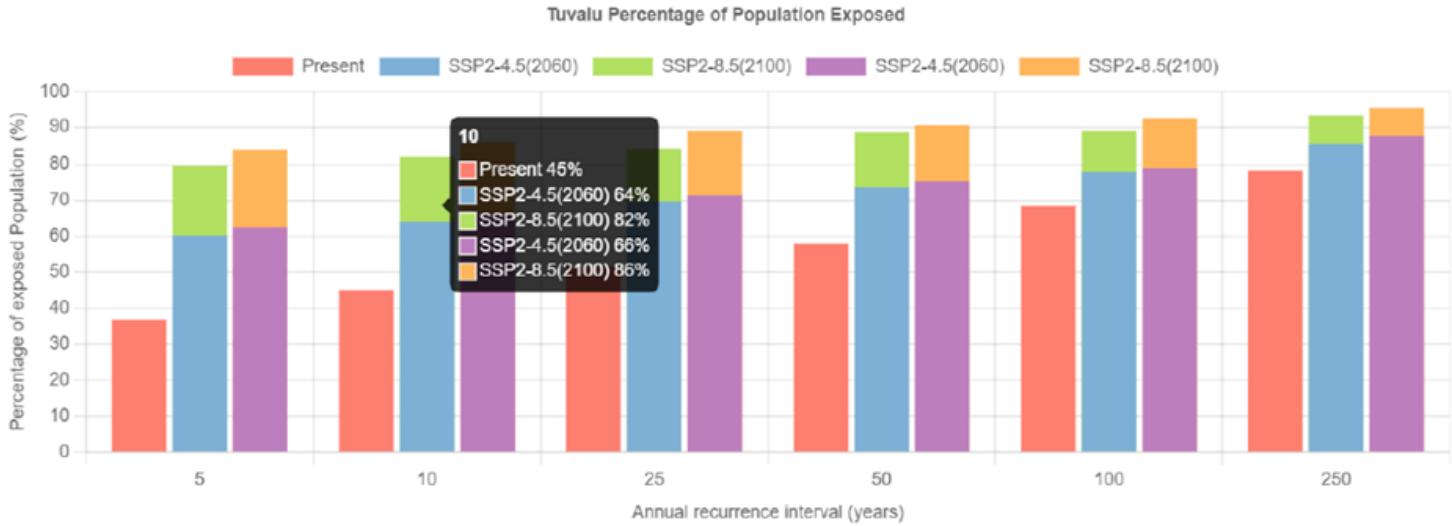


SCOPE
Hazard: Coastal inundation

Exposure: population, buildings, roads

Vulnerability:
- Exposure to hazard
- Physical damage
- Economical loss

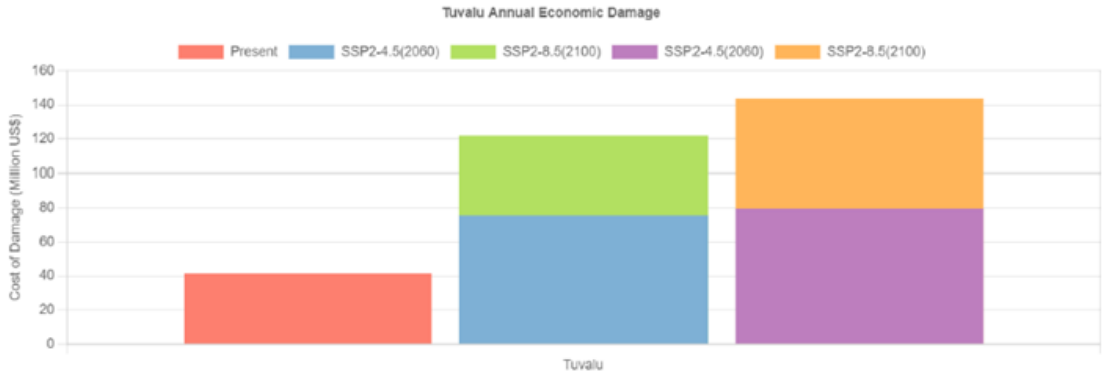
Scope to be extended with gov. led community consultation through the TCAP coastal risk monitoring and assessment programme.



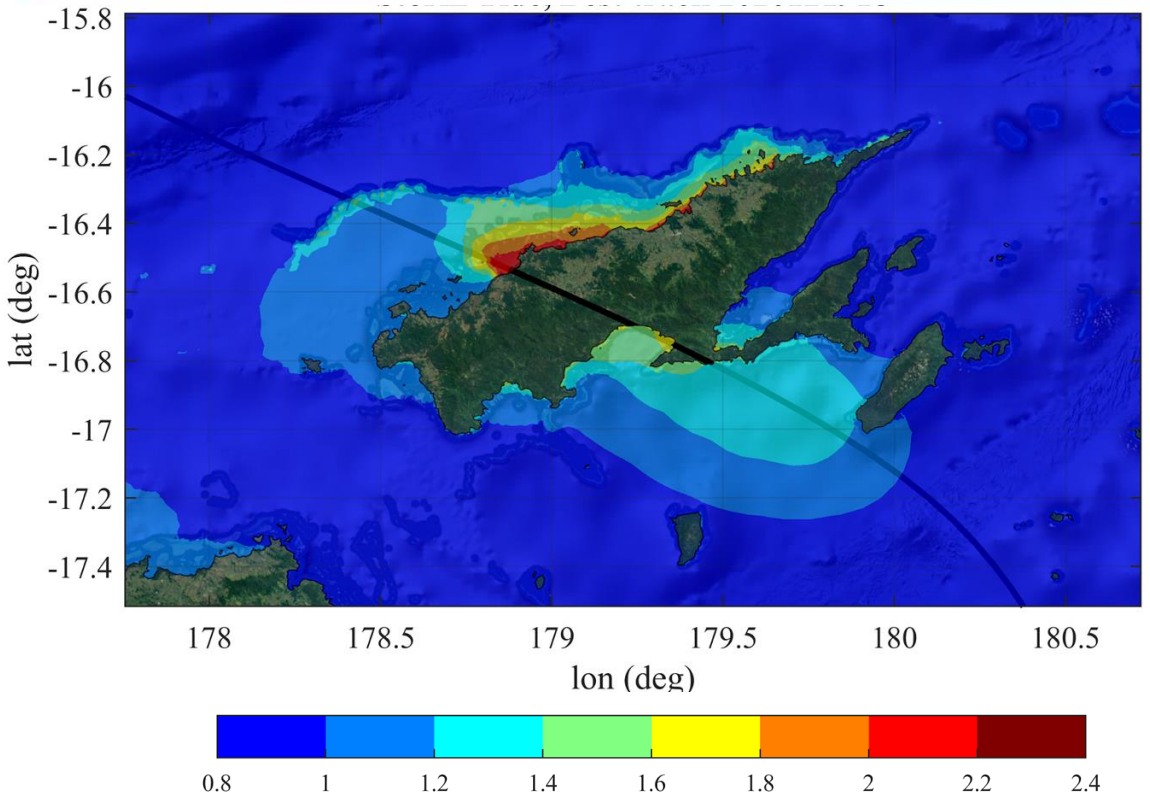
Population affected

Buildings affected

Annual Economic Damage



Towards impact(-based) forecasting



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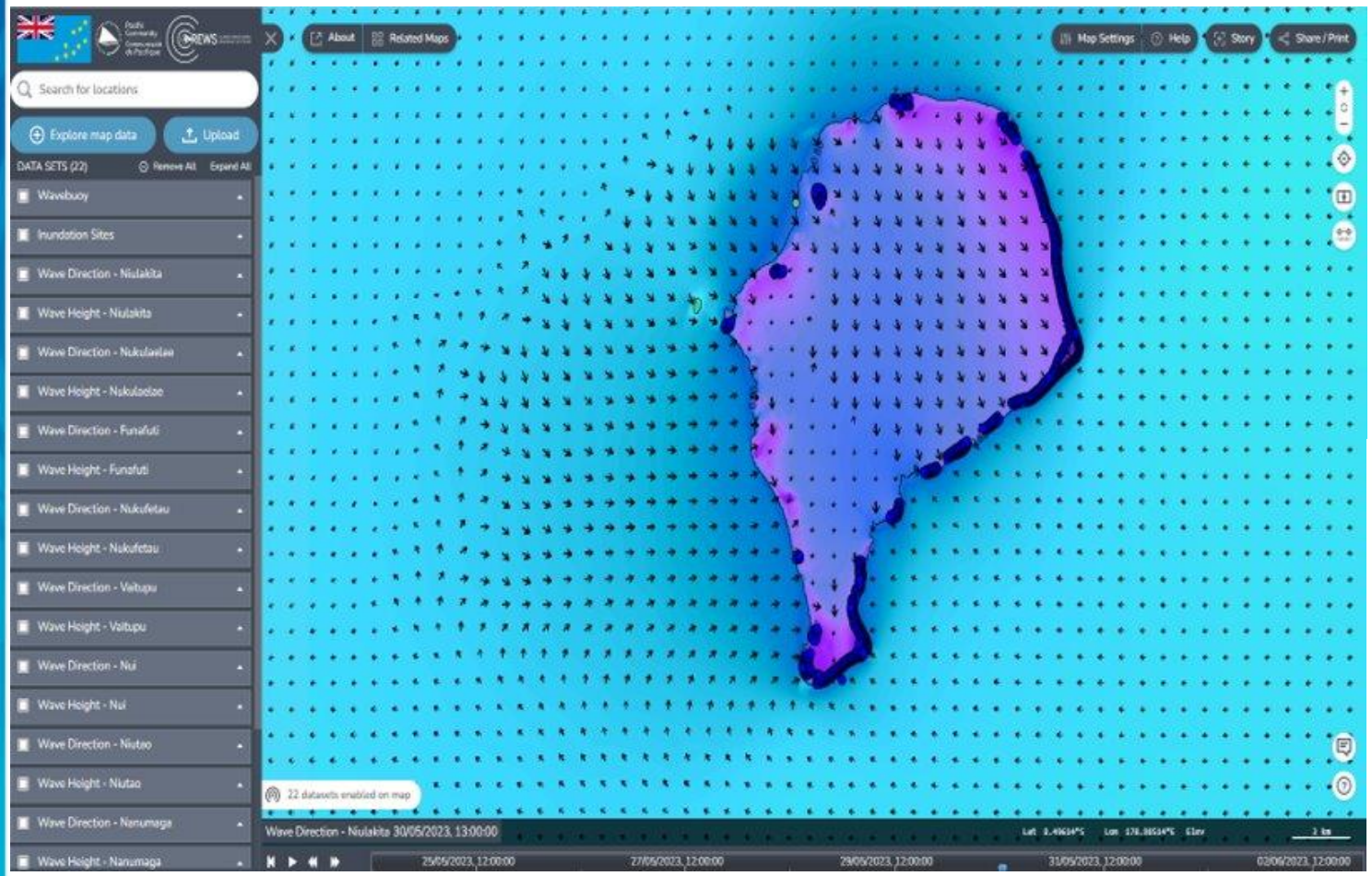
PCRAFI
Pacific Catastrophe Risk Assessment & Financing Initiative
Better Risk Information for Smarter Investments

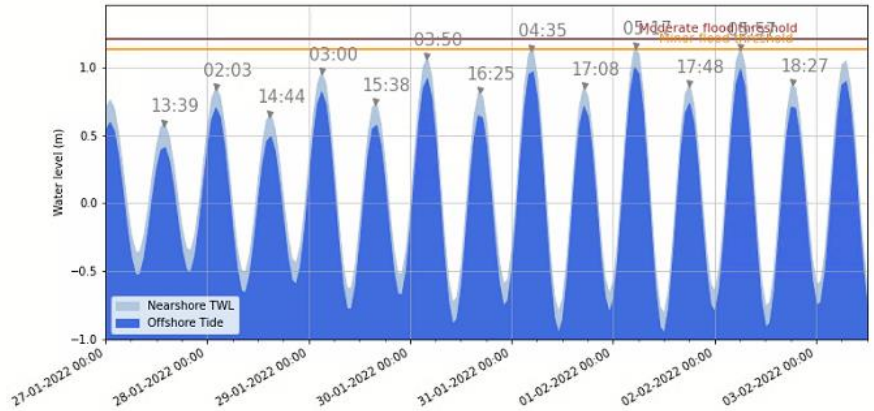
PARTneR-2
Pacific Risk Tool for Resilience, Phase 2



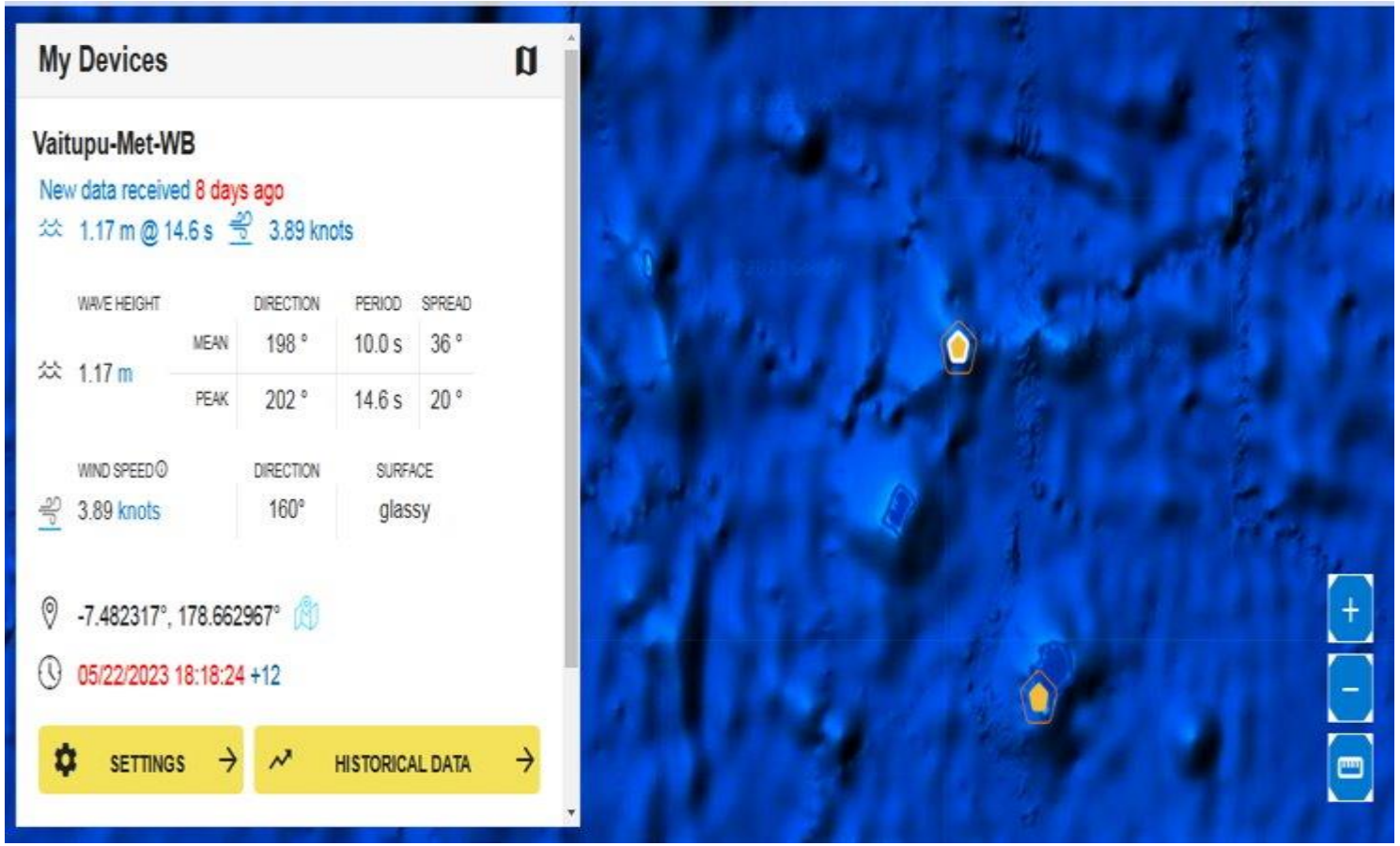


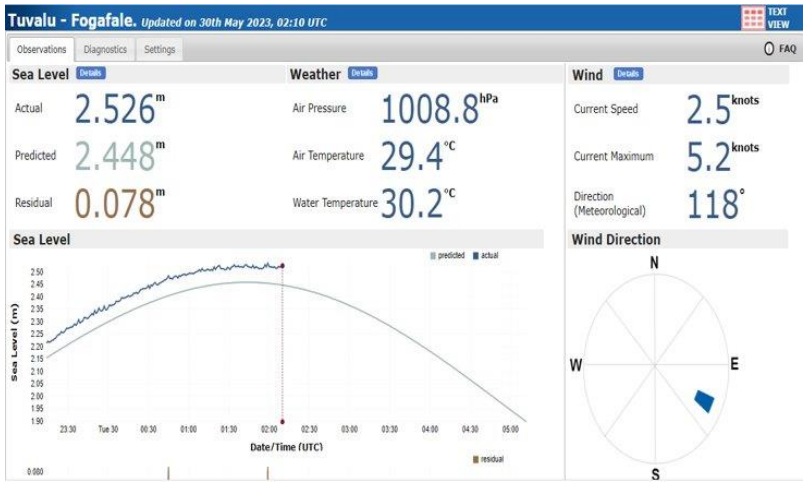

Detection and warning





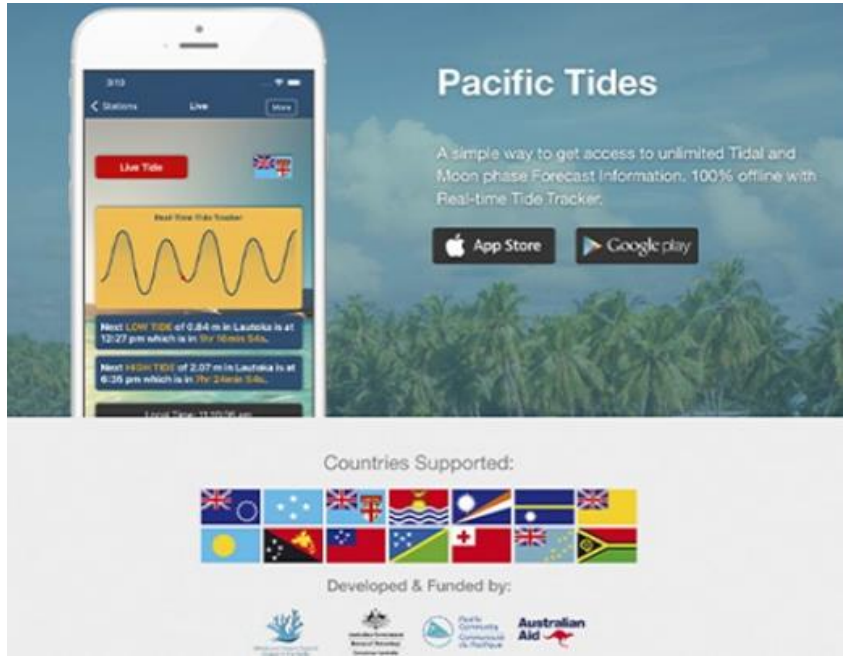
Monitoring/Observations





Pacific Tides App

- Available for free for Android and iPhone
- Provides tide predictions for the next 7 days.
- Available for 25 locations in the Pacific



Climate and Oceans Support Program in the Pacific

Pacific Ocean Portal

Tourism

Ocean Monitoring

Coral Reefs

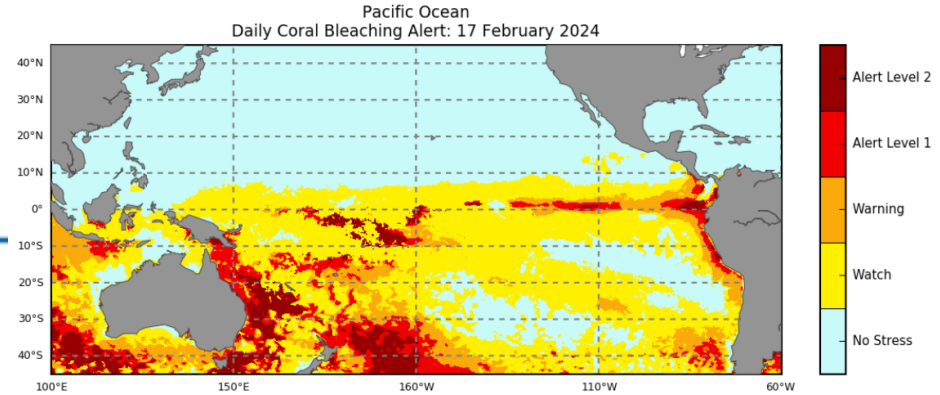
Sea Level

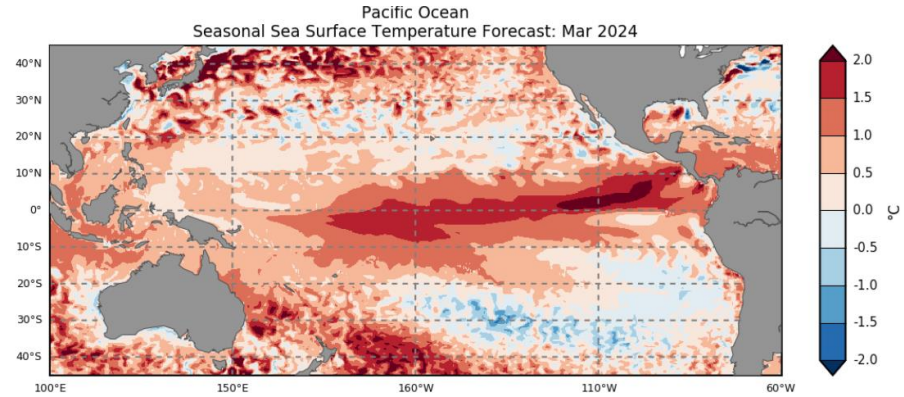
Fisheries

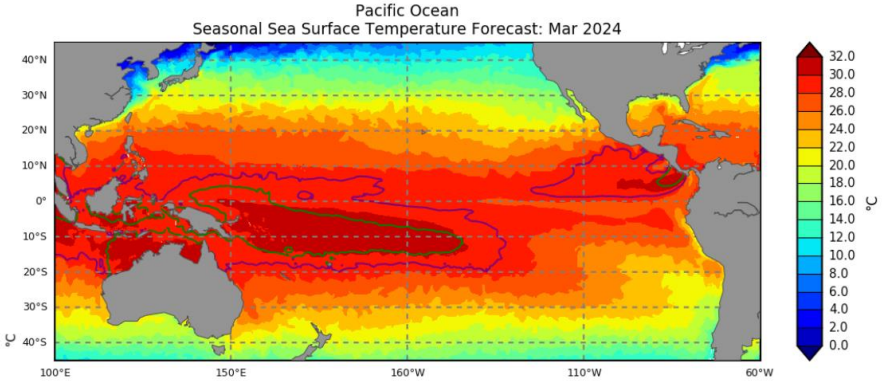
Shipping

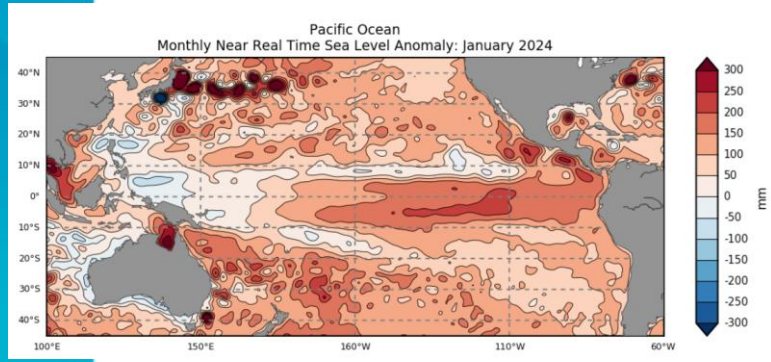
Library

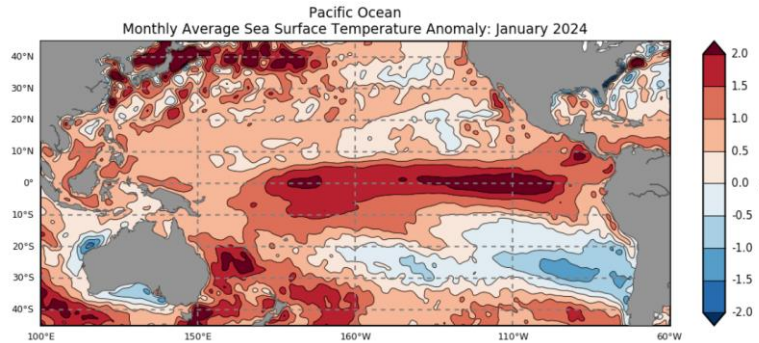
Pacific Tides App











Communications and Dissemination

Communications: pathway to reach the last mile

Tuvalu Meteorological Service
June 2 at 8:01 PM ·

Te tau ote aso mo Tuvalu ne fakatoka mai te Ofisa o 'Tau o aso I Funafuti Po 02nd o Iuni, 2023 te 06.00 ite afiafi nei.

Situation:
✅Te alaaga matagi agi malielie kite agi feoloolo mai saegalaa ki matuu-saegalaa e fakalava nei iluga o Tuvalu.
✅Aso feoloolo ka aofia iei Niulakita.

Faka'tauga:
✅Tau ote aso ite afiafi nei ke oko kite 6.00 ite taeao:
✅Mo Niulakita: ka solo kaumana kite nai kaumana mote fakamoemoega me ka mafai o isi ne afuafuga vaiua ine taimi.
✅Toega o fenua ka lasi kite lei.
✅Te matagi ka agi mai saegalaa 05 kite 10 nooti.
✅Te moana ka lei.

Kilokiloga mo aso e 3 mai mua nei:
☀️Aso Ono - Ka lasi kite lei.
Te matagi ka agi mai saegalaa ki matuu-saegalaa 05 kite 10 nooti.
Te moana ka lei.
☀️Aso Saa - Ka lasi kite lei.
Te matagi ka agi mai saegalaa ki matuu-saegalaa 05 kite 10 nooti.
Te moana ka lei.
☀️Aso Gafua - Ka lasi kite lei.
Te matagi ka agi mai saegalaa ki saute-saegalaa 05 kite 10 nooti.
Te moana ka lei.

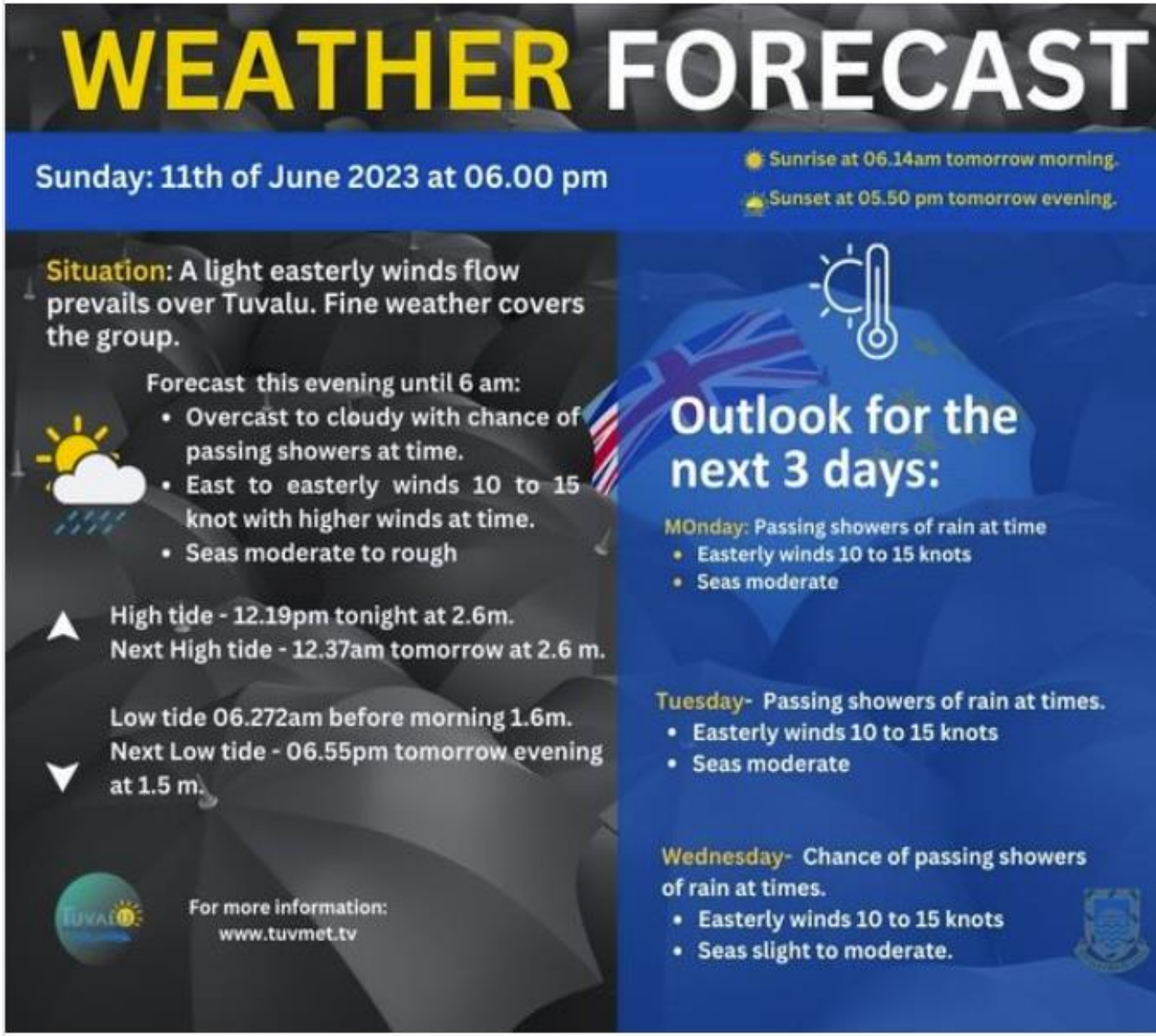
Gasuesuega ote tai:
✅Tai ka Masa - 09.44 ite poo nei kise malalo e 1.3 mita.
✅Tai ka Fonu - 04.00 ite fakavaveao kise maluga e 2.9 mita.
✅Tai ka toe Masa - 10.24 ite taeao ma taeao kise malalo e 1.2 mita.
✅Tai ka toe Fonu - 04.26 ite fakafiafi ma taeao kise maluga e 2.7 mita.

Fakailoaga mo tatou katoa:
✅ka lasi te lofiaga mo Koo'gakoga malalo ote fenua pela foki mo taisala salalau mo koo'gakoga tafatafa ki feitu ki tai mo namo mai tai lasi ote masina nei ka kamata ite poo nei kae ka fakasoko atu kite Aso Tolu ite vaiaso fou po 07th ote masina nei.
✅Tai ka lasi malosi atu ite taeao malu ote aso Gafua ite vaiaso fou po 05th o luni 2023.

Saega mo 'toga ote laa ite aso nei:
✅Ne sae te laa ite 06.12 ite taeao nei.
✅Kae ka too te laa ite 05.49 afiafi nei.

Tuvalu Meteorological Service
2d ·

Tuvalu Weather Forecast for this Evening!!



Response Capability

- Internal Coordination
- Community Disaster Preparedness, Response and Recovery Planning

Decision Support Tools

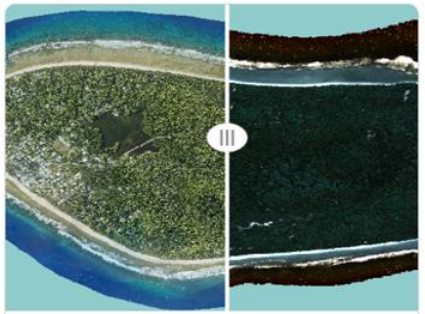
TCAP Dashboard

This dashboard was developed under the Tuvalu Coastal Adaption Project (TCAP). The portal provides home for gridded and geospatial data produced by the project.

Inundation

Shows inundation for different climate projections.

Browse >



Shoreline Change

Tool to analyze shoreline change overtime.

Browse >

Risks

Shows risk level on different assets.

Browse >

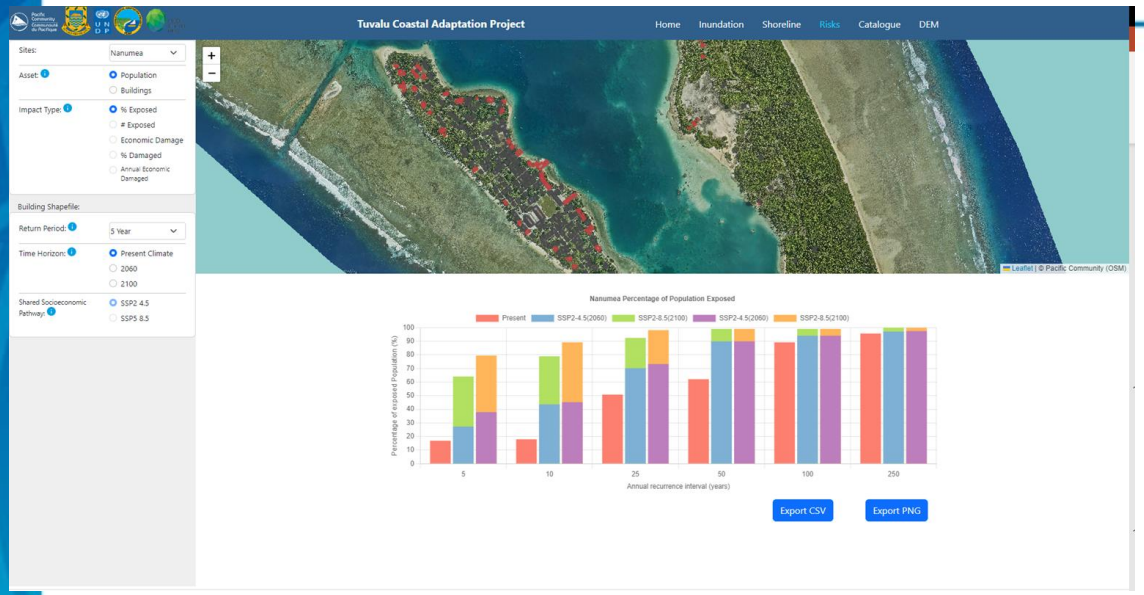
Catalogue

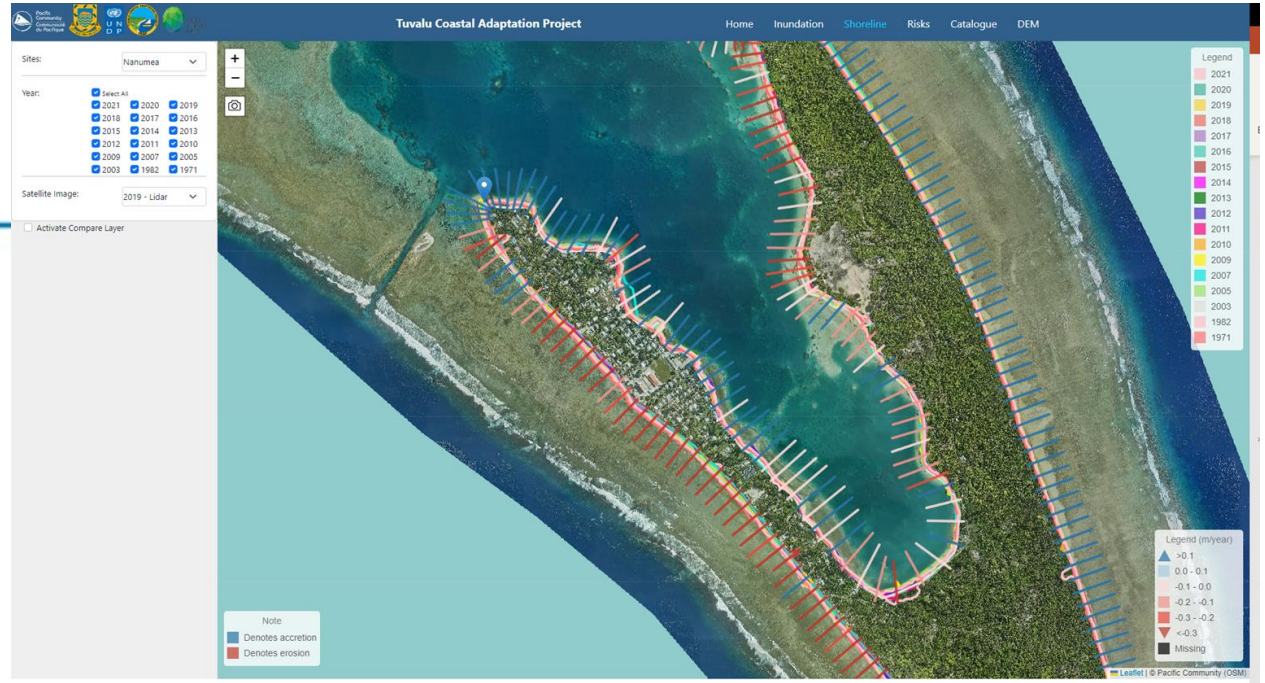
A collection of reports produced.

Browse >

Developed and Funded by:

DASHBOARDS (TCAP)





https://opm.gem.spc.int/tcap/home

Added benefits

DateTime	Hs	Tp	PkDir	Tm	Mwd	Wsp	Gst	WD	Vis	SST
2023-06-25 07:00:00	0.9	12.9	155	3.1	163	13.1	14.3	115	24135	29.8
2023-06-25 08:00:00	0.9	12.9	155	3.1	163	13.0	14.3	115	24135	29.7
2023-06-25 09:00:00	0.9	12.9	155	3.0	163	12.8	14.2	115	24135	29.7
2023-06-25 10:00:00	0.9	12.9	155	3.0	163	12.8	14.2	113	24135	29.7
2023-06-25 11:00:00	0.9	12.9	155	3.0	163	12.8	14.2	112	24135	29.7
2023-06-25 12:00:00	0.9	12.9	155	3.0	164	12.8	14.2	111	24135	29.7
2023-06-25 13:00:00	0.9	12.9	155	3.0	164	13.0	14.2	110	24135	29.7
2023-06-25 14:00:00	0.9	12.9	155	3.0	164	13.2	14.2	109	5913	29.8
2023-06-25 15:00:00	0.9	12.9	155	3.0	164	13.4	14.2	108	5913	29.8
2023-06-25 16:00:00	0.9	12.9	155	3.0	164	13.2	14.1	105	5913	29.8
2023-06-25 17:00:00	0.9	12.9	155	3.0	164	13.0	13.9	103	24135	29.7
2023-06-25 18:00:00	0.9	12.9	155	3.0	164	12.8	13.8	100	24135	29.7
2023-06-25 19:00:00	0.9	12.9	155	3.0	165	13.1	13.9	101	24135	29.7
2023-06-25 20:00:00	0.9	12.9	155	3.0	165	13.5	14.1	102	24135	29.8
2023-06-25 21:00:00	0.9	12.9	155	3.0	165	13.8	14.2	102	24135	29.8
2023-06-25 22:00:00	0.9	12.9	155	3.0	165	13.0	13.5	104	24135	29.8
2023-06-25 23:00:00	0.9	12.9	155	3.0	166	12.2	12.8	105	24135	29.9
2023-06-26 00:00:00	0.9	12.9	155	3.0	166	11.3	12.1	106	24135	29.9
2023-06-26 01:00:00	0.9	12.9	155	3.0	166	11.5	12.3	108	24135	29.9
2023-06-26 02:00:00	0.9	12.9	155	3.1	167	11.8	12.6	110	24135	29.9
2023-06-26 03:00:00	0.9	12.9	155	3.1	167	12.0	12.8	113	24135	29.9
2023-06-26 04:00:00	0.9	12.9	155	3.1	167	12.1	12.9	112	24135	29.9
2023-06-26 05:00:00	1.0	12.9	155	3.1	168	12.3	13.0	111	24135	29.8
2023-06-26 06:00:00	1.0	12.9	155	3.1	168	12.5	13.0	110	24135	29.8
2023-06-26 07:00:00	1.0	12.9	155	3.1	168	12.4	13.2	110	24135	29.8
2023-06-26 08:00:00	1.0	12.9	155	3.1	168	12.2	13.4	110	24135	29.7
2023-06-26 09:00:00	1.0	12.9	155	3.1	169	12.1	13.6	110	24135	29.7
2023-06-26 10:00:00	1.0	12.9	155	3.1	169	11.7	13.2	109	24135	29.7
2023-06-26 11:00:00	1.0	12.9	155	3.1	169	11.3	12.8	108	24135	29.7
2023-06-26 12:00:00	1.0	12.9	155	3.2	169	10.9	12.4	107	24135	29.7
2023-06-26 13:00:00	1.0	12.9	155	3.2	169	11.1	12.3	107	24135	29.7
2023-06-26 14:00:00	1.0	12.9	155	3.2	170	11.3	12.2	106	21415	29.6
2023-06-26 15:00:00	1.0	12.9	155	3.2	170	11.5	12.1	105	21415	29.6
2023-06-26 16:00:00	1.0	12.9	155	3.2	170	11.4	12.2	106	21415	29.6
2023-06-26 17:00:00	1.0	12.9	155	3.2	170	11.3	12.4	107	24135	29.6
2023-06-26 18:00:00	1.0	12.9	155	3.2	170	11.2	12.6	108	24135	29.6
2023-06-26 19:00:00	1.0	12.9	155	3.2	170	11.1	12.4	110	24135	29.6
2023-06-26 20:00:00	1.0	12.9	155	3.2	170	11.0	12.1	111	24135	29.8
2023-06-26 21:00:00	1.0	11.7	155	3.2	170	10.9	11.9	112	24135	29.8
2023-06-26 22:00:00	1.0	11.7	155	3.2	170	10.8	11.7	116	24135	29.8
2023-06-26 23:00:00	1.0	11.7	155	3.2	170	10.7	11.6	120	24135	29.9
2023-06-27 00:00:00	1.0	11.7	155	3.3	170	10.7	11.5	125	24135	29.9
2023-06-27 01:00:00	1.0	11.7	155	3.3	170	10.5	11.4	120	24135	29.9
2023-06-27 02:00:00	1.0	11.7	155	3.3	170	10.4	11.4	115	24135	29.9
2023-06-27 03:00:00	1.0	11.7	155	3.3	171	10.3	11.3	110	24135	29.9
2023-06-27 04:00:00	1.0	11.7	155	3.3	171	10.3	11.2	108	24135	29.9
2023-06-27 05:00:00	1.0	11.7	155	3.3	171	10.3	11.0	106	24135	29.8
2023-06-27 06:00:00	1.0	11.7	155	3.3	171	10.3	10.9	104	24135	29.8
2023-06-27 07:00:00	1.0	14.2	155	3.3	171	10.4	11.1	106	24135	29.8
2023-06-27 08:00:00	1.0	14.2	155	3.3	171	10.4	11.3	107	24135	29.7
2023-06-27 09:00:00	1.0	14.2	155	3.3	171	10.4	11.5	109	24135	29.7
2023-06-27 10:00:00	1.0	14.2	155	3.3	171	10.8	11.8	107	24135	29.7
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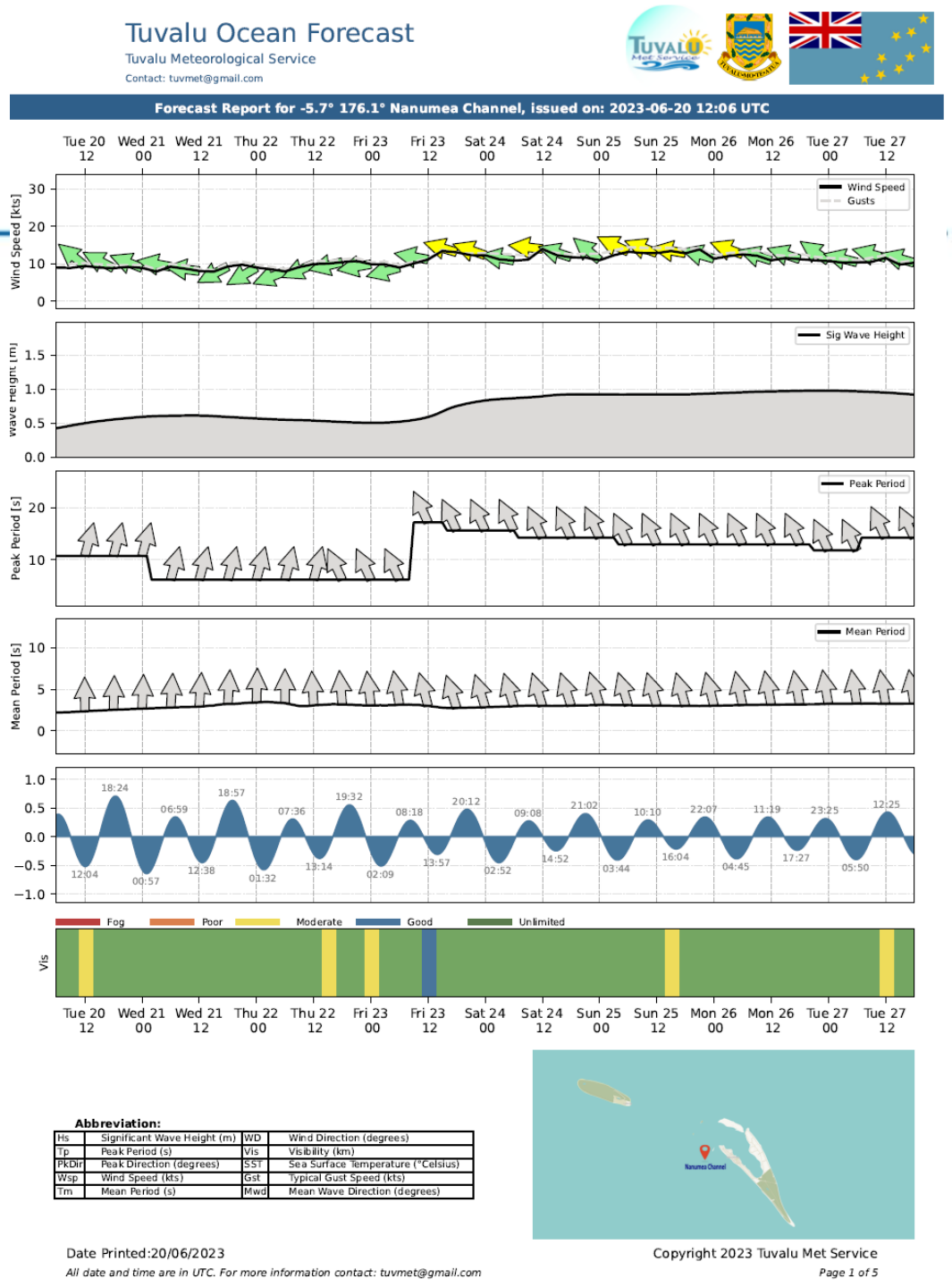

Science informed decisions

https://tcap.tv/

Adaptation Options or Hazards?

Source: Matt Blacka Cook Islands

Thank you/Vinaka

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Pacific Community (SPC)

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