Mid-Morning Session
10:30: Hazard mapping in the Pacific

Dan Rodger
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Today

- Very Large Scale Hazard Mapping
- Available data and tools you can use
- Analysis methods
- Getting help

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Cyclones & typhoons

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Cyclones & typhoons

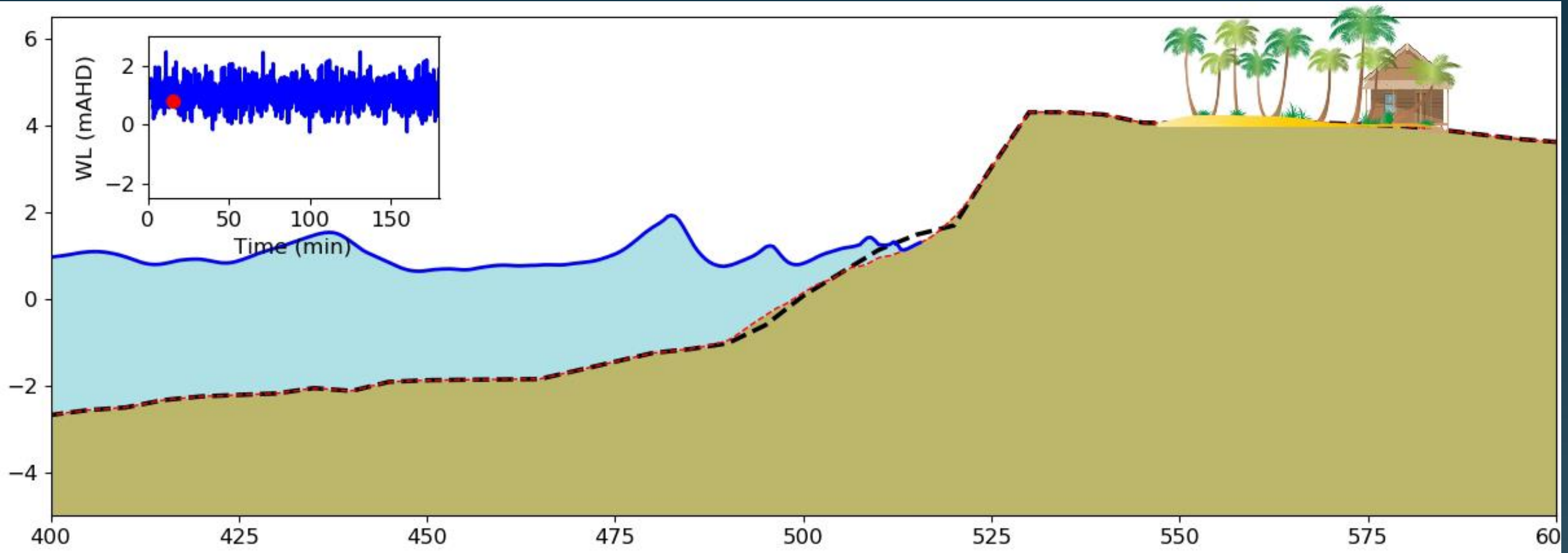
Delft3D Cyclone Model
(free open source model)

Erosion

Coconut Island, Torres Strait

Erosion

Xbeach erosion model
(free open source model)



Shoreline recession

Google Earth Engine (free online tool)

Paramaribo,
South America

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Tsunami

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Tsunami

Delft3D Tsunami Model
(free open source model)

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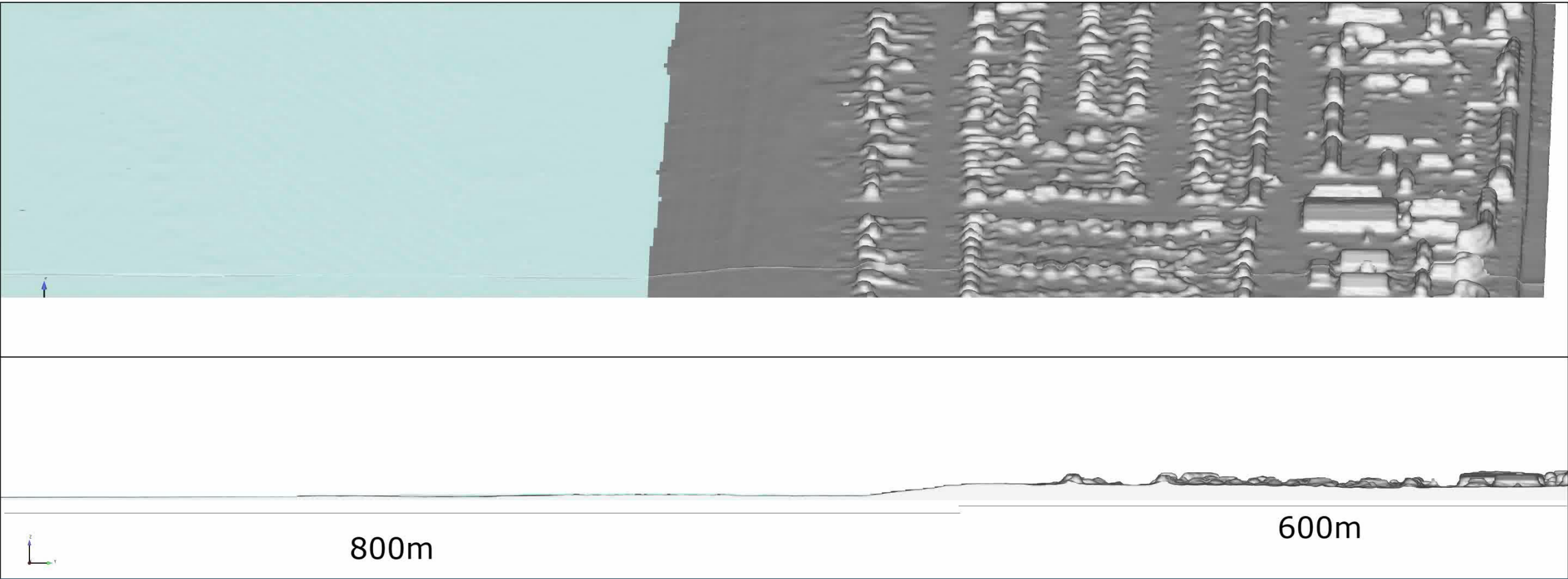
Tsunami

Flow3D model
(not open source – sorry ☹)



Flood

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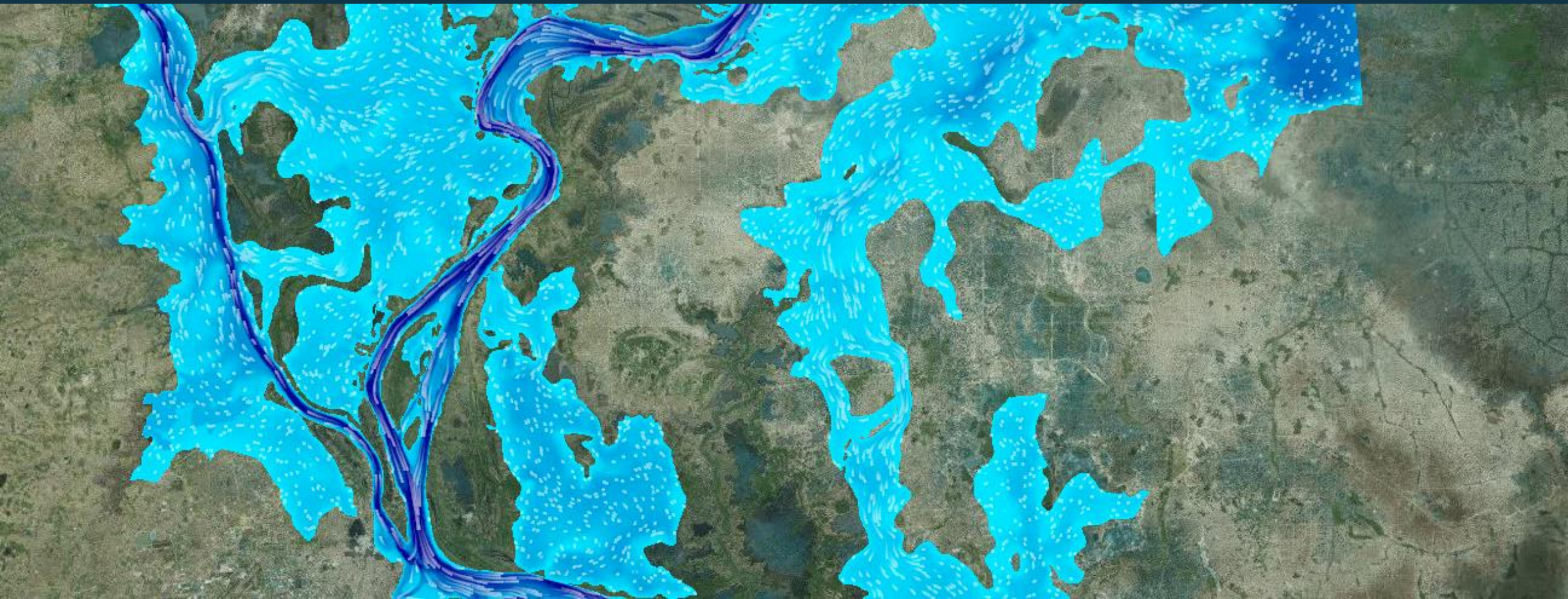
Flood

HEC5 flood model
(free open source model)



Today

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- Available data and tools you can use
- Analysis methods
- Getting help

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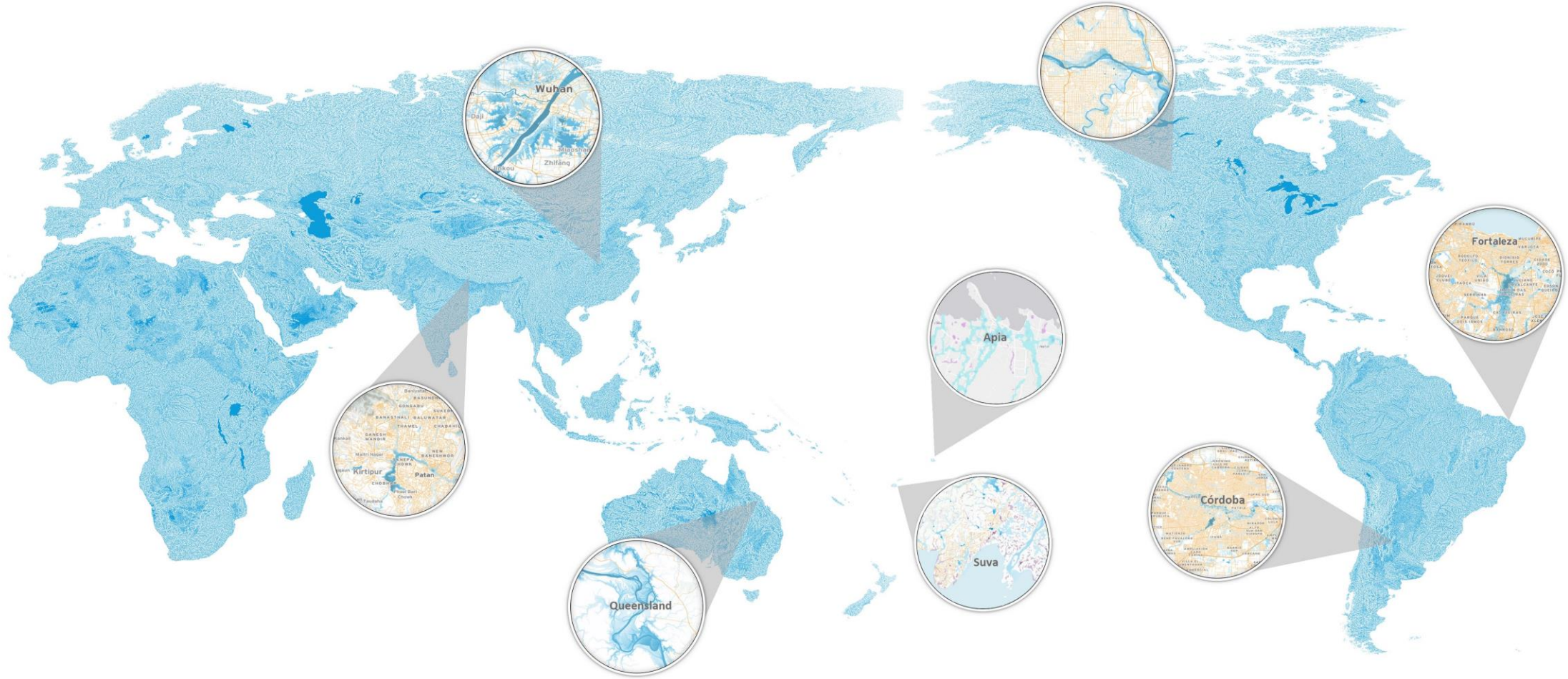
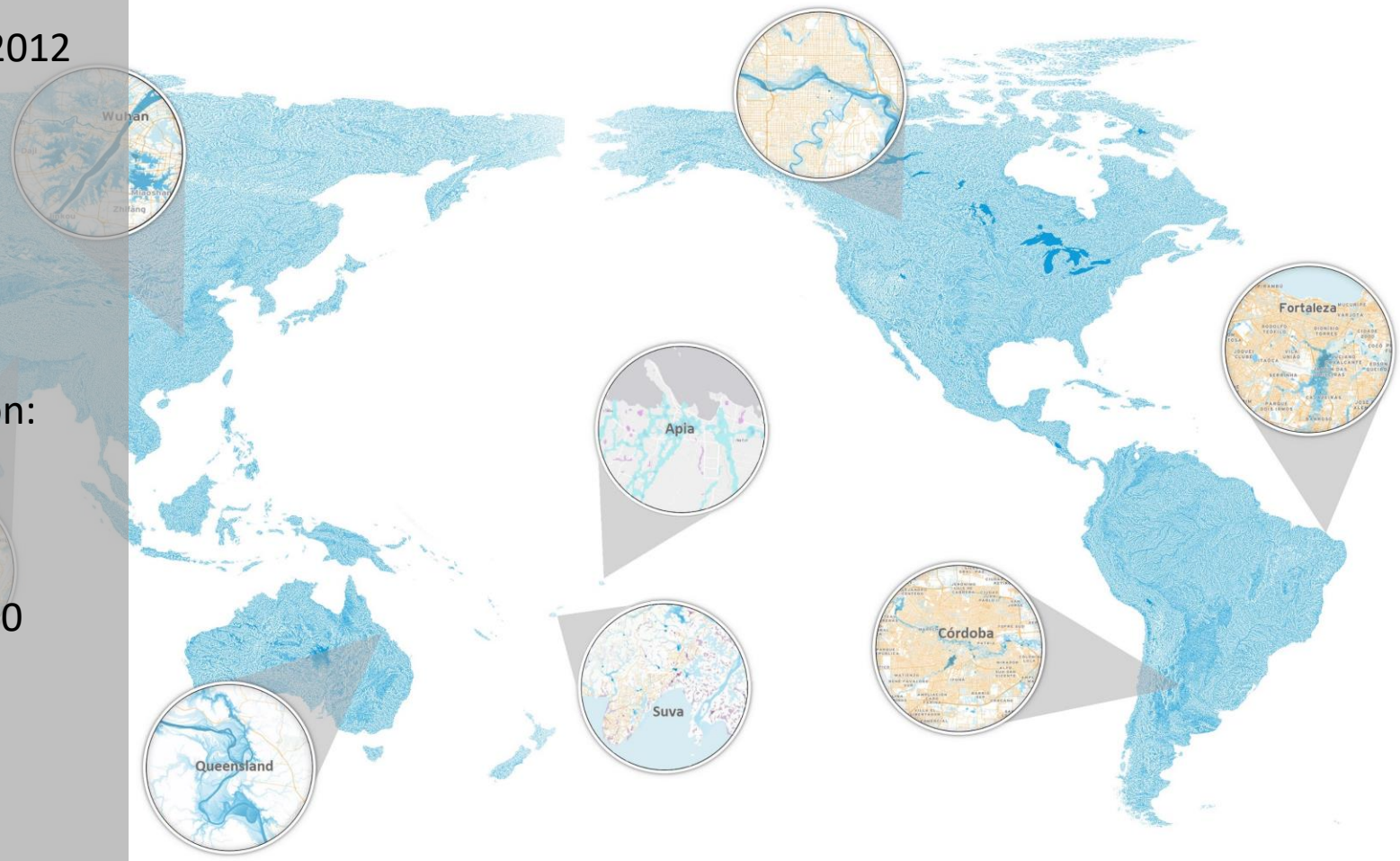
Available data and tools you can use



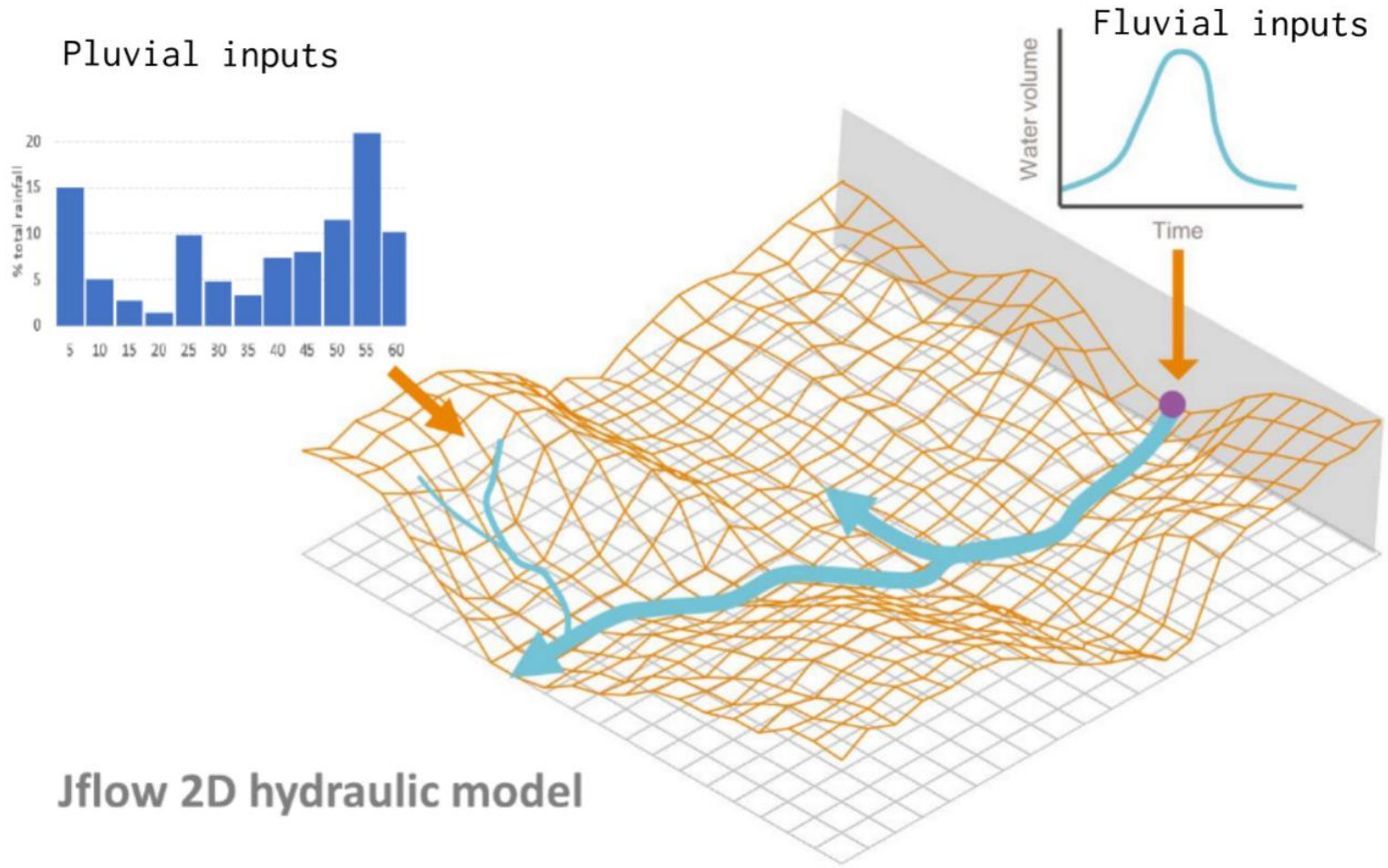
Available data and tools you can use

- First detailed world-wide map created circa 2012
- Catchment delineation from 30m DEM
- Rain/flow stats from 110-year hindcast:
  Global Land Precipitation Dataset (mth)
- IFD from CFSR re-analysis dataset (hr)
  NCEP Climate Forecast System Reanalysis
- Includes hydrology modelling
- Includes hydraulic modelling at grid resolution:
  - 30m mapping
  - Direct rainfall modelling (pluvial)
  - Inflow hydrograph modelling (fluvial)
- Six return periods: 20, 50, 100, 200, 500, 1500
- Available world-wide



Available data and tools you can use

- Mapping
  - Uses Jflow
  - 2D hydraulic model
  - Runs on graphics processors (GPU)
  - Developed since 2012, for very-large flood mapping
  - Run on a computer cluster of 400,000 stream processors



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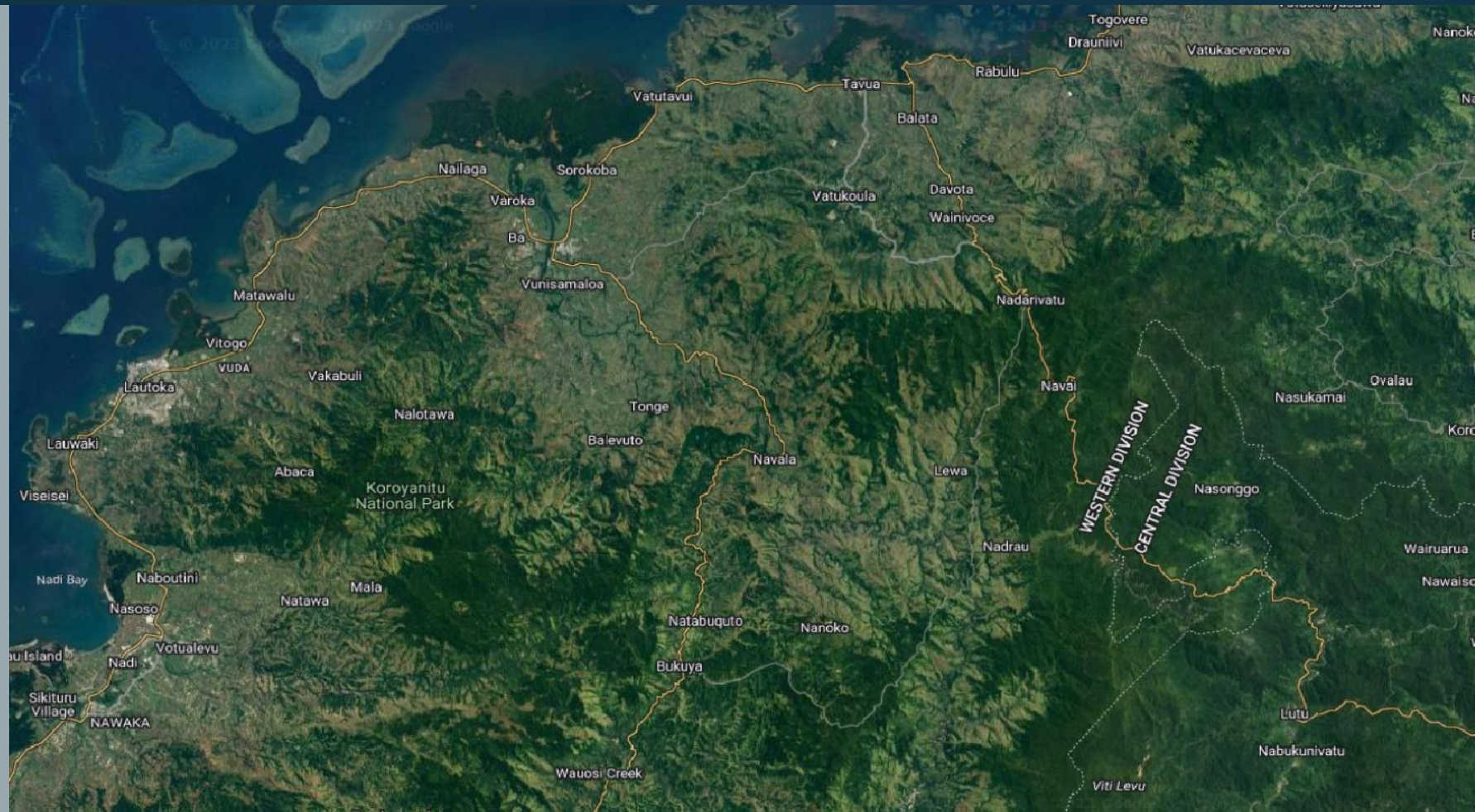
PACIFIC-WIDE FLOOD MAPPING

Example Area:
Ba River, Fiji



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PACIFIC-WIDE FLOOD MAPPING

Example Area:
Ba River, Fiji

Catchment delineation

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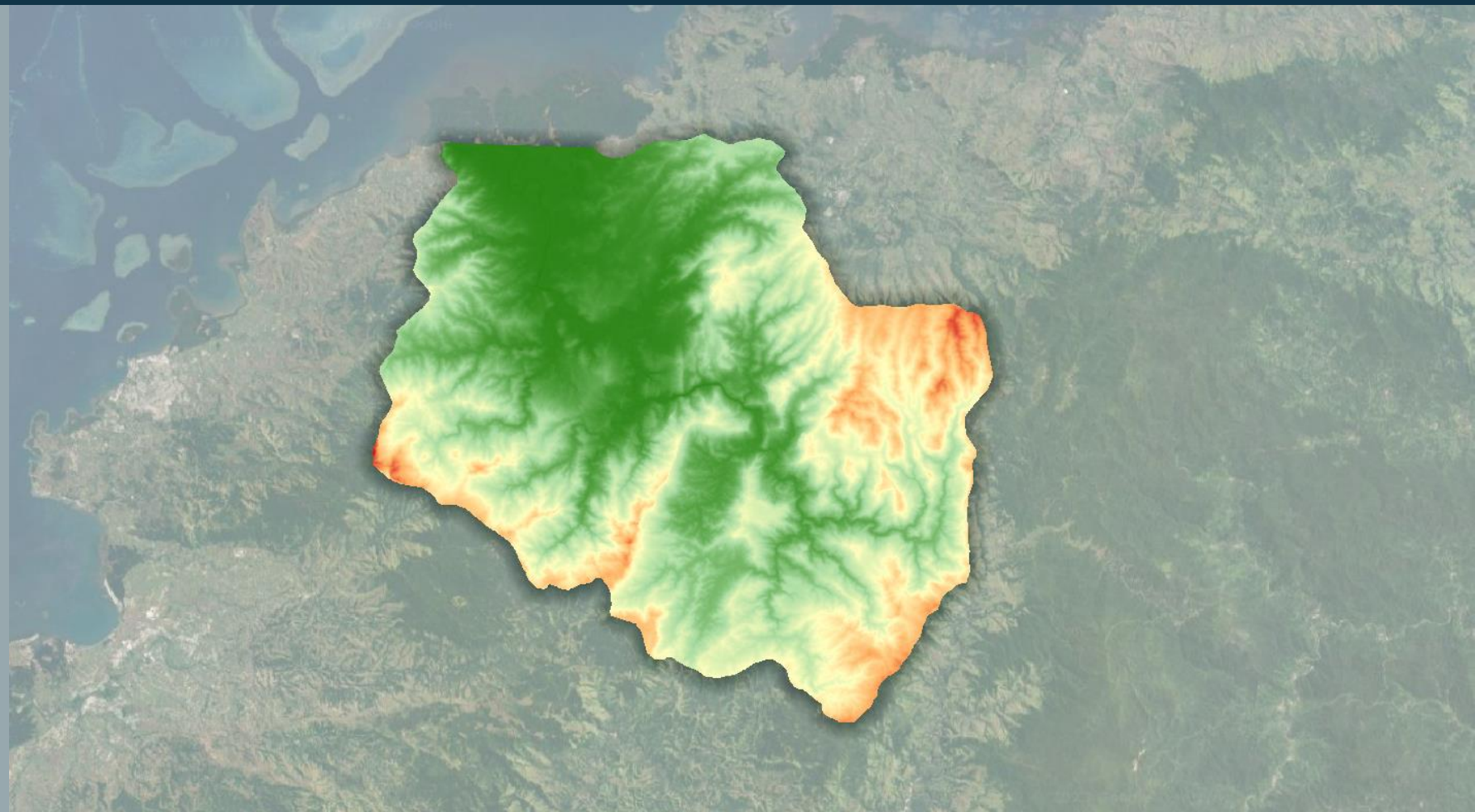
PACIFIC-WIDE FLOOD MAPPING

Example Area:
Ba River, Fiji

DEM analysis



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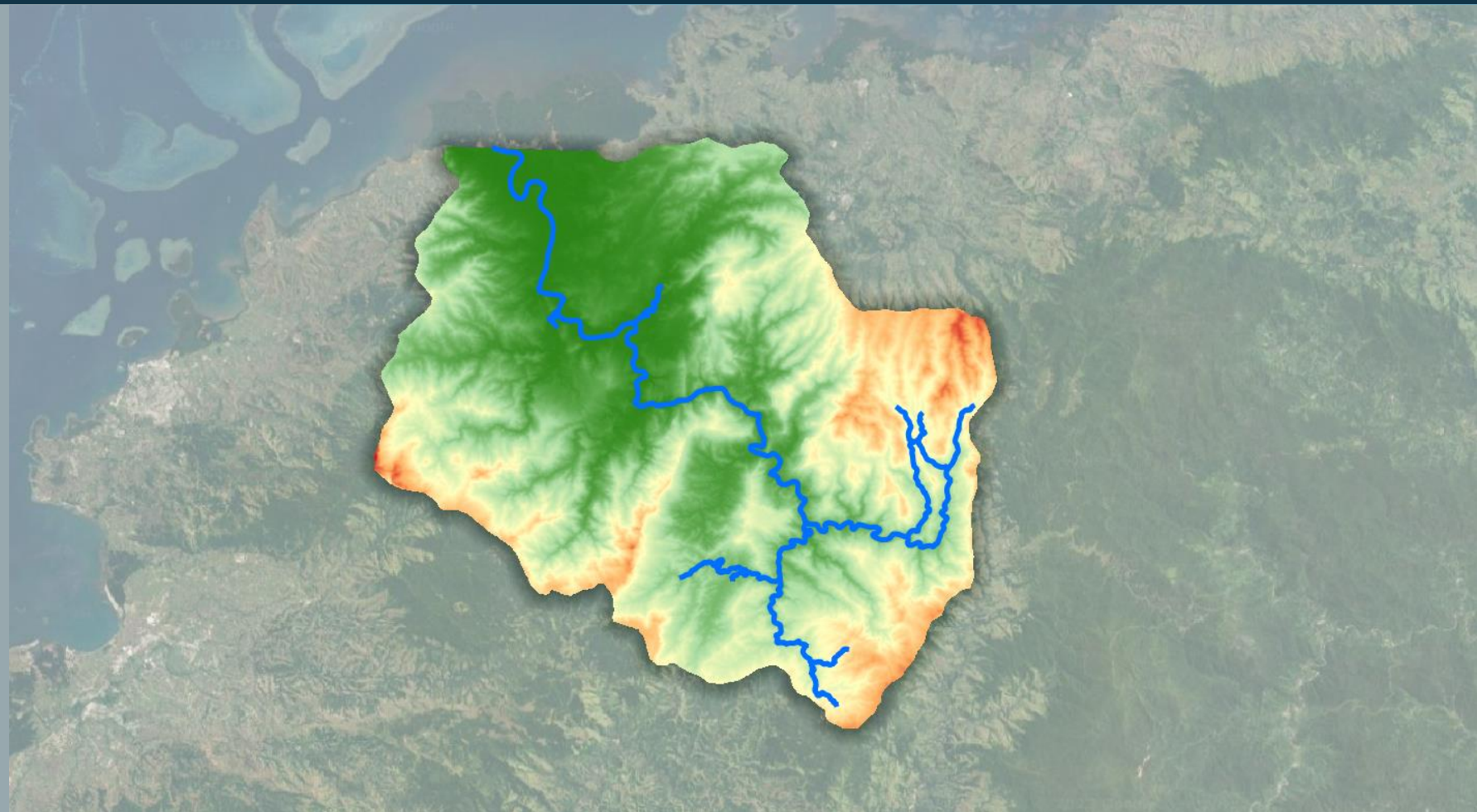
PACIFIC-WIDE FLOOD MAPPING

Example Area:
Ba River, Fiji

Stream Delineation



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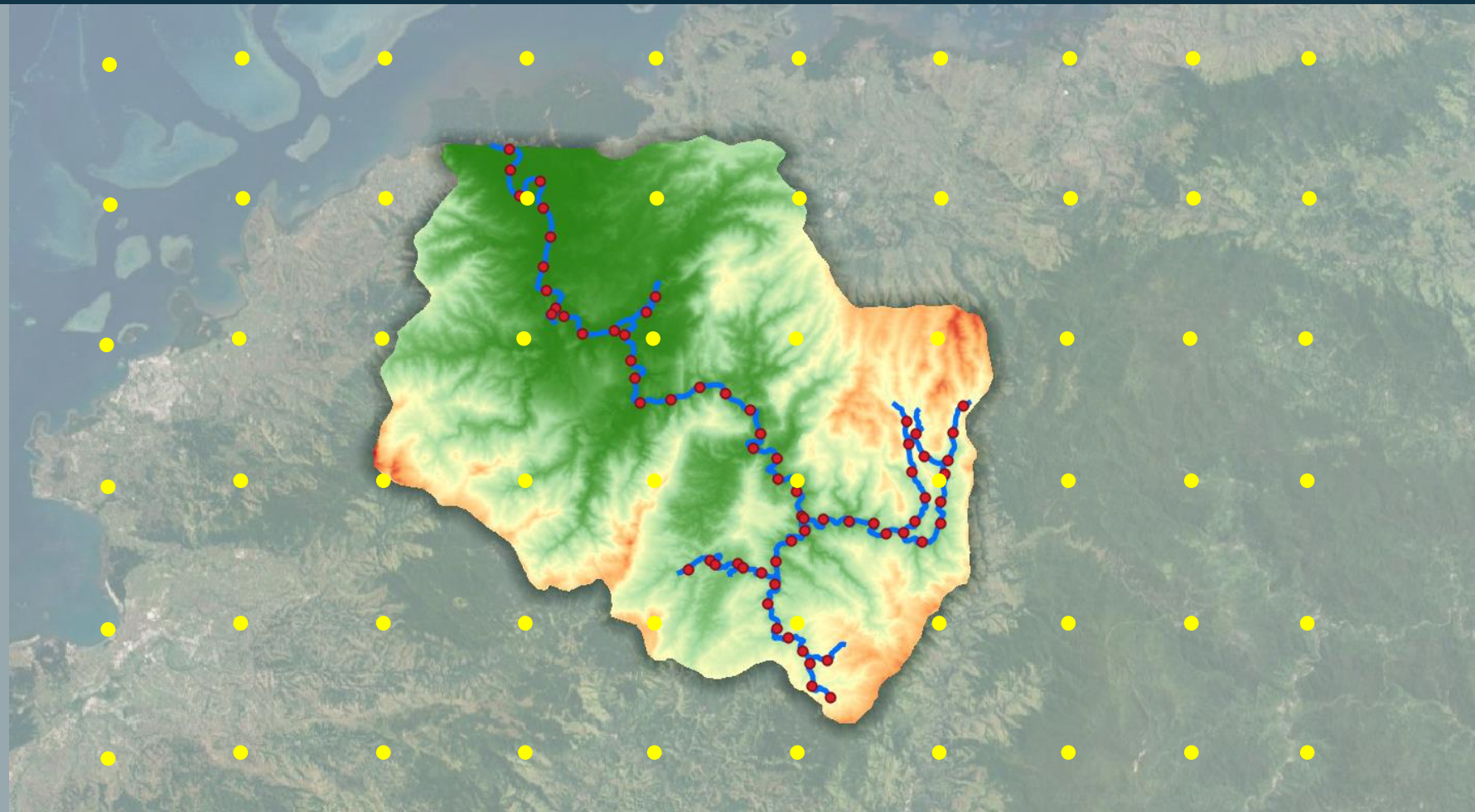
PACIFIC-WIDE FLOOD MAPPING

Example Area:
Ba River, Fiji

Streamflow estimation
Rainfall estimation



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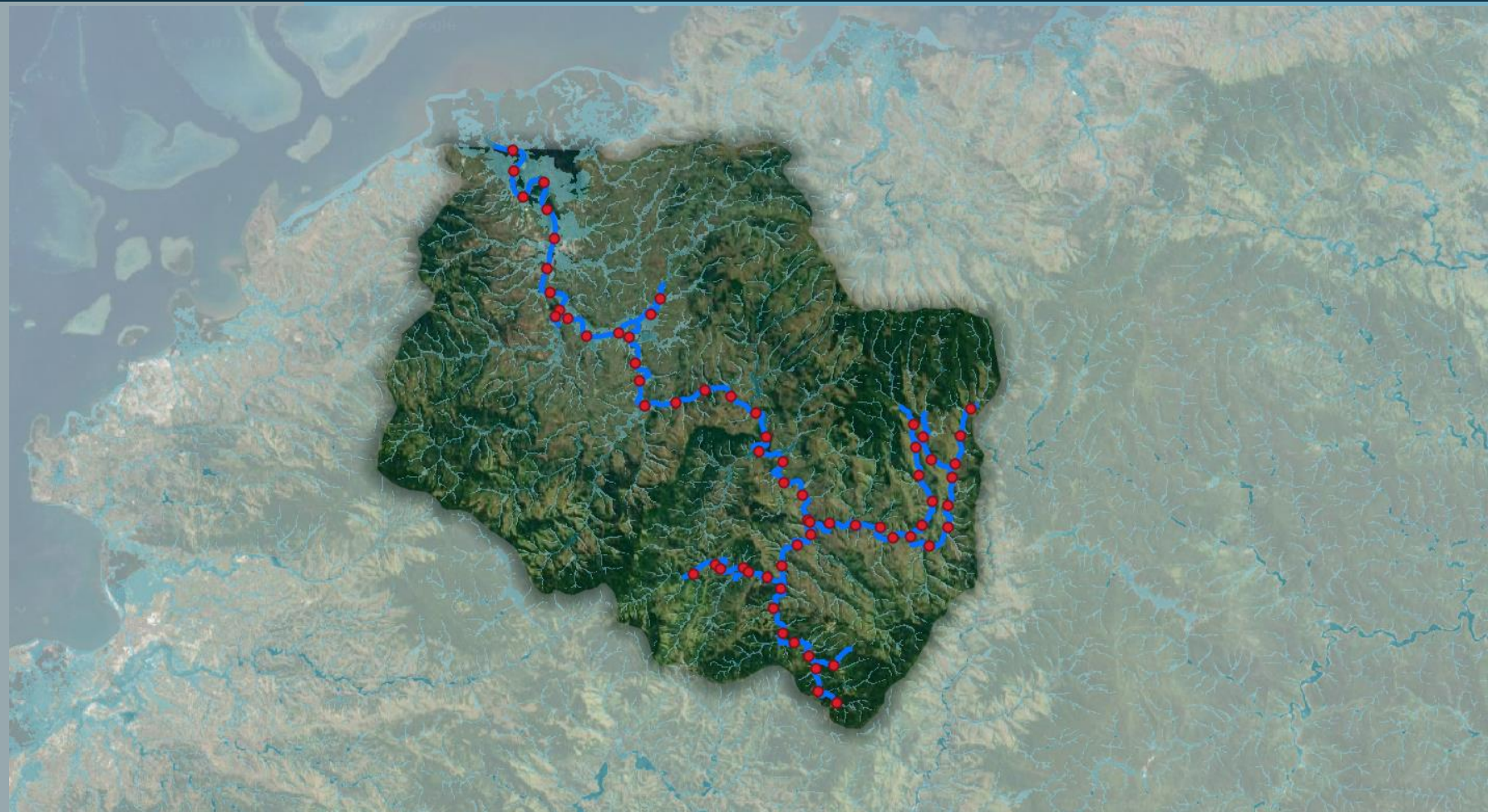
PACIFIC-WIDE FLOOD MAPPING

Example Area:
Ba River, Fiji

Flood depth maps



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PACIFIC-WIDE FLOOD MAPPING

Example Area:
Ba River, Fiji

Pluvial (rainfall) depth maps

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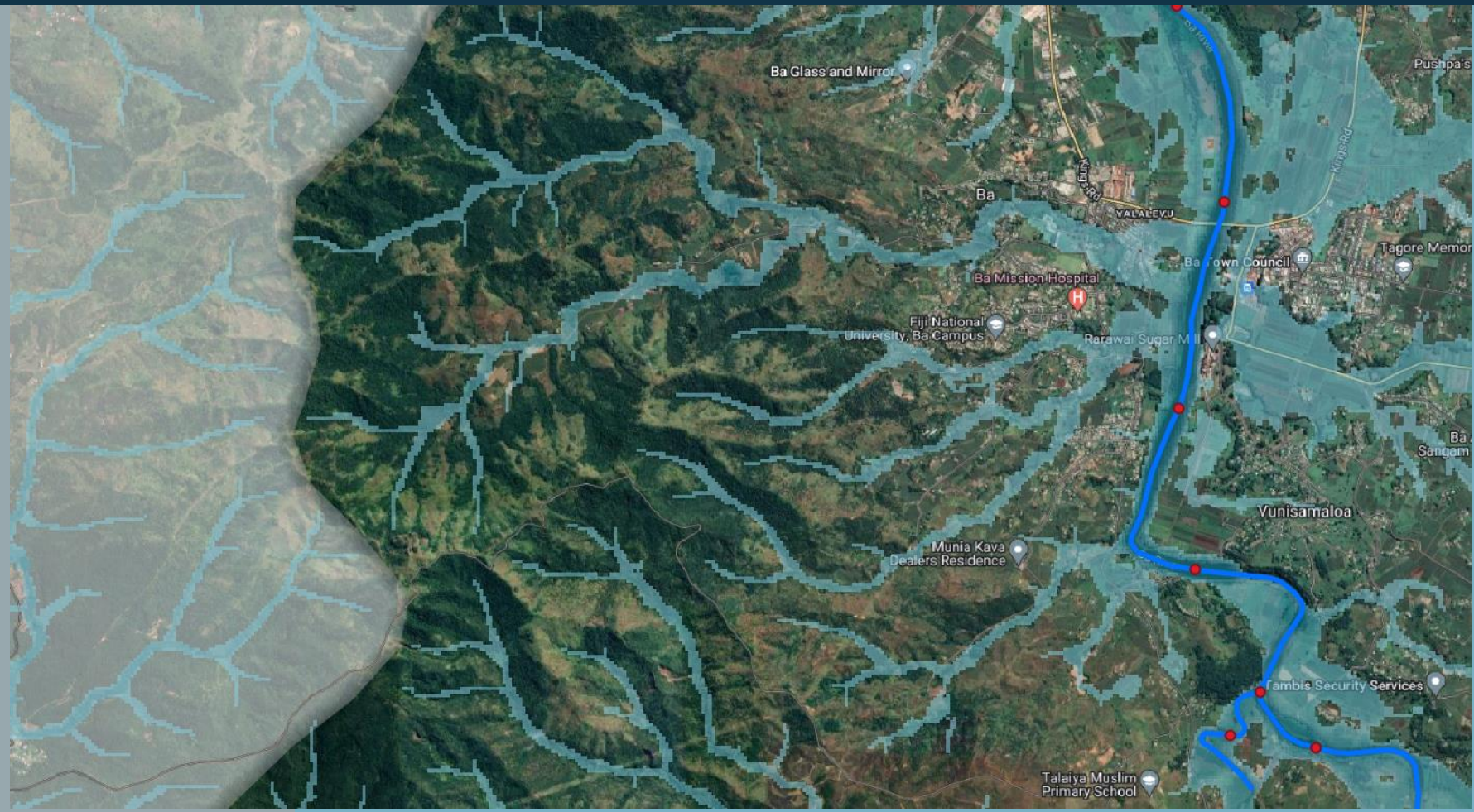
PACIFIC-WIDE FLOOD MAPPING

Example Area:
Ba River, Fiji

100-ARI River flood maps



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PACIFIC-WIDE FLOOD MAPPING

Example Area:
Ba River, Fiji

1500-ARI River flood maps

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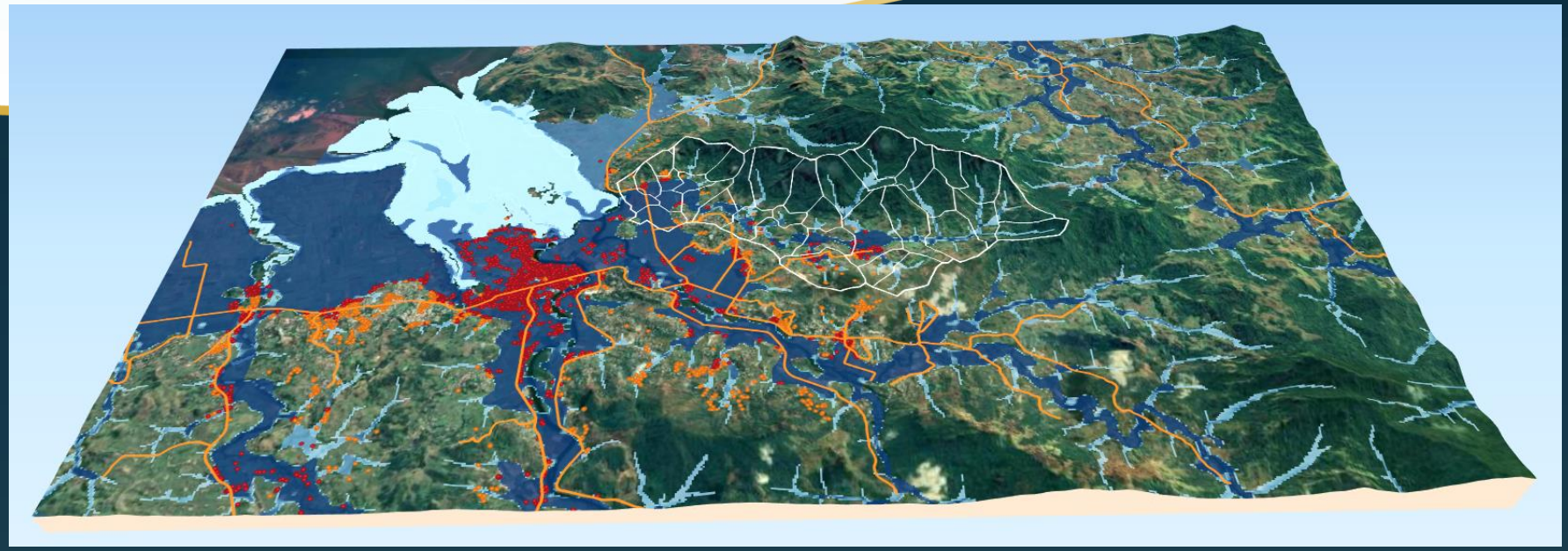
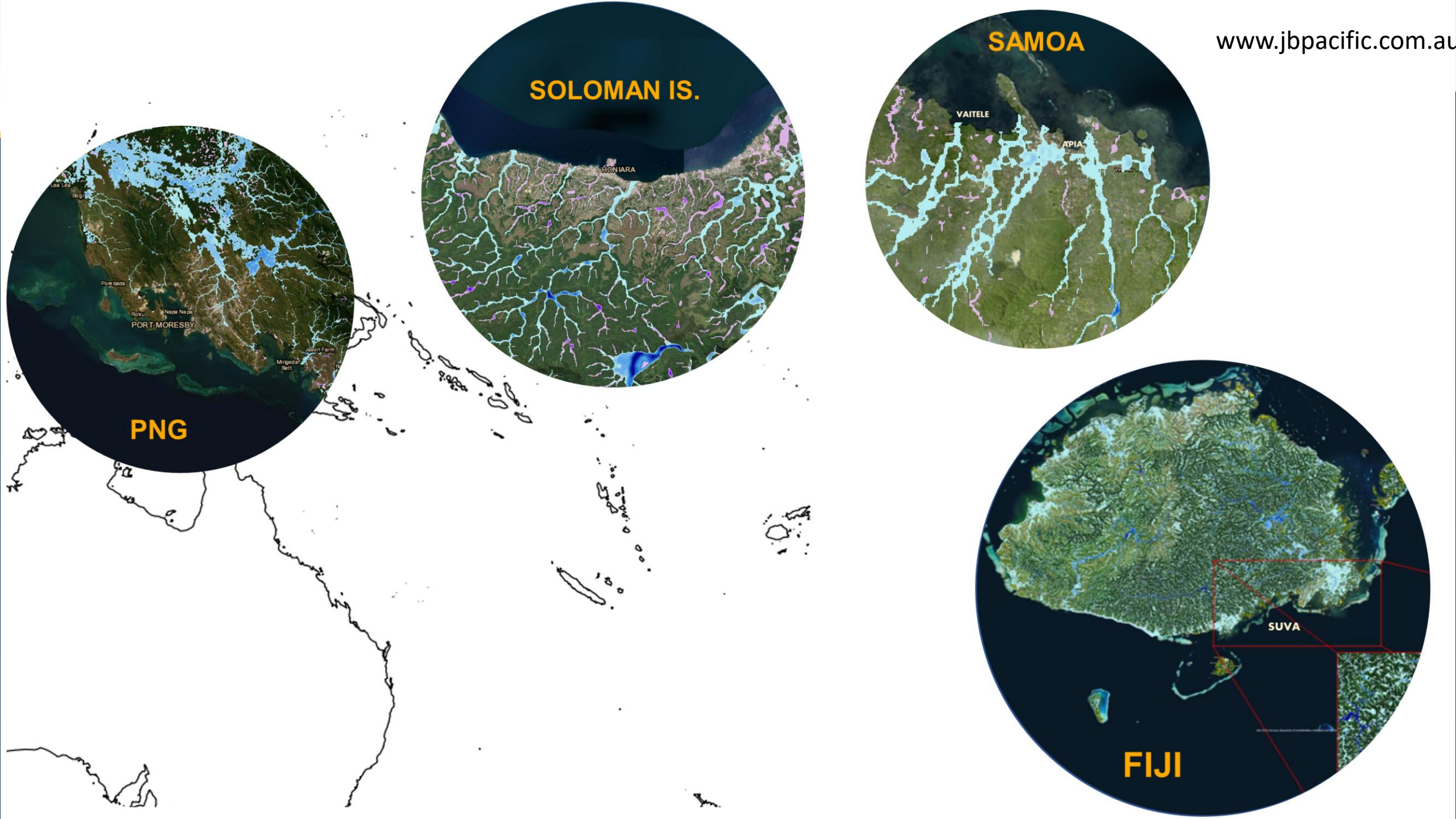
PACIFIC-WIDE FLOOD MAPPING

Example Area:
Ba River, Fiji

Impacted houses





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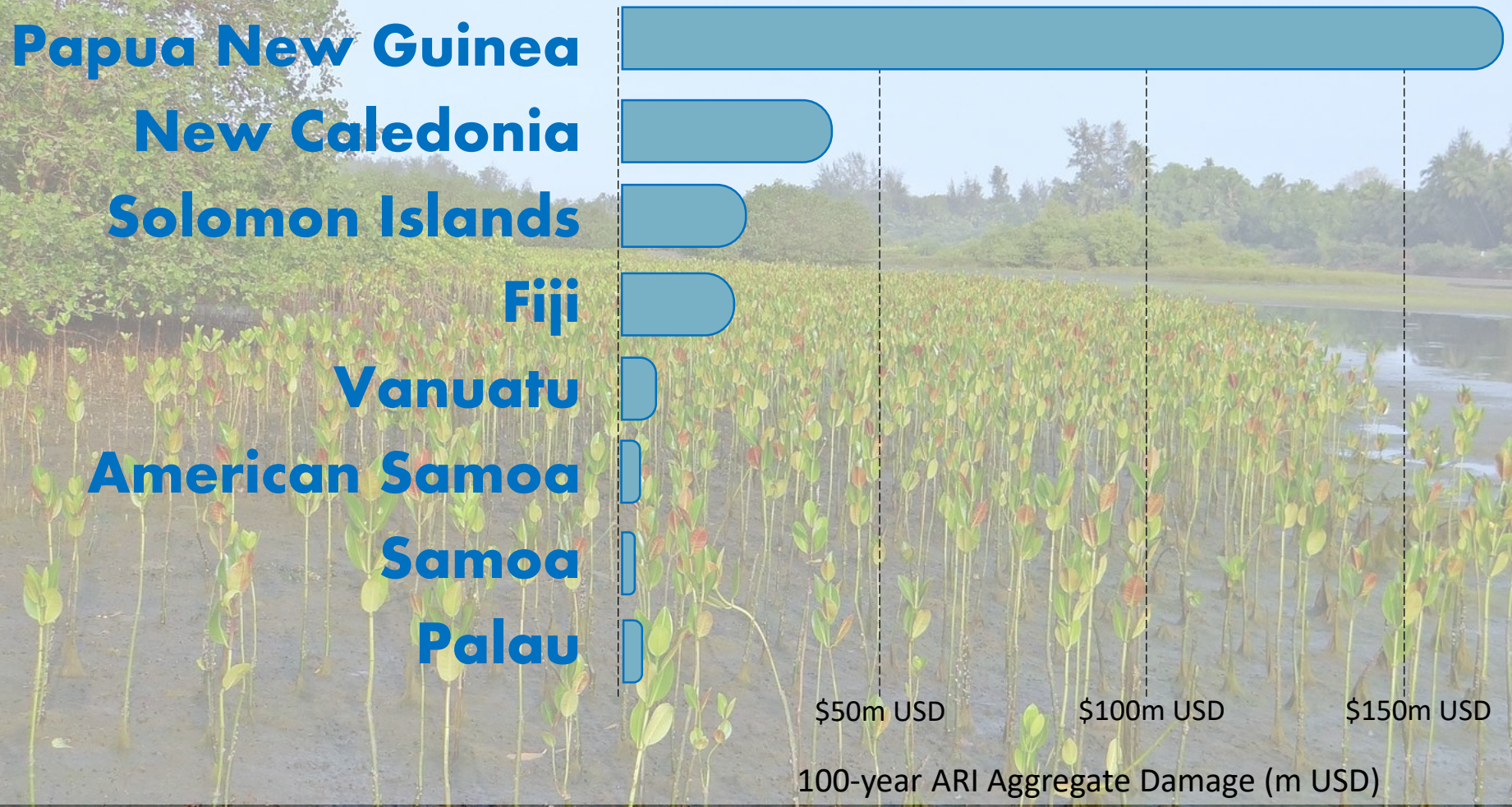
FLOOD IMPACTS THROUGH THE PACIFIC



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Today

- ~~Very Large Scale Hazard Mapping~~
- ~~Available data and tools you can use~~
- Analysis methods

} Case study in PNG

GCCA+ Scaling Up The Pacific (GCCA+ SUPA)

- Large scale hazard mapping has been used within the GCCA+ Scaling up Pacific Adaptation (GCCA+ SUPA) program
- 4.5 year project (2019-2023), spending € 14.89 million funding
- Lots of partners rolling this out, including The Pacific Community (SPC), Secretariat of the Pacific Regional Environment Programme (SPREP), University of the South Pacific (USP)
- New hazard mapping will increasingly be used to support local-scale projects

GCCA+ SUPA work in PNG

- Karama village – literally not on the map
- Extremely data poor region

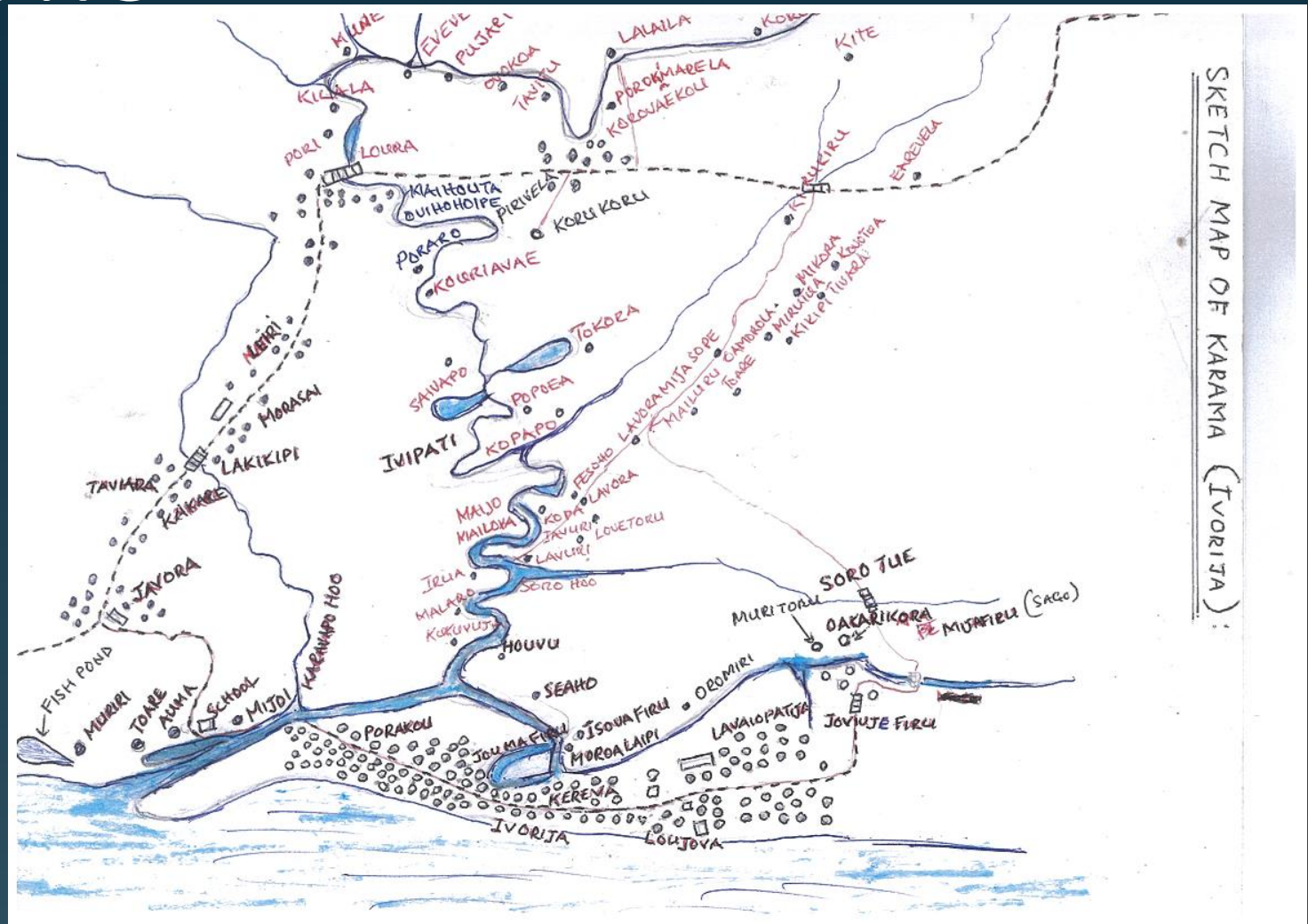
- Available hazard tools used to understand the local coastal-estuarine-river processes
  - Why are we eroding?
  - Why is our water turning salty
  - Can we better prepare for natural disasters?

GCCA+ SUPA work in PNG

- Karama villages
- Located on the banks of an unknown river (we called it Karama River)
- Not to be confused with Kerema (nearby town)

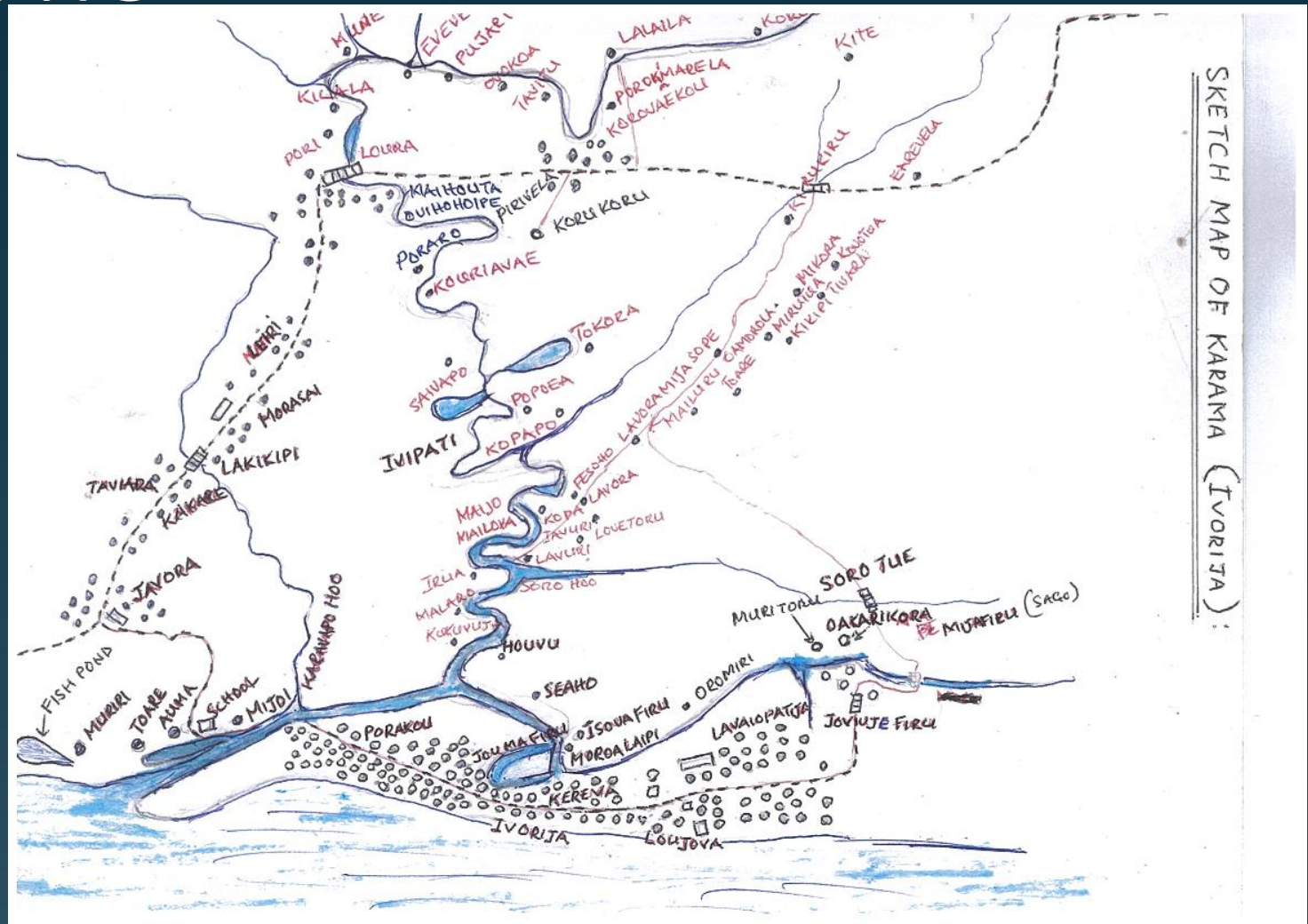
GCCA+ SUPA work in PNG

- The best mapping was developed by our team during site inspections!



GCCA+ SUPA work in PNG

- The best mapping was developed by our team during site inspections!



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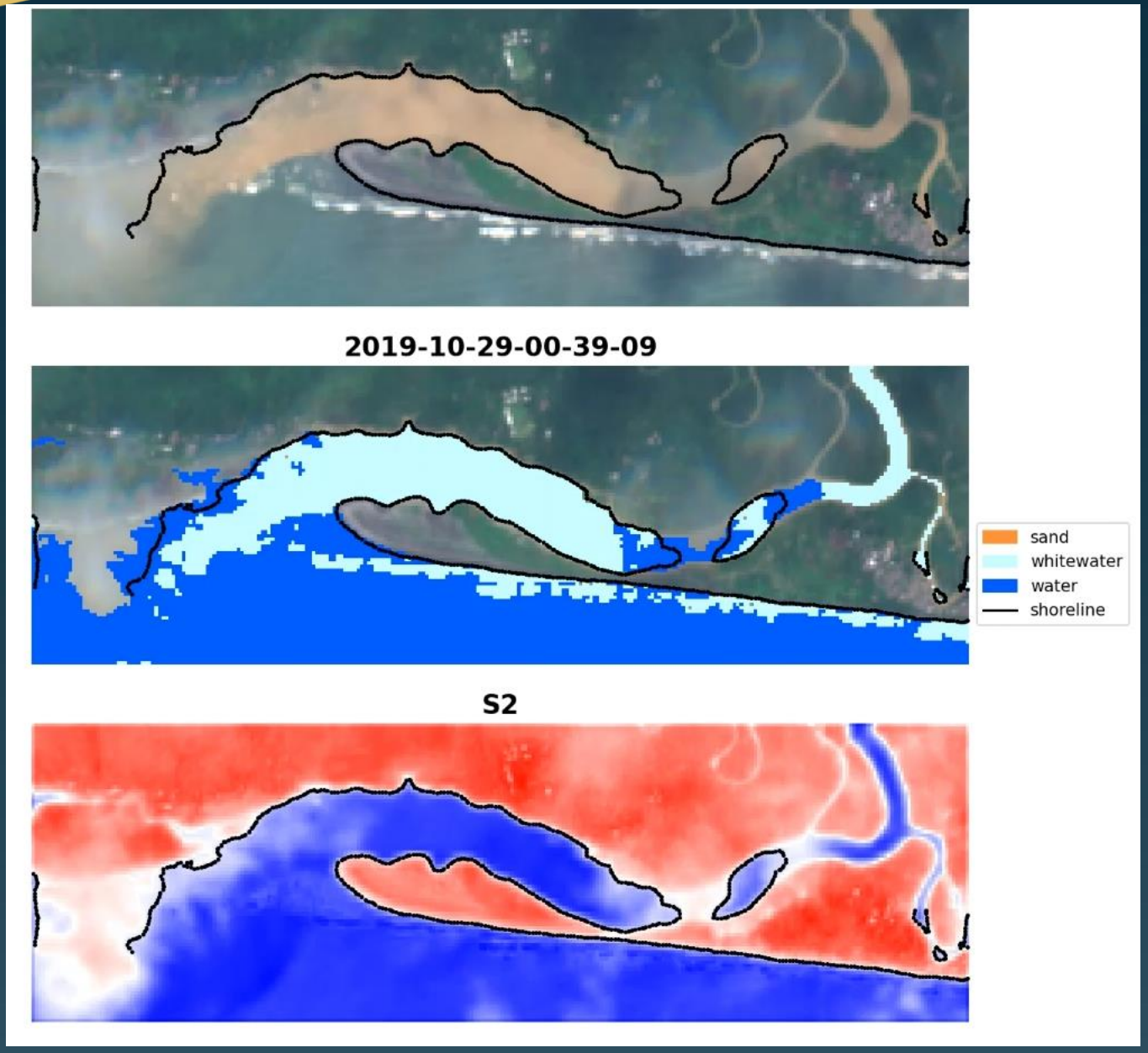
Why are they eroding?

Why are they eroding?

- Needed a quick way to quantify erosion
- CoastSat analysis
- Free software from UNSW
- Analyses satellite imagery
- Tracks coastlines over time

http://coastsat.wrl.unsw.edu.au/

Can also be used with Google Earth Engine:
https://earthengine.google.com/timelapse/

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Imagery Date: 3/28/2003 8°02'04.69" S


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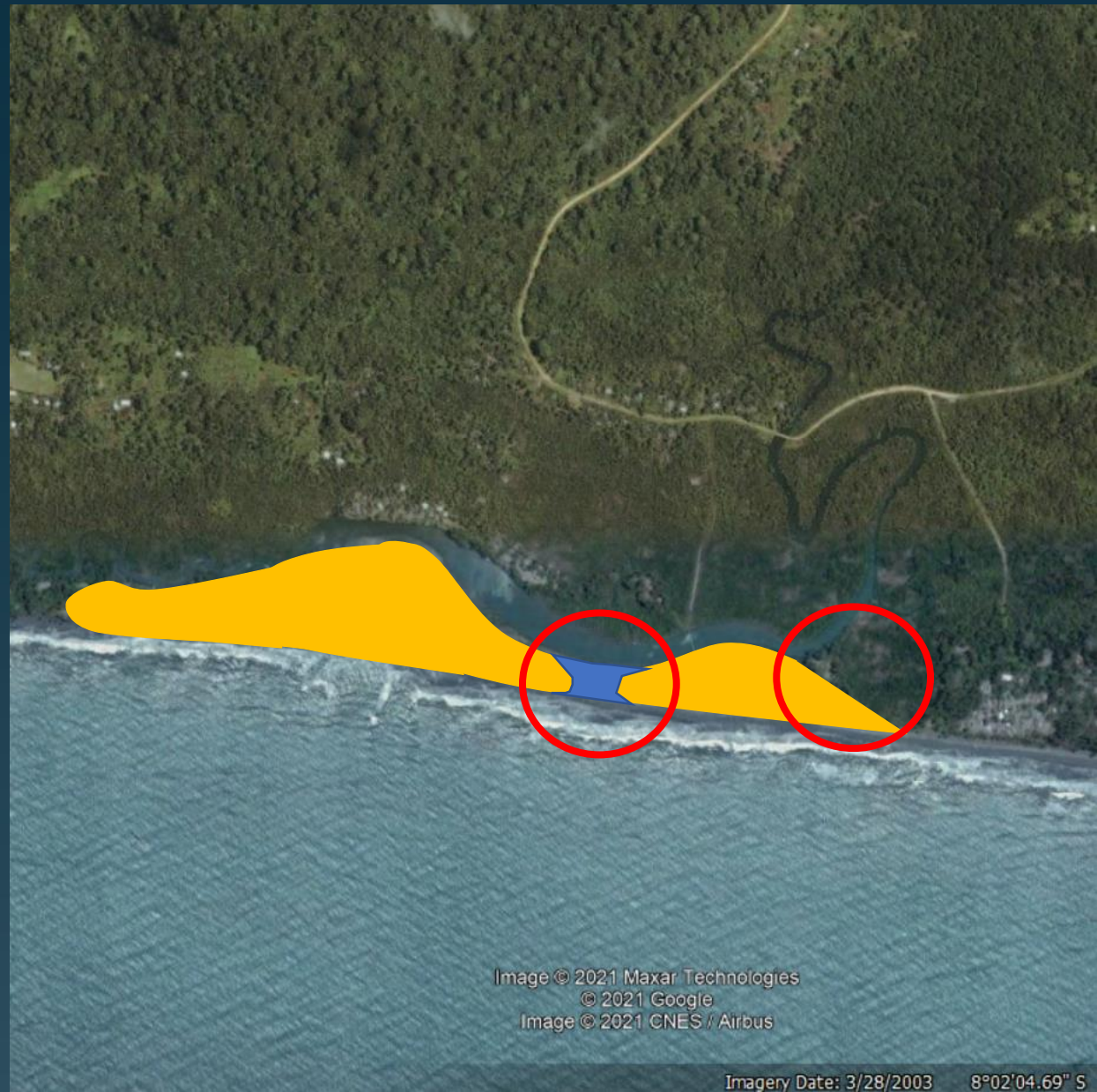
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Imagery Date: 3/28/2003 8°02'04.69" S

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Why is our water turning salty?

Why is our water turning salty?

- Needed a quick way to assess risk

- Review of water infrastructure
- Review of water assets
- Review of wells

Why is our water turning salty?

- Needed a quick way to assess risk

- Review of water infrastructure — None
- Review of water assets — None
- Review of wells — Shallow (~0.5m), in sandy soil, close to other WASH features

Are they too close to the tidal planes?

Can they be rebuilt better, in other areas?

Why is our water turning salty?

- Review of wells:
- Are they too close to the tidal planes?

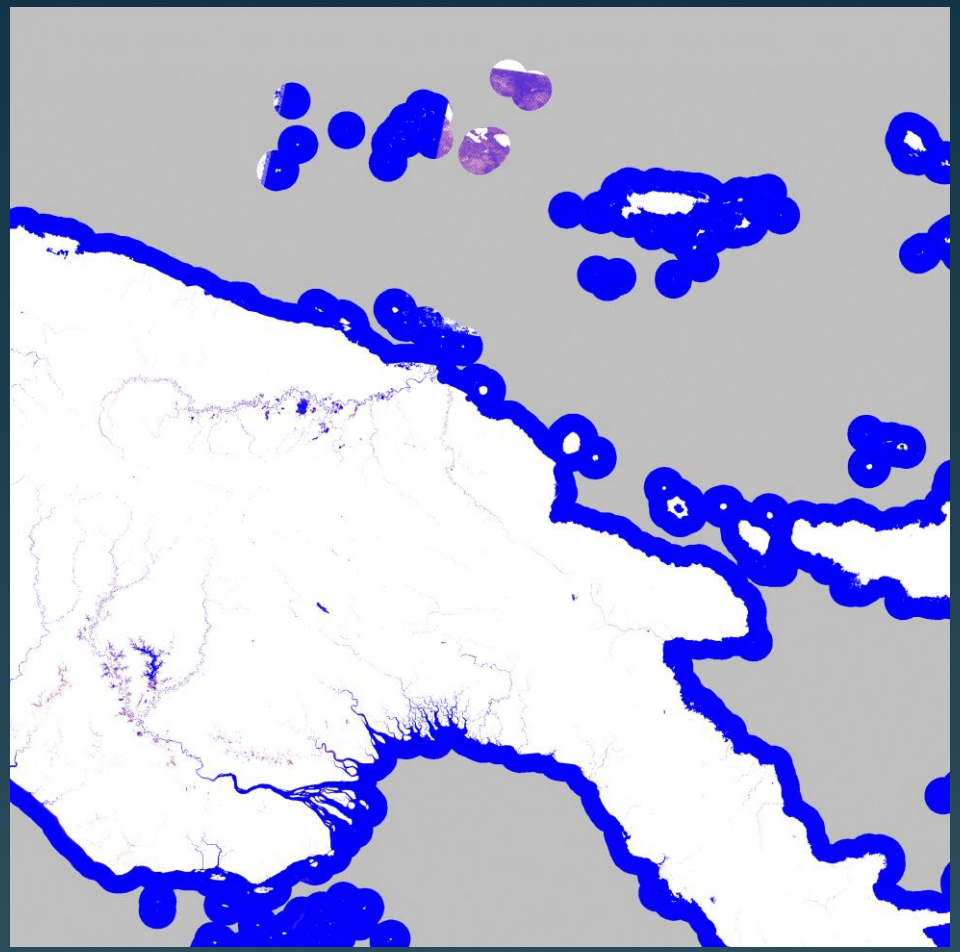
Global Surface Water Explorer

Based on satellite image analysis

Every pixel contains 0 - 100% water

- 1% water: HAT
- 10% water: MHWS
- 50% water: MSL
- 100% Water: LAT

https://global-surface-water.appspot.com/



Why is our water turning salty?

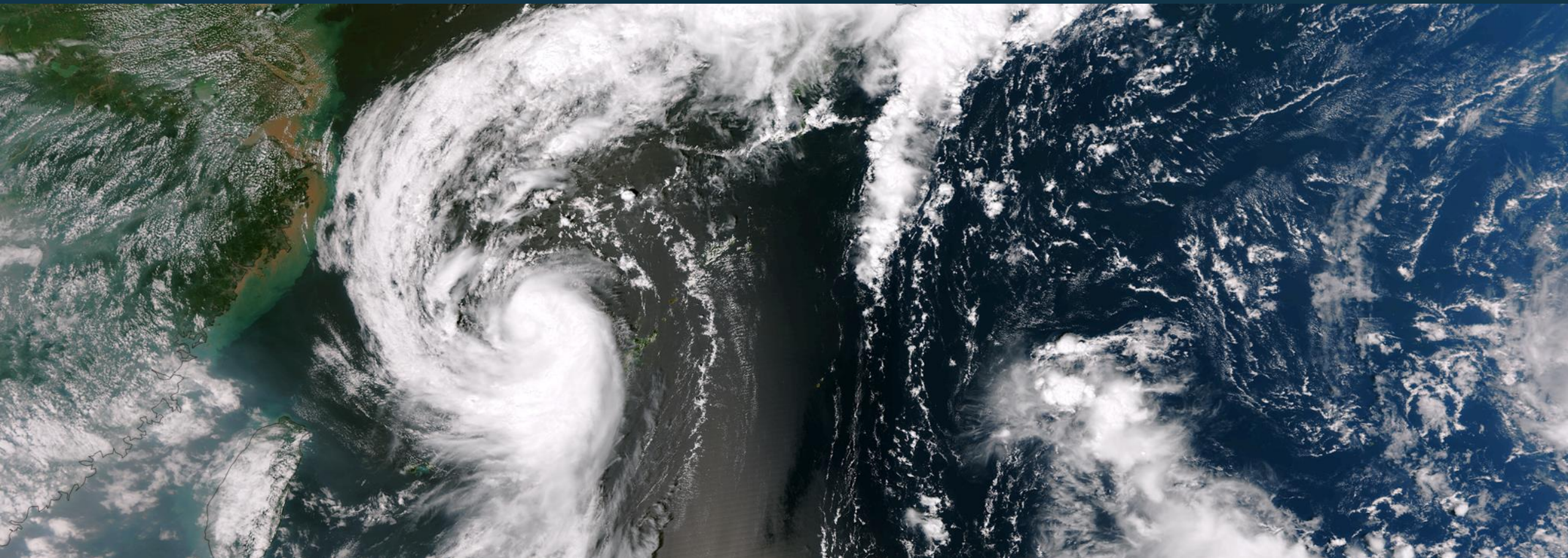
- Review of wells:
- Are they too close to the tidal planes?

WELLS

RISK ASSESSMENT USING WATER EXPLORER

Blue areas have been ‘observed’ through satellites to have been inundated in the past. i.e. Tidal Areas

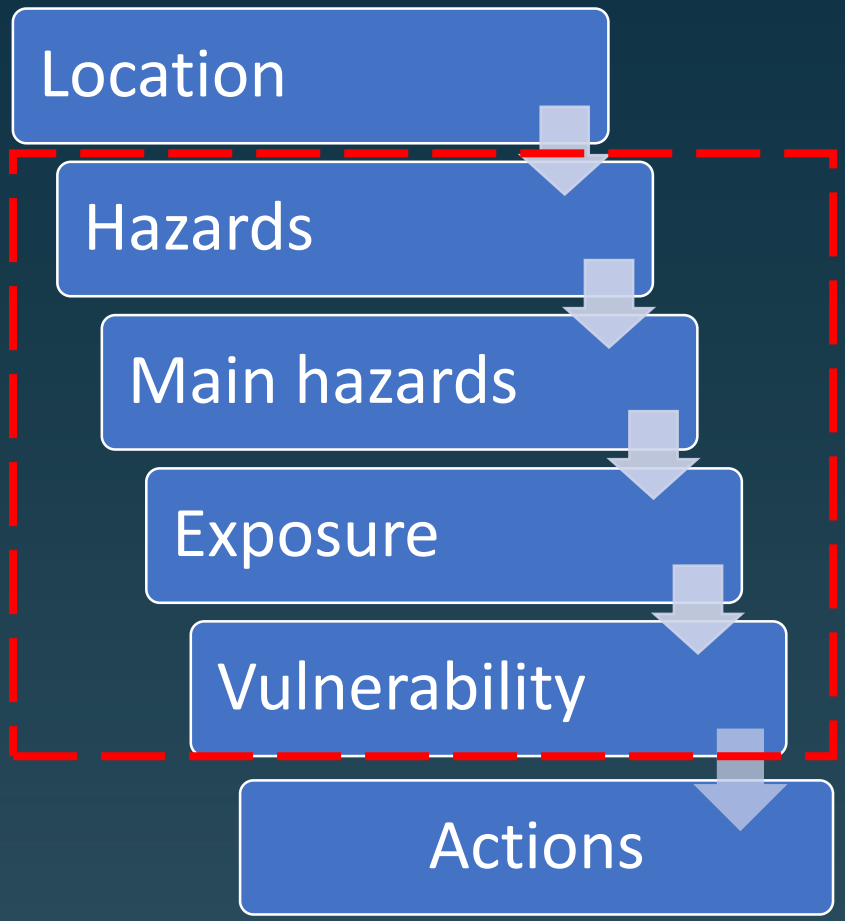
Can we prepare for natural disasters?



Can we prepare for natural disasters?

Lots of guidance available:

- PNG National Disaster Risk Reduction Framework 2017–2030
- Sendai Framework for Risk Reduction
- Integrated Vulnerability Assessment (IVA) framework (Pacific countries initiative)
- United Nations Quick Risk Estimation (UNQRE) framework
- But you still need hazard data!




River flooding - *Pacific flood maps*
Surface water - *Pacific flood maps*
Tide flooding and waterways – *Water explorer*
Coastal erosion zone – *CoastSat and Google Earth Engine*
Lakikipi
Javora
Uamai 1
Uamai 2
Lavare
Mora'a
Toare
Karama
Pukari

High Risk infrastructure and assets

High Risk WASH assets

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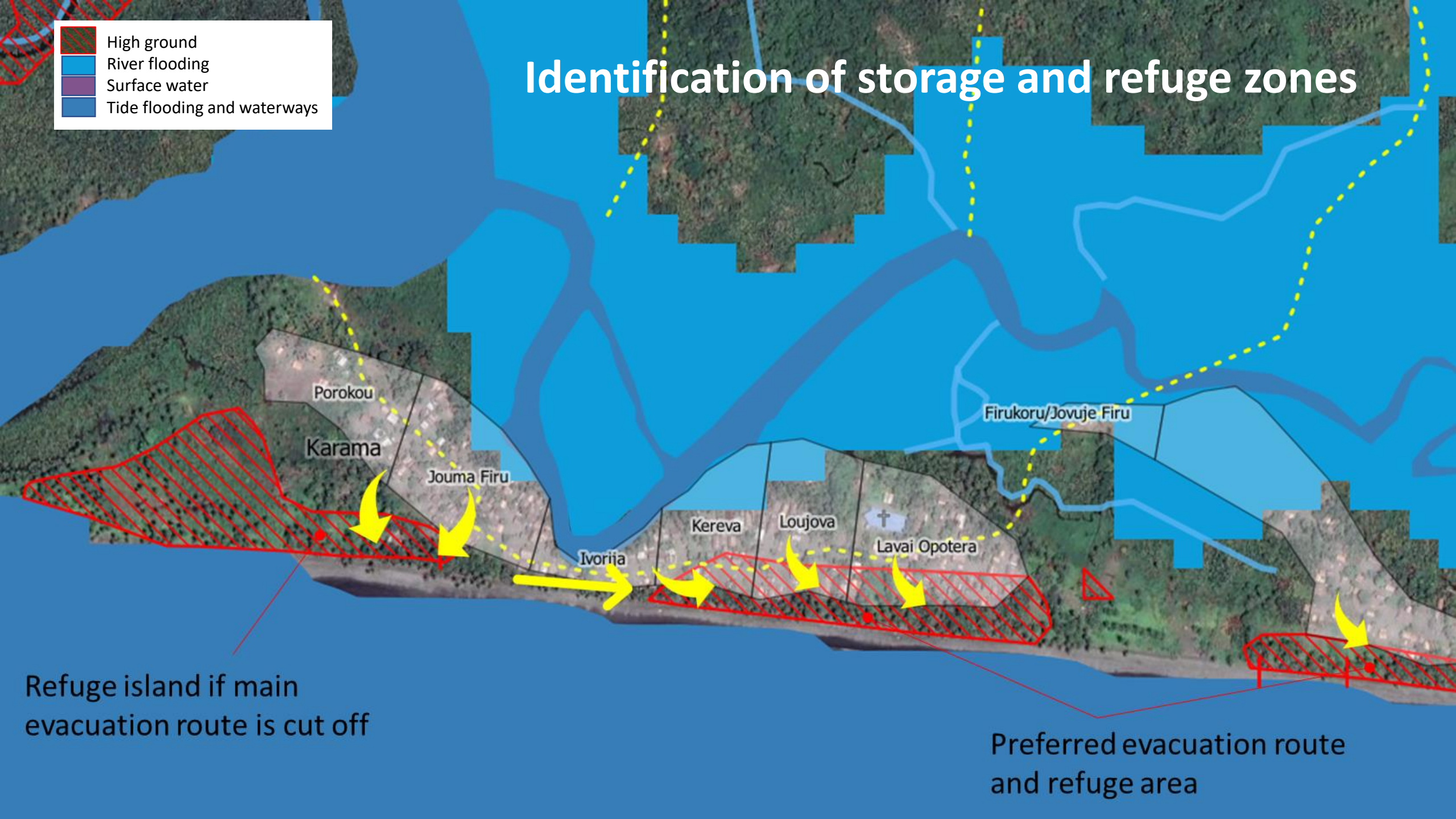
Identification of storage and refuge zones



Mapping of evacuation routes

MAJOR FLOOD

Preferred evacuation route

Avoiding flooded waterways and creeks

Getting Help

Simple online tools:

- Google Earth Engine historic shorelines: https://earthengine.google.com/timelapse/
- Global water explorer (tides): https://global-surface-water.appspot.com/

Flood maps:

- Contact JBP (daniel.Rodger@jbpacific.com.au)

More advanced tools (free / open source):

- HEC flood modelling software: https://www.hec.usace.army.mil/software/hec-ras/
- Delft3D Cyclone and Tsunami model: https://oss.deltares.nl/web/delft3d
- Xbeach coastal erosion model: https://oss.deltares.nl/web/xbeach/
- CoastSat Shoreline Analysis: http://coastsat.wrl.unsw.edu.au/

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Coastal Risk and Early Warning Systems
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Thank you!

Thank you! Get in touch for any questions: daniel.rodger@jbpacific.com.au

Mid-Morning Session
11:30: Early Warning Systems

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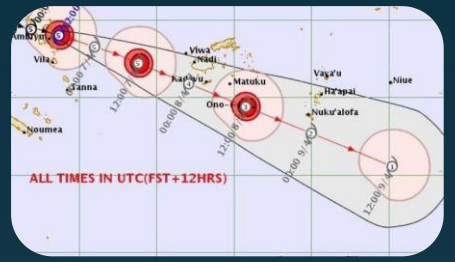
Today

- Why Early Warnings
- References
- Examples
- Development

Why early warnings

Tropical Cyclone Harold, Fiji (2020)



April 2. The system moved into the Fiji Meteorological Service's (FMS) area of responsibility and began to intensify.

The cyclone was downgraded to category four before reaching the waters of Fiji.

April 6, FMS issued a tropical cyclone alert for Viti Levu, Kadavu, Lomaiviti.

April 7, cyclone effects began, including winds, coastal flooding, and storm surge.

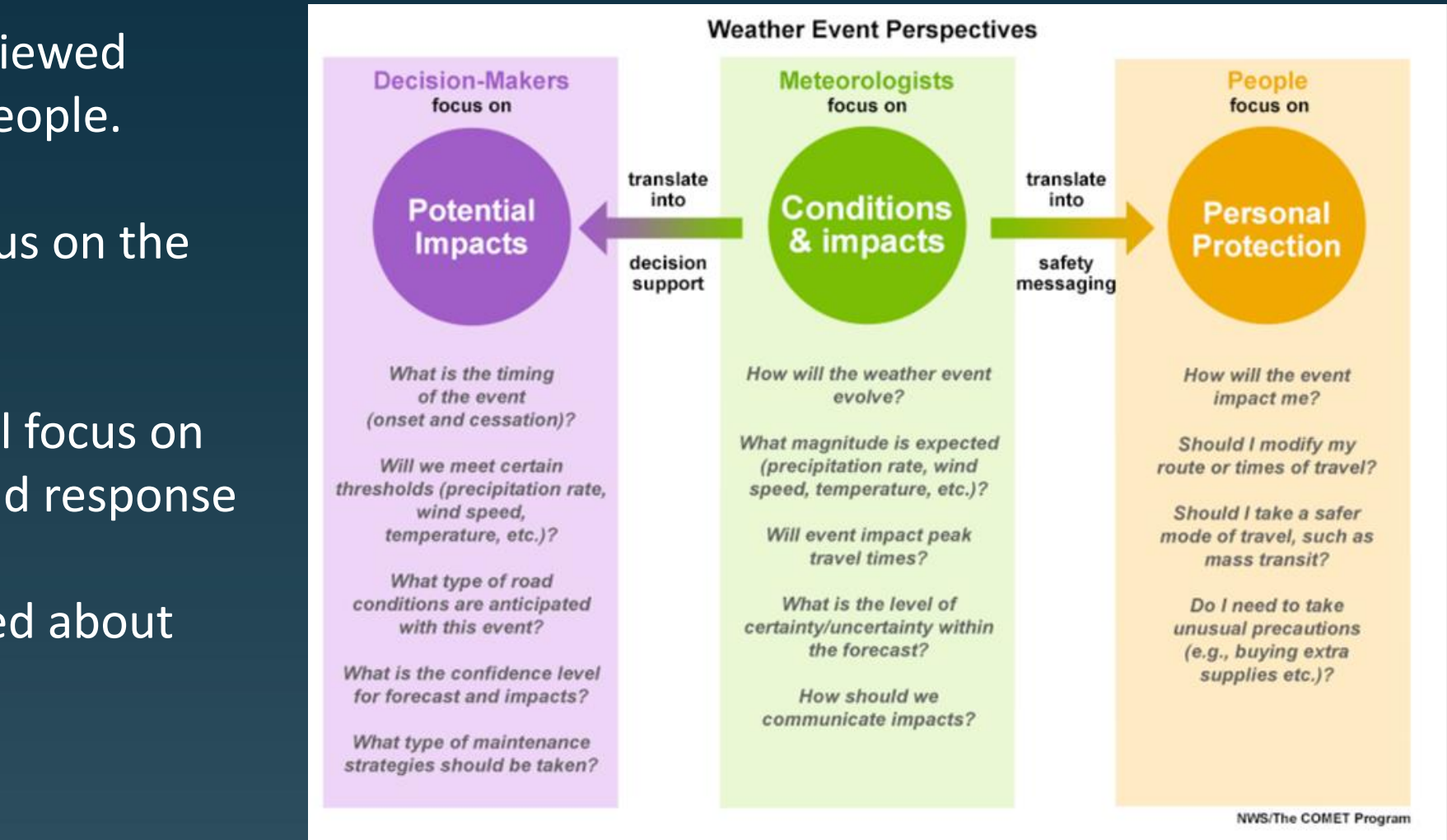
April 8, homes were damages and roofs lost, trees uprooted, power poles felled, low-lying areas of Suva were inundated along the coastal waterfront.

Within three days of impact 26 people were injured across Fiji, one life list, widespread damage and power lost.

Why early warnings

Weather information is viewed differently by different people.

- A **forecaster** will focus on the weather
- **Decision-makers** will focus on potential impacts and response
- **People** are concerned about personal impacts



Why early warnings

- Best practice early warning systems are shifting towards:

Impact Based Warning Systems

Historically, forecasters have issued weather predictions, with a focus on *what the weather will **be***.

However, an impact-based approach is needed to make the connection between *weather* and *impacts*.

Systems now need to include more information about *what the weather will **do*** so that they can take timely actions and informed decisions to protect their lives, livelihoods, assets, and property.

References

- The WMO Strategy for Service Delivery and its Implementation Plan (WMO/TD-No. 1129)
- The WMO Guidelines on Multi-hazard Impact-based Forecast and Warning Services (WMO- No.1150 part 1 and part 2)
- Multi-Hazard Early Warning Systems: A Checklist. Outcome of the First Multi-Hazard Early Warning Conference
- Leveraging Social Science to Improve Risk Communications (COMET)
- Communicating Risk: The Impact-based Forecast and Warning Services Approach (COMET)
- Communicating Forecast Uncertainty (COMET)

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Examples

- Cyclone wind speed warning system
- Flooded road warning systems
- Full Impact-based flood warning systems

redicova | Map

Joint Typhoon Warning Center

redicova.jbphosting.com.au/map

Inbox CMS CMS 10.10.1.13 Cascade JBA JBP Coastal Hydrology Flood Forecasting Disaster Mgmt Uni Apps Pics Tenders GIS Pacific Catchments

Cyclone wind speed warning system

Map My account Log out

Cyclone data

- Cyclones
  - Current Hurricane Area
    - Hurricane area
    - Transparency: 40 %
  - Historic Hurricane Area
    - Hurricane path
    - Transparency: 60 %
  - Buffered Hurricane Area
    - 5k buffered area
    - Transparency: 60 %
  - Current Location (All Categories)
    - Current location
    - Transparency: 60 %
  - Path (All Categories)
    - Cyclone path
    - Transparency: 60 %

Queensland

Vanuatu

Port Vila

Date: 10/02/2023 06:50 reset

500 km 1:16,000,000

Automatic Weather Station - LUCINDA POINT

70 km/h
52.5 km/h
35 km/h
17.5 km/h
0 km/h

2023-02-14 20:00
Observed: 24 km/h
Forecast: - km/h

Close

Type here to search

ENG 6:53 AM 10/02/2023

Flooded road warning system

Examples

Mossman River Flood Forecasting System Alerts Conditions Developer Interface

Flooded Road Alert Portal

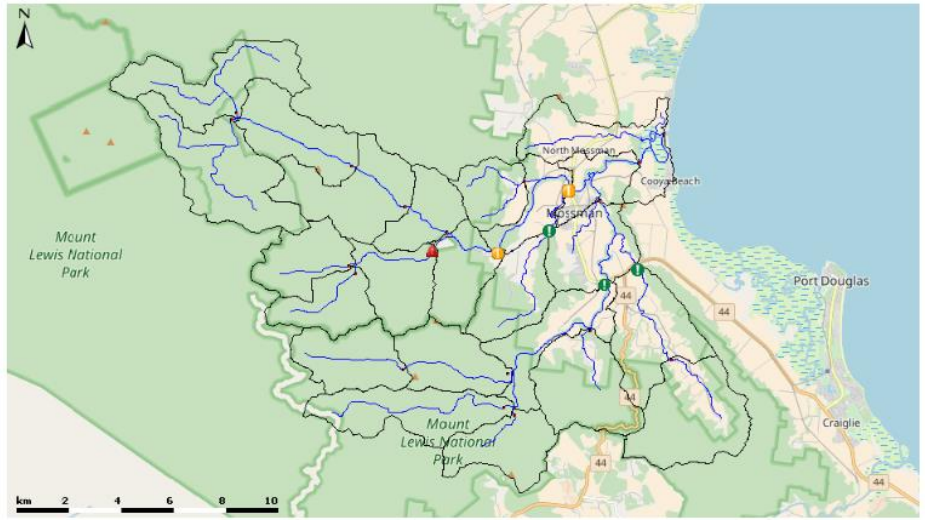
DOUGLAS SHIRE COUNCIL

Forecast time (T0):	Thu 10/01/2019 06:00
Time of Report:	Tue 12/02/2019 16:17
Time of Current BOM ADFD forecast:	Thu 10/01/2019 06:00

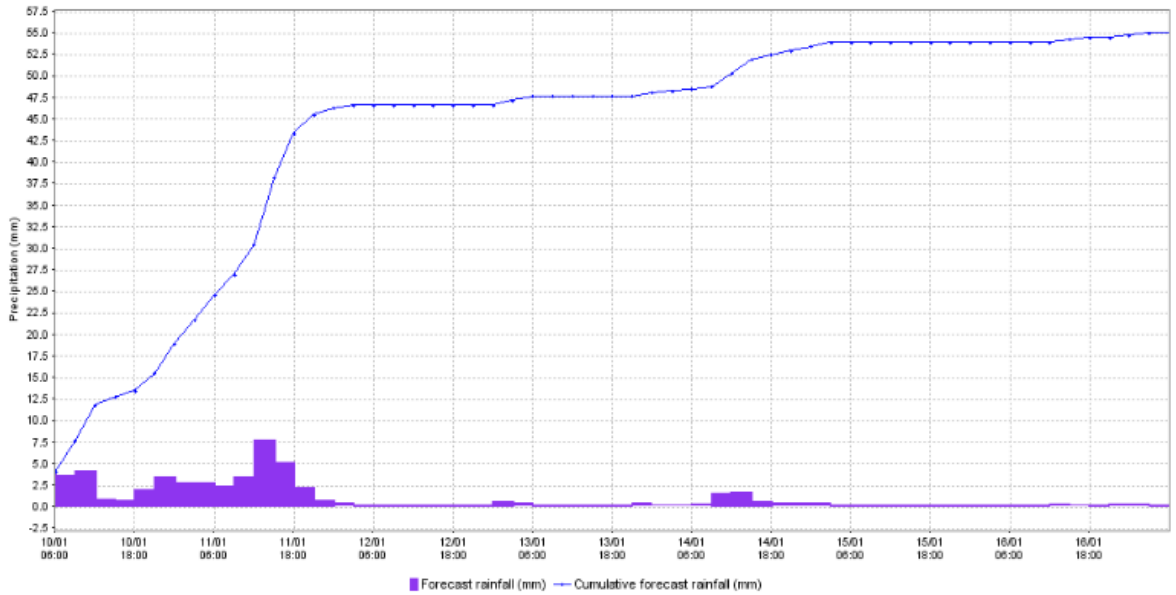
Road Status

	Status	Peak threshold	Day of crossing
Foxton Bridge		Moderate Flood Level	Thu 10/01/2019 12:00
Mossman Gorge		Moderate Flood Level	Thu 10/01/2019 09:00
South Mossman River		Minor Flood Level	Thu 10/01/2019 12:00
Cassowary Creek		Minor Flood Level	Thu 10/01/2019 09:00
Marr Creek		Minor Flood Level	Thu 10/01/2019 09:00
Rex Intake		Major Flood Level	Thu 10/01/2019 09:00

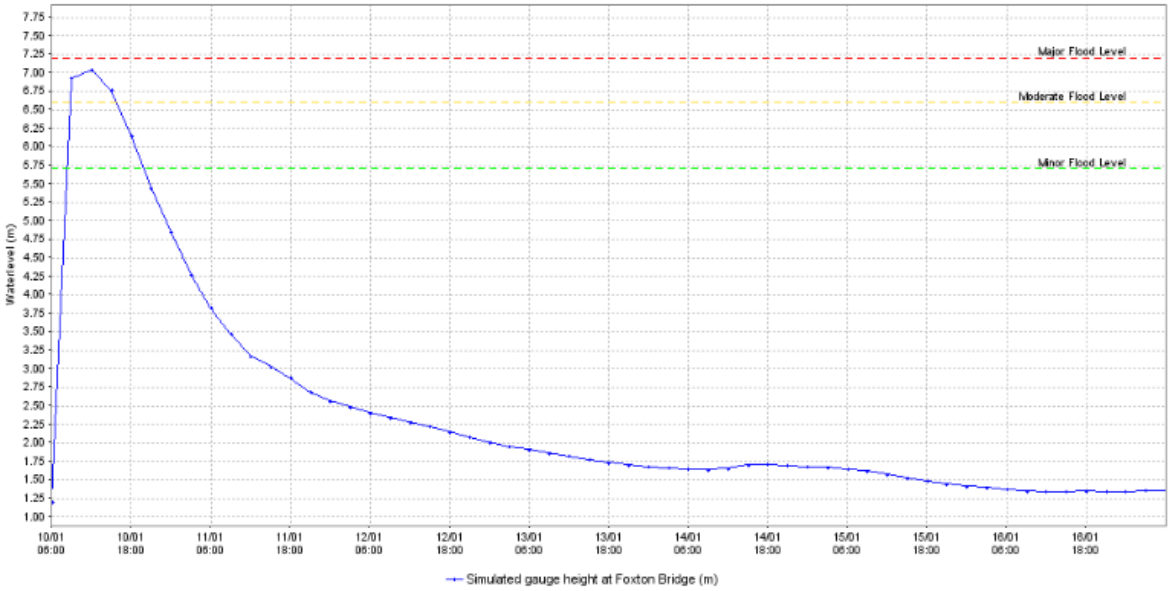
Road status map



Graph 1: Rainfall in mid catchment (Sub-catchment C17)



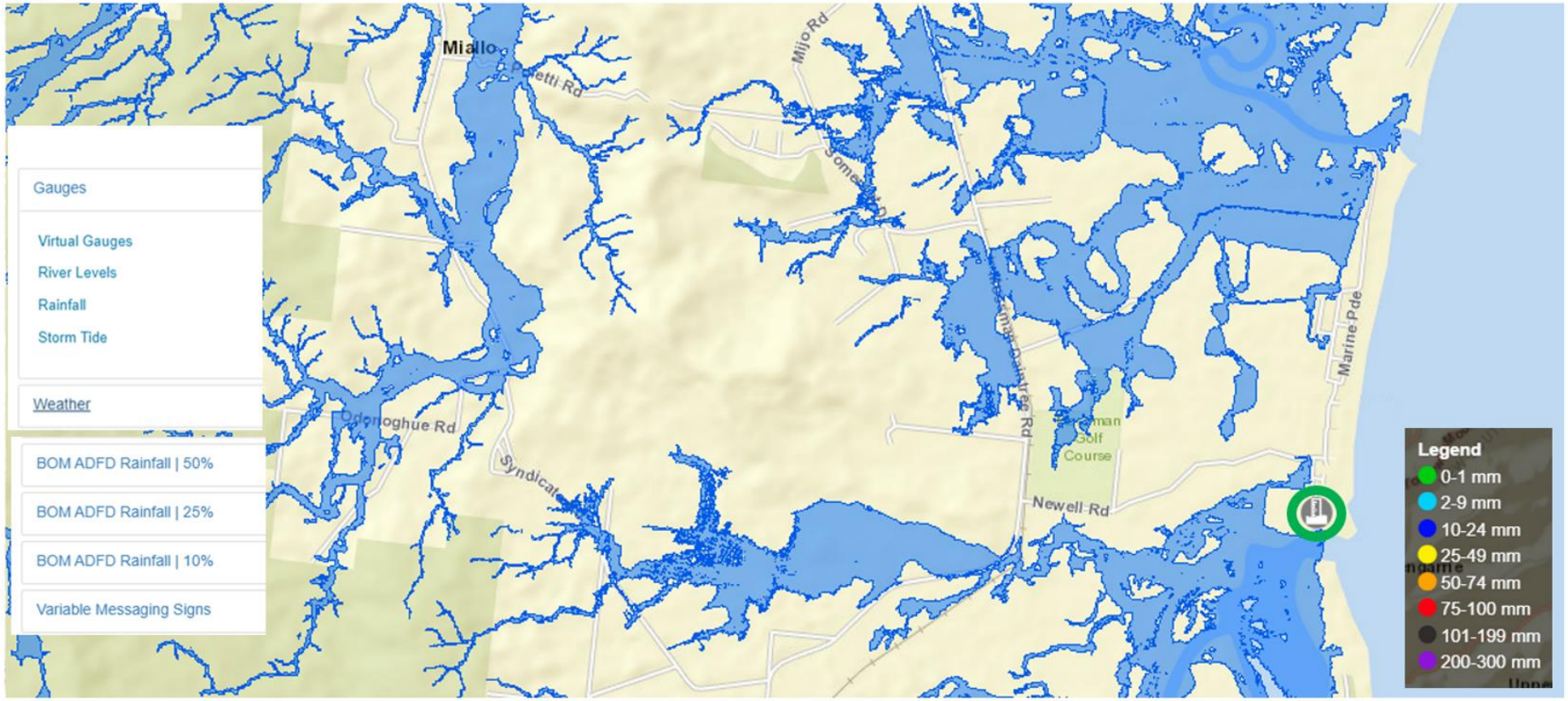
Graph 2: Predicted water levels at Foxton Bridge (gauge datum)



Water levels have been calculated using the Mossman Gauge rating table and are reported in gauge datum. To convert to metres Australian Height Datum subtract 1.238. The moderate threshold is the trigger for road inundation.

GUARDIAN IMS 0

Flood Intelligence System Dashboard



- Gauges
  - Virtual Gauges
  - River Levels
  - Rainfall
  - Storm Tide
- Weather
- BOM ADFD Rainfall | 50%
- BOM ADFD Rainfall | 25%
- BOM ADFD Rainfall | 10%
- Variable Messaging Signs

Catchments Overview

Daintree River | Mossman River | External

Integration Status

Gauge Telemetry Data
Next Update in 09:49

Enviromon Updated: 27/07/2022 11:30AM	Enviromon Updated: 27/07/2022 11:30AM
JBP Virtual Updated: 27/07/2022 11:30AM	

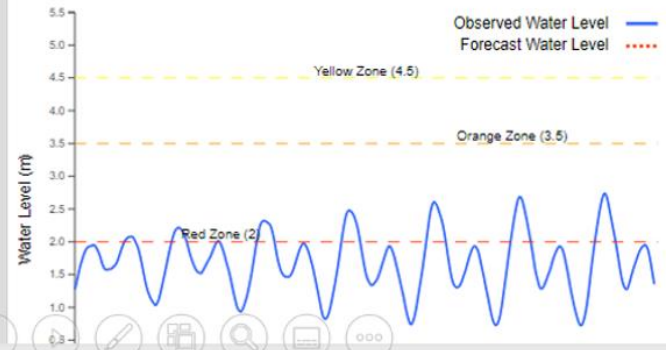
FME Update 15:28	ArcGIS Update 05:28
BOM Update 05:28	JBP Update 15:28

Dynamic Flood Forecast

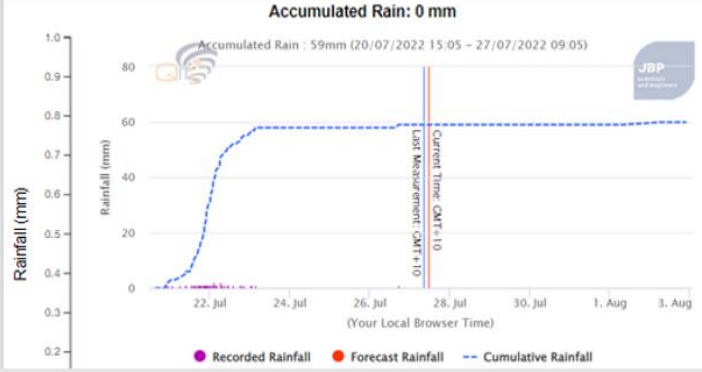
No Flooding Forecasted.

GAUGE ANALYSIS

Water Level - From 20/07/2022 11:35 for 7 Days



Rainfall (15 Minutes interval) - From 26/07/2022 11:35 for 24 Hours

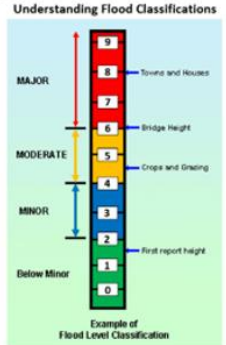


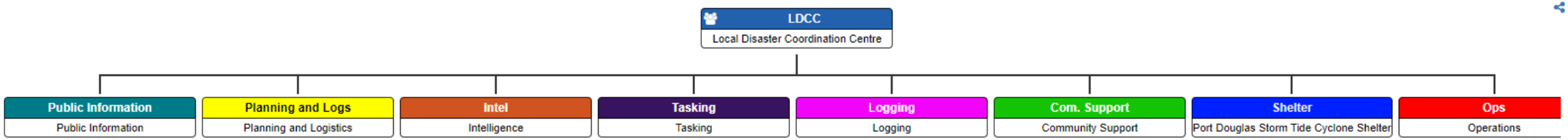
Aide Mémoire

Understanding Rainfall Terminology

Average Recurrence Interval (ARI)	Annual Exceedance Probability (AEP)	Potential Impact
2000	1 in 2000 (0.05%)	Major flooding likely to occur because of rainfall
1000	1 in 1000 (0.10%)	
500	1 in 500 (0.20%)	
200	1 in 200 (0.5%)	Rainfall may lead to major flooding
100	1 in 100 (1%)	
50	1 in 50 (2%)	Rainfall may lead to moderate flooding
20	1 in 20 (5%)	
9.49	1 in 10 (10%)	Rainfall may lead to minor to moderate flooding
4.48	1 in 5 (20%)	Rainfall may lead to minor flooding
1.44	1 in 2 (50%)	Rainfall may lead to below minor flooding
1	1 in 1.58 (63.2%)	

Understanding Flood Classifications





Schedules for the Day

Show entries Search:

Schedule	Facility	Facility Code	Start Time	End Time	Time to Start	Time to End

No Schedules to display

Showing 0 to 0 of 0 entries

Previous Next

External Urls

Show 10 entries Search:

External Links
BoM Cyclone Track Map
Cairns Dashboard
Cook Shire Dashboard
Coronavirus COVID-19 Global Cases Dashboard by Johns Hopkins CSSE
Douglas Shire Dashboard
Mareeba Shire Dashboard
Tablelands Regional Dashboard
WHO Novel Coronavirus (COVID-19) Situation Dashboard

Showing 1 to 8 of 8 entries

Previous 1 Next

Dashboard tools

Trigger issue or incident

Operations scheduler

Identify affected region

GUARDIAN IMS | QIT Plus Pty Ltd | Tropical Storm Sanjeev | 1 1 2 3 | Chris MacGeorge, QIT Plus - Staff

- Home
- Operations
- Operational Status
- Map
- Organization Chart
- District RFA
- Bulletins
- Add New Requests
- Tasking
- Incidents
- My Tasks
- Safety Assessment
- Dashboards
- Charts and Metrics
- Reports
- Summaries
- Communications
- Contact Manager
- Rosters
- Resources
- Service Requests
- Facilities
- Survey

(●) Issue ( ) Incident

Created By: Chris MacGeorge

Select Operations* *There are 4 Active Operation(s)*

Tropical Storm Sanjeev ⊗

Please select at least one operation

Short Description*

Bridge flooded, no access into area

105 Characters Left

Actual Start Date/Time* 15/07/2019 14:21

Estimated Resolution Time* ☑ Unknown

External System: Please select

External Reference Number

Reported By: Chris MacGeorge (Contact - Email: chris.macgeorge@qitplu

☐ Add new contact

Name: Chris MacGeorge

Mobile: 0427654863 | Phone | E-mail: chris.macgeorge@qitplus.com

Details*

Flooding in the Burdekin has exceeded the major flood level and cut access to the Burdekin Bridge. Alternate route required.

Additional Information

Location Option

( ) Location ( ) Schedules ( ) Facilities (●) Existing Polygons

Search For Polygon: Original Polygon

Proximity Range (in Metres): 00

Latitude: eg. -27.123456* -19.640646981484338

Longitude: eg. 153.123456* 147.394638

Cancel | Next

Guardian IMS User Manual | Training | Guardian IMS 3.4 aa1fb44 [04/06/2019] - QIT Plus © 2018 | Chat Users

Development

Guardian Incident Management System (Guardian IMS)

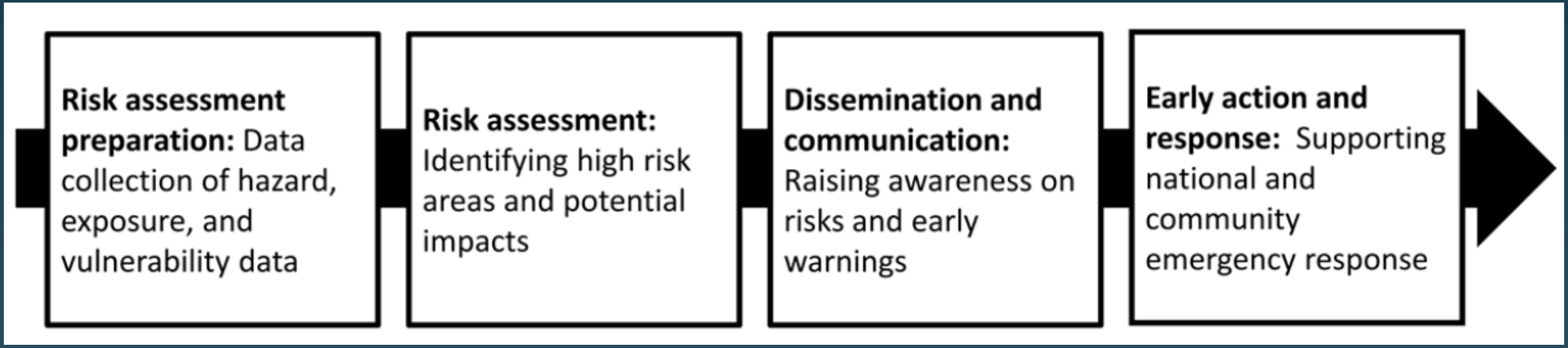
Developed by QIT Plus and their fiji team: QIT Pacific

- https://www.qitplus.com/guardian-ims/

Development

Identify risk

- Relationships between hazard thresholds and severity of impact levels
- Design and communication approach for impact-based warnings
- Implementation



Development

Identify risk

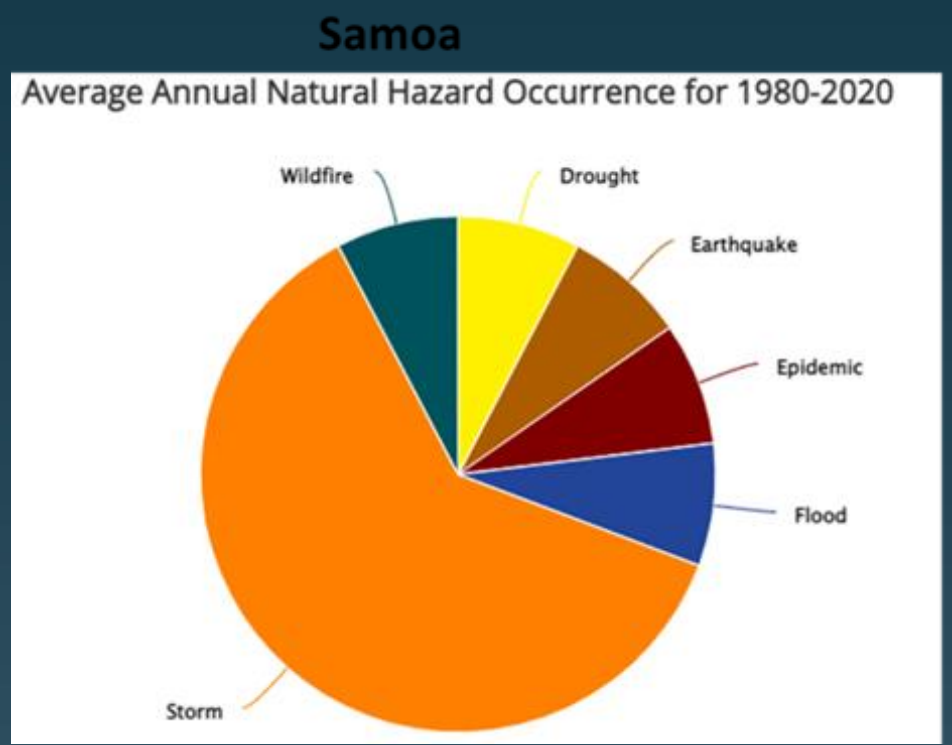
- An Introduction to IBFWS in the Pacific (WB, 2021) lists hydrometeorological hazards within the Pacific

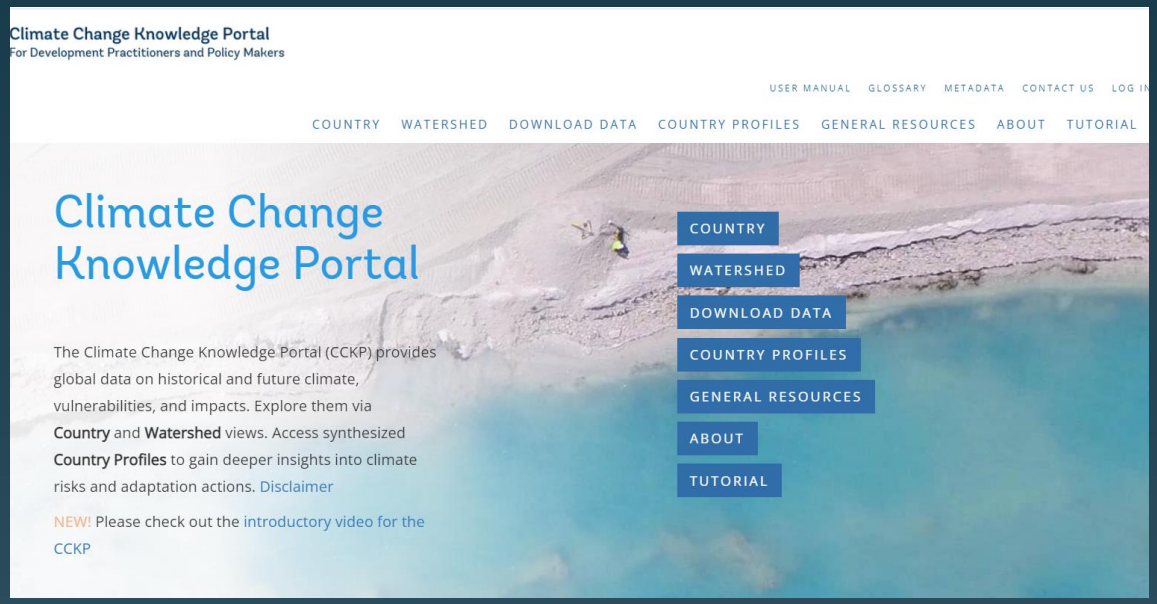
https://climateknowledgeportal.worldbank.org/

Development

Identify risk

- Can be refined through WB Climate Change Knowledge Portal (CCKP)





Development

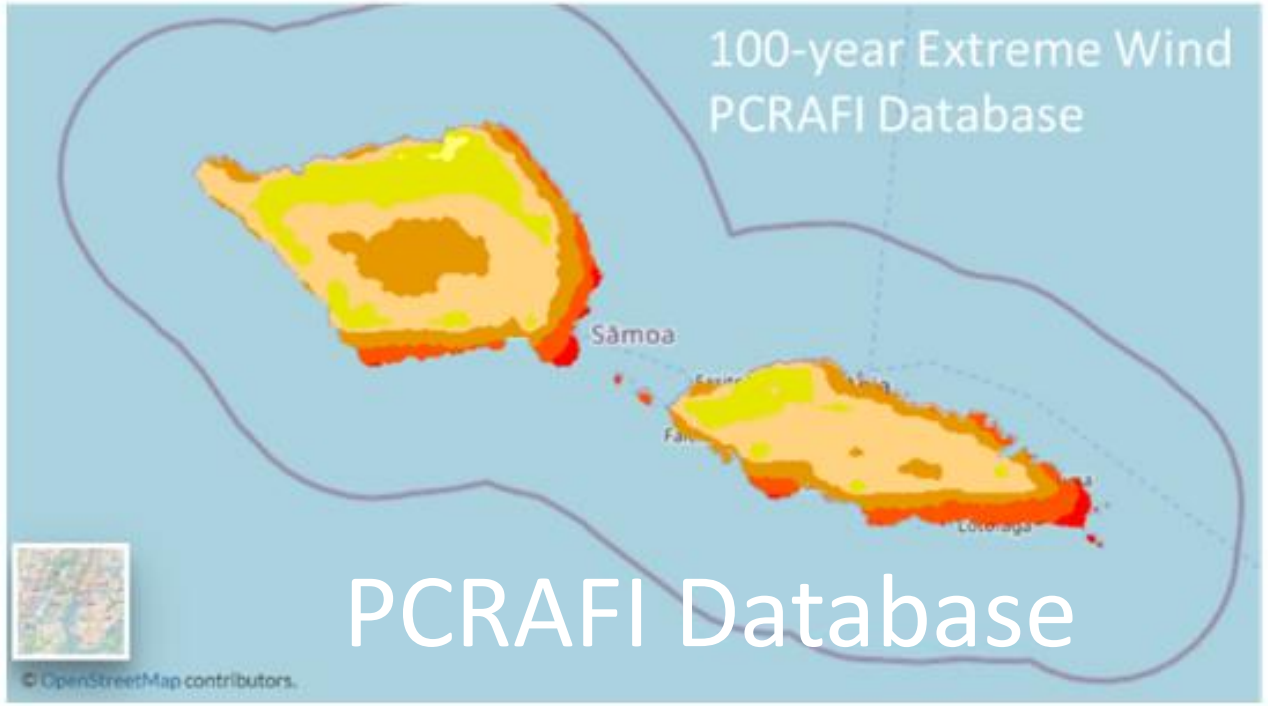
Identify risk

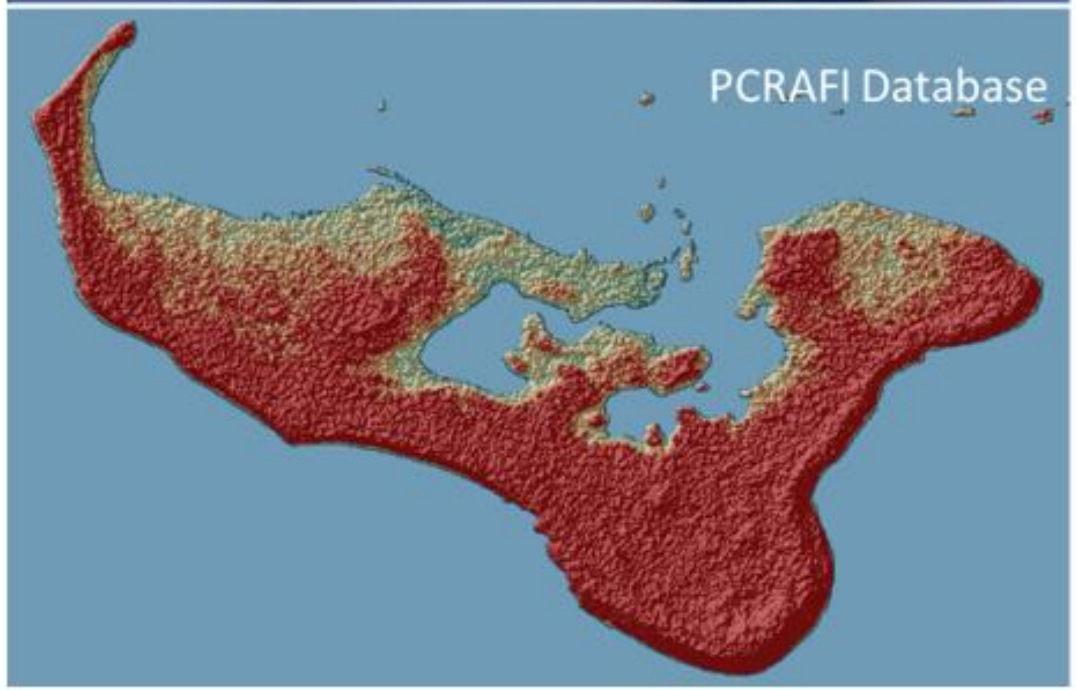
Other datasets that can be used:

- River flooding - Pacific flood maps
- Surface water - Pacific flood maps
- Tide flooding and waterways – Water explorer
- Coastal erosion zone – CoastSat and Google Earth Engine
- PCRAFI Database (https://risk.spc.int/about/)


Samoa
Samoa
Savaii
Upolu
Apia


Tongatapu
Nukunuku
Lakepa
Houma
Vaini

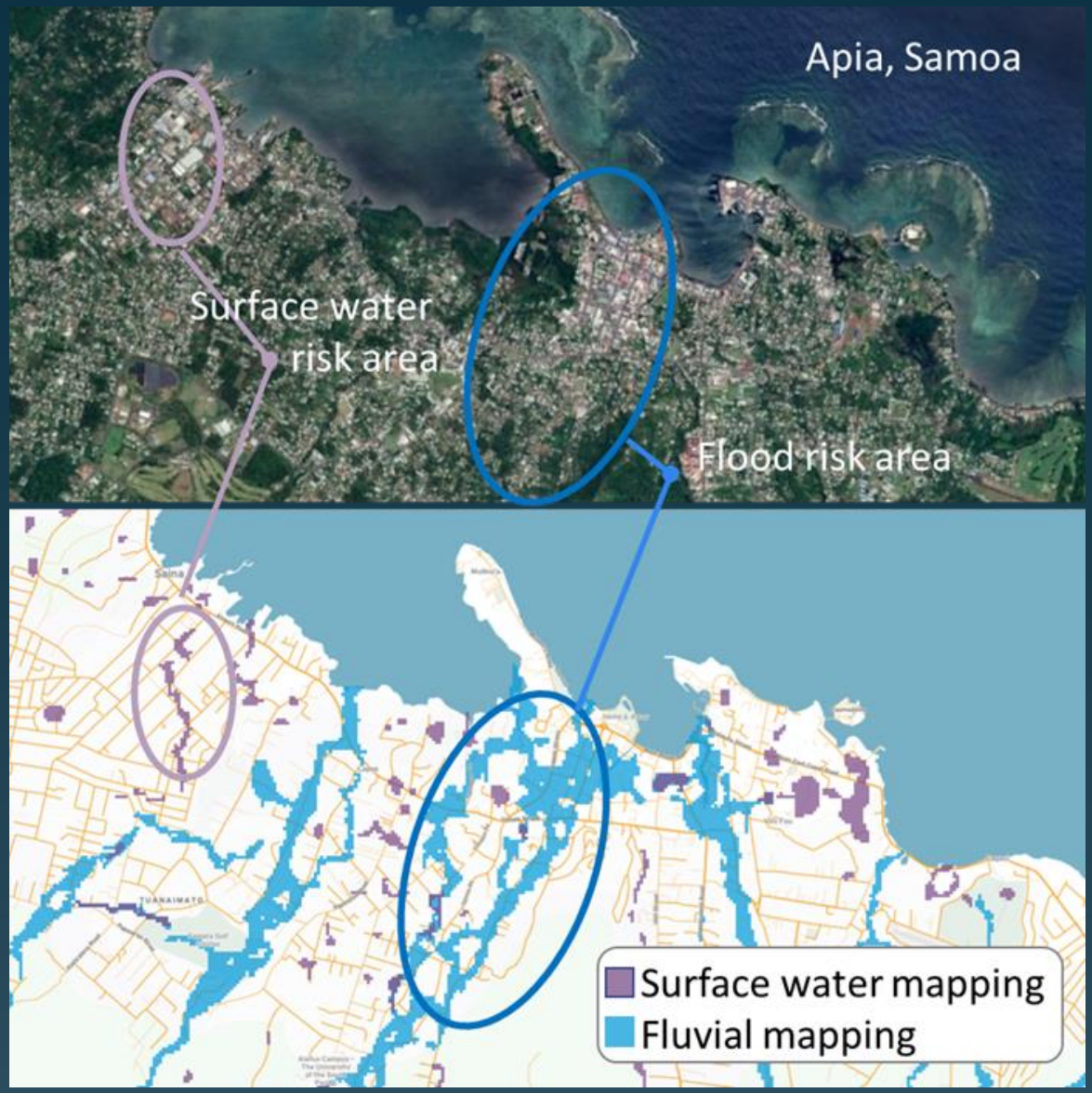

100-year Extreme Wind
PCRAFI Database
Sāmoa
PCRAFI Database
© OpenStreetMap contributors.


PCRAFI Database

Development

Relationships between hazard thresholds and severity of impact levels

- E.g. What rainfall will impact roads, buildings, houses, hospitals?

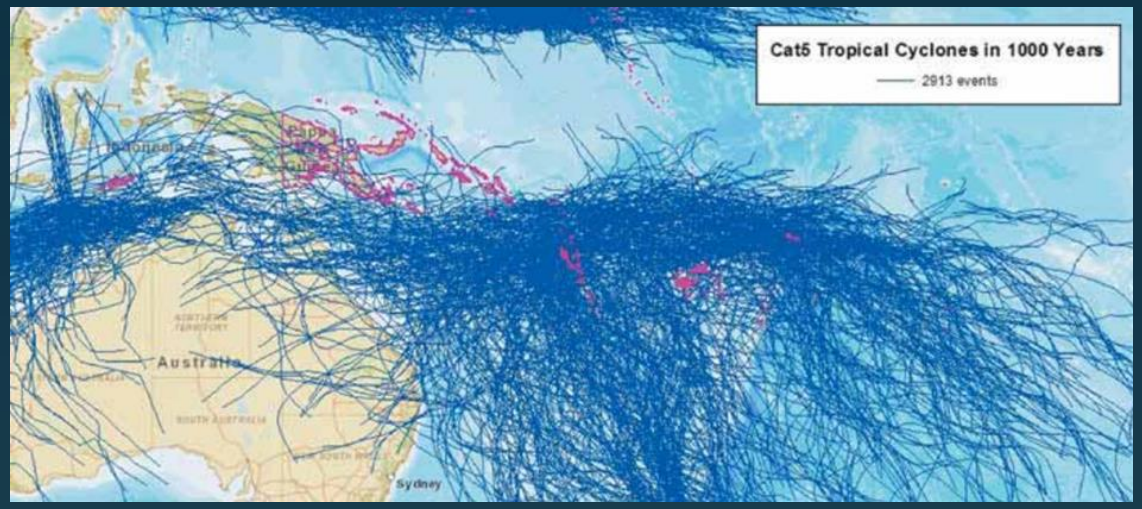


http://www.bom.gov.au/cyclone/tropical-cyclone-knowledge-centre/understanding/tc-info/

Development

Relationships between hazard thresholds and severity of impact levels

- E.g. What wind speed will damage a hut, house, building?



Category	Maximum Mean Wind (km/h)	Typical Strongest Gust (km/h)	Typical Effects
1	63 - 88	< 125	Damaging winds. Negligible house damage. Damage to some crops, trees and caravans. Craft may drag moorings.
2	89 - 117	125 - 164	Destructive winds. Minor house damage. Significant damage to signs, trees and caravans. Heavy damage to some crops. Risk of power failure. Small craft may break moorings.
3	118 - 159	165 - 224	Very destructive winds. Some roof and structural damage. Some caravans destroyed. Power failures likely. (e.g. Clare, Olwyn)
4	160 - 199	225 - 279	Significant roofing loss and structural damage. Many caravans destroyed and blown away. Dangerous airborne debris. Widespread power failures. (e.g. Tracy, Debbie, Lam)
5	> 200	> 279	Extremely dangerous with widespread destruction. (e.g. Vance, Marcia, Yasi)

Development

Relationships between hazard thresholds and severity of impact levels

- E.g. What duration of zero rainfall will effect a dam or reservoirs water supply?

- 1 month?
- 3 months?
- 12 months?

Development

Relationships between hazard thresholds and severity of impact levels

Hazard type:			Region				
Severity	Threshold	Unit	Exposure/Risk				
			Population	Buildings	Infrastructure	Land	Other
Low	30mm	30mm/hour	20	8	Local roads		
Moderate							
High							

Hazard type: Rainfall / Surface water — Region: Apia

Severity	Threshold	Unit	Exposure/Risk				
			Population	Buildings	Infrastructure	Land	Other
Low	100	mm/hr, over one hour	Nil	Nil	Minor roads	<0.1km2	Shops
Moderate	150	mm/hr, over one hour	3	13		0.2km2	
High	200	mm/hr, over one hour	100	26		1 km2	

Hazard type: Flood — Region: Apia

Severity	Threshold	Unit	Exposure/Risk				
			Population	Buildings	Infrastructure	Land	Other
Low	400	mm/hr, day total	6,976	14	Minor roads	3km2	School
Moderate	500	mm/hr, day total	12,000	85	3km Arterial road	5km2	
High	800	mm/hr, day total	16,000	191	3km Highway	6km2	Hospital

Hazard type: Storm surge / coastal inundation — Region: Apia

Severity	Threshold	Unit	Exposure/Risk				
			Population	Buildings	Infrastructure	Land	Other
Low	1.1	m, gauge datum	4,360	11	Minor roads	3km2	
Moderate	1.5	m, gauge datum	7,500	67	Arterial road	5km2	School
High	1.8	m, gauge datum	10,000	150	2km Highway	6km2	

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Development

Design and communication approach for impact-based warnings

- Growing amount of literature:
  - Australian Bureau of Meteorology
  - UK Met Office
  - Industry groups such as the Understanding Risk community organization
  - University Corporation for Atmospheric Research (UCAR) Cooperative Program for Operational Meteorology, Education and Training (COMET) programme

Development

Design and communication approach for impact-based warnings

- Advances in hand-held technology offers an increasing potential to share warnings to at-risk users.
- Smart phone weather apps and social media are increasing in popularity
- Traditional media, such as radio, remains an important and reliable
-
- Other approaches can include spoken language, visualisations, printed media, sirens and alarms etc

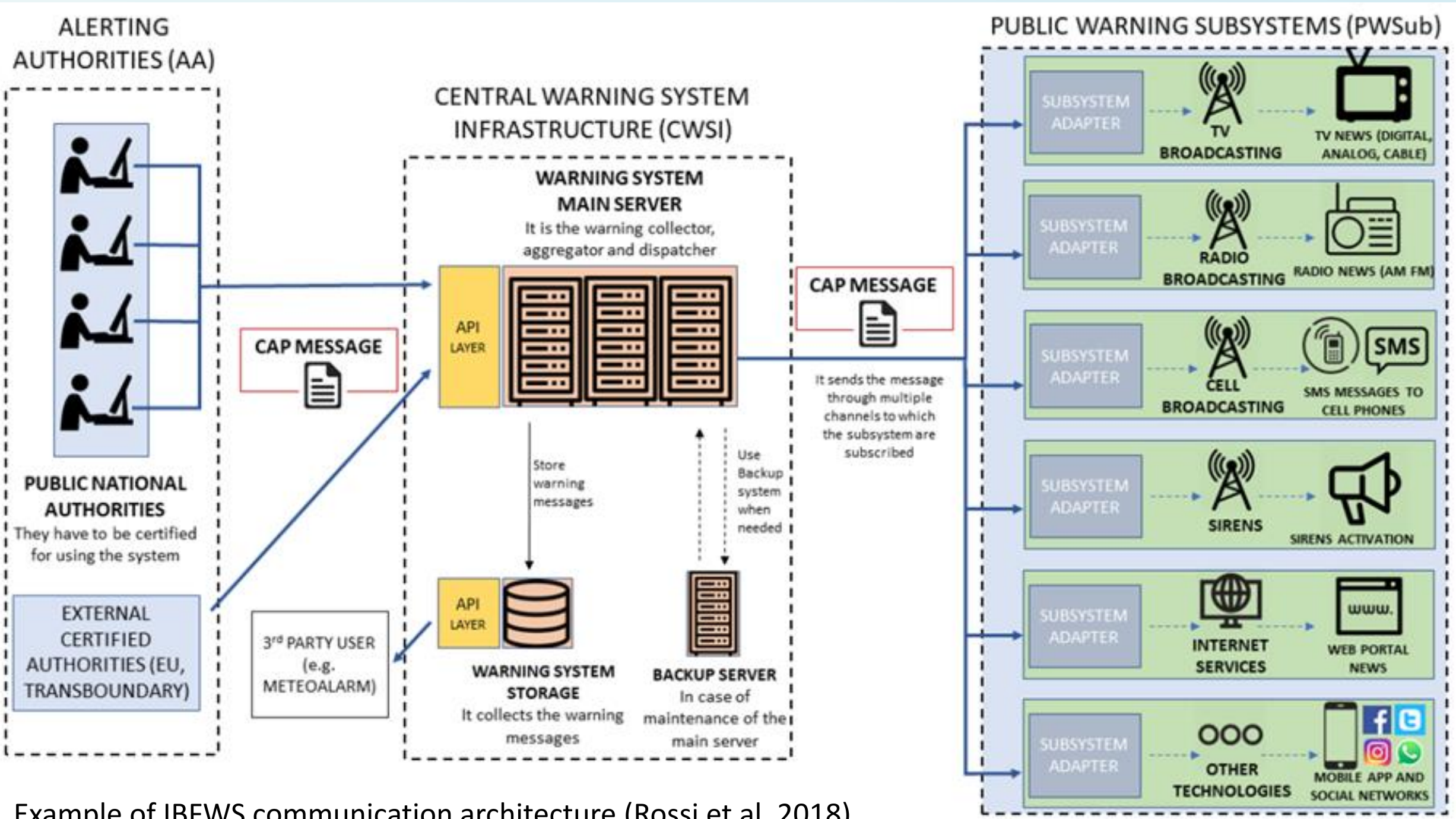
Dissemination – Platforms and technologies used to send warnings	Communication – Methodologies and tools used to present and explain the information in forecasts and warnings
Common Alerting Protocol (CAP)	Spoken words – clear, simple, jargon free
Radio – weather forecasts, news	Written words – clear, simple, jargon free
TV – weather forecasts, news	Language – relevant language
Newspapers – print and online	Graphics
Email	Diagrams
Telephone	Animations
SMS	Explainer videos
Fax	Blogs
Websites	Press releases
Cell phone weather Apps	
Cell phone messenger Apps	
Interactive Voice Response[46]	
Social media	
Community leaders	
In person, door-to-door by authorities	
Notice boards	
Flags	
Loud hailers/Megaphones	
Sirens and alert towers	
Religious building speakers	

Development

Design and communication approach for impact-based warnings

- Central to communications is the use of a Unified Messaging System (UMS).
- Leverage multiple channels of communication from a single point, using Common Alerting Protocol (CAP).

- Basically – lets things talk to each other



Example of IBFWS communication architecture (Rossi et al, 2018)

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Development

Implementation

- You need a forecasting system
  - This needs weather inputs
    - It needs to make predictions
      - Analyse thresholds
        - Disseminate warnings

Development

Implementation

- Forecasting system

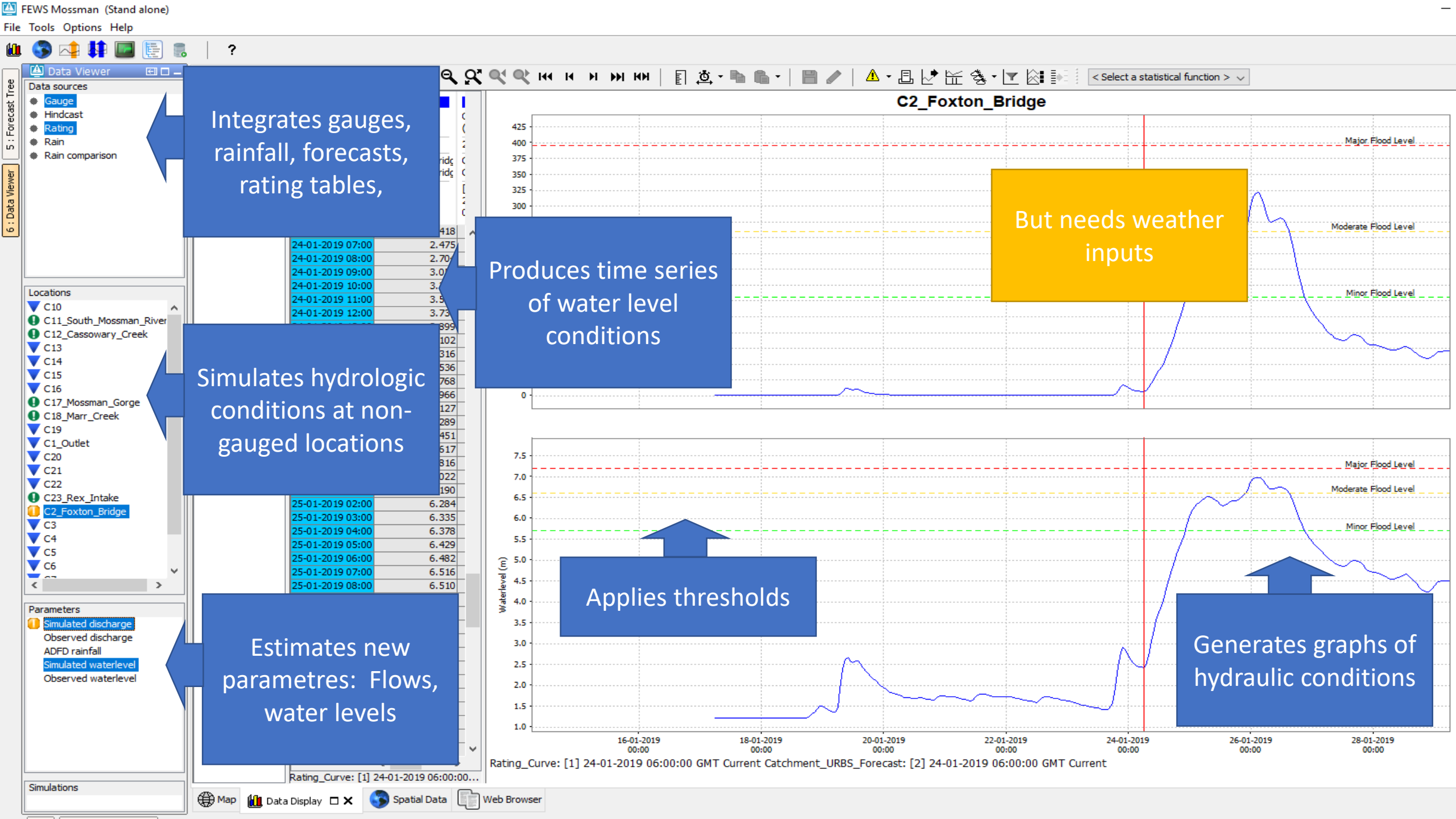
- DELFT FEWS

Delft-FEWS is an operational data management, monitoring and forecasting environment.

Used by forecasting centres around the world, including the US National Weather Service, the UK Environment Agency and the Australian Bureau of Meteorology.

Delft-FEWS is free for use, and as non-proprietary software it allows greater data transfer between parties, and it is scaleable up to a national-level and beyond.

https://oss.deltares.nl/web/delft-fews


FEWS Mossman (Stand alone)
File Tools Options Help
Data Viewer
Data sources
Gauge
Hindcast
Rating
Rain
Rain comparison
Integrates gauges, rainfall, forecasts, rating tables,
Locations
C10
C11_South_Mossman_River
C12_Cassowary_Creek
C13
C14
C15
C16
C17_Mossman_Gorge
C18_Marr_Creek
C19
C1_Outlet
C20
C21
C22
C23_Rex_Intake
C2_Foxton_Bridge
C3
C4
C5
C6
Simulates hydrologic conditions at non-gauged locations
Parameters
Simulated discharge
Observed discharge
ADFD rainfall
Simulated waterlevel
Observed waterlevel
Estimates new parametres: Flows, water levels
Simulations
5 : Forecast Tree
6 : Data Viewer
< Select a statistical function >
24-01-2019 07:00 2.475
24-01-2019 08:00 2.70
24-01-2019 09:00 3.0
24-01-2019 10:00 3.
24-01-2019 11:00 3.
24-01-2019 12:00 3.73
25-01-2019 02:00 6.284
25-01-2019 03:00 6.335
25-01-2019 04:00 6.378
25-01-2019 05:00 6.429
25-01-2019 06:00 6.482
25-01-2019 07:00 6.516
25-01-2019 08:00 6.510
Rating_Curve: [1] 24-01-2019 06:00:00...
Produces time series of water level conditions
C2_Foxton_Bridge
Major Flood Level
Moderate Flood Level
Minor Flood Level
But needs weather inputs
Waterlevel (m)
Applies thresholds
Generates graphs of hydraulic conditions
16-01-2019 00:00
18-01-2019 00:00
20-01-2019 00:00
22-01-2019 00:00
24-01-2019 00:00
26-01-2019 00:00
28-01-2019 00:00
Rating_Curve: [1] 24-01-2019 06:00:00 GMT Current Catchment_URBS_Forecast: [2] 24-01-2019 06:00:00 GMT Current
Map
Data Display
Spatial Data
Web Browser

Development

Implementation

- Weather inputs

Wind observations

Sea levels observations

Wave and storm surge forecasts

Delft-FEWS

Wind and cyclone forecasts

Rain forecasts

Flood forecasts

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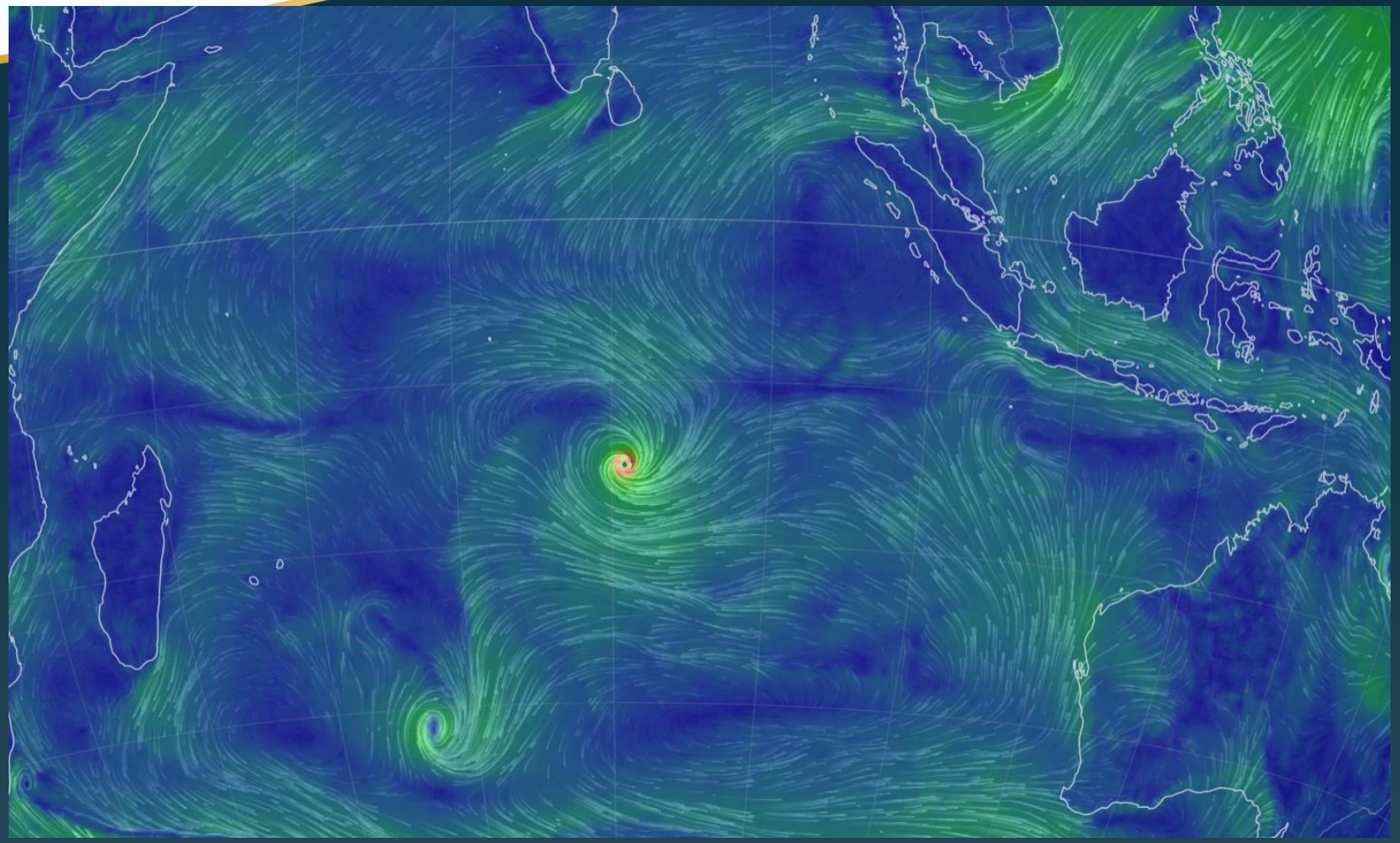
Development

Implementation

- Weather inputs – Wind

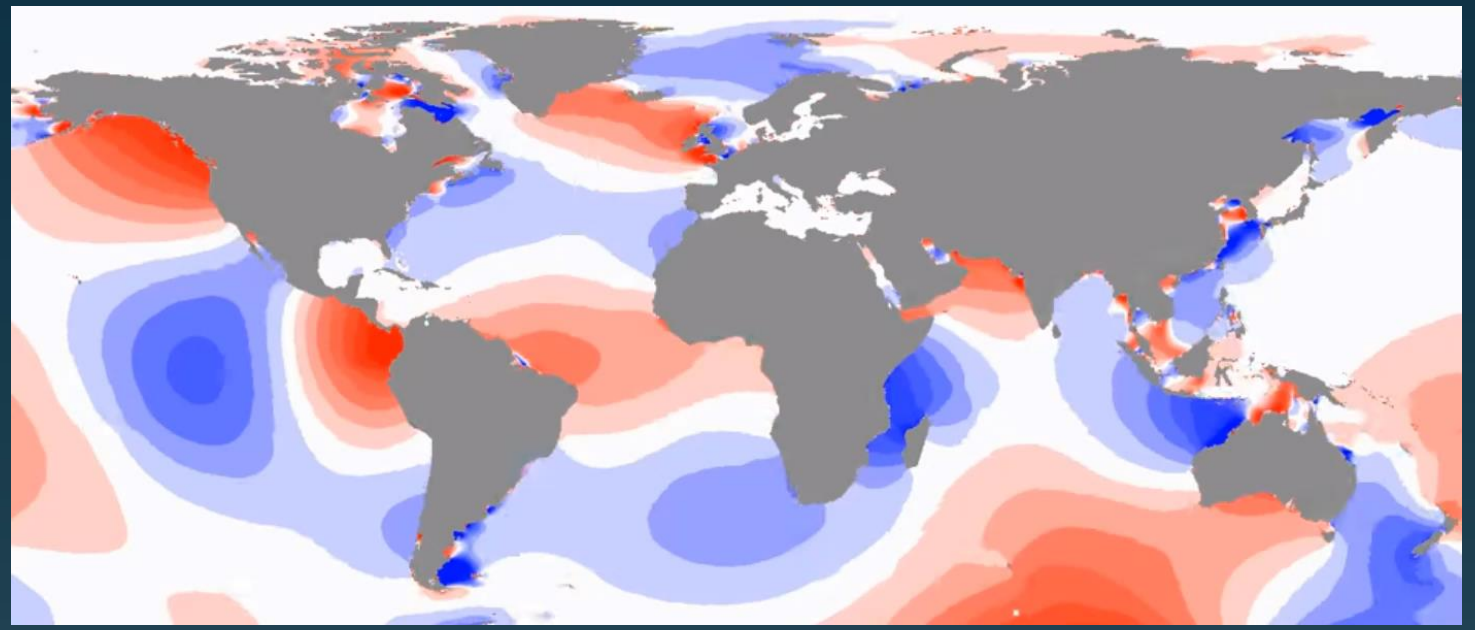


The NOAA Global Forecast System (GFS) weather model can predict winds.
The model updates every six hours and forecasts for 10 days, in three-hour time increments

Development

Implementation

- Weather inputs – Sea levels

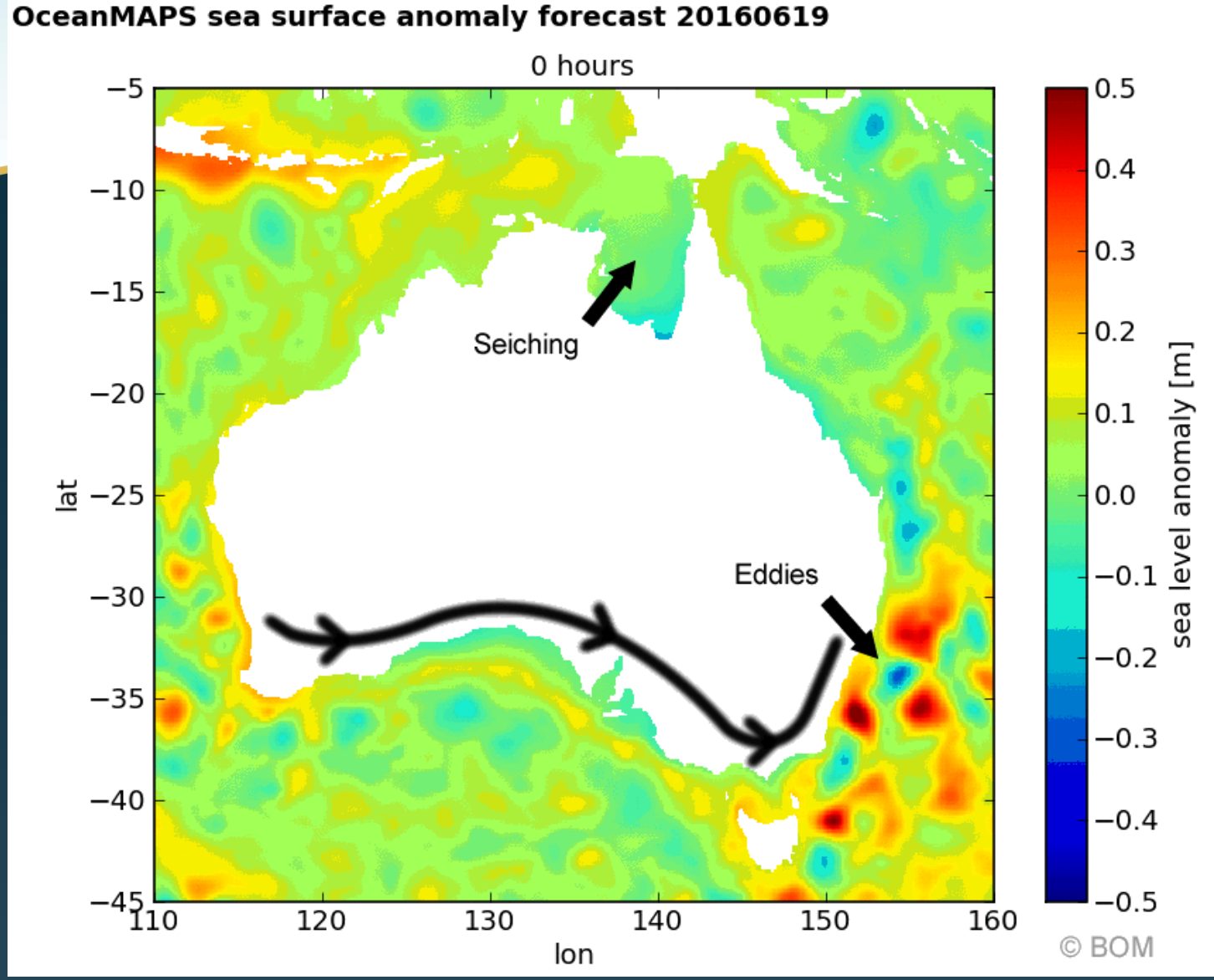


Tides can be predicted based on astronomical data, for any location in the world, out for the next decade!

Development

Implementation

- Weather inputs – Sea levels



Storm surges predicted by various agencies (inc. BoM) via OceanMaps.

Global datasets include Global Storm Surge Information System (GLOSSIS), with 10-day tide and surge forecasts updated four times a day

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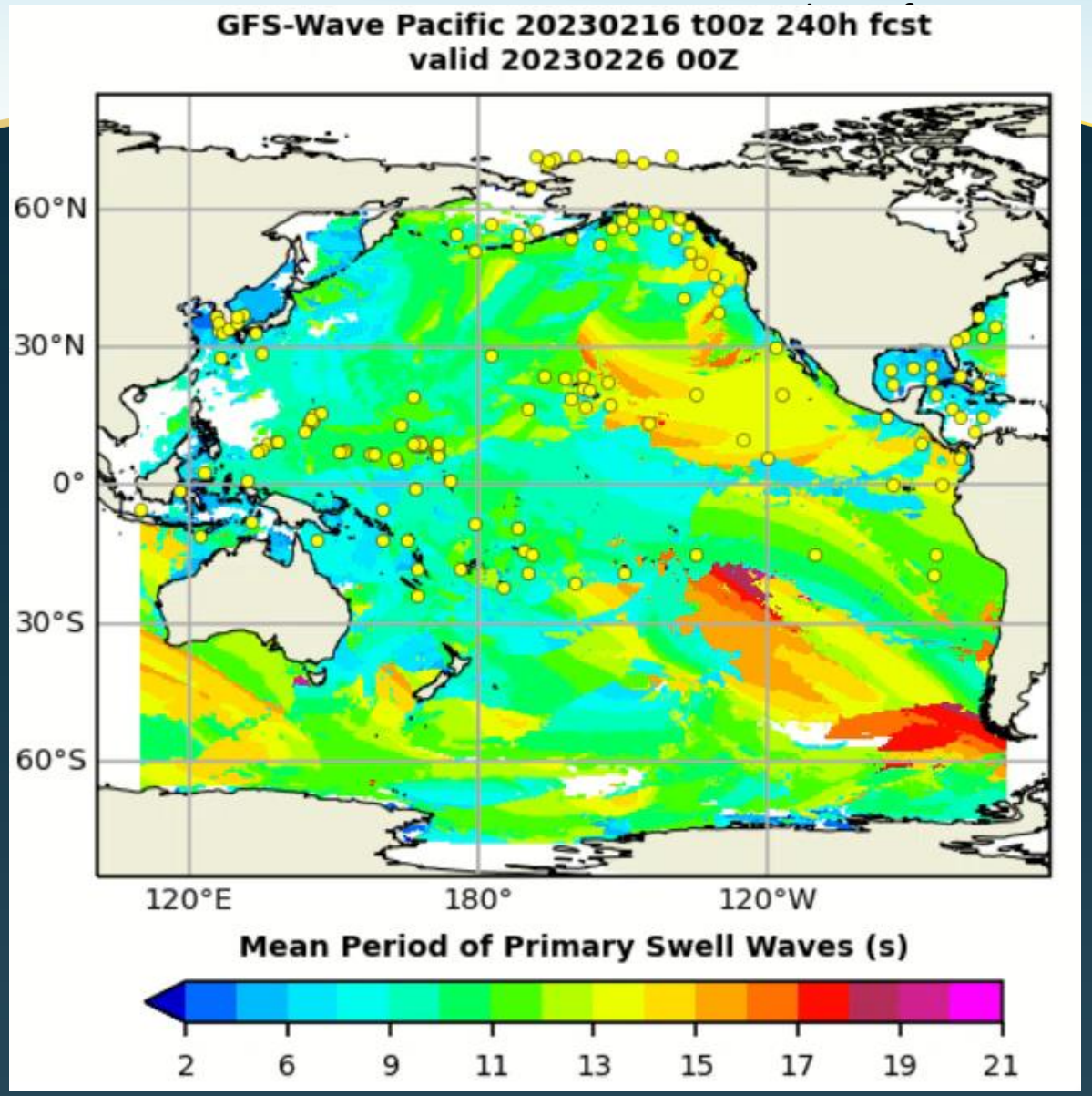
Development

Implementation

- Waves

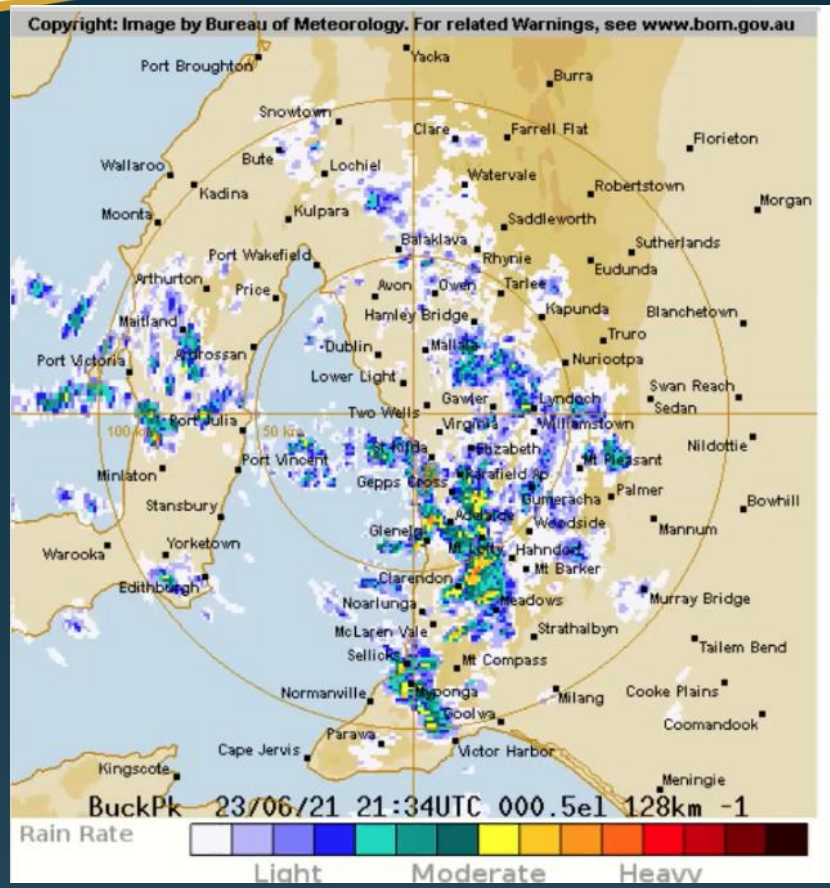
Offshore waves are available through the NOAA Wave Watch III (WW3) model. This model forecasts wave conditions four times a day. Forecasts out to 7 days.

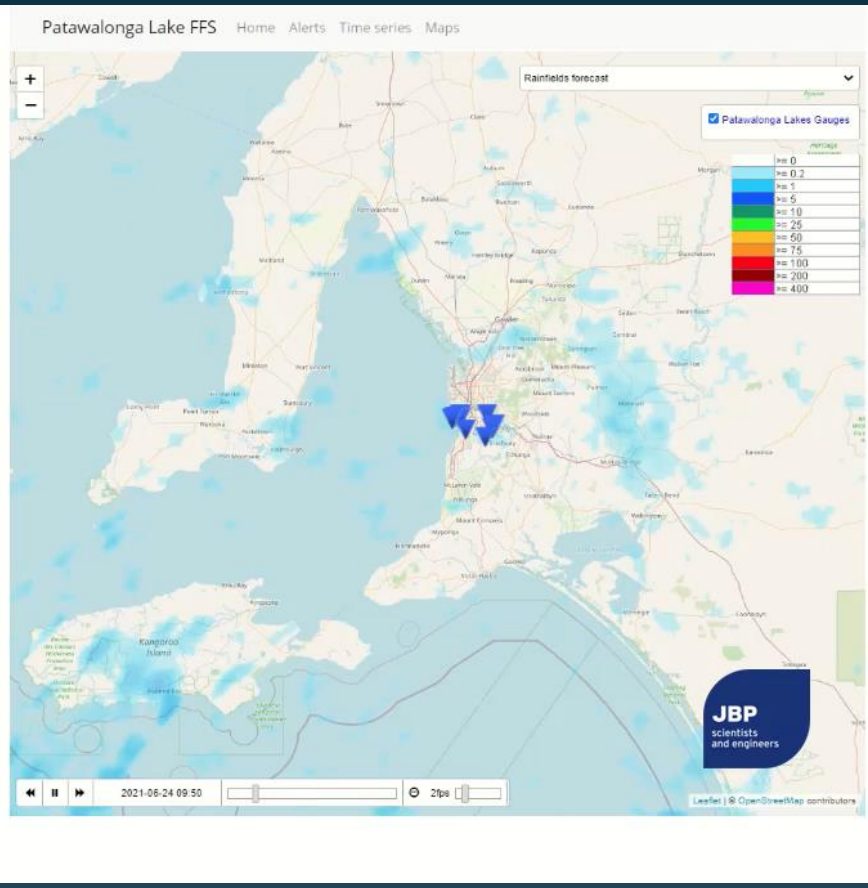


Development

Implementation

- Weather inputs –Rain





Live rainfall gauges are best, or alternatively the eartH2Observe (www.earth2observe.eu) product is available which provides global gridded rainfall rates in real-time.
Forecasts can be based on a number of sources – including GFS, BoM, ECWMF etc

Development

Implementation:

- It needs to make predictions
    - Analyse thresholds
        - Disseminate warnings

Development

Data

Meteorology
(Rain, wind, waves)

Astronomy *(Tides)*

Antecedent conditions
(Infiltration, rainfall, water levels)

Lookups?
Rule?
Modelling?

Prediction System

Automatic?
Scheduled?
Manual?

Analysis?
Mapping?
Receptors?
Roads?
Assets?
Buildings?
People?

Intelligence

Development

Data

Rain: BoM ADFD t+7 day rainfall forecast
BoM Rainfields t+2h radar-based forecast
Wind: BoM ADFD and ACCESS-TC models
Waves: BoM Wave model
Storm surge: BoM Oceanmaps
Tides: BoM astronomic tides
Infiltration: BoM AWRA-L
Rainfall: ENVIROMON & BoM FTP
Water levels: ENVIROMON & BoM FTP

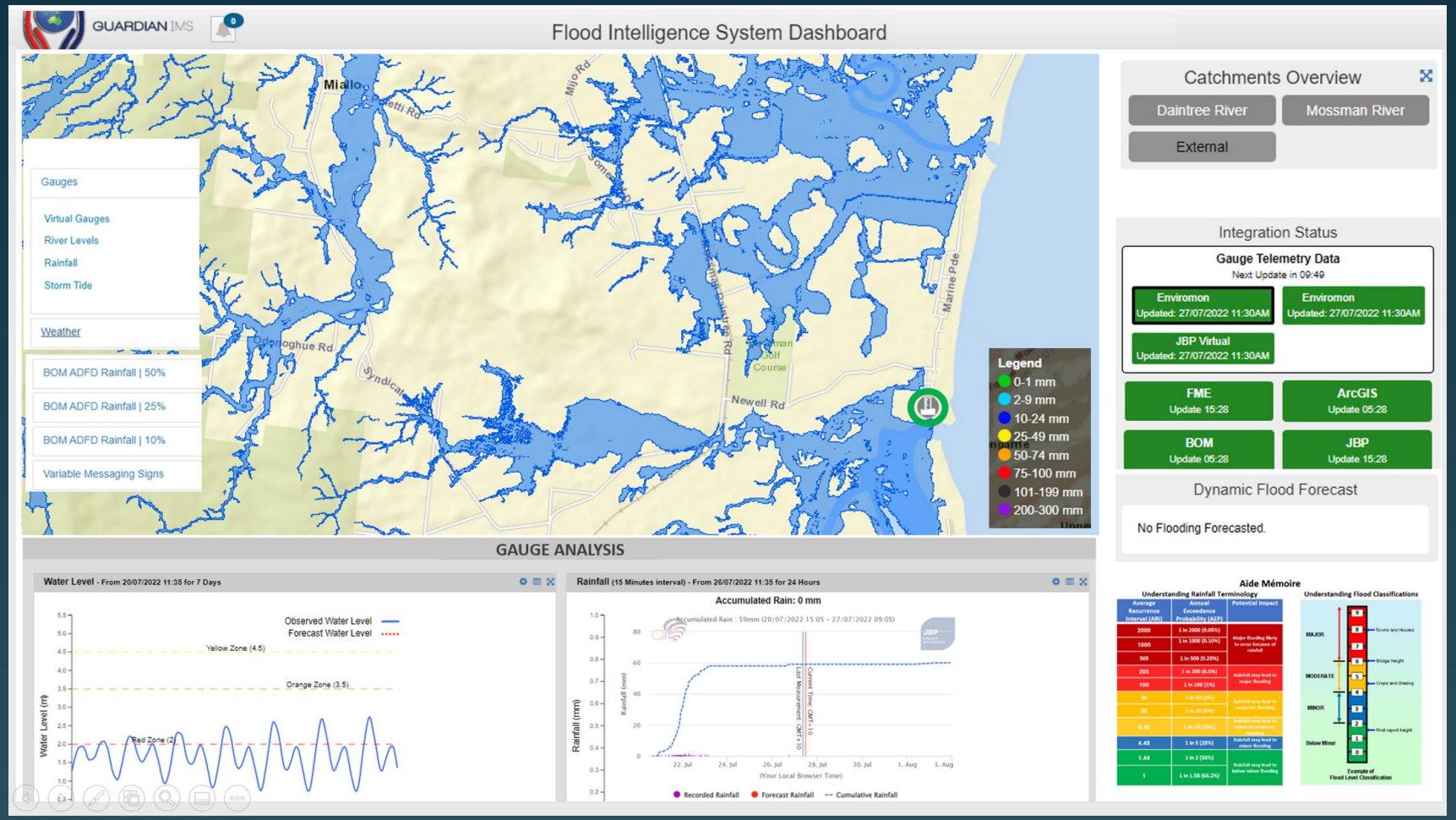
Prediction System

Delft FEWS
Live models
Simulation library

Intelligence

Guardian IMS

Development



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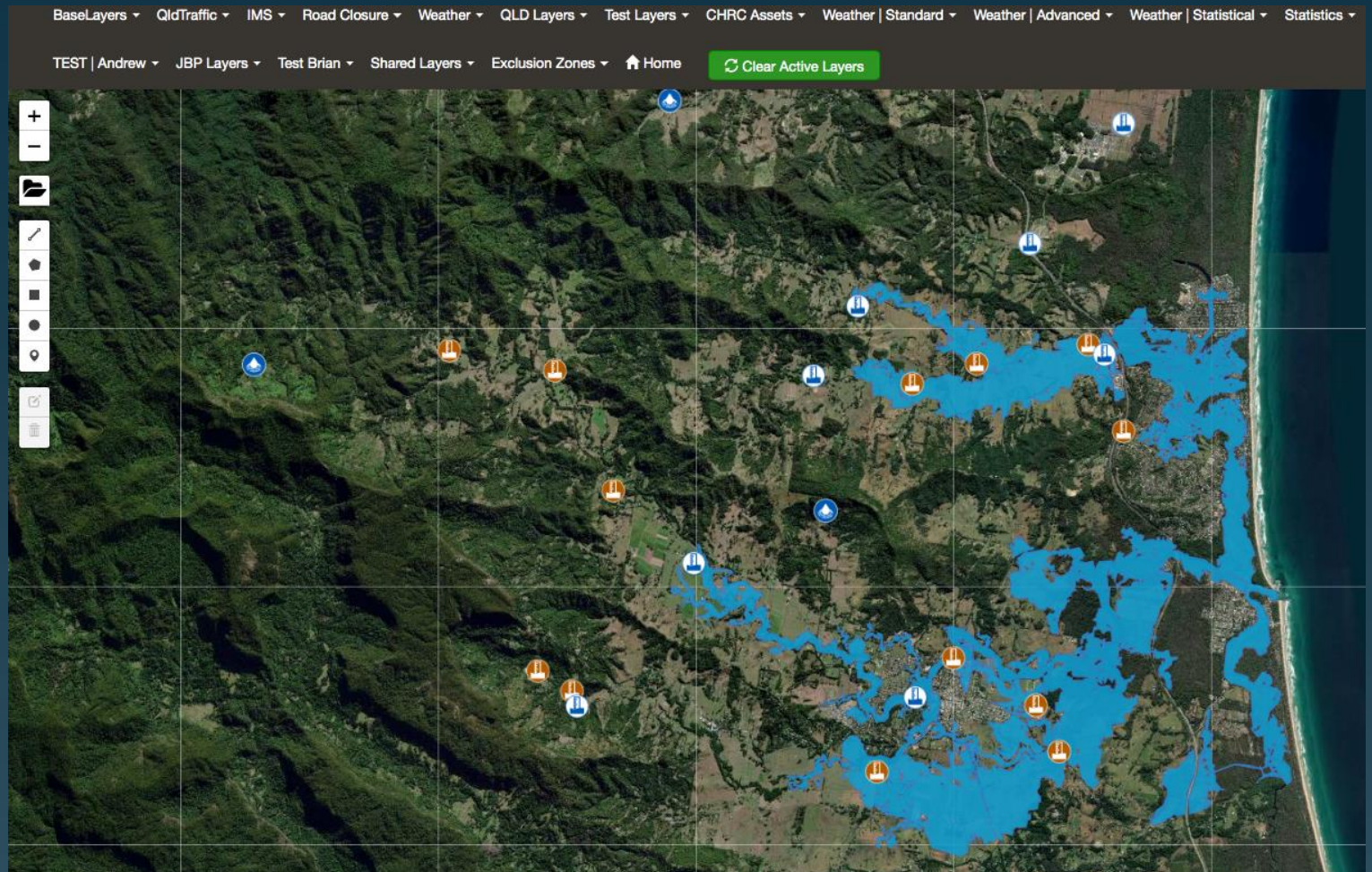
Development



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Development

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Thank you!

Email me at:
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www.JBPacific.com.au