

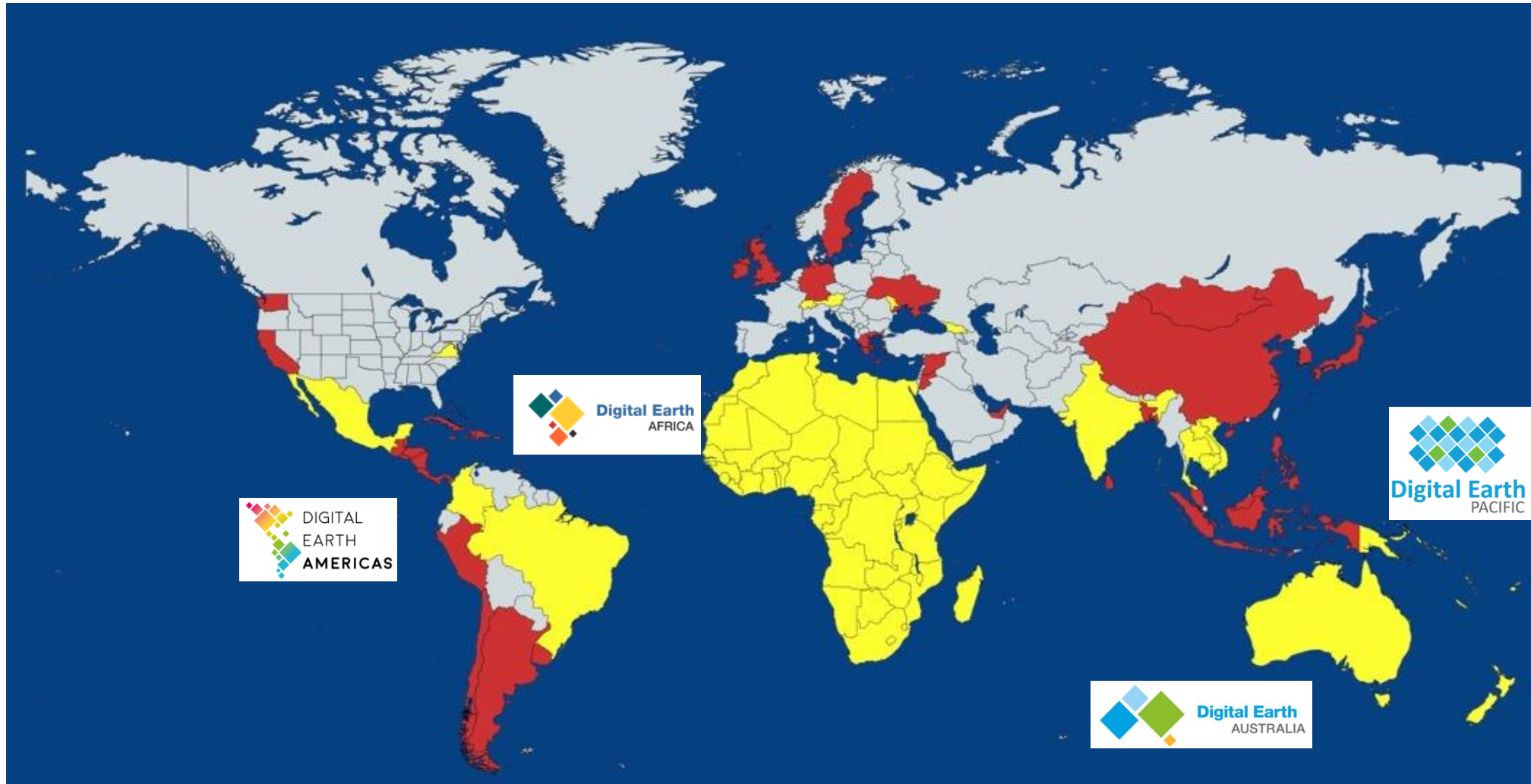


# Digital Earth Pacific

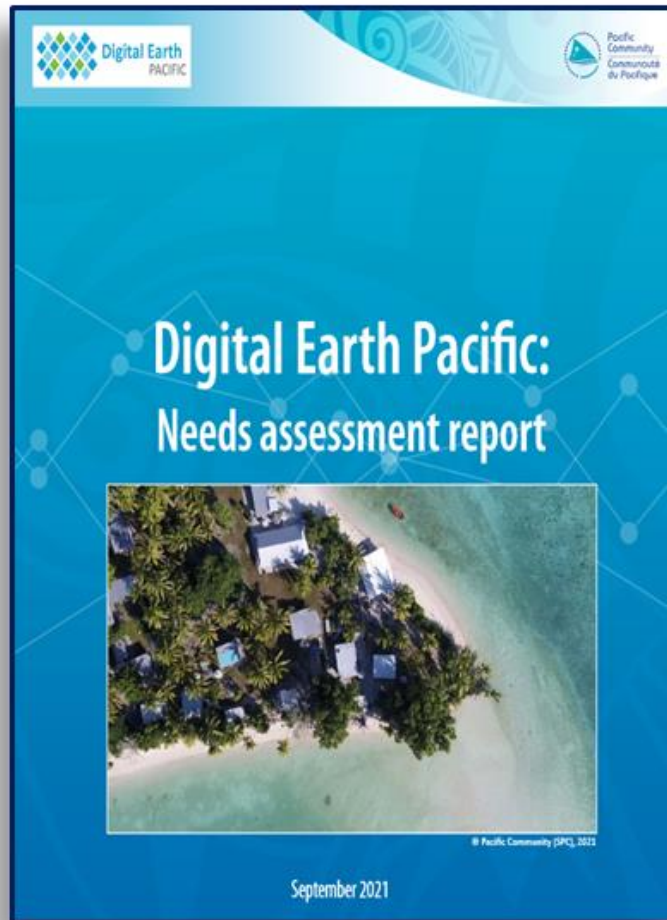
Potential of Earth Observations for  
fisheries management



# Digital Earth – Expanding Globally



# Pacific Needs Assessment and Results



## Tier 1

- Land Cover Change Detection
- Coastline Change Detection
- Agricultural Census
- Vegetation Indexes – Crop and Disease Detection

## Tier 2

- Hazards Impact Mapping - Cyclones, Tsunami, Droughts
- Digital Elevation Models - for Coastal Inundation
- Fishing Vessels Tracking - Unregulated
- Mapping Buildings and Population
- Mangroves Change Detection
- Near-Shore Bathymetry

- Country virtual, hybrid & face to face consultations
  - Vanuatu
  - Republic of Marshall Islands
  - Tonga
  - Fiji Islands
- Steering Committee guidance
- In-country workshops
- Country requests
- SPC country needs assessments

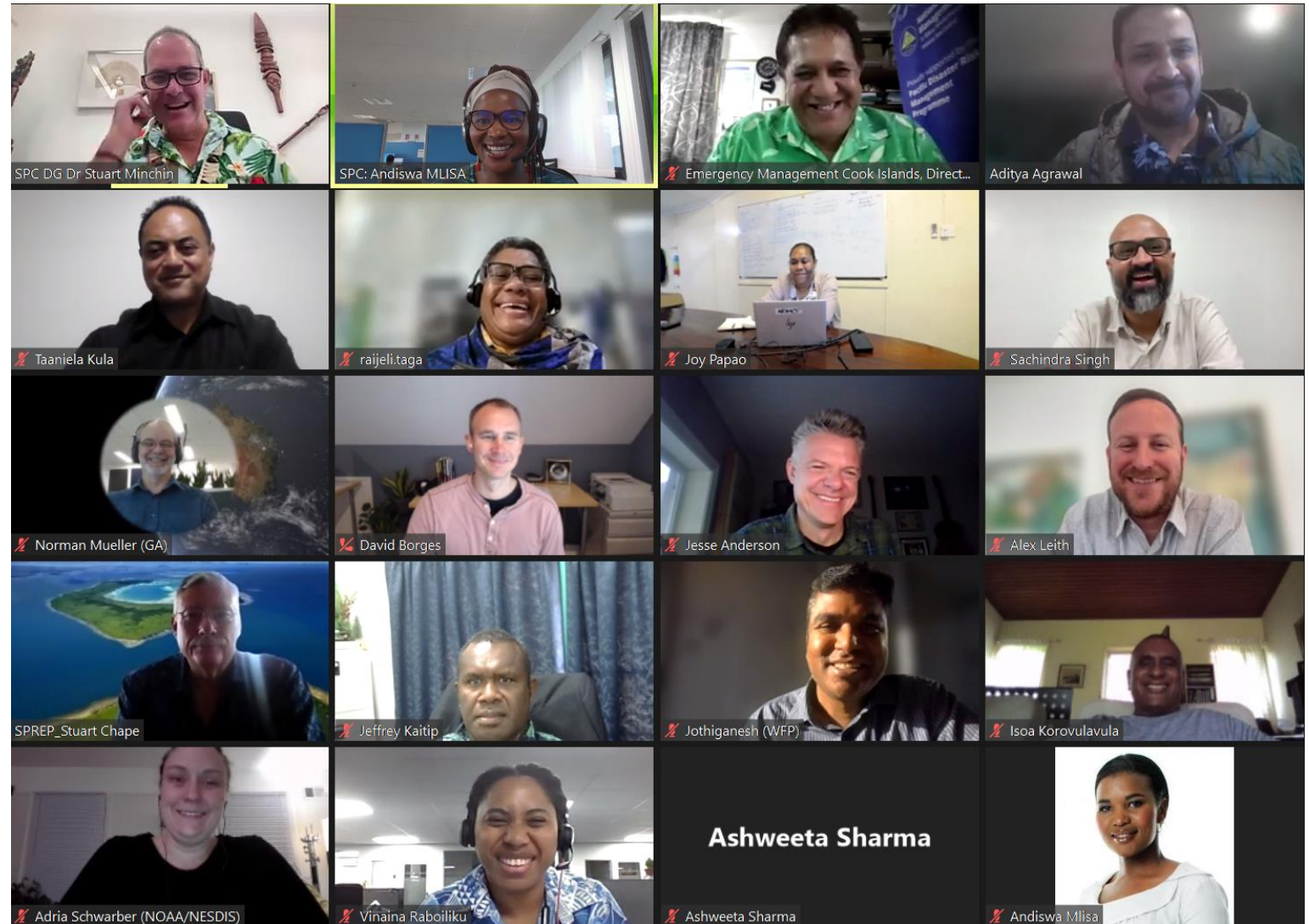
# Roadmap 2022-2030



- **Phase 1 (2022-2024): Setting the Foundation**
  - Set the strategic foundations, iterating on the technical infrastructure and related use cases, engage stakeholders and develop a fully operational program.
- **Phase II (2025-2027): Increase Capacity, Uptake and Engagement**
  - Fully operationalize DEP. Existing capabilities will be leveraged and built upon to create new innovative, decision-ready products and applications with a focus on engagement, capacity development to ensure uptake and usage, and impact.
- **Phase III (2028-2030): Establish a Data Ecosystem**
  - DEP will have a network of data, users, applications and knowledge in place where data is flowing bi-directionally across organizations and platforms creating a data ecosystem approach. Governments, private sector and civil society are not only using data, products and services provided by DEP, but creating their own innovations powered by DEP.

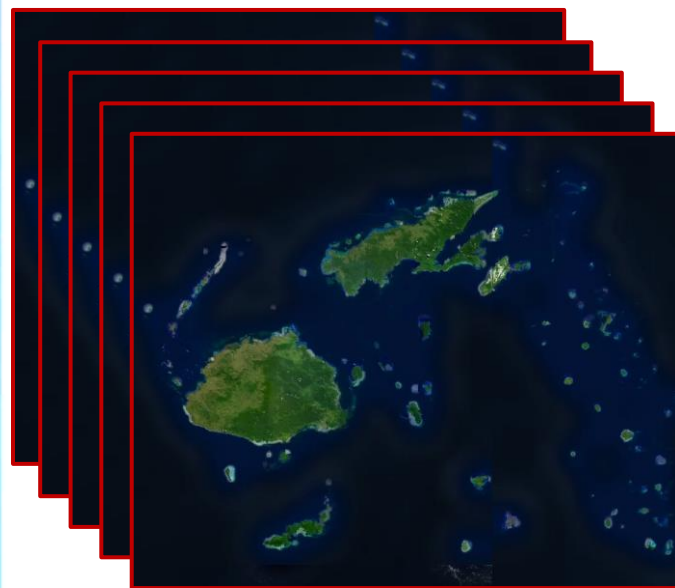
# Governance: Steering Committee

- Countries
  - 1) Cook Islands
  - 2) Fiji
  - 3) Papua New Guinea
  - 4) Marshall Islands
  - 5) Solomon Islands
  - 6) Tonga
  - 7) Tuvalu
  - 8) Vanuatu
- Organizations
  - 9) Committee on Earth Observation Satellites (CEOS)
  - 10) Geoscience Australia
  - 11) Group on Earth Observations (GEO)
  - 12) NOAA
  - 13) SPREP
  - 14) University of South Pacific
  - 15) World Food Programme

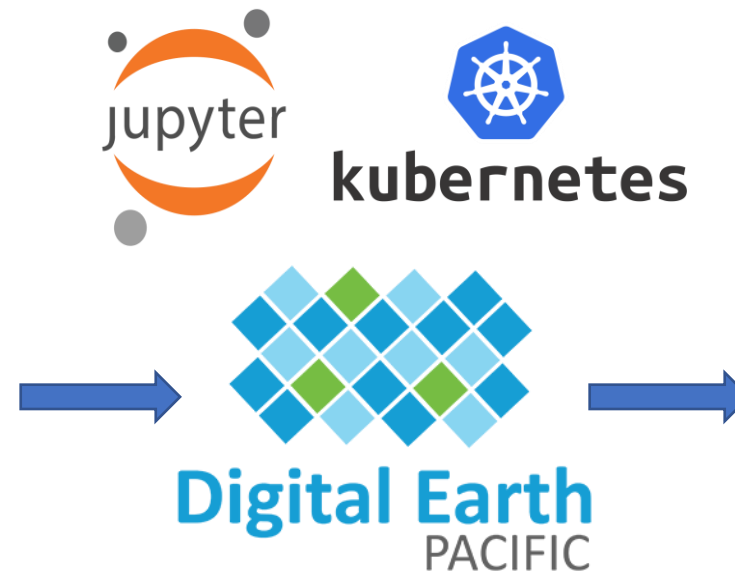


# DEP in a (technical) nutshell

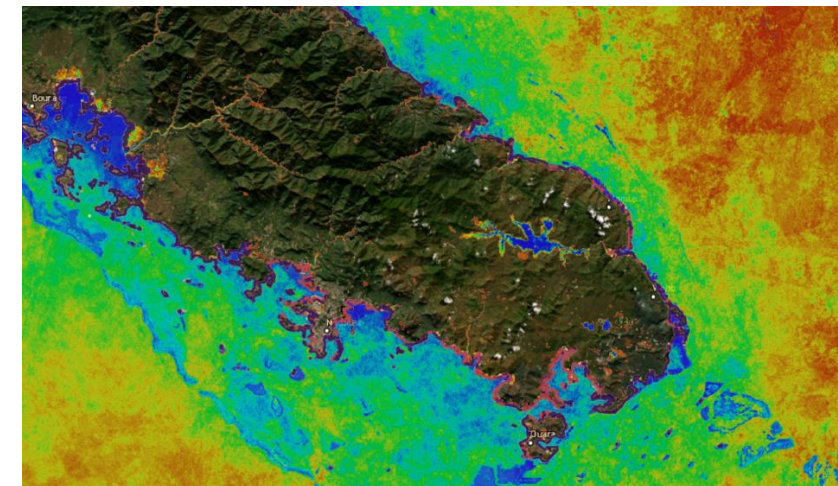
**Digital Earth Pacific** is an **analytical geospatial cloud-native platform** that makes **decades** of remotely-sensed analysis ready data (ARD) accessible via well-defined **standards** ; and enables users to perform highly **scalable** EO **tempo-spatial** analysis using **open source** data science libraries and models.



Multi-spectral Satellite Data



**DEP Analytical Hub**  
built on **RESUABLE** components that combines live code, visualisations, documentation and configurations to enable EO analysis at scale.



Earth Observation Product

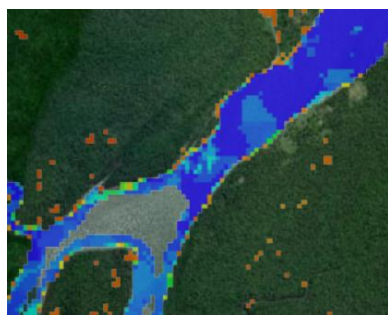
# DEP Alpha Products



- **22 years of coastline change**
- 34k km of coastline for the Pacific (22 PICTS)
- ~10% of global coastlines



- **7 years of mangrove data**
- Illustrates loss and recovery



- **11 years of Water Observations** from Space (WoFS)
- Useful for understanding flood zones and water security



- Accessed 450,000 Landsat and 300,000 Sentinel-2 satellite images
- Processed over 500 tb of data
- If on premises, it would cost 10s of millions USD to build the infrastructure + 300k annually to operate
- Through cloud computing, we are doing this at \$30,000 per year = **10x cost savings**

*If Landsat data was not made open, just these data would cost 450M USD*

# Pacific Coastlines



Landsat annual mosaics were created by calculating the median image values among times of near-average (0-m) sea level using a tidal model. A water discrimination technique was applied which allowed delineation of exact coastlines at the subpixel level.

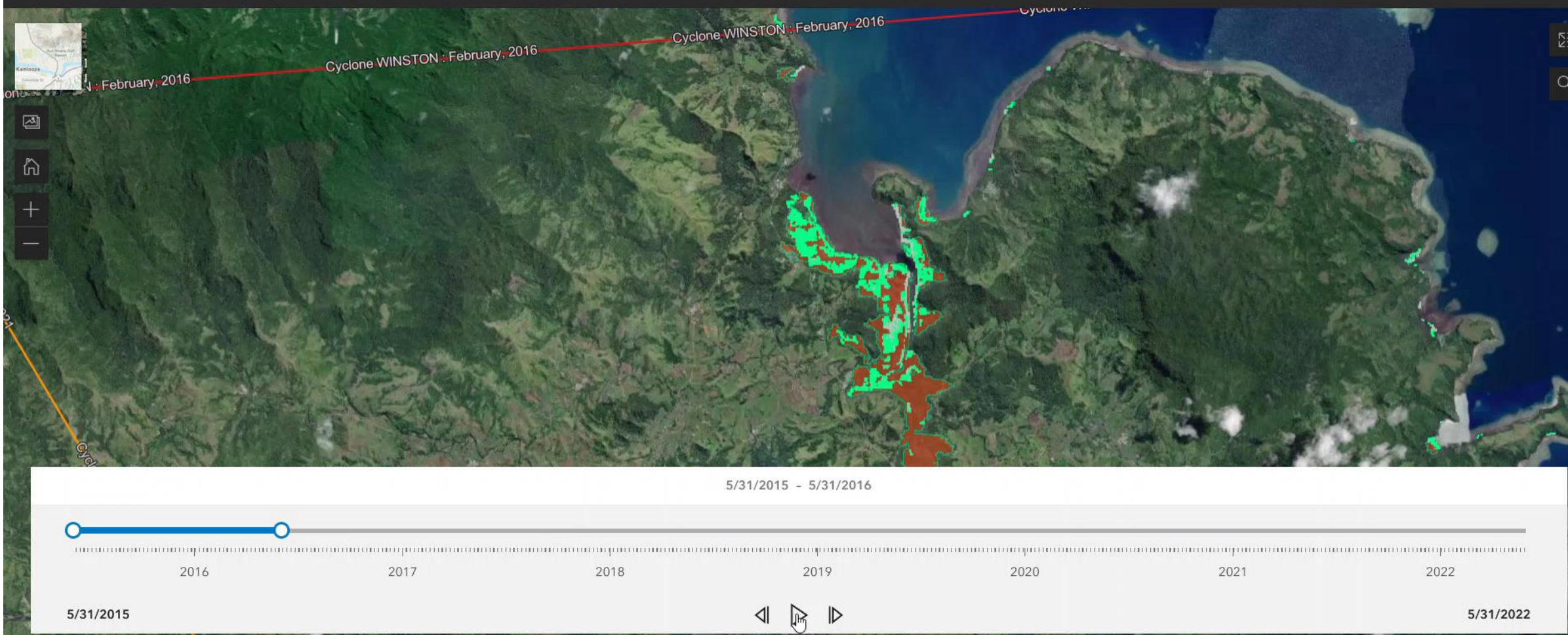
# Water Observations from Space



Annual summary of temporal and spatial extent of water bodies. In PNG during and after El-Nino Drought 2015/2016. Able to detect flood plains, used for drought monitoring, disaster planning, water security.

# Pacific Mangroves

## Digital Earth Pacific Mangrove Damage and Recovery Analysis



The changes in mangroves extent classified into three categories of closed (high-density), open (lower density) and non-mangrove. This was used as the baseline training layer where mangrove categories between 2016 and 2022 were analysed.



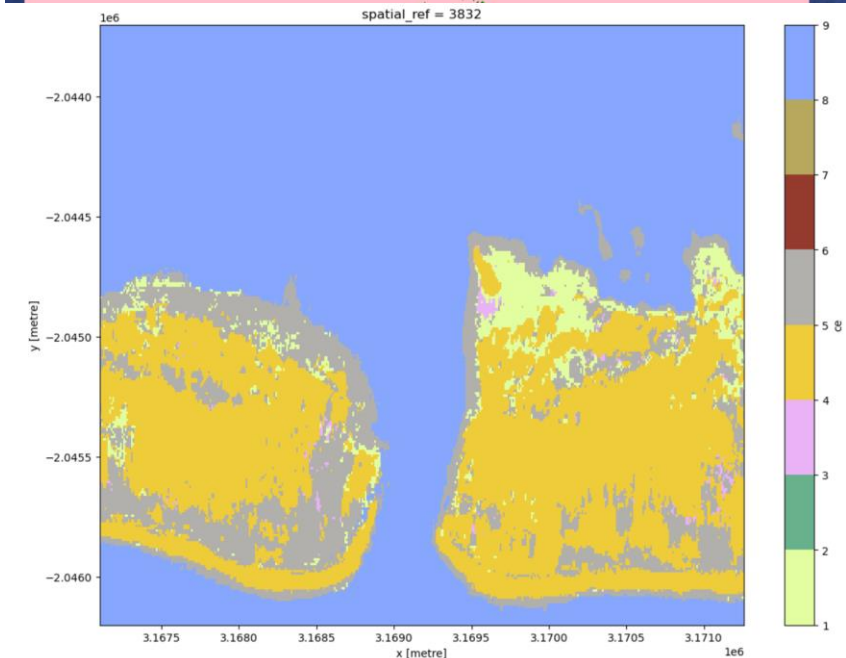
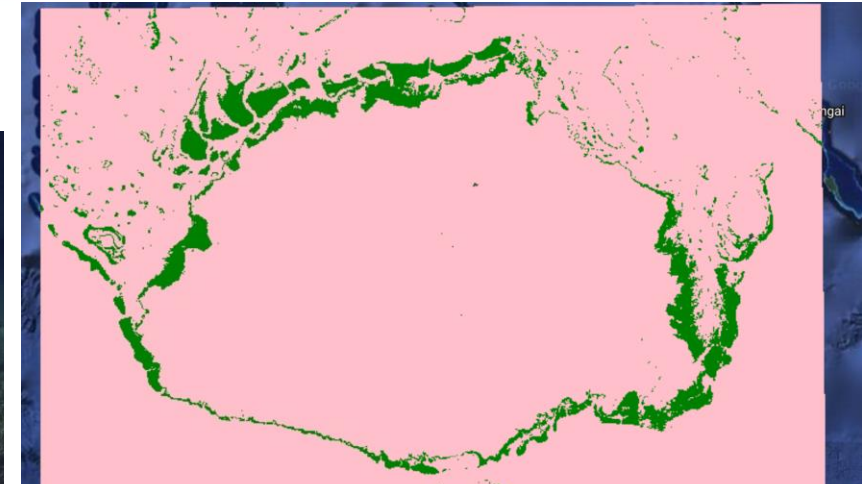
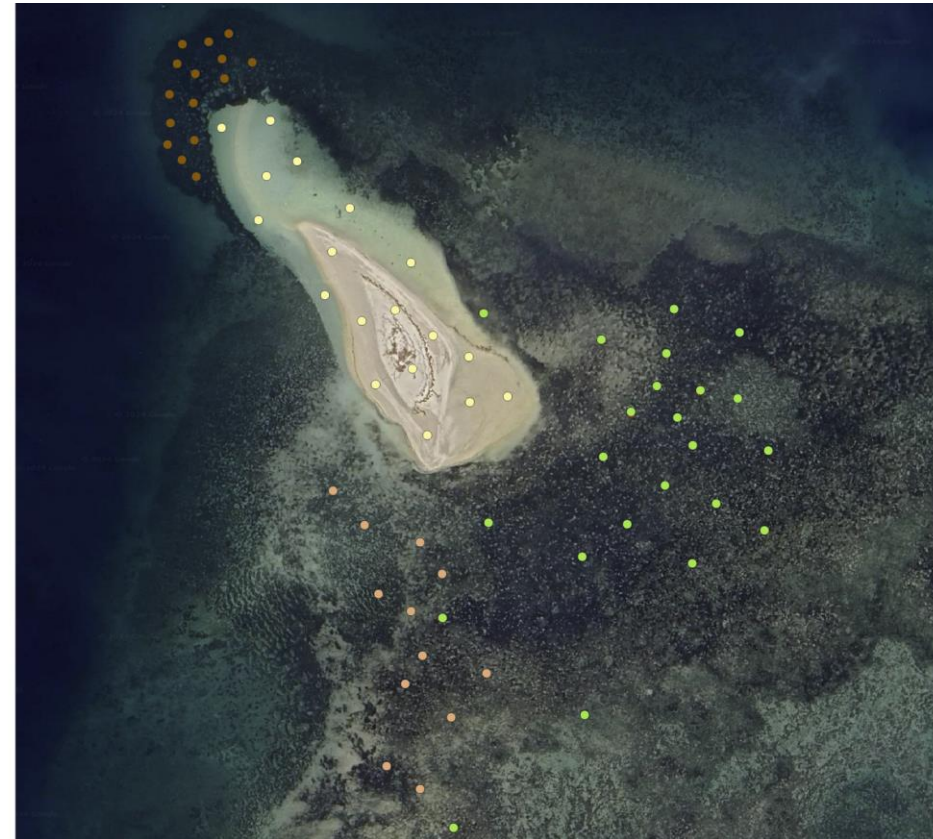
# Coastal Ecosystem classification

To identify marine habitats, fisheries, seagrass, mangroves etc...

## CE classification

Ecosystem types:

benthic_code	benthic_class
1	seagrass
2	mangrove
3	microalgal_mats
4	sand
5	coral_algae
6	rubble
7	rock
8	other



# Need for bathymetrical data

Bathymetry data is an essential tool for understanding and managing the ocean.

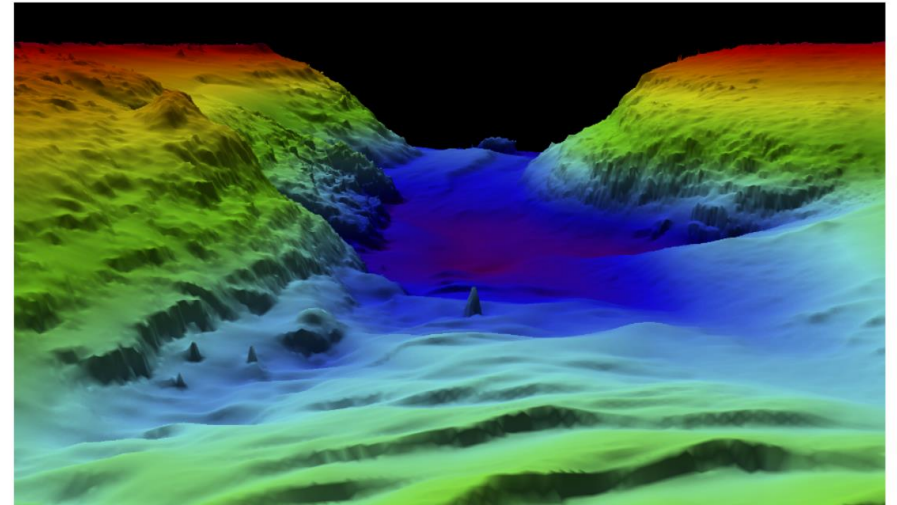
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**Fisheries management**: identify and map fishing grounds.

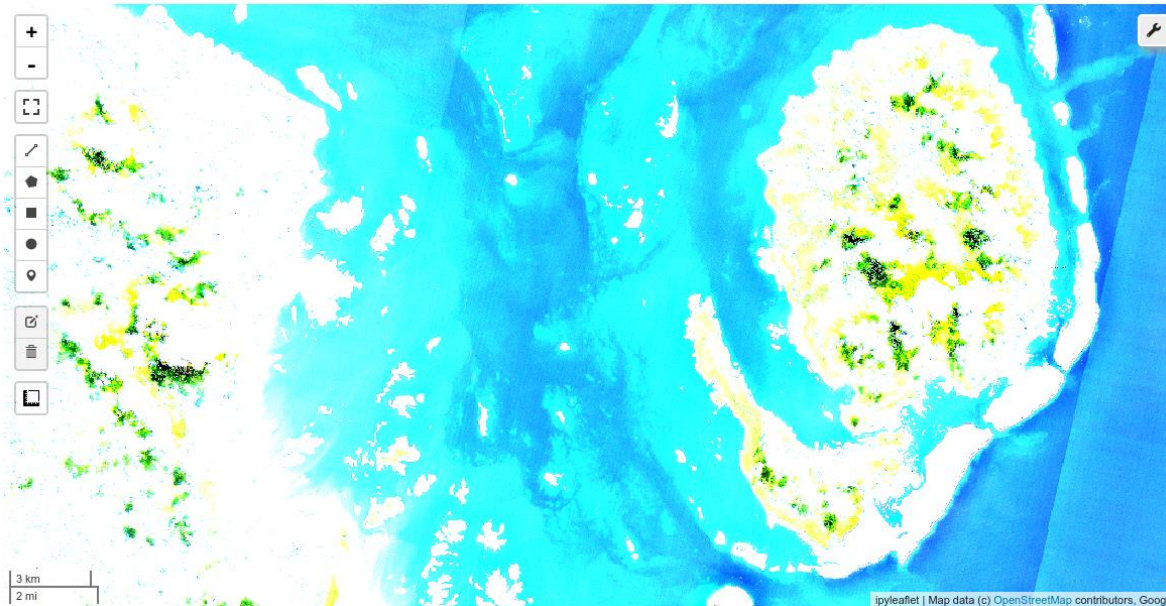
• **Environmental management**: monitor coastal erosion and sea level rise, map and monitor benthic habitats to identify and protect sensitive marine ecosystems.

• **Scientific Research**: study ocean currents, tsunamis, **and other marine processes.**

• **Safety of navigation and marine transportation**: create nautical charts that help ships navigate safely.



# Satellite Derived Bathymetry



We are currently doing research and development into a Satellite Derived Bathymetry (SDB) Product.

This will also have applications for the fisheries sector

# Products Roadmap

<p><b>Satellite Derived Bathymetry</b></p>	<p>Dual approaches of using active and passive sensors for a uniform regional bathymetric map. Using Sentinel 2 for near shore regional product and Sentinel 1 SAR for detecting water depths based on swell wave heights using Fast Fourier Transformations (FFT).</p> <p>Validation using SPC's historical multi-beam surveys along with additional surveys for up to 4 identified pilot country sites.</p>
<p><b>Improved Coastlines with Rates of Change</b></p>	<p>Current results will be further refined with additional noise removal techniques and validated against survey data.</p> <p>Improvements in extracting land-water delineation and vectorisation processes.</p> <p>Calculation of rates of changes at 30m intervals to identify hotspots. Using rates of change to do targeted clean-up, artefact removals etc.</p>
<p><b>Enhanced Mangroves Change Detection and Canopy Density</b></p> <p><b>Seagrass Extent Detection</b></p>	<p>Building on existing based product using a combination of <i>coasttrain</i> and SPC-collated data points to build a ML model to detect extent and derive density using Mangrove Vegetation/Forest Index.</p>
<p><b>Regional LULC Workflow and Methodology</b></p>	<p>Standardisation of classes and base years. eg: IPCC, FAO plus country-defined priority classes.</p> <p>Statistics per classes and distribution change.</p>
<p><b>Regional Agro-Census and Crop Yield Workflow and Methodology</b></p>	<p>Identification of national crops and seasonality.</p> <p>Access to existing agricultural and market access national data.</p> <p>Using vegetation indices to identify crop extents and change.</p>
<p><i>Coastal Water and Lagoon Health</i></p>	<p><i>Analysing chlorophyll and water clarity estimates using S2 MSI to detect algae blooms and suspended sediments.</i></p>
<p><i>Marine Habitat Mapping</i></p>	<p><i>Based on the regional SDB product. Predictive distribution maps for species etc.</i></p>

# Our Call to Action

- We want to engage with member countries to:
  - Identify opportunities for broader showcasing of DEP
  - Demonstrate current capabilities and products and understand relevance to your country
  - Improve existing products through co-design
  - Identify additional use cases and quick wins
  - Identify opportunities for workshops focused on capacity development
- Develop partnerships that support the long-term sustainability of Digital Earth Pacific
- Embed DEP in your science-policy interface to drive action and decision making from DEP products and services
- Improve satellite data coverage