WP23_25: Digital Earth Pacific

1516,208

Basic Information

Full title of the Initiative

Digital Earth Pacific

Short Title or Acronym

DE-PACIFIC

Current category in the 2020-2022 GWP

Community Activity

Proposed category in the 2023-2025 GWP

- no answer given -

Points of Contact

First Name	Last/Family Name	Email
Aditya	Agrawal	aditya@d4dinsights.com
Jens	Kruger	jensk@spc.int
Stuart	Minchin	stuartm@spc.int

Purpose

Objective

Digital Earth Pacific will provide a fundamental digital infrastructure that will ensure every nation in the Pacific has access to free, open and operational earth observation data, tools and technologies to routinely monitor and track national development challenges through robust decision-ready products.

Please provide a short description of the Initiative

Thanks to generous funding from the Australian Department of Foreign Affairs and Trade (DFAT) and the US National Oceanic and Atmospheric Administration (NOAA), the Pacific Community (SPC) initiated Phase I of Digital Earth Pacific to engage stakeholders, conduct a needs assessment, develop use cases and a prototype infrastructure, and use this experience to develop a business case for making free, open and operational satellite data available for the region. Digital Earth Pacific will provide a fundamental digital infrastructure that will ensure every nation in the Pacific has access to tools and technologies to routinely monitor and track challenges such as coastal inundation, deforestation, illegal fishing through robust decision-ready products. The system condenses decades of freely available datasets to provide a near real-time understanding on issues such as how disasters have changed coastlines, the impact climate-change is having on lagoon health, where hot spots for wave energy are located, and to combine weather outlooks and agricultural production for farmers across

countries.

Initiated in March 2021, Phase I for Digital Earth Pacific focused on stakeholder engagement to better understand the needs and priorities of PICTs. An Interim Steering Group, as the governance mechanism, was created inclusive of member countries and international organizations. A needs assessment was conducted by holding national, multi-stakeholder consultations with the Marshall Islands, Vanuatu and Tonga (with Fiji planned for March 2022 due to earlier COVID restrictions). Outreach and engagement was conducted through regional and international events and an approach developed raising funds and developing a sustainable financing plan. A strategic partnership with Microsoft was also formulated to have the Planetary Computer power Digital Earth Pacific. A prototype as a minimum viable product was developed with early demonstration data products generated. Lastly, inputs from this entire process were used to generate this business case.

Why is this Initiative needed?

Pacific Island Nations are among the most vulnerable from the effects of climate change. Issues related to food security, disaster management and biodiversity loss are of huge concern to this region and countries have called for better access and use of earth observation data to address these needs. Further, Digital Earth Pacific will not only make the data accessible, but provide an operational service that makes the data, products and applications available at scale for every country routinely and reliably based on updated satellite data.

What evidence is there to support this need?

A needs assessment was produced based on a national consultation process with 4 countries: Marshall Islands, Tonga, Vanuatu and Fiji. Based on comments from governments officials and the priorities identified, there is a clear need for this type of program as noted by countries themselves. Therefore, the need is being identified through a demand-driven approach. These four countries are also part of the governance structure for DE-Pacific.

Is this Initiative open to participation by representatives of any GEO Member, Participating Organization, and GEO Associate?

Yes

Are you aware of other projects or initiatives at a global or regional scale (both in GEO and externally) that provide similar products or services?

Yes

Please describe.

Digital Earth Africa; Digital Earth Australia

How is this Initiative unique?

Digital Earth Pacific builds off the experience of both Australia and Africa. Unique to these other Digital Earth programs, DE-Pacific has partnered with Microsoft to use the Planetary Computer to power the backend of DE-Pacific.

Also, the other Digital Earth programs, and many of the Open Data Cube implementations, are occurring over land. DE-Pacific will be unique as it needs to address the Blue Pacific Continent - a vast area for which 98% is water. Therefore, DE-Pacific will need to address many oceans and marine environment issues in addition to the land based issues.

Please identify the most important actual and/or intended outputs (products, services, etc.) produced by the Initiative, along with their intended and/or actual users. This list does not need to be comprehensive but should identify the outputs which are most used and are expected to have the greatest potential impact.

Output	Status	Users	Additional info
vegetation index for crop detection	In development	SPC, country stakeholders	
coastline change detection	In development	SPC, country stakeholders	
inundation areas and flooding	In development	SPC, country stakeholders	
mangroves	In development	SPC, country stakeholders	

If needed, please provide additional comments or explanation to accompany the outputs table

- no answer given -

What kinds of decisions are the outputs of this Initiative primarily intended to support?

Once further developed, the outputs will go through a data validation process and be made available to all users. SPC will work with countries on the uptake and usage of these products and how they inform decision making, action and policy.

How will these decisions benefit from the outputs of this Initiative?

The outputs will be based on needs and priorities identified by the countries. The outputs will be operational services that will be reliable and routinely updated based on new satellite data. Furthermore, the outputs will be made into decision-ready products meaning that either through visualization or application development, the output will be something that is easily understood by a decision-maker.

What kinds of impacts (for example, reduced loss of life, monetary savings, conservation of biodiversity, etc.) are anticipated as a result of the use of the outputs of this Initiative?

Improved livelihoods, increased crop productivity, better monitoring and planning around sea level rise, disaster management and preparedness, increase revenue from tracking illegal fisheries, conservation of forested areas and marine areas, identifying and mitigating against invasive species, monitoring illegal mining, understanding water quantify and quality.

Has this Initiative been asked to provide specific information (for example, reports, data, services) on an ongoing basis to an international convention, organization, or other multilateral body?

No

Technical Synopsis

Please provide a brief description of the methods used by the Initiative to produce its (actual or planned) outputs.

A Minimum Viable Product (MVP) was developed to demonstrate the capabilities of a cloud-based, digital infrastructure serving Earth observation data, products and services for the Pacific. At a minimum, the MVP was to:
? Provide access to the Landsat and Sentinel-2 satellite data in analysis-ready data (ARD) format
? Provide access to derived, demonstration products based on prioritized use cases
? Provide a product development environment

? Be based on open-source software
? Enable control and management of user authentication to SPC
? And provide an intuitive user interface for the map viewer

A competitive procurement process (see Appendix 7.2 for scope) was initiated by inviting four companies with known global expertise on developing similar platforms to respond to the bid. Three of the four companies submitted bids, with Development Seed ultimately winning the contract.

A key decision point in the development of the MVP was to select the cloud infrastructure, data provider and architecture to be used. SPC had already engaged with Microsoft and its sustainability science team including those developing the Planetary Computer. According to Microsoft, the Planetary Computer combines a multi-petabyte catalogue of global environmental data with intuitive Application Programming Interface (APIs), a flexible scientific environment that allows users to answer global questions about that data, and applications that put those answers in the hands of conservation stakeholders. Most importantly, the Planetary Computer is completely open-source and can be set up so that the host institution (SPC) can maintain control over user authentication and make its own data, products and services available. Additional specifications also made the Planetary Computer attractive including its indexing and search capabilities using the STAC API, focus on usability and front-end, and the types of data available or planned.

As a result, SPC decided to use the Planetary Computer, and therefore the Azure Cloud, to power Digital Earth Pacific. However, this was not only due to its technical merit, but rather to formulate a more strategic partnership with Microsoft to support the intended outcomes of this program. On 18 November 2021, a Letter of Intent between SPC and Microsoft was signed formalizing the partnership.

Unfortunately, a delay in the scheduling of the national workshops based on availability of countries to participate caused the start of the prototype development process to not begin until September 2021. Outcomes of the needs assessment were used to guide the development of demonstration products, and SPC worked closely with Development Seed and Microsoft on the development of the MVP.

A map viewer using Microsoft's Planetary Computer front end was open-sourced and used as the viewer to power the front-end for Digital Earth Pacific:

The map viewer provides the general public with an easy-to-use interface to explore the geospatial and Earth observation data provided by Digital Earth Pacific. This includes those data that are made available by the Planetary Computer, as well as derived datasets developed by SPC and its partners. Datasets at the appropriate time interval (if applicable) can be selected along with the level of cloud cover if the selection is satellite imagery. If satellite imagery is selected, there is a drop-down menu that has pre-set rendering options for viewing that imagery in, for example, natural colour, infrared or NDVI. Functionality was also included to allow for comparison of the same type of satellite data across two time periods by using a slide bar to pan across the view to visualize differences across each scene.

Jupyter notebooks provide the product development environment to access, manipulate and run algorithms. Notebooks allow for general analysis needs (e.g. NDVI, cloud masking, vegetation change) and more specific, use-case oriented applications (e.g. water observations from space (WOfS), coastline change, crop extent or urban extent). The notebook environment is based on Pangeo, which is an open-source community effort to develop software for big data geoscience research and applications. A staging and production environment allows for testing new algorithms and publishing tested notebooks for broader consumption. Running analysis through the Jupyter notebook environment does incur compute costs on the Azure Cloud, and therefore, SPC can manage usage by managing user authentication and monitoring usage against expenditure. Through the partnership with Microsoft, a 15,000 USD gift was provided to SPC to support compute costs as part of the MVP stage.

If you would like to provide further details on the technical methods, you may upload one or more documents here.

- no supporting documents provided -

Are there any significant scientific or technical challenges that need to be resolved by the Initiative during the 2023-2025 period?

No

Does the Initiative expect to complete any key new outputs, improvements to existing

outputs, or improvements to the methods of producing outputs, in the 2023-2025 period?

Yes

Please describe these new outputs or improvements.

All products will need to go through a data validation process based on a strategy and approach yet to be developed. Based on additional computing infrastructure to be established, products will be scaled to be inclusive of all countries in the Pacific.

Please identify the key tasks that must be implemented to ensure delivery of these changes, with target dates for completion.

- no answer given -

Resources

Have all resources required to implement the Initiative's planned work in the 2023-2025 period been secured?

- Gap in financial resources
- Gap in human resources

What is the estimated funding gap for the 2023-2025 period?

7.5M USD

What are the essential skill sets needed by the Initiative but are not currently resourced?

EO Team Lead, monitoring and evaluation expert, remote sensing scientists, capacity development specialists, administrative support, communications support, data scientists, cloud computing experts.

What actions is the Initiative taking to obtain the required resources?

A business case outlining the objectives, need, approach and roadmap has been developed. An active fundraising campaign has been initiated.

Please list all financial and non-financial contributions to the Initiative (other than in-kind, voluntary participation by individual contributors) having a value of more than USD 50,000.

Contributing Organization	GEO Status	Type of Resource	Value	Currency
Australia Department of Foreign Affairs and Trade	Australia	Financial	100000	USD
NOAA	United States	Financial	600000	USD

Lessons from the 2020-2022 Period

Were all planned activities for the 2020-2022 period implemented as expected?

Yes

Were there any key challenges faced by the Initiative in the 2020-2022 period?
Yes

Please describe.
Due to COVID, there were delays in the national consultations. This also meant that international support could not meet in person in the pilot countries. This also prevented the Lead Consultant from meeting with staff at the Fiji and New Caledonia headquarters.

SPC held several recruitments for the EO Lead position that were all unsuccessful.

Were there any impacts or changes to operations due to COVID-19?
Yes

Please describe.
see above.

Please describe the key changes proposed for the 2023-2025 period, for example, new projects, new areas of focus, or adjustments to the activity governance.
Further iterate on development of the core infrastructure, products and services made available by DEP.
Develop a funding strategy that incorporates increased communications and outreach to raise the needed funds to launch the DEP program.
Develop the enhanced governance structures at the programmatic and technical levels.
Develop a partnership strategy and network to support implementation of the DEP program.
Develop a communications, engagement and outreach strategy to build an active user community
Create key impact metrics and KPIs, which are easy to measure on a regular basis.
Focus on the development of 2-3 prioritized use cases based on governance feedback
Develop capacity development tools and resources
Conduct training workshops, webinars, and online training and education resources
Increase communications and outreach in events and ensure DEP and its outcomes are integrated into SPC events
Continue to increase staffing and needed partnerships for DEP design, development and deployment
Develop a financial sustainability plan for DEP and continue fundraising
Continue to build and iterate on the core infrastructure and identify 4-5 additional use cases

Does the Initiative have outputs (products, services, etc.) available to users now, even if only on a pilot or testing basis?
Yes

Please provide any available information describing this usage (for example, user statistics, results of user testing) and/or feedback from users (for example, user comments, evaluations).
Fiji mangroves
Pacific crop disease detection
Pacific crop health
Pacific enhanced vegetation index
Pacific mangroves

Please provide supporting documentation if available.
- no supporting documents provided -

Do you have evidence of any impacts that have occurred in part as a result of using the outputs of the Initiative (for example, policy decisions taken, behaviour changes by users, risks mitigated)?

No

Have there been any internal or external reviews or evaluations of the Initiative since 2019?

No

Please indicate any GEO Work Programme activities with which you have ongoing collaboration.

- DE-AFRICA - Digital Earth Africa
- EO4SDG - Earth Observations for the Sustainable Development Goals

Please indicate any additional GEO Work Programme activities with which you would like to establish new collaborations.

- C3S - Copernicus Climate Change Service
- EO4DRM - Earth Observations for Disaster Risk Management
- GEOGLAM - GEO Global Agricultural Monitoring
- GEOGLOWS - GEO Global Water Sustainability
- GFOI - Global Forest Observation Initiative
- BLUE-PLANET - Oceans and Society: Blue Planet

Stakeholder Engagement and Capacity Building

Are there specific countries or organizations that your Initiative would like to engage?

Yes

Please list these countries, regions or organizations.

All 22 member countries and territories of SPC.

What are your plans to engage them?

This will be done through the mandate and operational capabilities of SPC.

Does your Initiative engage users in the work of the Initiative (for example, consultation, testing, co-design)?

Yes

Please briefly describe the Initiative's approach to engaging users.

It will, but we have not gotten there yet.

Does the Initiative have a user engagement strategy or similar kind of document?

No

Are there categories of users that are not represented at this time, but you would like to engage?

No

Does the Initiative have a documented capacity development strategy?

No

Please describe the approach to capacity development that is being implemented by the Initiative?

To be developed. Included in the business case.

Are there any commercial sector organizations participating in this Initiative?

No

Are there opportunities for commercial sector uptake of the outputs of the Initiative?

Yes

Please describe these opportunities.

Digital Earth Pacific will be a free and open data infrastructure. We want entrepreneurship and innovation to be developed through the private sector.

Is there already commercial uptake occurring?

No

Are there opportunities for further commercial sector participation in the Initiative?

Yes

Please describe these opportunities.

There will be, but we have not gotten to that stage yet.

Does the Initiative have a plan for commercial sector engagement?

No

Governance

Please describe the roles of each of the key leadership positions, as well as any team structures involved in day-to-day management.

Stuart Minchin, Director General for SPC - Champion and Executive lead for the program.
Jens Kruger, Deputy Director at SPC - Project Manager
Aditya Agrawal, Founder at D4DInsights, Lead Consultant
Sachin Singh, Technical Manager for DEP

Is there a steering committee or other governance bodies that advise the Initiative but are not involved in day-to-day management?

Yes

Please describe the roles of each body. If there are multiple governance bodies, please describe the relationships among them (such as through a governance structure diagram).

The Interim Steering Group (ISG) is being established as an advisory body tasked with supporting and guiding Phase I of Digital Earth Pacific to include:
• Development of a needs assessment that reflects priorities across four pilot countries (those included in the ISG) and the region.

• Development of a prototype open data cube infrastructure for the region.
• Development of early win products for the pilot countries.
• Development of a business case that reflects the institutional, political, technical, financial and capacity development requirements needed to launch a sustainable Digital Earth Pacific program for the region.
• Regional and global outreach to gain political buy-in and donor support.

The ISG will be multi-stakeholder inclusive of representative government institutions across the Pacific, private sector and other key organizations within the broader Earth observations community. The Pacific Community (SPC) as the founding Co-Chair will invite members to initiate the ISG. A country representative should be selected as the second Co-Chair. Thereafter, additional membership can be determined based on consensus.

Founding members for the ISG include:
1. Pacific Community (Co-Chair)
2. Ministry of Lands and Natural Resources, Tonga (Co-Chair)
3. Lands and Survey Department, Fiji
4. Office of the Chief Secretary, Republic of Marshall Islands
5. Ministry of Lands and Natural Resources, Vanuatu
6. University of South Pacific
7. Committee on Earth Observation Satellites (CEOS)
8. Geoscience Australia
9. Group on Earth Observations
10. NOAA

Terms of Reference:
• Provide overall advice and guidance towards the successful completion of Phase I - needs assessment, early wins and business case;
• Provide recommendations and introductions to key stakeholders;
• Support development of buy-in from key institutions and politically with countries across the Pacific;
• Provide technical expertise, alignment with key institutions and policy guidance;
• Support the development of a permanent governance structure;
• Support broader outreach and communications needs; and
• Support funding efforts as needed.

Beginning in May 2021, the ISG will meet on a bi-monthly basis or more frequently as needed. Discussions will be open to all members facilitated by the Co-Chairs, who will also be responsible for achieving consensus and any major decisions. The ISG will operate in an inclusive, agile and productive manner.

- no supporting documents provided -

What methods does the Initiative use to communicate with its participants?

- Email / e-newsletters
- Regular conference calls
- Regular events

Please describe the key risks that could delay or obstruct the completion of the planned activities and outputs of the Initiative, along with any actions taken to mitigate these risks.

Description of the hazard	Description of the possible impacts	Scale of impact	Likelihood of occurrence	Mitigation measures
Fundraising	Funding not raised to fully launch the program	Severe	Not very likely	
Recruitment for staff positions is challenging in a highly competitive market and during COVID Explore hiring through another organization.	The right skillsets cannot be acquired to properly run the program	Moderate	Possible	Create a competitive salary structure that makes these positions competitive Work with HR to streamline and expedite hiring process Leverage resources from partner organizations Use consultants to support and fill the gap.
The culture and bureaucracy of the host institution limits progress and innovation	The program runs slower than expected	Limited	Not very likely	Work with leadership to set the tone and culture of the program. Work with procurement to support processes that are more agile and speak to the culture and innovation required for the program. Leverage capabilities through partner organizations when roadblocks are insurmountable internally.
Using a cloud computing solution becomes too costly with user demand and data growth	Need to consider other options for infrastructure	Limited	Not very likely	Hire cloud computing expertise to optimize the system and perform regular checks on usage and data storage. Create a plan for cleaning up unnecessary data. Develop a partnership approach with the cloud services provider to support optimization and

				negotiation on costs, i.e. free data storage and options on compute. Evaluate usage across sectors to determine if alternative business models apply like charging for compute time to the private sector.
Internet connectivity and bandwidth is poor with frequent power outages	Users don't have access to the data and services	Limited	Possible	A cloud computing framework mitigates against this as connectivity and power are only needed to send commands. All data processing takes place on external servers once command is received. Develop a hybrid approach that also considers local installations. Being potentially hosted in a country with some of these issues will be beneficial so the development team can directly encounter some of the issues other countries are facing and factor these constraints into new products.
The value proposition of DEP is not well understood with decision-makers limiting its uptake within government.	We don't get the buy-in needed from countries	Moderate	Possible	Develop and execute against a strategy for high-level political buy-in using the CRGA and other mechanisms available to SPC. Develop communications and outreach materials that further convey the importance and value of DEP coupled with user stories. Identify

				those countries where there is limited uptake and work closely with core stakeholders on needs and conveying the value proposition.
Capacity at the country level is limiting uptake of DEP products and services.	Products and services provided by DEP are not being used limiting progress	Severe	Possible	SPC as the key technical institution serving the Pacific region will create products and services and work with countries on context, policy and decision-making implications. Not all countries will have the capacity nor want to conduct their own analysis, and will rely on products and services provided by SPC. Create a users group across countries to increase capacity and share experiences and lessons learned. Understand the needs for capacity development at the country level and develop a holistic program that considers technical, executive and generalist users. Create a train-the-trainers program. Create partnerships with regional institutions, including UPC, to support capacity development, training and education.

What methods are used by the Initiative to monitor its effectiveness?

- Informal discussions with users / beneficiaries
- Consultations or events

Would the Initiative be interested in assistance from the GEO Secretariat for

developing an impact plan?

Yes

How are the results of the monitoring and evaluation activities shared with participants and the wider GEO community?

Currently not taking place.

Are any monitoring or evaluation activities required by funders/contributors?

No

Participants

Please list the active individual participants in the Initiative

First name	Last name	Email address	Member	Org
Stuart	Minchin	stuartm@spc.int	SPC - Secretariat of the Pacific Community	
Aditya	Agrawal	aditya@d4dinsights.com	United States	D4DInsights - D4DInsights
Jens	Kruger	jensk@spc.int	SPC - Secretariat of the Pacific Community	SPC - Secretariat of the Pacific Community
Karena	Lyons	karenal@spc.int		
Sachin	Singh	sachindras@spc.int	SPC - Secretariat of the Pacific Community	
Nic	Metherall	nicholasm@spc.int		
Rosamond	Bing	rosamond.bing@gmail.com	Tonga	
Brian	Killough	brian.d.killough@nasa.gov	CEOS - Committee on Earth Observation Satellites	
Emma	Luke	emma.luke@ga.gov.au	Australia	GA - Geoscience Australia
Catalino	Kijiner	dcskijiner.rmi@gmail.com		
Kirsten	Larsen	kirsten.larsen@noaa.gov		
John	Marra	john.marra@noaa.gov		
Maree	Wilson	maree.wilson@ga.gov.au	Australia	
Meizyanne	Hicks	meizyanne.hicks@govnet.gov.fj		
Tim	Langrine	ndmodirector@gmail.com		
Rogerio	Bonifacio	rogerio.bonifacio@wfp.org	WFP - World Food Programme	WFP - World Food Programme
Steven	Ramage	sramage@geosec.org		
Henry	Vira	henryv@vanuatu.gov.vu		

Other information

Please provide any other comments or information that was not included in the previous sections, but you would like to appear in the Implementation Plan.

- no answer given -

- no supporting documents provided -

Co-Editor Management

List of co-editors for this initiative

- no answer given -