Report of the workshop "Earth Observation for water management: Building a Community of Practice"

Date: Monday 12th September 2022

Time: 13:30 central European time

Location: Room b4a, Bella Conference centre, Copenhagen, Denmark

Organising team

Chairs: Apostolos Tzimas (EMVIS S.A.), Katharine Cross (Australia Water Partnership)

Speakers: Eva Maria Haas (EOMAP), Christian Tøttrup (DHI), Djalia Umutangampundu (AfWA)

IWA secretariat: Samuela Guida, Erin Jordan

Agenda

Chair: **Apostolos Tzimas, EMVIS S.A.**

Co-chair: **Katharine Cross (Australian Water Partnership)**

13:30-13:40 Opening remarks - **Apostolos Tzimas (EMVIS S.A)**

Experts' perspectives:

- 13:40-13:50 **Eva Haas (EOMAP)** – *The now & tomorrow of earth observation for water management*
- 13:50-14:00 **Christian Tøttrup (DHI)** – *Towards operational satellite-based water resource monitoring*
- 14:00-14:10 **Djalia Umutangampundu (AfWA)** – *Mapping water extent using WofS and sentinel 1&2*

14:10-14:20 Q&A moderated by **Katharine Cross (AWP)**

14:20-14:50 Roundtable discussions

14:50-14:55 Summary of roundtables discussion

14:55-15:00 Wrap-up - **Katharine Cross (AWP)**

Participants

The session had a total of 46 participants including the speakers and the moderator. Of those 46 persons, 18 (39%) were female and 28 (61%) were male. The sector distribution of the workshop participants is presented in Figure 1. The majority of the participants were from the University and Consultancy sectors. The participants came from 19 countries, 68% HIC, 21% MIC, 5% LIC, 5% unknown (Figure 2).

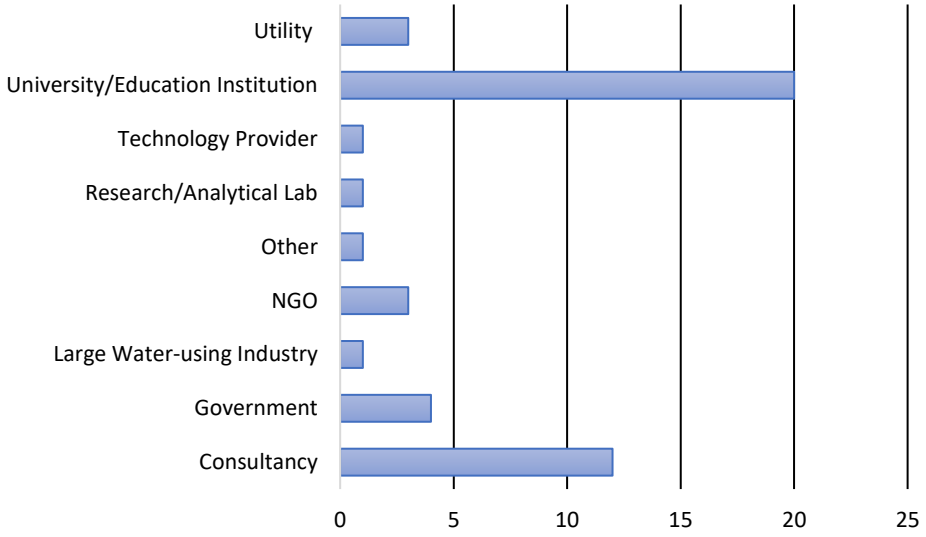


Figure 1 The sector distribution of the workshop participants. Majority were from the University and Consultancy sectors.

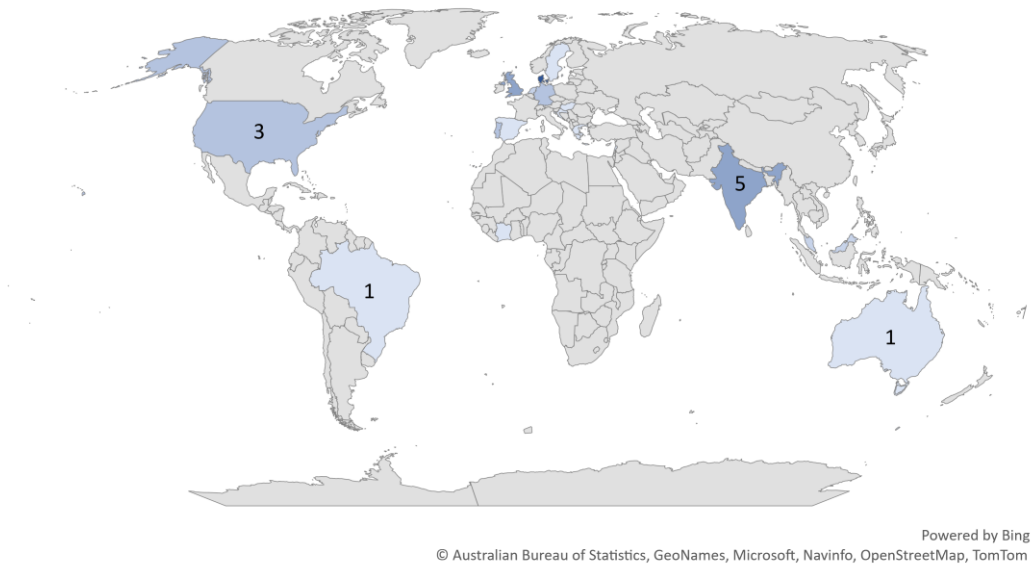


Figure 2 Geography of the participants.

Session objectives

The session was designed to give a background on the IWA Earth Observation (EO) Community of Practice (CoP) as well as showcasing the uses and applications of EO in water management in different cases and contexts. After the presentations, speakers participated in a short question and answer session which consisted of questions from the moderator and the audience. Finally, participants discussed amongst themselves in a roundtable format.

There were 4 roundtables, each moderated by a speaker. The session had 3 main objectives:

- Showcase the aims and objectives of the IWA EO CoP.
- Highlight the barriers to the uptake of earth observation tools and services in the water sector.
- Challenge attendees to develop a call-to-action on how the CoP can address the barriers and create opportunities for increased uptake.

Session outcomes

After the roundtable discussions, the following points and calls-to-action were highlighted:

Solutions to the barriers of EO uptake:

- Establish repository with relevant source data (e.g., basin boundaries, open-source water related databases)
- Develop educational material (incl. open-source tools)
- Promote public-private-academic partnerships
- Make EO tools user friendly
- Incorporate EO studies at high school level with practices
- Provide guidelines for EO usage
- Adopt appropriate learning steps for tech implications
- It was argued decision making about adoption of EO technologies must come after, because some LIC are still struggling to find basic food for citizens and their decisions will always depend on their level of ending famine.
- A ‘phonebook’ that shows where to find EO information related to water topics at different expert levels, from technical to high level decision maker
- Better download options for EO data and derived products: the need for easy-to-use portals

Calls-to-Action:

- Understand common set of EO standards for each country to be able to help those that are still far behind in technology
- Policies to support EO projects and initiatives in the countries
- Have a Central Platform: Integrate data into specific fields to make information relevant for each stakeholder
- Have access with one click to EO data and information and the option to ‘play’ with it (example is EOMAPs new EOSmart solution https://incubed.esa.int/portfolio/eosmart/)

- Mobile apps are required and a 'Diagnosis tool' that allows to quickly access all issues of interest around you.
- Alert systems are needed that send out warnings e.g., for irrigation, decrease in water quality, Harmful Algae Blooms

What is needed?

- Collaboration with countries
- Create more opportunities for youth from LIC to innovate using EO tools, under the guidelines of their countries (example: Africa Earth Observation Challenge, Youth Mappers Competition, etc.)
- Increase communication (a CoP would track and document the progress of EO uptake in LIC: Benchmarking, White papers, etc.)

Who should be involved?

Politicians, NGOs, Academia, research and incubation centres, investment institutions such as banks, etc.

Other points raised:

Question: If we are talking about accelerating SDGs and inclusion by 2030, should developed/developing countries consider slowing down their investments in new technologies to reach out to LIC in terms of ending poverty and technology transfer?

- A contradicting argument was that LIC are small and poor so they must figure out the way to accelerate especially that many things have been placed for them for free (example: FAO AquaMap, where they can get all data for free)

Suggestion: Engage more African and other LIC Youth to join the CoP to get updates on the new EO technologies for water management that they can easily adopt in their countries. The CoP will help getting hand-on experience on researching, writing white papers, reporting as well as other opportunities in EO sector (jobs, business, mentorship, and so on). A collaboration with AfWA on this can be a good initiative.

ANNEX 1 :

PRESENTATIONS

Earth Observation technologies for Water Management

Building a Community of Practice

the international water association

WORKSHOP | 12 SEPT 2022

Bella Centre, Room B4a

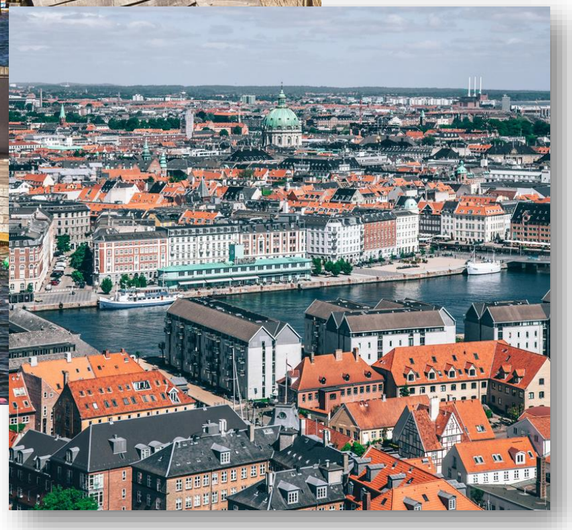
13:30-15:00

IWA World Water Congress & Exhibition

11 – 15 September 2022 | Copenhagen, Denmark

Earth Observation for Water Management

Building a Community of Practice



Agenda

- **Opening Remarks**– Apostolos Tzimas (EMVIS S.A)
- **Experts Perspectives**
  - *The Now & Tomorrow of Earth Observation for Water management*– Eva Haas (EOMAP, Marine Earth Observation Evangelist)
  - *Towards operational satellite-based water resource monitoring* – Christian Tøttrup (DHI)
  - *Mapping water extent using WOfS and Sentinel 1&2*– Djalia Umutangampundu (AfWA)
- **Q&A** – All speakers – moderated by Katharine Cross (AWP)
- **Roundtable Discussions** – All
- **Summary of discussion –** Moderators
- **Closing remarks** – Katharine Cross (AWP)

Opening Remarks

Apostolos Tzimas, EMVIS S.A

Community of Practice

WHAT IS A COMMUNITY OF PRACTICE?

- A community of practice (CoP) is a group of people who share a common concern, a set of problems, or an interest in a topic and who come together to fulfil both individual and group goals.
- CoP often focus on sharing best practices and creating new knowledge to advance a domain of professional practice. Interaction on an ongoing basis is an important part of this.
- Many CoPs rely on face-to-face meetings as well as web-based collaborative environments to communicate, connect and conduct community activities.

Community of Practice

Community members have a **shared domain of interest**, **competence** and **commitment**. These create common ground, inspire members to participate, guide their learning, and give meaning to their actions.

Members pursue this interest through **joint activities, discussions, problem-solving opportunities, information sharing and relationship building**. The notion of a community creates the social fabric for enabling collective learning. A strong community fosters interaction and encourages a willingness to share ideas

Community members are **actual practitioners** and build a shared **repertoire of resources** and **ideas that they take back to their practice**. While the domain provides the general area of interest for the community, the practice is the **specific focus** around which the community develops, shares and maintains its core of collective knowledge.

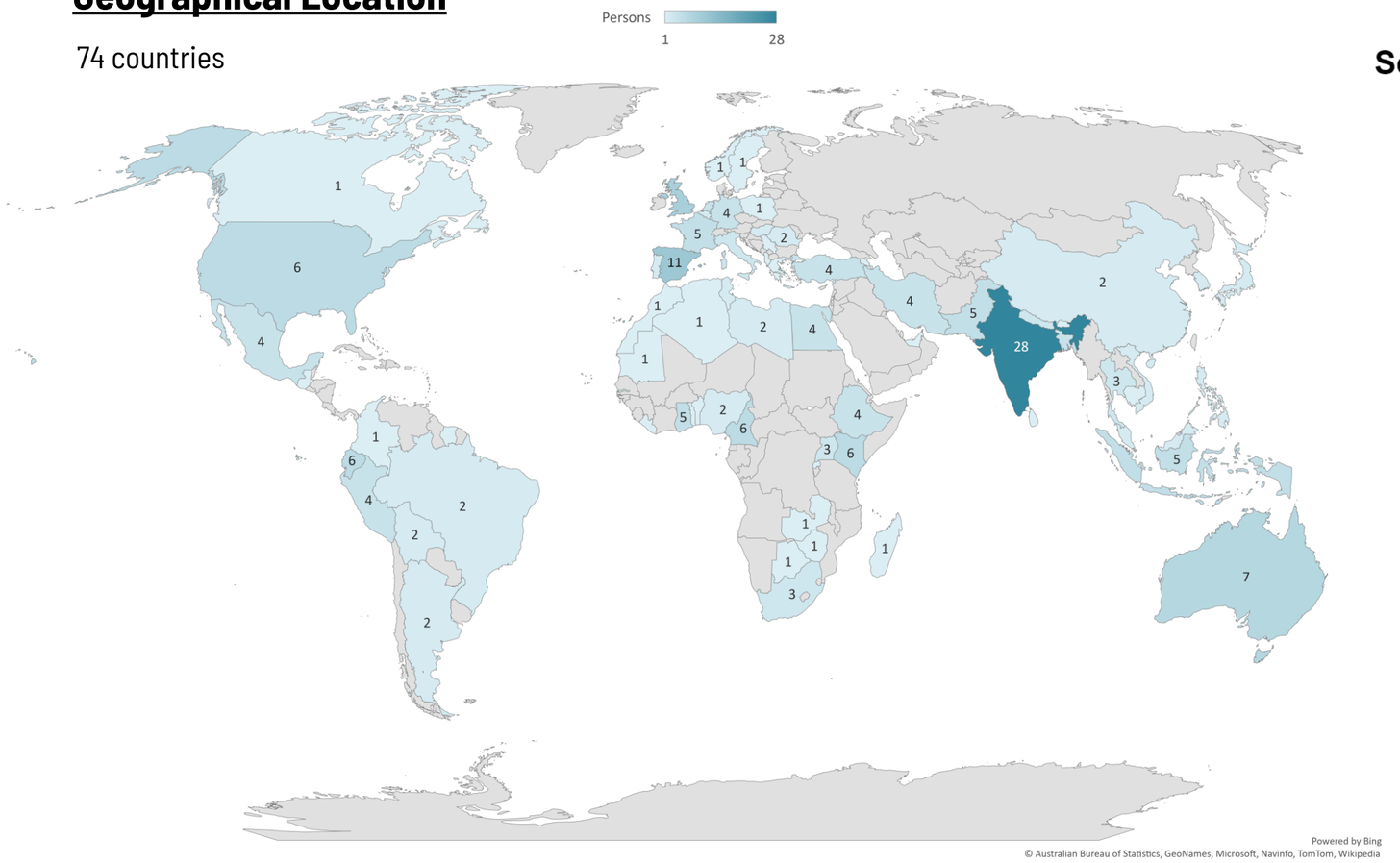
Community of Practice

The IWA Earth Observation for Water Management Community of Practice (CoP) brings together experts from different sectors of the water industry interested in the use of Earth observation technologies for improved water quality and quantity management. The CoP is also linked to the PrimeWater H2020 EU project, and the GEO AquaWatch initiative.

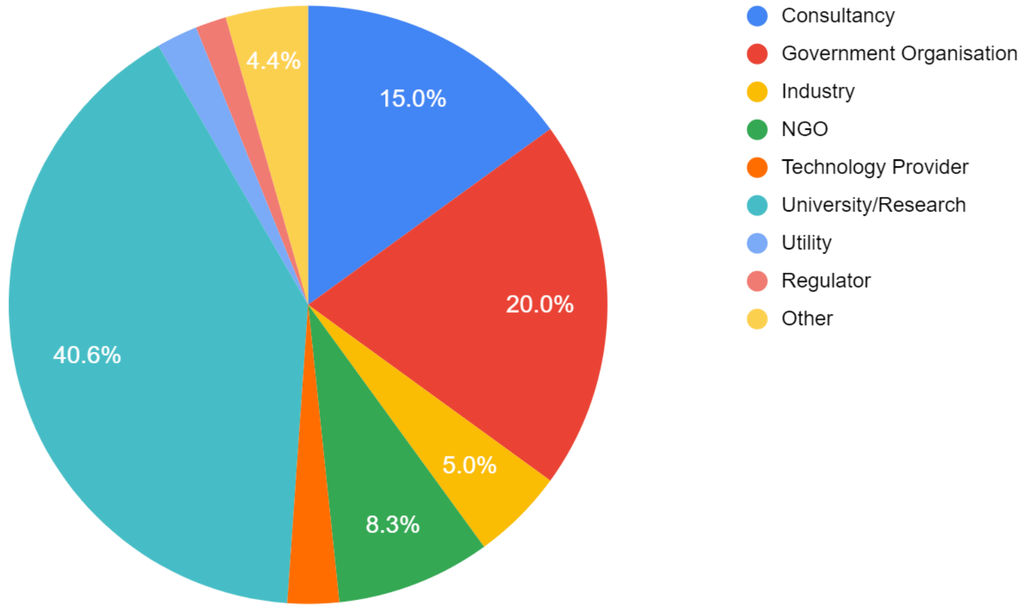
Community of Practice

Geographical Location

74 countries



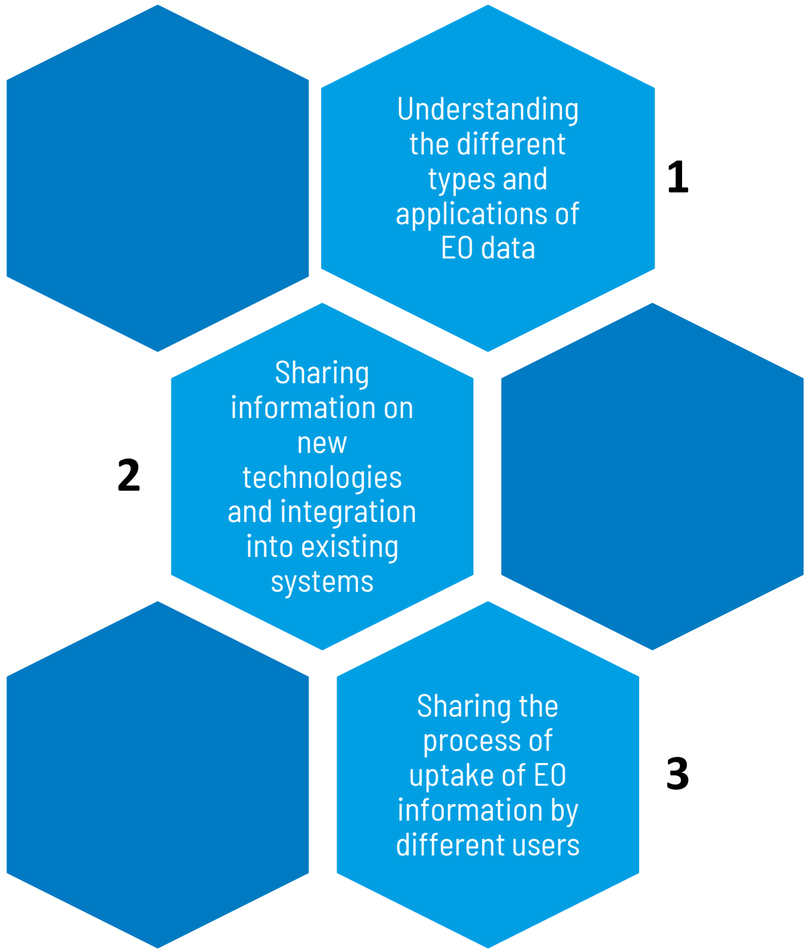
Sector Representation



218 persons registered

Community of Practice

Priority Areas



*** In order of preference*

We held the 1st international meeting for the Community of Practice addressing the first priority topic of 'Understanding different types of applications of EO data'.
240 participants listened to expert perspectives, as well as engaged in fruitful discussions about their experiences working with EO applications and tools.

The PrimeWater Multi-User Panel

The purpose of the MUP is to serve as an international panel of users providing expert feedback on Earth Observation-enabled services developed or extended in the context of the PrimeWater project and participate in the co-generation process itself through dialogue.

The **first MUP** workshop, held in **October 2020**, gathered initial feedback on what different users think about different services (e.g. monitoring water quality, forecasting, and provision of decision support on forecast and observations).
The **second MUP** was organised in **November 2022**. Stakeholders from different sectors engaged in topics about water resources management, disaster risk management, potable water, energy, amenity and recreation, and aquaculture.
The **third and final MUP** will take place in **December 2022**.

Feedback from PrimeWater

Being aware of the barriers to EO uptake, the core aims of the PrimeWater Project include:

- Maximising the potential of the Earth Observation (EO) technologies for the water sector by enhancing and expanding the information base for inland water quality attributes, increasing the situational intelligence of water regulators, emergency planners, water-related industry professionals and local communities.

- Delivering water intelligent services that capitalize on advanced EO data products and intersections with other data sources, will build on cause-effect analyses through diagnostic modelling tools, and will utilize predictive and prescriptive calculations by integrating forecasting capabilities with planning and scenario analysis.

Barriers and problems in EO uptake

Causes	Effects	Solutions
• Lack of reliable data/monitoring (forecasts, WQ parameters, etc.) • Expensive EO tools and services • Low capacity (workers and stakeholders un- or misinformed about EO applications) • Little to no trust • Geopolitical hindrances • Relevance of warnings	• Decrease in infrastructural integrity • Inconsistent/decreased service provision • Loss of aquaculture/stock/produce • High repair costs • Hesitance to uptake by utilities and policy makers • Data unused and/or standardised	• Coupling EO services with other methodologies (climate models, machine learning, local knowledge) • Regional stakeholders pooling funds to help each other • End user capacity building specific to region/sector • Data and experience sharing

Future MUP topics: monitoring, decision support systems and forecasting

Barriers and problems in EO uptake

How can a CoP address these issues?

Speakers

Eva Maria Haas
EOMAP

Christian Tøttrup
DHI

Djalia Umutangampundu
African Water Association

F I R E | European Forum for Earth Observation

The Now & Tomorrow of Earth Observation for Water management

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869634.

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01

Current perspective

- EO benefits on organisational level
- Maturity versus adoption of EO products and services
- Current gaps in EO uptake

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What is in for the customer?

With new constellations and new capabilities being deployed, in the following years there are going to be numerous opportunities for serving market needs that at the moment can’t be solved!

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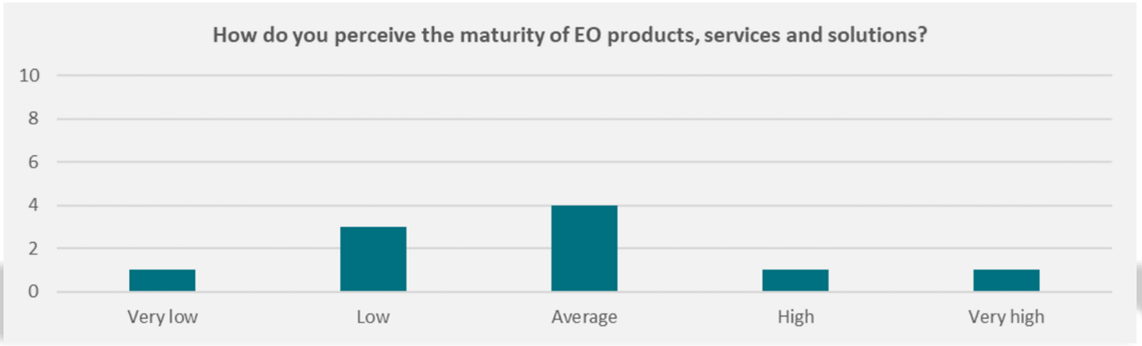
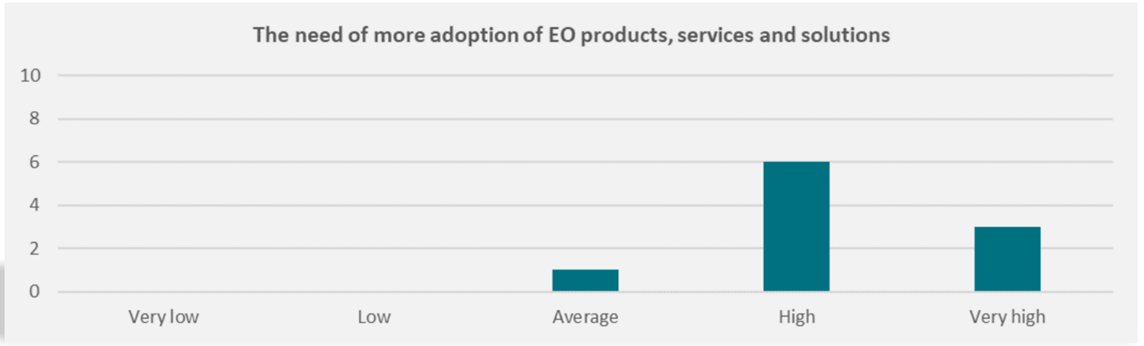
EO maturity versus adoption





- The solutions that exist on the market are not yet fully matched to these subsectors and their needs.
- EO industry should put more effort in understanding their specific problems and create solutions that solve them.
- Data services are not so easy to use by stakeholders

- Lack of technical capabilities to work with geospatial data and difficulty to understand the data
- Disconnect between what customers need and the solutions offered by the EO sector
- Solutions need to have a balance between being scalable and being customizable enough

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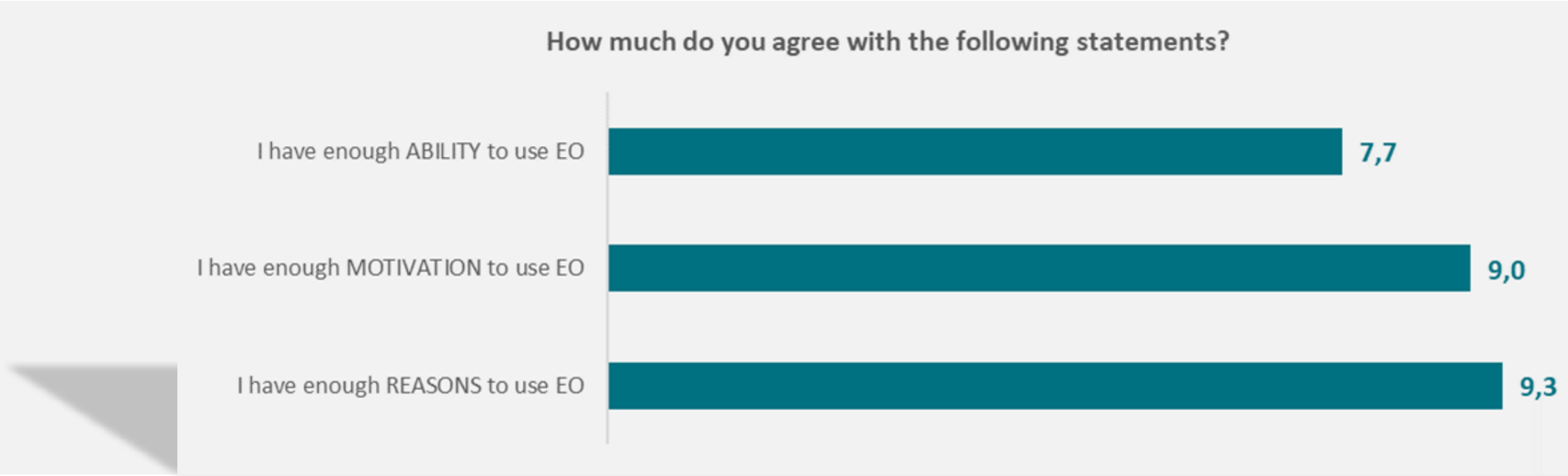
What holds back organisations to use EO?



" The EO industry has to provide solutions that do not require the customer to have EO capabilities in house to implement them"

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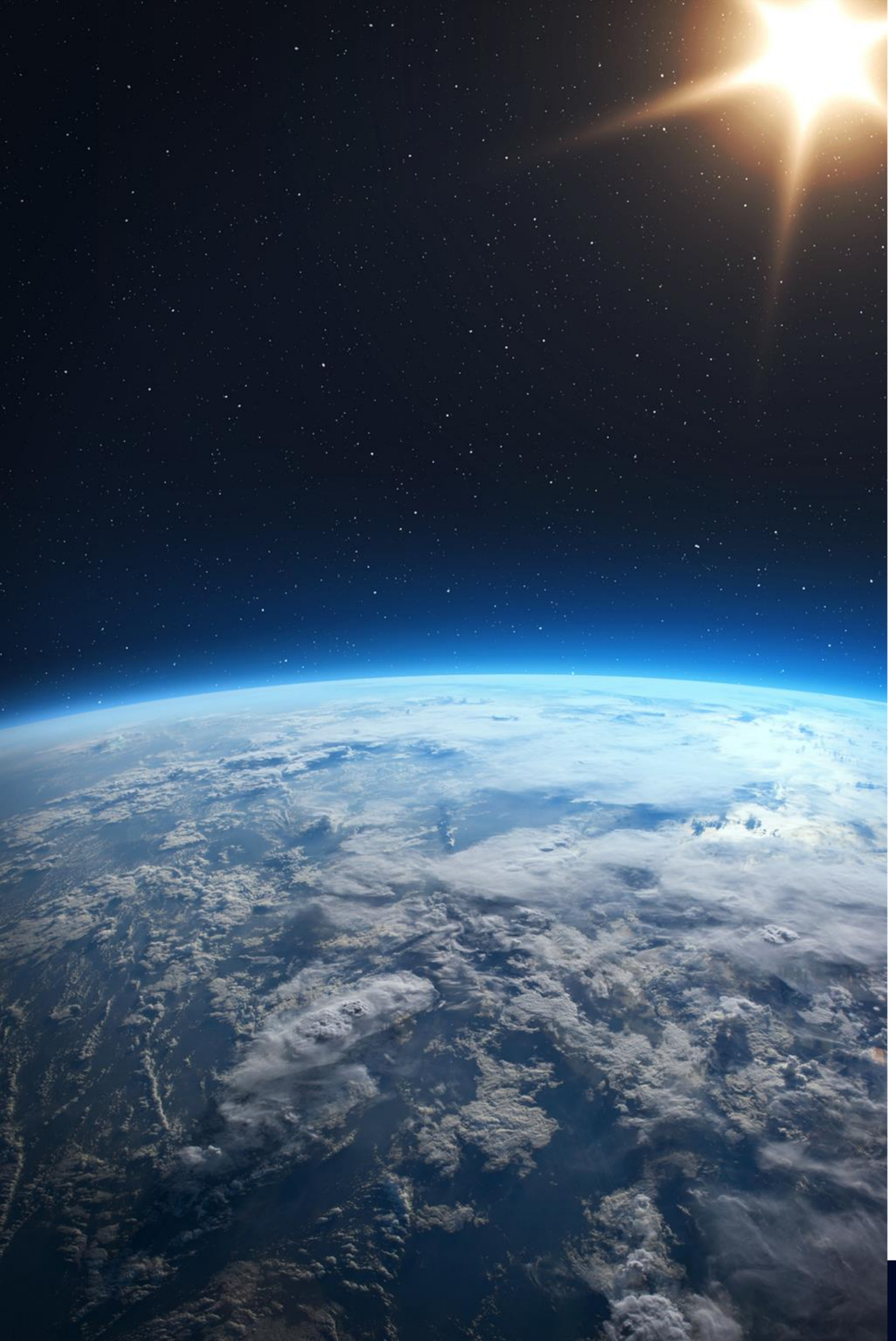


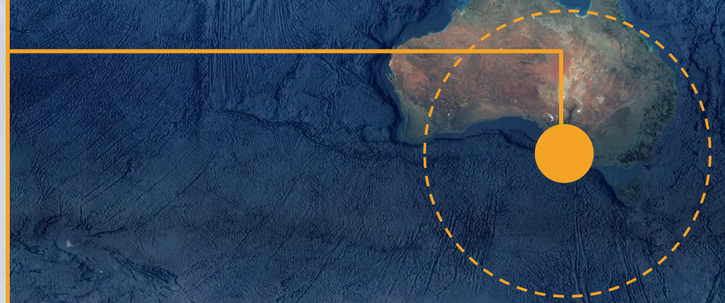
02

Existing solutions and Future perspective

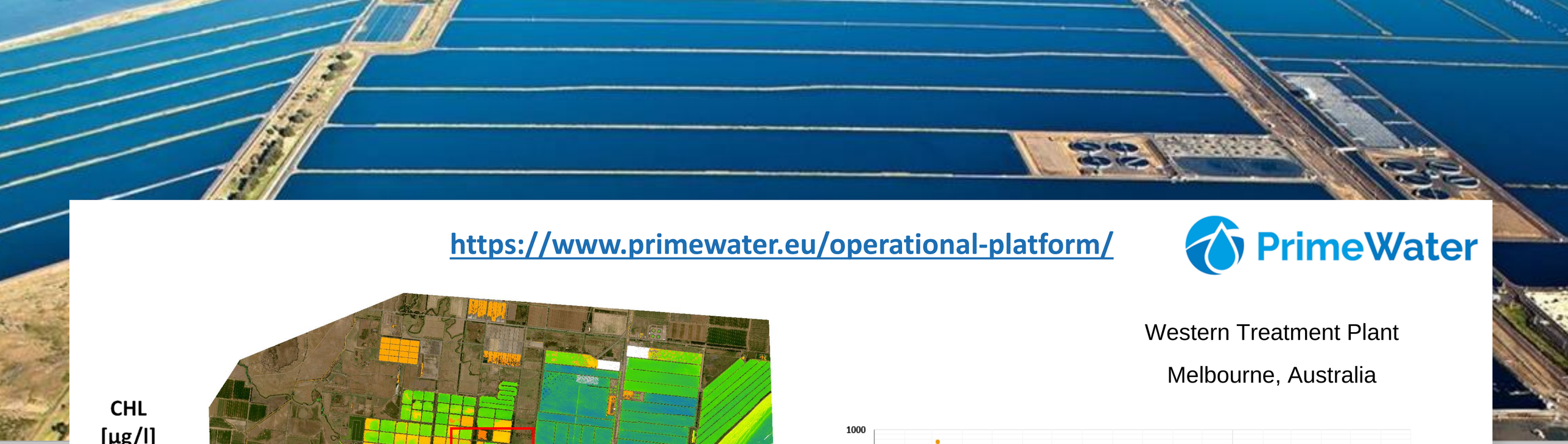
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869634.

WATER TREATMENT PLANTS

Site	Western Treatment Plant, Melbourne, Australia
Challenge	Yearly Cyanobacteria blooms interrupting the water supply and reduce efficiency
Outcome	Establishment of a dense Satellite-Derived Algal Bloom monitoring solution for all ponds using different satellite sources in combination with modelling
Benefits	Rapid quantification of algal blooms Early warning capability and adjusted management



EOMAP

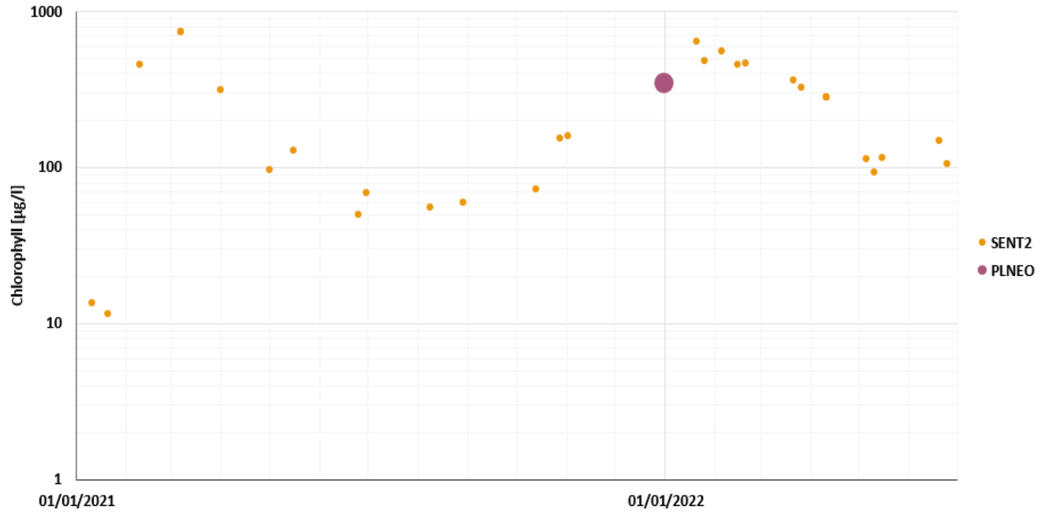


https://www.primewater.eu/operational-platform/

PrimeWater

Western Treatment Plant

Melbourne, Australia



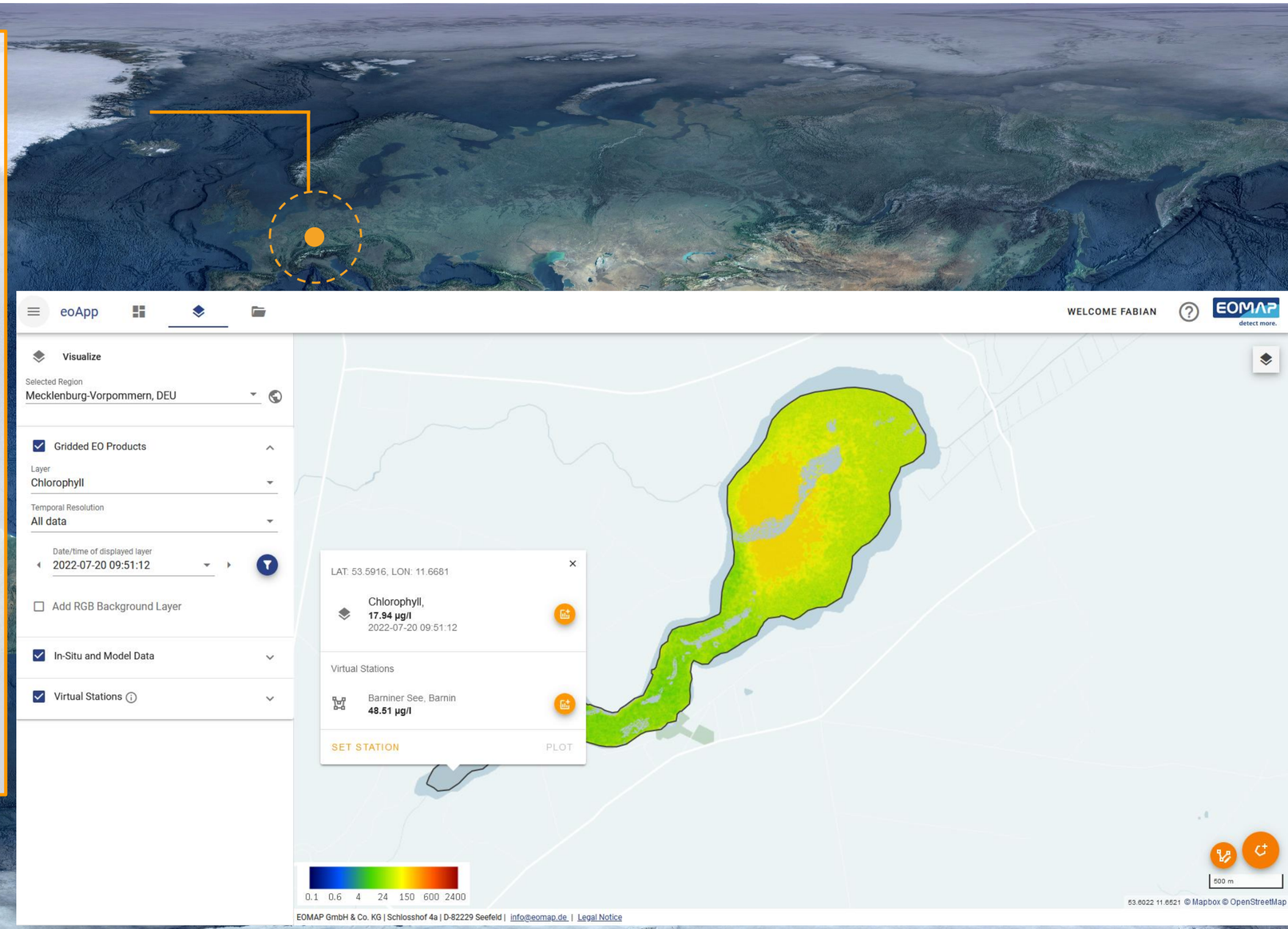
=> Increasing spatial and temporal resolution

Pleiades Neo, 1.2m pixel

EOMAP

BATHING WATER MONITORING

Site	Germany
Application	Bathing water monitoring
Outcome	Online visualization of weekly water quality
Benefits	Spatial information on small water bodies Customized delivery



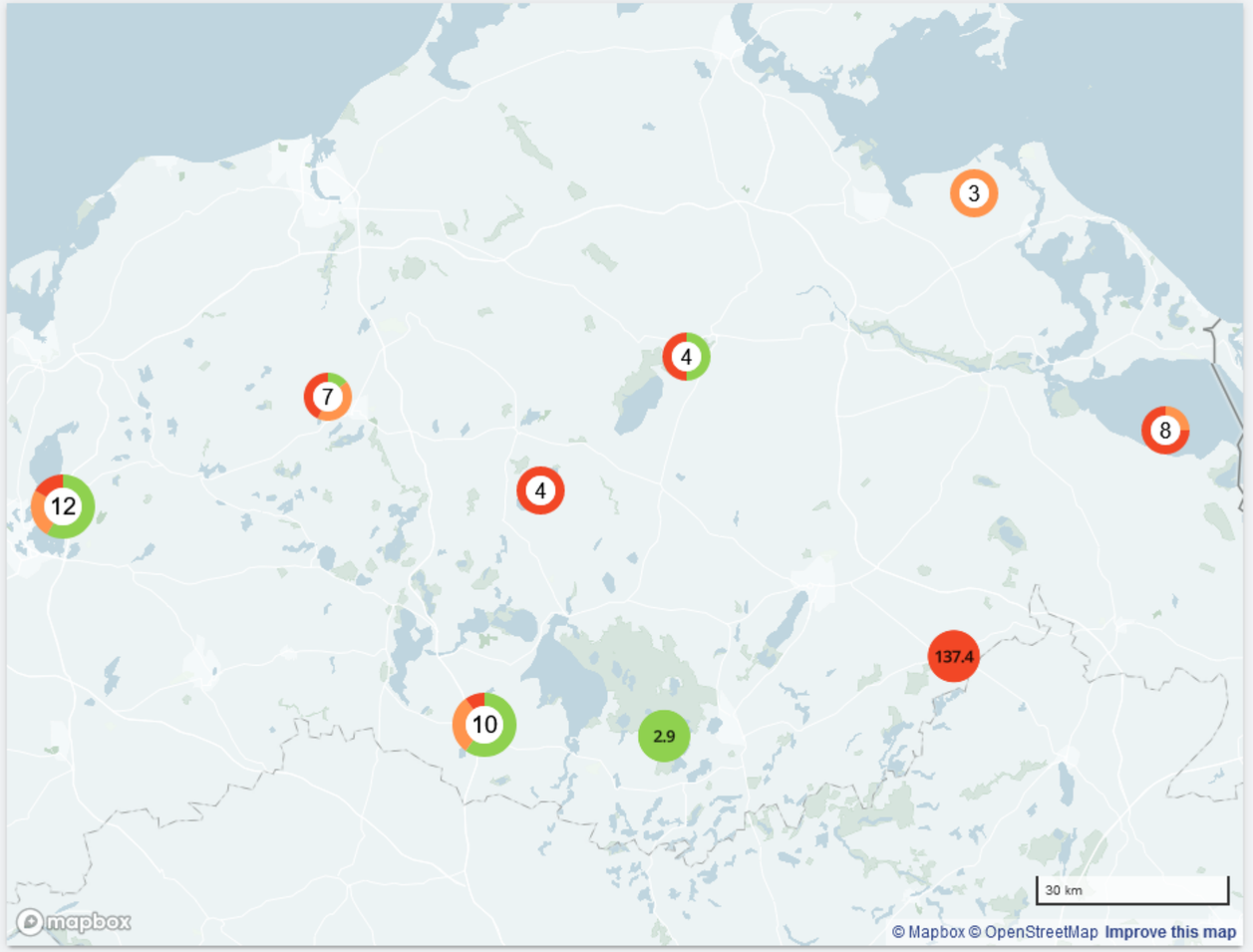
EOMAP

eoApp

WELCOME FABIAN

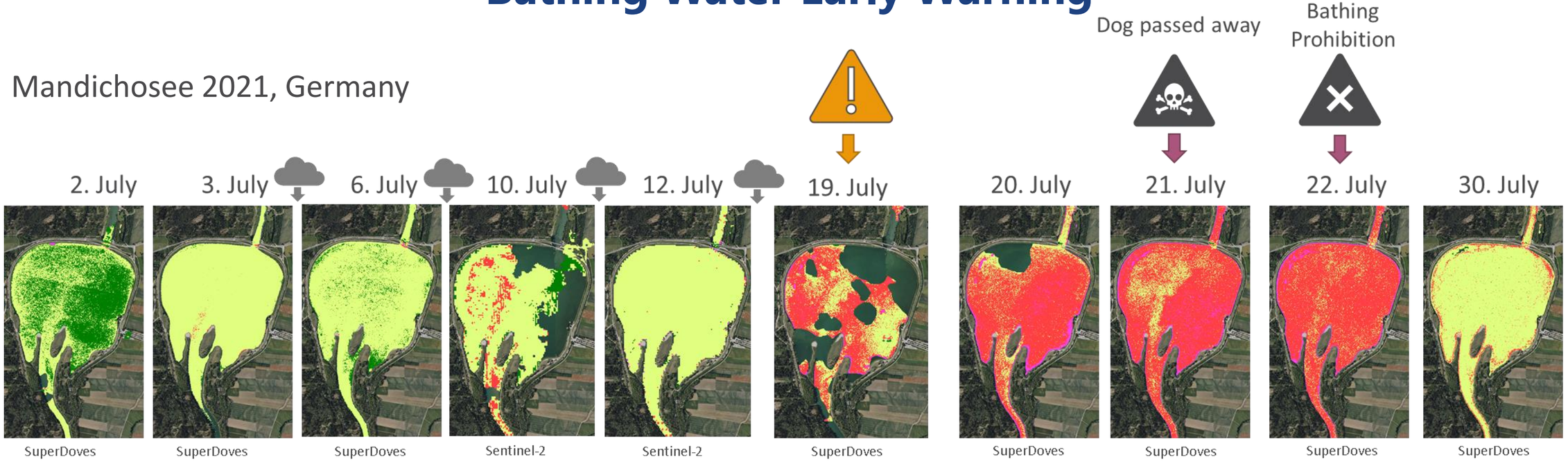
Chlorophyll-a | Last 3 months | Mecklenburg-Vorpommern, ... | Search | SET THRESHOLDS

	Current status	Previous status	Alerts
Massower See, Massow	2022-09-02 09:34:46	2022-09-02 09:07:20	23
Mueritzarm, Vipperow	2022-09-02 09:07:20	2022-08-23 09:46:59	1
Barniner See, Barnin	2022-09-04 10:07:36	2022-09-04 10:07:34	18
Stadtsee, Woldegk	2022-09-03 09:46:22	2022-09-02 09:34:46	16
Jamelsee, Blankenfoerde CP	2022-09-01 09:47:11	2022-08-31 09:11:28	0
Mueritz, Kleine Mueritz Rechlin	2022-09-02 09:07:20	2022-08-24 09:51:26	0
Warnow, Schwaan, Campingplatz	2022-09-03 09:13:28	2022-08-24 09:35:08	11



Adding of very high temporal satellite missions for Bathing Water Early Warning

Mandichosee 2021, Germany



Data Sources:

PlanetLabs SuperDoves, 3m spatial, daily
Sentinel-2A/B, 10m spatial, every 5 days

EOMAP

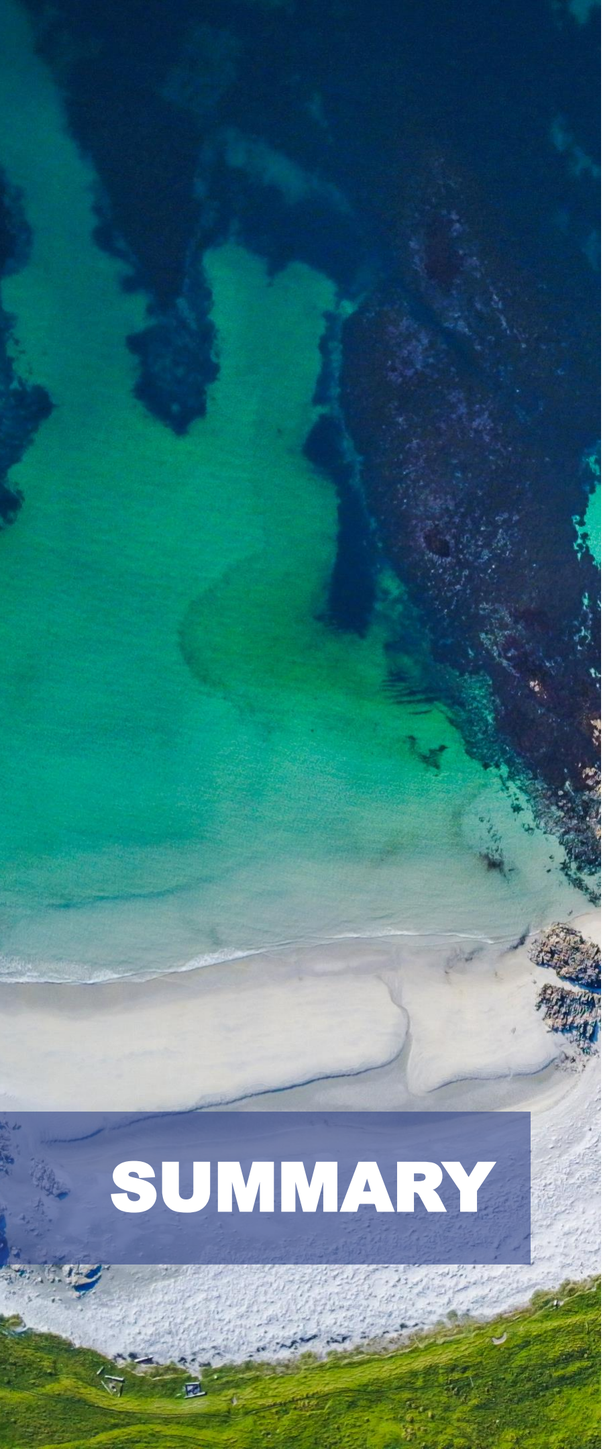
Cost
—
Benefits

01 Lab analysis > 100 € vs. <10 € for EO measurement

02 Sensor installation 10,000 € vs. 1,000 € EO 1 year

03 Less HSE risk due to less monitoring campaigns

04 Cost savings for boats and equipment



SUMMARY

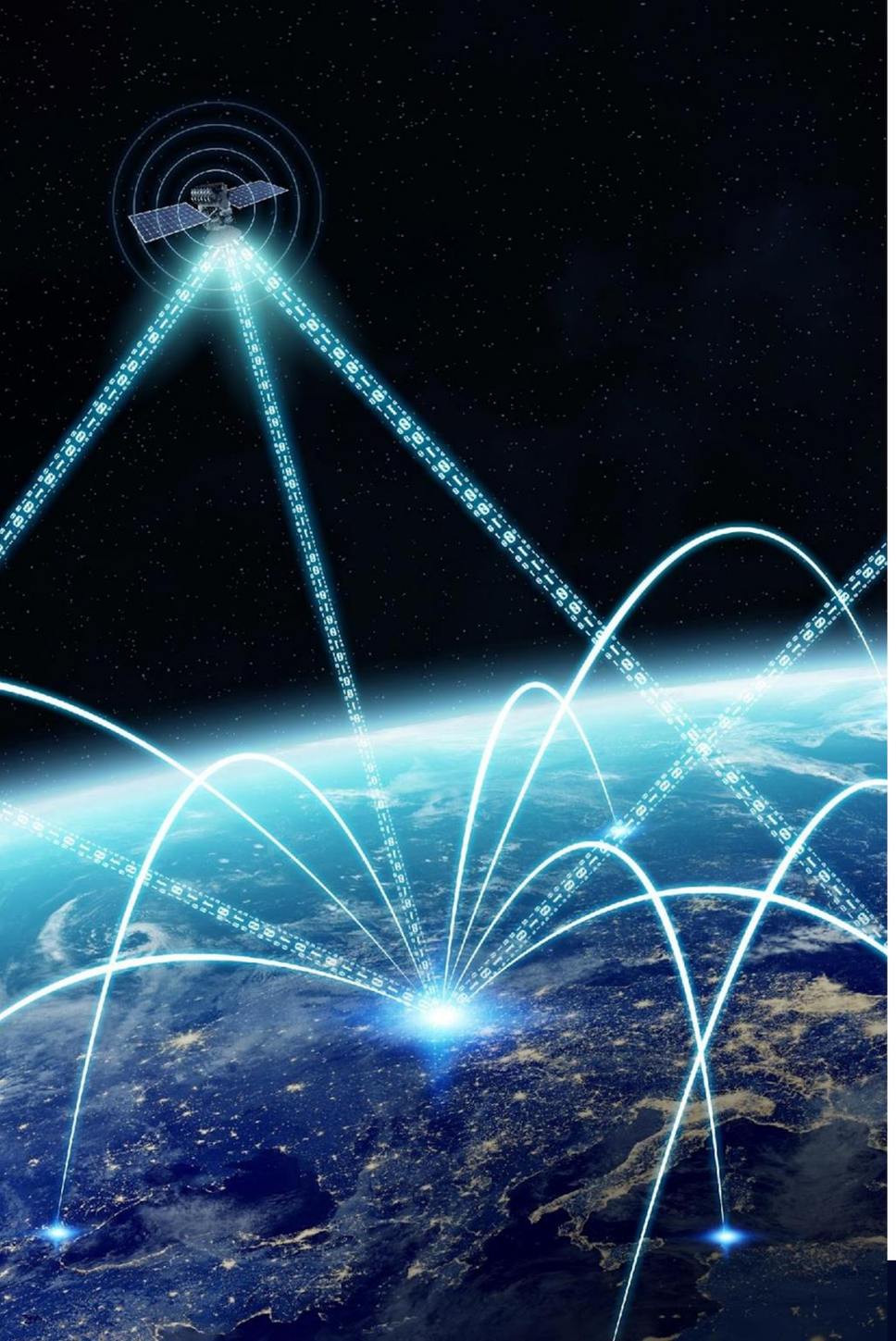
Satellite analytics empower …

…world wide monitoring of water bodies

…a holistic view on water bodies

…easily access through online portals

…cost-efficient monitoring



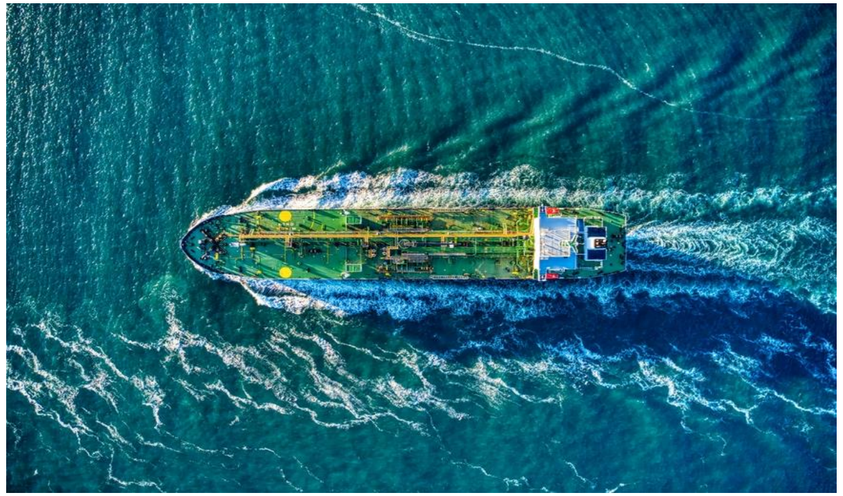
03

Action to boost uptake

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869634.

Key actions to accelerate adoption

In water management



Playbook

Develop a reference playbook with guidelines on how water managers can start using EO.

Outreach

Explain the usefulness of EO for the water sector and show success stories

Business models & solutions

Awareness

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Key actions to accelerate adoption

In water management

Support tool

Create targeted decision support tools (DST) to support decision makers in taking quick action.

Fund and develop

Fund and develop advanced EO-based data sets that will enable new applications.

Business models & solutions

Policy levers

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 869634.

FIRE | European Forum for Earth Observation

Dr. Eva Haas

Head of Strategic Accounts EOMAP

haas@eomap.de

Get even closer to the customer.

Make it as easy as the weather forecast.

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IWA World Water Congress & Exhibition

11 – 15 September 2022 | Copenhagen, Denmark

Towards operational satellite-based water resource monitoring

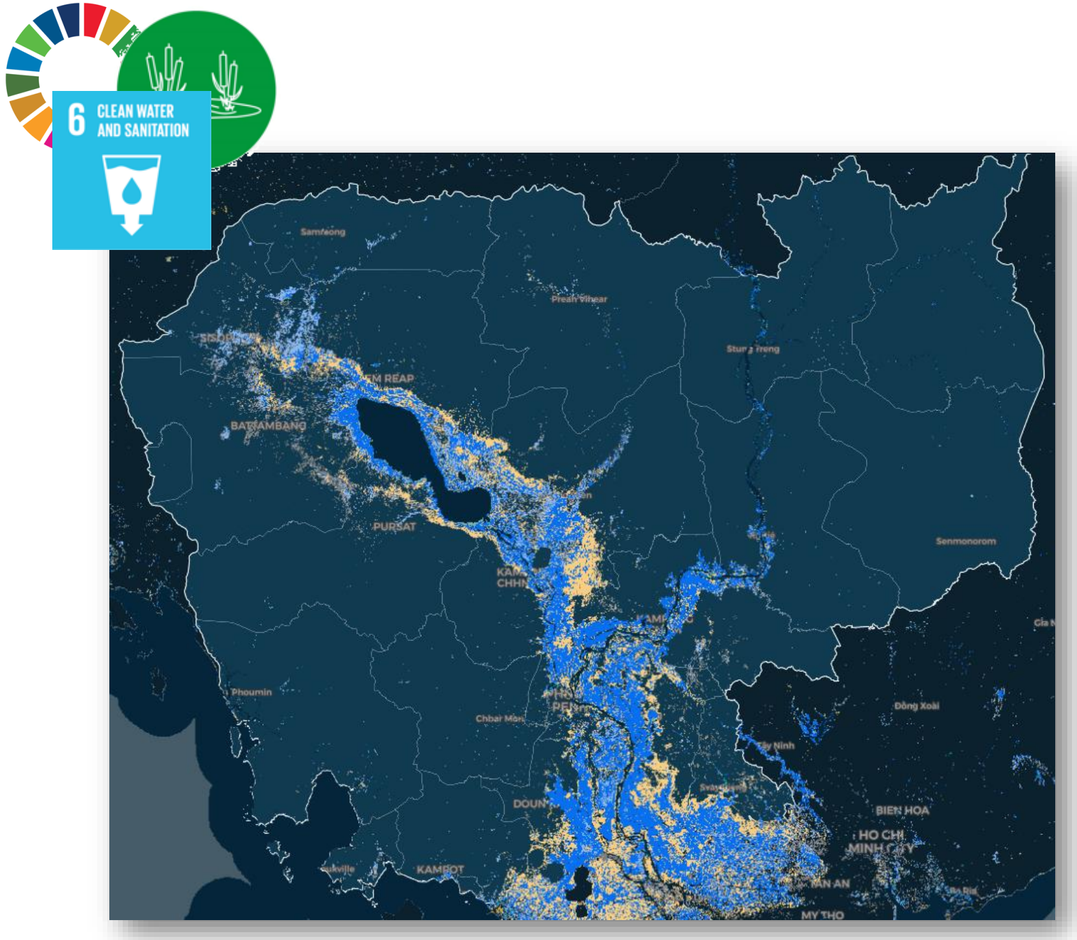
Christian Tottrup, DHI A/S

Background

- Inland freshwater resources are affected by climate change as well as increasing demands for food production, energy, and water
- There is a need to monitor freshwater resources at national, regional, and global levels to understand their vulnerability to change and ensure sustainable management
- The last decades have seen a steady decline in in-situ hydrological monitoring, and satellite Earth Observation is now being recognized as an essential tool for large-scale monitoring of water resources

EO serving the 2030 Agenda

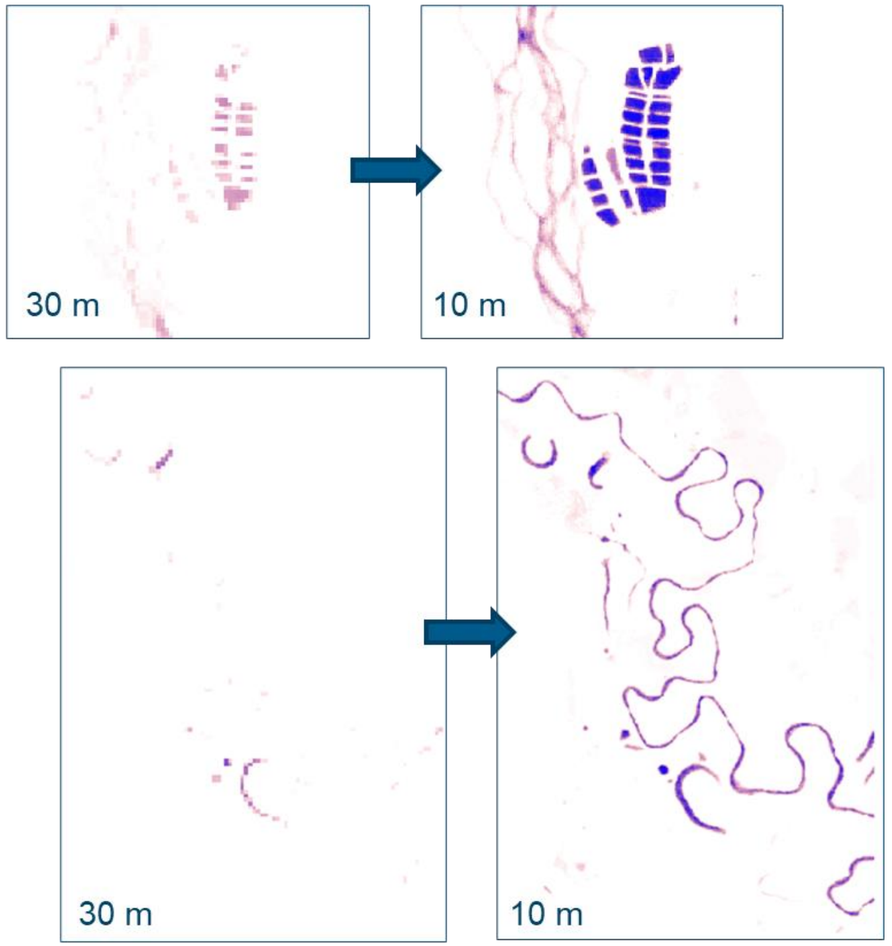
- The SDG661 indicator is designed to measure changes in the extent (and quality) of different types of freshwater ecosystems over time
- UNEP has the custodian responsibility for SDG 661
- Earth Observation was used to fill a global data gap as many countries don't have this information available



The Freshwater Ecosystem Explorer | https://map.sdg661.app/#

Global data tend to have bias

- 10-15% of global water is mixed with land at a 30 m resolution
- Next generation mapping
  - Capture more details
  - More consistent seasonal variations



remote sensing

MDPI

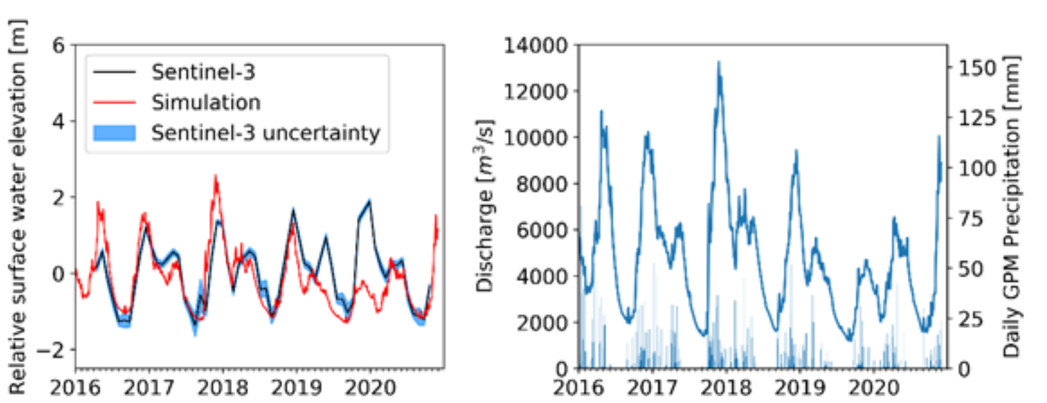
Article

Surface Water Dynamics from Space: A Round Robin Intercomparison of Using Optical and SAR High-Resolution Satellite Observations for Regional Surface Water Detection

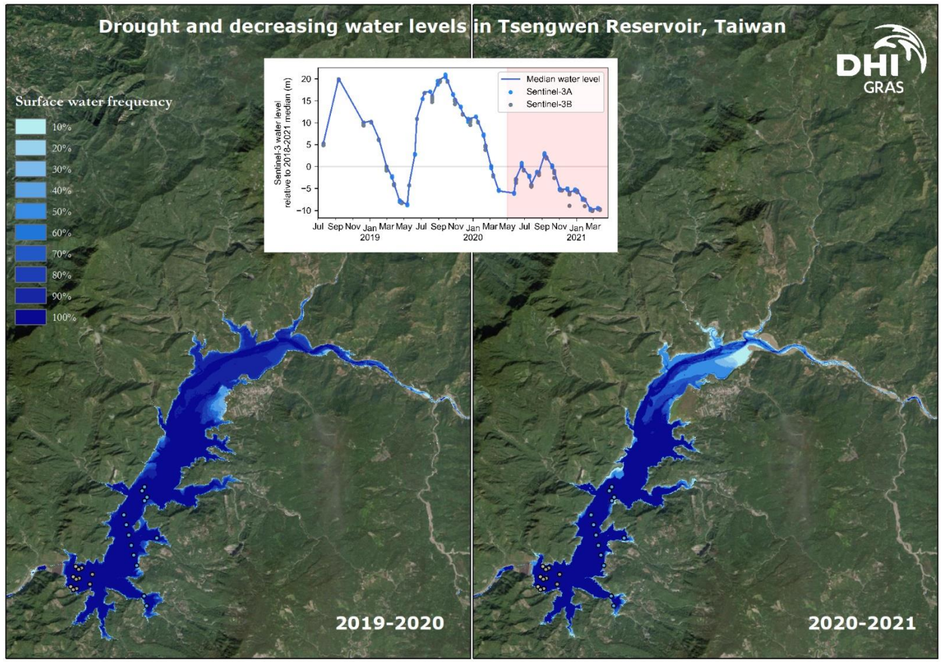
Christian Tottrup [1,*], Daniel Druce [1], Rasmus Probst Meyer [1], Mads Christensen [1], Michael Riffler [2], Bjoern Dulleck [2], Philipp Rastner [2], Katerina Jupova [3], Tomas Sokoup [3], Arjen Haag [4], Mauricio C. R. Cordeiro [5], Jean-Michel Martinez [5], Jonas Franke [6], Maximilian Schwarz [7], Victoria Vanthof [8], Suxia Liu [9, 10], Haowei Zhou [9, 10], David Marzi [11], Rudiyanto Rudiyanto [12], Mark Thompson [13], Jens Hiestermann [13], Hamed Alemohammad [14], Antoine Masse [15], Christophe Sannier [15], Sonam Wangchuk [16], Guy Schumann [17], Laura Giustarini [17], Jason Hallowes [18], Kel Markert [19] and Marc Paganini [20]

From water extent to quantity

- Satellite altimetry missions monitor river & lake level changes globally
- Surface water extent maps can be used to optimize altimetry target selection for inland water bodies



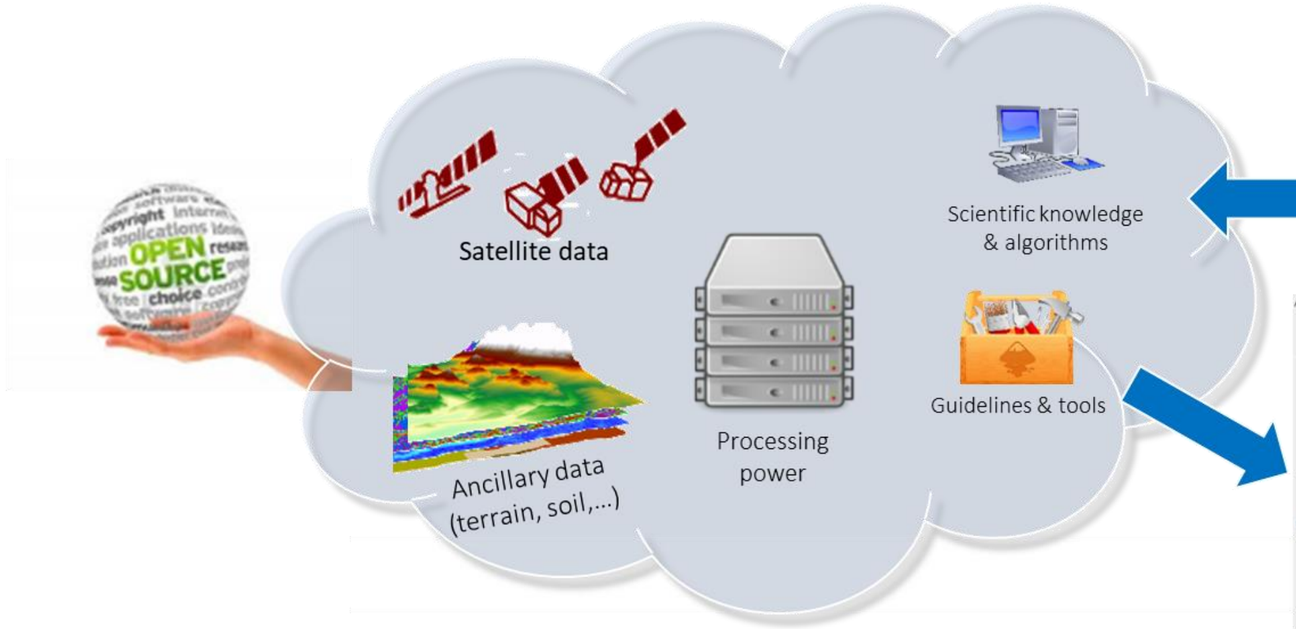
Water levels from altimetry missions can inform hydrologic and hydraulic modelling to produce discharge in ungauged river basins



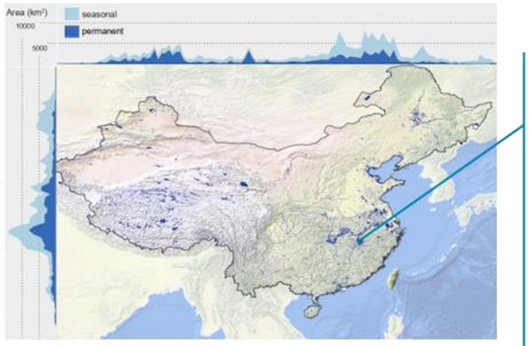
Water extent dynamics and water level time series can track water storage changes in reservoirs

Towards efficient “big data” exploitation

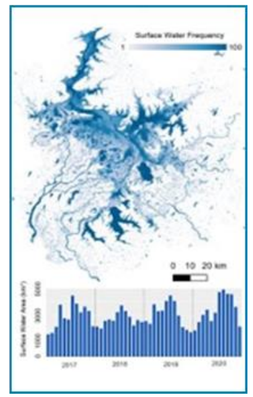
The power of the **Cloud**
“Bringing the users to the data”



Efficient remote access for users

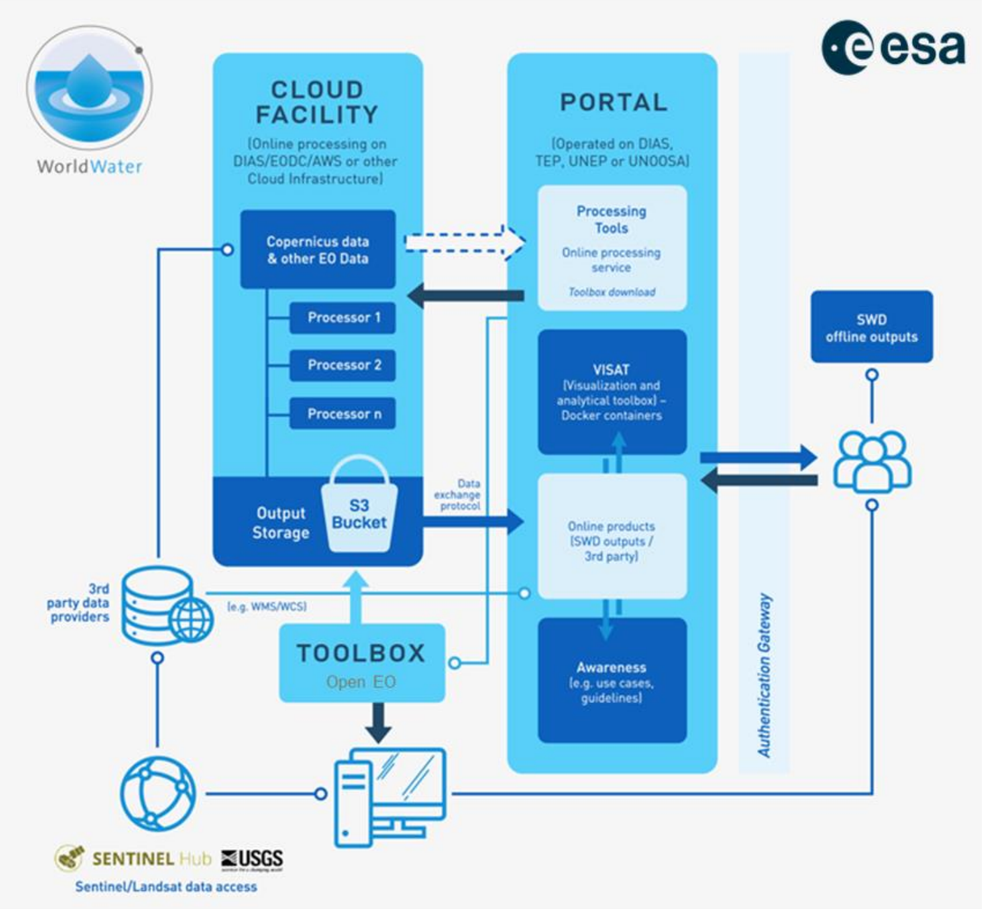


User generated results



Conclusion & Outlook

- Regular and systematic EO data acquisitions provides an efficient tool for monitoring, statistical reporting, analysis and communication on the status of inland waters
- Combined with the advances in technical infrastructures for big data analysis, it is now within the realm of countries to implement satellite-based surface water monitoring systems



WorldWater → Empower national and regional stakeholders with EO data and tools to better monitor their water resources and report on the global water agenda.

Digital Earth AFRICA

AfWA /AAE

Mapping water extent using WOfS and Sentinel 1&2

Djalia Umutangampundu
Programs Technical Officer
African Water Association
Udjalia@afwa-hq.org

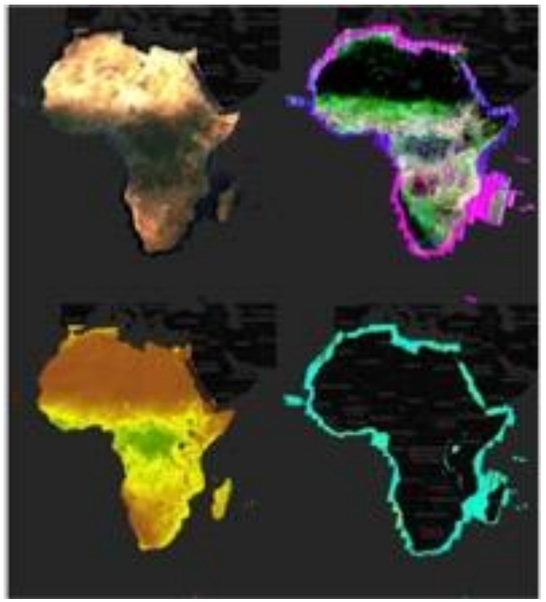
DE Africa products

Water Observations from Space (WOfS)

- from 1980s

Crop Mask

-Eastern, Southern, Northern, Western Africa



Sentinel-2 & Landsat Annual GeoMAD

- cloud free composites

… and more

https://www.digitalearthafrica.org/platform-resources/services-and-analysis-tools

DE Africa Data

There are many ways to access DE Africa data:

View data	**DE Africa Map**	Digital Earth AFRICA MAP	http://maps.digitalearth.africa/
Analyse data	**DE Africa Sandbox**	Digital Earth AFRICA Digital Earth Africa Sandbox	https://sandbox.digitalearth.africa/
Other platforms include:			
Access in GIS software	OWS Map Services		https://ows.digitalearth.africa/
Learn how to access & analyse data	Digital Earth Africa Learning Platform		https://learn.digitalearthafrica.org/

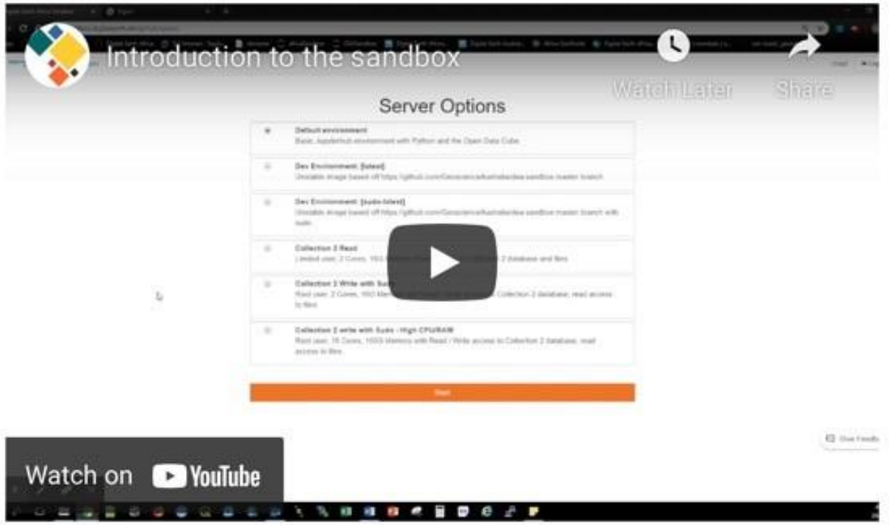
Mapping water extent using Sentinel 2

DE Africa Sandbox

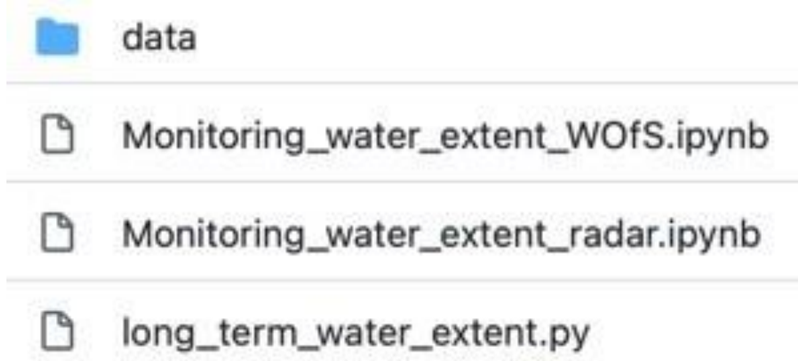
https://sandbox.digitalearth.africa

The DE Africa Sandbox is a cloud-based computational platform that operates through a Jupyter Lab environment. It provides a limited, but free compute resource for technical users and data scientists to explore DE Africa data and products.

Mapping water extent using Sentinel 2 notebooks are available on github https://github.com/digitalearthafrica/deafrica-sandbox-notebooks/blob/main/Real_world_examples/Water_extent_sentinel_2.ipynb



https://youtu.be/QRKX6jwN3kM



Mapping water extent using Sentinel 2

Mapping water extent using Sentinel 2 notebooks are available on github

 # Define the area of interest
lat = -6.0757 #-5.9460 #Lake Sulunga
lon = 35.1679 #35.5188 #
lat_buffer = 0.25
lon_buffer = 0.25

The notebook demonstrates how to:

1. Load satellite data over the water body of interest
2. Calculate the water index MNDWI
3. Resample the time-series of MNDWI to seasonal medians
4. Generate an animation of the water extent time-series
5. Calculate and plot a time series of seasonal water extent (in square kilometres)
6. Find the minimum and maximum water extents in the time-series and plot them.
7. Compare two nominated time-periods, and plot where the water-body extent has changed.

https://youtu.be/QRKX6jwN3kM

main deafrica-sandbox-notebooks / Use_cases / Monitoring_water_extent /

Mapping water extent using Sentinel 2

Mapping water extent using Sentinel 2 notebooks are available on github

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Mapping water extent using Sentinel 2

Mapping water extent using Sentinel 2 – Lake Sulunga, Tanzania.

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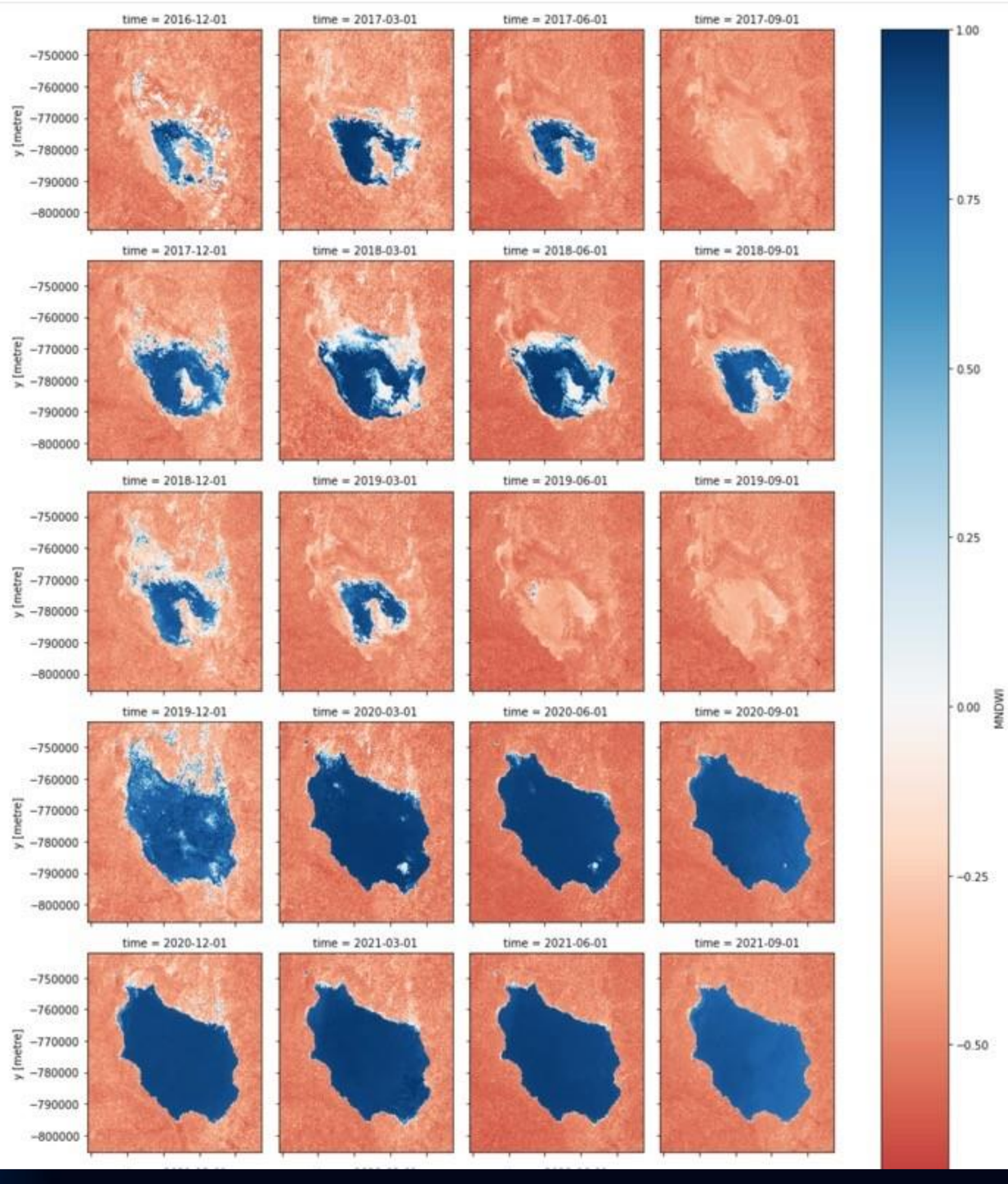
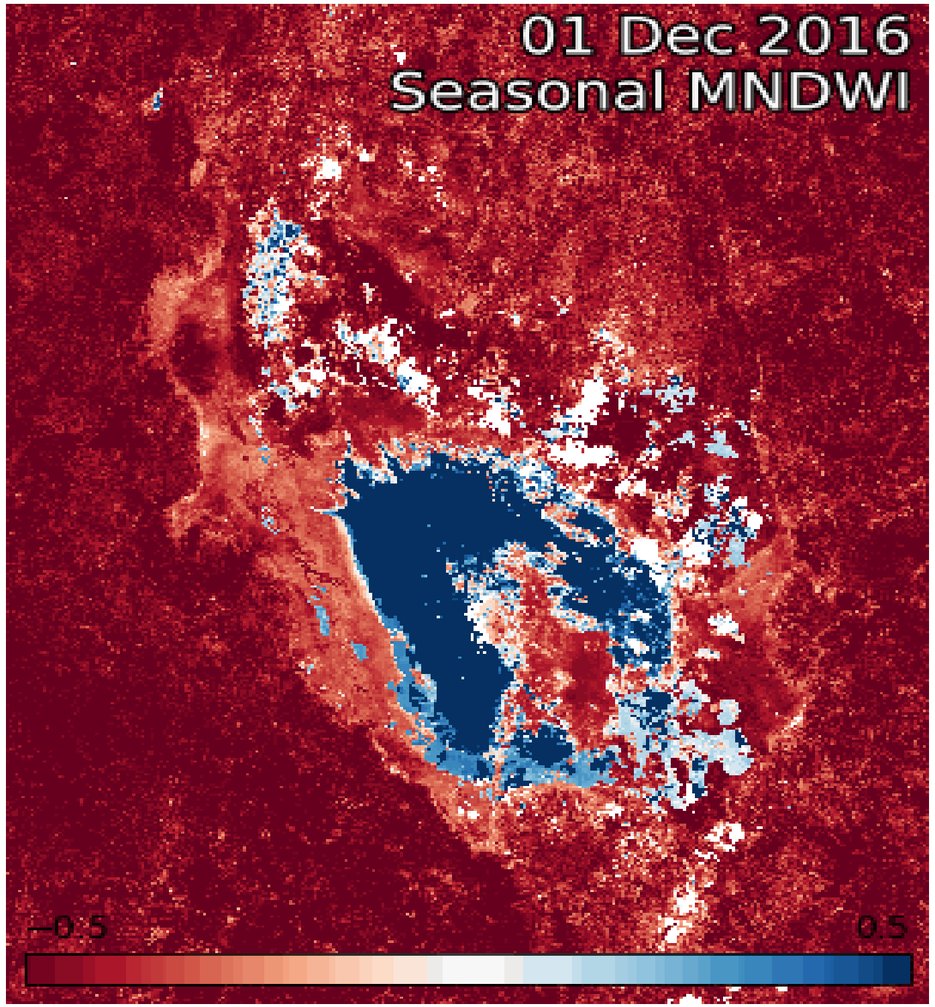


Mapping water extent using Sentinel 2

Mapping water extent using Sentinel 2 – Lake Sulunga, Tanzania.



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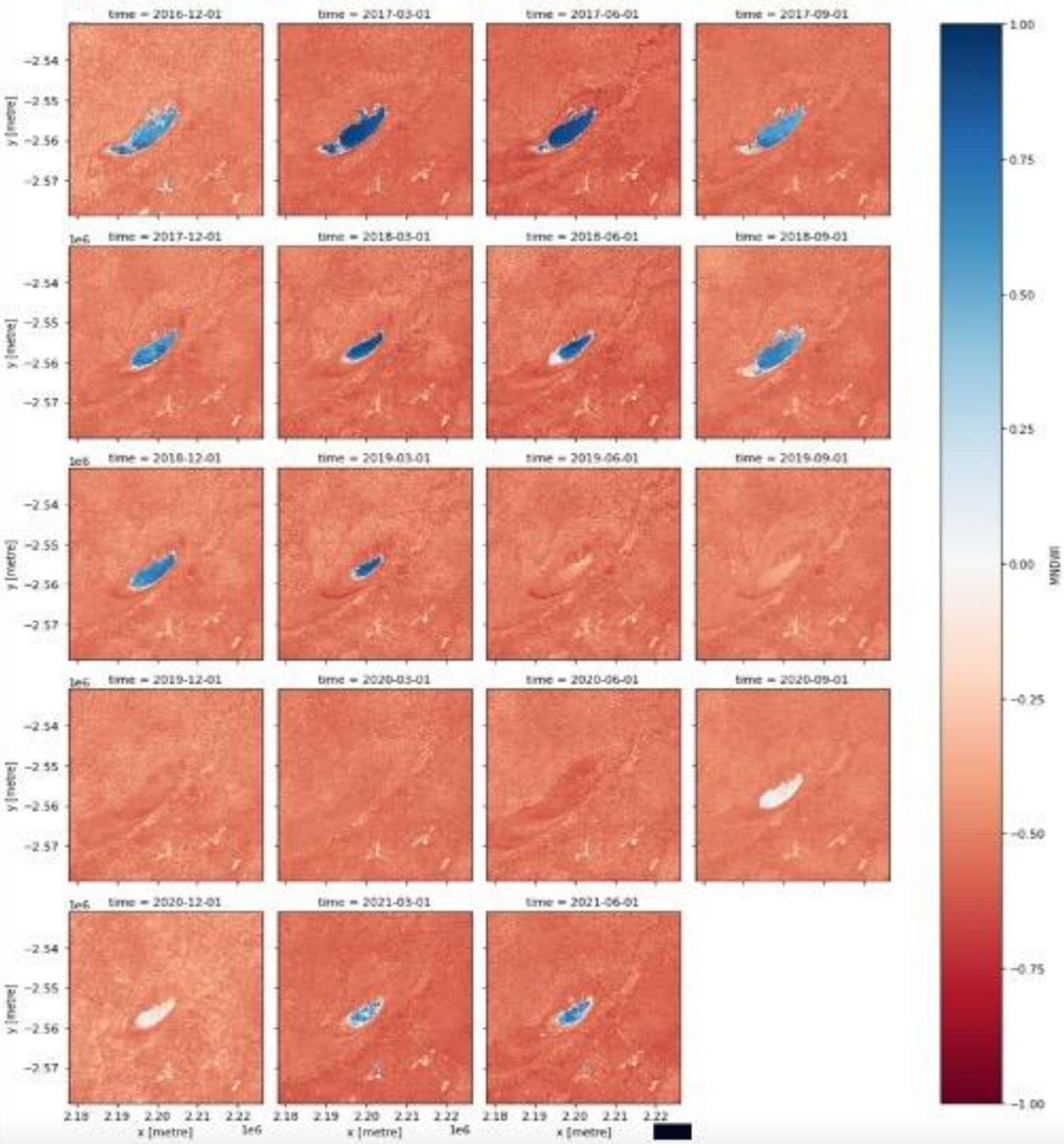
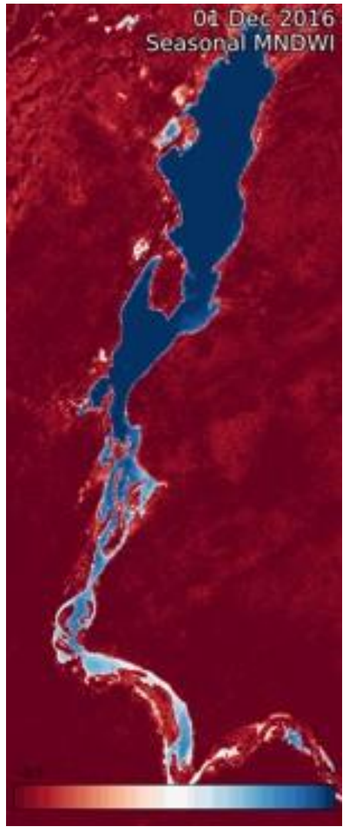
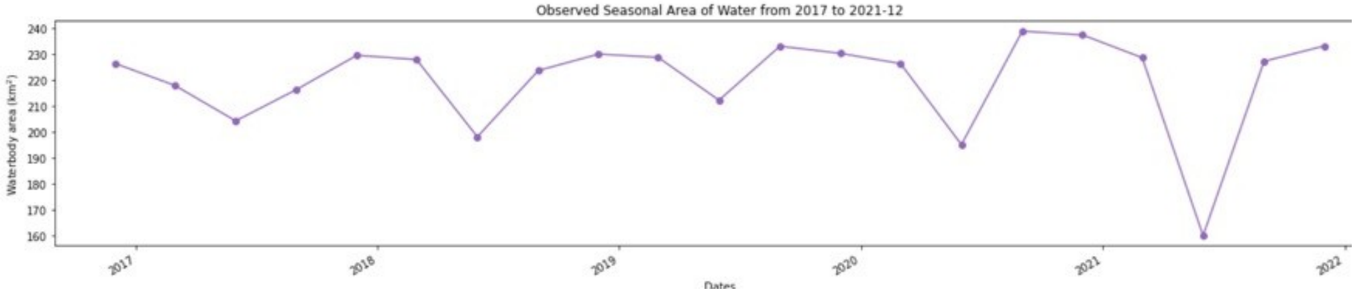
Mapping water extent using Sentinel 2 – Lake Ngami, Botswana

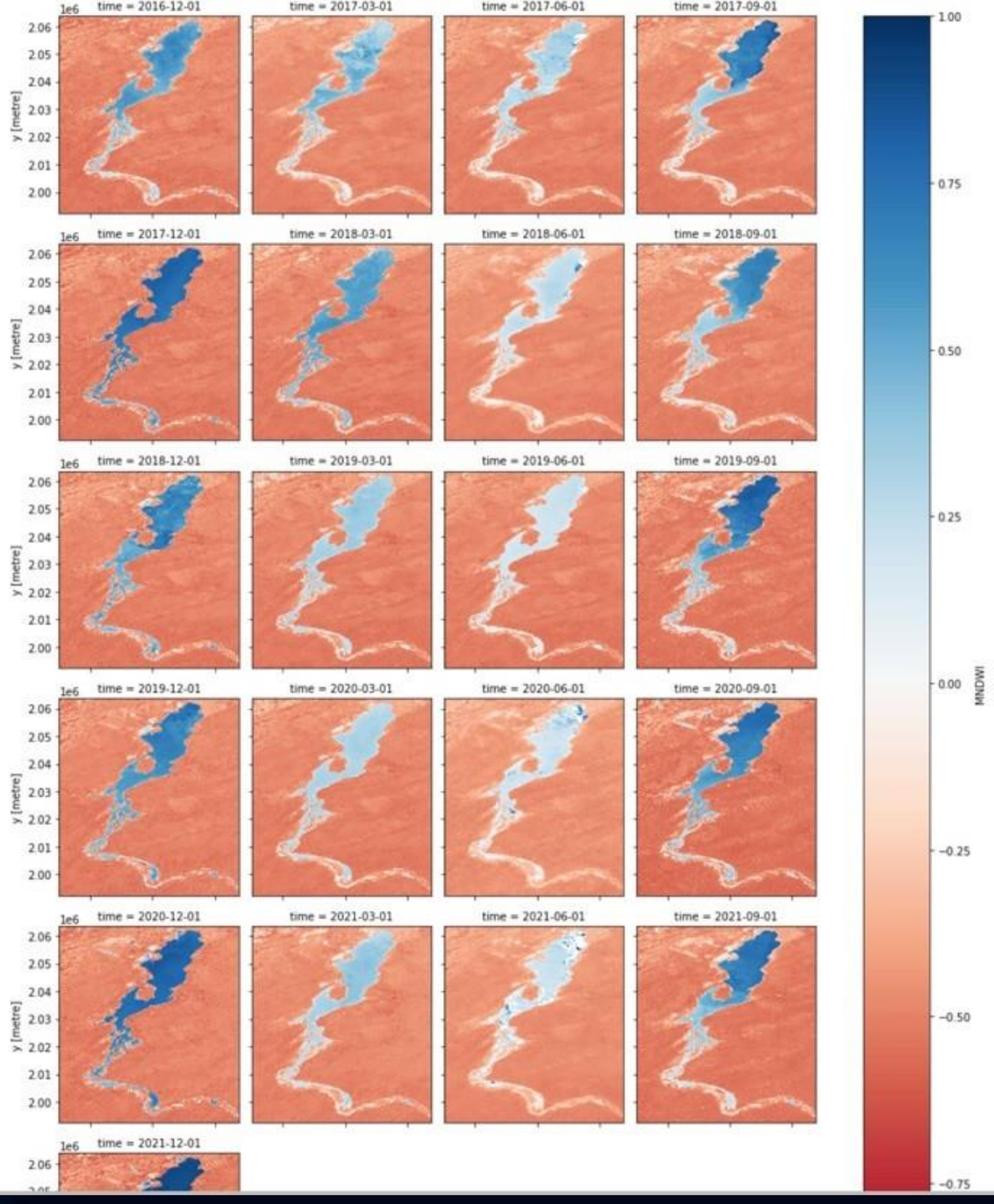
- Lake Ngami extent using Water extent algorithm, which uses MNDWI using Sentinel 2: 2017 to 2021.
- Water variability is visualized over the four years, with low levels witnessed in June 2019, September 2019, December 2019, June 2020.
- High volumes are witnessed in December 2016, March 2017, June 2017, September 2017 and September 2018.
- This can be attributed to extreme weather events namely drought (low volumes) and floods (high volumes).



Mapping water extent using Sentinel 2 – Lake Guiers, Senegal



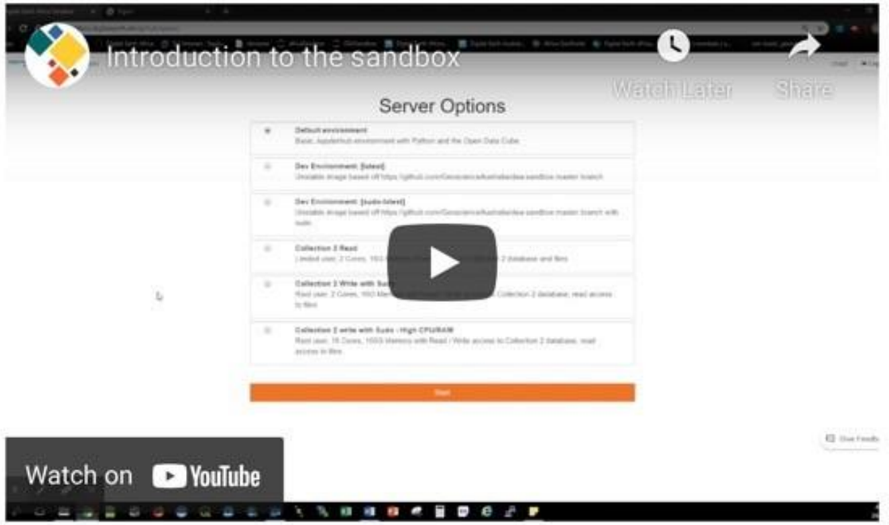




Mapping water extent using WOfS and Radar

DE Africa Sandbox

Mapping water extent using WOfS (30 metres) and radar (Sentinel 1) notebooks are available on github https://github.com/digitalearthafrica/deafrica-sandbox-notebooks/tree/main/Use_cases/Monitoring_water_extent



https://youtu.be/QRKX6jwN3kM

main deafrica-sandbox-notebooks / Use_cases / Monitoring_water_extent /

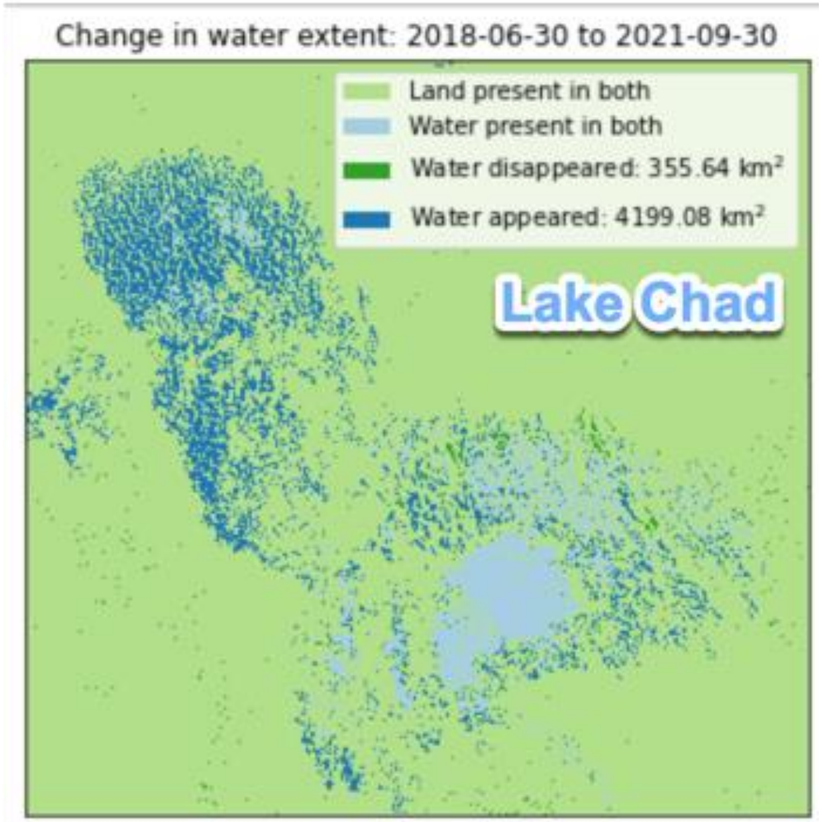
- data
- Monitoring_water_extent_WOfS.ipynb
- Monitoring_water_extent_radar.ipynb
- long_term_water_extent.py

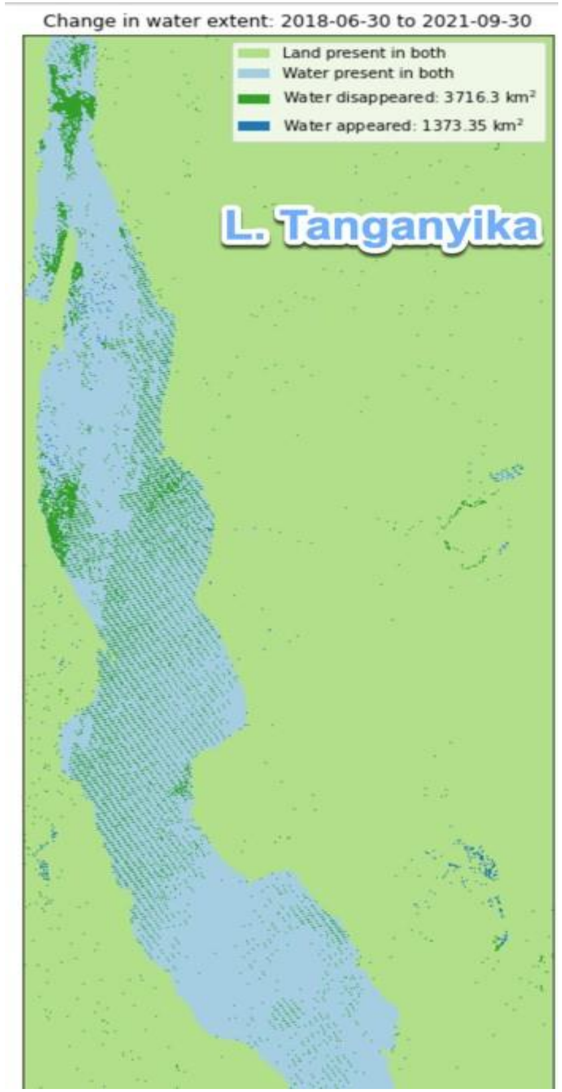
Mapping water extent using WOfS

Monitoring_water_extent_WOfS.ipynb

Steps:

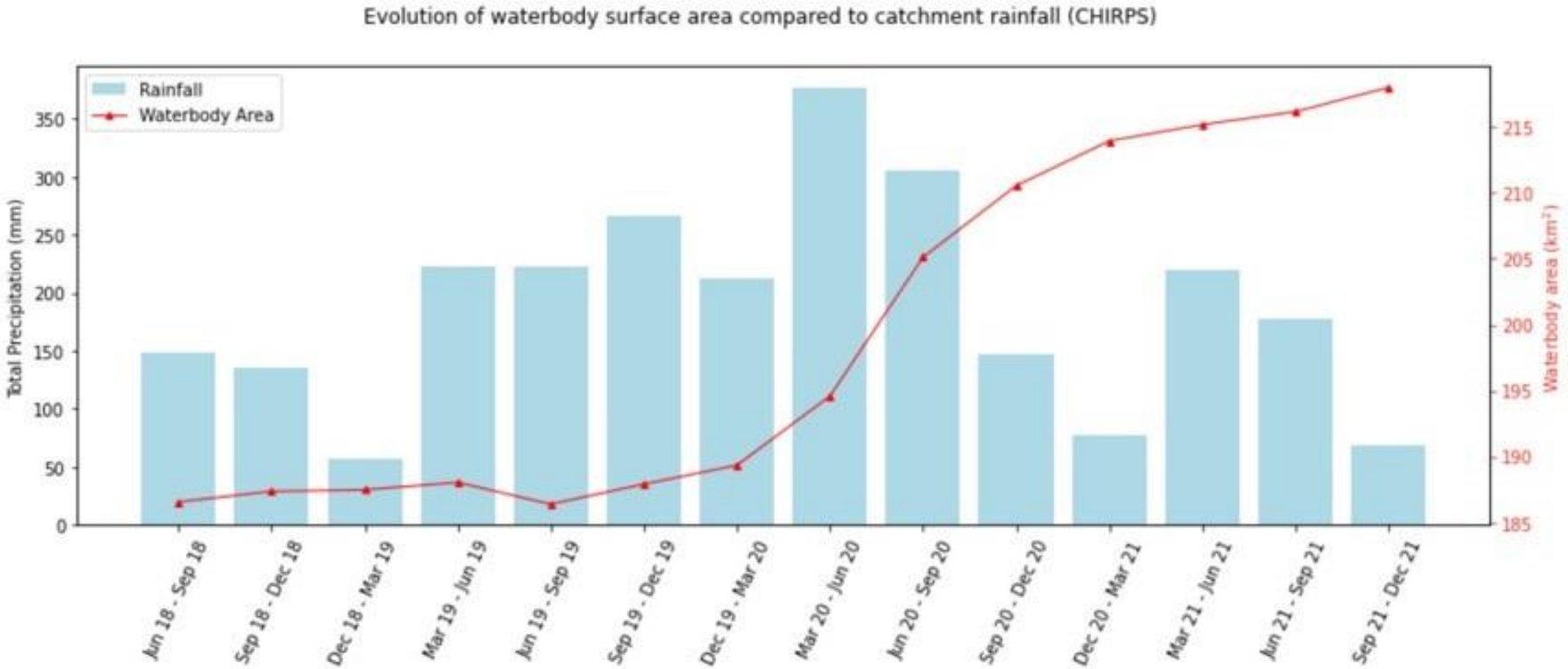
Compare water extent



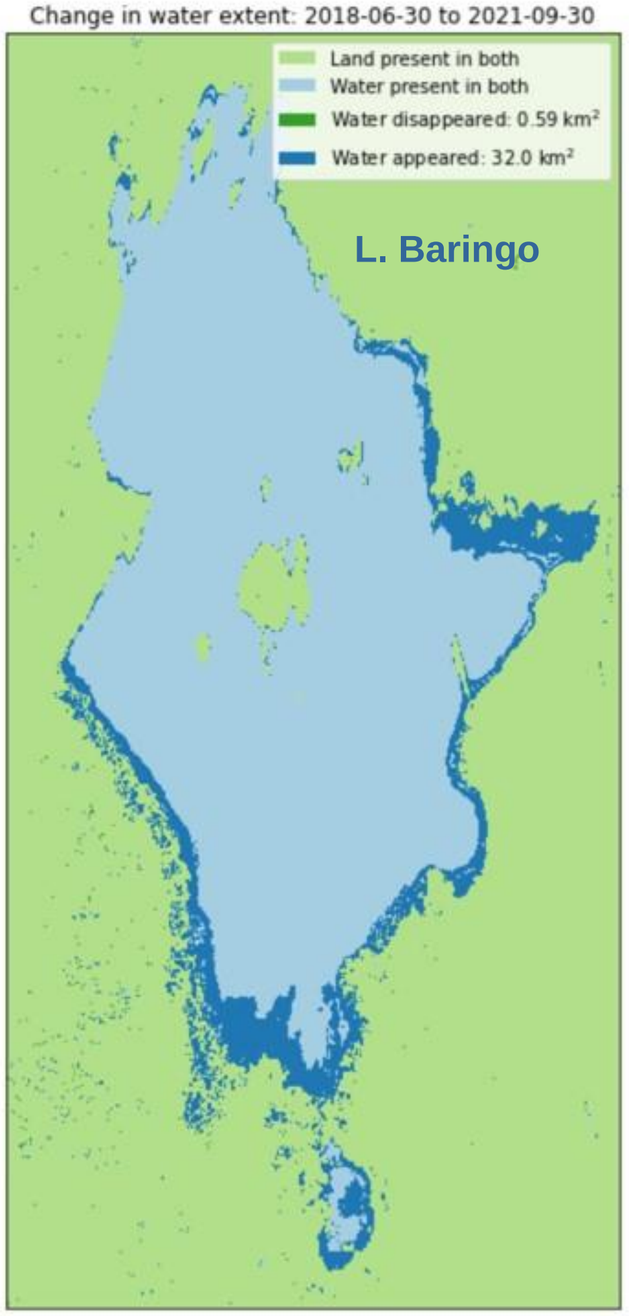


Mapping water extent and rainfall using Sentinel-1 and CHIRPS

Monitoring_water_extent_radar.ipynb



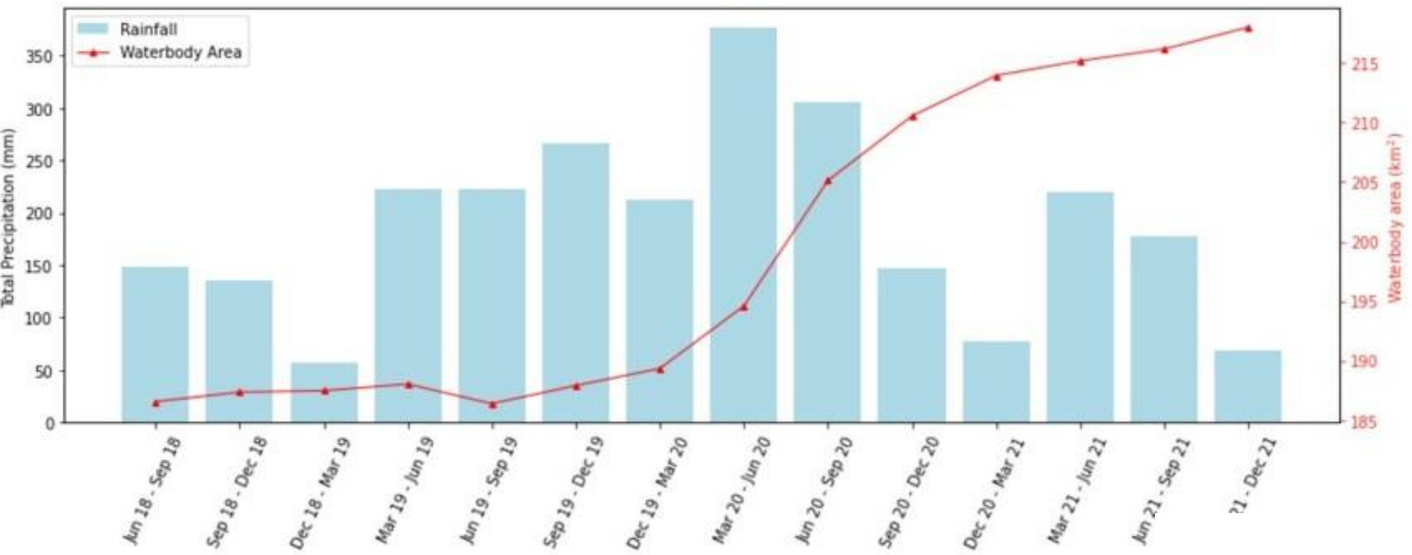
Compare waterbody area to catchment rainfall



Mapping water extent and rainfall using Sentinel-1 and CHIRPS

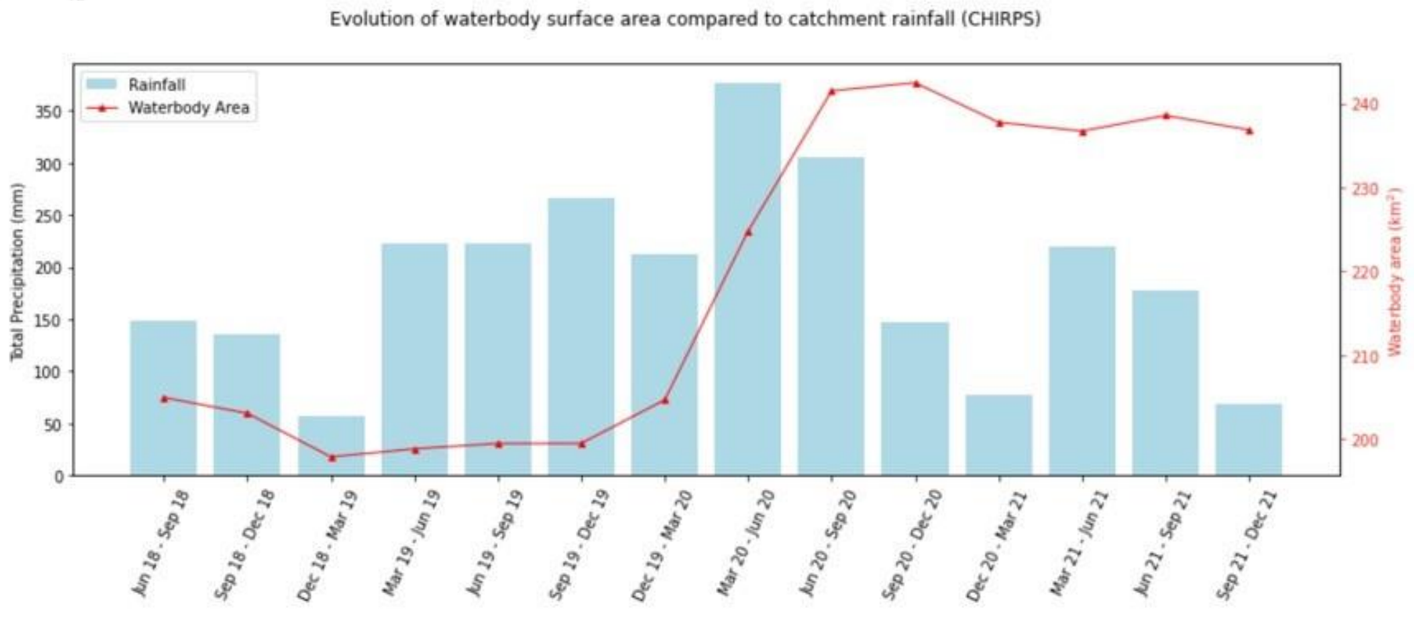
Compare waterbody area to catchment rainfall using Sentinel 1 (left) versus WOfS (right)

L. Baringo



Sentinel 1

WOfS



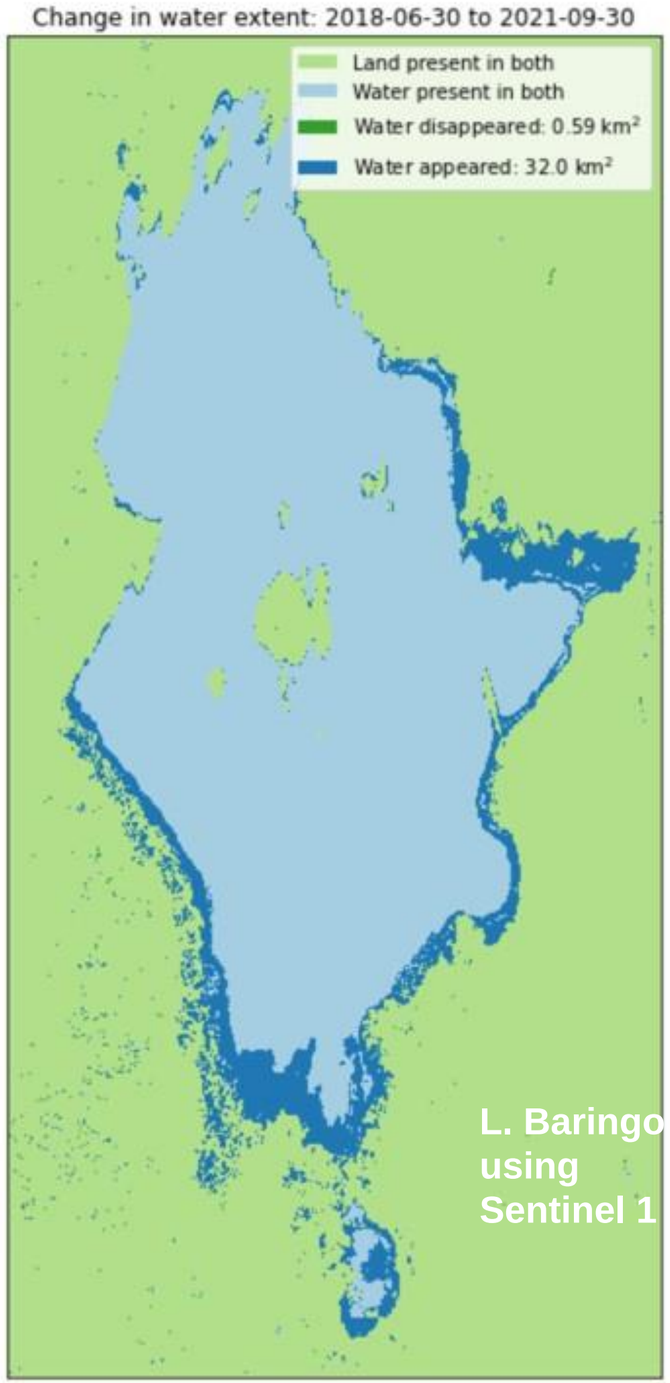
Mapping water extent and rainfa using Sentinel-1 and CHIRPS

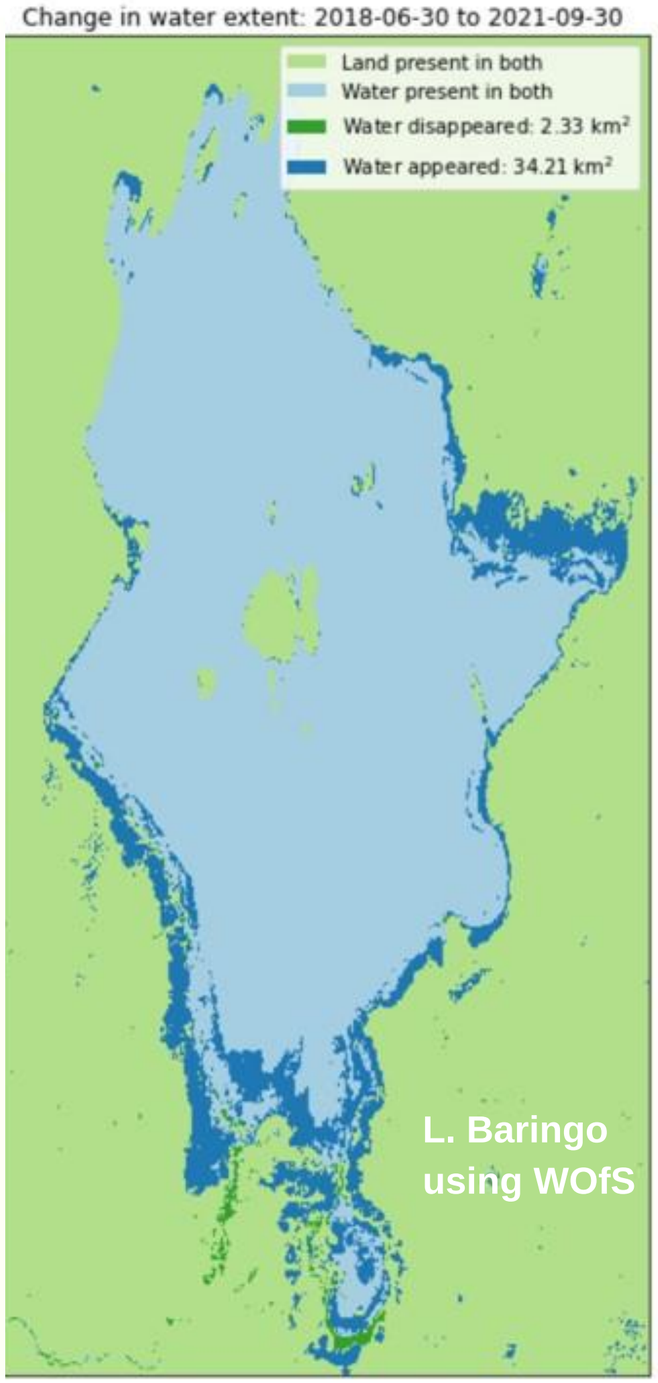
Compare water extent for two different periods using Sentinel versus WOfS)

Conclusion

- Similar results
- Address gaps
- Ground data – important – citizen generated data/statistics

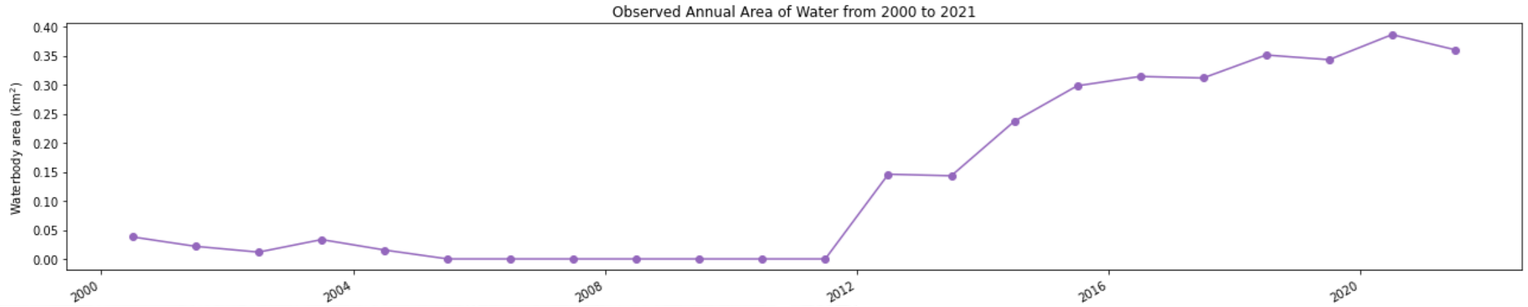
https://helpdesk.digitalearthafrica.org/portal/en/community/digital-earth-africa

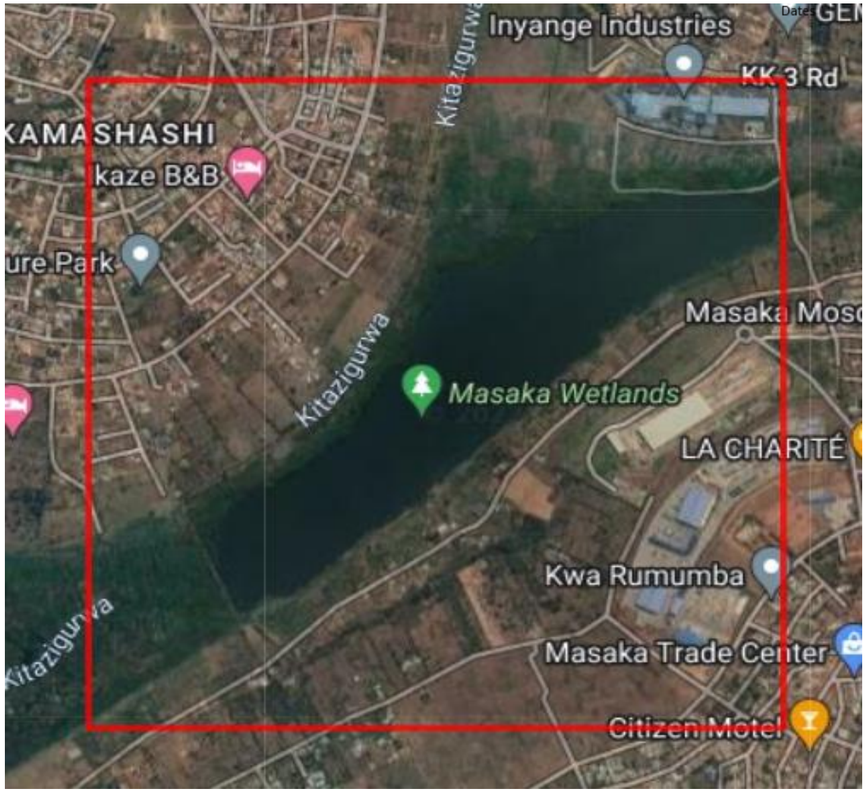




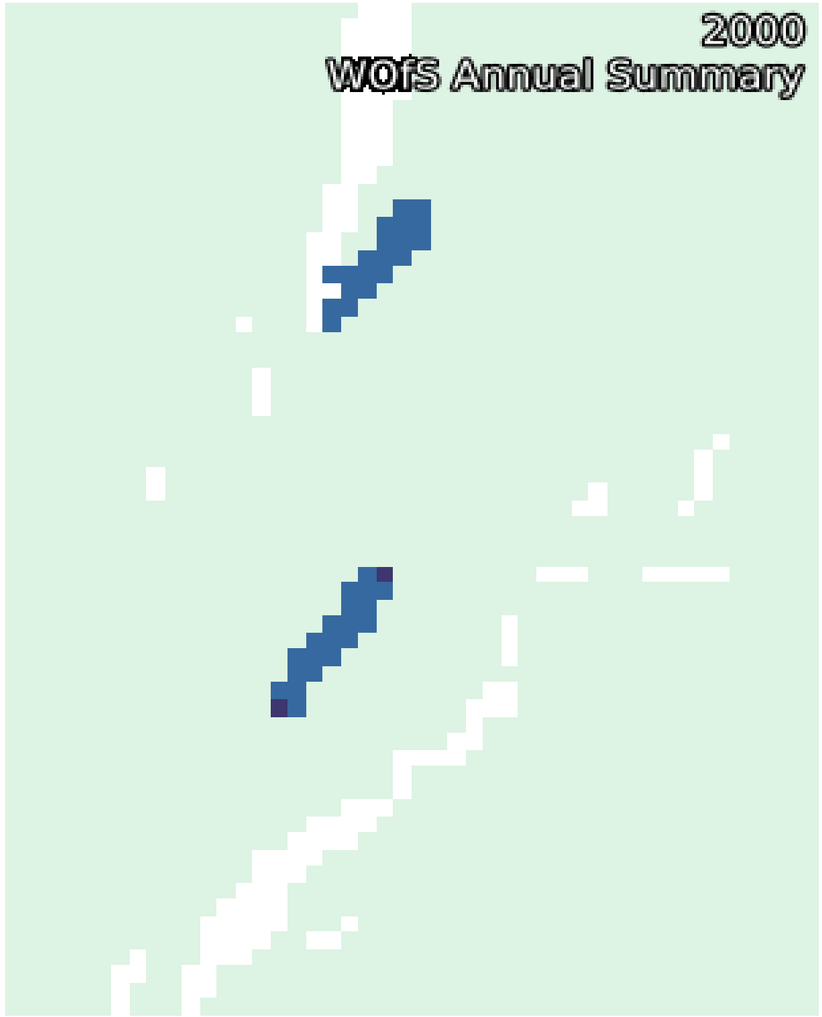
Water Observation from Space (WoFS)

Area: Masaka-Kabuga-Kigali, Rwanda (-1.992303, 30.182879)





- Appearance of a new water pond from 2013
- Through WOfS, we can monitor water extent and related hazards/benefits from 1980s to date
- This could be equally applied to other areas



How can I earn more hands-on skills?

- A link to the website https://www.digitalearthafrica.org
- The opportunity to subscribe to the DE Africa community to receive quarterly newsletters and invitations to attend events https://helpdesk.digitalearthafrica.org
- How to sign up to the DE Africa weekly Live Learning Sessions: every Wednesday at 11am, GMT zero) - ask questions and connect:

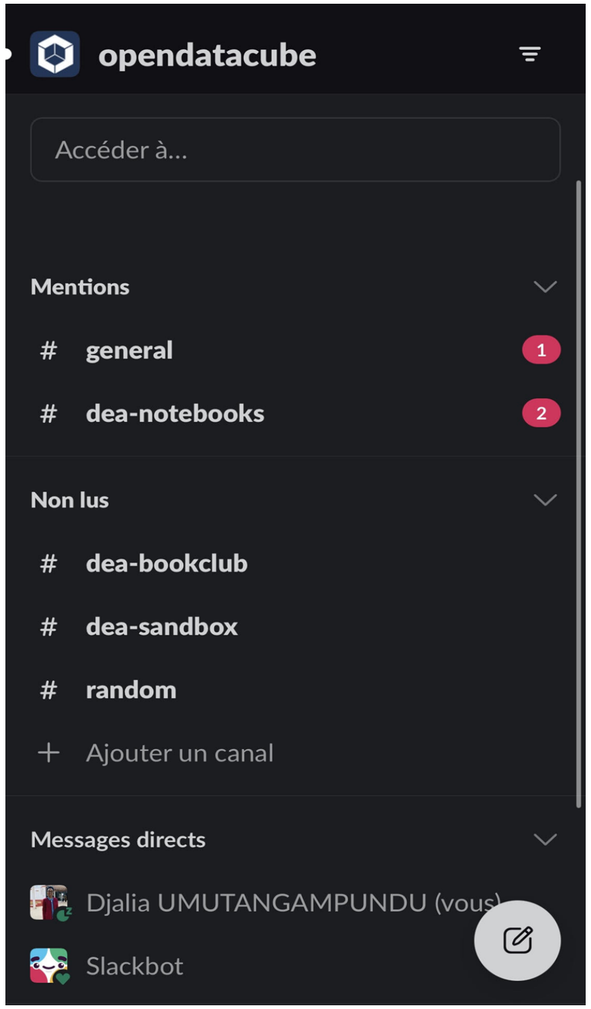
  https://zoom.us/j/5890793425

- The email address info@digitalearthafrica.org

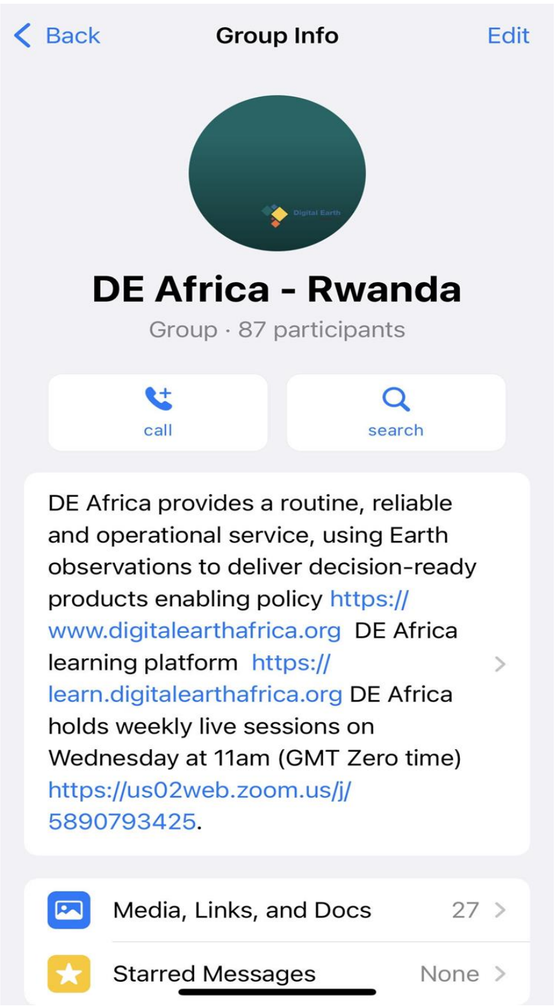
Support and knowledge exchange?

[DEA User Engagement]

[Slack Community: OpenDatacube]



[Country Whatsapp Groups]



Thank you Merci obrigada

Asante. E ṣeun. Murakoze.

Amesegnalaw. Weebale.

Jërëjëf. Kea leboga. meda wo ase

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Acknowledgment

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Q
A

Roundtable Discussions

Roundtable Discussions

1. Introduction and rules of the session – *Katharine Cross (AWP)*
2. Discussion in groups
3. Summary of each group

Roundtable Discussions – INSTRUCTIONS

Part 1: Discussion on barriers ***(10 min)***

Following from the presentations, what further barriers are there to the uptake of EO Services? Categorize barriers into:

- Knowledge/capacity/skills
- Technology
- Regulatory
- *Other barriers??*

Part 2: Develop a call to action on how the CoP can address the barriers and create opportunities for the uptake of EO services ***(20 min)***

- What can be done (practical action)?
- What steps need to be taken?
- Who should be involved and what will they do?

Barriers and problems in EO uptake

Causes	Effects	Solutions
• Lack of reliable data/monitoring (forecasts, WQ parameters, etc.) • Expensive EO tools and services • Low capacity (workers and stakeholders un- or misinformed about EO applications) • Little to no trust • Geopolitical hindrances • Relevance of warnings	• Decrease in infrastructural integrity • Inconsistent/decreased service provision • Loss of aquaculture/stock/produce • High repair costs • Hesitance to uptake by utilities and policy makers • Data unused and/or standardised	• Coupling EO services with other methodologies (climate models, machine learning, local knowledge) • Regional stakeholders pooling funds to help each other • End user capacity building specific to region/sector • Data and experience sharing

Future MUP topics: monitoring, decision support systems and forecasting

Roundtable Discussions– Summary

Expected Outputs:

- Tangible calls-to-action on how to address barriers; who needs to be involved, and what needs to be done.
- How can members of the CoP help facilitate these calls-to-action

IWA World Water Congress & Exhibition

11 – 15 September 2022 | Copenhagen, Denmark

Wrap Up

Katharine Cross, Australian Water Partnership