



Digital Earth
AFRICA



DE Africa Coastlines service to
inform climate actions in Indian
Ocean Region

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User Engagement Manager
Digital Earth Africa



About Digital Earth Africa



Our vision

DE Africa will provide a routine, reliable and operational service, using Earth observations to deliver decision-ready products enabling policy makers, scientists, the private sector and civil society to address social, environmental and economic changes on the continent and develop an ecosystem for innovation across sectors.

Our mission

DE Africa will process openly accessible and freely available data to produce decision-ready products. Working closely with the AfriGEO community, DE Africa will be responsive to the information needs, challenges and priorities of the African continent. DE Africa will leverage and build on existing capacity to enable the use of Earth observations to address key challenges across the continent.



Open and Free Data

- Interoperability
- Privacy and Integrity



Operational Service

- Continental-scale
- Sustainable
- Domain expertise



Accountability and transparency

- Responsive to African priorities
- Agile, nimble and actions oriented



Diversity and inclusion

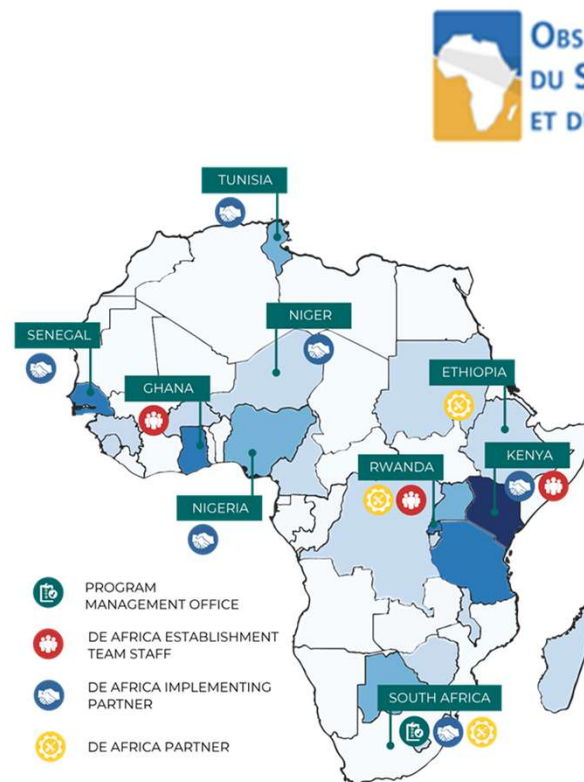
- Multi-sector perspectives
- Span data communities
- Foster collaboration

The governance of DE Africa is guided by several key principles

Implementing Partners

Digital Earth Africa is working with partners across Africa:

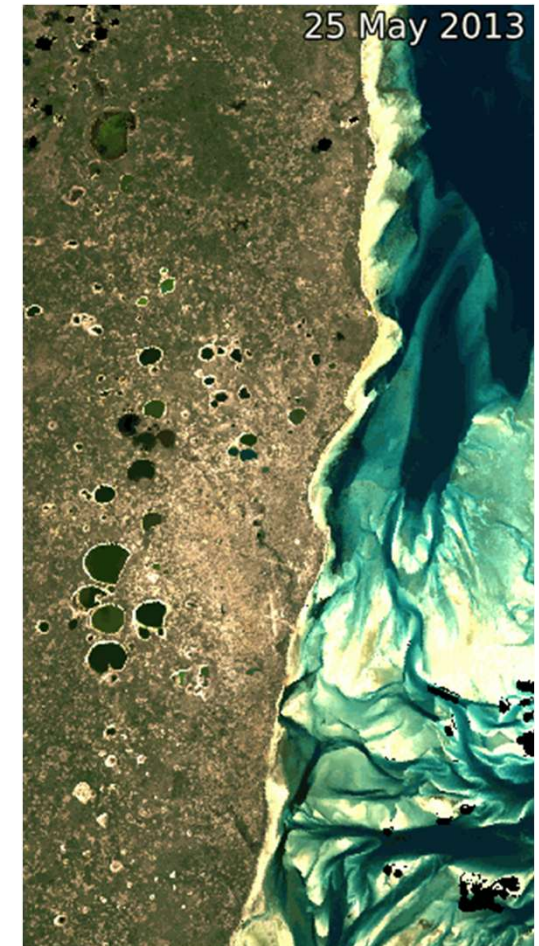
- African Regional Institute for Geospatial Science and Technology (AFRIGIST), **Nigeria**
- AGRHYMET Regional Centre, **Niger**
- Centre de Suivi Ecologique (CSE), **Senegal**
- Regional Centre for Mapping for Resource Development (RCMRD), **Kenya**
- Observatoire du Sahara et du Sahel (OSS), **Tunisia**
- AfriGEO



Digital Earth Africa's continental-scale satellite data archive



- 37 years (> 3 petabytes) of Landsat and Sentinel-2 satellite imagery from 1986
- Freely accessible in the cloud via Open Data Cube and AWS S3 + STAC
- Continental scale products and services
- Analysis tools and training materials
- Different interfaces for difference needs



https://docs.digitalearthafrika.org/en/latest/data_specs/Coastlines_specs.html?highlight=coastline

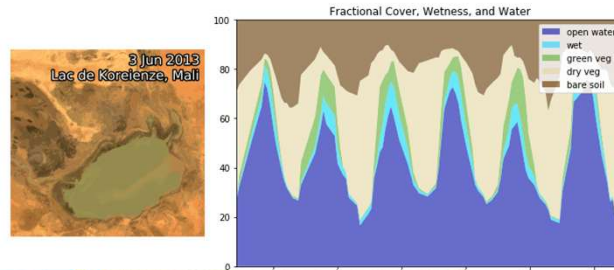
DE Africa Continental Services



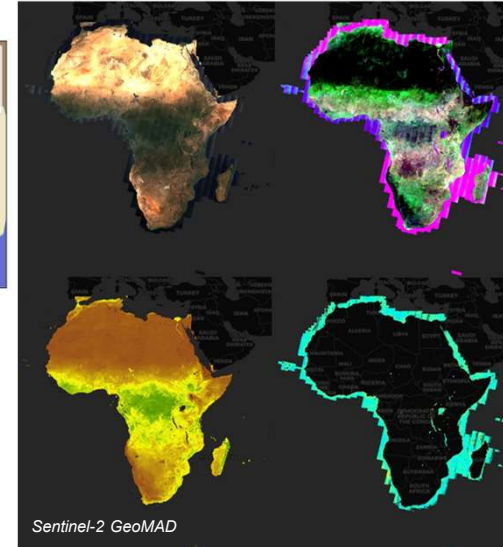
- 3.1PB data in Cape Town
- Multiple continental scale operational services
- Extensive library of SDG-oriented tools
- Product co-design with Africa partners



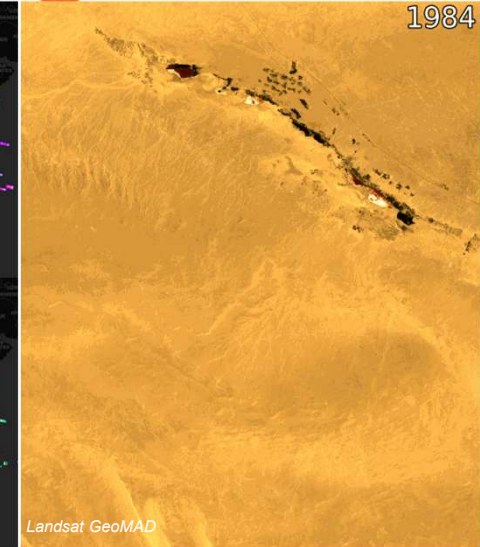
OPEN DATA CUBE



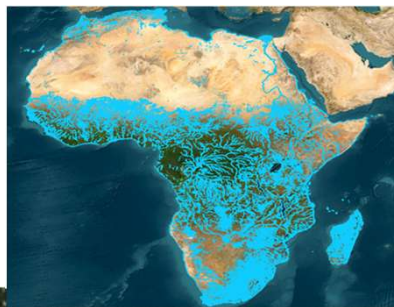
coastline service



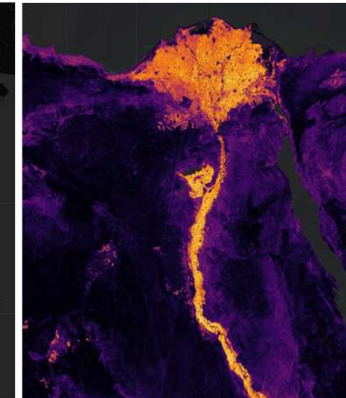
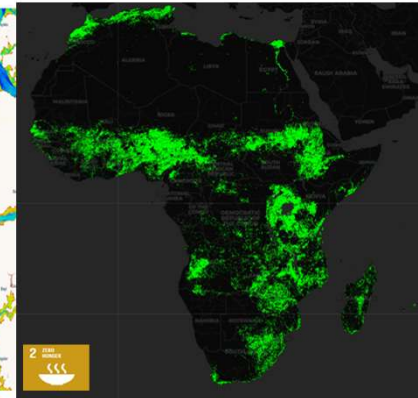
Sentinel-2 GeoMAD



Landsat GeoMAD



Water Observation from Space



Cropland extent map

The Context

Coasts serve as major socio-economic hubs for 38 African countries:

- Africa's coastal areas host half of the 15 African megacities which are fast expanding due to migration and population growth
- Coastal communities and the blue economy are vulnerable to the impacts of climate change

Issues

- Rising sea levels and rates of coastal erosion
- Need for effective management of coastal changes and mitigation of risk, as well as sustainable coastal zone management



Digital Earth Africa Coastlines

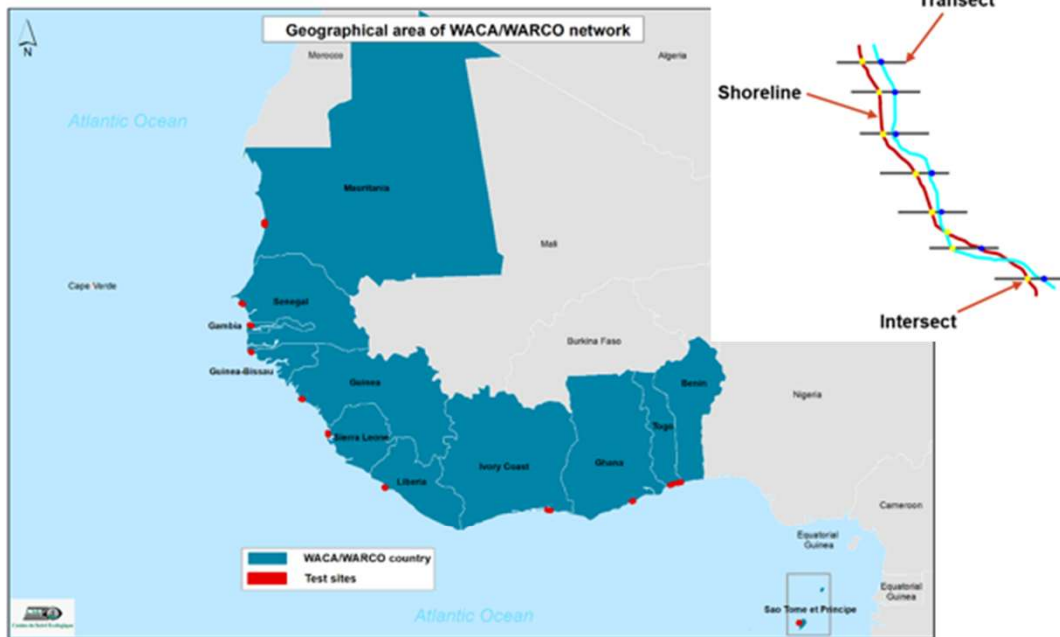


- **Adapted from the Australian Coastlines**
- **Co-developed and validated** with implementing **partners in Africa**: Centre de Suivi Ecologique (CSE) – Senegal, RCMRD – Kenya
- **First Africa-wide** Coastlines monitoring service
- Tracks continental changes **from 2000 to present**
- Monitors more than **60,000 km of coast** with **30 m spatial resolution**
- Provides **free interactive access** to
 - Hotspots
 - Rates of changes
 - Average yearly shorelines



Impactful in addressing

Coastlines Validation:

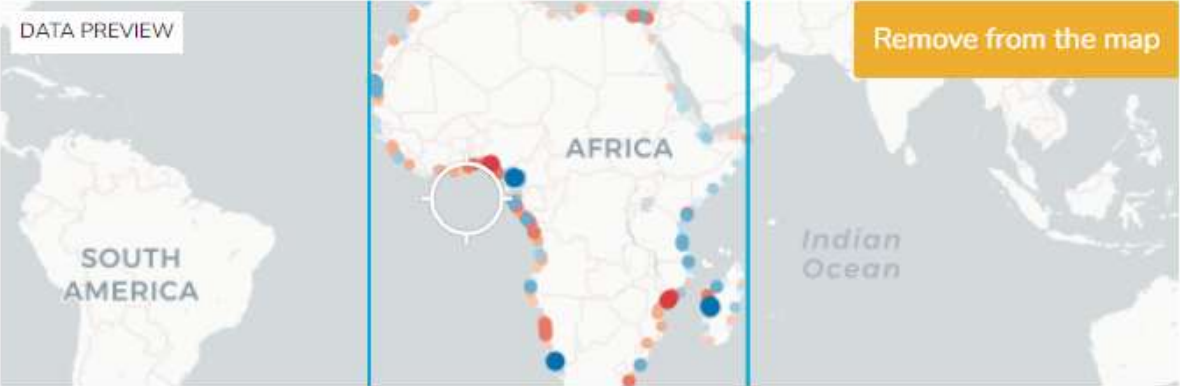


Pays	Min	Max	MAE	RMSE (m)	RMSE %	RMSE (Px)	PRECISION
Mauritanie	0,00	31,29	7,17	8,79	29,30	2/5	Bonne
Sénégal	0,36	10,17	4,51	5,42	18,07	1/5	Très bonne
Gambie	0,00	22,32	5,26	7,77	25,90	2/5	Bonne
Guinée Bissau	0,37	16,00	6,41	7,80	26,00	2/5	Bonne
Guinée	0,25	24,81	8,14	9,75	32,50	2/5	Bonne
Libéria	0,12	17,15	8,21	9,31	31,03	2/5	Bonne
Sierra Leone	0,02	21,43	6,21	7,87	26,23	2/5	Bonne
Côte d'Ivoire	0,15	12,50	4,34	5,48	18,27	1/5	Très bonne
Ghana	2,43	17,44	10,33	10,91	36,37	2/5	Bonne
Togo	0,01	16,30	2,95	4,39	14,63	1/5	Très bonne
Benin	0,00	14,85	4,83	5,61	18,70	1/5	Très bonne
Sao Tomé et Príncipe	0,02	12,19	2,64	4,12	13,73	1/5	Très bonne
Moyenne	0,31	18,04	5,92	7,27	24,23	2/5	Bonne



<https://www.digitalearthafrika.org/media-center/blog/monitoring-coastal-erosion-africa-using-earth-observation-data>

Monitoring coastal erosion



- Free images from satellites such as NASA/USGS Landsat, Copernicus Sentinel-1/2
- Use optical images
- Possibility to use sentinel-1 radar
- Effects of water quality and tide height



DE Africa Coastlines

DE Africa Coastlines
Time: 2022-01-01T00:00:00.000000000Z

Retreat (m / year)

- 5.0 m +
- 3.0 to -5.0 m
- 1.0 to -3.0 m
- 0.5 to -1.0 m
- 0.3 to -0.5 m
- 0.0 to -0.3 m
- no significant change or low certainty
- 0.0 to 0.3 m
- 0.3 to 0.5 m
- 0.5 to 1.0 m
- 1.0 to 3.0 m
- 3.0 to 5.0 m
- 5.0 m +

Annual shorelines

Most recent

Oldest (2000)

Growth (m / year)

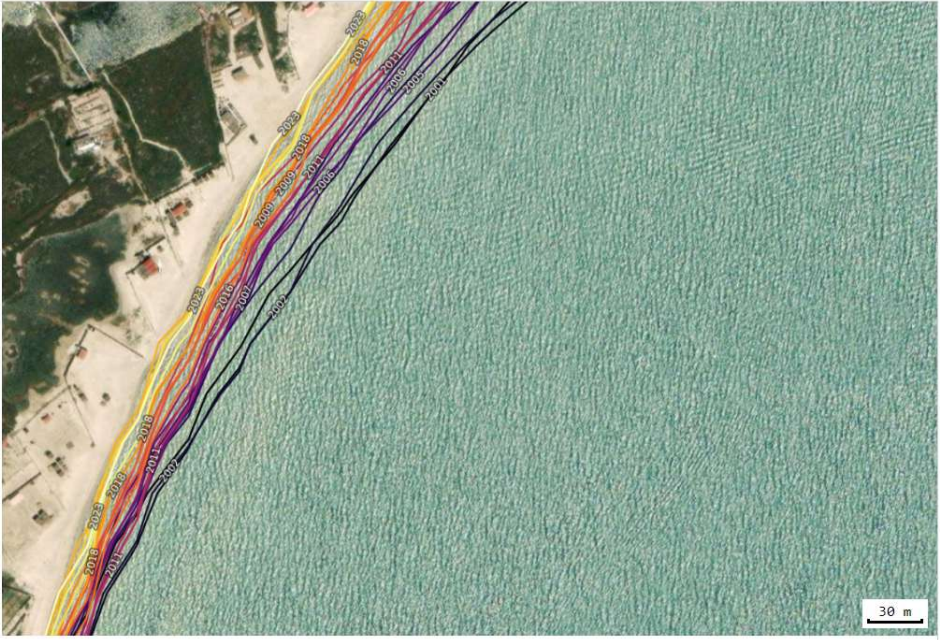
- Good quality
- Low quality

Water Observations from Space annual summary

Styles: Water frequency (Legacy colourmap)

Water Observations from Space annual summary
Time: 2022-01-01T00:00:00.000000000Z

0 20 40 60 80 100 120
Water frequency (legacy colourmap)



Suivi de l'érosion cotière

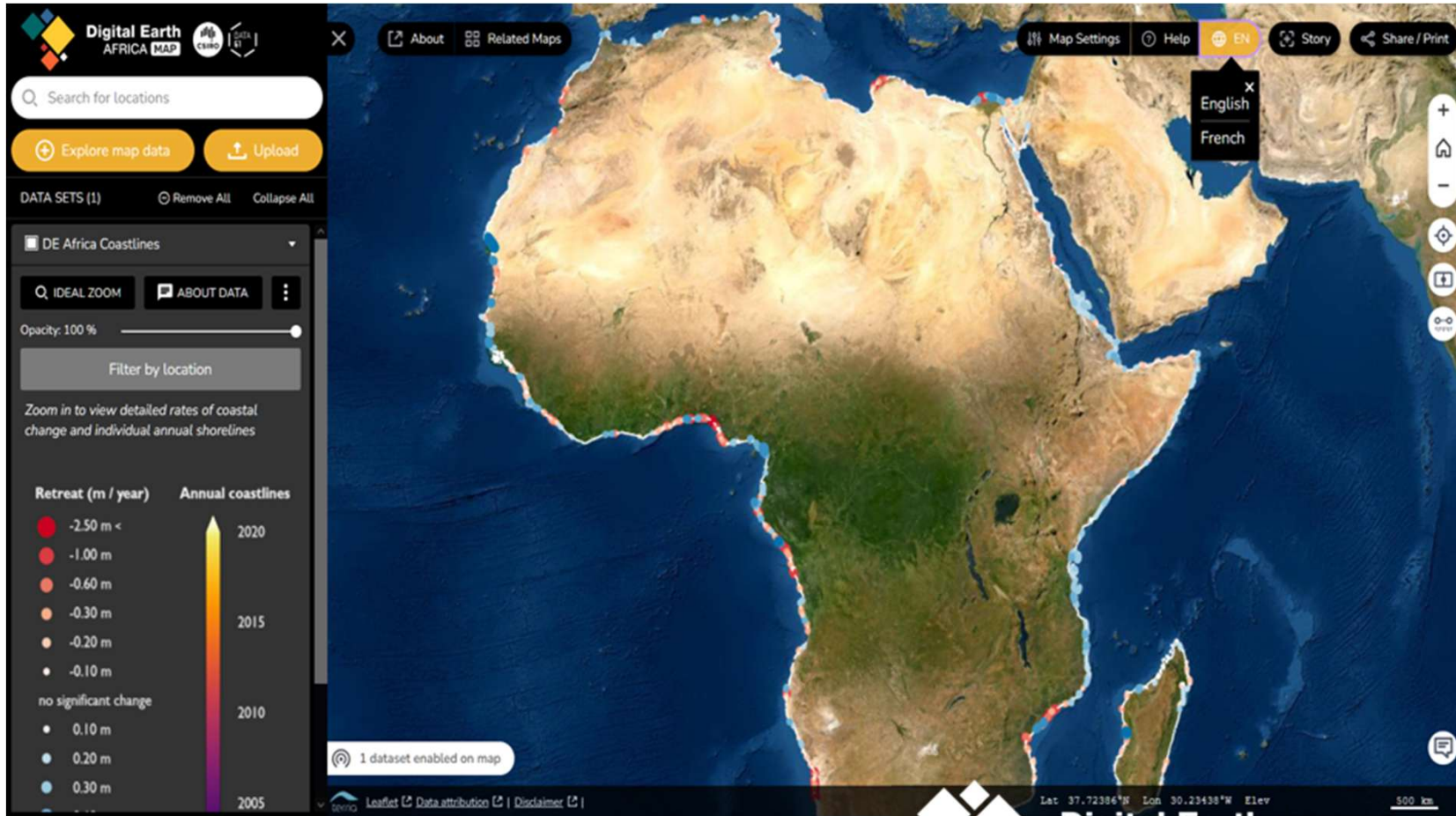


- Continental service operational
- Co-developed and validated in collaboration with CSE and RCMRD
- Possibility of refining on a small scale
- Accessible via maps, sandbox and OWS

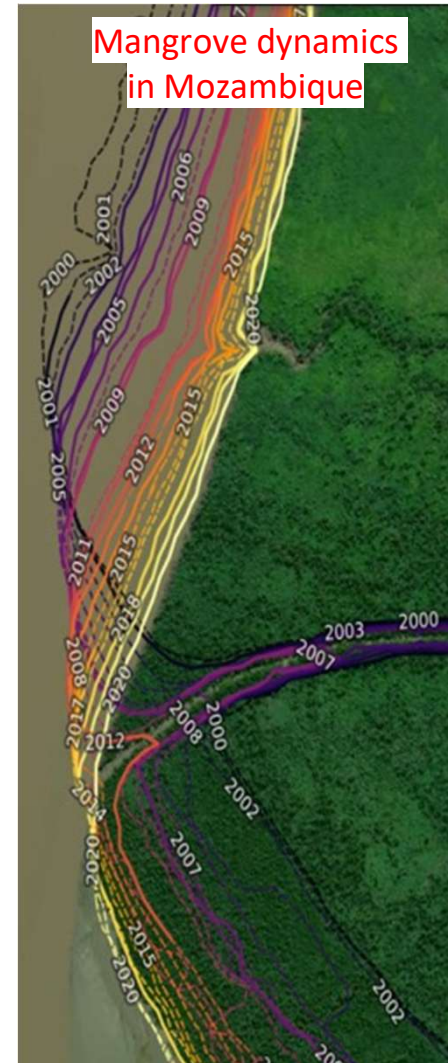
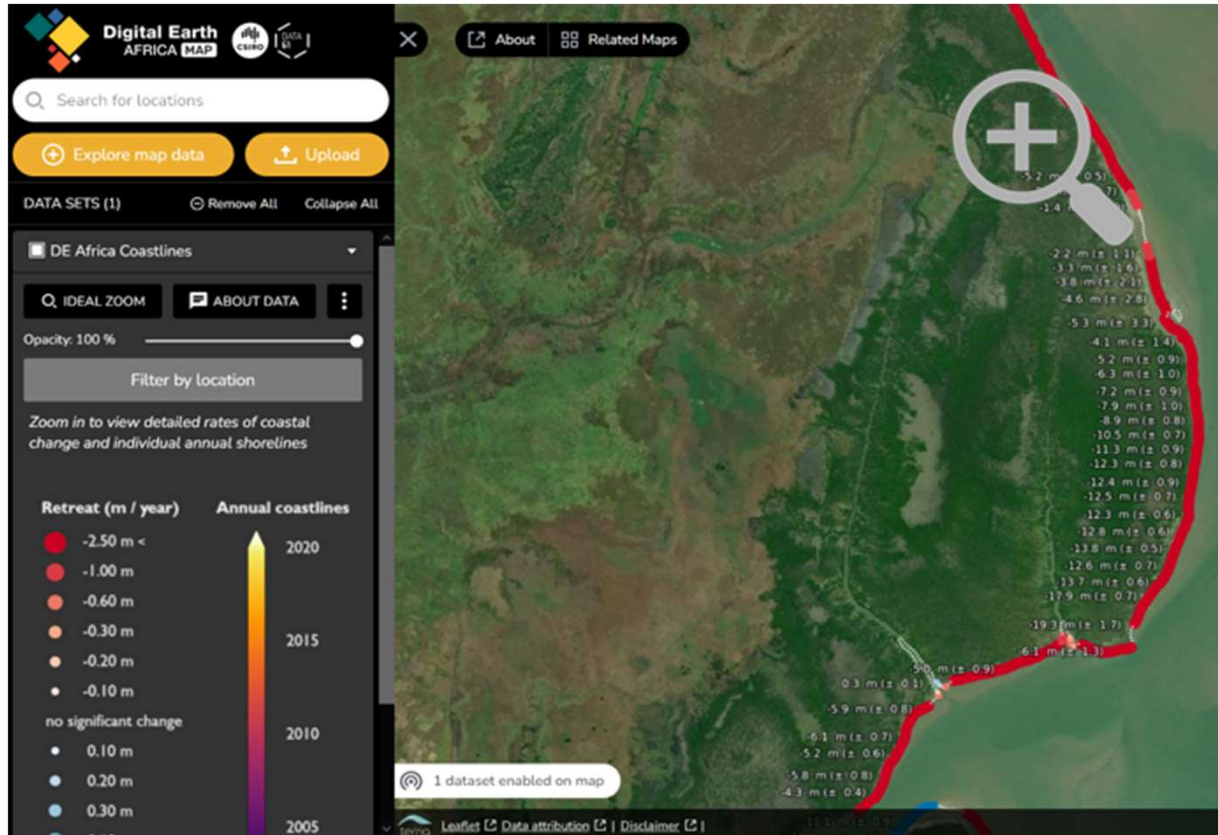
<https://www.youtube.com/watch?v=k7S49TX7SHE>

View it on the Maps

<https://maps.digitalearth.africa/>



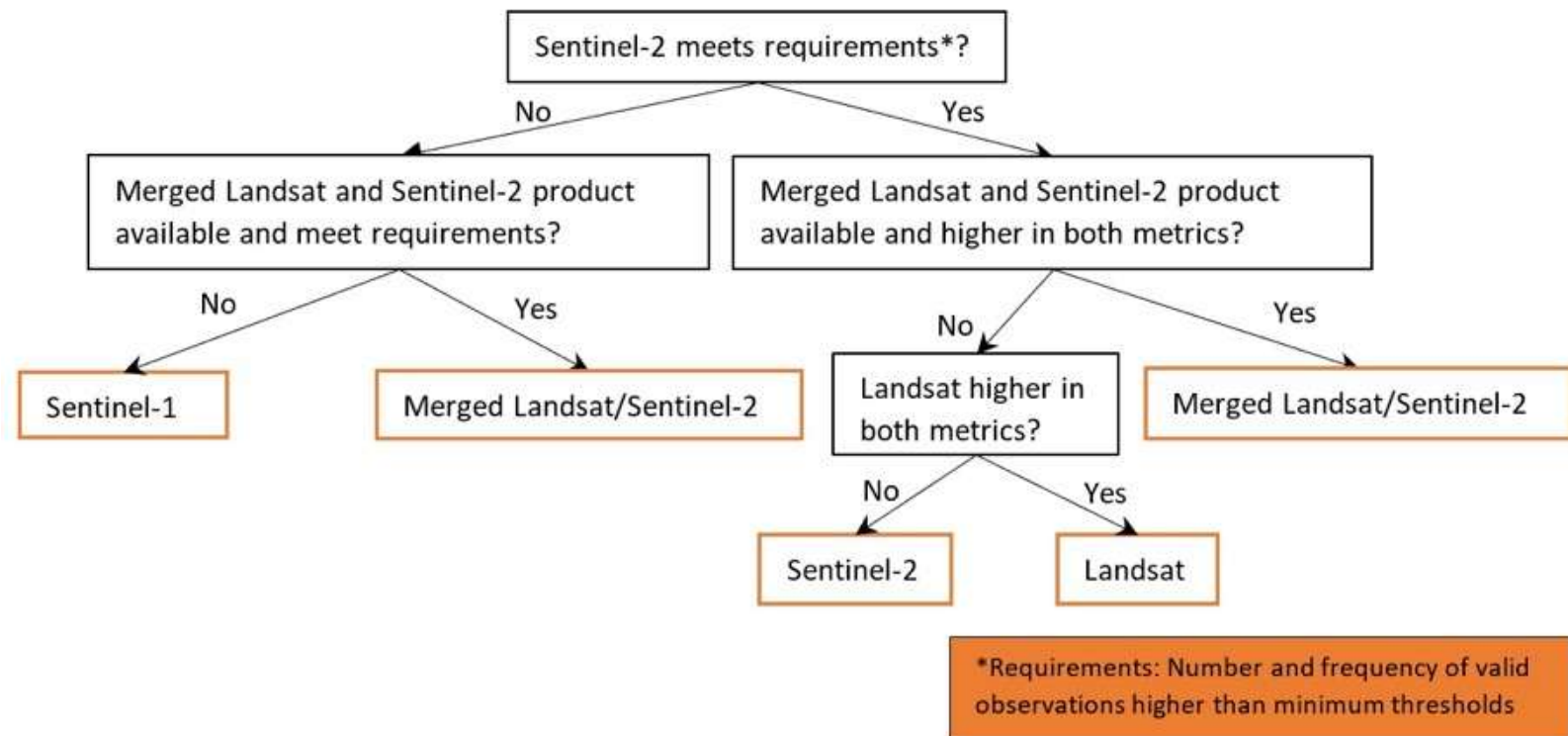
Identify hot spots and rates of change



DE Africa coastal erosion-adapted at small scale



This notebook shows how to load, plot, and conduct a simple analysis using the `Digital Earth Africa Coastlines` Process the **selected data** and generate annual composite images for each year: lat=-12.27, lon=43.726, buffer=0.01, Fomboni, Comoros KM



DE Africa coastal erosion

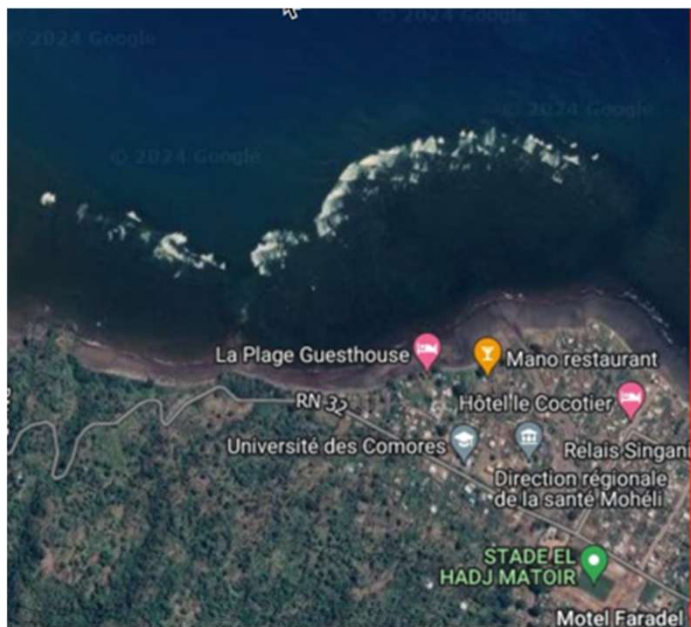
<https://sandbox.digitalearth.africa/>



This notebook shows how to load, plot, and conduct a simple analysis using the `Digital Earth Africa Coastlines`

1. Query the satellite data and select best available product
2. Process the selected data and generate annual composite images for each year
3. Extract shorelines and calculate rates of coastal change

Example: lat=-12.27, lon=43.726, buffer=0.01, Fomboni, Comoros KM



https://github.com/digitalearthafrica/deafrica-sandbox-notebooks/blob/main/Real_world_examples/Coastal_erosion.ipynb

<https://maps.digitalearth.africa/#share=s-h6rAlHhQCpTPv6mlauYF4DH5Vf>

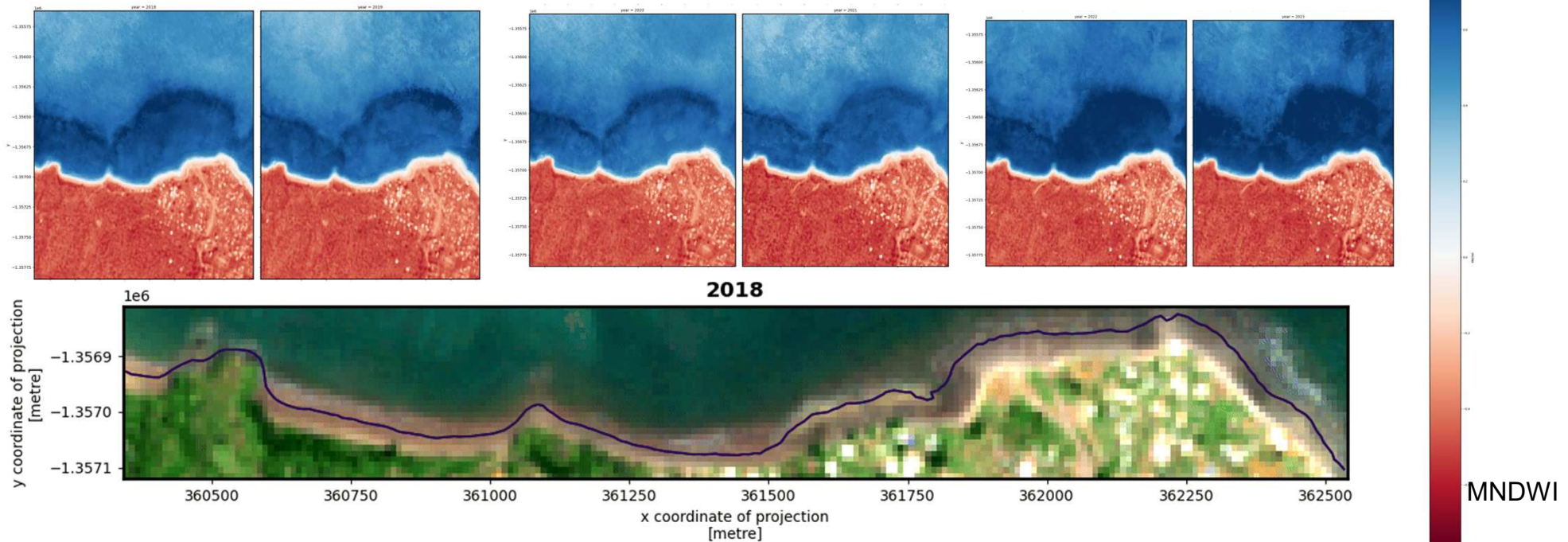
DE Africa coastal erosion

<https://sandbox.digitalearth.africa/>



This notebook shows how to load, plot, and conduct a simple analysis using the `Digital Earth Africa Coastlines`

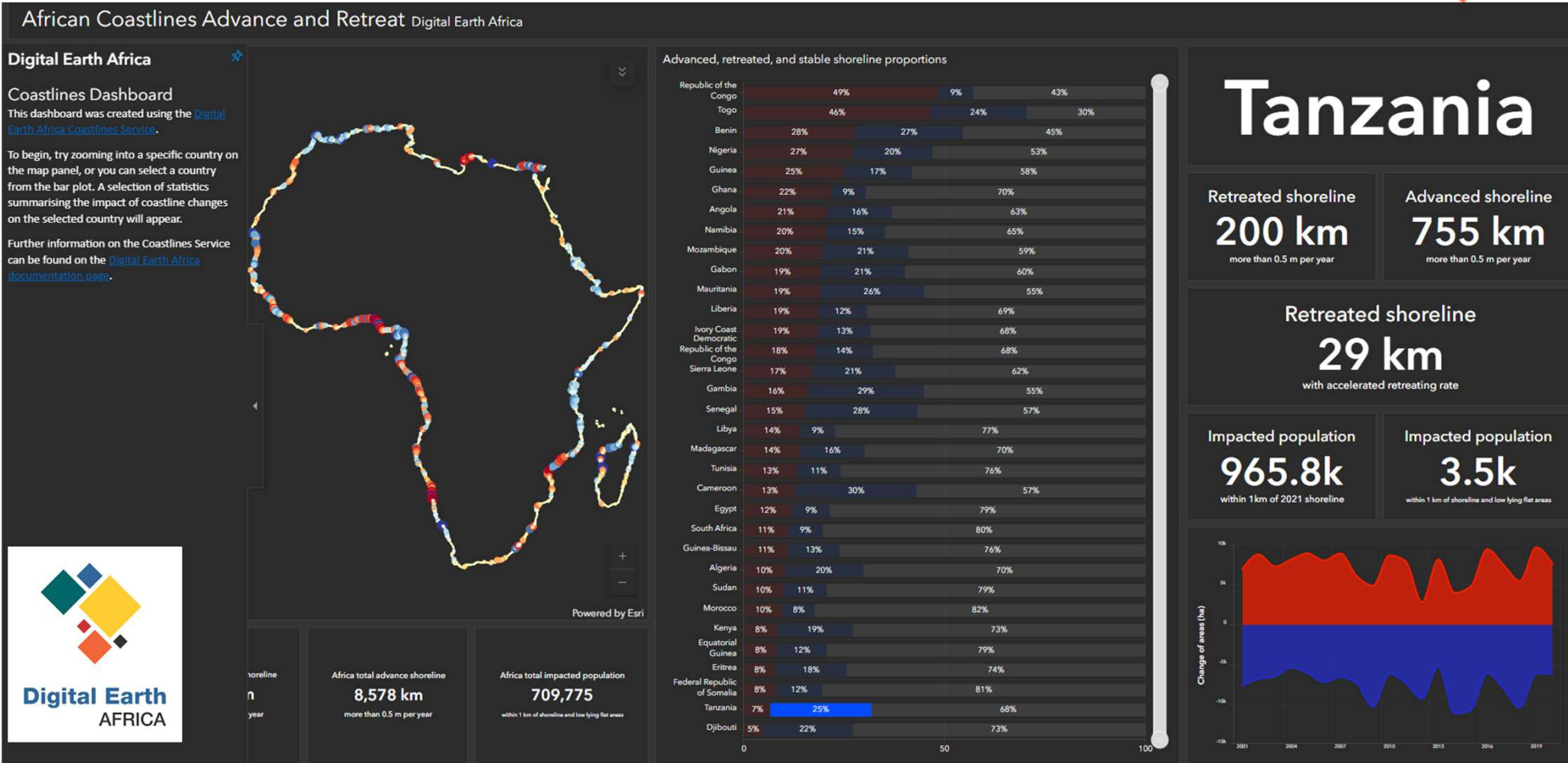
1. Query the satellite data and select best available product
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https://github.com/digitalearthafrika/deafrica-sandbox-notebooks/blob/main/Real_world_examples/Coastal_erosion.ipynb

DE Africa coastlines dashboard

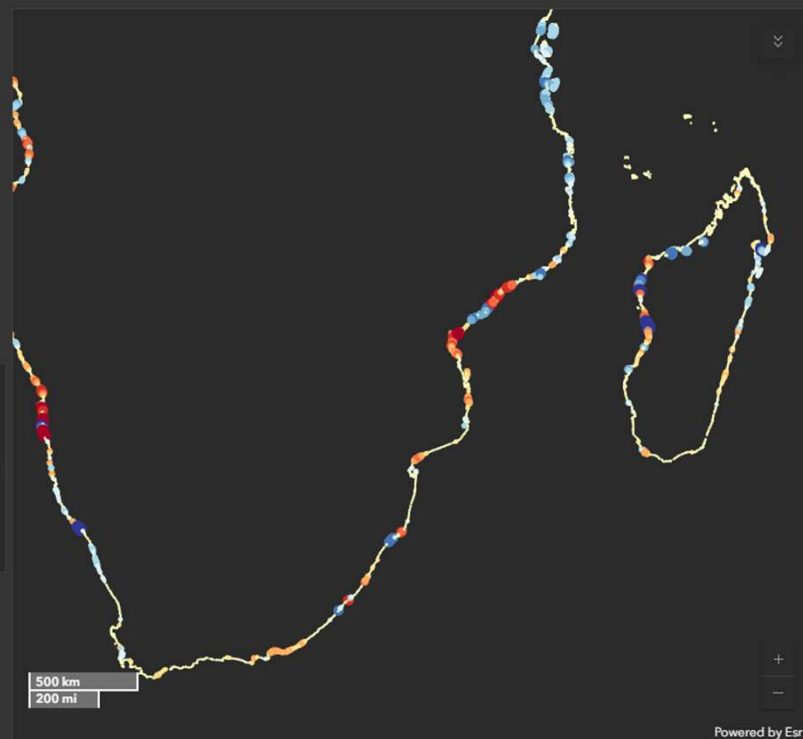


<https://afri.cageoport.al.maps.arcgis.com/apps/dashboards/1d25d95b5854e56a3111bdbe0c9499f>

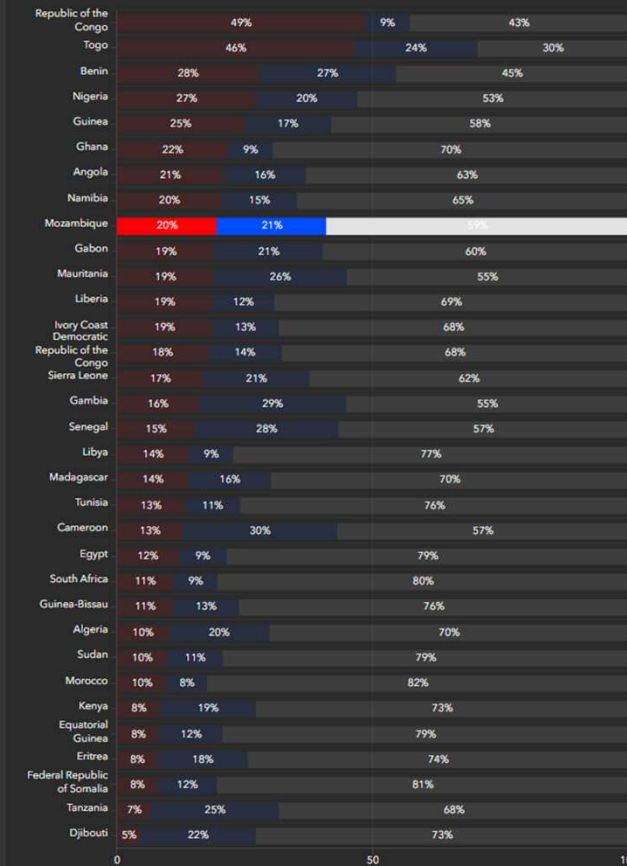
DE Africa coastlines dashboard



African Coastlines Advance and Retreat Digital Earth Africa



Advanced, retreated, and stable shoreline proportions



Mozambique

Retreated shoreline

1k km

more than 0.5 m per year

Advanced shoreline

1k km

more than 0.5 m per year

Retreated shoreline

169 km

with accelerated retreating rate

Impacted population

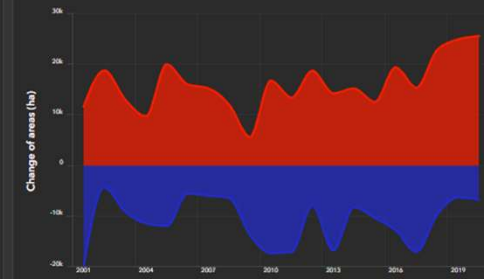
848.4k

within 1 km of 2021 shoreline

Impacted population

53.5k

within 1 km of shoreline and low lying flat areas



Africa total retreated shoreline
7,582 km
more than 0.5 m per year

Africa total advance shoreline
8,578 km
more than 0.5 m per year

Africa total impacted population
709,775
within 1 km of shoreline and low lying flat areas

<https://africageoport.al.maps.arcgis.com/apps/dashboards/1d25d95b5854e56a3111bdbe0c9499f>

DE Africa coastline in Africa Geo Portal



Data Library

Learning Center

Geospatial Tools

Community ▾

<https://www.africageoportal.com/>

DISCOVER

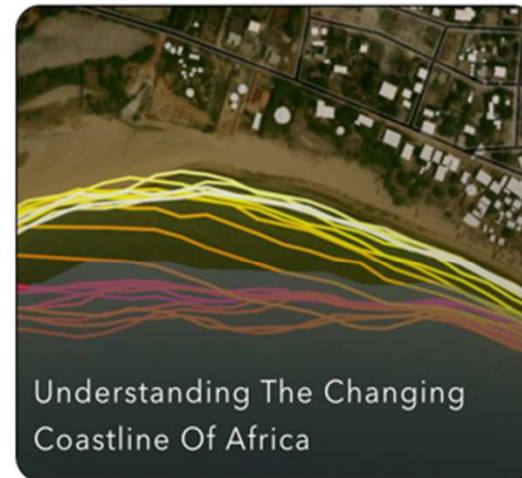
Featured Content

The Africa GeoPortal hosts an extensive collection of readily accessible datasets and maps. These resources include contributions from Esri, as well as data shared by users and organizations with a focus on Africa. By combining this data with your own, you can create a more comprehensive understanding, discover solutions, and improve your decision-making capabilities.

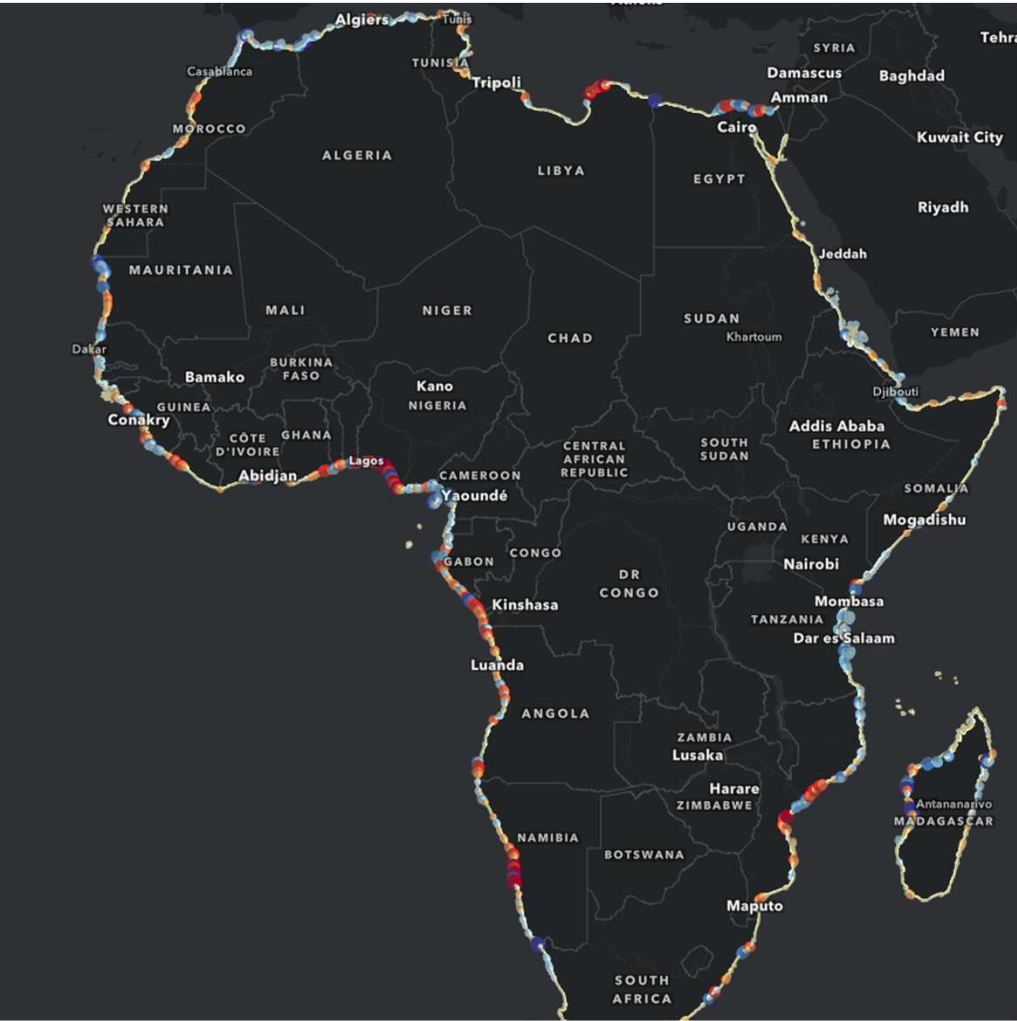
DATA LIBRARY

<https://storymaps.arcgis.com/stories/d3b9843486064c72a8d72cdc4e780fa3>

<https://africageoportal.maps.arcgis.com/apps/mapviewer/index.html?webmap=c25500f0271d481ea31aa2e321930b5c>



DE Africa coastline in Africa Geo Portal



Legend

Coastlines Hotspots in Africa

Coastlines hotspots 15km
annual rate of change

- 2.5 m >
- 1.0 to 2.5 m
- 0.6 to 1.0 m
- 0.3 to 0.6 m
- 0.2 to 0.3 m
- 0.2 to -0.2 m
- -0.2 to -0.3 m
- -0.3 to -0.6 m
- -0.6 to -1.0 m
- -1.0 to -2.5 m
- -2.5 m <

- Understand the trends of coastlines along the Africa coast
- Easy to use by non experts in EO including journalists

<https://africageoportal.maps.arcgis.com/apps/mapviewer/index.html?webmap=c25500f0271d481ea31aa2e321930b5c>

Africa's Impacted Resources from Changing Shorelines

Select year
2000 - 2021

Impacted Area

Most Impact

Madagascar

Total	Growth	Retraction
1,530 km ²	812 km ²	718 km ²

Mozambique

Total	Growth	Retraction
1,127 km ²	590 km ²	537 km ²

Egypt

Total	Growth	Retraction
545 km ²	265 km ²	280 km ²

South Africa

Total	Growth	Retraction
496 km ²	273 km ²	223 km ²

Somalia

Total	Growth	Retraction
477 km ²	278 km ²	199 km ²

Angola

Total	Growth	Retraction
359 km ²	169 km ²	189 km ²

Eritrea

Total	Growth	Retraction
472 km ²	294 km ²	177 km ²

Tanzania

Total	Growth	Retraction
496 km ²	321 km ²	175 km ²

Nigeria

Total	Growth	Retraction
285 km ²	120 km ²	165 km ²

Guinea

Total	Growth	Retraction
265 km ²	108 km ²	158 km ²



Esri, TomTom, FAO, NOAA, USGS | The Coastlines algorithms incorporated in this product are the work of Robbi-Bishop Taylor, R... Powered by Esri

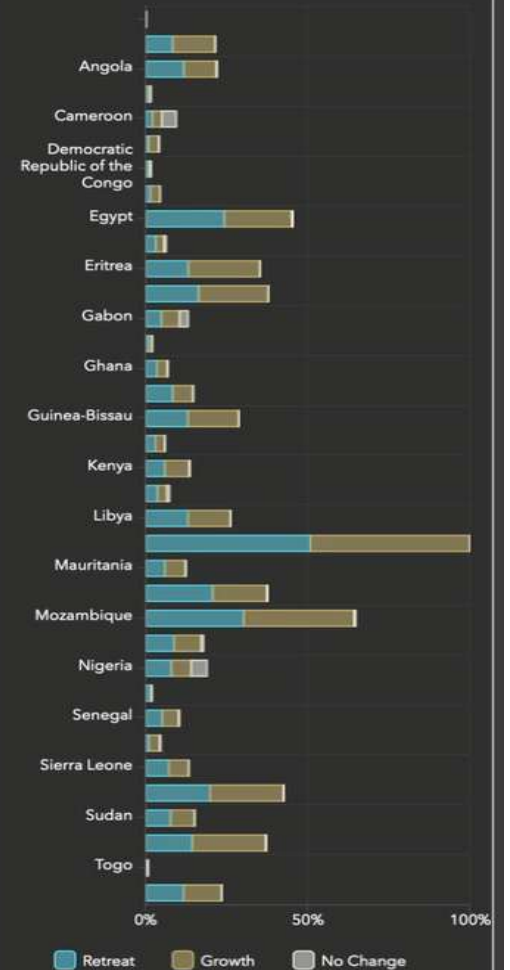
Impacted Land Cover (km²)

Population	Built Areas	Croplands	Forests	Mangroves
👤 3,090,000	🏠 20,400	🌾 63,900	🌳 7,900	🌿 8,538

Impacted Infrastructure

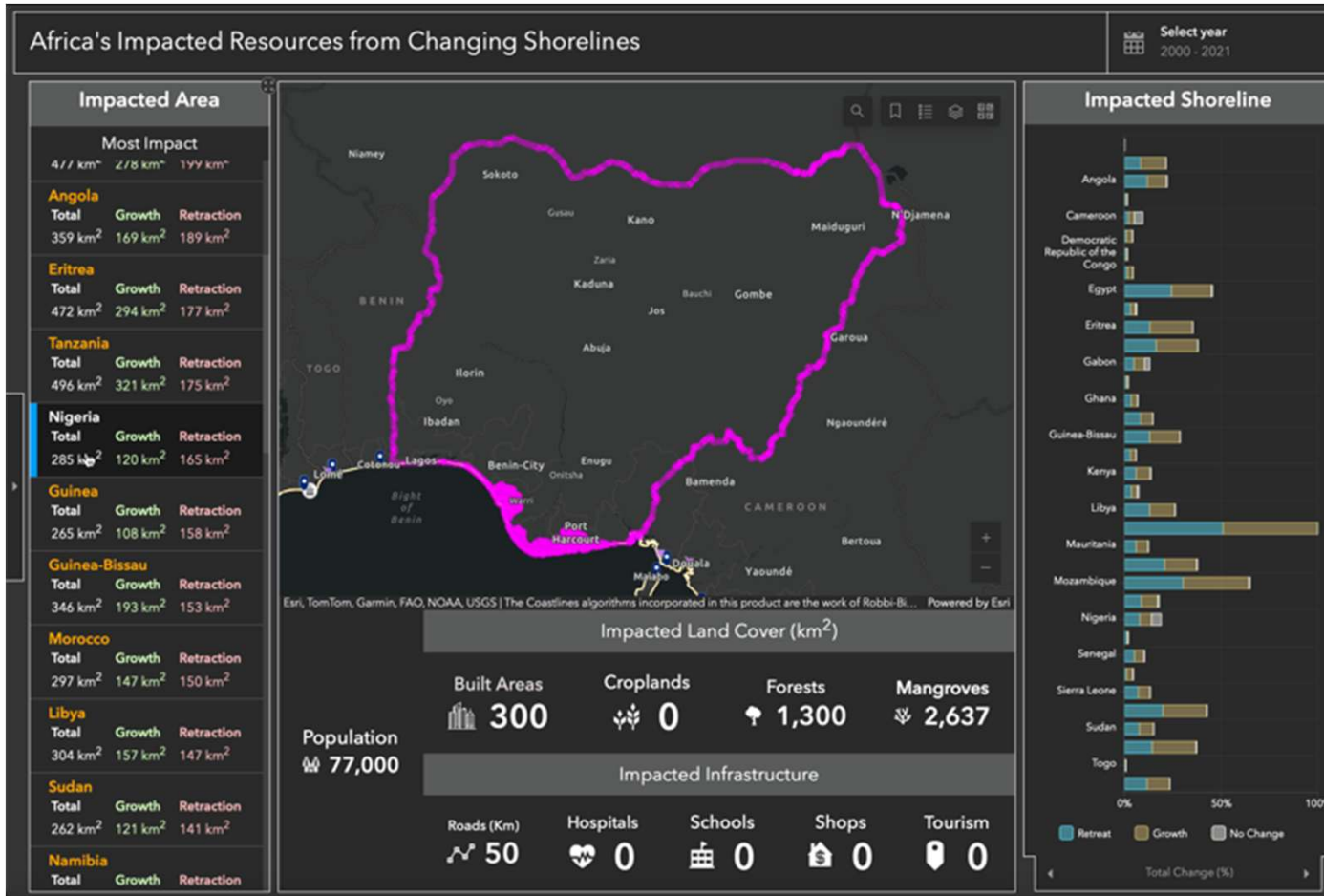
Roads (Km)	Hospitals	Schools	Shops	Tourism
🛣️ 7340	🏥 6	🎓 14	🏪 339	🏰 532

Impacted Shoreline



Total Change (%)

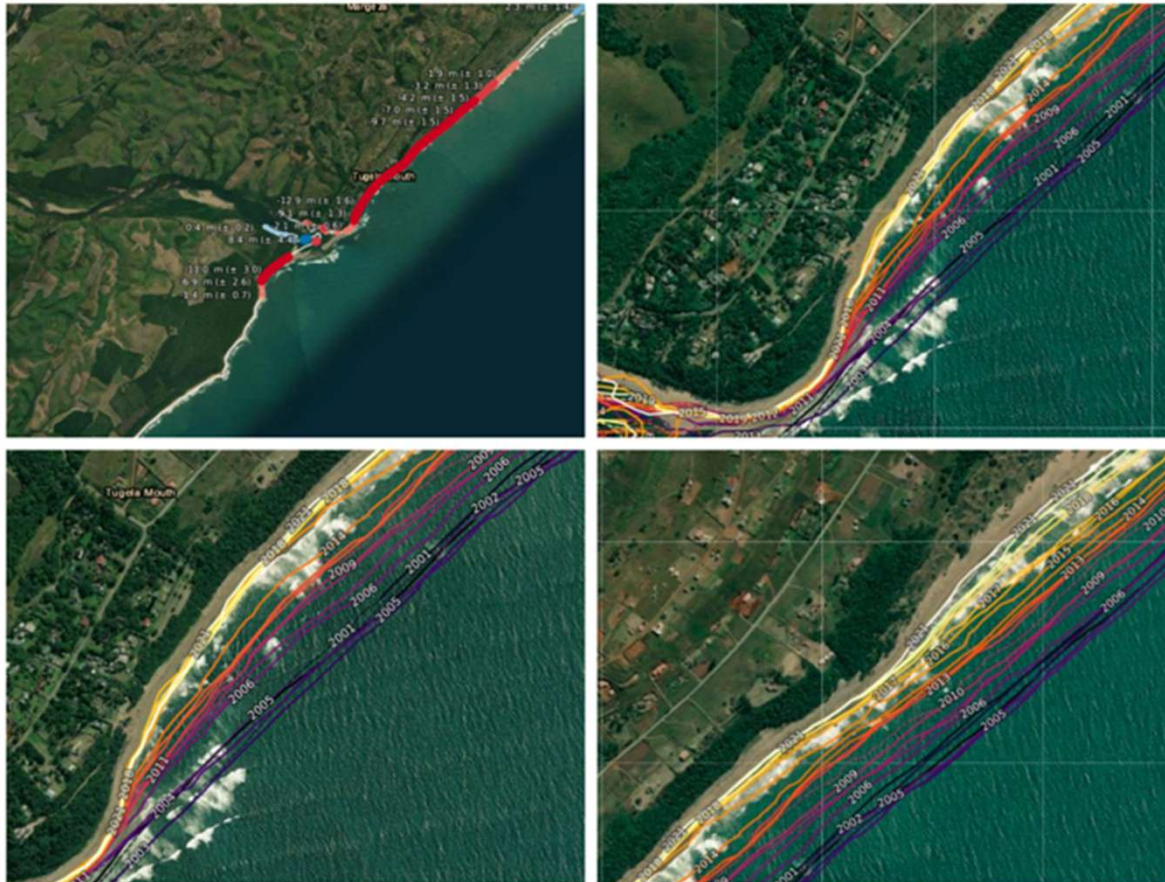
Digital Earth Africa coastline in Africa Geo Portal



Digital Earth Africa coastline service providing insights into coastal erosion in Africa such in this example, 77000 are vulnerable to coastal flooding and a key service to help Nigeria update its coastal management plans. This dashboard has been developed by Esri on Africa GeoPortal, empowering communities.

<https://africageoportal.maps.arcgis.com/apps/dashboards/35de25728e834383af0bb21566d2029e>

Monitoring coastline change in the Kwa-Zulu Natal Tugela River mouth using Coastlines on DE Africa maps showing how coastlines have retreated over the years.



Coastal Risk & Vulnerability

This research blog is aimed at describing the nature of coastal risks and vulnerability in South Africa, highlighting the commonly experienced threats that leave coastal communities, infrastructure and ecosystems more susceptible to hazardous events.

13 CLIMATE ACTION

14 LIFE BELOW WATER

15 LIFE ON LAND

Monitoring coastline change in the Kwa-Zulu Natal Tugela River mouth using Coastlines on DE Africa maps showing how coastlines have retreated over the years.

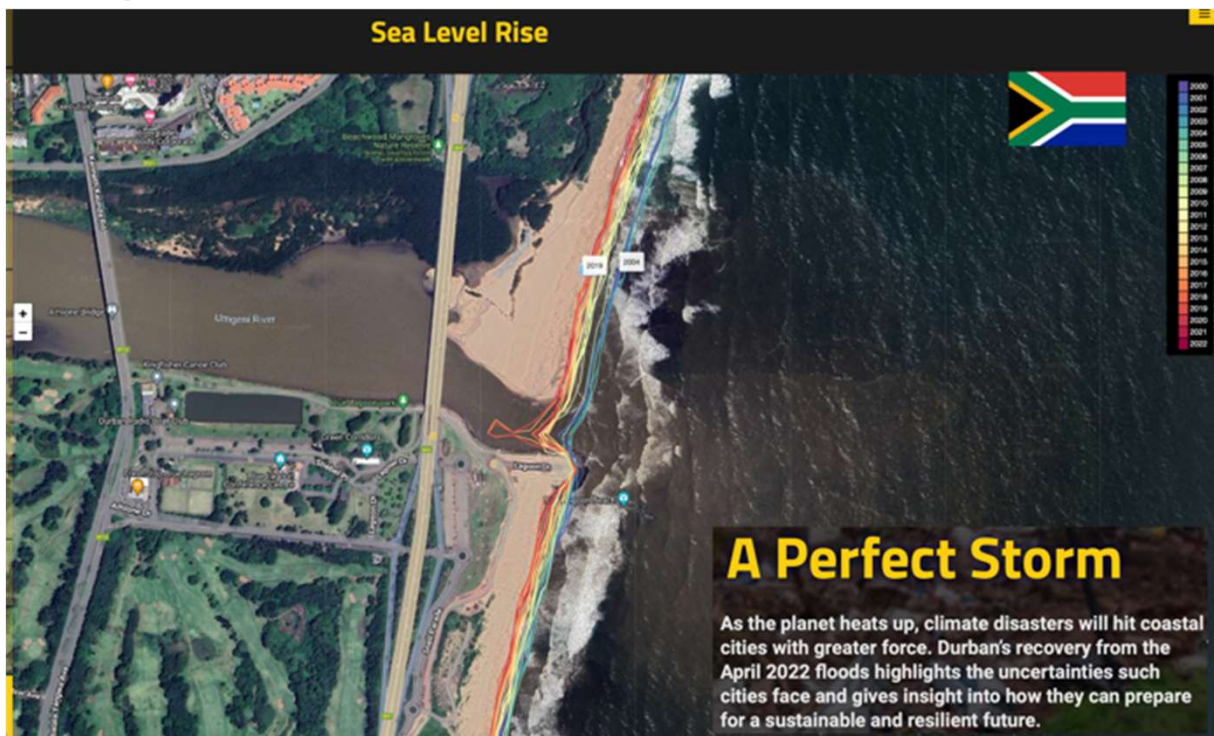
<https://sarva.saeon.ac.za/coastal-vulnerability/>

<https://maps.digitalearth.africa/#share=s-5Y65KQly5B1i5ICw6QTm4S7EoQC>



Google Earth Engine Coastlines script: Bishop-Taylor, R., Nanson, R., Sagar, S., Lymburner, L. 2021. Digital Earth Australia Coastlines. Geoscience Australia, Canberra. <https://doi.org/10.26186/116268>

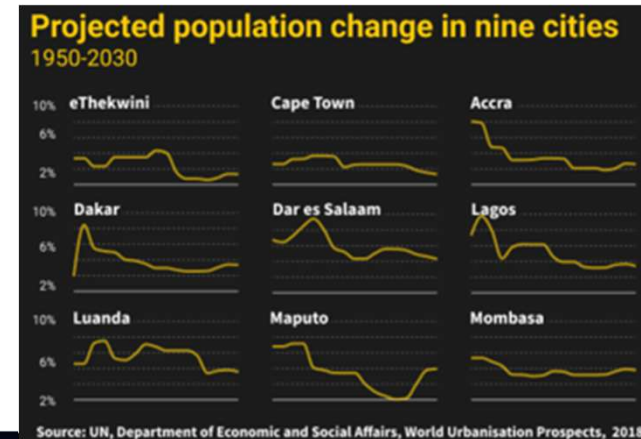
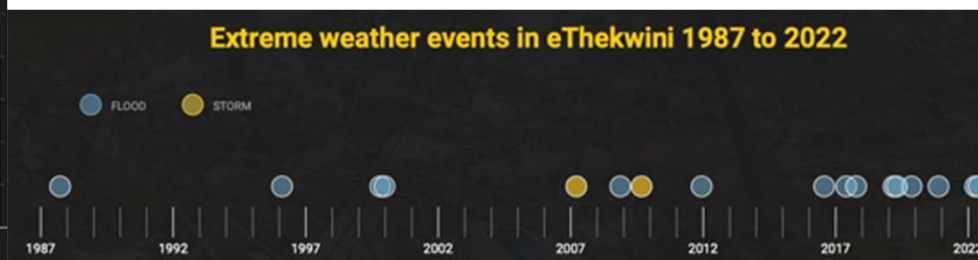
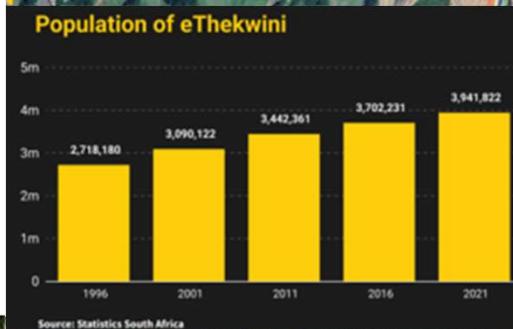
Monitoring coastline change in eThekweni, Durban, South Africa using Coastlines on DE Africa



Digital Earth Africa is revolutionising coastal management and supporting decision-making in infrastructure and livelihood-threatening situations. Insights into #coastalresilience are available through Digital Earth Africa, addressing the need to take #ClimateAction in #Durban, #SouthAfrica. story by @outlierafrica

<https://perfectstorm.theoutlier.co.za>

The April 2022 flooding in Durban was a case of inland river flooding, rather than a coastal storm surge.



DE Africa training courses



- **Self-paced, free-to-access, fully online:**
 - Videos, recorded tutorials, manuals
 - Hands-on exercises
 - English and French versions
- **Certificate of Completion is awarded upon completion of exercises**

<https://learn.digitalearthafrika.org/>



English

Digital Earth Africa
DEA101-en
Introduction to the Digital Earth Africa Sandbox

Starts: Oct 19, 2021



Français

Digital Earth Africa
DEA101-fr
Introduction à la sandbox de Digital Earth Africa

Starts: Oct 19, 2021



Change in water extent: 2019-03-01 to 2020-03-01

Digital Earth Africa
DEA201-en
Digital Earth Africa Water Resources

Starts: Oct 16, 2022



01 Mar 2021
Seasonal MNDWI

Digital Earth Africa
DEA-202
Digital earth afrique ressources en eau

Starts: Jan 30, 2023



Agriculture and food security

Digital Earth Africa
DEA201-en
Digital Earth Africa Agriculture and Food Security

Starts: Feb 1, 2023



01 Mar 2021
Seasonal MNDWI

Digital Earth Africa
DEA_202_FN
Digital Earth Afrique Agriculture et sécurité alimentaire

Starts: Mar 17, 2023

<https://learn.digitalearthafrika.org/>

DE Africa training courses



<https://learn.digitalearthafrika.org/>



Digital Earth Africa Agriculture and Food Security

- > Course information
- > Session 1 - Rainfall Anomalies
- > Session 2 - Vegetation Anomalies
- > Session 3 - Soil Moisture
- > Session 4 - Vegetation Phenology
- > Session 5 - Crop Health
- > Course conclusion



Digital Earth Africa Urbanisation

- > Course information
- > Session 1 - Detecting Change in Urban Extent
- > Session 2 - Urban Area Mapping Using Sentinel 1 Data
- > Session 3 - Machine learning with ODC
- > Course conclusion



Course information

Digital Earth Africa Coastlines

- > Session 1 - DE Africa Coastlines on DE Africa Map
- > Session 2 - DE Africa Coastline in Sandbox
- > Session 3 - Coastal erosion
- > Session 4 - Mangroves
- > Course conclusion

Digital Earth Africa Water Resources

- > Course information
- > Session 1 - Mapping Water Extents using WOFs
- > Session 2 - Flood Impact Assessment using Sentinel 1 data
- > Session 3 - Turbidity in wetlands
- > Course conclusion



Digital Earth Africa Water Resources

Digital Earth Africa - DEA201-en
Started - Oct 16, 2022

https://learn.digitalearthafrika.org

Connect with DE Africa



- Website <https://www.digitalearthafrika.org>
- The opportunity to subscribe to the DE Africa community to receive quarterly newsletters and invitations to attend events <https://helpdesk.digitalearthafrika.org> and user guide <https://docs.digitalearthafrika.org/>
- Free learning course <https://learn.digitalearthafrika.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>
- Email address info@digitalearthafrika.org

<http://bit.ly/DEAfricaLiveSessions>.

Acknowledgements of Ecosystem builders





Australian Government

THE LEONA M. AND HARRY B.
HELMSLEY
CHARITABLE TRUST



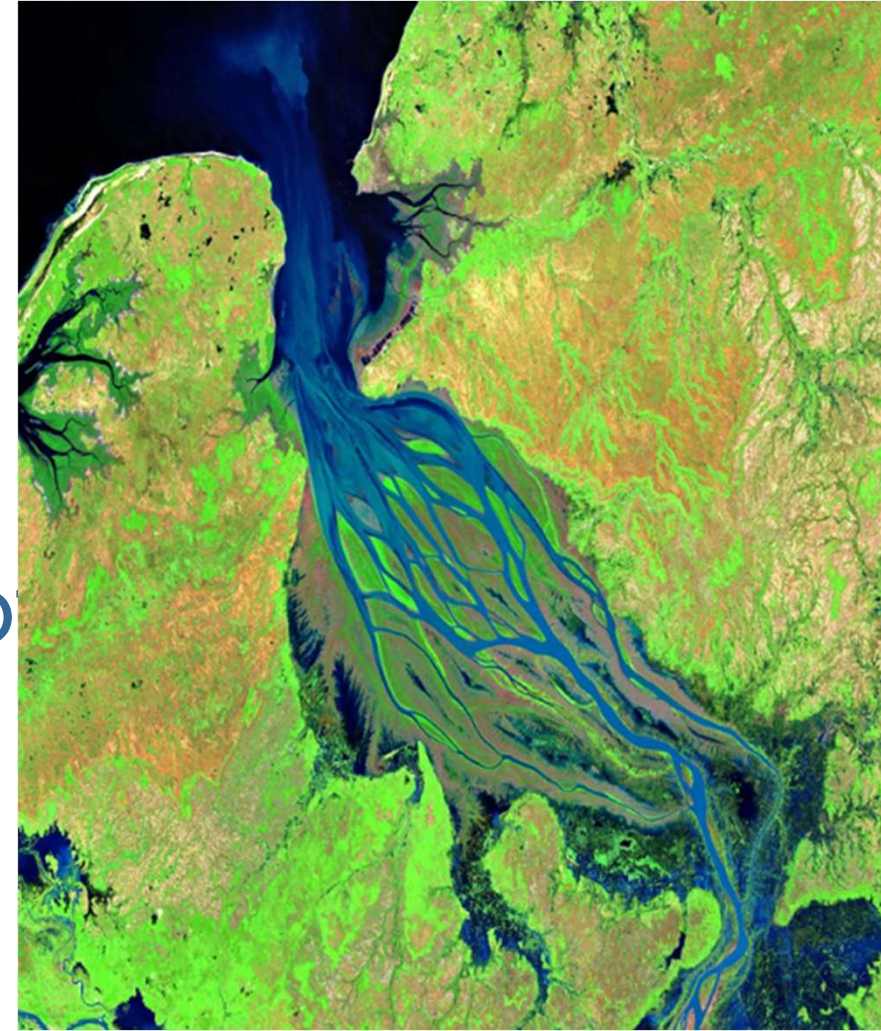
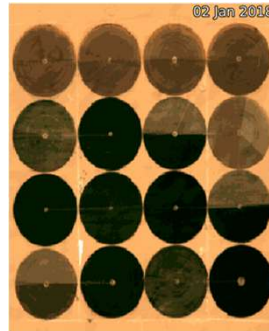
Thank you.

<https://forms.gle/AjerZ436kTHcHsLv5>

Let's unlock the promise of tomorrow **together.**

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Bombetoka Bay, Madagascar

Website <https://www.digitalearthafrika.org>