Digital Earth
AFRICA

Digital Earth Africa helps assess changes in water levels in Lake Ngami, Botswana

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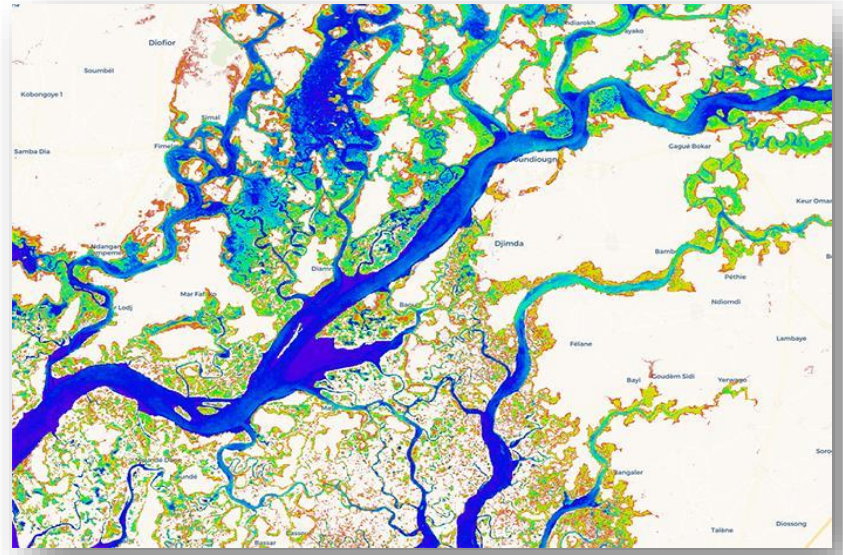
Digital Earth Africa helps assess changes in water levels in Lake Ngami, Botswana

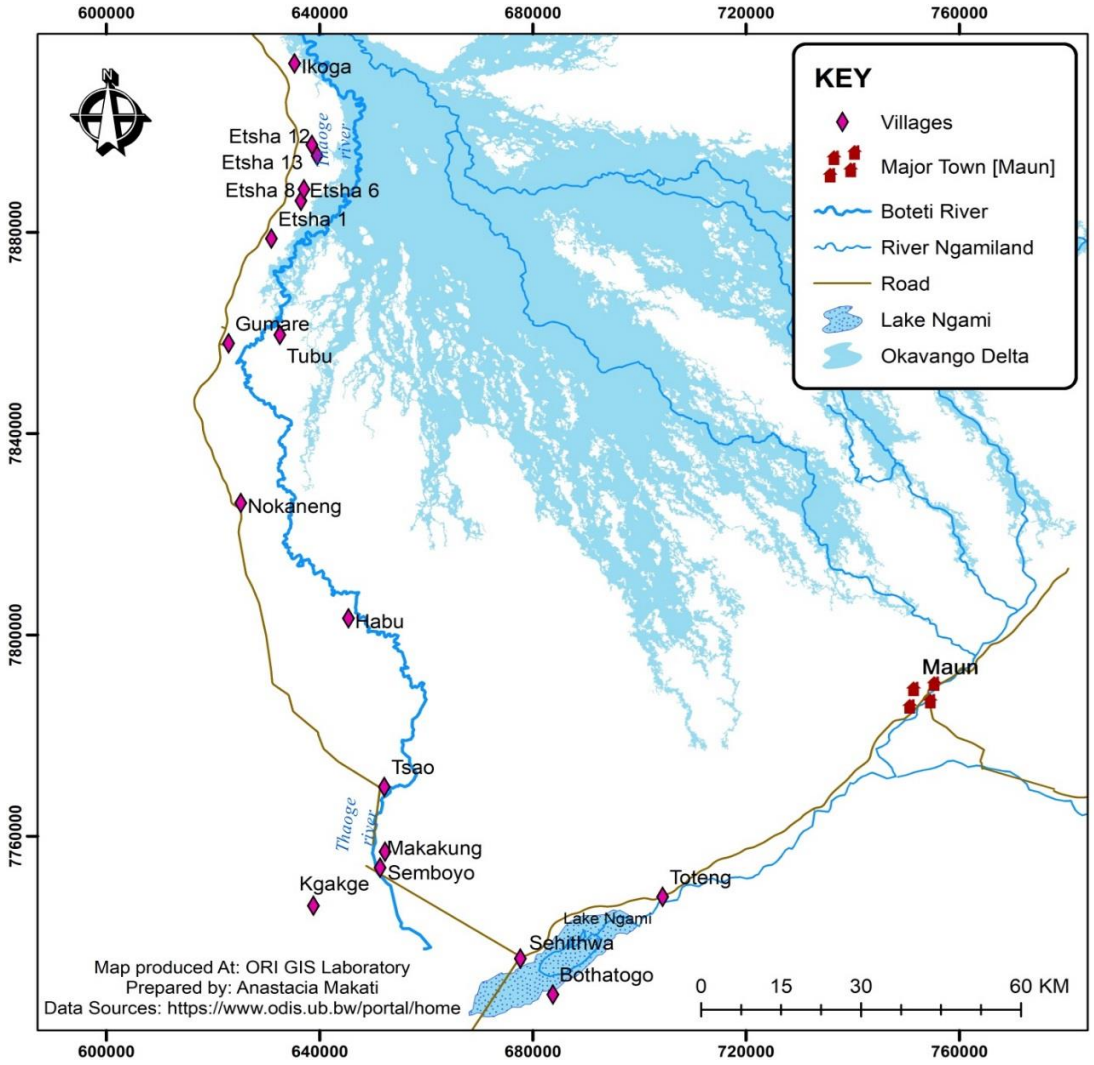
Presented by Edward Boamah

Presentation outline

- Introduction
- Methodology
- Results
- Conclusion



Water Assessment and Monitoring in the Lake Ngami



- Lake Ngami is an endorheic lacustrine system located at the western part of the lower Okavango Delta. It is an indicator for environmental change and climate variability in the Okavango Basin.
- Furthermore, it supports the livelihoods of communities around it through provisional services. The lake provides fish for commercial and subsistence purposes and water for livestock during inundation periods.
- Digital Earth Africa provided the Water Observation from Space (WOfS) derived from Landsat 8 at 30 metres and water extent assessment using Sentinel 2 at 10 metres to evaluate water variability in Lake Ngami, Botswana from the year 2017 to 2021

Water Assessment and Monitoring in the Lake Ngami

- The Digital Earth Africa (DE Africa) Water Observations from Space (WOfS) are a suite of surface water products, which are generated using the WOfS classification algorithm on Landsat 8 satellite data at 30 metres.
- Lake Ngami extents are at latitude 20.39 to 20.51 South and longitude 22.73 to 22.88 East.
- WOfS is best visualized using the Digital Earth Africa Maps from the year 2013 to 2019.
- WOfS includes: annual summary and all time summary described below.

WOfS Annual Summary: The ratio (%) of wet to clear observations from each calendar year
WOfS All-Time Summary: The ratio (%) of wet to clear observations over all time

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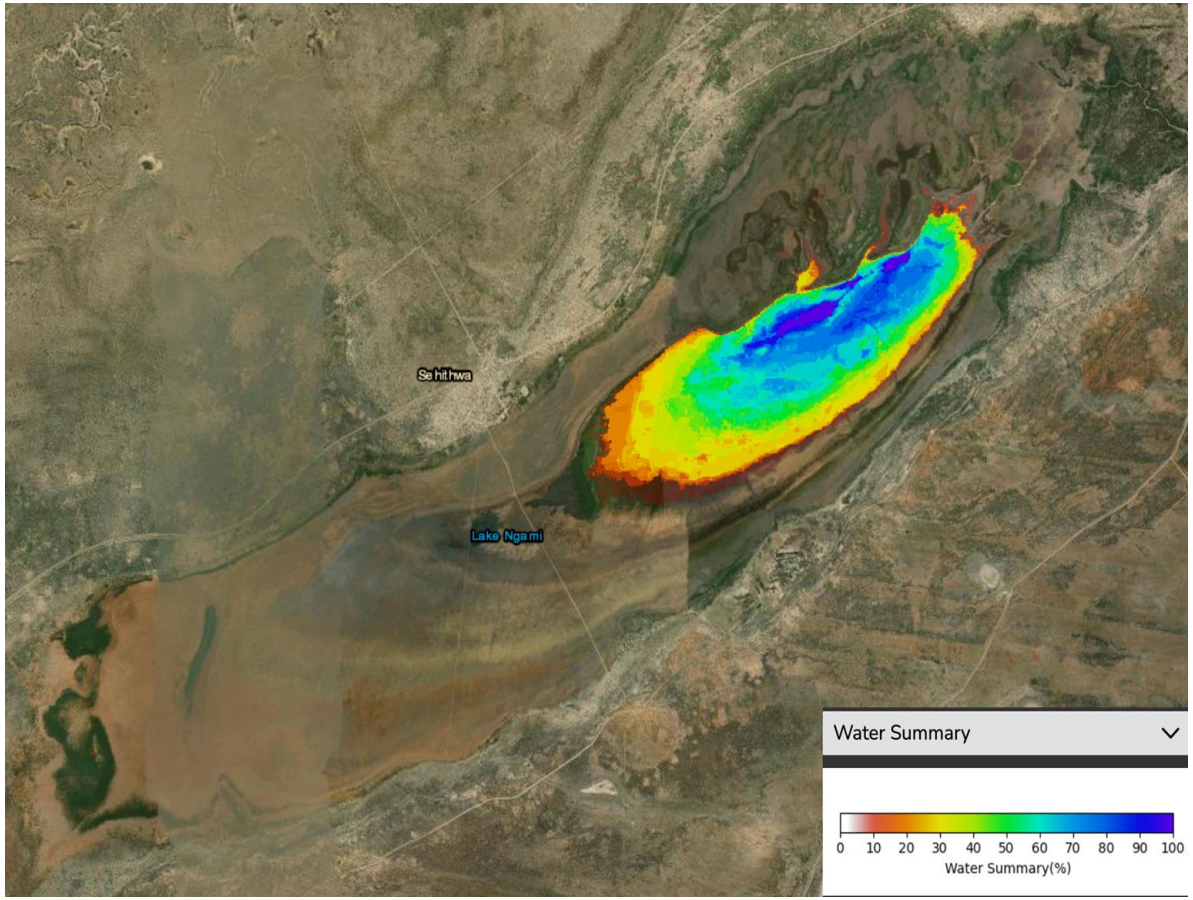
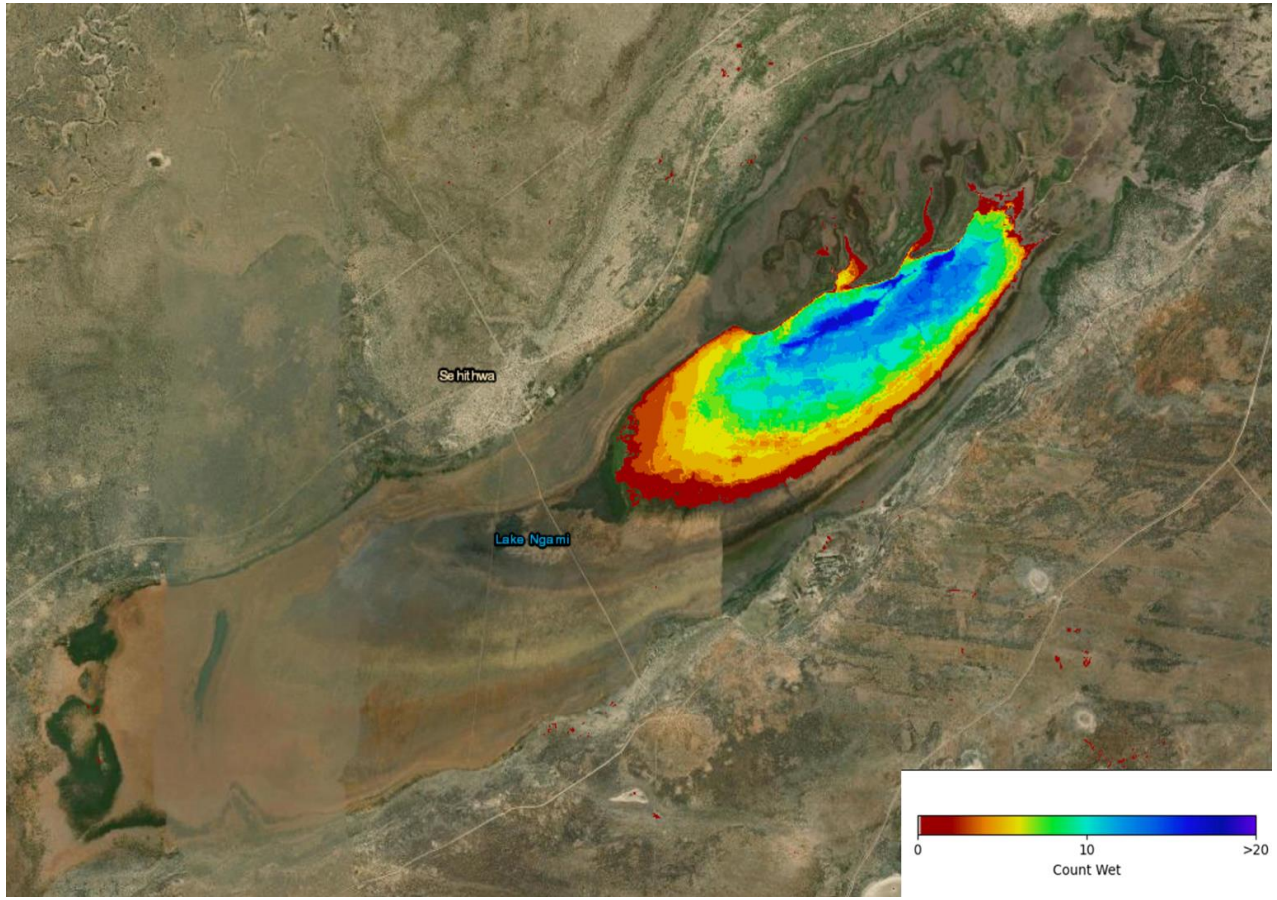


Water Summary from 2013 - 2019 using WOfS Annual summary



Water Summary from 2013 - 2019 using WOfS All-Time Summary (wet observations)

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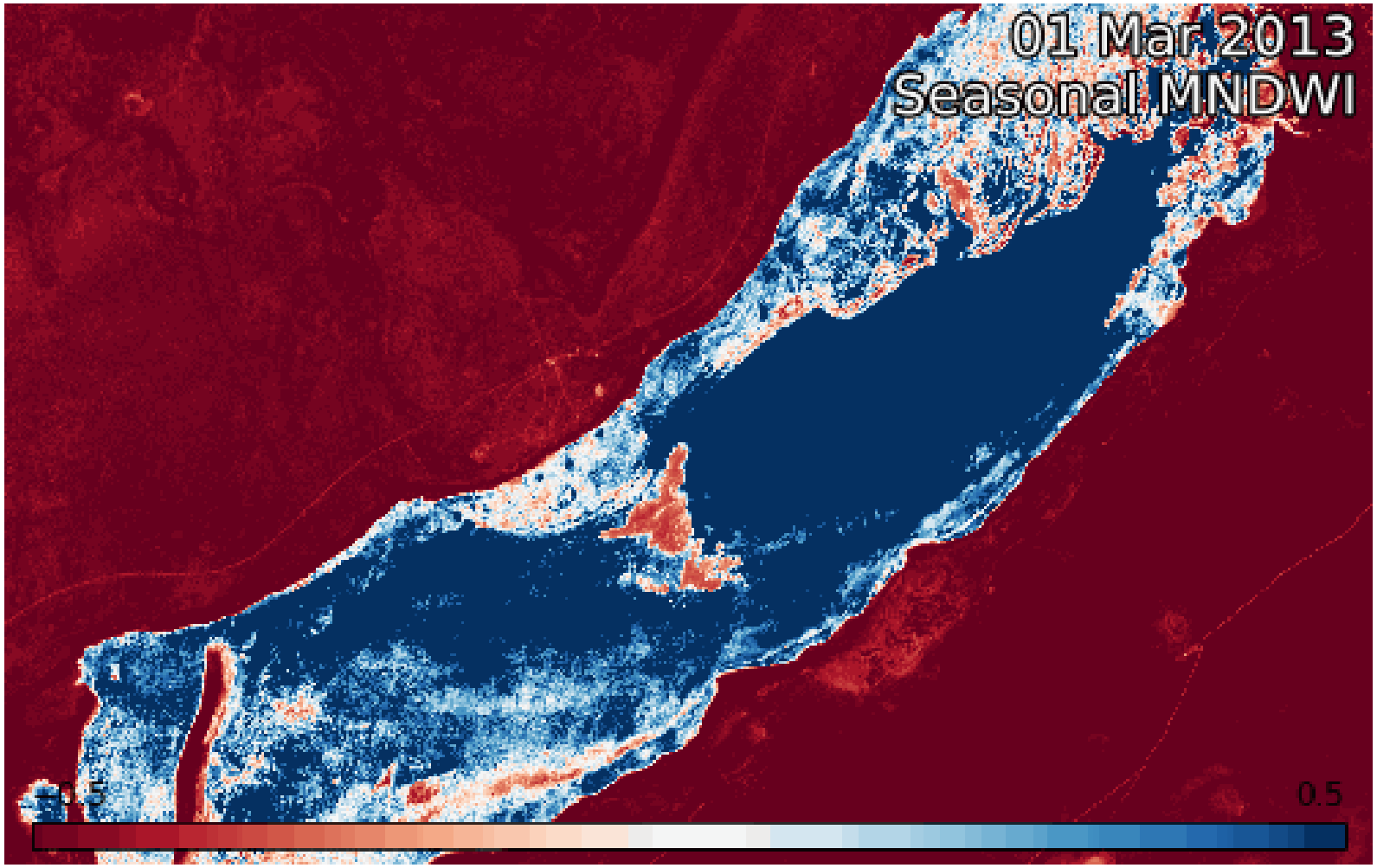

Water extent using the Modified Normalized Difference Water Index (MNDWI) from Landsat 8: 2013 to 2021

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Later, Sentinel 2 imagery was used in the water extent analysis: 2017 to 2021

- The Digital Earth Africa Sandbox has an algorithm which performs water extent in support of the UN SDG Goals SDG 6.6.1, “The spatial extent of water-related ecosystems”
- The water extent uses the water index Modified Normalized Difference Water Index (MNDWI).
- **MNDWI = (Green - SWIR) / (Green + SWIR)**
- The algorithm completes the following steps:

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

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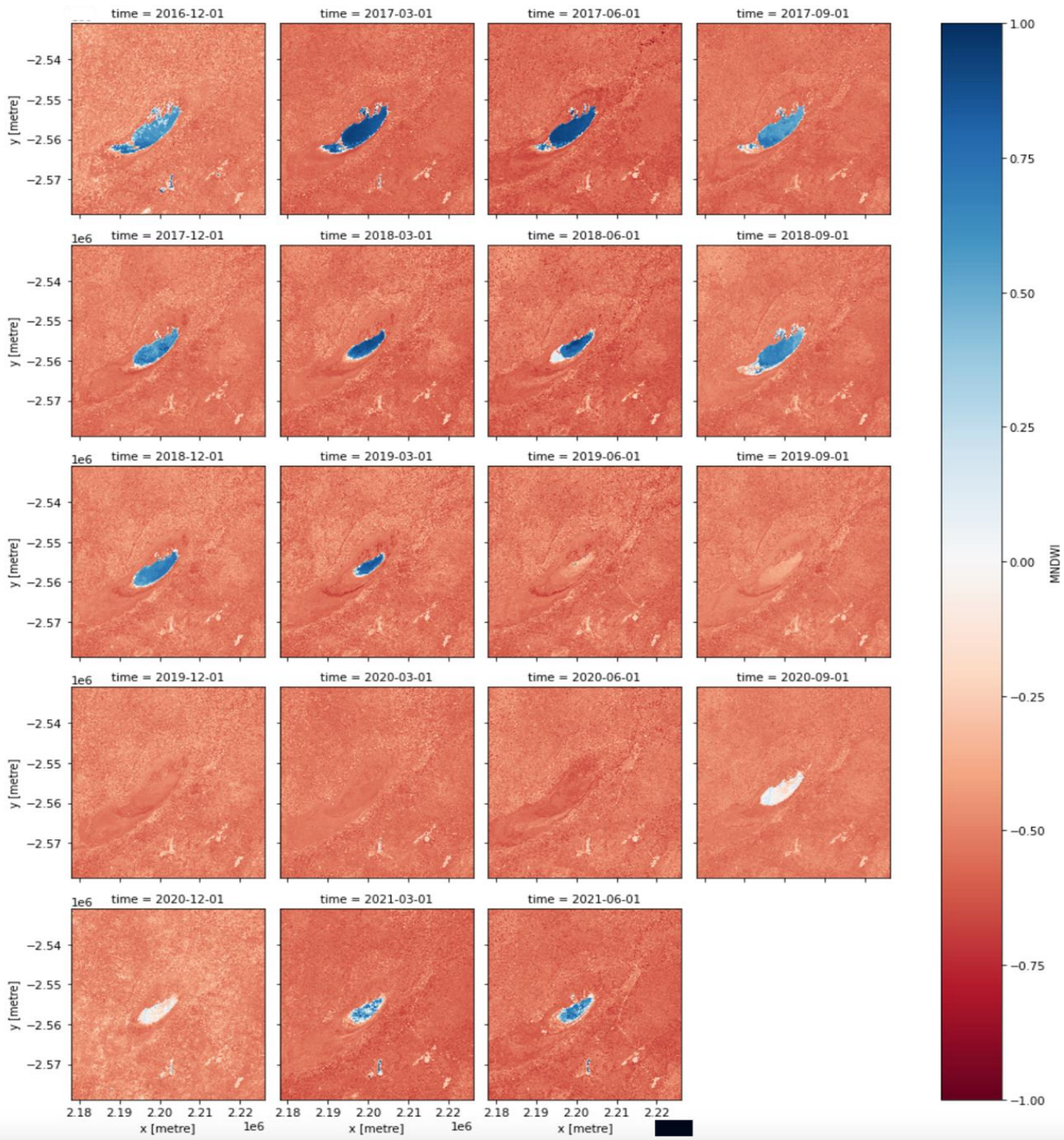
- Lake Ngami extent using Water extent algorithm, which uses MNDWI using Sentinel 2: 2017 to 2021.
- Water variability is visualized over the four years, with low levels witnessed in June 2019, September 2019, December 2019, June 2020.
- High volumes are witnessed in December 2016, March 2017, June 2017,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



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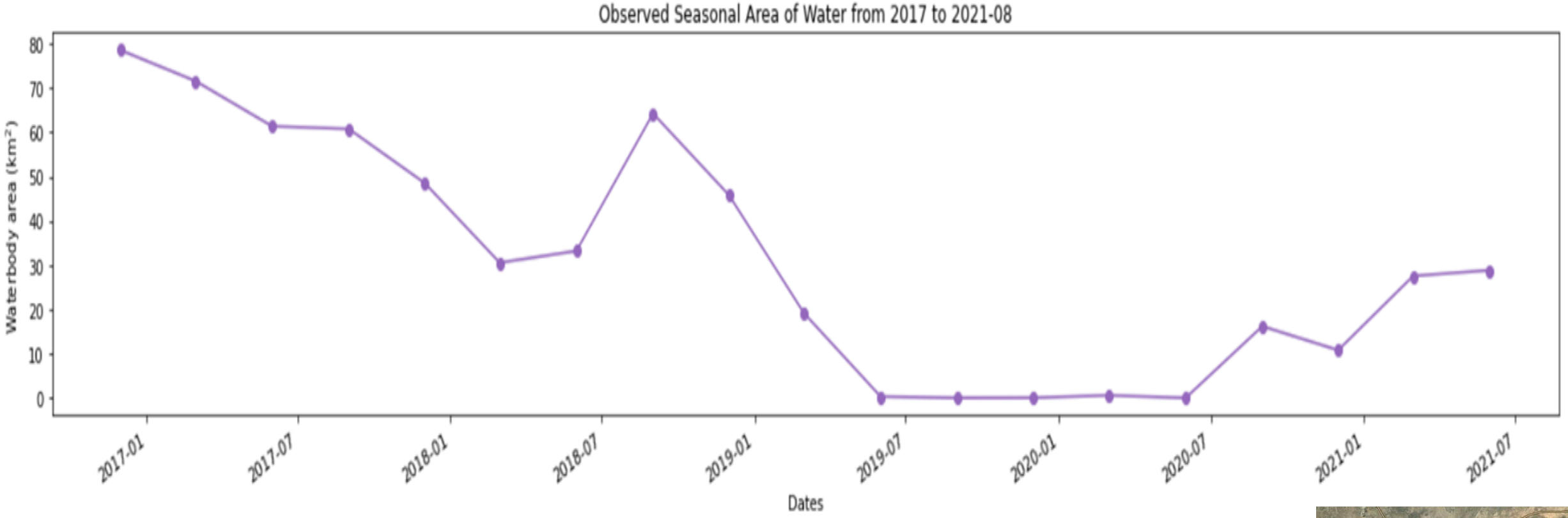
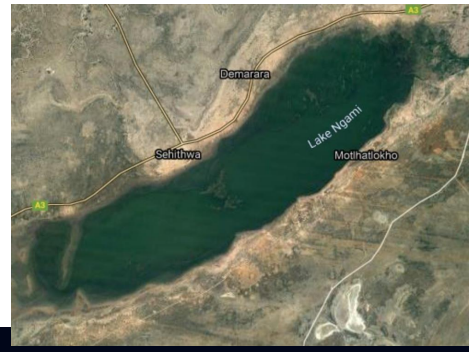


Seasonal changes over time from 2017 to 2021



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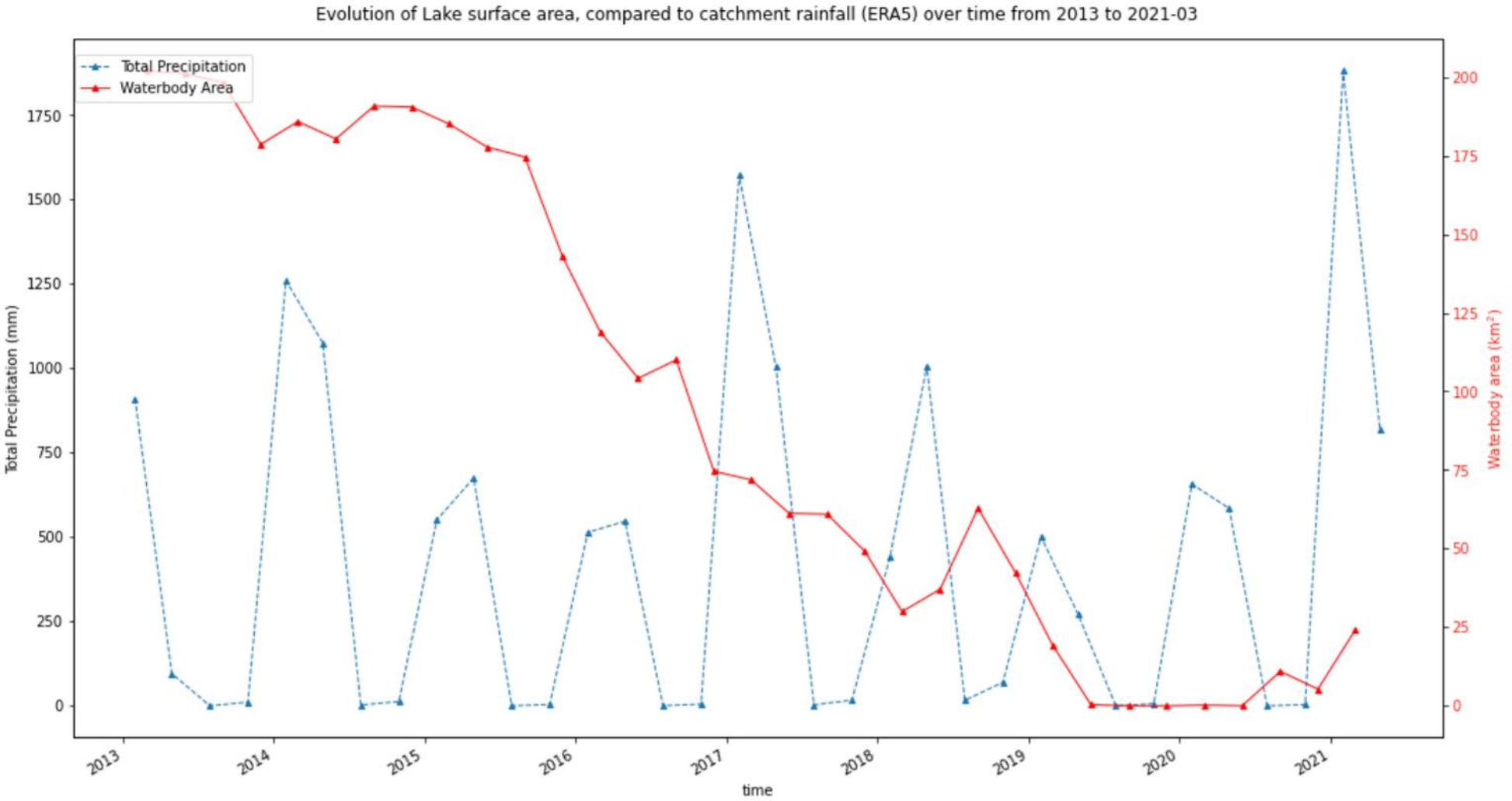

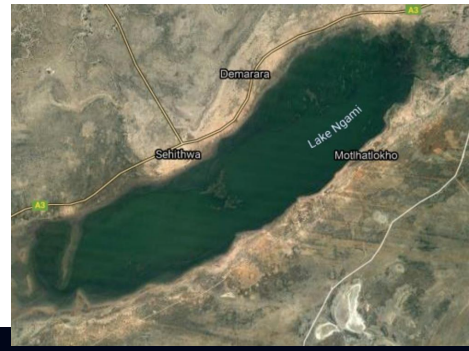

Seasonal changes over time from 2017 to 2021 plotted against precipitation data (ERA5)

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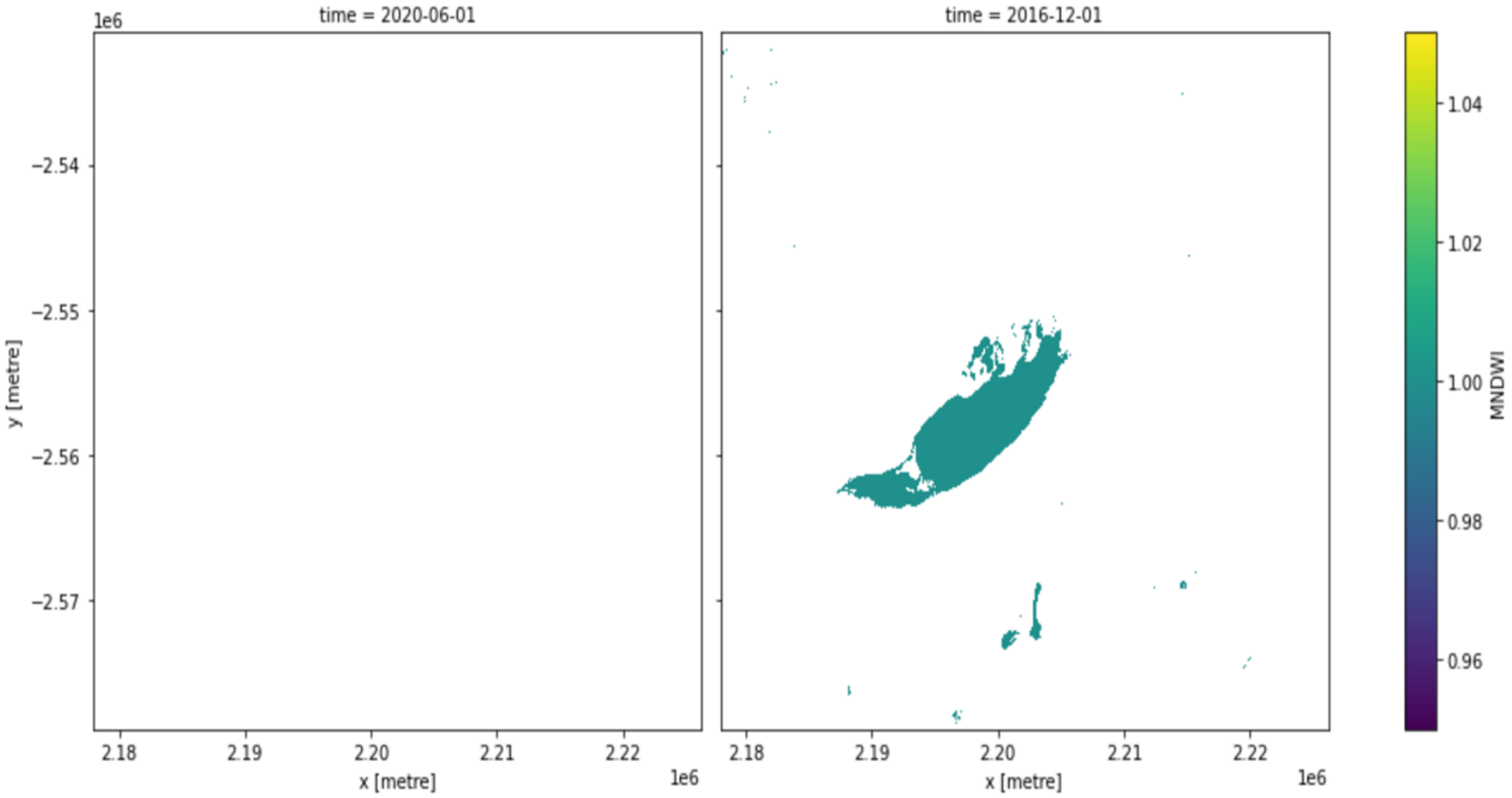

Minimum and maximum water levels

Maximum water levels were witnessed in December 2016 (floods) and the lowest water levels in June 2020 (drought)

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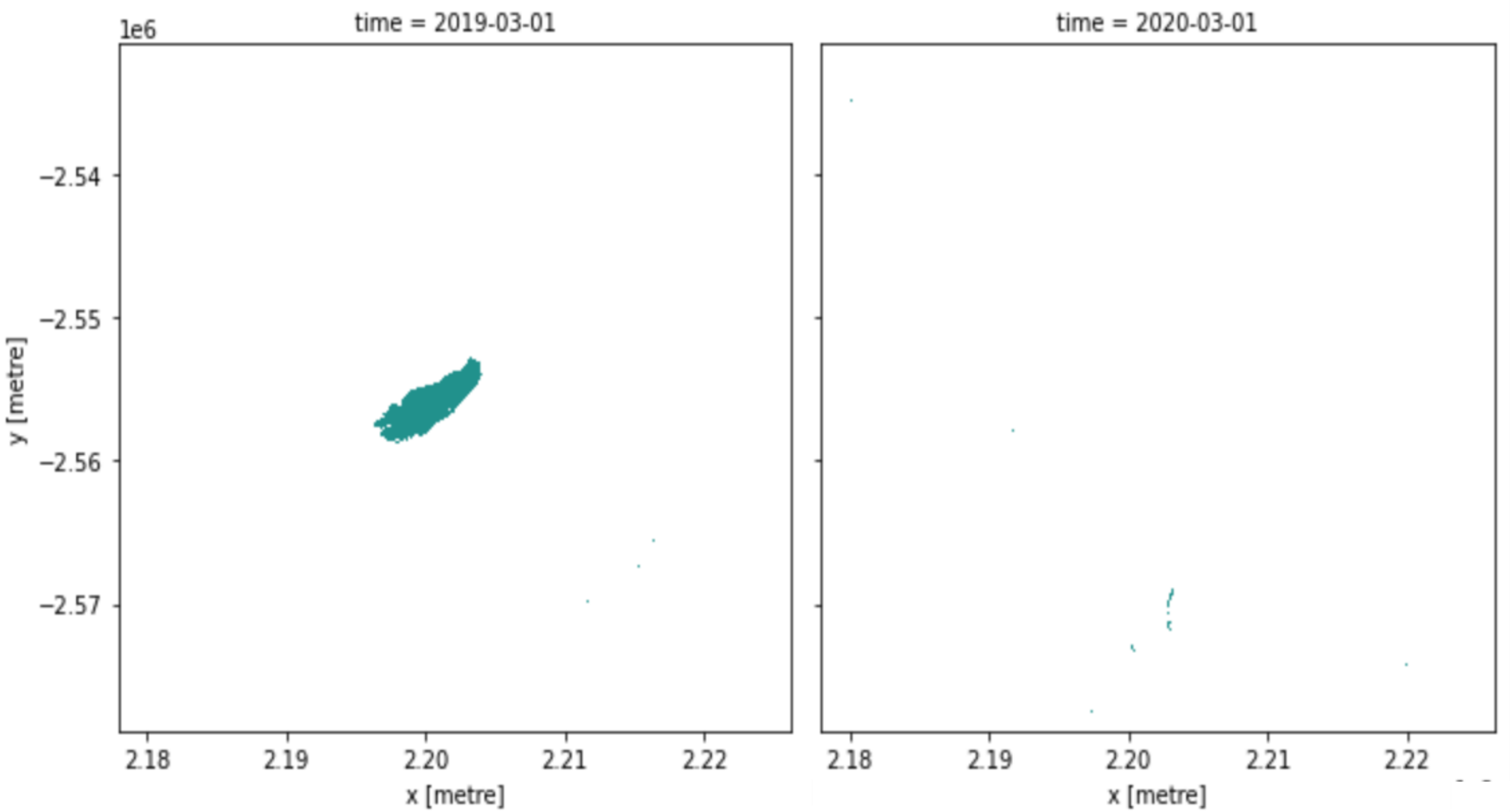

Plot of water extent of the MNDWI product for the two chosen periods: March 2019 and March 2020

Maximum water levels in the year 2019 to 2020 was witnessed in March 2019 (floods) and the lowest water levels in March 2020 (drought)

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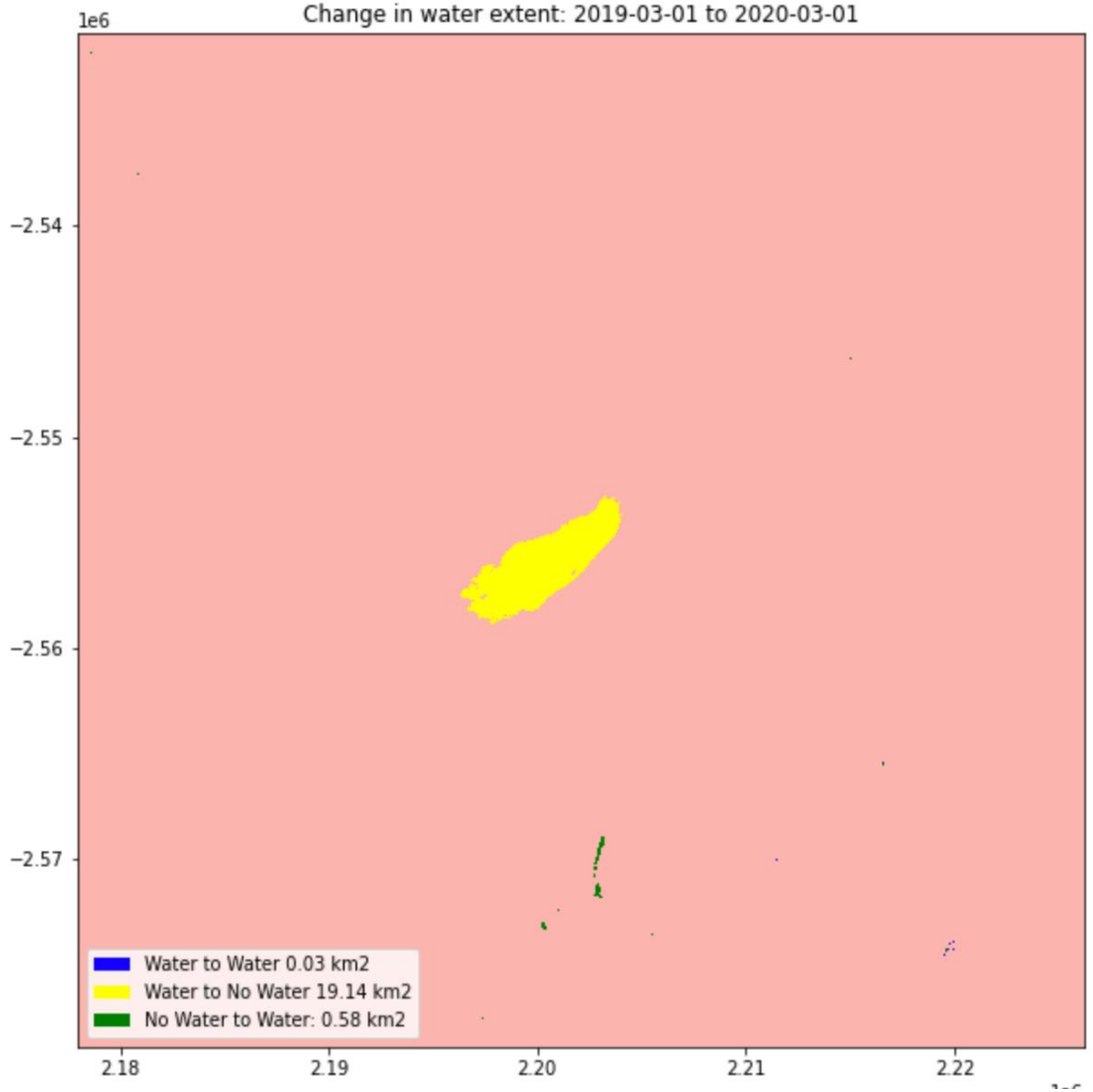

Maximum water levels in the year 2019 to 2020 was witnessed in March 2019 (floods) and the lowest water levels in March 2020 (drought)

Observed water extent in area: March 2019 to March 2020

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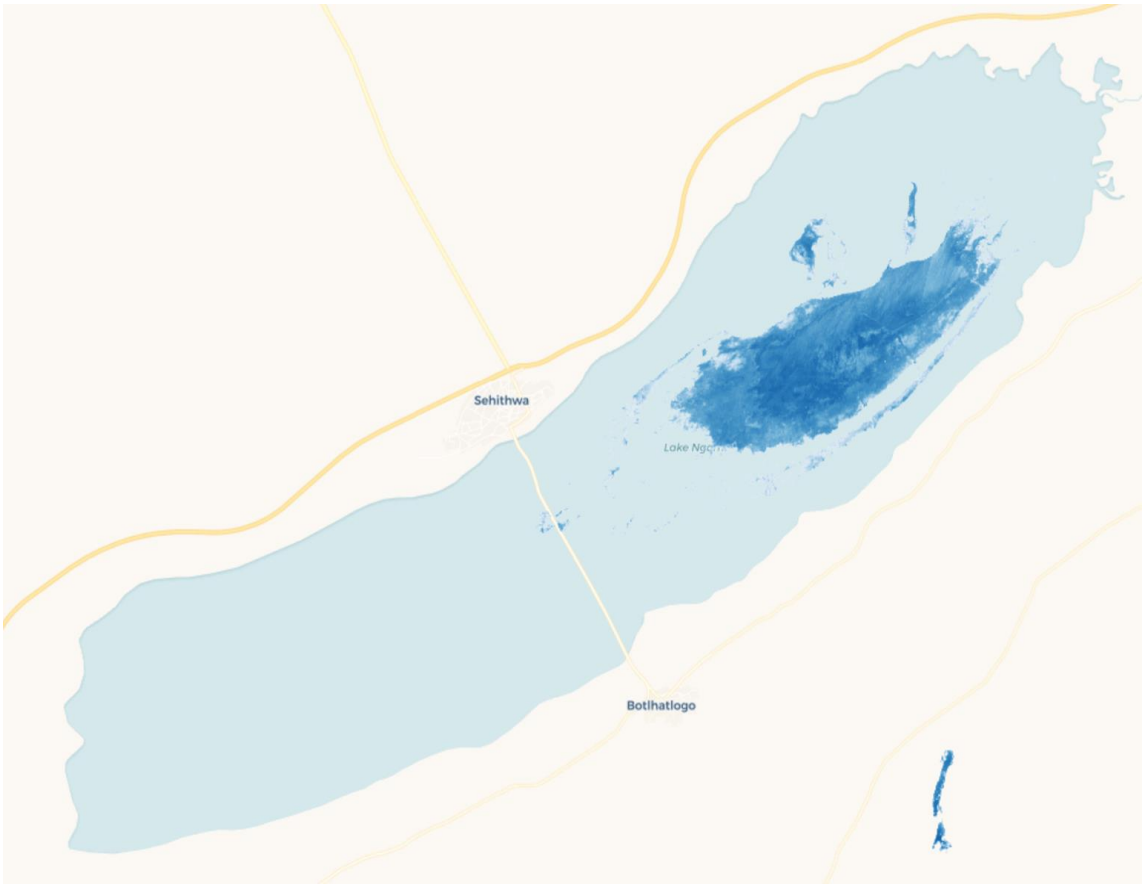
Sentinel 2 image captured on 23 August 2021, shows the variability of water in Lake Ngami



Sentinel 2 imagery captured on 23 August 2021 and viewed in Digital Earth Africa Map with the MNDWI index (Source: https://maps.digitalearth.africa/#share=s-ltq7s9z8GDiw2UJmhuzRSc20lk3)

Water Assessment and Monitoring in the Lake Ngami

Call to Action

- Digital Earth Africa provided insights into changes in the water variability over time.
- The results indicate the need for an integrated watershed plan that encompasses the Okavango delta.
- The effects of climate change have affected water variability.
- The results are useful for policy makers and will help engaging multi-disciplinary stakeholders in the Okavango.
- Let us make the Africa we want as we join efforts in the conservation of the Okavango watershed, *leave no one behind.*

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aws
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COOi studios
WORLD ECONOMIC FORUM
CEOS Committee on Earth Observation Satellites
OPEN DATA CUBE
ITC
IWMI International Water Management Institute

THANK YOU

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