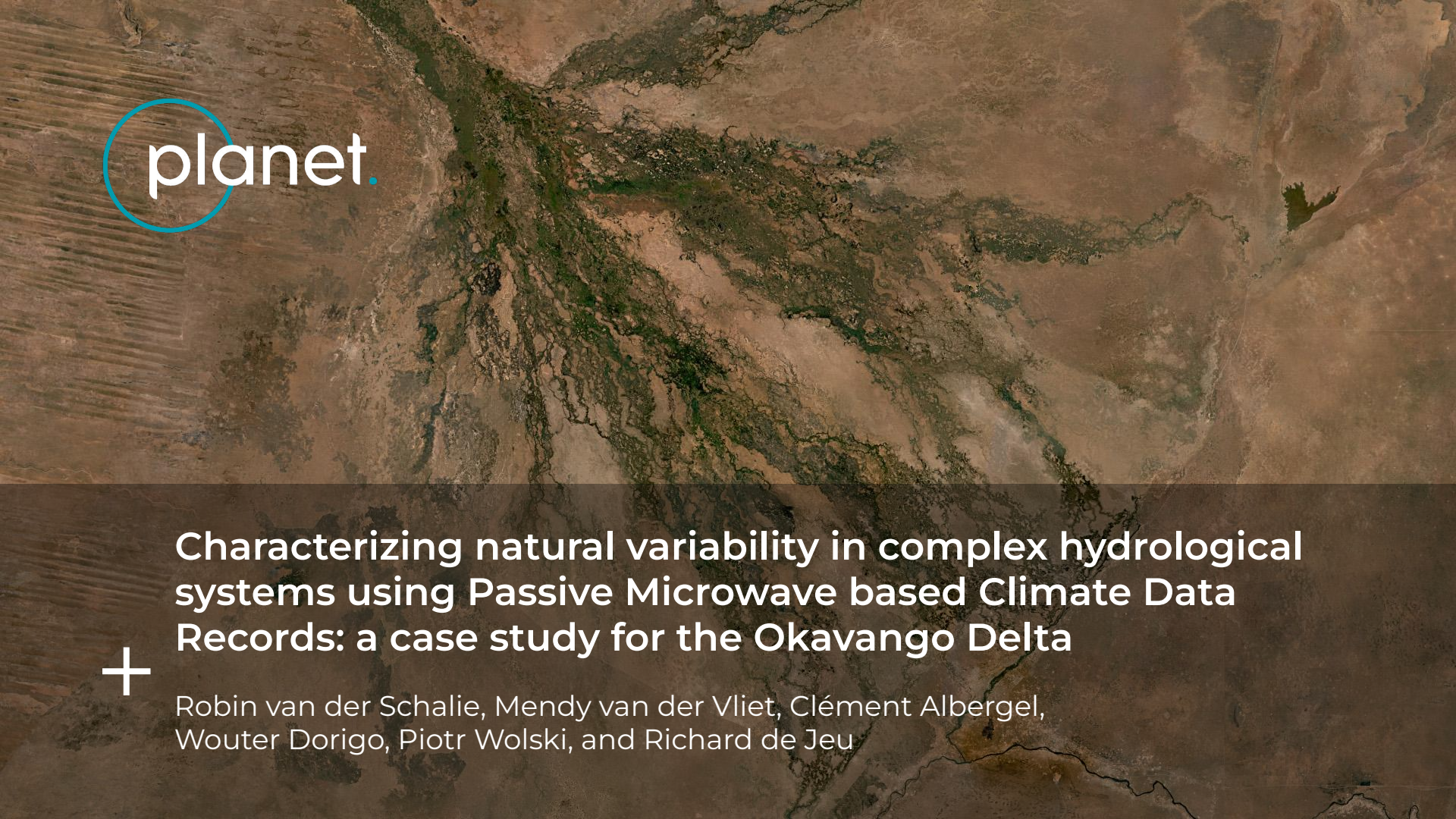

# Characterizing natural variability in complex hydrological systems using Passive Microwave based Climate Data Records: a case study for the Okavango Delta

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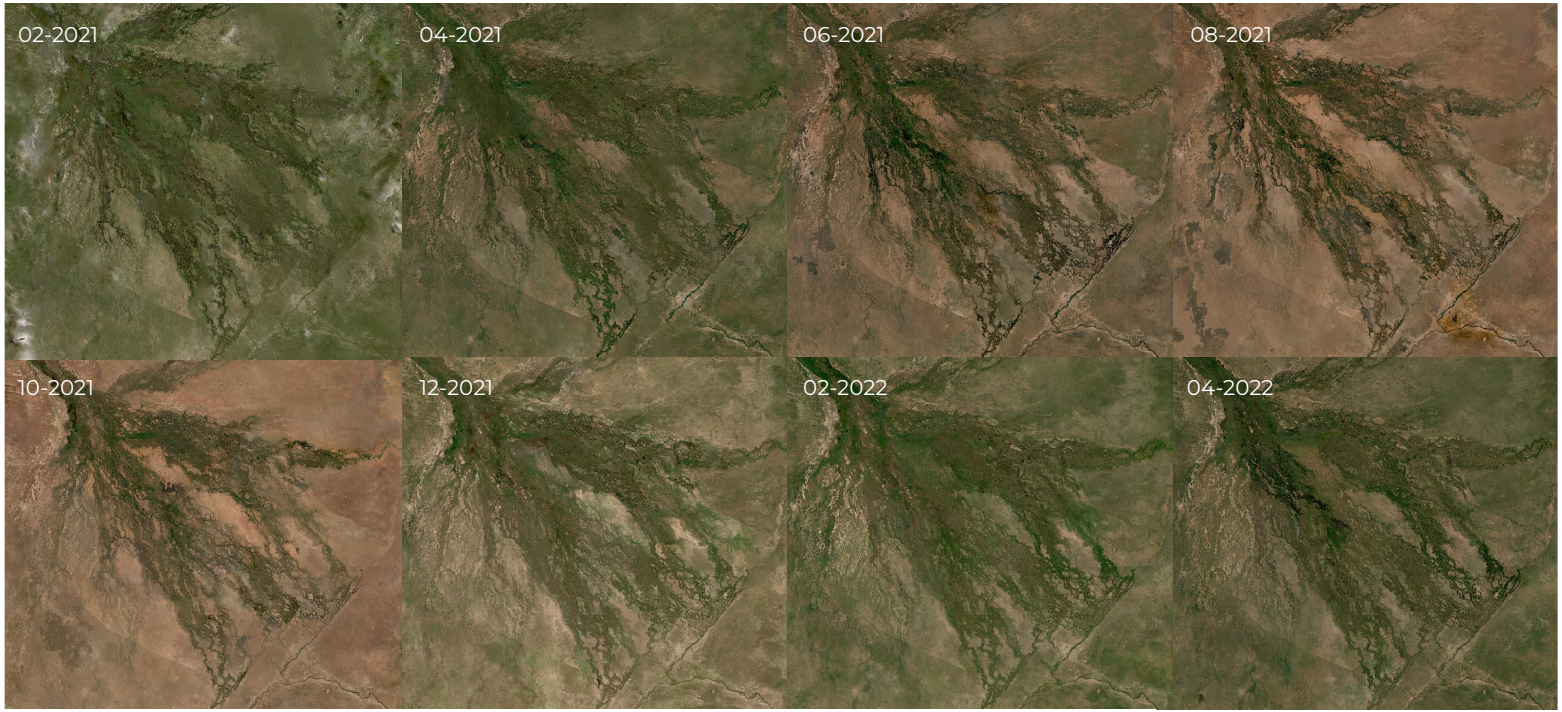
Wouter Dorigo, Piotr Wolski, and Richard de Jeu

# Climate Data Records over the Okavango Delta

## Change from above for this unique UNESCO World Heritage site



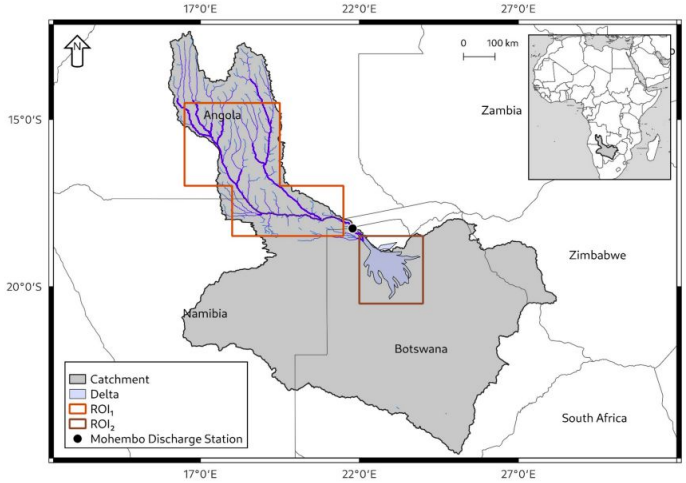

**Wet - dry - wet transition of the Okavango Delta over the last 16 months**

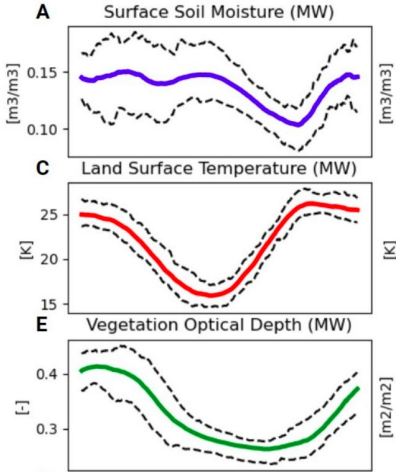
Planet Basemaps, captured with a constellation able to image the entire land surface of the Earth every day

# Climate Data Records over the Okavango Delta

## Quantifying multi-decadal anomalies of geophysical parameters

Climate Data Records (CDR), e.g. derived from passive microwave observations, can help us to better understand the vulnerability and (un)natural variability and in complex hydrological systems like the Okavango Delta, having a multi-decadal perspective. For this study, we used surface soil moisture (SSM), vegetation optical depth (VOD) and land surface temperature (LST).



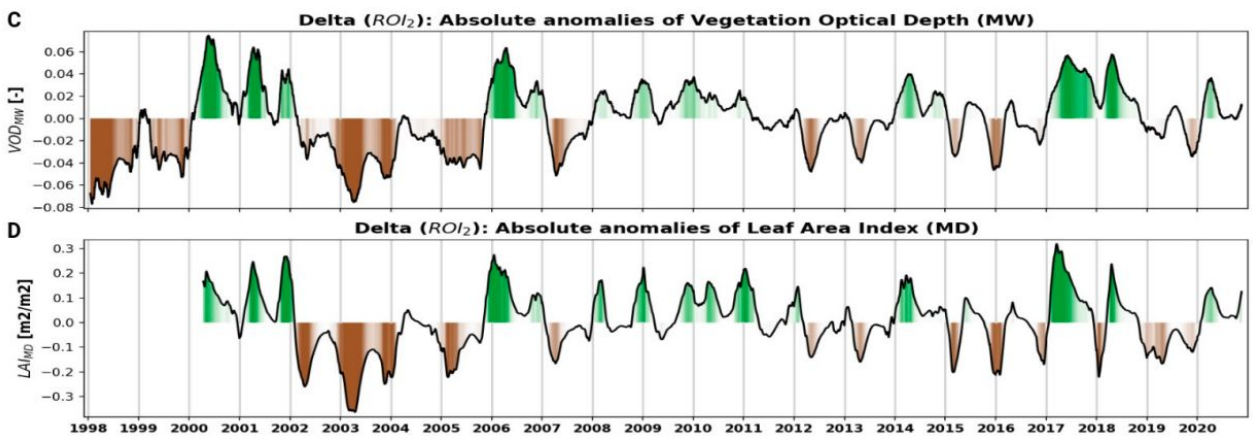

*← Climatology and 10/90 percentiles over the Delta based on 25 years of data*

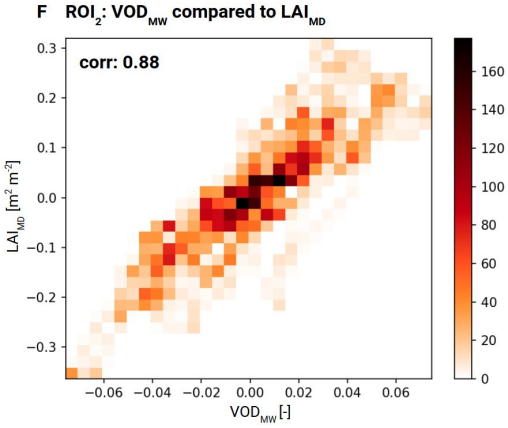

Van der Schalie, R., van der Vliet, M., Albergel, C., Dorigo, W., Wolski, P., & de Jeu, R. (2022). Characterizing natural variability in complex hydrological systems using Passive Microwave based Climate Data Records: a case study for the Okavango Delta. Hydrology and Earth System Sciences Discussions, 1-32.

# Climate Data Records over the Okavango Delta

## Vegetation Optical Depth

Anomalies captured with VOD and the more well known Leaf Area Index (LAI). The strong correlation between the two anomaly data sets shows they capture the same historical variability in two independent EO datasets, strengthening the credibility of these VOD datasets, while having coverage during cloudy conditions, several observations per week and data all the way back to the early 90s.



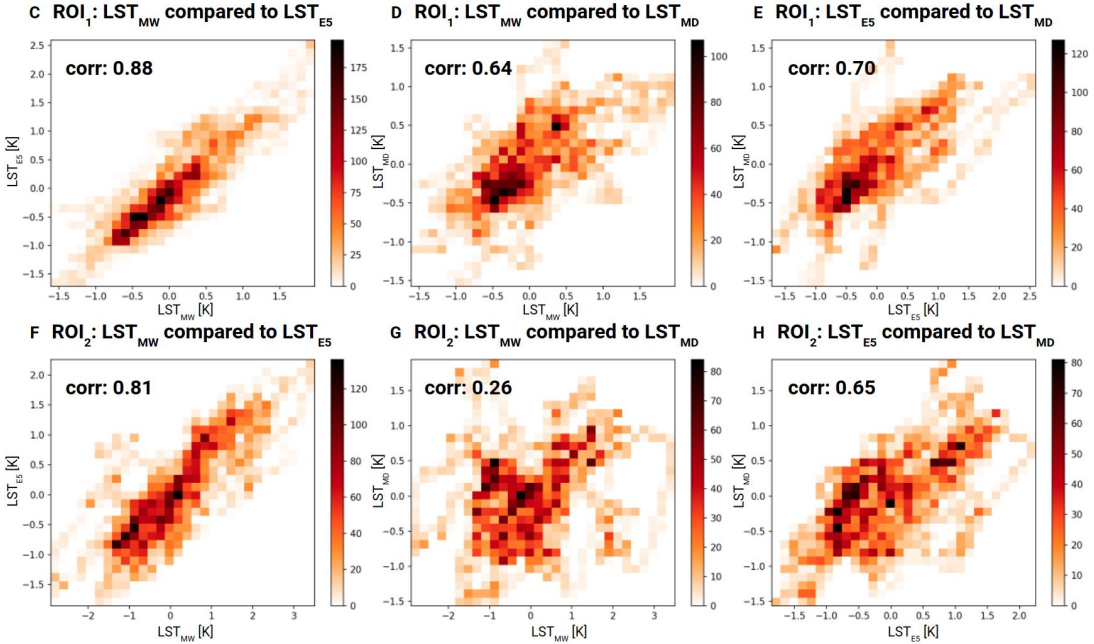
# Climate Data Records over the Okavango Delta

## Land Surface Temperature

Three products were evaluated for nighttime land surface temperature:

- Microwave based
- ERA5 Reanalysis
- MODIS

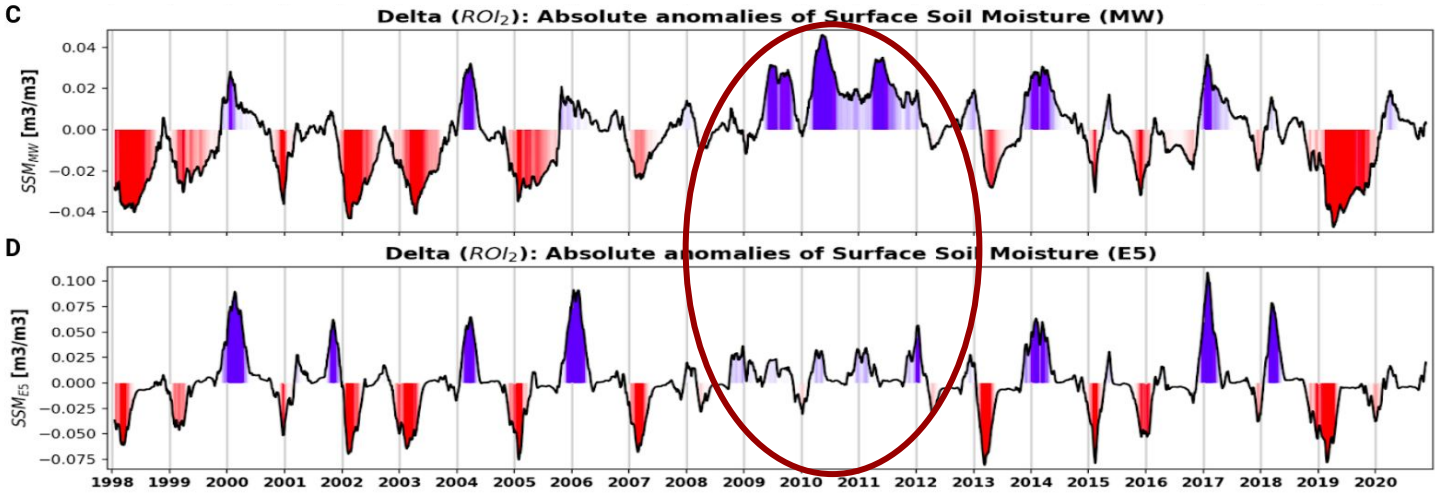
The strong correlation between MW and ERA5 anomalies, including their independence from each other, indicate that they are both able to capture this variability.



# Climate Data Records over the Okavango Delta

## Soil Moisture

The SSM conditions of this region are complex, as they are driven by both lateral fluxes from river inflow and precipitation. This causes state-of-the-art land surface models and reanalysis like ERA5-Land to occasionally show strong differences as compared to satellite derived soil moisture.



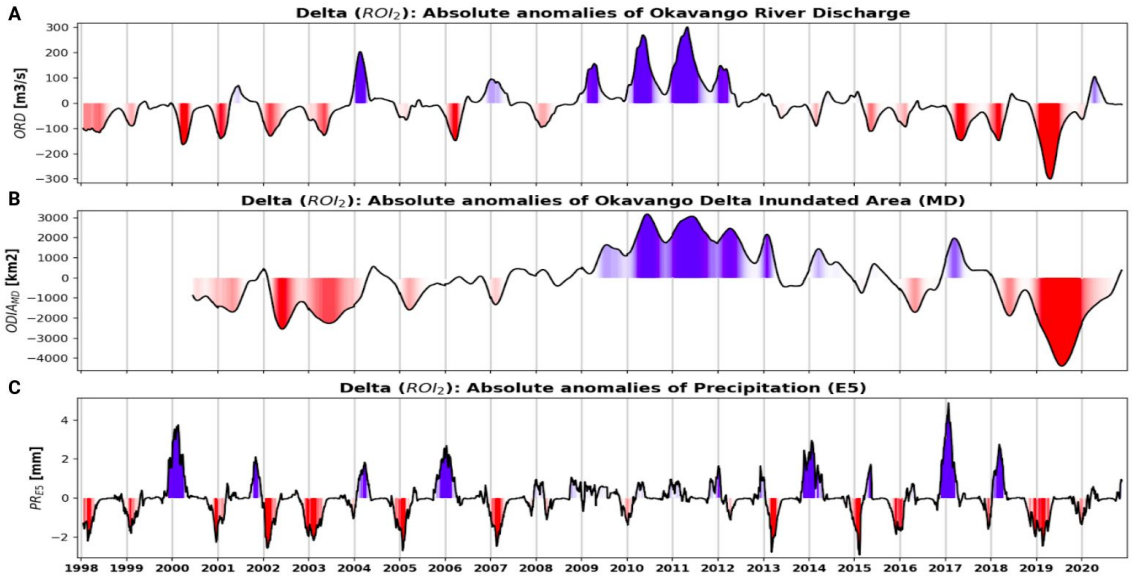
# Climate Data Records over the Okavango Delta

## Importance of not only relying on Land Surface Models

Information on river inflow and precipitation (PR from ERA5 and IMERG) used to evaluate mismatch.

Results show microwave SSM best captures both water inputs, while ERA5 is driven by PR forcing.

In some years, this also affects the LST (too high due to underestimation of latent heat flux)



# Climate Data Records over the Okavango Delta

## Conclusion, outlook, contract information

Climate Data Records from passive microwave observations are vital for detecting emerging climate abnormalities. Highlighting the importance of maintaining and improving observation based public data sets like the ESA CCI SM (Dorigo et al., 2017) or VODCA (Moesinger et al., 2020) for climate research and other applications.

This also causes a need for newly developed innovative products that give uses daily access to this type of information, to allow for improved decision making and timely emergency response. The newly available Planetary Variables aim to do exactly that, providing a daily data feed globally for high resolution soil moisture, biomass and land surface temperature.

For more information, visit **Planet.com** or email **rvanderschalie@planet.com**