Understanding Water Availability Within Ugandan through the Drought and Flood Mitigation Service

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The DFMS approach

- Project to develop the Drought and Flood Mitigation Service (DFMS) for Uganda, i.e. create a cloud-based platform that transforms environmental data into actionable information that's accessible via an online portal.

- Primarily aimed at mitigating the impacts of drought and floods on Ugandan society, it will also provide information that enables improved agricultural management.

- Developed in cooperation with the Government of Uganda, led by the Ministry of Water and Environment, and receives funding through the UK's International Partnership Programme, administered by the UK Space Agency.

Consortium partners

- RHEA GROUP – Prime, Software Platform, Architect, System Integrator, Operator
- UK Met Office – Climate Modelling/Forecast, Service Development, User Engagement, Training & Capacity Building
- Pixalytics – Satellite Data Processing and Products
- Environment Systems – Analysis Ready Data and Agricultural Satellite Products
- HR Wallingford – Hydrological modelling
- Databasix – People focussed design approach
- MercyCorps – Major International NGO active in Uganda
- AgriTechTalk Uganda – NGO active in the Karamoja region
- AA International – PET in-situ data collection App
- Oxford Policy Management – Monitoring & Evaluation

Soil moisture (m3/m3)

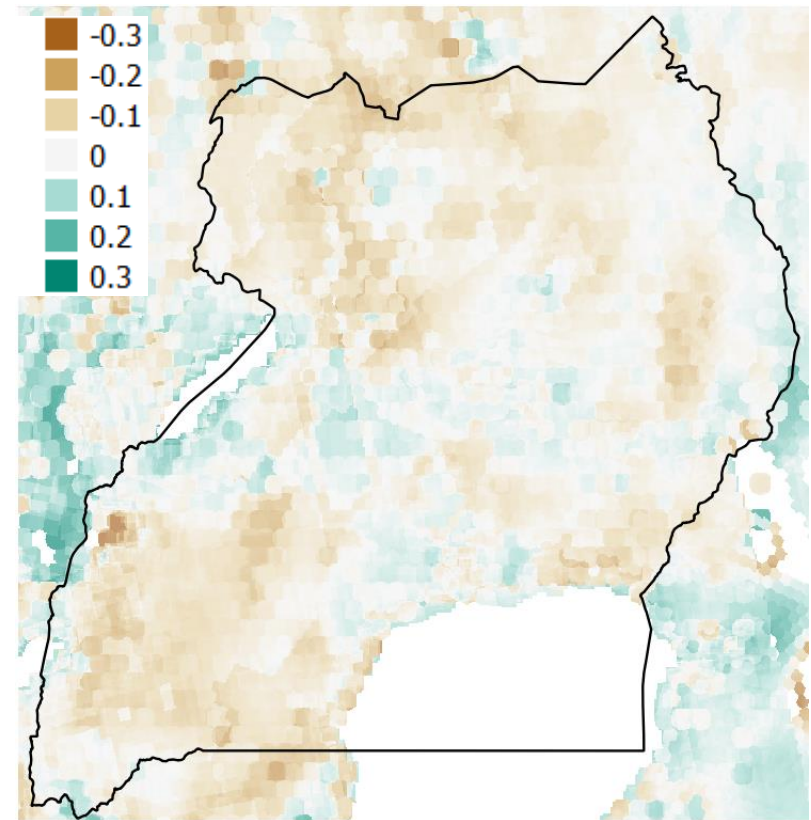|	
Frequency >>	Daily
Temporal sampling technique >>	Average of all measurements in 24 hours
Period >>	January 2012 –
Coverage >>	Uganda
Spatial resolution	1 km
Layers >>	Daily average and anomaly
Derived from >>	SMOS (ESA), ASCAT (EUMETSAT) and AMSR2 (NASA/JAXA).

Soil moisture content within the top few cm.
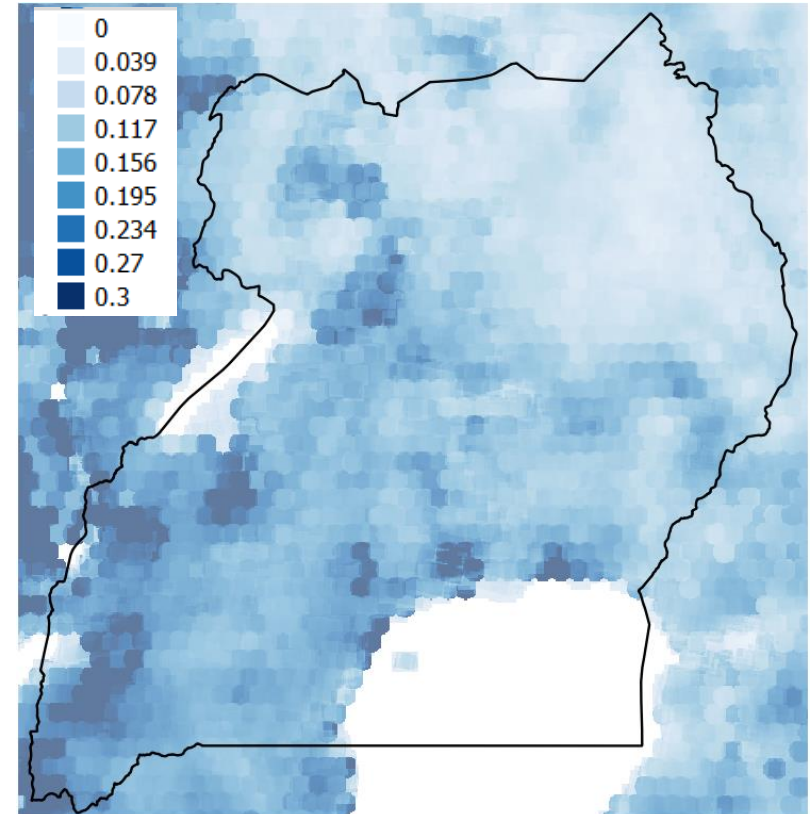
Baseline (2012-2018) average used for anomaly calculation, 29th January – doesn't include AMSR2

Soil moisture (m3/m3) – NRT data
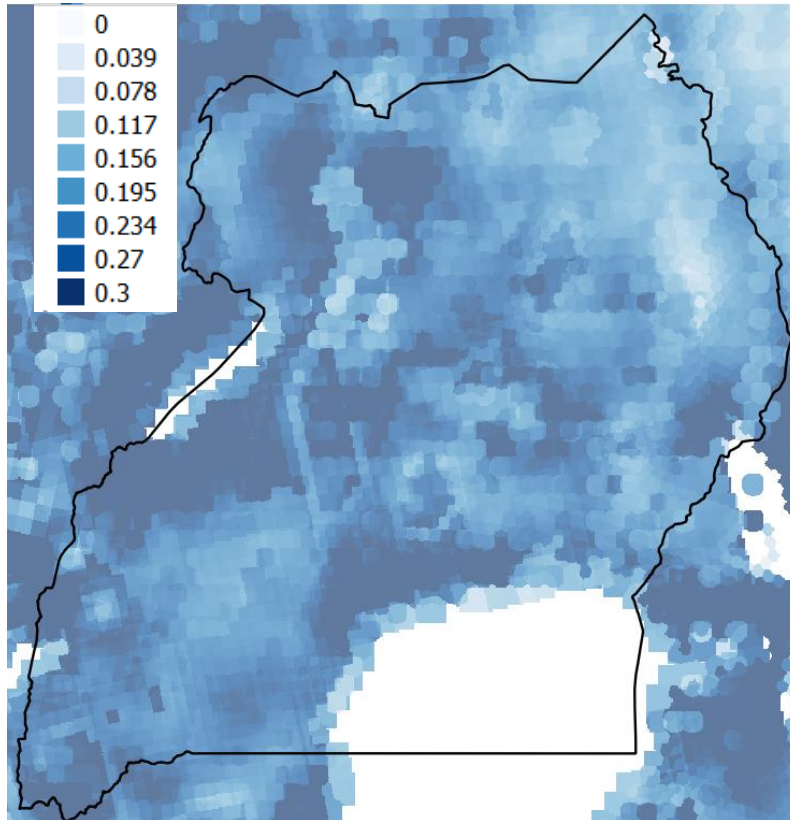
NRT product, 18th November 2019

NRT anomaly, 18th November 2019

Land surface temperature (K)

Frequency >>	Daily
Temporal sampling technique >>	Daytime only measurement (max temperature)
Period >>	January 2012 –
Coverage >>	Uganda
Spatial resolution	1 km
Layers >>	Daily maximum and anomaly
Derived from >>	Aqua & Terra MODIS (NASA), Landsat-8 OLI (USGS/NASA) and Sentinel-3 SLSTR (Copernicus/ESA)
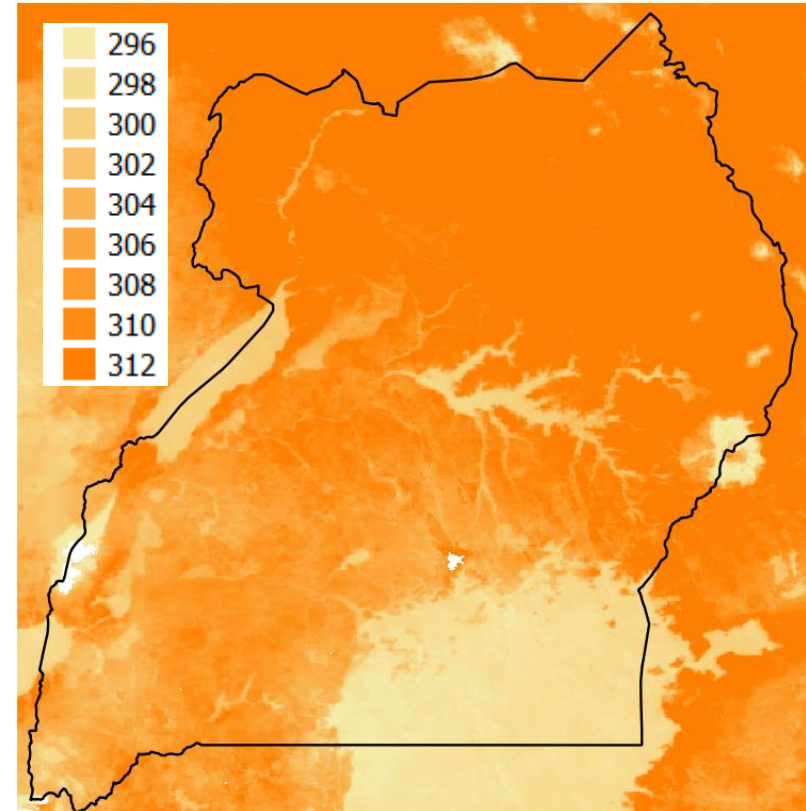
Long-term average, 29th January

Land surface temperature – NRT data
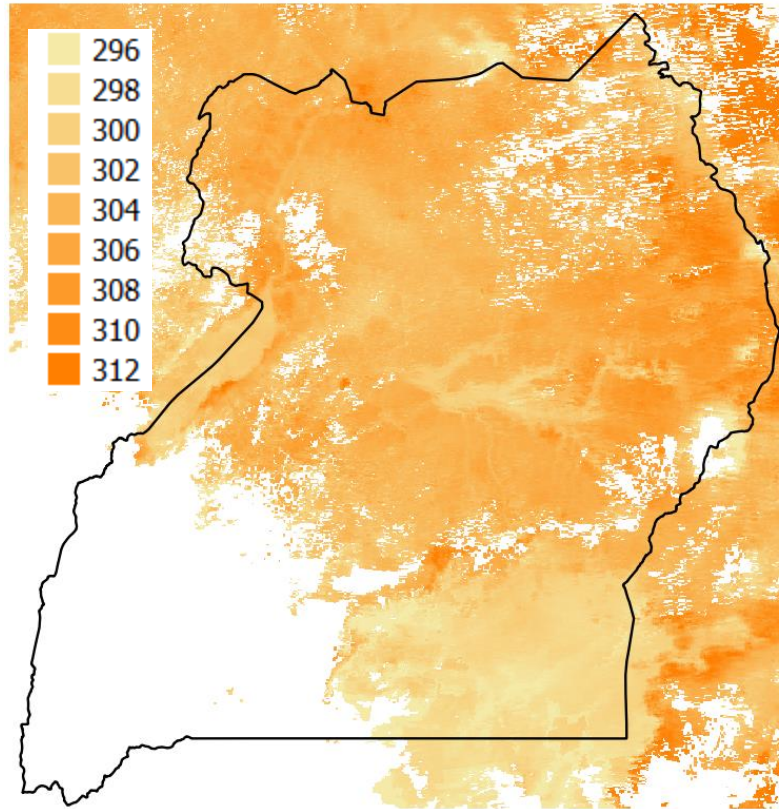
NRT product, 16th November 2019
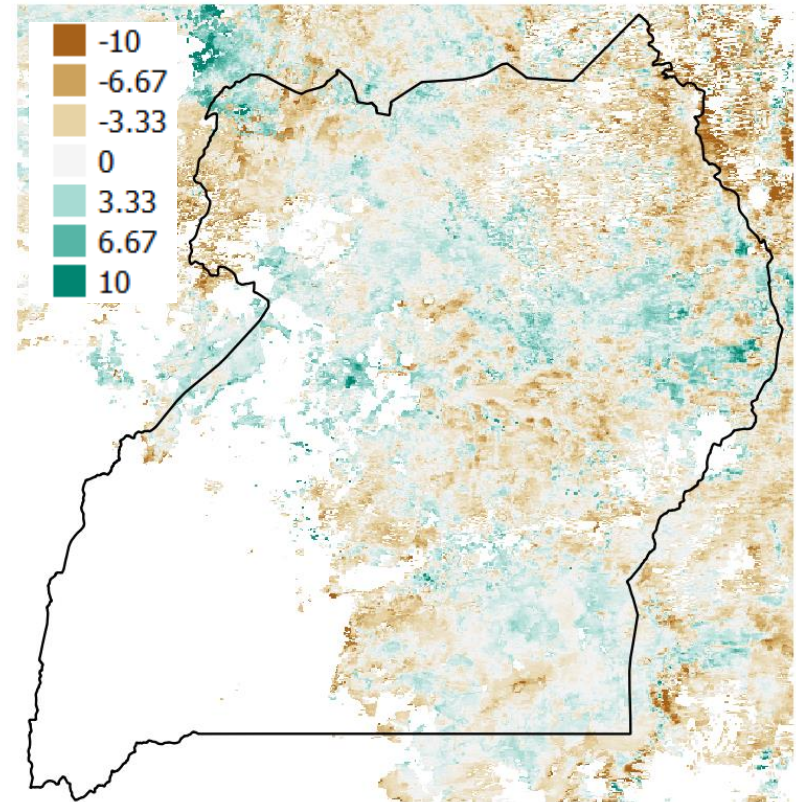
NRT anomaly, 16th November 2019 (test using new anomaly layer that includes Sentinel-3)

Water extent

Frequency >>	~12 days
Temporal sampling technique >>	Monthly composite
Period >>	January 2018 -
Coverage >>	Uganda
Spatial resolution	10m
Layers >>	Polygons for open water / saturated ground
Derived from >>	Sentinel-1 SAR-C (Copernicus/ESA)
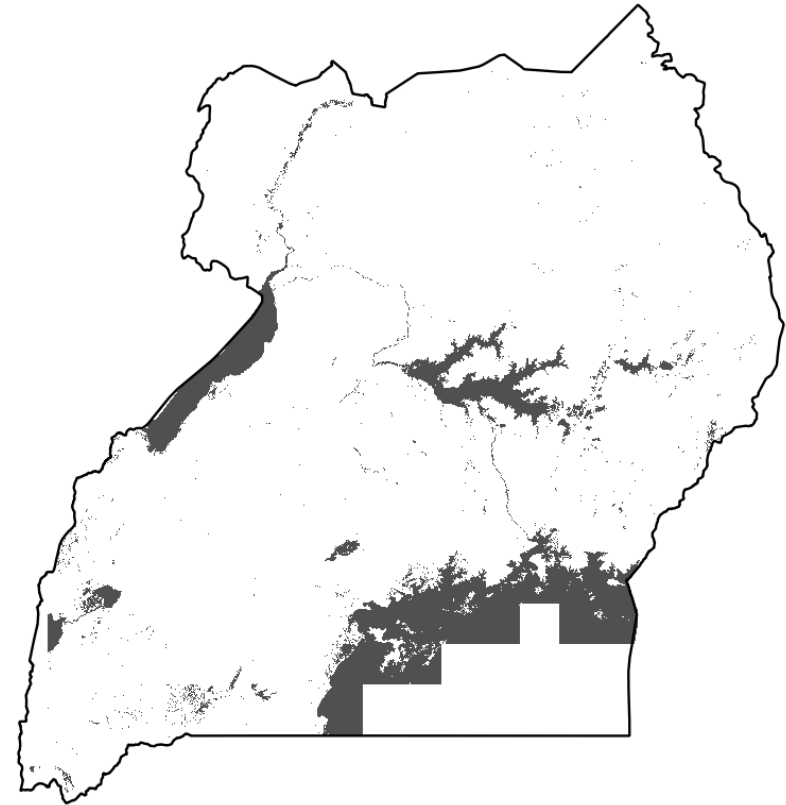
October 2019 monthly composite

Captures both permanent water and transient water / saturated ground

Water extent
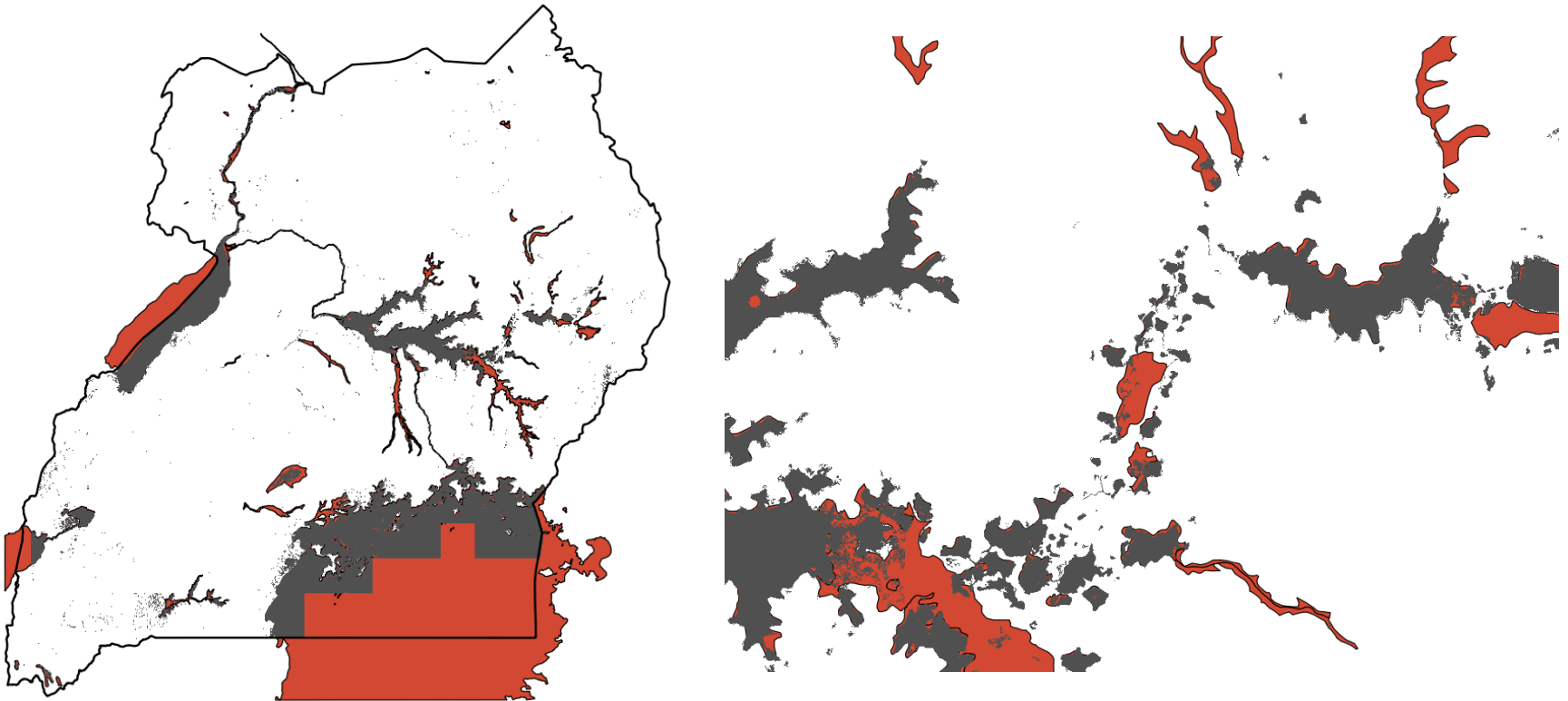
In red, comparison to 2005 map from Uganda Bureau of Statistics

Water height

Frequency >>	~10 days at best
Temporal sampling technique >>	Depends on satellite track locations and whether there's cross-over
Period >>	January 2018 -
Coverage >>	Uganda, large water bodies
Spatial resolution	Points of several km diameter, but weighted towards the centre
Values >>	Average and standard deviation of height
Derived from >>	Topex / Jason Series (CNES/NOAA/EUMETSAT) + Sentinel-3 SRAL (Copernicus/ESA)

Captures long term variations in waterbody height
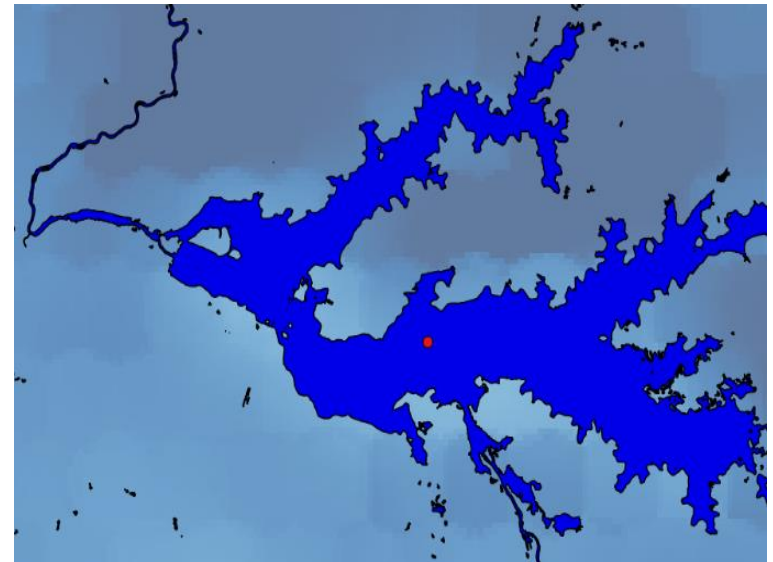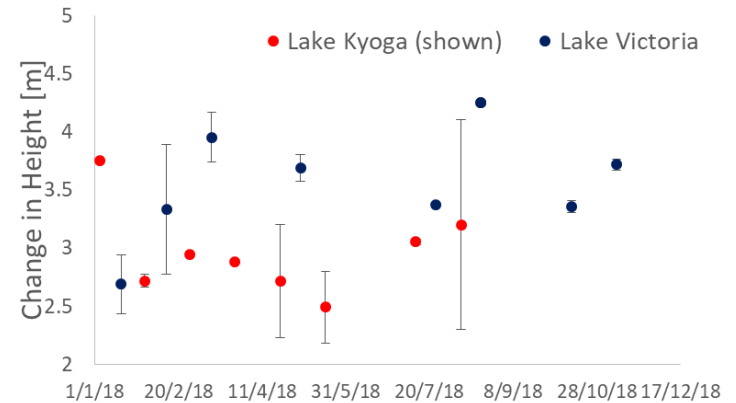
Next step: calculation of evapotranspiration (mm/day)

Current product – ~11 km resolution resampled to 1km
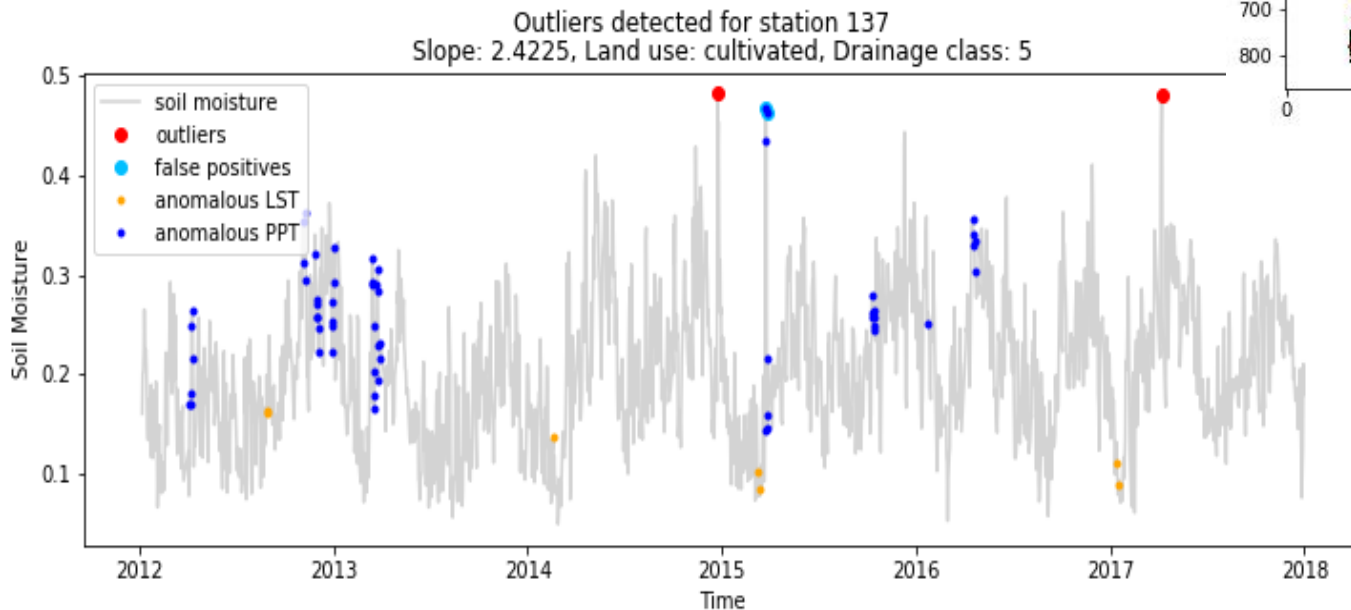

Rough location of zoomed in area
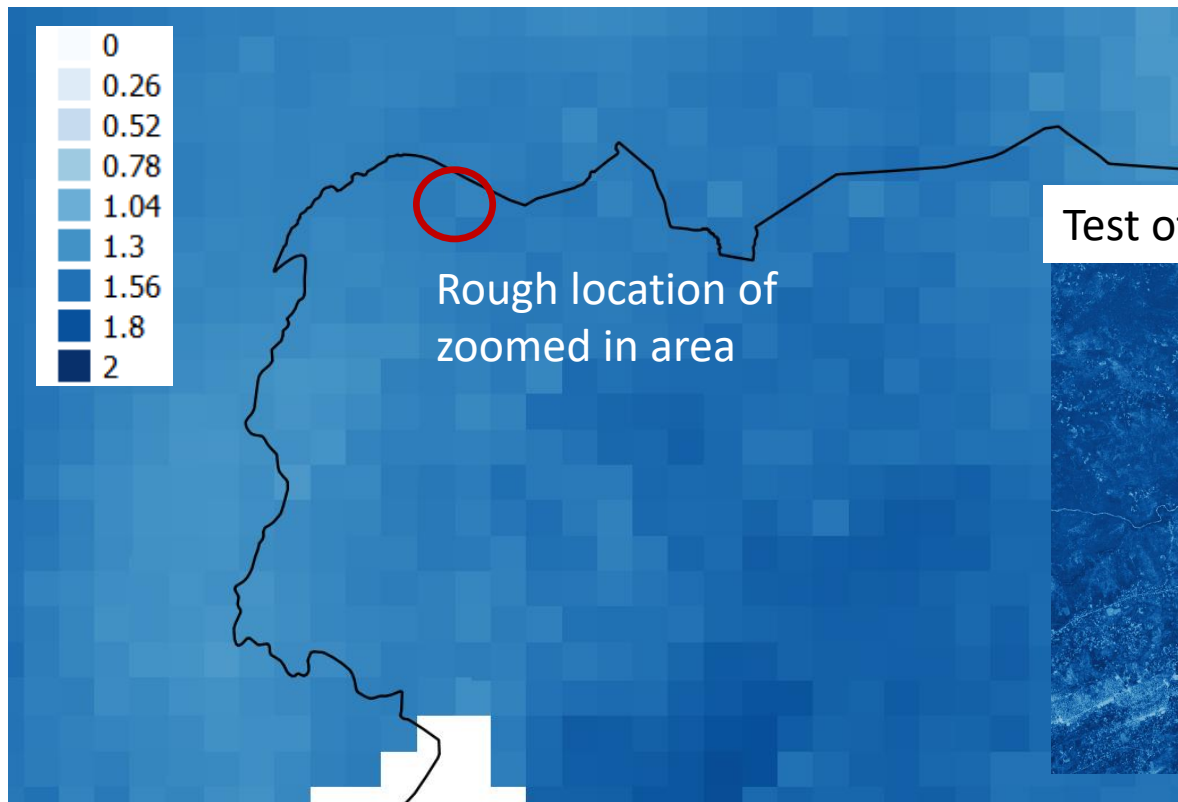
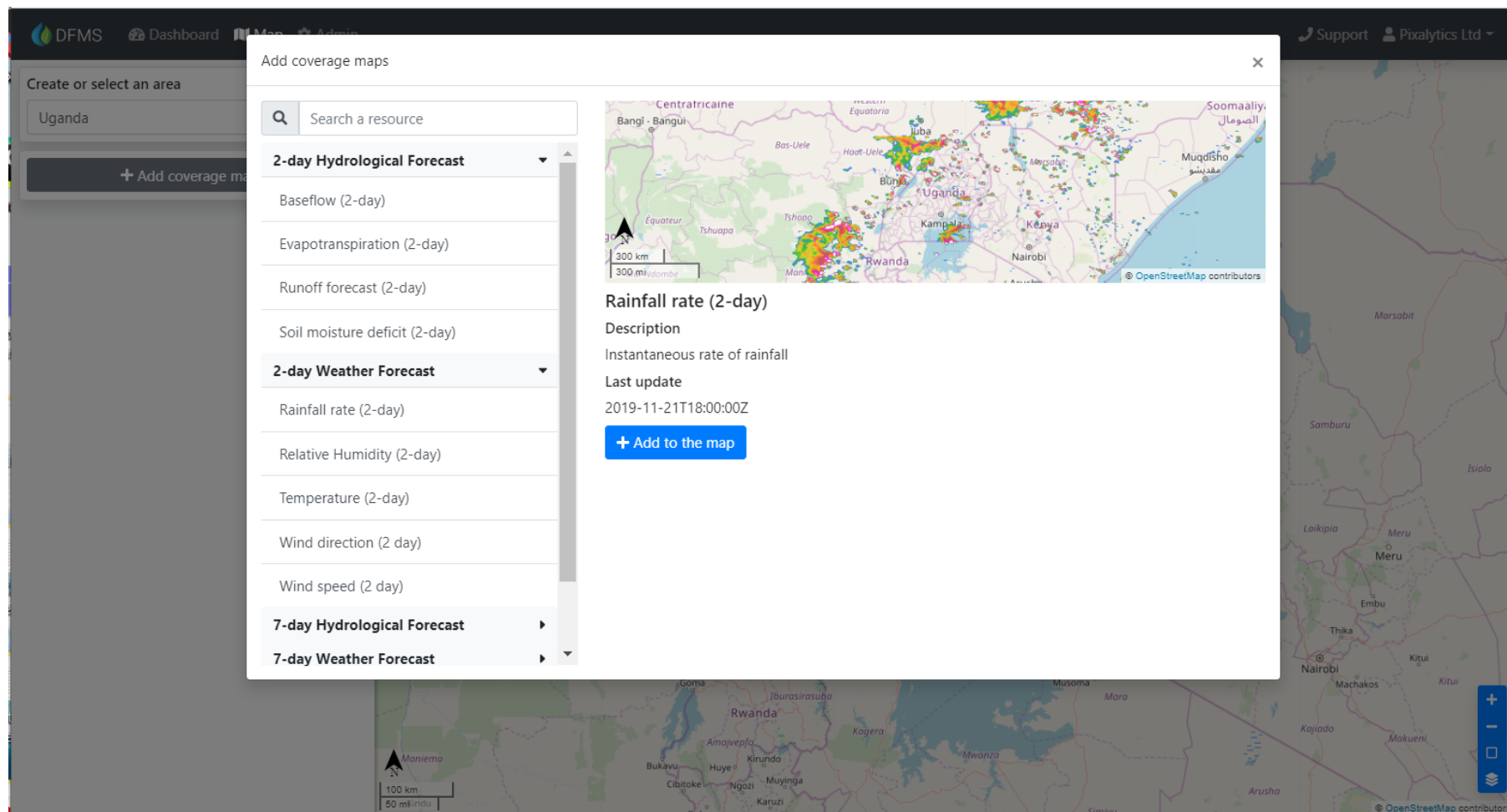Test of new product – 10 m resolution
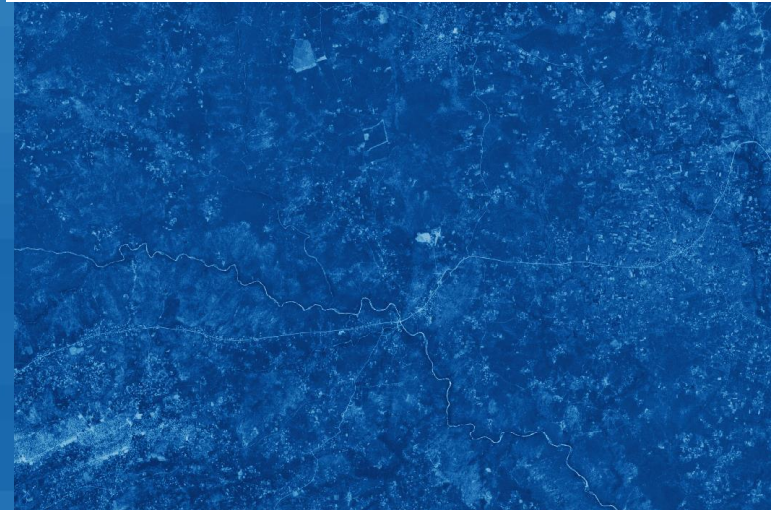
Verification of the satellite data

Correlation of soil moisture against ECMWF ERA-Interim data, and analysis of outliers compared to land surface temperature (LST) and precipitation (PPT) – station 137 near Lake Victoria

Portal also contains Weather (from UK Met Office) and Hydrological forecasts (HR Wallingford) alongside vegetation and land cover satellite products (Environment Systems).

Conclusions / recommendations

- The DFMS platform has the potential to be a powerful tool for understanding how water availability across Uganda changes over time.

- It aims to deliver Uganda-specific output products with an improved quality, detail and frequency compared to those already available via other early warning platforms.

- A key component of the project is stakeholder engagement, so that's what's developed has fitness for purpose. Current stage is user up-take for the evaluation version.