



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.



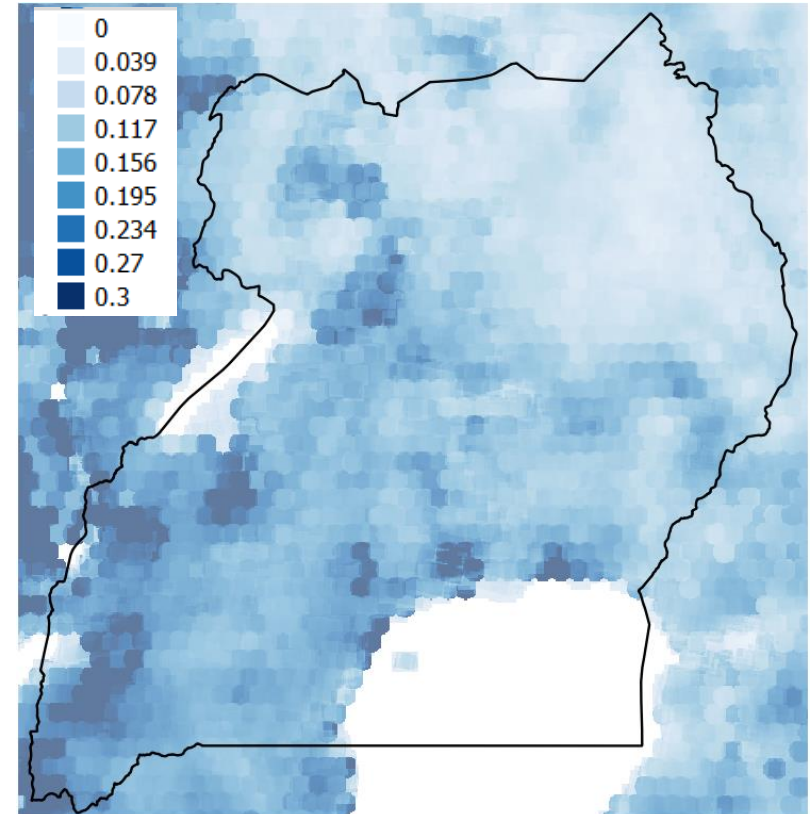
Consortium partners

- 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)

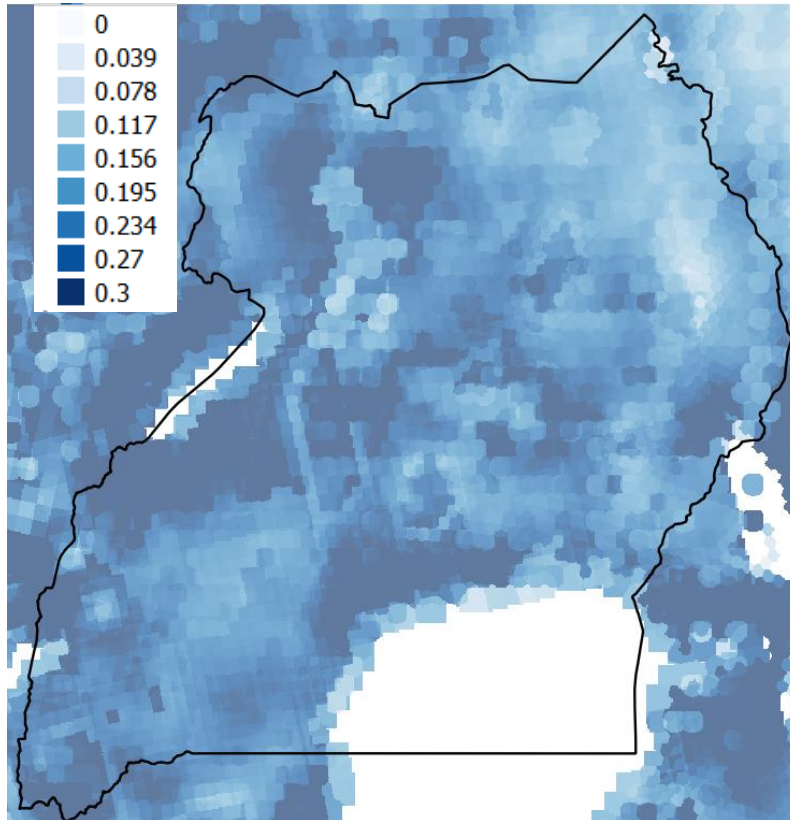
<i>Frequency >></i>	Daily
<i>Temporal sampling technique >></i>	Average of all measurements in 24 hours
<i>Period >></i>	January 2012 –
<i>Coverage >></i>	Uganda
<i>Spatial resolution</i>	1 km
<i>Layers >></i>	Daily average and anomaly
<i>Derived from >></i>	SMOS (ESA), ASCAT (EUMETSAT) and AMSR2 (NASA/JAXA).



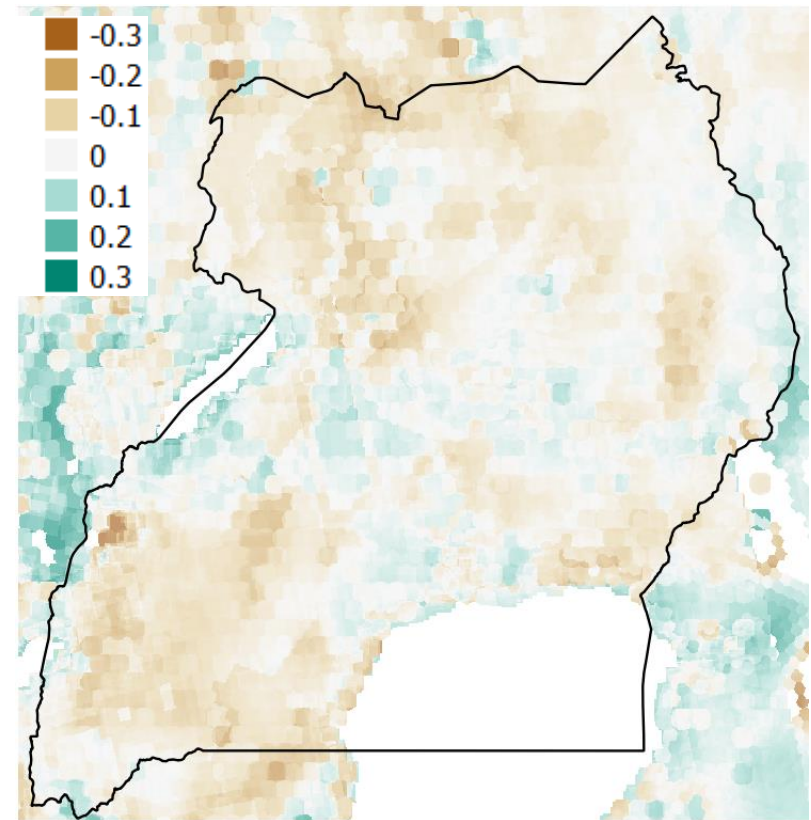
Baseline (2012-2018) average used for anomaly calculation, 29th January – doesn't include AMSR2

Soil moisture content within the top few cm.

Soil moisture (m³/m³) – NRT data



NRT product, 18th November 2019



NRT anomaly, 18th November 2019

Land surface temperature (K)

Frequency >>
Temporal sampling technique >>

Daily

Daytime only
measurement
(max temperature)

Period >>

January 2012 –

Coverage >>

Uganda

Spatial resolution

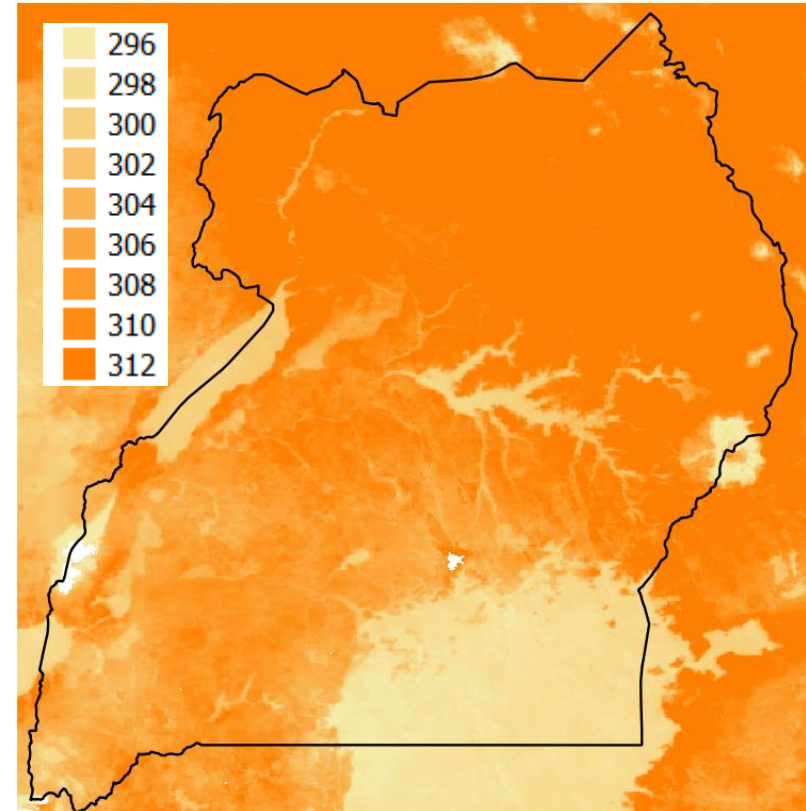
1 km

Layers >>

Daily maximum and
anomaly

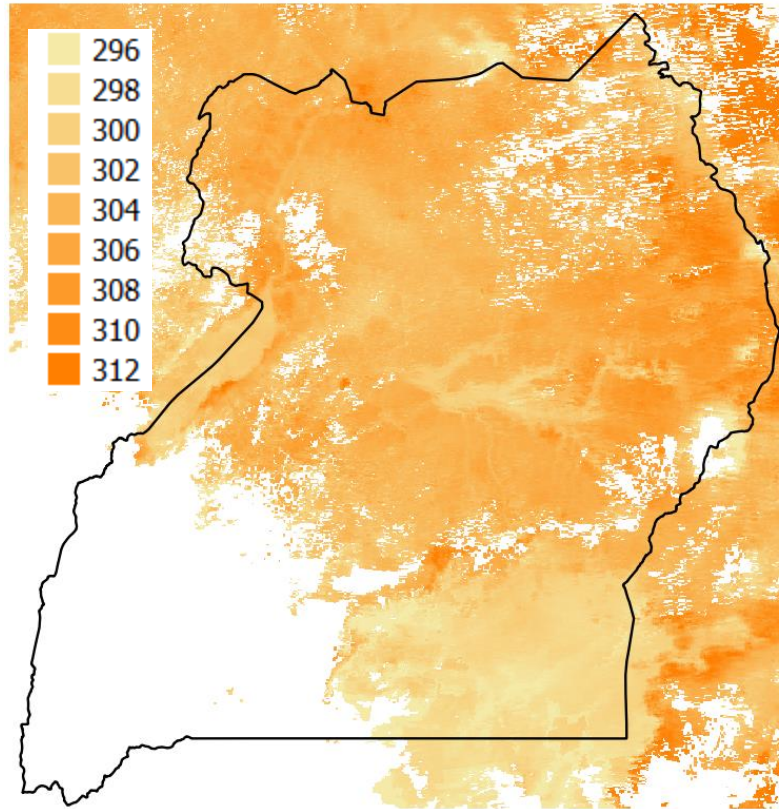
Derived from >>

Aqua & Terra
MODIS (NASA),
Landsat-8 OLI
(USGS/NASA) and
Sentinel-3 SLSTR
(Copernicus/ESA)

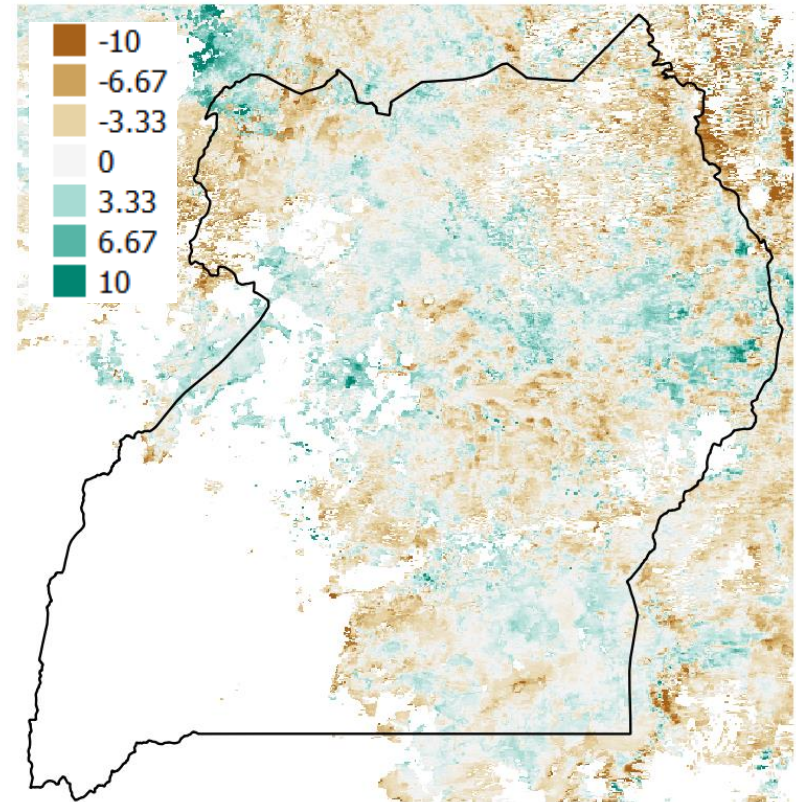


Long-term average, 29th January

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

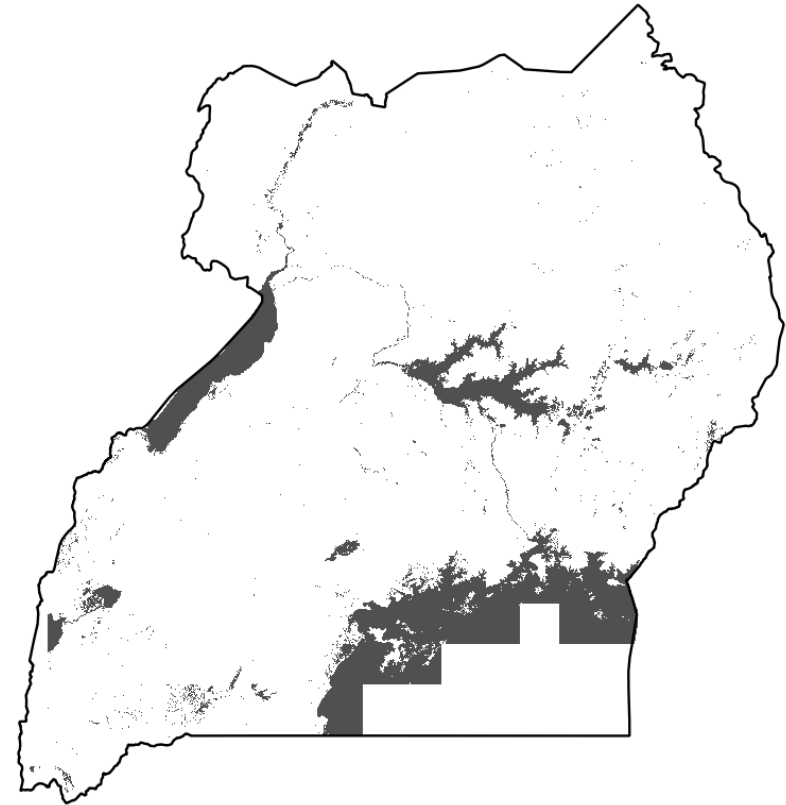
10m

Layers >>

Polygons for open
water / saturated
ground

Derived from >>

Sentinel-1 SAR-C
(Copernicus/ESA)

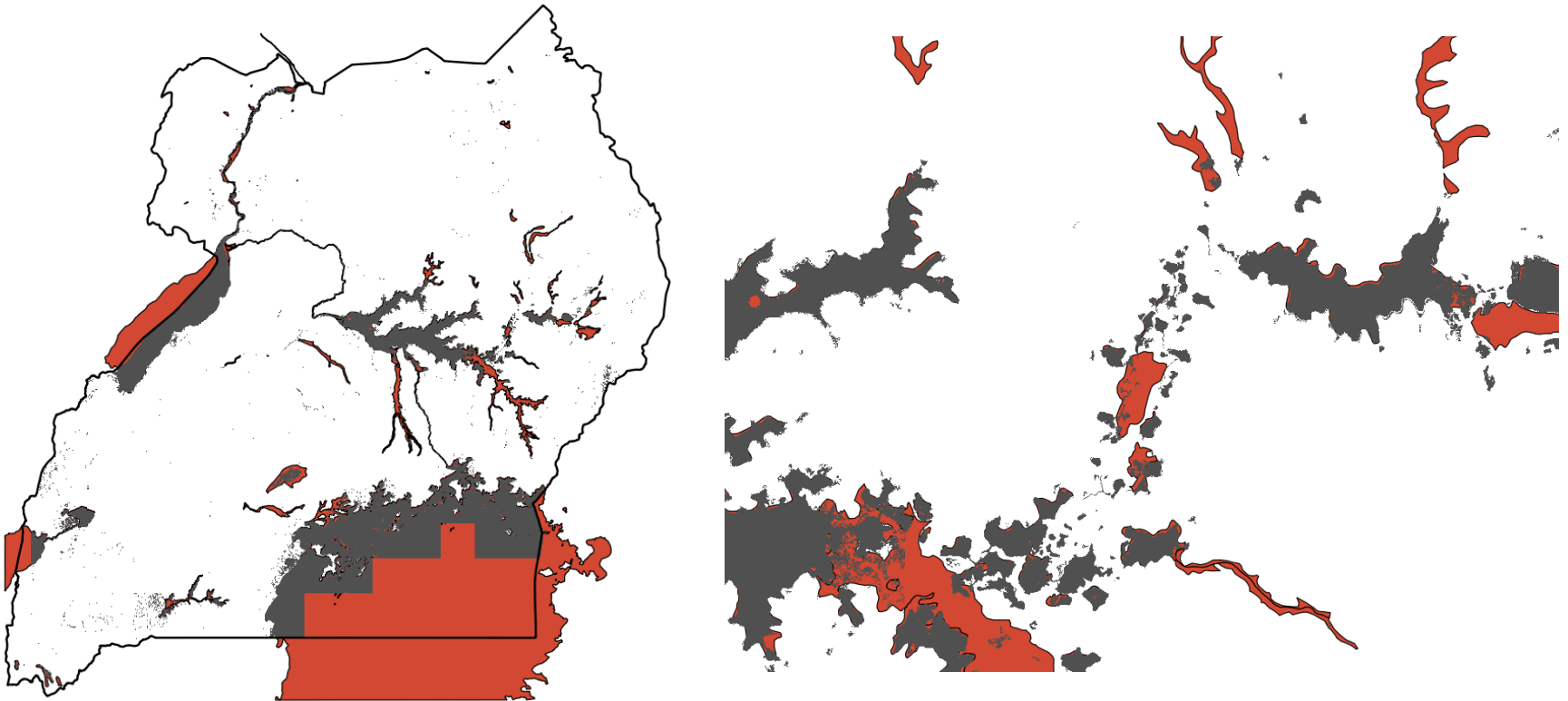


October 2019 monthly composite

Captures both permanent water and transient
water / saturated ground



Water extent

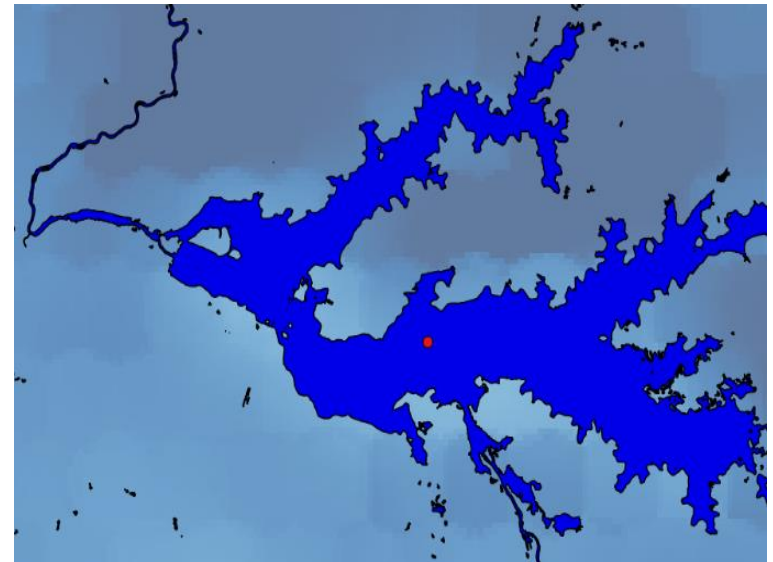
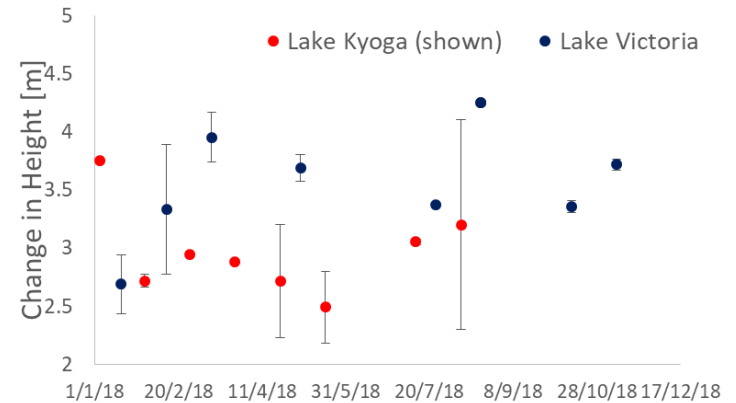


In red, comparison to 2005 map from Uganda Bureau of Statistics



Water height

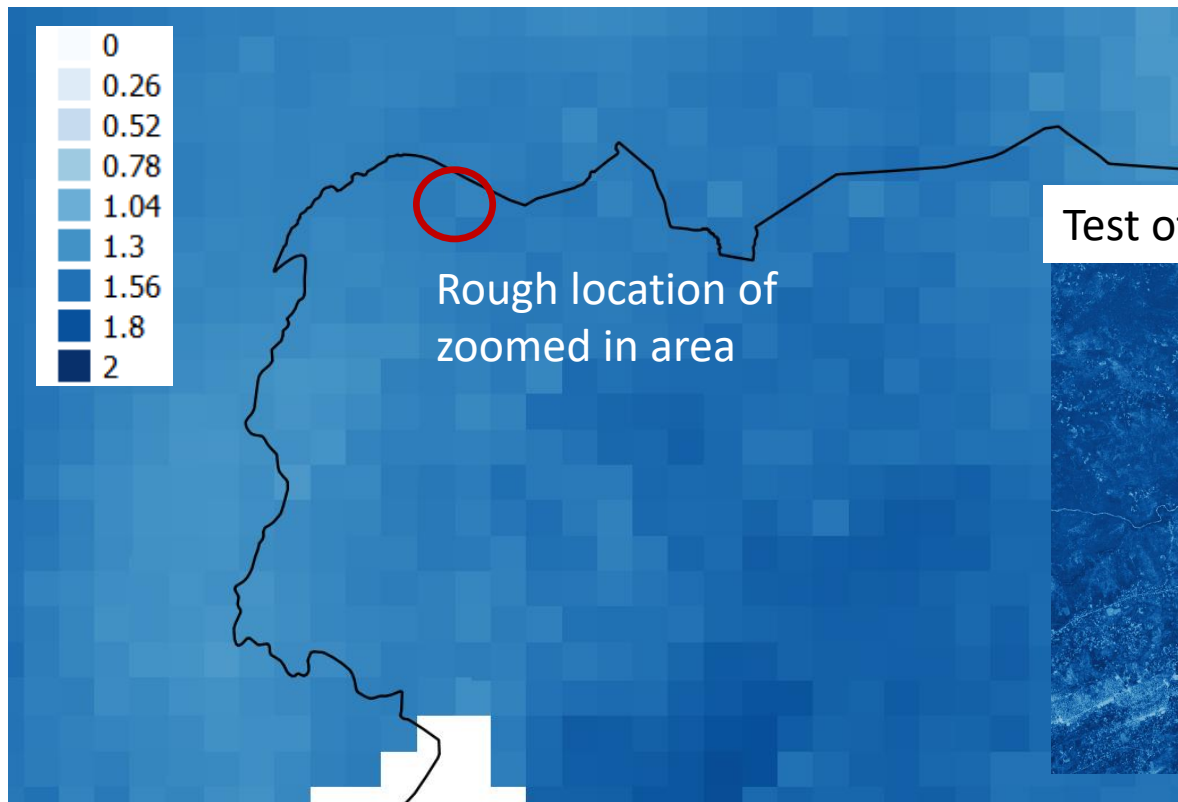
<i>Frequency >></i>	~10 days at best
<i>Temporal sampling technique >></i>	Depends on satellite track locations and whether there's cross-over
<i>Period >></i>	January 2018 -
<i>Coverage >></i>	Uganda, large water bodies
<i>Spatial resolution</i>	Points of several km diameter, but weighted towards the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



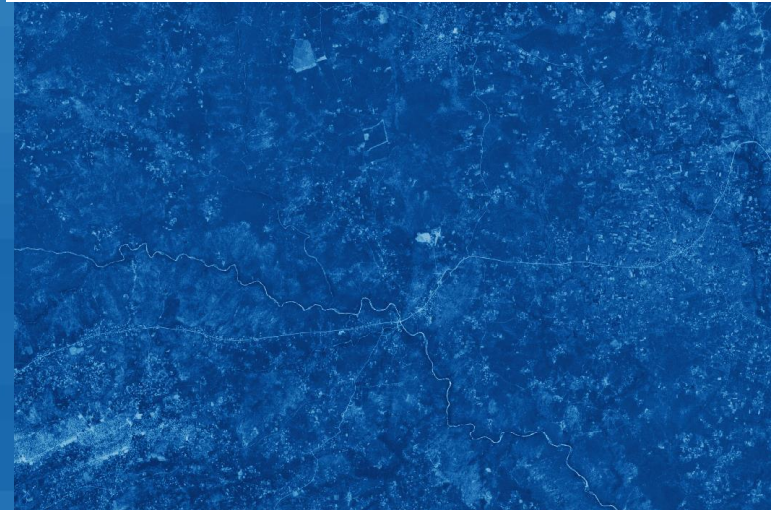


Next step: calculation of evapotranspiration (mm/day)

Current product – ~11 km resolution resampled to 1km



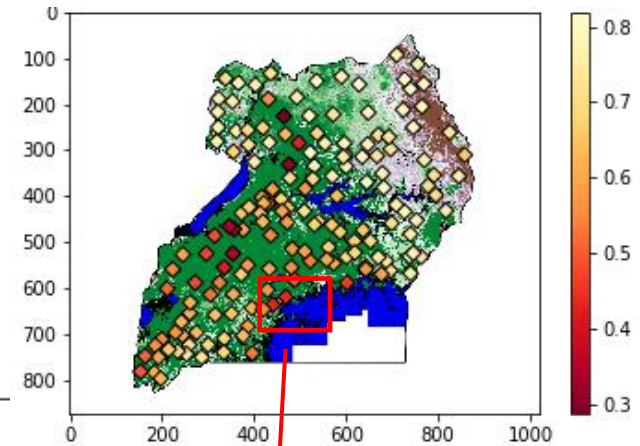
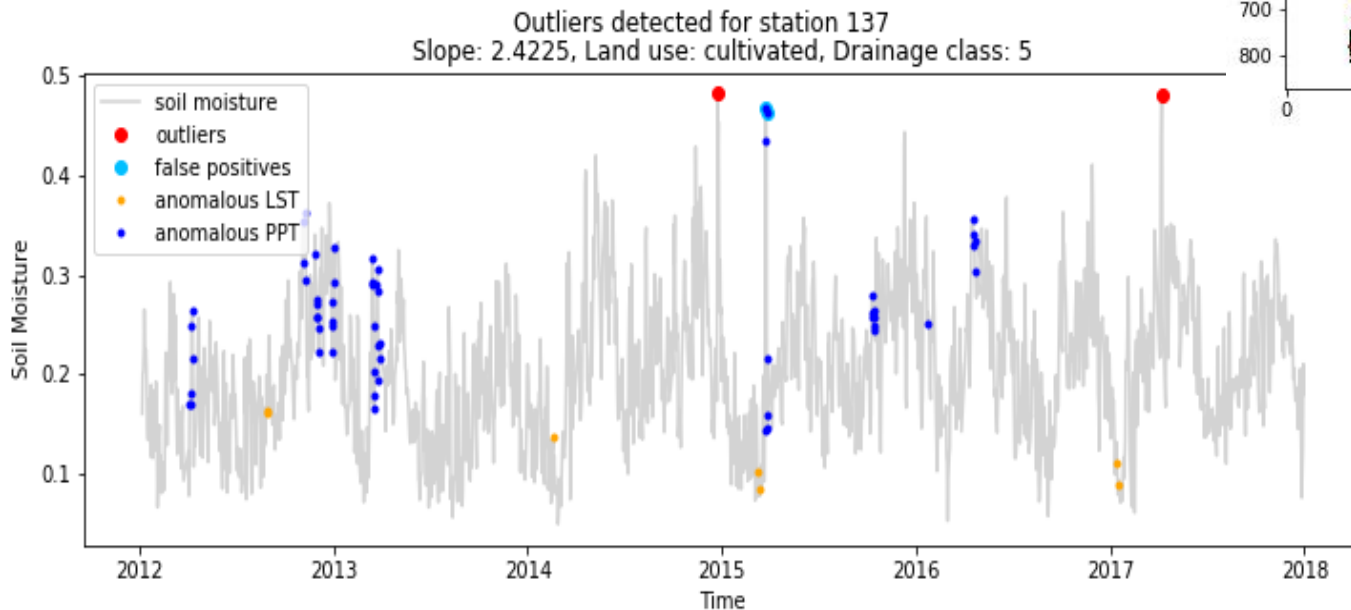
Test of new product – 10 m resolution

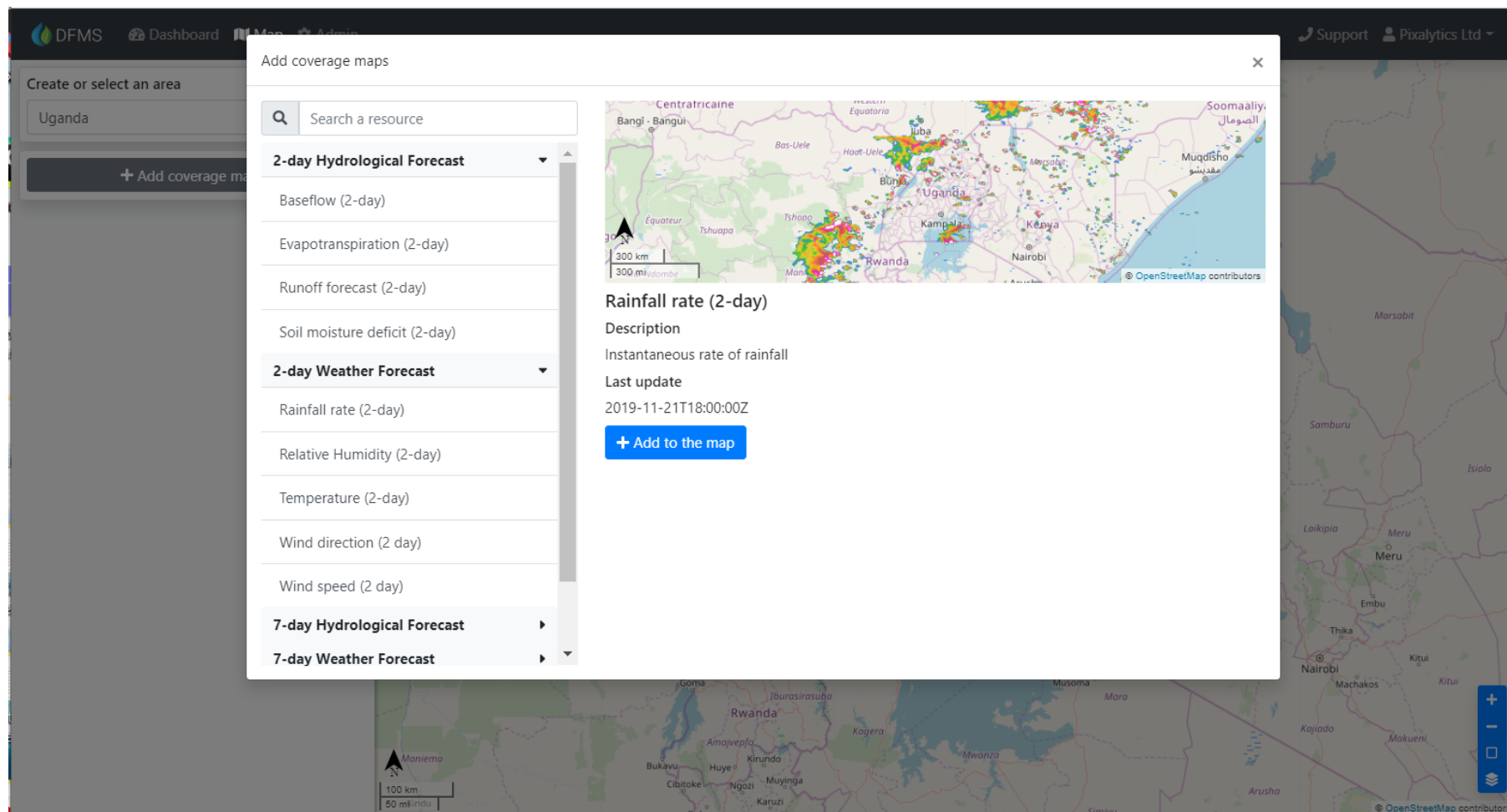




Verification of the satellite data

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





The screenshot displays the DFMS web application interface. On the left, a sidebar contains the DFMS logo, navigation links for 'Dashboard' and 'Map', and a section titled 'Create or select an area' with a search bar containing 'Uganda' and a '+ Add coverage maps' button. The main content area shows a map of East Africa with a dialog box titled 'Add coverage maps' overlaid. This dialog box features a search bar labeled 'Search a resource'. Below it, a list of resources is shown, categorized into '2-day Hydrological Forecast' and '2-day Weather Forecast'. The '2-day Hydrological Forecast' category includes 'Baseflow (2-day)', 'Evapotranspiration (2-day)', 'Runoff forecast (2-day)', and 'Soil moisture deficit (2-day)'. The '2-day Weather Forecast' category includes 'Rainfall rate (2-day)', 'Relative Humidity (2-day)', 'Temperature (2-day)', 'Wind direction (2 day)', and 'Wind speed (2 day)'. The '7-day Hydrological Forecast' and '7-day Weather Forecast' categories are also listed at the bottom of the dialog. The 'Rainfall rate (2-day)' resource is selected, and its details are shown on the right side of the dialog: 'Description: Instantaneous rate of rainfall', 'Last update: 2019-11-21T18:00:00Z', and a blue '+ Add to the map' button. The background map shows a region in East Africa, including parts of Uganda, Rwanda, and Kenya, with various geographical features and place names visible.

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.