
THE DROUGHT & FLOOD MITIGATION SERVICE IN UGANDA – FIRST RESULTS

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OVERVIEW



- Throughout Africa, the **intensity** and **length** of the dry seasons as well as the **timing** and **intensity** of the rainy seasons are becoming more and more unpredictable.
- Only **capacity building** of Uganda's National Meteorological & Hydrological Services can deliver a **sustainable response** to this increased uncertainty.
- However, **reliable and actionable weather forecasts and crop information** is needed now to reduce the loss of human lives and the destruction of crops and livestock, and mitigate other impacts of extreme weather events.
- The UK Space Agency's **International Partnership Programme** enables British expertise and capacity in weather forecasting and satellite remote sensing to be used in providing relevant information products to Uganda now.
- DFMS has been **operational since November 2019** and is being trialled by the Uganda National Meteorological Authority (UNMA) and the Ministry of Water and Environment (MWE)

FOCUS OF THE DFMS PROJECT



- DFMS stands for **D**rought and **F**lood **M**itigation **S**ervice
- To mitigate the effects of droughts and floods, **decisions and advice** that have a positive **impact** need be informed by accurate **knowledge** about the pertinent meteorological, hydrological, and geophysical conditions. Such knowledge is created by applying expertise to **information**, which is created by gathering **data** and processing it.



Source: RHEA Group

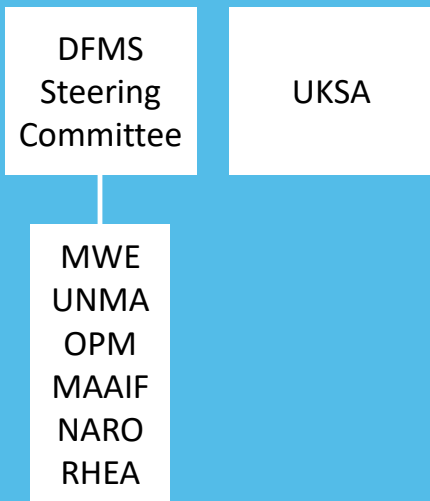
- All along this *information value chain* opportunities for improvement exist in Uganda, but we concluded that significant impact could be achieved by improving **access to data** as well as the **quality, range, timeliness, and frequency of information**.



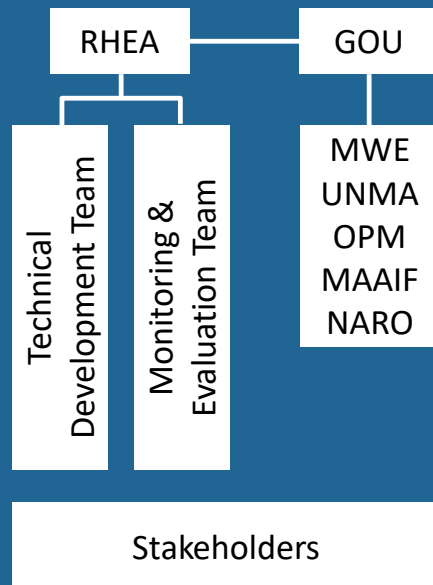
PROJECT ORGANISATION



GOVERNANCE

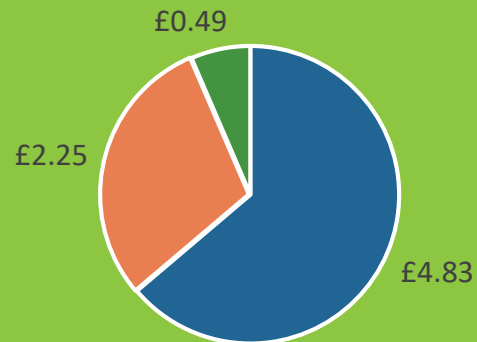


DESIGN & DELIVERY



FUNDING

(in millions GBP)



■ UKSA (IPP)

■ RHEA

■ Other DFMS Consortium

In kind contributions are made by the GOU Partners.

Return on investment for DFMS Consortium to come from commercial exploitation in partnership with UNMA

PROJECT PARTNERS



UK-based

- RHEA Group (platform & systems engineering)
- UK Met Office (meteorology)
- HR Wallingford (hydrology)
- Pixalytics (space-based EO)
- Environment Systems (space-based EO)
- AgriTechTalk (in-situ EO)
- Databasix (user interface)



- Oxford Policy Management (M&E)



Uganda-based

- Ministry of Water and Environment (lead)
- Uganda National Meteorological Authority
- Office of the Prime Minister
- Ministry of Agriculture, Animal Industry, and Fisheries
- National Agricultural Research Organisation



- Kakira Sugar

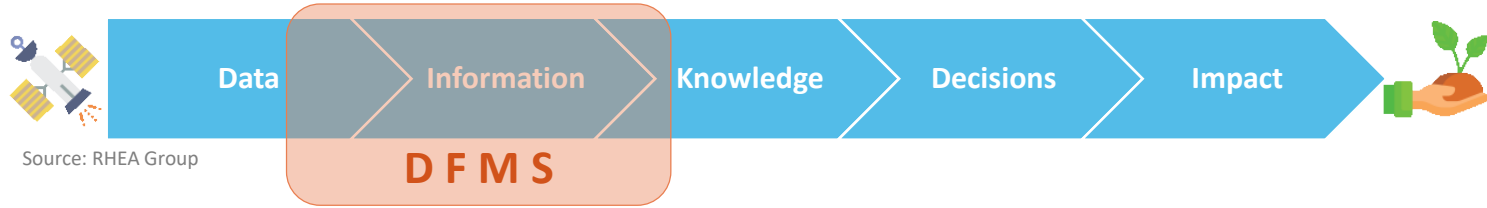


- Mercy Corps (M&E)



- AgriTechTalk Africa (M&E)

WHAT ENABLES DFMS TO MAKE A DIFFERENCE



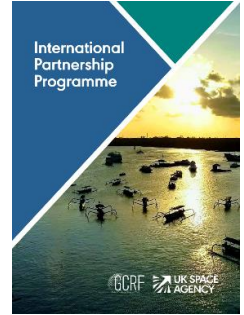
- The design of DFMS is driven by stakeholder requirements, enabled by the **cooperation** between DFMS Consortium led by RHEA and the five Ugandan government partners.
- The operation of DFMS is enabled by the **partnership** between UNMA, the semi-autonomous government agency mandated to offer weather and climate services in Uganda, and RHEA as leader of the DFMS Consortium.
- **Freely available EO data** and **open technologies** (e.g. Open Data Cube) allow operating costs to be kept low and the price of access to the service to be affordable.
- The **funding** provided by the UK Space Agency's International Partnership Programme (IPP) lowered the investment risk for the DFMS Consortium members to an acceptable level.

THE INTERNATIONAL PARTNERSHIP PROGRAMME (IPP)



IPP seeks to maximise the practical impact on the lives of those living in developing countries by partnering with developing countries to use space solutions to address their specific development challenges

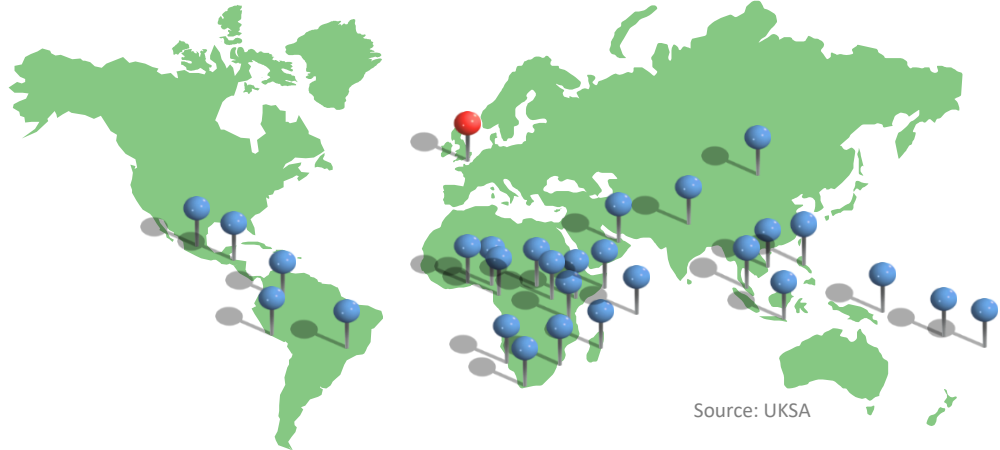
It is the biggest space-technology-enabled aid programme in the world: 5 year, £152m, run by the UK Space Agency, funded from the £1.5b BEIS Global Challenges Research Fund (GCRF), part of the UK's Official Development Assistance (ODA) ring-fenced budget.



Source: UKSA

IPP currently funds 33 projects around the world that are developing and testing potential solutions spanning multiple development sectors.

➤ www.spacefordevelopment.org



Source: UKSA

SUSTAINABILITY CONCEPT



- Central to the sustainability concept is that in first instance the leave behind of the DFMS Project is not a system that is handed over to the local government partners to operate, maintain and develop, but instead access to a service which provided using a system that is operated, maintained and further developed by the organisations that designed and built it.
- DFMS users are skilled professionals who would primarily require dependable access to actionable information, not skills development. The final beneficiaries of the benefits DFMS provides (e.g. smallholder farmers) are impacted through existing information channels (e.g. district officers or extension workers).
- This service is provided at cost to GOU users, with the use of free satellite data, open technologies, and cloud computing allowing this cost to be brought down to acceptable levels. Marketing the service to commercial customers in cooperation with UNMA, allows to DFMS consortium to recover its investment over time, whilst at the same time those commercial customers will provide the drive the continue development of the system so as to meet the changing requirements and exploit the opportunities new data sets will provide.
- Handing over the system to a local entity (public or private) is not excluded in the longer term.

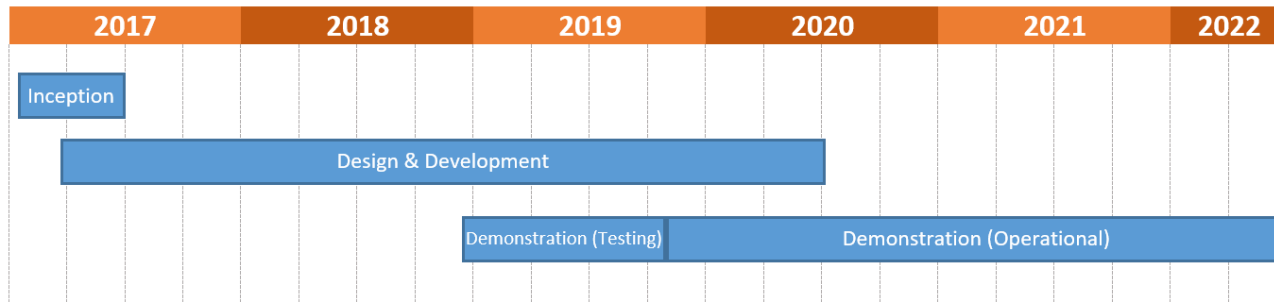
SYSTEM VS. SERVICE



Benefits of our *providing-a-service* approach over a *handing-over-a-system* approach:

- Significantly improved probability that the system is operated and maintained correctly (no dependence on capacity development), reducing the risk of critical failures.
- Use of cloud technology severely reduces user bandwidth requirements as there is no need the download very large satellite data sets for local processing.
- Use of cloud technology severely reduces user capital investment to the cost of an Internet-connected personal computing device (e.g. laptop or tablet).
- Providing a commercial service introduces market pressure to quickly respond to usage issues (→ quicker bug fixing, improved user support) and changing user requirements (→ constant service development)
- Recognising that capacity development of Uganda's NMHSs is the only sustainable long term solution, the service approach provides a more sustainable solution to bridging the capacity development gap and providing impact for the final beneficiaries in the short-term.

PROJECT STATUS



- Beta testing started in November 2018. Service has been operational since November 2019.
- GOU usage of DFMS during the Demonstration Phase should proof the service provides value-for-money. This proof would enable access to DFMS to be funded from the GOU budget starting July 2022 (FY2022/2023).
- 50+ users from MWE, UNMA, OPM, MAAIF, and NARO have received basic user training to date.
- The development of a DFMs Capacity Building Programme was added to the project in September 2019 to enable more central and local government officials to make use of the service. The first Capacity Building workshops were held in February 2020.
- The Corona Pandemic has effectively put use of DFMS on hold. Impacts are currently being assessed.

DFMS PRODUCTS



FORECAST SERVICES

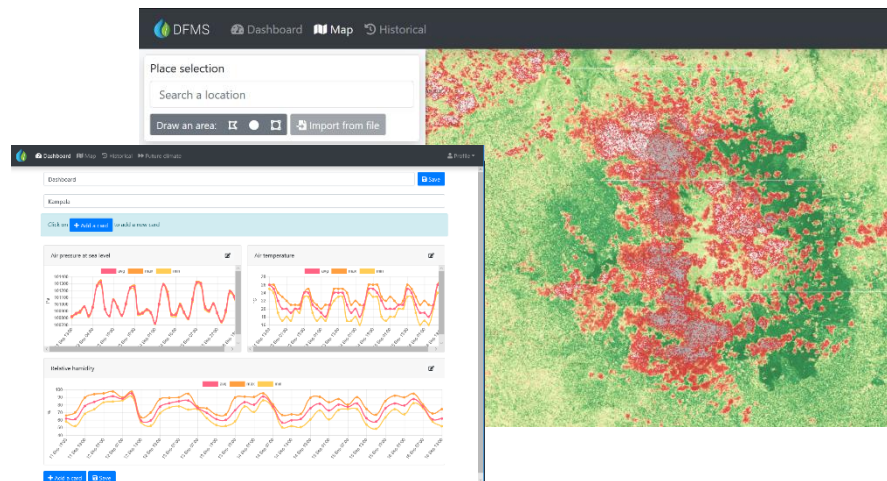
- 2, 7, and 90-day weather (temperature, rainfall, wind, etc.; deterministic and probabilistic)
- 2 and 7-day hydrological (runoff, soil moisture deficit, evapotranspiration)
- Flood Runoff Indicator, Standardized Precipitation Index

MONITORING AND ANALYSIS SERVICES

- Land Surface Temperature (LST)
- Water Height, Water Extent
- Evapotranspiration
- Soil Moisture
- Normalized Difference Vegetation Index (NDVI)
- Burn Area Index (BAI)

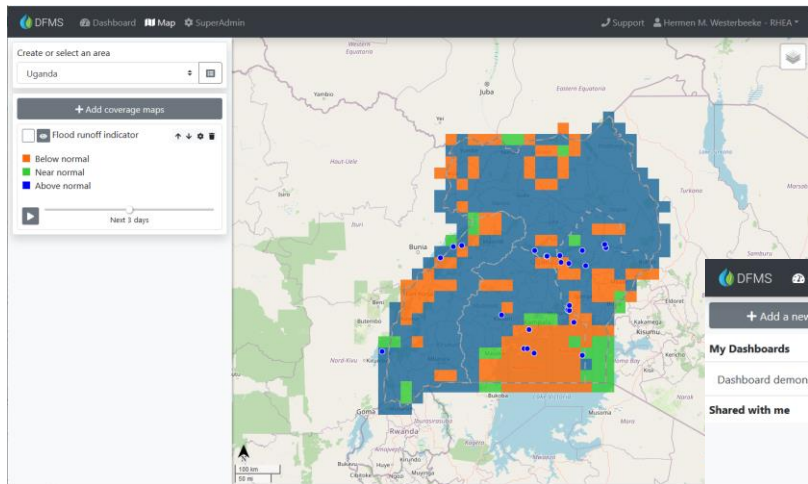
DFMS Platform

- Cloud-processing, cloud-storage
- Open Data Cube at the core
- Delivered as a service



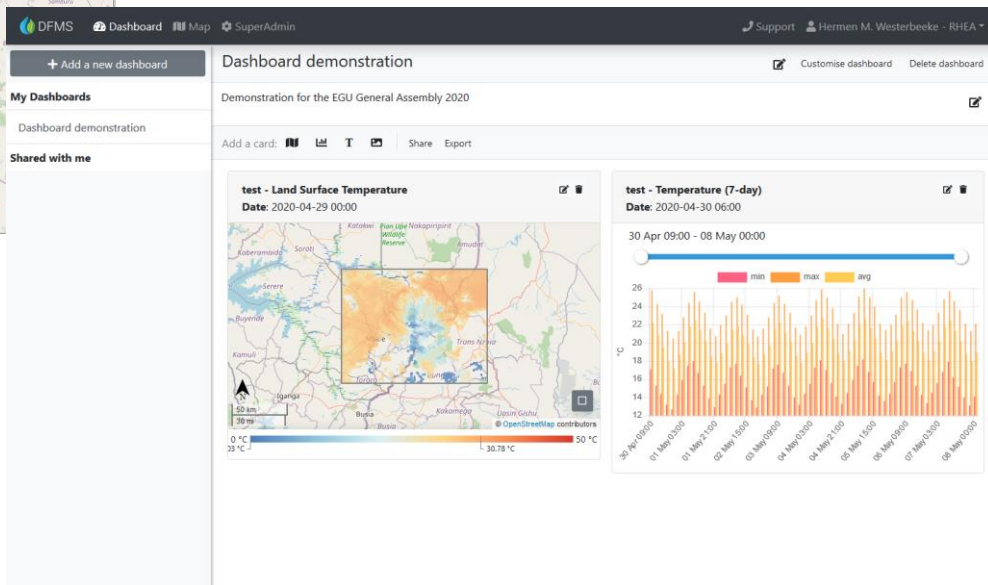
Source: RHEA Group

IMPRESSIONS (INSTEAD OF LIVE DEMONSTRATION)



Use the MAP view (left) to explore areas and products and the DASHBOARD view (below) to set up predefined information sets for regular monitoring or reporting.

Dashboards can be shared with other users.

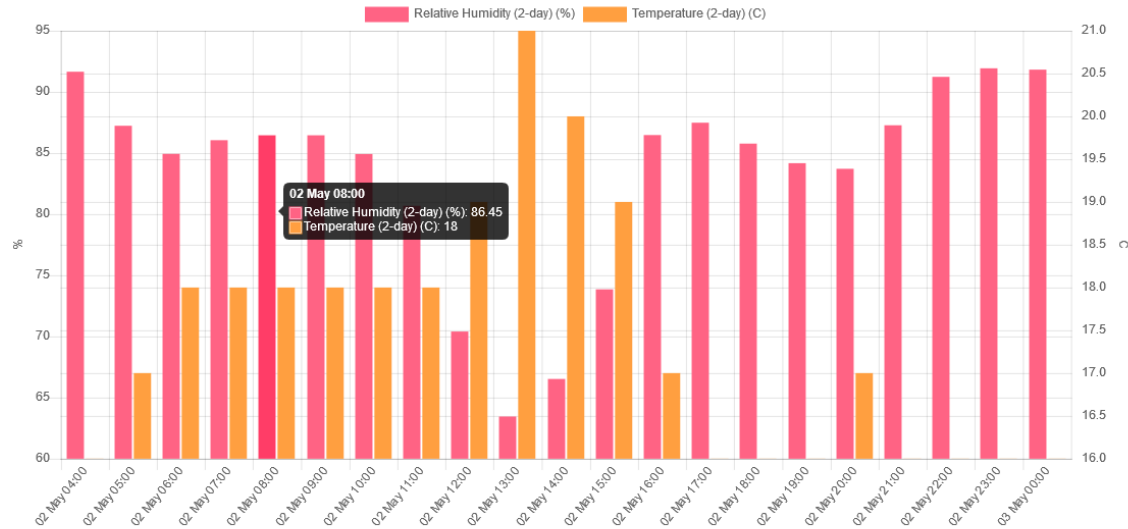


IMPRESSIONS (INSTEAD OF LIVE DEMONSTRATION)



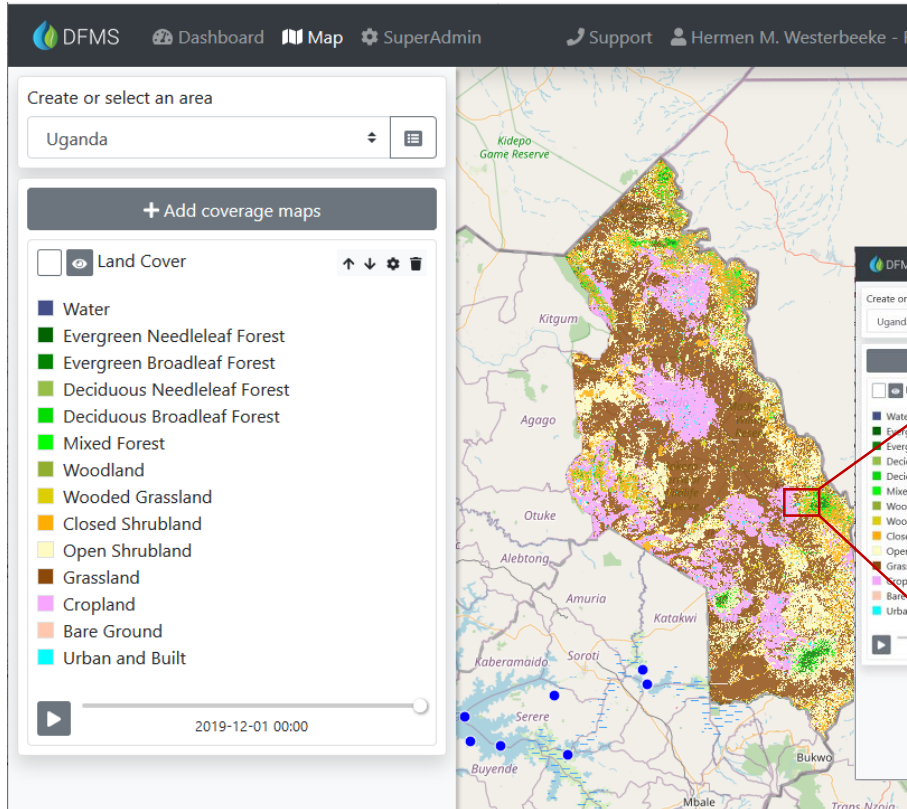
Mount Elgon

02 May 04:00 - 03 May 00:00

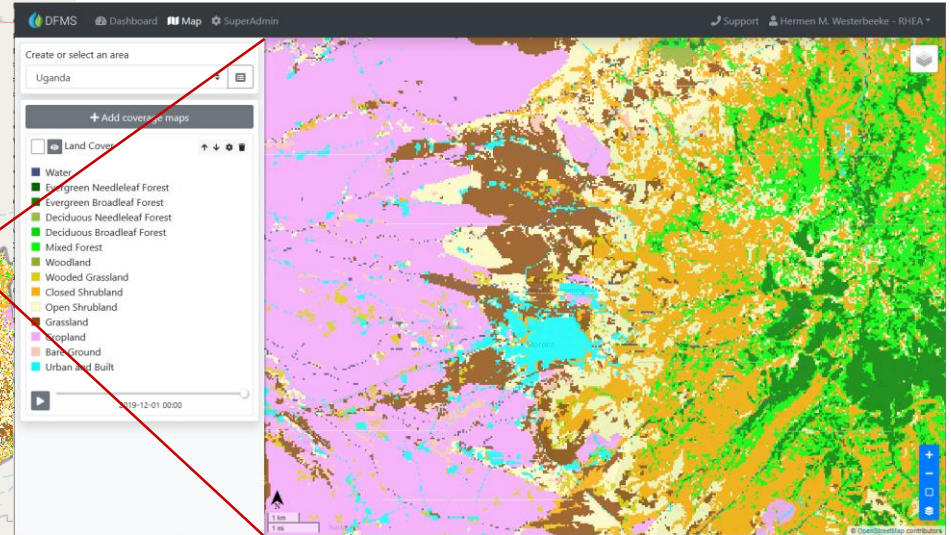


Display sets of forecast products

IMPRESSIONS (INSTEAD OF LIVE DEMONSTRATION)



Features 10x10m land cover maps for Karamoja region for 2019, 2028, and 2019



IMPRESSIONS (INSTEAD OF LIVE DEMONSTRATION)



DFMS Dashboard Map SuperAdmin Support Hermen M. Westerbeeke - RHEA

User Settings

- Profile
- Password
- Notifications
- Settings

Settings menu

Weather units

Temperature units C °C °F K

Wind speed mph kt bt f m/s mph km/h

Precipitations mmh mm/hr mm/h

Pressure Pa Pa hPa

Base map selection

Opendreetmap Grayscale

Customisation of units and base maps.

Possibility to create email notifications

DFMS Dashboard Map SuperAdmin Support Hermen M. Westerbeeke - RHEA

User Settings

- Profile
- Password
- Notifications
- Settings

Manage Notifications + New

Area.name	Resource.label			
Mount Elgon	Rainfall rate (2-day)	<input type="checkbox"/> off		
Mount Elgon	Flood runoff indicator	<input checked="" type="checkbox"/> on		

IMPRESSIONS (INSTEAD OF LIVE DEMONSTRATION)



Product	spatial resolution	refresh rate	Satellite (Instrument)
Normalised Difference Vegetation Index	10m	~5 days	Sentinel-2
Soil Moisture	1km	daily	SMOS (MIRAS) + METOP (ASCAT)
Burned Area Index	10m	~5 days	Sentinel-2
Land Surface Temperature	1km	daily	MODIS + Landsat 8
Water Extent	20m	~12 days	Sentinel-1A + Sentinel-1B
Water Height	specific points	~10 days	JASON

Product	spatial resolution	temporal resolution	refresh rate	Model
2-day weather	4 km	3 hr	12 hr	Tropical Africa Model (Met Office)
7-day weather	20 km	3 hr	6 hr	MOGREPS (Met Office)
90-day weather	60km	1 month	2 wks	GloSea5 (Met Office)
2 and 7-day hydrological	4 / 20 km	3 hr	12 / 6 hr	VIC model (Liang et al., 1994).



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