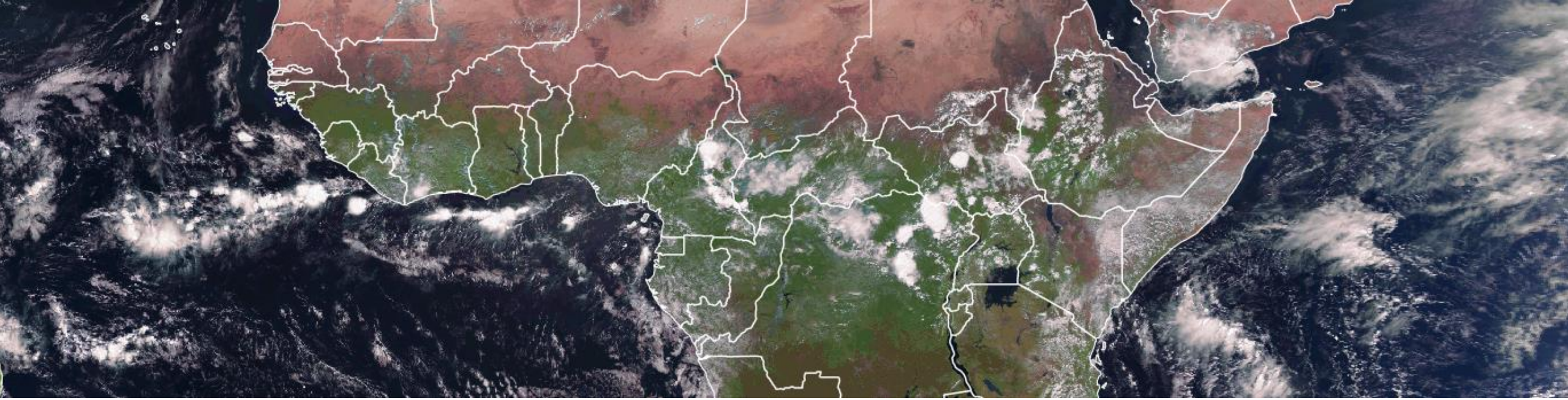


@TAMSAT_Reading

TAMSAT Climate Services

Dr Ross Maidment, TAMSAT Group, University of Reading

15th EUMETSAT User Forum in Africa, 13-16th September 2022, Dar es Salaam

What is TAMSAT?

Tropical **A**pplications of **M**eteorology using **SAT**ellite and ground-based observations

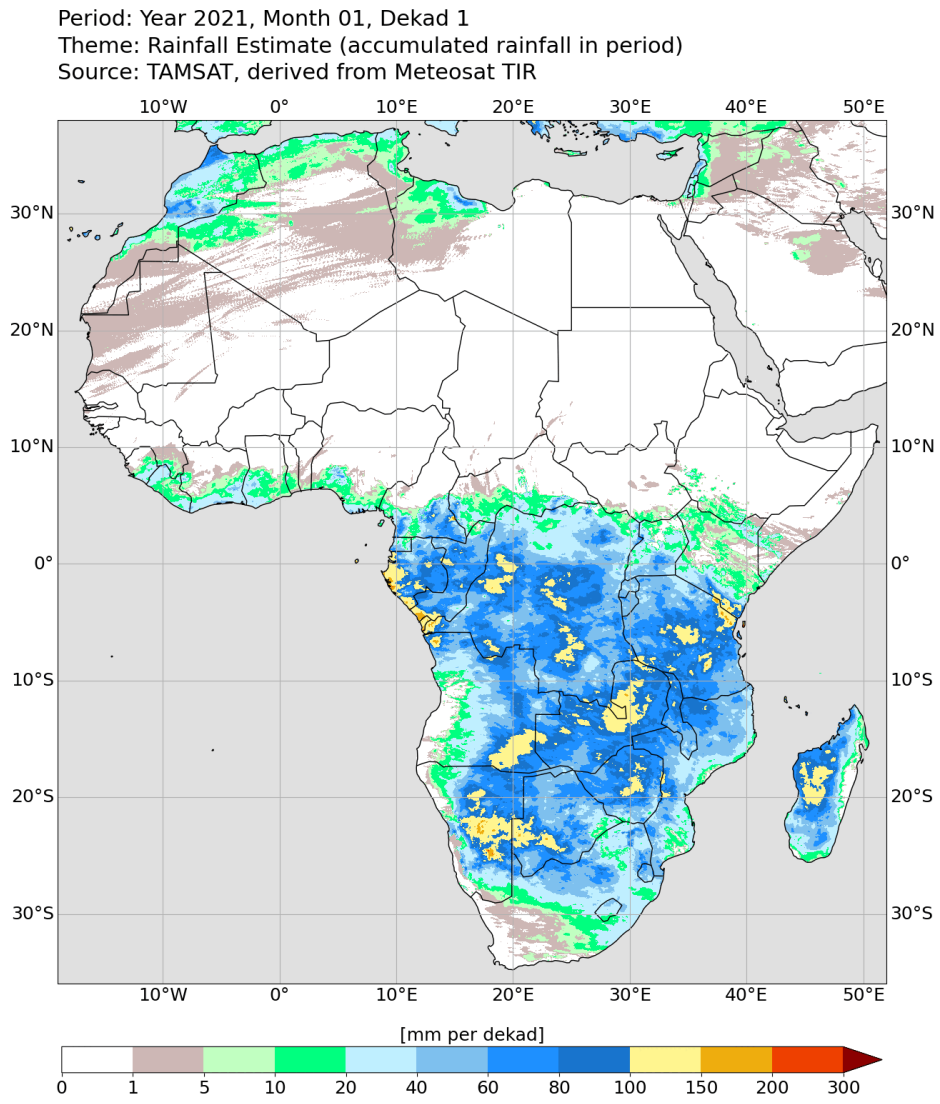
- The TAMSAT Group (Uni. of Reading) formed in 1977 and have provided **locally calibrated**, operational **satellite-based rainfall estimates** for **Africa** since the early 1980s.
- TAMSAT's primary aim is to **enhance the capacity of African meteorological agencies** and other organizations by providing and supporting the use of satellite-based rainfall estimates and related data products.
- TAMSAT rainfall estimates are used in a **wide range of applications**, e.g. drought/flood monitoring and agricultural applications (i.e. crop insurance).
- TAMSAT is part of a relatively small family of long-term (+30 years) operational TIR-based rainfall datasets providing coverage for Africa (notable others being CHIRPS and ARC).

In this talk:

- TAMSAT satellite rainfall estimates (current and in development)
- TAMSAT soil moisture estimates (historical & TAMSAT-ALERT forecasts)
- Data access and capacity building

TAMSAT rainfall estimates (v3.1)

Characteristic	TAMSAT v3.1 (operational)
Inputs	**Meteosat TIR imagery** (*used to derive cold cloud duration (CCD)*); **rain gauges** (*for calibration*)
Spatial Resolution	4km (0.0375°)
Temporal Resolution	Daily; 5-day (*primary product*); 10-day; monthly; seasonal (3-month)
Products	**rainfall amount; rainfall anomalies** (*using 1983-2012 climatology*)
Start date	1st Jan 1983 (+39 years)
Latency	2 days
Strengths	• Longevity (+39 years) -> stable climatology • Temporally consistent • Skillful in many places • Well suited for drought monitoring
Weaknesses	• Underestimates very intense rainfall events • Less skillful where warm rain or cirrus persist

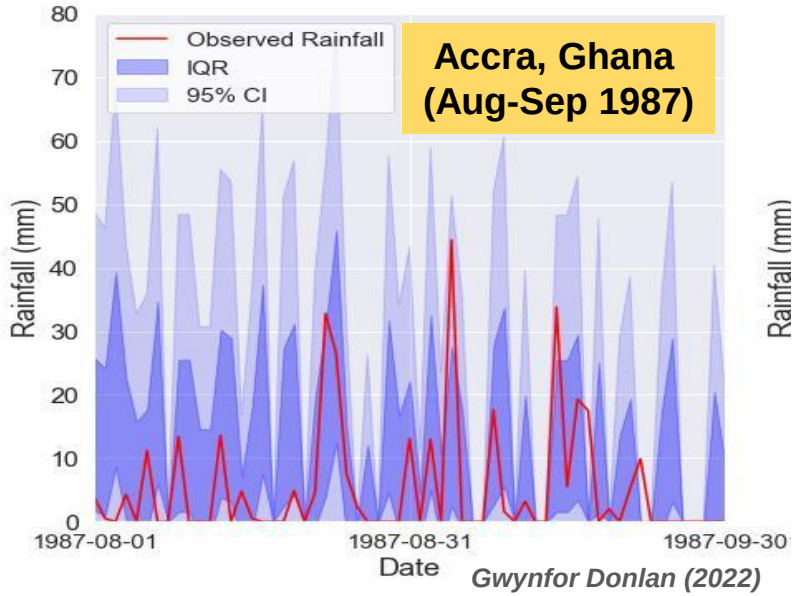


Further reading on TAMSAT method:
Maidment et al. (2017) https://www.nature.com/articles/sdata201763

Two new TAMSAT rainfall products in development

1. TAMSAT v3.2 (*will replace v3.1 during 2023*)

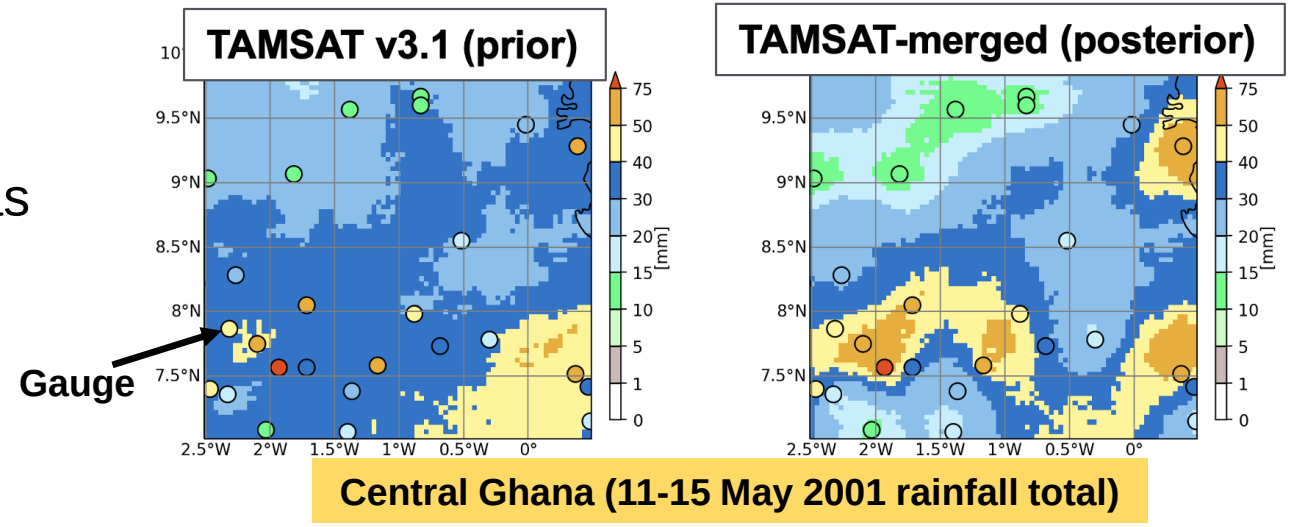
- Estimates of uncertainty
- Latency < 24 hours
- Based on v3.1 calibration, but with improvements to correct occasional issues in semi-arid regions.
- Release: End of 2022



Gwynfor Donlan (2022)

2. TAMSAT-RTS v3.x (with Real-Time Stations)

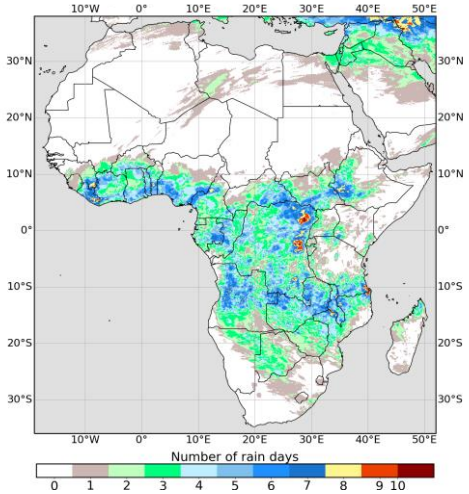
- Merges real-time daily rain gauge measurements with TAMSAT v3.x rainfall estimates
- Improves estimation of rainfall amount in areas where rain gauges are included
- Provides robust estimates of uncertainty
- Release: First half of 2023



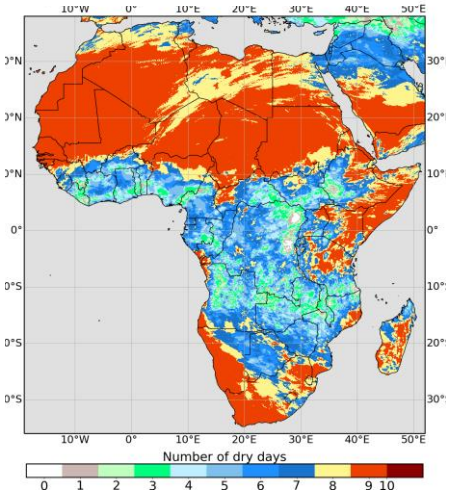
User-relevant metrics based on TAMSAT v3.1 are now available

- User-relevant **drought and extreme rainfall metrics**, trialled in conjunction with AGRHYMET (*through WMO CREWS-West Africa project*)
- Generated at 10-day, monthly and seasonal timesteps.
- Let us know if other metrics would be of use!

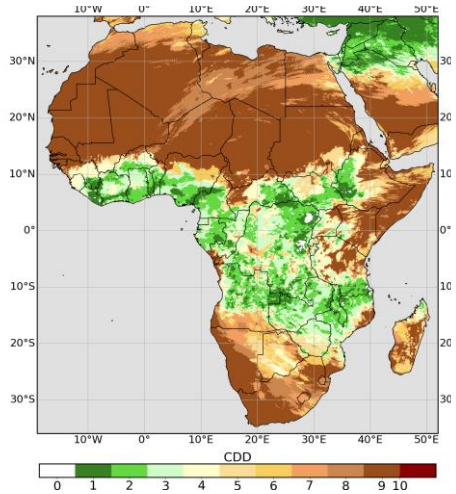
No. of rain days



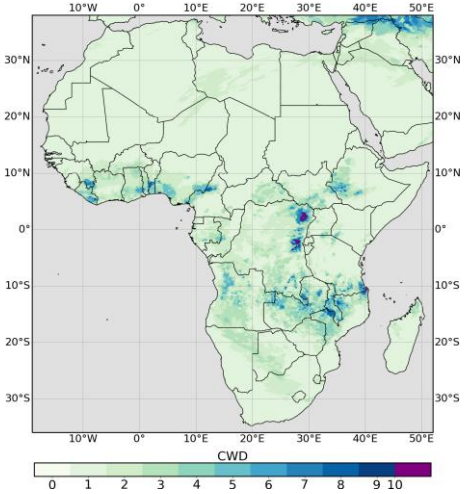
No. of dry days



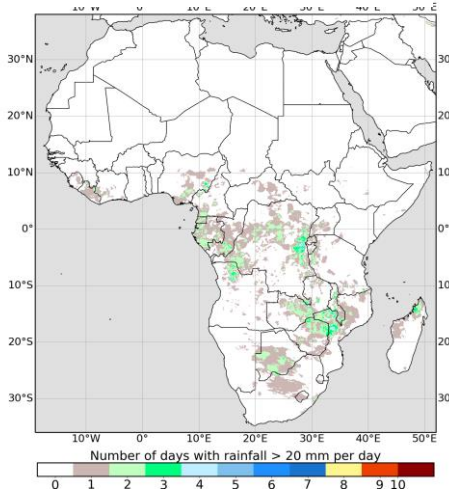
Max consec. dry days



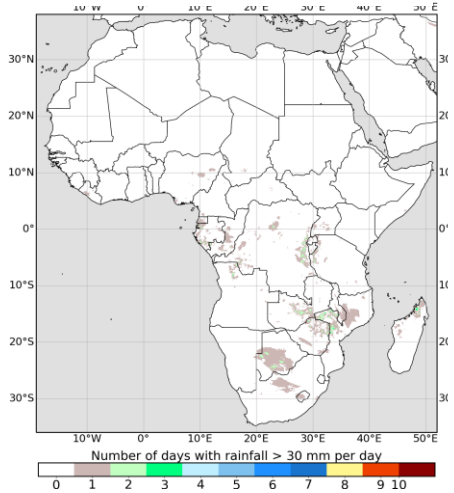
Max consec. wet days



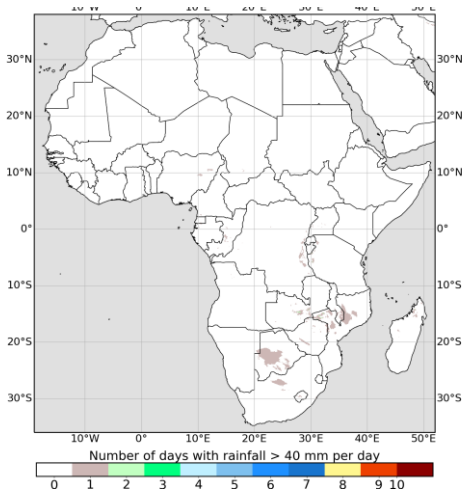
Rain days >20mm



Rain days >30mm



Rain days >40mm



TAMSAT rainfall estimates: Data access

Website: www.tamsat.org.uk

How to access TAMSAT rainfall estimates

There are several options to download TAMSAT rainfall estimates:

Time and area subsetting tool

Extract a time-series for a given location or an area-average from January 1983 to present.
This tool is recommended for users conducting time-series analysis.

Data download tool (individual files)

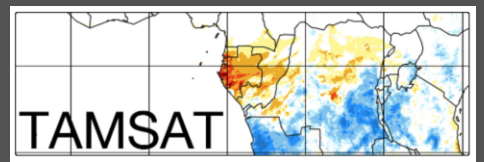
Download individual rainfall files (netCDF format at 0.0375° resolution) and accompanying quicklook files (png format).
This is useful if you want to look at rainfall estimates for a single event or over a short time-period. You can also browse these files using HTTP file listing here.

Zipped files (by year)

Rainfall estimates for a given time-step and year compressed into a single zip file.
This is useful if you need to download multiple files at once. If you need to download the entire archive, we suggest using a download utility such as wget. An example (bash shell) s

Regridded files

Rainfall estimates interpolated to a common grid (0.2
These regridded files enable users to handle the data wit
interpolation package within cf-python.



Data Subset Service

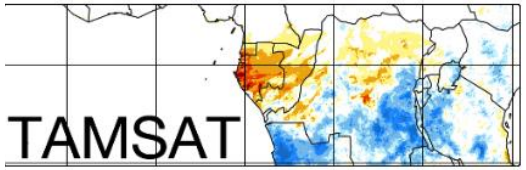
Dataset: TAMSAT v3 Daily

Timeseries at a point (CSV)
Timeseries over a region (CSV)
Regional data (NetCDF)
Latitude: 0
Longitude: 0

Start Date: 1/1983
End Date: 2/2018

Email address
Job/Group Reference: tamsat-subset

Submit Job

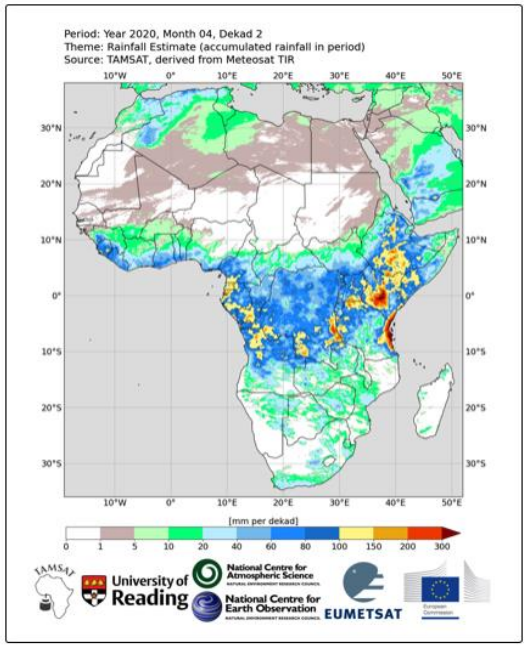


Rainfall Estimates

If you wish to download large sections of the archive, please click here, otherwise use the form below to download individual files.

Version: v3.1
Product: Dekadal
Year: 2020
Month: 04
Dekad: 2 (11th-20th of month)

Download



Regridded TAMSAT v3.1 files

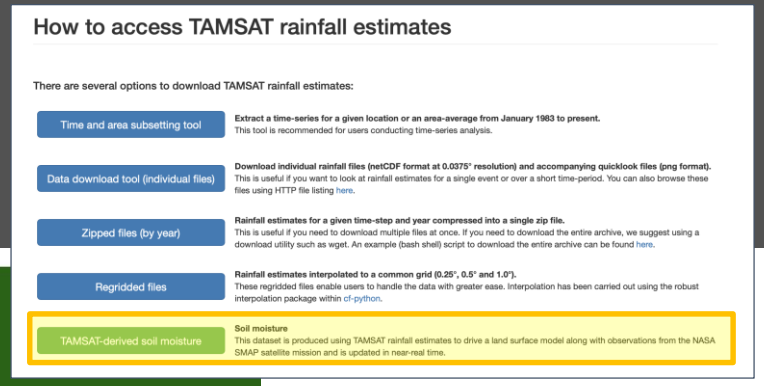
TAMSAT (v3.1) rainfall estimates interpolated to a common grid (0.25°, 0.5° and 1.0°). These regridded files enable users to handle the data with greater ease. Interpolation has been carried out using the robust interpolation package within cf-python. These files are updated routinely and cover the period 1st January 1983 to the present day.

Timestep	0.25°	0.5°	1.0°
Daily	Download File (approx file size: x Mb)	Download File (approx file size: x Mb)	Download File (approx file size: x Mb)
	Download File (approx file size: x Mb)	Download File (approx file size: x Mb)	Download File (approx file size: x Mb)
	Download File (approx file size: x Mb)	Download File (approx file size: x Mb)	Download File (approx file size: x Mb)
	Download File (approx file size: x Mb)	Download File (approx file size: x Mb)	Download File (approx file size: x Mb)
	Download File (approx file size: x Mb)	Download File (approx file size: x Mb)	Download File (approx file size: x Mb)

Index of /public/tamsat/rfe/data_zipped/v3.1

Name	Last modified	Size	Description
Parent Directory		-	
daily/	2020-06-11 19:49	-	
dekadal-anomalies/	2020-06-11 19:50	-	
dekadal/	2020-06-11 19:50	-	
monthly-anomalies/	2020-06-11 19:50	-	
monthly/	2020-06-11 19:50	-	
pentadal-anomalies/	2020-06-11 19:50	-	
pentadal/	2020-06-11 19:49	-	
seasonal-anomalies/	2020-06-11 19:50	-	
seasonal/	2020-06-11 19:50	-	

TAMSAT soil moisture (historical)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Zipped files (by year) — **Rainfall estimates for a given time-step and year compressed into a single zip file.** This is useful if you need to download multiple files at once. If you need to download the entire archive, we suggest using a download utility such as wget. An example (bash shell) script to download the entire archive can be found here.

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TAMSAT-derived soil moisture — **Soil moisture** This dataset is produced using TAMSAT rainfall estimates to drive a land surface model along with observations from the NASA SMAP satellite mission and is updated in near-real time.

TAMSAT|NCEO Soil Moisture

Data About Team

These data are the first full release (v1.0.1) of our Africa soil mositure generated data by assimilating NASA SMAP data into the JULES land surface model. We are currently in the process of evaulating the data and we will include the results of that here in due course. For more information see the about tab.

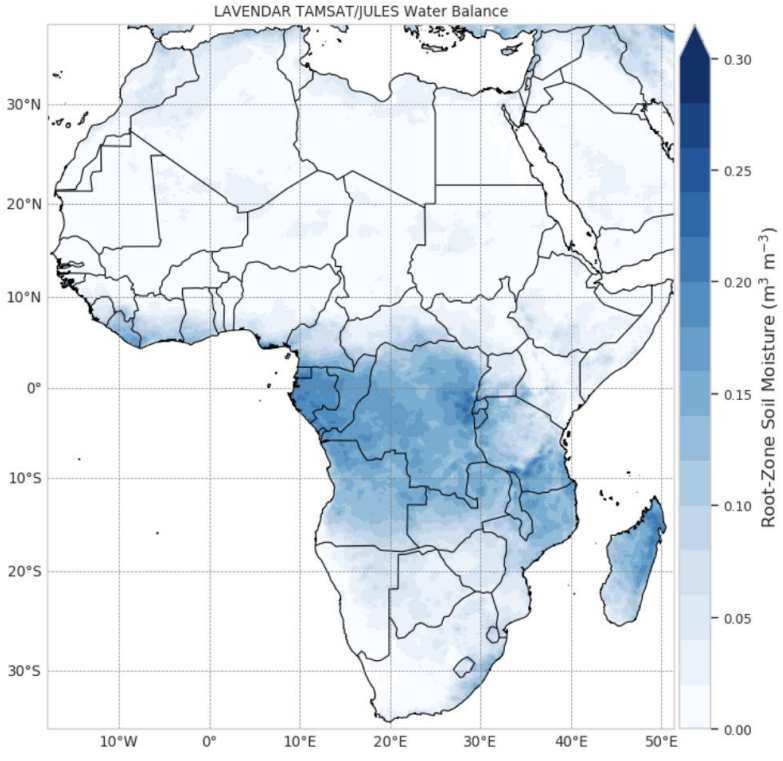
Select year:
2021
Select month:
Apr
Select day:
04

Select variable for display:

- Soil moisture, root zone, anomally
- Soil mositure, root zone, mean
- Evapotranspiration mean
- P-ET mean

Download netCDF for the displayed day.
Note: netCDF file contains all variables for one day.

Bulk download script
Please read the instructions in the script carefully.
CAUTION: can download a large amount of data!



- Daily estimates of **full column soil moisture** at 0.25° derived by assimilating NASA's SMAP soil moisture retrievals into the JULES land surface model.
- Model forced with TAMSAT rainfall.
- Currently, data from 1999-2021 available, but will be extended back to 1983 and made operational to provide NRT data during 2023.

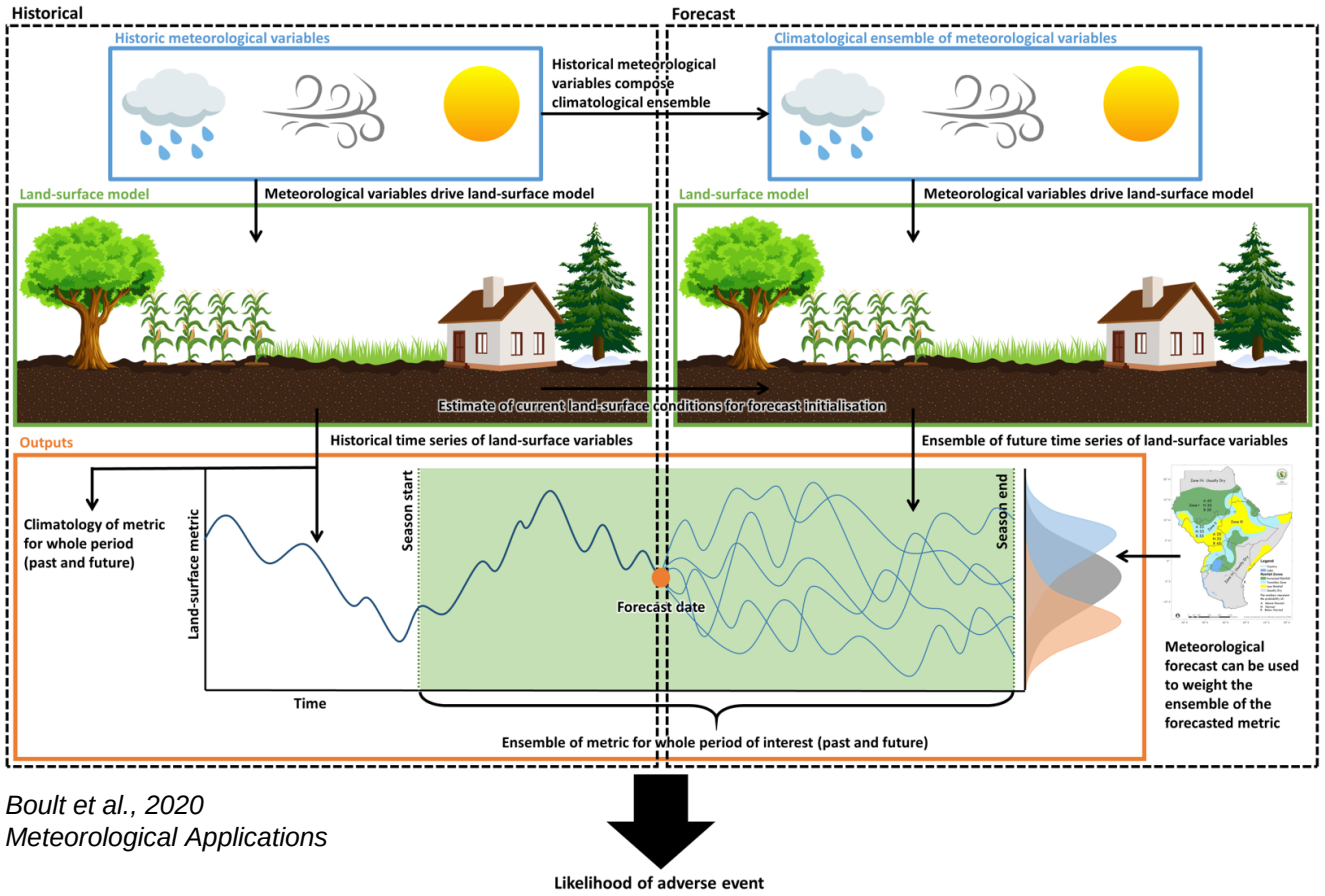
TAMSAT-ALERT (**TAMSAT-A**gricultura**L** **E**arly wa**R**ning sys**T**em)

A monitoring and decision support tool that makes use of meteorological data to assess and anticipate the risk of drought (Details: http://www.tamsat.org.uk/tamsat-alert)

How does TAMSAT-ALERT work?

- Provides **forecasts of land-surface conditions** (i.e. soil moisture) at timescales from weeks (for germination) to months (for crop yield).
- It uses **historical meteorological variables to drive a land surface model (JULES)** to construct an ensemble of future time-series for the current season.
- As the season progresses, more information about the current land surface is included, leading to forecasts with increased accuracy.
- TAMSAT-ALERT is currently being piloted by various organisations across Africa.

TAMSAT-ALERT Concept



Boult et al., 2020
Meteorological Applications

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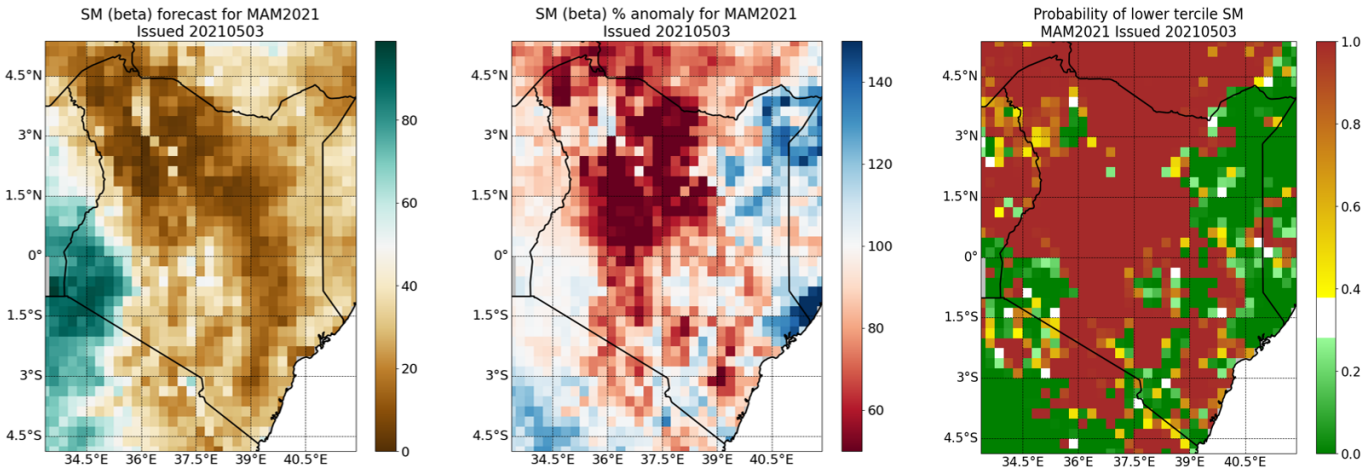
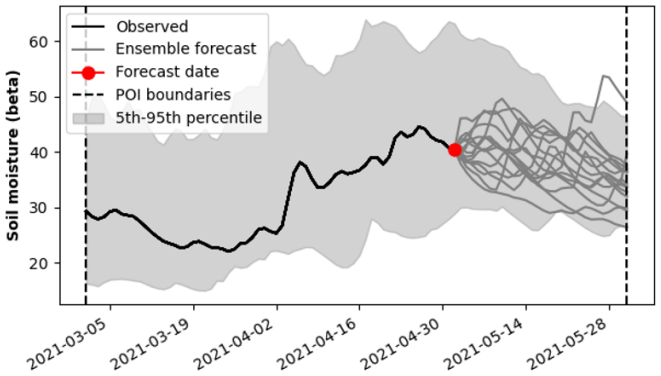
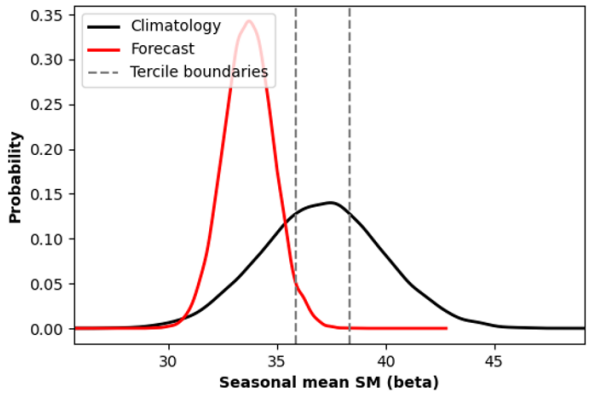
TAMSAT-ALERT Outputs



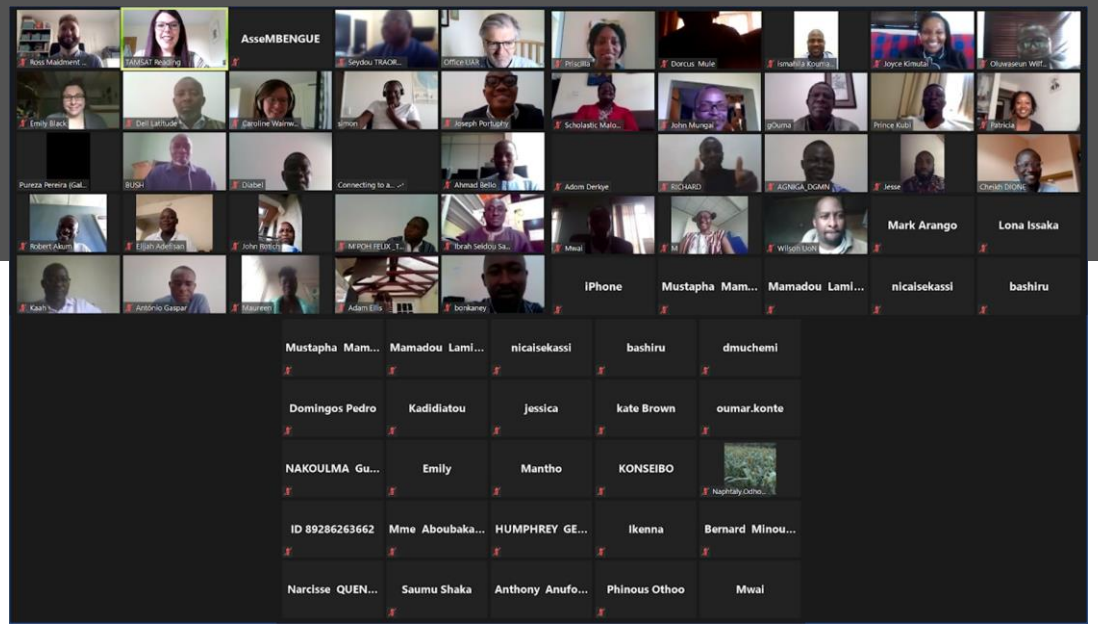


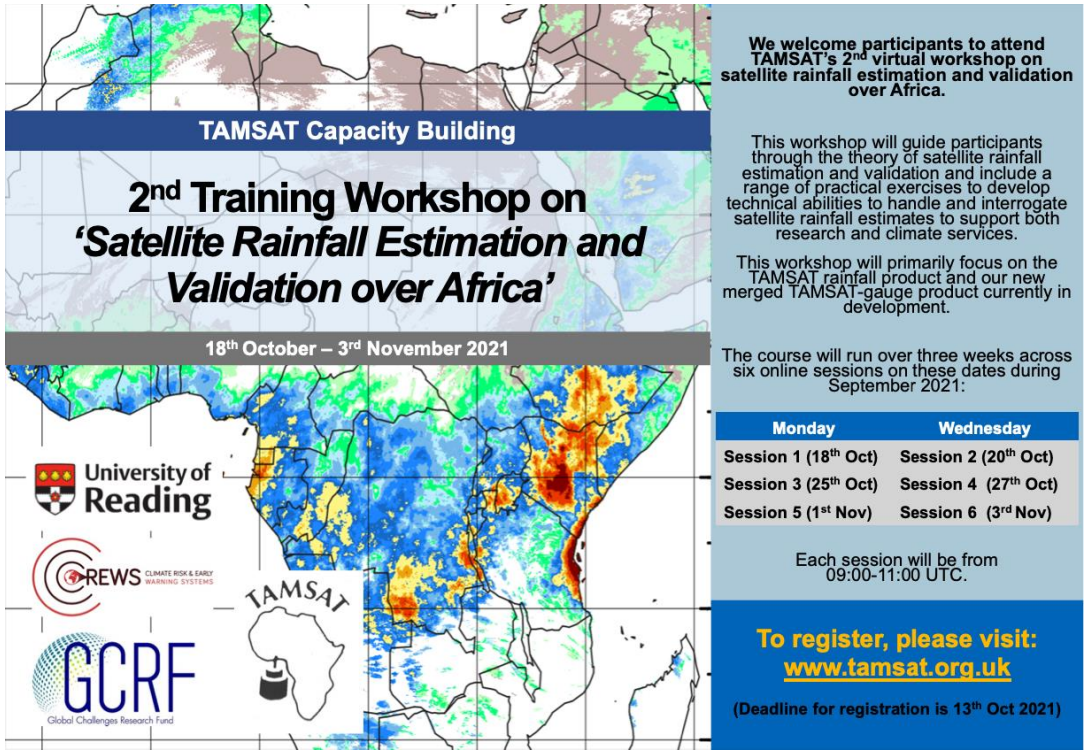


TAMSAT capacity building

http://www.tamsat.org.uk/capacity

- Since 2020, TAMSAT have hosted **virtual training events** on:
  - **Satellite rainfall estimation and validation**
  - **Drought forecasting**
- Events have been free to attend and are aimed at students and professional meteorologists from across Africa, although those from other sectors are welcome to attend.
- Training provided in both English and French.
- **Upcoming training events:**
  - **17th-21st October**: TAMSAT-ALERT training workshop, Nairobi (in person).
  - **7-18th November**: WMO-EUMETSAT Drought Training Workshop for Central Africa (virtual)
  - **Spring 2023**: Workshop on estimating and application of uncertainty in satellite rainfall estimates (virtual)
- All training materials are made publicly available.





Summary

TAMSAT provides several established and soon to be released products that can help support existing climate services

Rainfall products

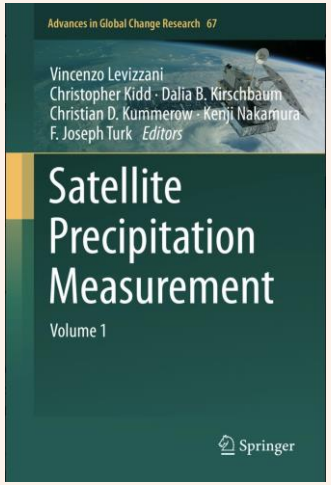
- **TAMSAT v3.1** (operational)
- **TAMSAT v3.2** (release: End of 2022)
  - *Estimates of calibrated uncertainty*
  - *Latency < 24 hours*
- **TAMSAT-RTS v3.x** (with Real-Time Stations) (release: 2023)
  - *Improved estimation of rainfall amount in areas where rain gauges are included*
  - *Robust estimates of uncertainty*

Soil moisture products

- Full column soil moisture estimates from 1999-2021 (will be extended back to 1983 and made operational during 2023)
- TAMSAT-ALERT soil moisture forecasts (operational)

More information

- TAMSAT are very keen to provide support to individual NMHS!
- Training materials on the TAMSAT website (English and French)



TAMSAT chapter: https://link.springer.com/chapter/10.1007/978-3-030-24568-9_22

- Website: www.tamsat.org.uk
- Email: tamsat@reading.ac.uk
  r.i.maidment@reading.ac.uk

Thank you

Merci

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