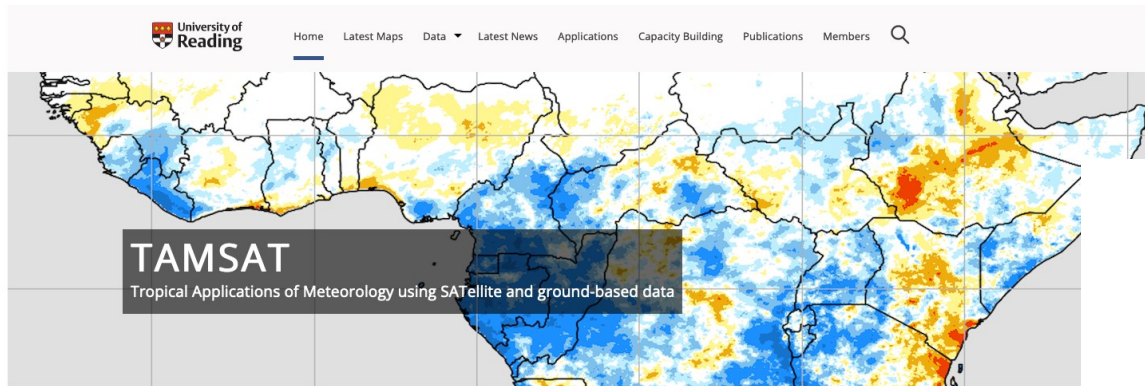


A JULES-BASED SYSTEM FOR DAILY TO SEASONAL FORECASTS OF SOIL MOISTURE

Emily Black, Ross Maidment, Vicky Boulton



What is TAMSAT?

TAMSAT* enhances the capacity of African meteorological agencies and other organisations by providing and supporting the use of satellite-based rainfall estimates, soil moisture estimates and forecasts, and related data products.

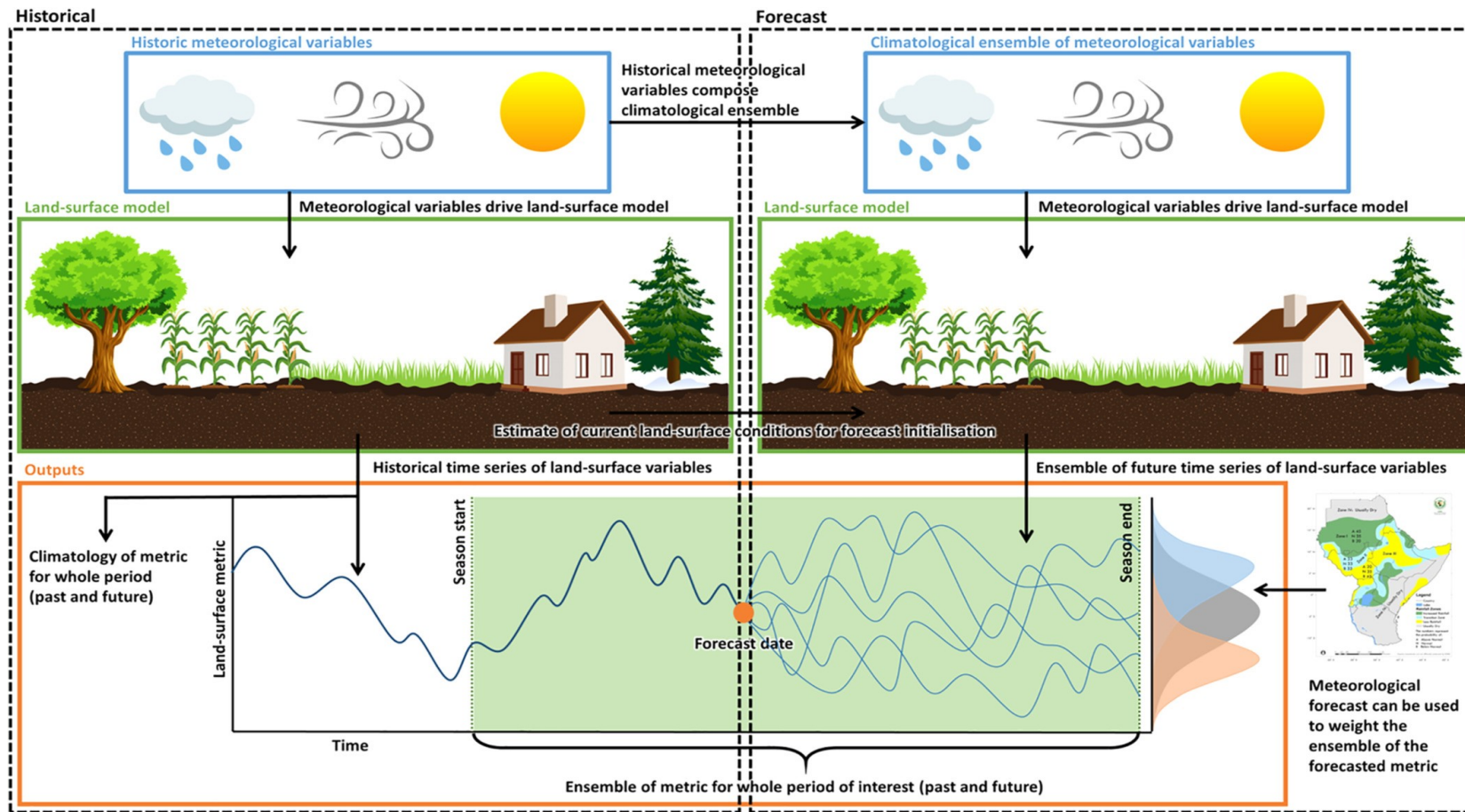
TAMSAT produces daily rainfall estimates for all of Africa at $0.0375^\circ \times 0.0375^\circ$ degrees, as well as soil moisture estimates and forecasts (out to 160 days) for all of Africa at $0.25^\circ \times 0.25^\circ$ degrees. The TAMSAT rainfall and soil moisture archives span 1983 to the delayed present. The longevity of these datasets makes them especially suitable for risk assessment. Applications of the data include famine early warning, drought insurance and agricultural decision support.

TAMSAT aims to enable African people to benefit from scientifically credible information on drought

- Operational data production: observations and forecasts
- Climate services
- Research and development
- Capacity building and technology transfer

Product	Daily	Pentad	Dekadal	Monthly	Seasonal
Rainfall					
Rainfall anomaly					
Soil moisture availability factor for plants					
Soil moisture availability factor for plants anomaly					

Combining monitoring, historical data and forecasts into soil moisture predictions



Complementary to existing methods/systems:

- Seamless integration of observations and forecasts (no drift or jumps)
- Capability to integrate multiple streams of information: observations, meteorological forecasts, climate modes of variability (e.g. ENSO)
- Ease of access to forecasts

Easy access to forecasts



Data Subset Service

Rainfall
 Soil moisture availability factor to plants (historical and forecast)

Dataset:

Timeseries at a point (CSV)
 Timeseries over a region (CSV)
 Regional data (NetCDF)

Region:

Map shows the point or region selected by the controls above.

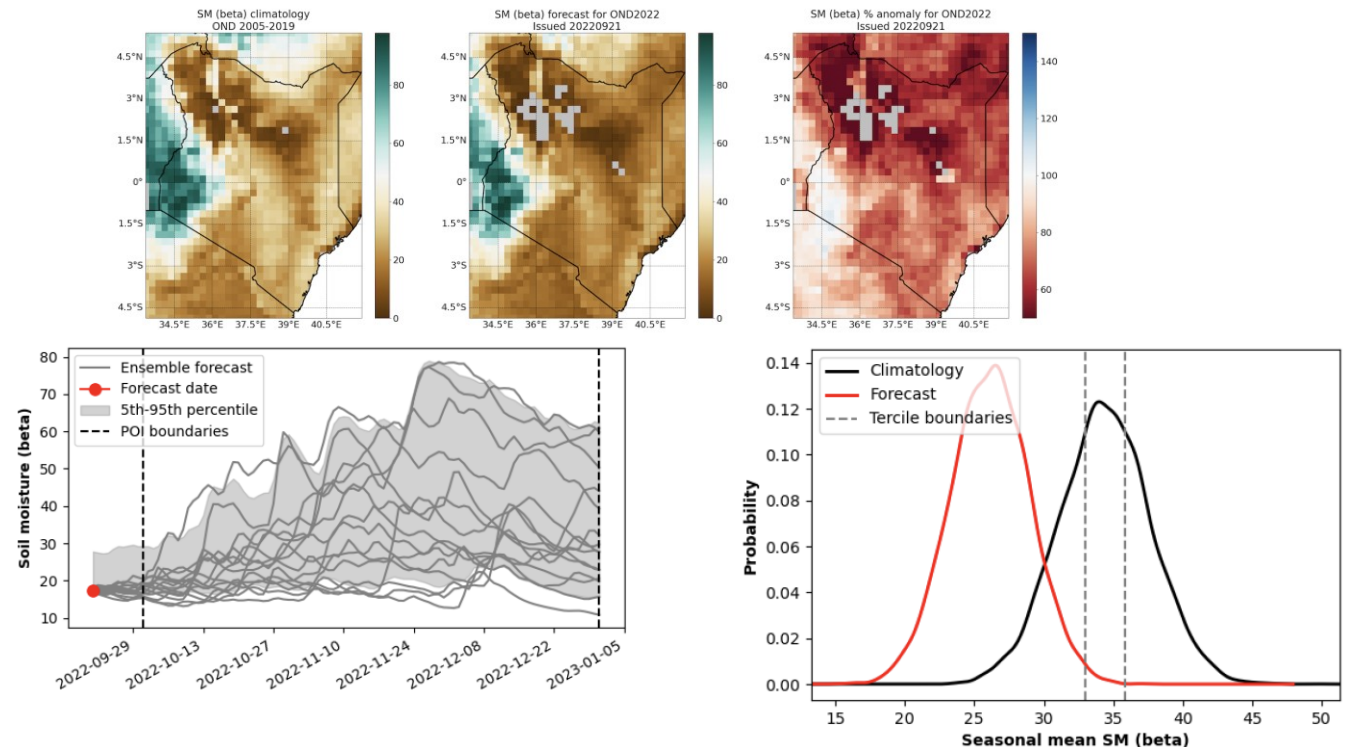
Start Date: Year Month
 End Date: Year Month

Email address:
 Job/Group Reference:

To run the TAMSAT-ALERT Python Tool and reproduce the 'test cases', you need only type a single line of code into the 'Anaconda Prompt' window. The format of that line of code is as follows:

```
python filepath forecast_date poi_start poi_end weight_up weight_mid weight_low roi lon_min lon_max lat_min lat_max
```

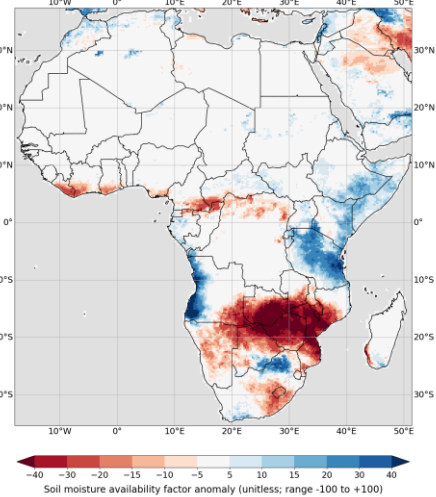
Argument	Description	Format	Example
filepath	The file path where the TAMSAT-ALERT Python Tool is stored and the file name of the TAMSAT-ALERT Python Tool. The file name	String	F:/ TAMSAT-ALERT_Python_Tool/T-A_API.py



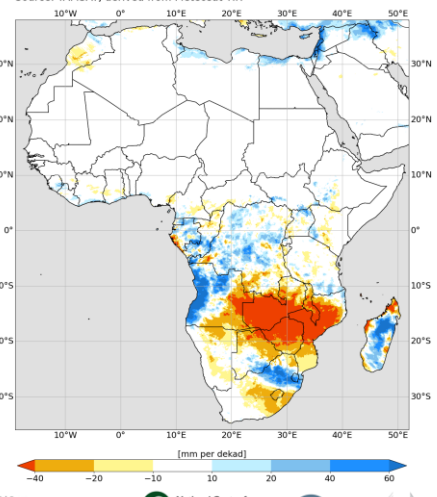
If you have already requested a data subset, and wish to check

An example: 2023-2024 drought in Zambia

Period: Year 2024, Month 02, Dekad 2
 Theme: Soil moisture availability factor for plants anomaly (2001-2020 climatology)
 Source: TAMSAT, derived from JULES (forced by TAMSAT rainfall)



Period: Year 2024, Month 02, Dekad 2
 Theme: Rainfall Anomaly Estimate (against 1983-2012 climatology)
 Source: TAMSAT, derived from Meteosat TIR



Rainfall

Soil moisture availability factor to plants (historical and forecast) ?

Dataset: Soil Moisture Pentadal An...

Timeseries at a point (CSV)

Timeseries over a region (CSV)

Regional data (NetCDF)

Region: Bounding Box

20 -15 30 -20

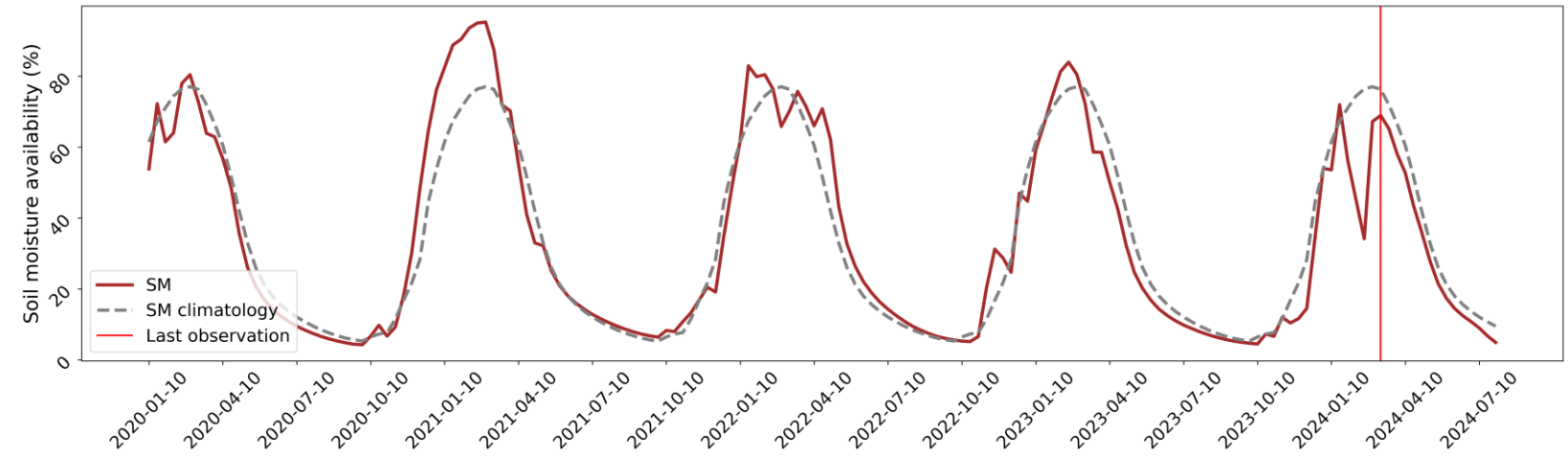
Map shows the point or region selected by the controls above.

Start Date
 Year 2020 Month January Day 6

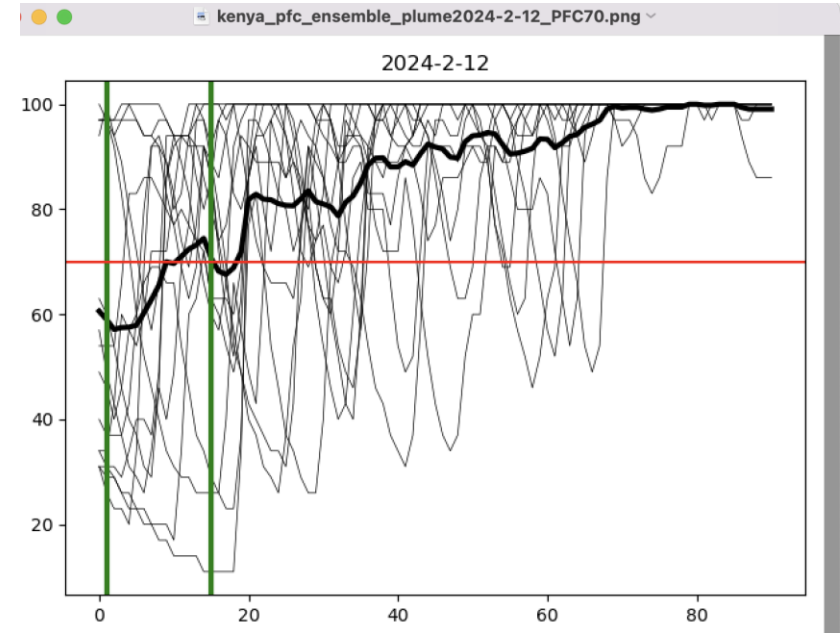
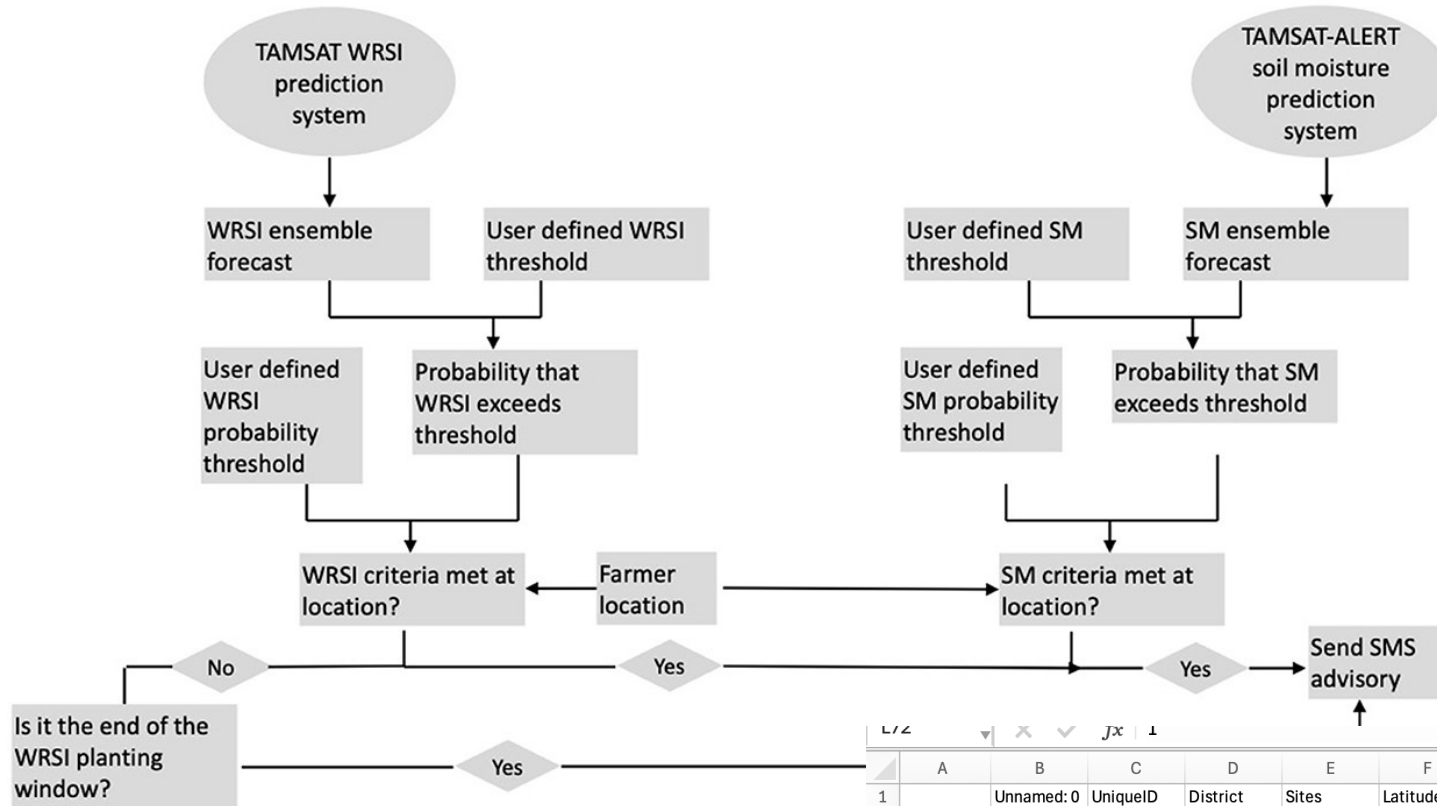
End Date
 Year 2024 Month August Day 5

Email address: e.c.l.black@reading.ac.uk

Job/Group Reference: tamsat-subset



Planting date decision support



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1		Unnamed: 0	UniqueID	District	Sites	Latitude	Longitude	pfc_probabili	wrsi_probabi	pfc_decision	wrsi_decision	overall_decis	forecast_cun	forecast_cumulative_precip_7	
76	76	76	Bugesera Ki	Bugesera	Kidirizi	-2.19	30.16	0.97	0.59	1	1	1	77.95	37.32	
79	77	77	Bugesera Kin	Bugesera	Kindama	-2.32	30.07	0.87	0.59	1	1	1	67.68	30.07	
80	78	78	Bugesera Kin	Bugesera	Kintambwe	-2.35	30.26	0.99	0.59	1	1	1	78.17	36.87	
81	79	79	Bugesera Mb	Bugesera	Mbyo	-2.14	30.08	0.97	0.59	1	1	1	77.95	37.32	
82	80	80	Bugesera Mu	Bugesera	Mugorore	-2.12	30.25	1	0.59	1	1	1	84.4	35.45	
83	81	81	Bugesera Mu	Bugesera	Murama	-2.35	30.08	0.87	0.59	1	1	1	67.68	30.07	
84	82	82	Bugesera Mu	Bugesera	Murambi	-2.33	30	0.87	0.59	1	1	1	67.68	30.07	
85	83	83	Bugesera Mu	Bugesera	Musovu	-2.07	30.18	0.97	0.59	1	1	1	77.95	37.32	
86	84	84	Bugesera Mw	Bugesera	Mwendo	-2.25	30.25	1	0.59	1	1	1	84.4	35.45	
87	85	85	Bugesera Ne	Bugesera	Nemba	-2.32	30.25	0.99	0.59	1	1	1	78.17	36.87	
88	86	86	Bugesera Ngi	Bugesera	Ngenda	-2.31	30	0.87	0.59	1	1	1	67.68	30.07	
89	87	87	Bugesera Ngi	Bugesera	Ngeruka	-2.31	30.13	0.87	0.59	1	1	1	67.68	30.07	
90	88	88	Bugesera Nki	Bugesera	Nkanga	-2.27	30.29	0.99	0.59	1	1	1	78.17	36.87	



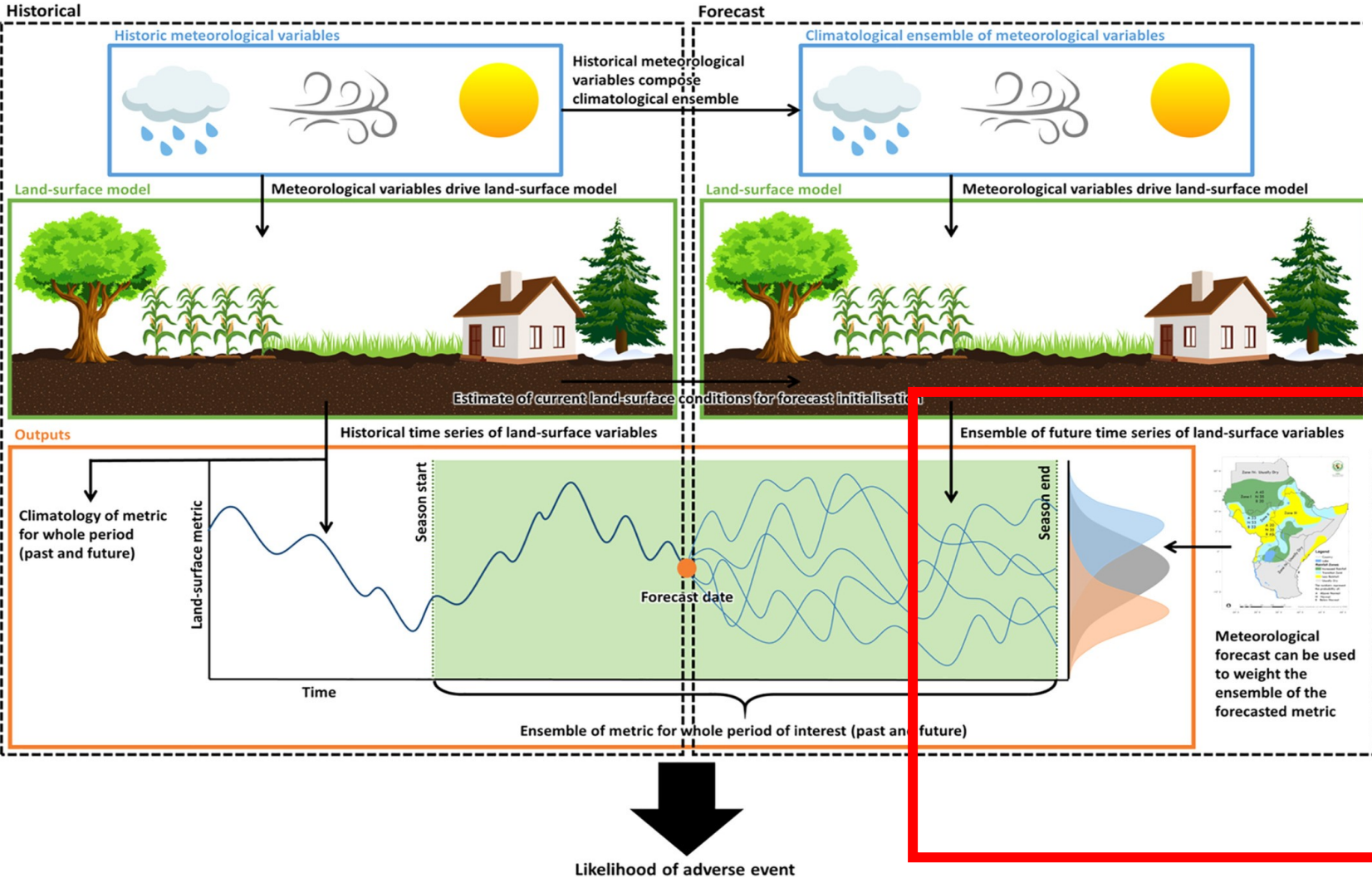
Credit: NicoElNino / iStock / Getty Images Plus

ECMWF now provides a much larger open dataset to the public, representing weather forecasts at a higher resolution and a reduction in some release times, after a first set of data was made available in early 2022.

The changes can be summarised as follows:

- Medium-range data of the Integrated Forecasting System (IFS) are provided at a resolution of 0.25 x 0.25 degrees (28 x 28 km), compared to 0.4 x 0.4 degrees before, and some additional parameters will be added.

Priorities over the next year



Further information (including formal skill assessments)

- **TAMSAT data and activities:** <https://www.tamsat.org.uk>
- **General TAMSAT-ALERT methodology:**
Black, E., Ellis, J. and Maidment, R., 2024. A computationally light-weight model for ensemble forecasting of environmental hazard: General TAMSAT-ALERT v1. 2.1. *Geoscientific Model Development Discussions*, 2024, pp.1-24. <https://gmd.copernicus.org/preprints/gmd-2024-75/>
- **Application to anticipatory drought modelling:**
Black, E., Maidment, R.I., Rees, E. and Nderitu, E., 2024. A new drought model for disaster risk management in the Punjab, Sindh and Baluchistan provinces of Pakistan. *Frontiers in Climate*, 6, p.1332233. <https://www.frontiersin.org/articles/10.3389/fclim.2024.1332233/full>
- **Agricultural decision support:**
Black, E., Asfaw, D.T., Sananka, A., Aston, S., Boulton, V.L. and Maidment, R.I., 2023. Application of TAMSAT-ALERT soil moisture forecasts for planting date decision support in Africa. *Frontiers in Climate*, 4, p.993511. <https://www.frontiersin.org/articles/10.3389/fclim.2022.993511/full>
- **Soil moisture seasonal forecasting:**
Boulton, V.L., Asfaw, D.T., Young, M., Maidment, R., Mwangi, E., Ambani, M., Waruru, S., Otieno, G., Todd, M.C. and Black, E., 2020. Evaluation and validation of TAMSAT-ALERT soil moisture and WRSI for use in drought anticipatory action. *Meteorological Applications*, 27(5), p.e1959. <https://rmets.onlinelibrary.wiley.com/doi/abs/10.1002/met.1959>