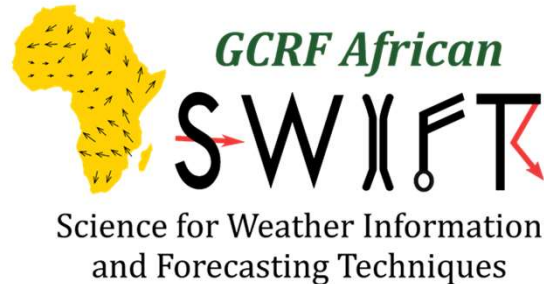


# Recent progress in nowcasting tools for Africa

Dr Alex Roberts - Nowcasting researcher for GCRF African SWIFT project



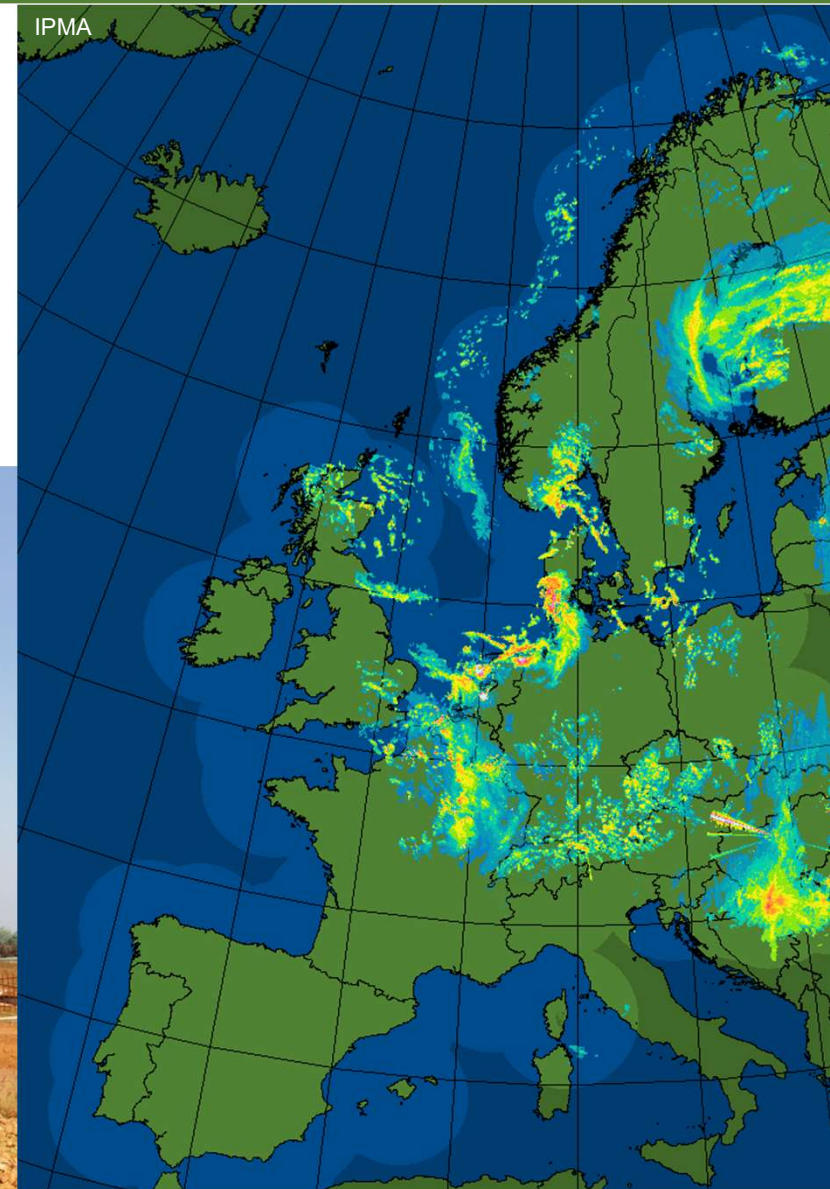
<https://africanswift.org/>



# Nowcasting Methods

# Rainfall radar

- Rainfall radar systems have existed since 1950s and have been widely used since 1970s.
- Coverage is good in Europe, North America and parts of Asia.
- Very expensive to implement and maintain.



# Nowcasting technologies

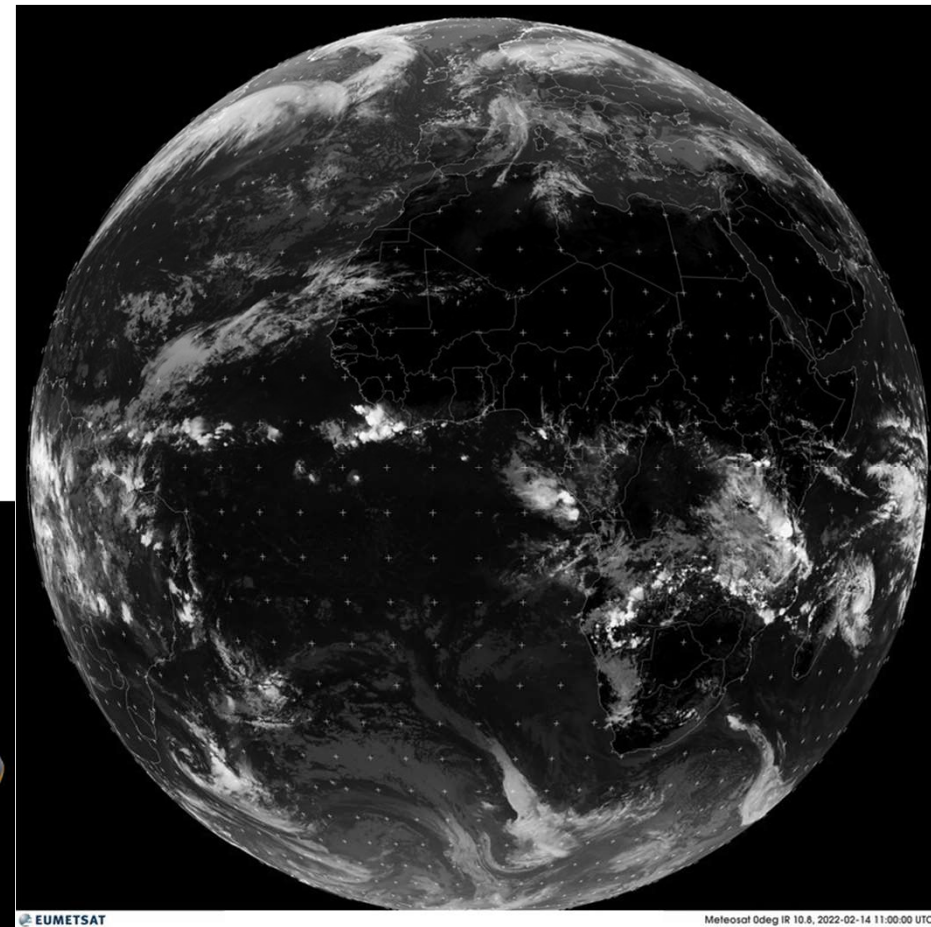
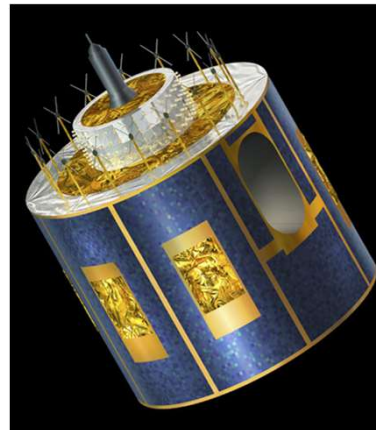
Solution for Africa - **use geostationary meteorological satellite data.**

High temporal resolution, pan-Africa coverage, spectrum of 12 wavelengths available and low latency (approx 15 mins).



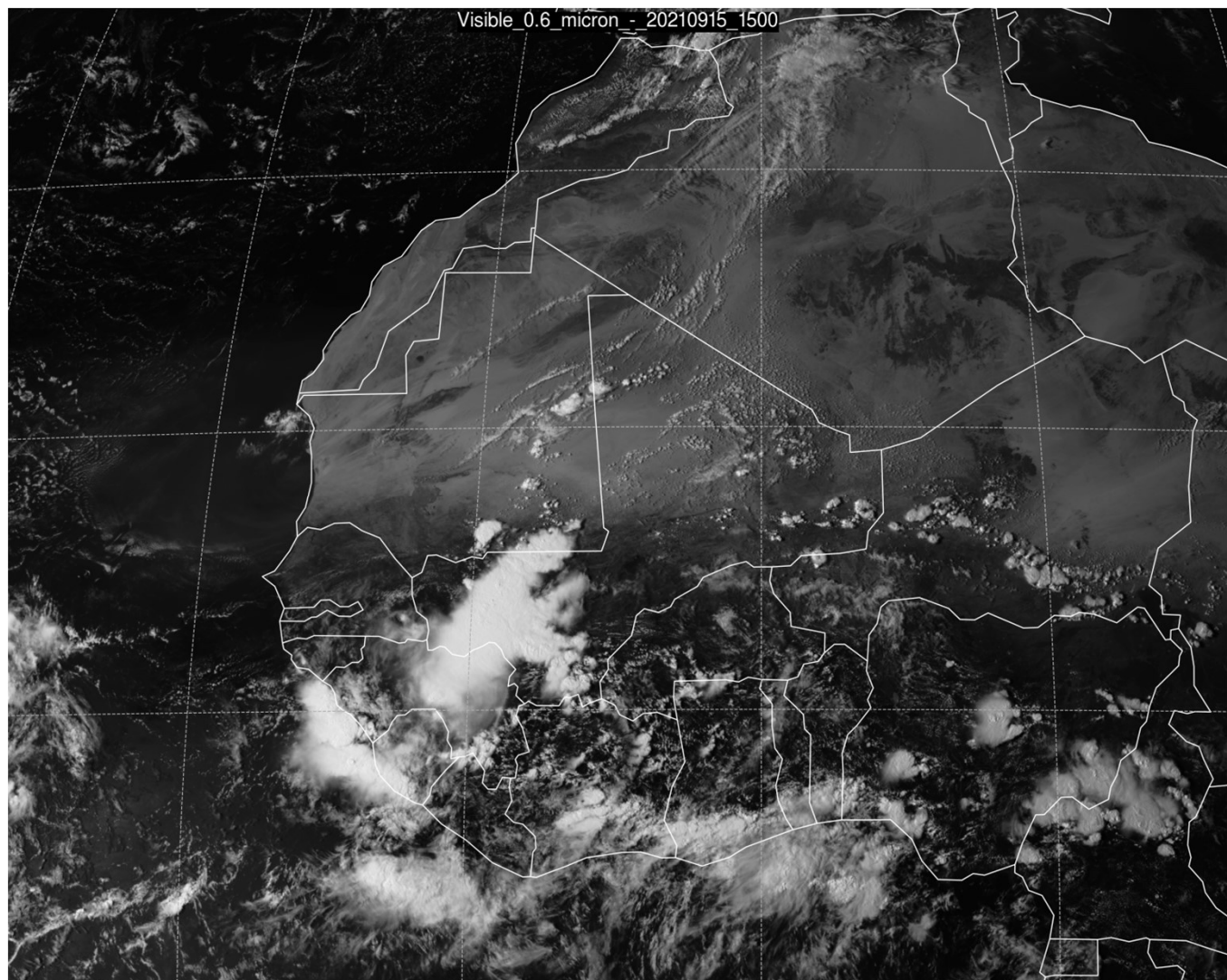
GMet receiving station

Meteosat  
Second Generation



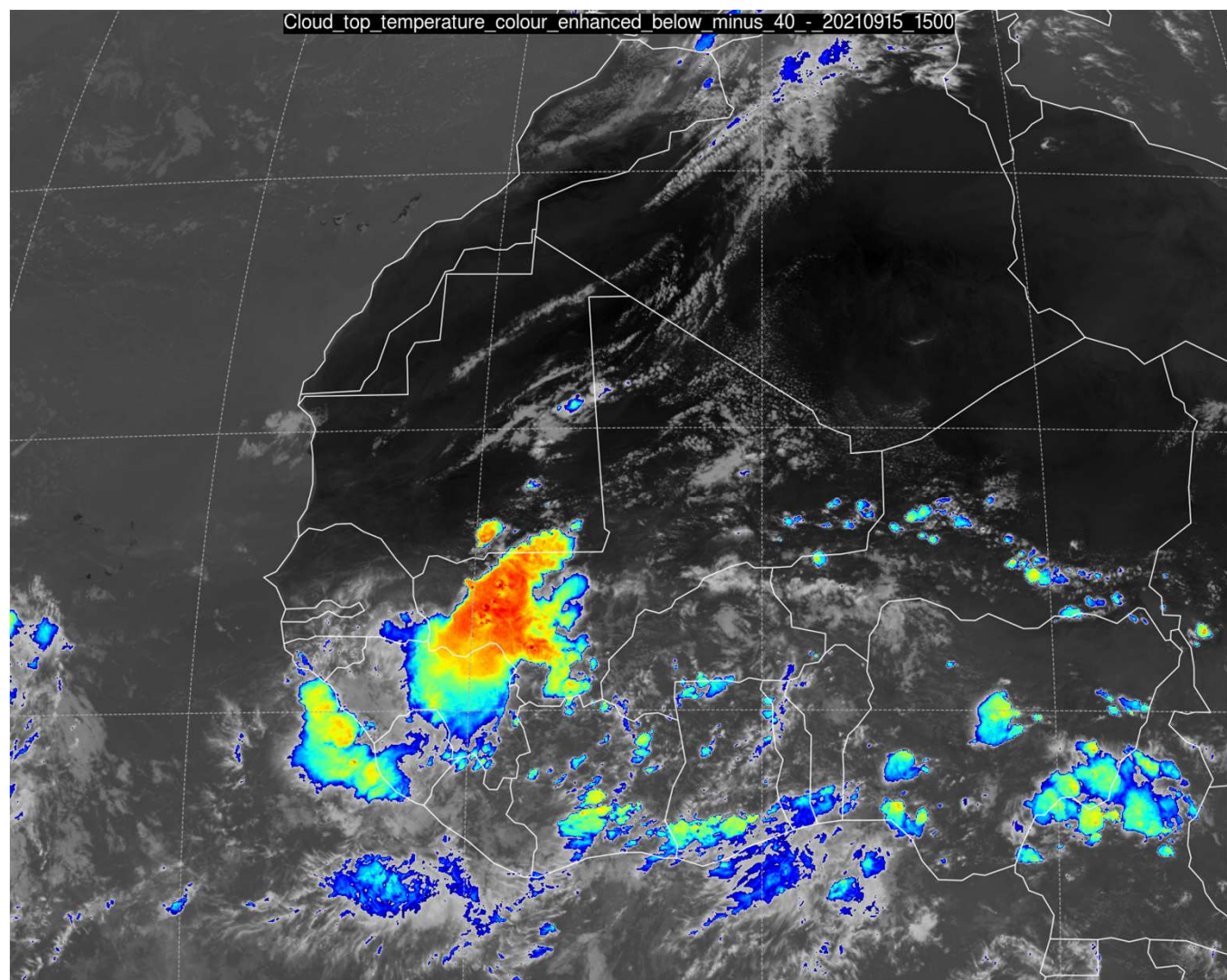
# Meteosat imagery

- Grayscale single channel imagery.



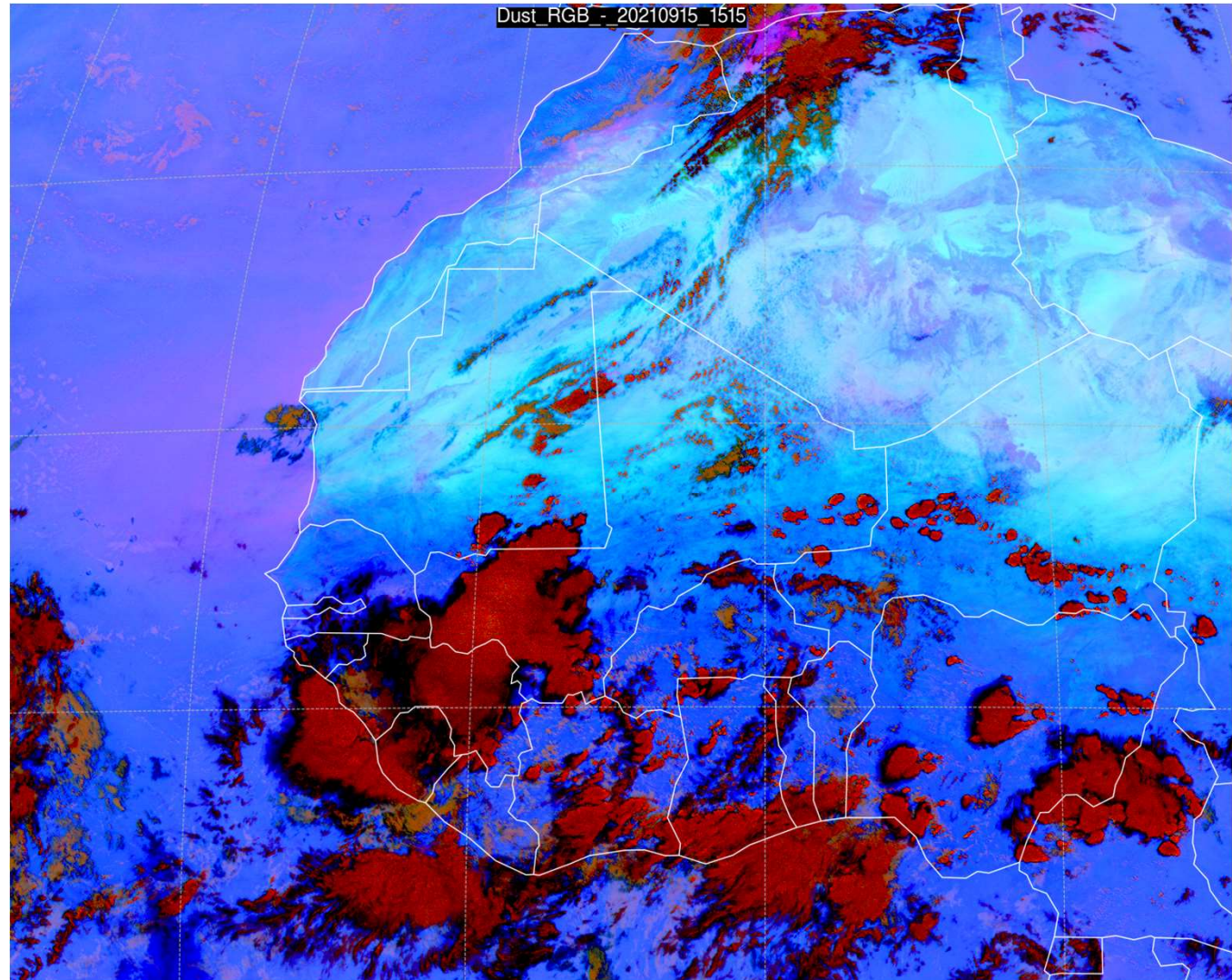
# Meteosat imagery

- Grayscale single channel imagery.
- Colour enhanced single channel imagery.



# Meteosat imagery

- Grayscale single channel imagery.
- Colour enhanced single channel imagery.
- Multichannel RGB imagery (dust RGB)



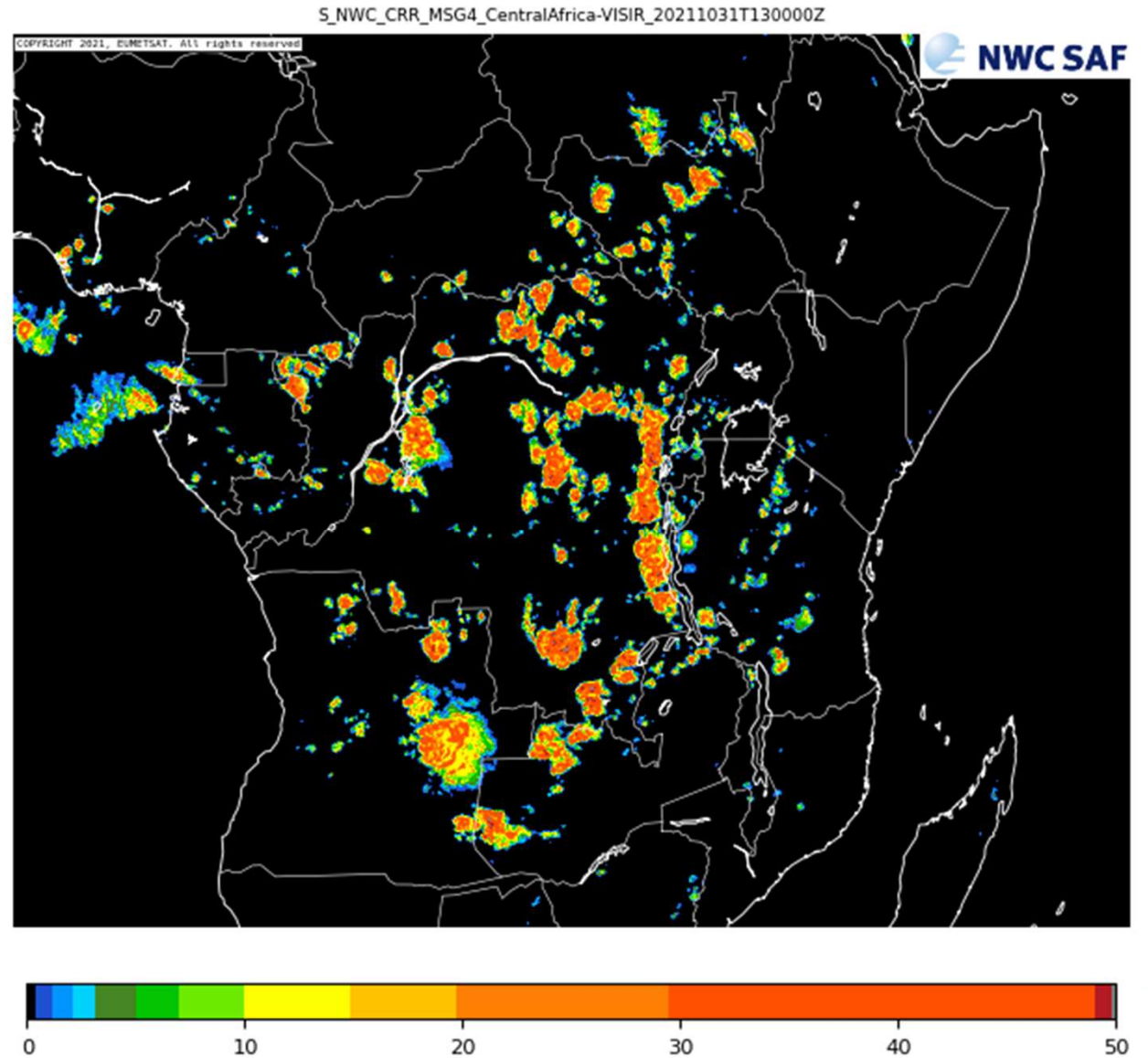
# NWCSAF

- **NWCSAF - NoWCasting Satellite Application Facility**
- One of 8 Satellite Application Facilities.
- *“provide to National Meteorological Services ... with an advanced, robust and reliable system to support both operational and research activities in Nowcasting”*
- Near real time processing of Meteosat data into a variety of added value products.



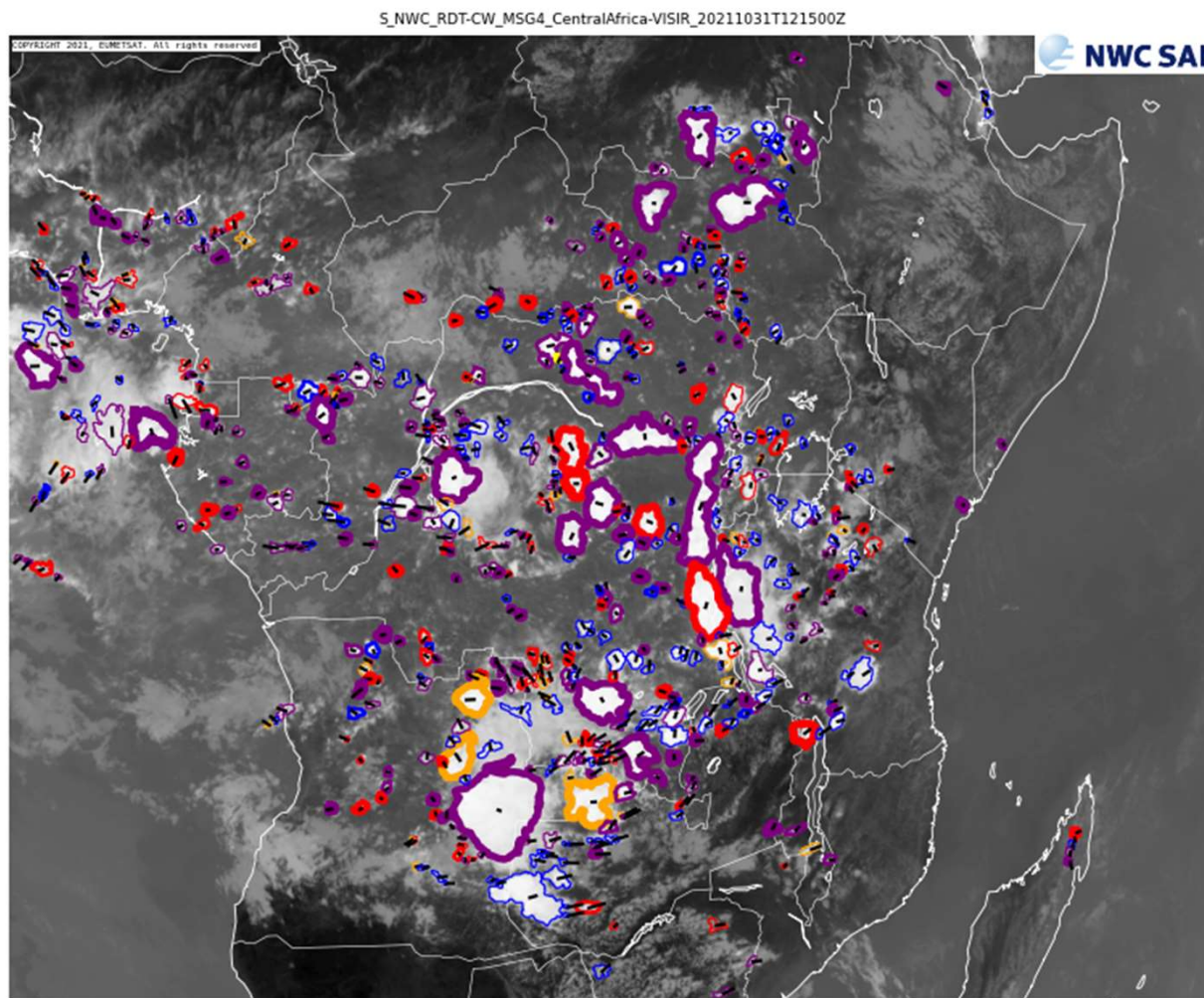
# Popular NWCSAF products

- Convective Rainfall Rate (CRR)



# Popular NWCSAF products

- Convective Rainfall Rate (CRR).
- Rapidly developing thunderstorms (RDT).



Triggering    Triggering from Split    Growing    Maturity    Decaying

<https://africanswift.org/>



## • Other products from NWC SAF

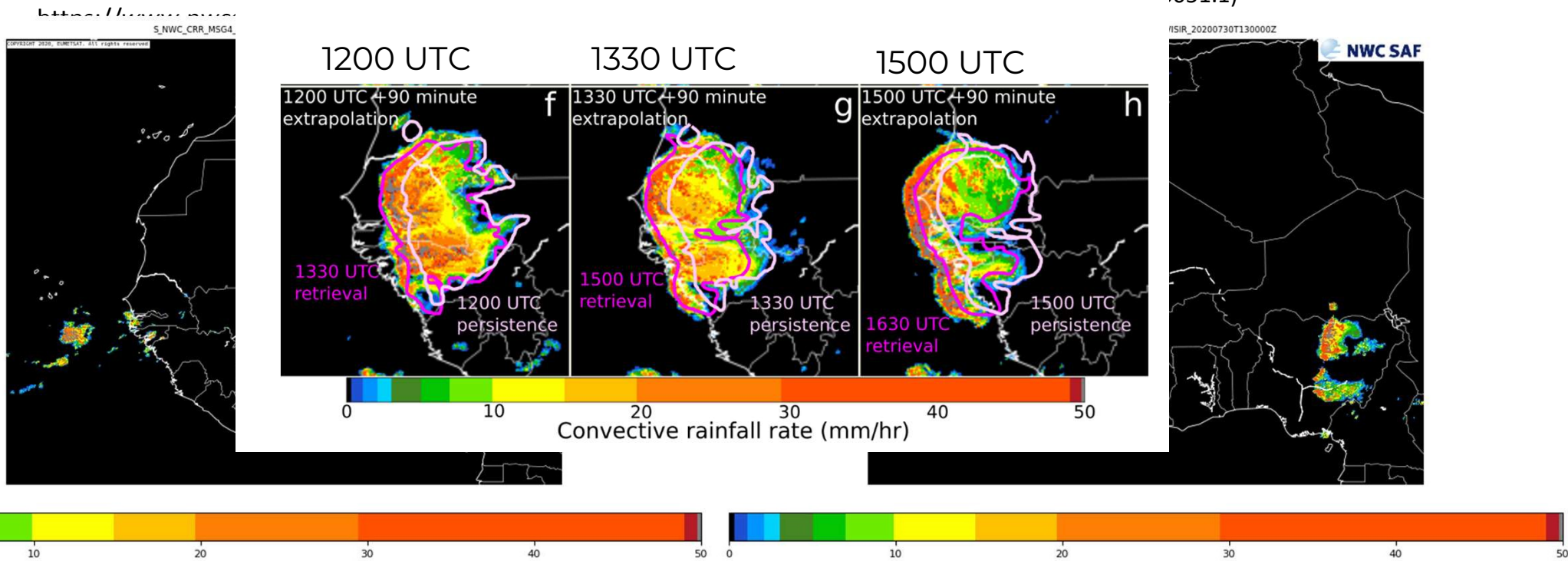
- Cloud motion vector winds.
- Atmospheric stability indices.
- Cloud top temperature and height.
- Cloud type and microphysics.
- Chance of precipitation.
- Convection initiation.
- Total column water vapour.
- **Extrapolation of imagery...**



# Automated extrapolation

Other forward propagation techniques are also available. One method (pysteps) has been tested and evaluated using CRR (Burton et al., 2022. <https://doi.org/10.1175/MSE-D-21-0051.1>)

## NWCSAF EXIM





UK CEH

# NFLICS

Nowcasting Flood Impacts of Convective Storms in the Sahel

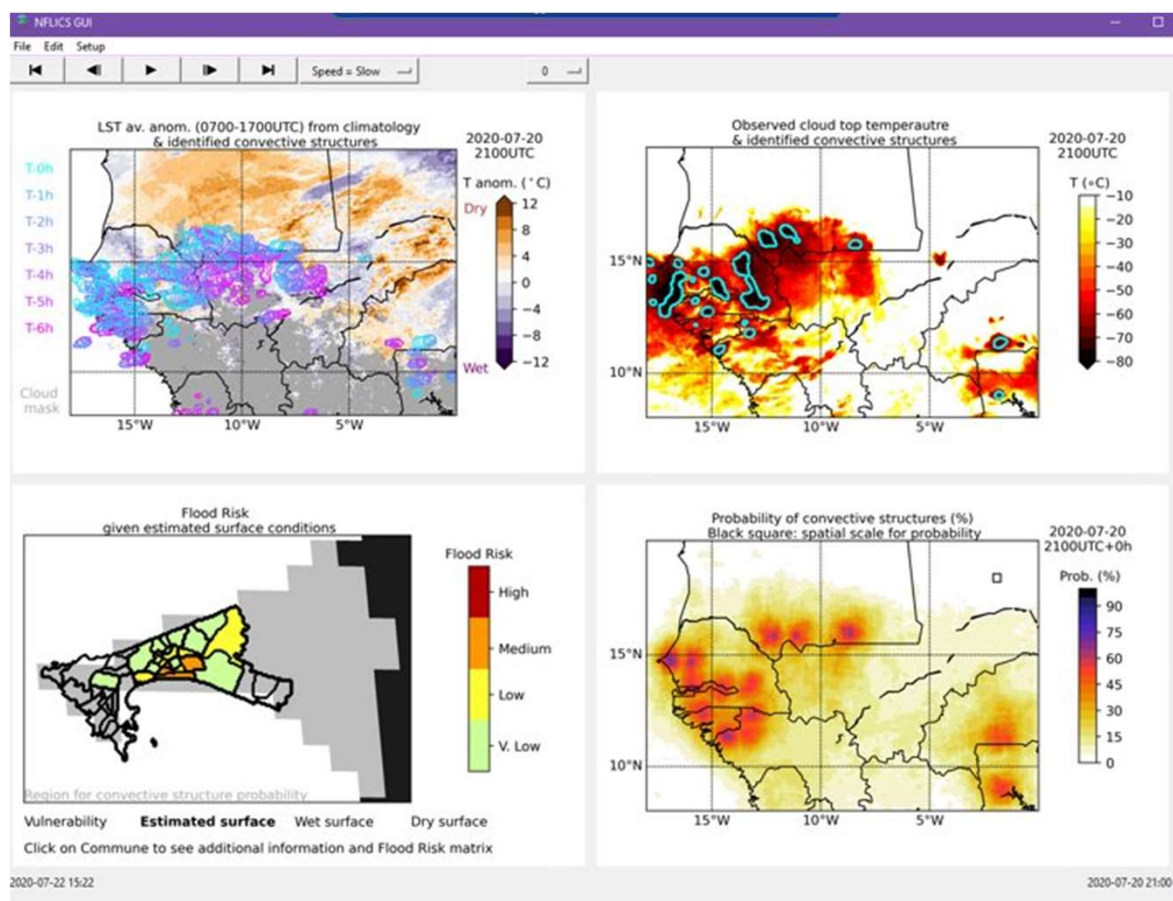
C. Taylor, S. Anderson, S. Cole, C Klein (UK Centre of Ecology and Hydrology)

4. Considering current surface conditions

3. Producing a Flood Risk Nowcast

1. Identifying convective structures from Satellite data

2. Producing a Convective Activity Nowcast based on historical data



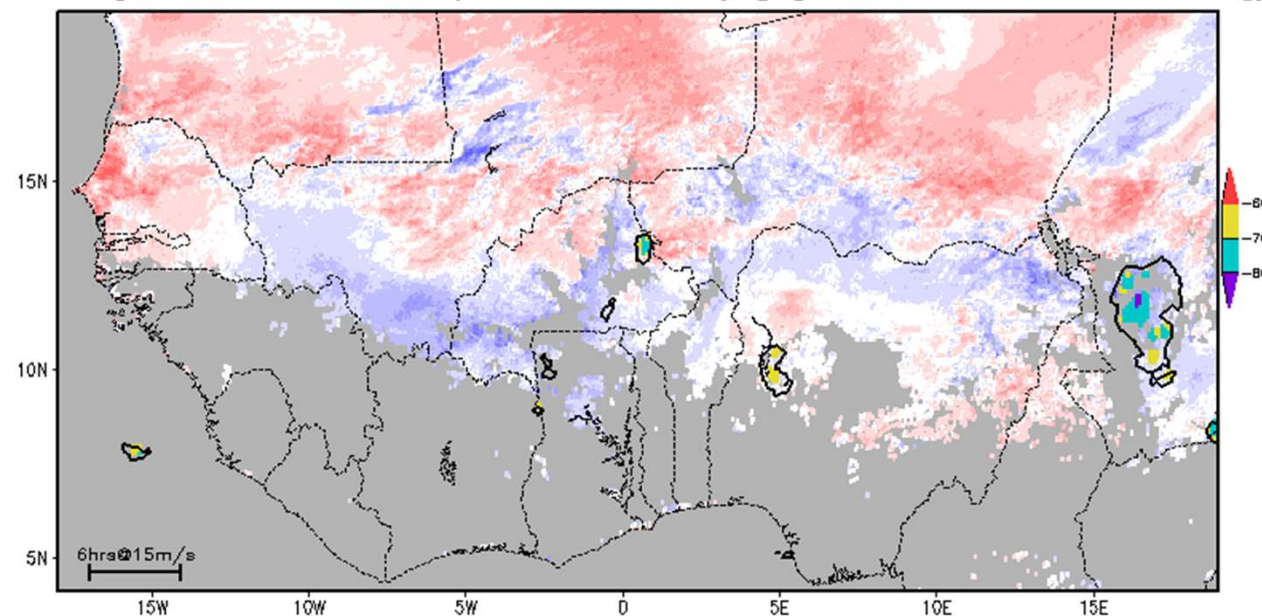
# NFLICS

Nowcasting Flood Impacts of Convective Storms in the Sahel



UK CEH

Convective core temperatures 10Z05SEP2021 (-60, -70, -80C)  
Shading: Land Surface Temperature Anomaly [K] From 2004-15 Climatology



ENVIRONMENTAL RESEARCH LETTERS

ACCEPTED MANUSCRIPT

## Nowcasting tracks of severe convective storms in West Africa from observations of land surface state

Christopher M Taylor<sup>1</sup>, Cornelia Klein<sup>1</sup>, Cheikh Dione<sup>2</sup>, Douglas J Parker<sup>3</sup>, John H Marsham<sup>4</sup>, Cheikh Abdoulahat Diop<sup>5</sup>, Jennifer Fletcher<sup>4</sup>, Abdoul Aziz Saidou Chaibou<sup>6</sup>, Dignon Bertin Nafissa<sup>6</sup>, Vallyaveetil Shamsudheen Semeena<sup>1</sup> + Show full author list

Accepted Manuscript online 9 February 2022 • NA

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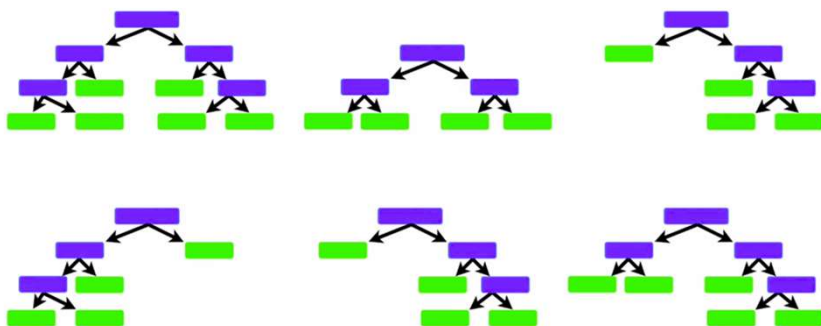
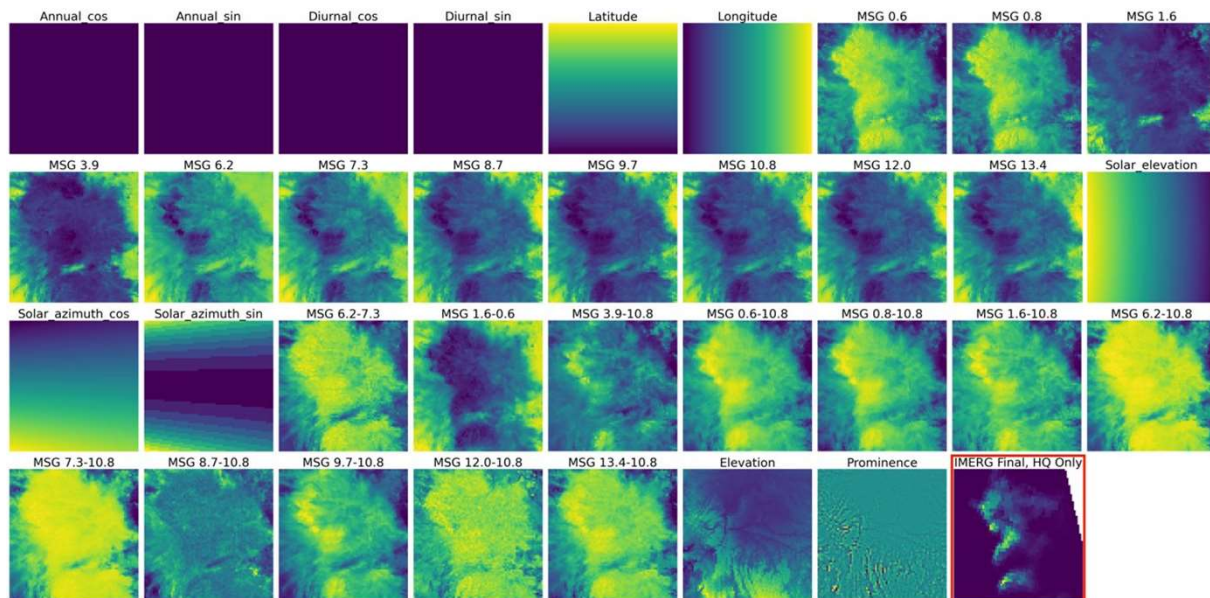
[Accepted Manuscript PDF](#)

[+ Article information](#)

### Abstract

In tropical convective climates, where numerical weather prediction of rainfall has high uncertainty, nowcasting provides essential alerts of extreme events several hours ahead. In principle, short-term prediction of intense convective storms could benefit from knowledge of the slowly-evolving land surface state in regions where soil moisture controls surface fluxes. Here we explore how near-real-time (NRT) satellite observations of the land surface and convective clouds can be combined to aid prediction of severe weather in the Sahel on time scales of up to 12 hours. Using Land Surface Temperature (LST) and soil moisture, we characterise the state of the surface energy balance and the convective parts of Mesoscale Convective Systems (MCS) that predictive skill provides.

# Machine learning (random forest) Ben Pickering (NCAS & U. of Leeds)

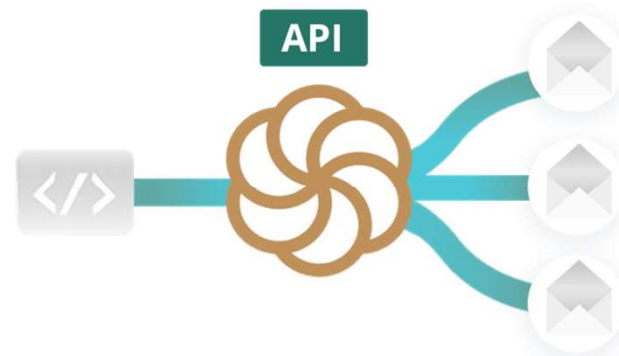
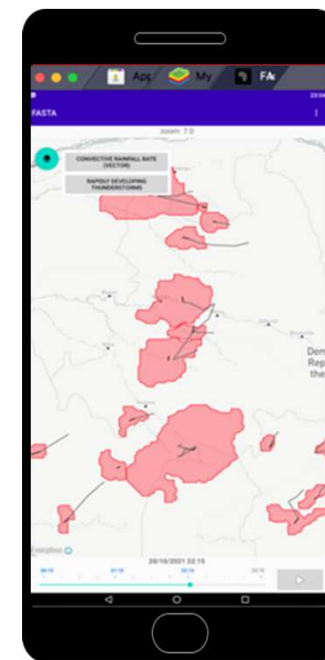
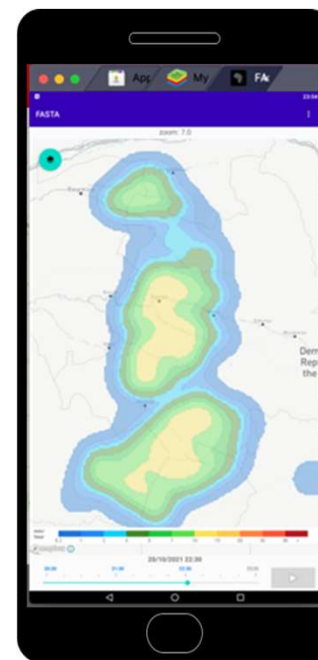
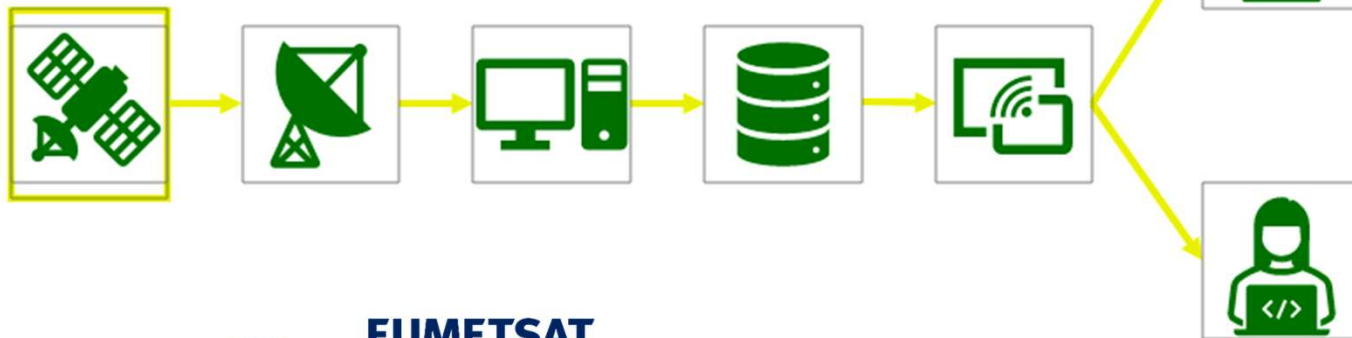


- Satellite channels (and some other features) used as inputs.
- Many decision trees make up a “forest”.
- Trained using IMERG high quality rainfall retrievals (passive microwave).
- Comparable skill to NWCSAF CRR (but at significantly reduced latency and day-night bias).

<https://fastaweather.com/>

# FASTA

Forecasting African STorms Application



Data available to a wide variety of users to tailor to their own needs.

# Future of African Nowcasting

# Nowcasting Scaling

- Automation (such as use of NWCSAF-GEO) is needed to scale up nowcasting.
- Could lead to commercial nowcasting opportunities for national met services.

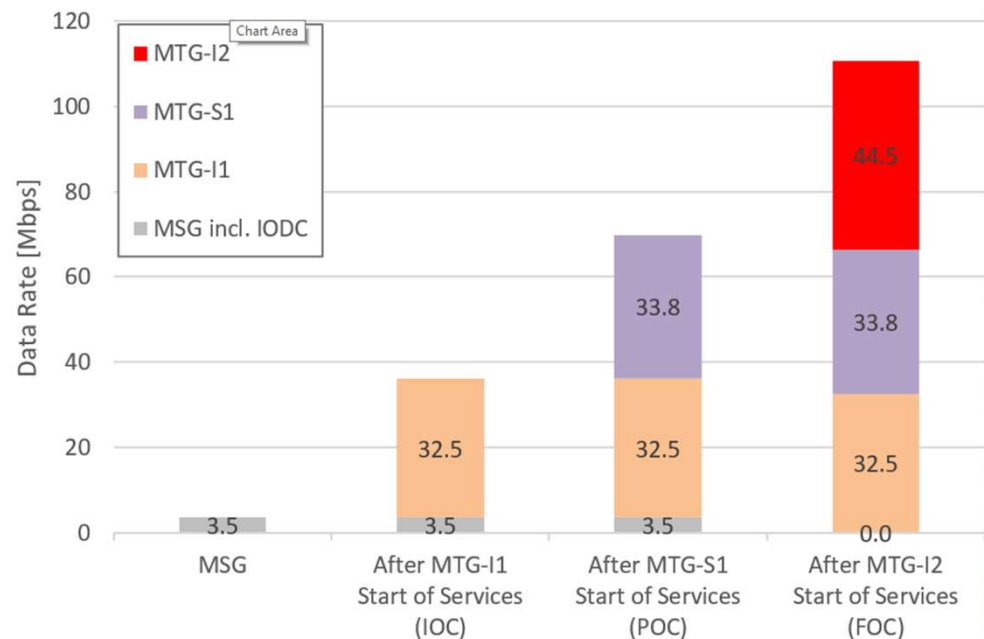


# New opportunities and challenges

- Meteosat Third Generation.
- Higher resolution, more channels, images every 10 minutes, 3D water vapour and temperature sounder and lightning sensor.
- However, new technology brings new challenges. Particularly in terms of receiving ever increasing amounts of data.
- Need to building critical mass of expertise in African institutions.



Data Rate Evolution (MSG and MTG)



# Summary

- SWIFT has advocated for a satellite approach to nowcasting.
- There has been great success in introducing existing products to the operational forecast and research communities in African partner countries.
- Development of new tools has yielded both new nowcasting products and routes of distribution.
- The future of nowcasting in Africa has the potential to offer great benefits to Africans.
- However, uncertainty around the upcoming Meteosat upgrade and the need for more expertise in African institutions presents future challenges.

