

# Understanding of convective organisation is needed for tropical nowcasting. Douglas Parker Professor of Meteorology

School of Earth and Environment & School of Mathematics University of Leeds





### Short-range forecasts and nowcasting.

NWP for tropical Africa is not winning the battle to forecast storms:

 "Forecast performance is generally ... worst ... over tropical Africa, where models misrepresent the high degree of convective organization, such that even post-processed forecasts are hardly better than climatology."

> Vogel et al. 2020. Skill of Global Raw and Postprocessed Ensemble Predictions of Rainfall in the Tropics

Continuous Ranked Probability Skill Score (CRPSS) for 1-day ECMWF (a) raw and (b) postprocessed forecasts for accumulated precipitation amount relative to Extended Probabilistic Climatology during 2009–2017.



Nowcasting is needed – but currently very limited.









## What is nowcasting? For Africa we propose:

1. Nowcasting includes analysis of near-real-time observations,

to define the current weather conditions.

2. Nowcasting forward projects observed weather features, by

extrapolation but also more sophisticated methods using a wide

range of data and dynamical understanding ...

In addition, nowcasting is typically ...

Facilitated by computer systems that bring together disparate data and process them ready for input by seasoned forecasters.

Roberts et al. 2021. Weather







# What do we need for African nowcasting?

1. Conceptual models for storm lifecycles.

a) Noo

b) Early Afternoon

Storm Steering Flow

Cold Poo

Mid Afternoor

- Initiation and growth
- Organisation
- Movement
- Decay

2. Algorithms to automate the use of those (e.g. but not only, machine-learning).

3. Means of communicating complex information to forecast users (often requires conceptual models).



## Learning from RCE (Gorm Jensen, at this meeting)

14

12

9

10

8

time [days]

16

#### The diurnal path to persistent dry patches

Dry patches are initiated by a moist event leading to stabilisation of profile over following hours.

8

1

8

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1234

2 3 4 5 6

56

[m4] z [



(after Roehrig et al., 2013)

the dry-anor

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# Conni Klein – this meeting: what atmospheric conditions favour convective cores?



Sahel region within MCS > 15,000km2

#### 925hPa divergence and wind anomaly



#### Spec. Humidity anomaly & low-level wind shear



### Cores favoured where midday conditions show:

- Large low-level specific humidity from nocturnal advection (convective instability)
- Strong wind shear (more organised convection)
- Low level convergence (stronger ascent)

# The land-atmosphere coupling at play



Drier soil enhances:

Klein et al., PNAS in review

meridional T gradient, AEJ (wind shear), instability (dry capping), q-convergence -> MCSs get colder, bigger & produce more rain





### **Satellite-based African Nowcasting**

- Prior to SWIFT, Nowcasting was not formally being conducted in these countries.
- We have made NWC SAF products available and we are starting to adapt them. Operational agencies are starting to use them. Universities using them for teaching.
- Evaluation shows impressive skill for rainfall.
- We are innovating on new nowcasting algorithms, including AI.



- The hardware has successfully been installed at Kwame Nkrumah University of Science and Technology (KNUST), Kumasi.
- KNUST staff have then installed the software at GMet: an African solution.







### **NFLICS** prototype nowcast system for Senegal





The latest news from Google AI

### A Neural Weather Model for Eight-Hour Precipitation Forecasting

Wednesday, March 25, 2020

Posted by Nal Kalchbrenner and Casper Sønderby, Research Scientists, Google Research, Amsterdam

Predicting weather from minutes to weeks ahead with high accuracy is a fundamental scientific challenge that can have a wide ranging impact on many aspects of society. Current forecasts employed by many meteorological agencies are based on physical models of the atmosphere that, despite improving substantially over the preceding decades, are inherently constrained by their

### Some remarks and assertions

- Nowcasting is vitally important and saves lives, in circumstances where NWP is not able to provide useful guidance.
  - The goal of conceptual understanding of convection is not just NWP and parametrisation.
- New statistical methods (including machine learning) will benefit from underlying principles guiding the data and algorithms.
- Evaluation is critical (and complicated).
- The term "nowcasting" has recently migrated from meteorology to economics and epidemiology ...

Roberts and Wilson 2017. Nowcasting. Chapter 6 in Parker and Diop-Kane 2017. Meteorology of tropical West Africa: The forecasters' handbook.. Wiley.