Integrating convection information into products and services

Caroline Bain

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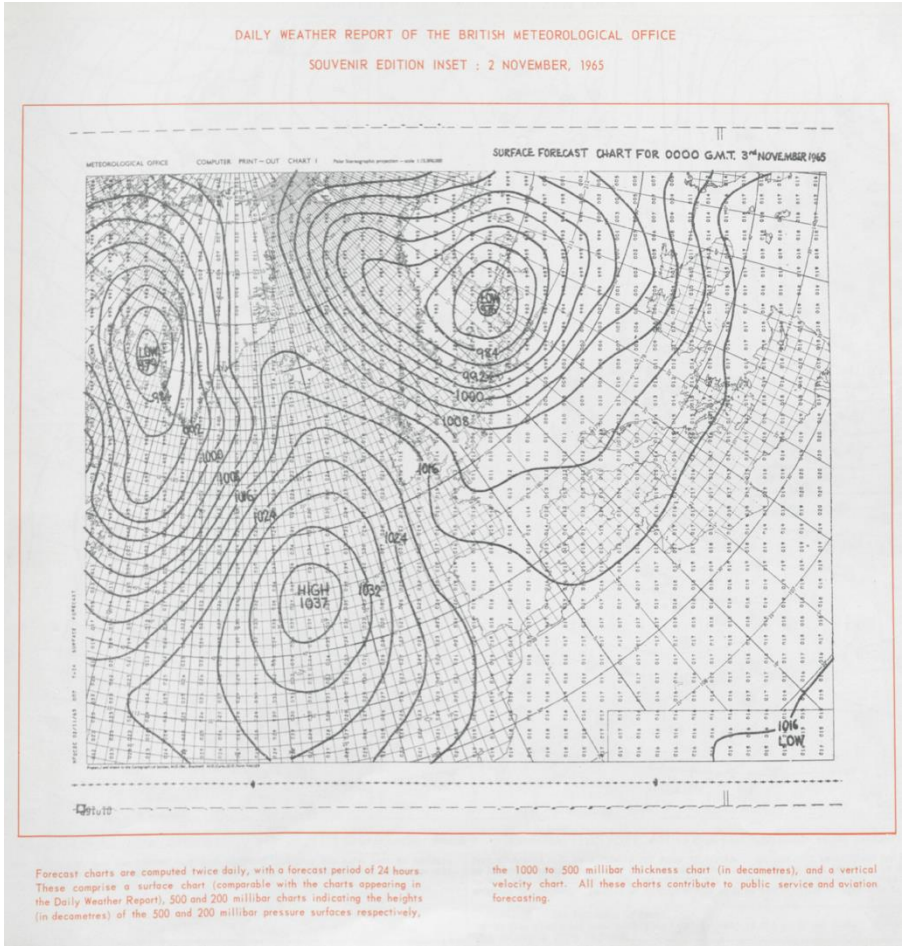
Met Office

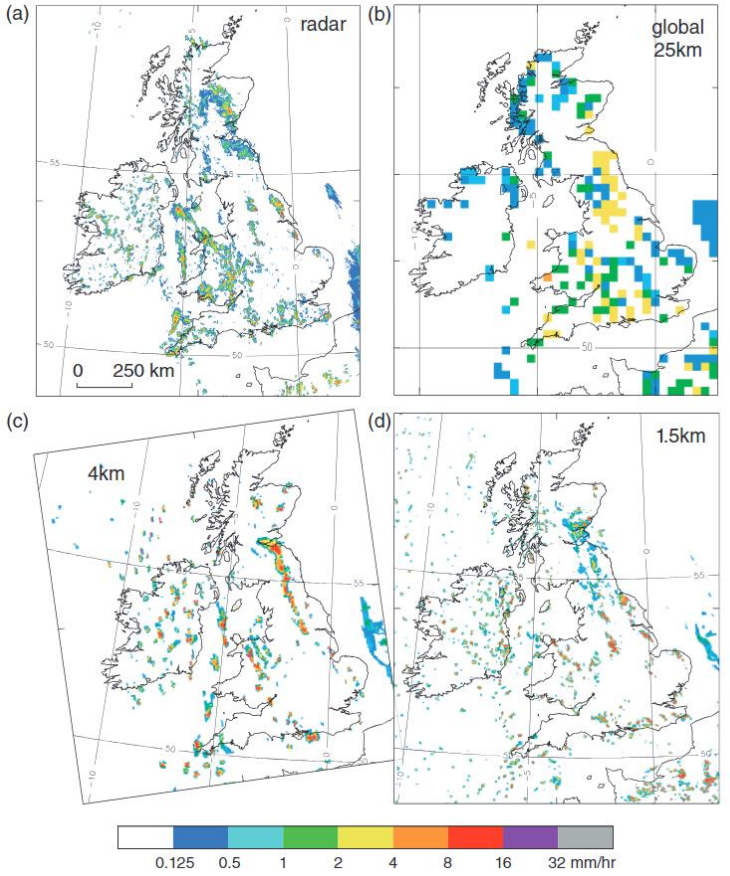
Why convection prediction matters

Why predicting convection is hard

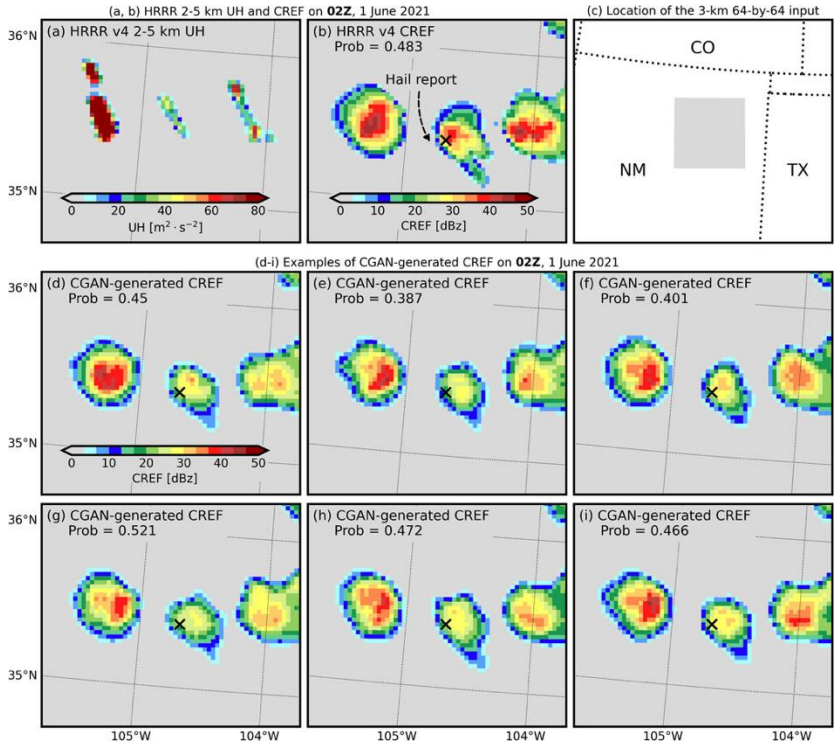


1st NWP output 2/11/1965

Where have we come from? Where are we going?



Clark et al. (2016)



Sha et al. (2024)

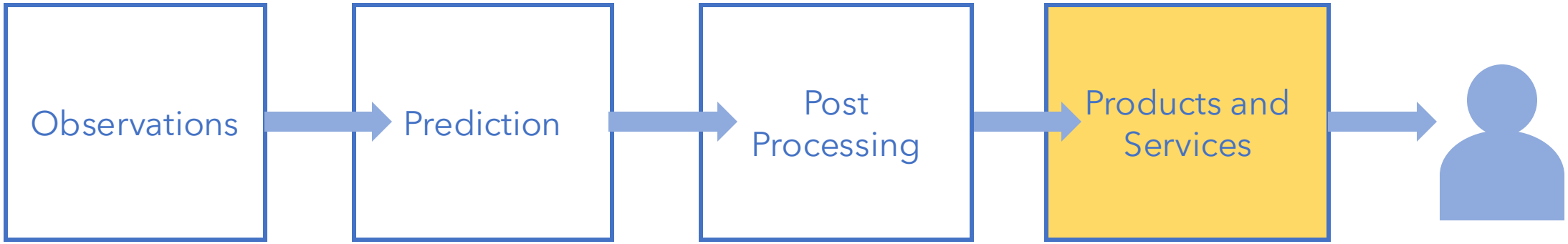
Great… but if we don't use it, who cares? We need to understand what it should be used for and how….

What is a National Meteorological Service for?

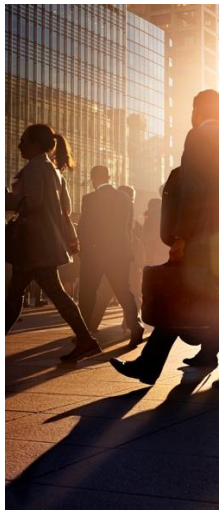
Prof. Penny Endersby, CEO Met Office

"Our role is to perform the very **best scientific** research that we can**."**

"We turn data into **valuable information** that affects people in their everyday lives."


Observations
Prediction
Post Processing
Products and Services

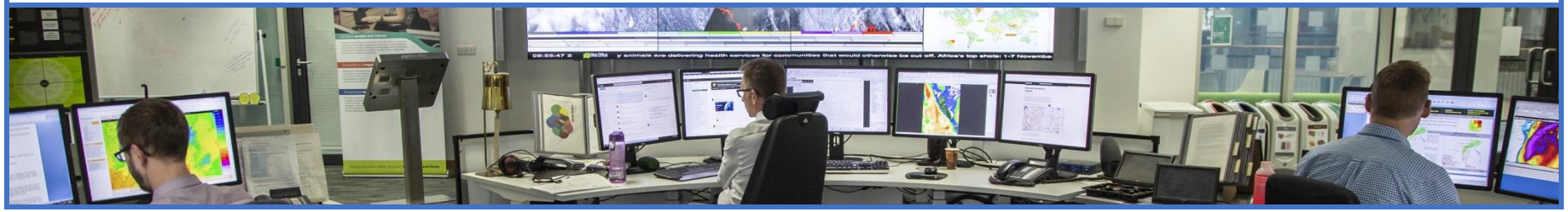
Weather Products and Services

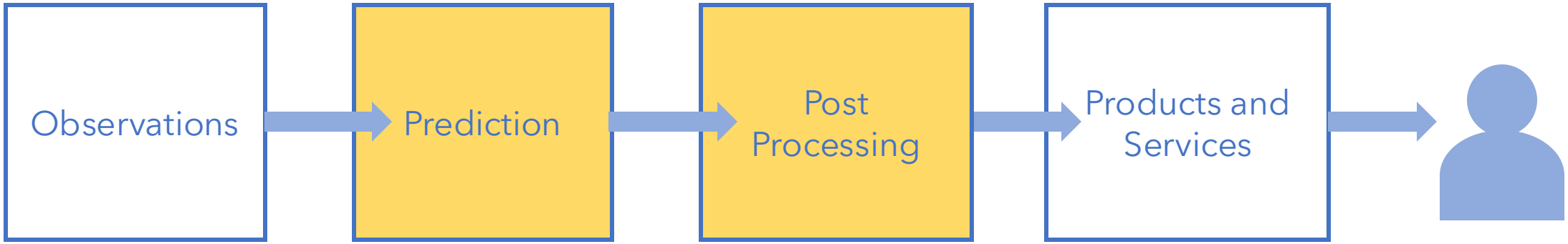


- Public good
  - Weather warnings
  - Web & app
- Emergency responders
- Flood forecasting
- Government

- Defence
- Aviation
- Data Provisioning
- Other industry
  (Energy, Transport, Health etc.)

Underpinned by Operational Meteorologists




Observations
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What are we (as scientists) trying to achieve with convective scale modelling?

Does the convection ‘look’ real? Is the evolution/ behaviour/ shape right? e.g. tracks of the storms Does it impact other parameters correctly? Physical correctness	**Physical realism**
Is the timing right? Start/ initiation Duration Is the location right? x, y, z Is the magnitude right?	**Predictive skill**

But do our customers care about all of this?

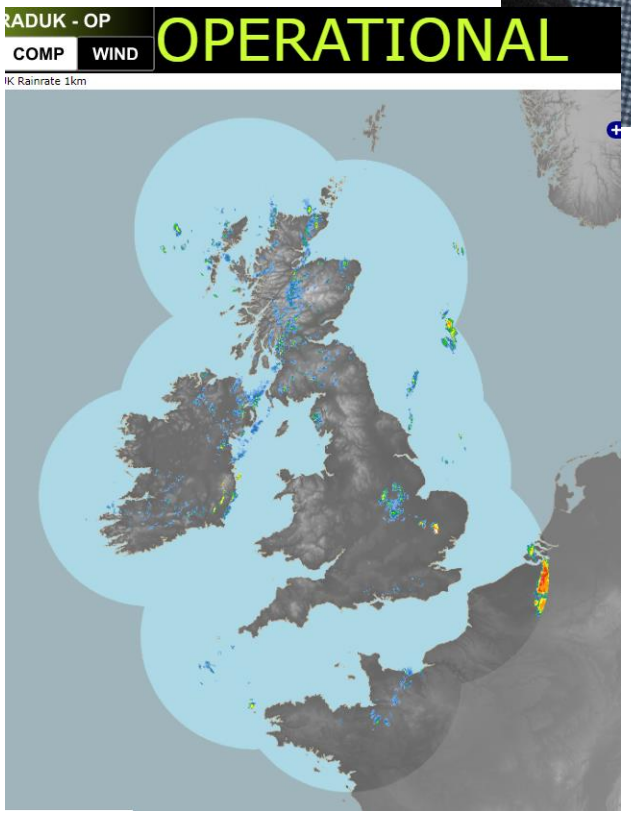
Are there things they care more or less about?

Should we be focussing on particular aspects?

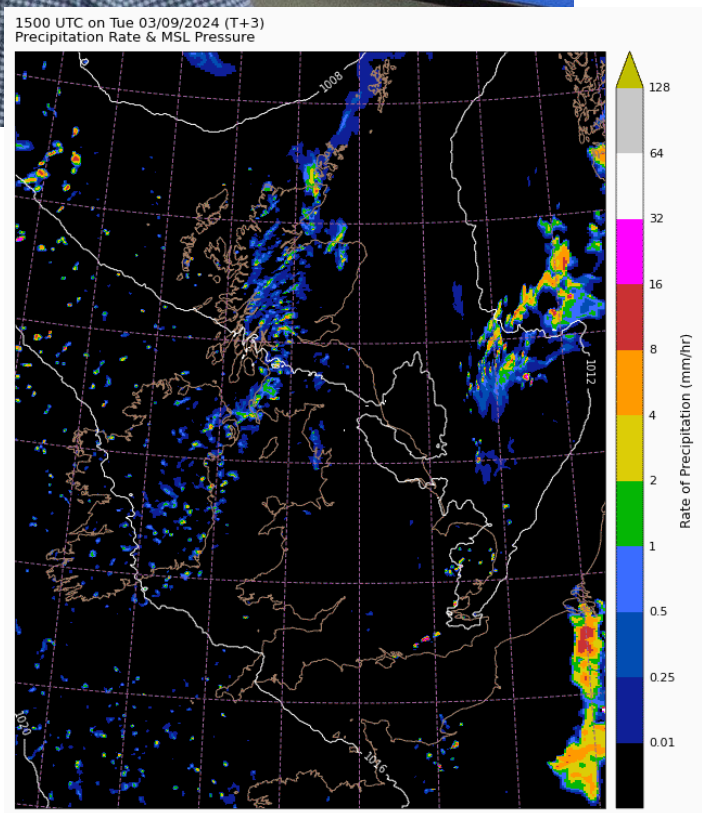
Physical realism

Does the convection look real?
Does it behave as it should and is it physically consistent?

- **‘Map layer/ Object service’**
- **Decision making for super-users**
  - Operational Meteorologists (NSWWS)
  - Scientists (development, understanding, application)
  - Other experts (some pilots, marine)
- User probably knows how real world behaves



radar

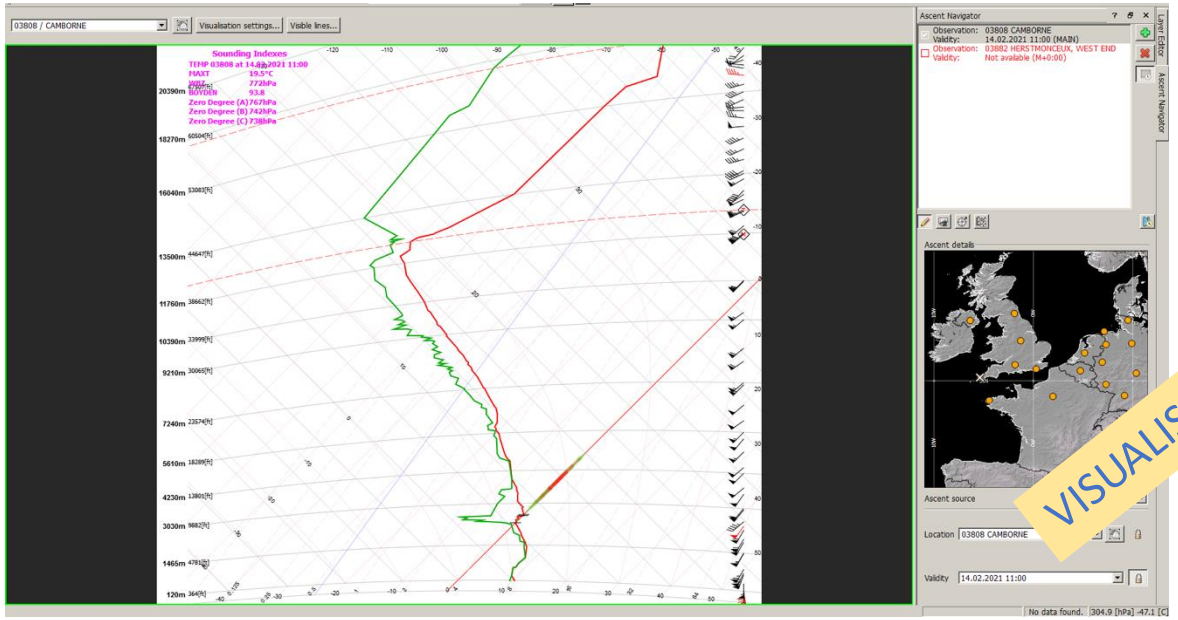


UKV

A huge majority of our services are underpinned by expert advice and guidance for decision making…

Expert users often care a lot about…..

… tephigrams!



"Model convection diagnostics offer insights into potential thunderstorms, but without assessing atmospheric stability via tephigrams, predicting storm intensity and associated hazards like hail is challenging.

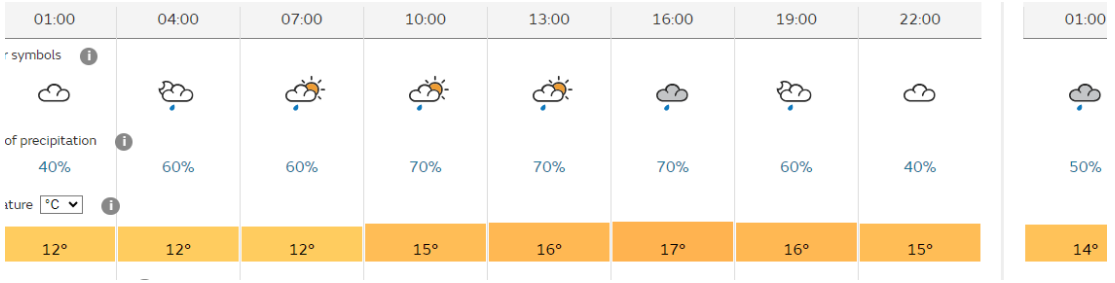
Tephigrams provide a comprehensive view of CAPE, moisture, wind shear, and steering flow, crucial for accurate area forecasts."

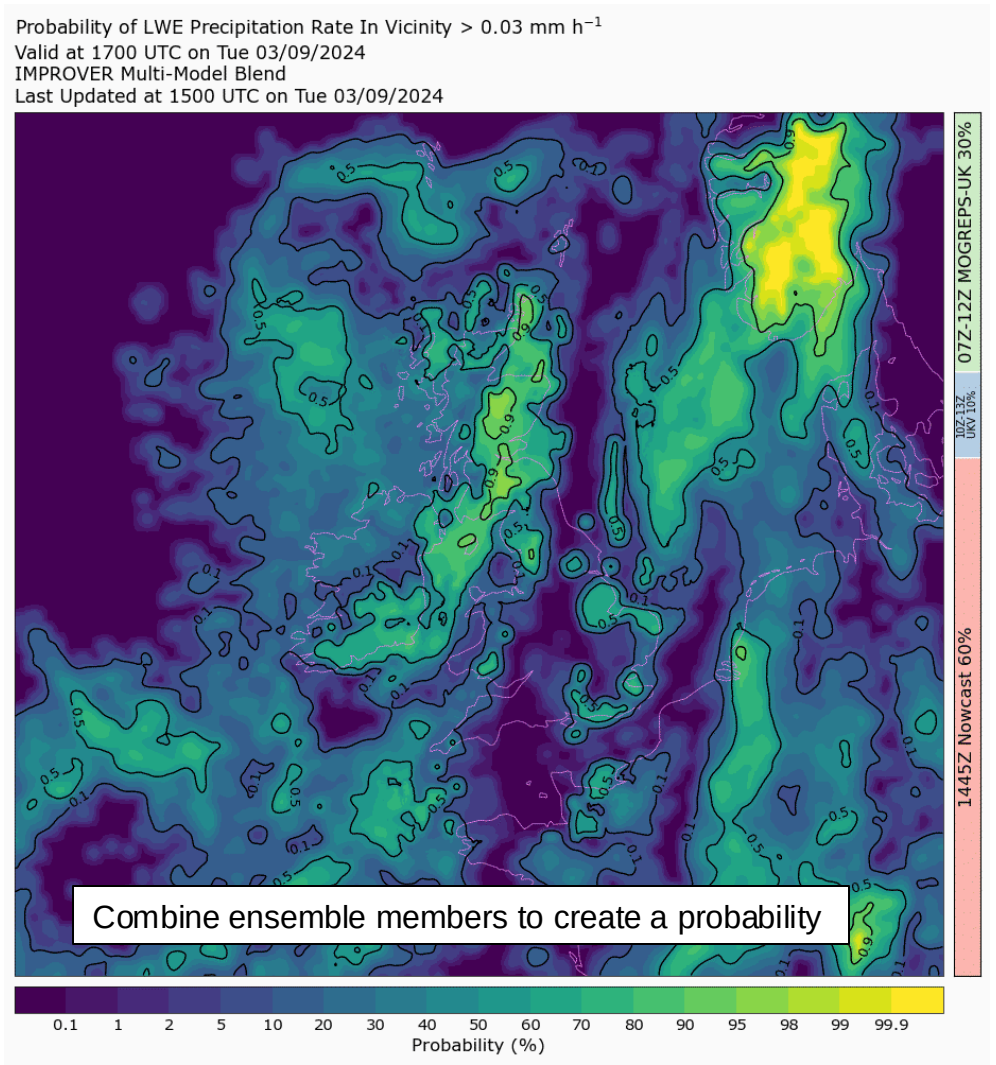
"Tephigrams allow for quick understanding of depth, energy and potential mode of convection as well as understanding multiple other potential hazards such as fog or icing. No other technique allows for such complete vertical assessment of the atmosphere or gives the extra detail that bulk parameters such as CAPE can hide behind their single scalar number"

Predictability/ skill

Confirmed by verification statistics!
Timing, location, magnitude

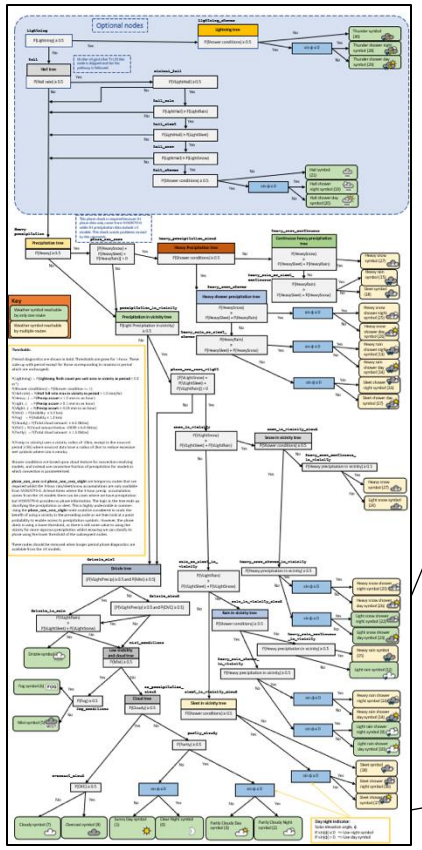
- **‘Feature service’**
- **Decision making for general users**
  - Public
  - Airport
  - Site location specific
- User might not know how real world behaves
- User might have help from super-user as well as this information

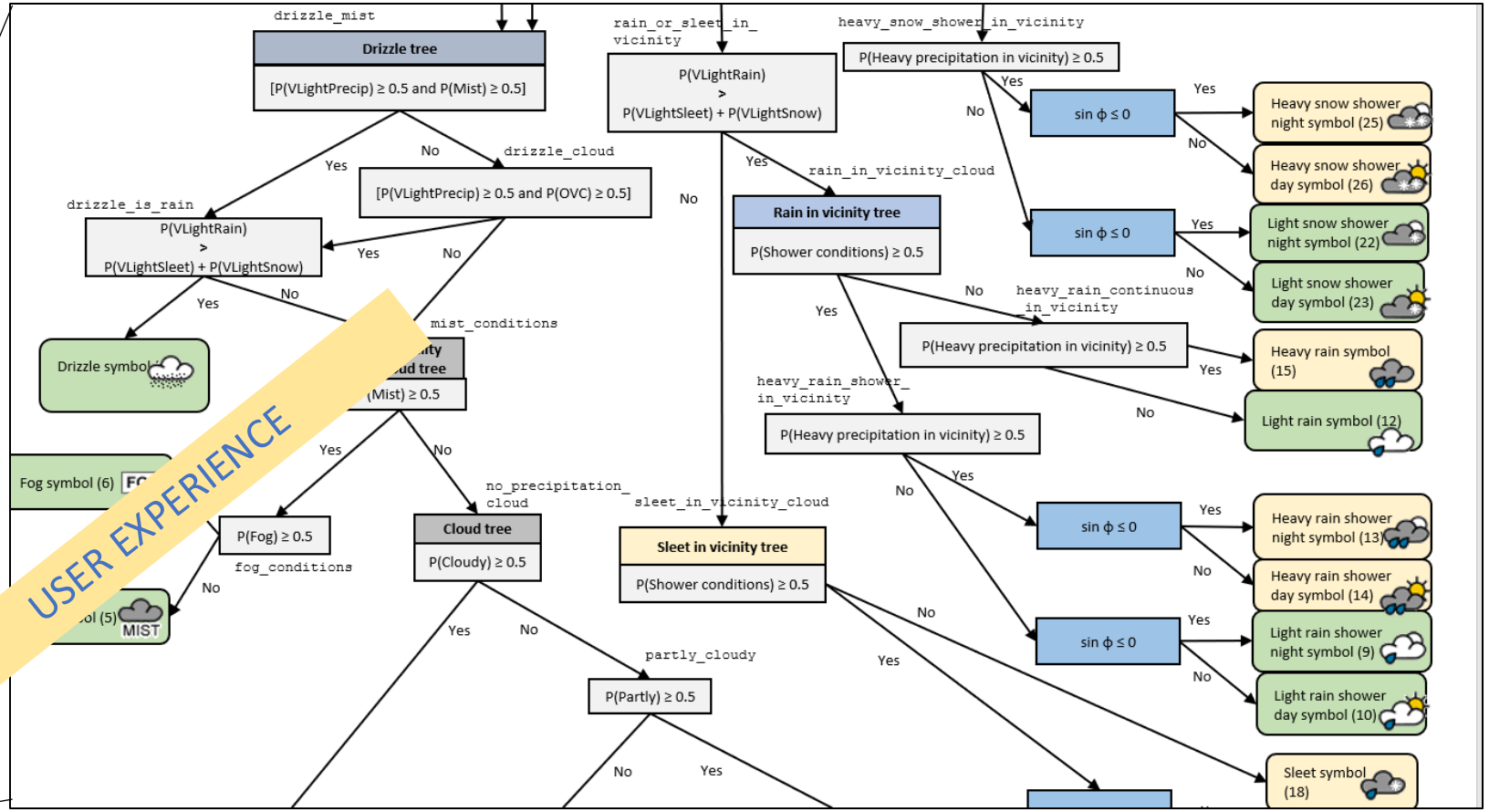




Public users often care a lot about.....

... weather symbols!

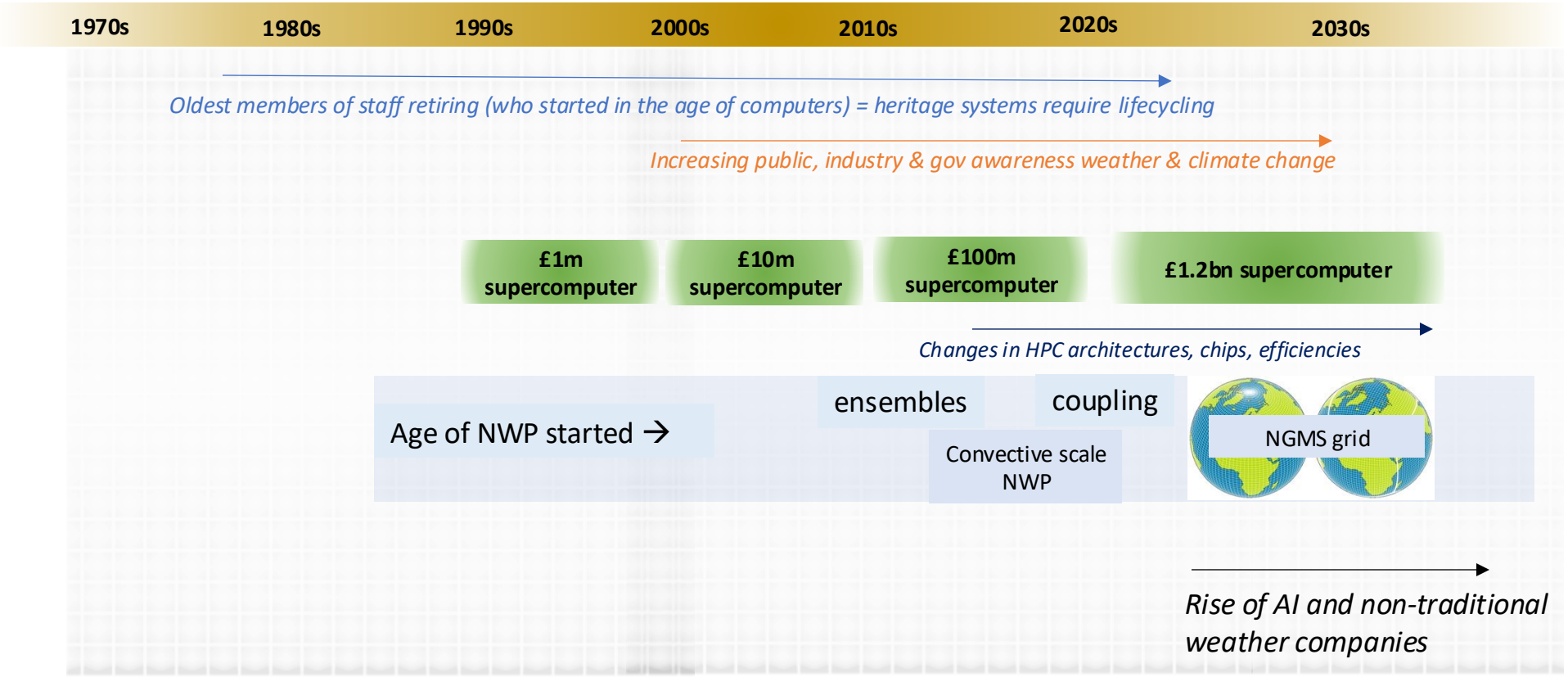




Timing, probabilities, interparameter consistency and search zones matter

So what next? Where are we historically?

Context: The pace of change in the 2020s….



Lots of data, lots of new skill…

….a need to translate this to better services

1) We are interested in convective behaviour AND predictability

2) To exploit (use!) the power of convection simulation we need:

- Interdisciplinary research
- User centric UX principles and co-design
- Agnostic/ scalable tech architecture
- Big data visualisation
- Multi-faceted quality monitoring (verification & evaluation)

3) We should always ask ourselves **what really matters….?**

Met Office

Thank you for listening!
I welcome comments, new ideas, thoughts and challenges

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