From NWP Output to Operational Forecasts

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Head of Numerical Modeling

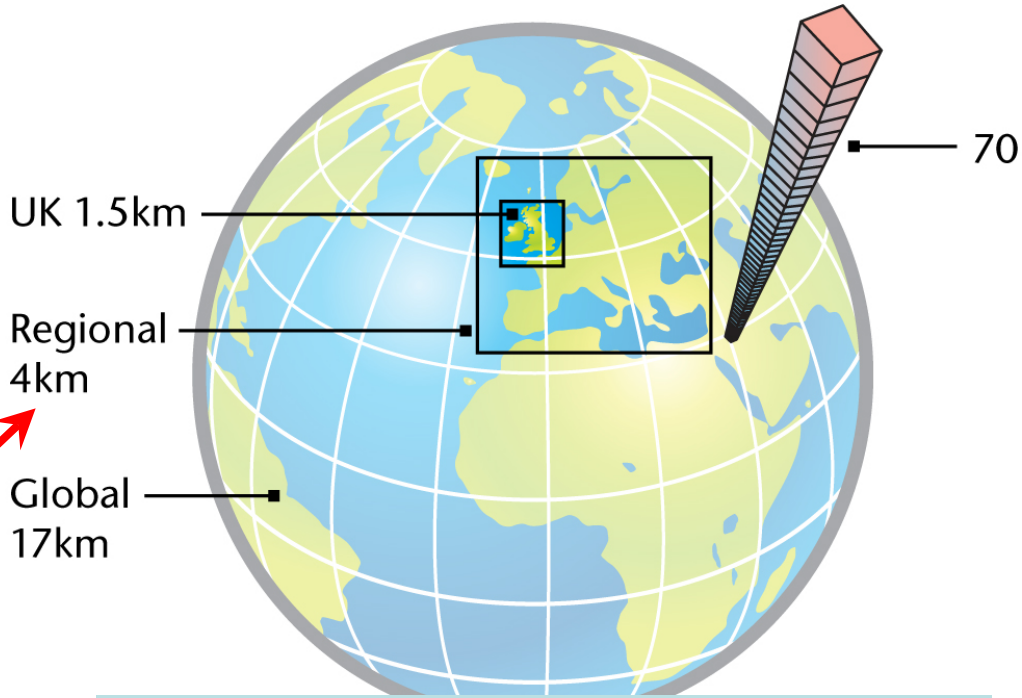
ECMWF Operations Workshop, 18-20 Nov 2013.

2013 NWP Models in Suite

Met Office

UKV and MOGREPS-UK

- 1.5km 70L (40km model top)
- 3DVAR (3 hourly)
- 36hr forecast
- 4 times per day
- 12-member EPS - 2.2km 4x/day 36h



Euro4

- 4km 70L (40km model top)
- Global downscaler
- 66hr forecast twice/day
- 144hr forecast twice/day

Global and MOGREPS-G

- 25km 70L (80km model top) (17km from PS34)
- Hybrid 4DVAR – 60km
- 66hr forecast twice/day
- 144hr forecast twice/day
- 12-member EPS - 33km 4x/day 72hr
- 24-member EPS - 60km 2x/day 15d
  - Ocean coupled up to 6 months

Medium-Range

ECMWF

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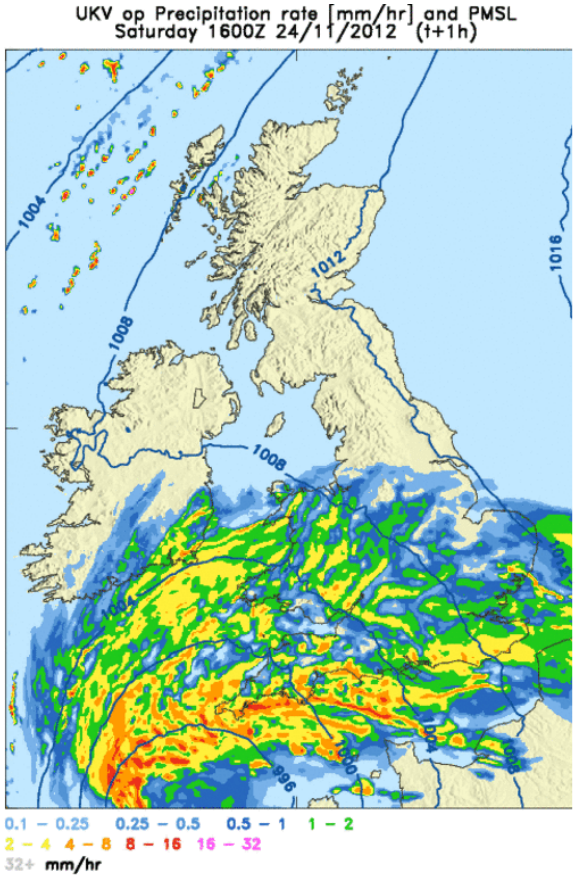
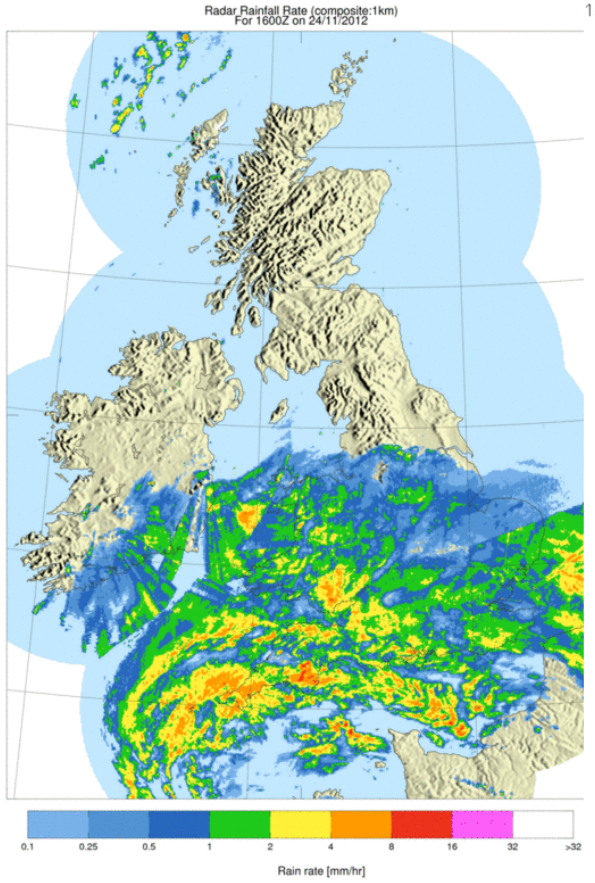
Lots of high-quality NWP available

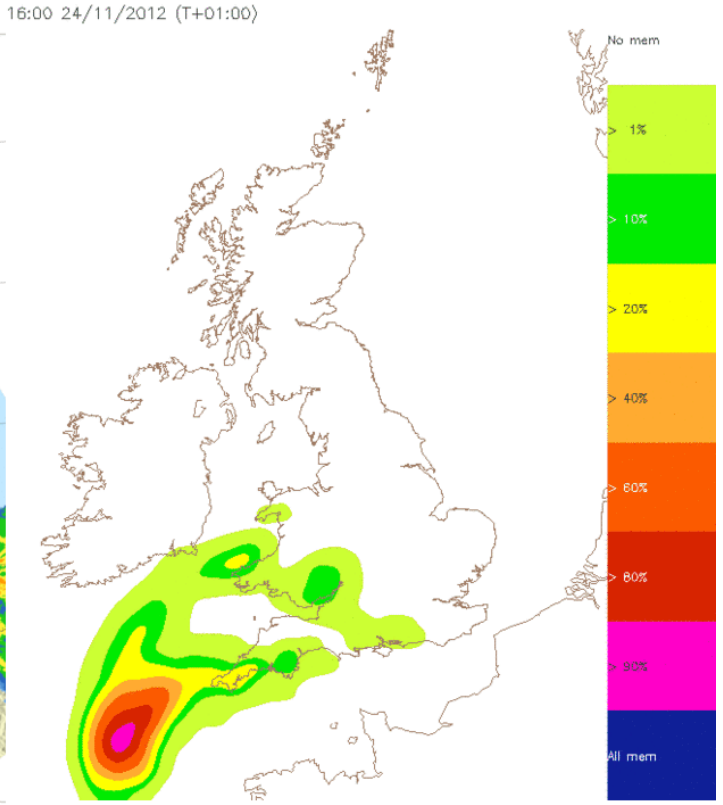
e.g. Hi-res models for UK Floods 24th November 2012



UKV 1.5km



Radar



MOGREPS-UK 2.2km

Chance of Heavy Rain in the Hour

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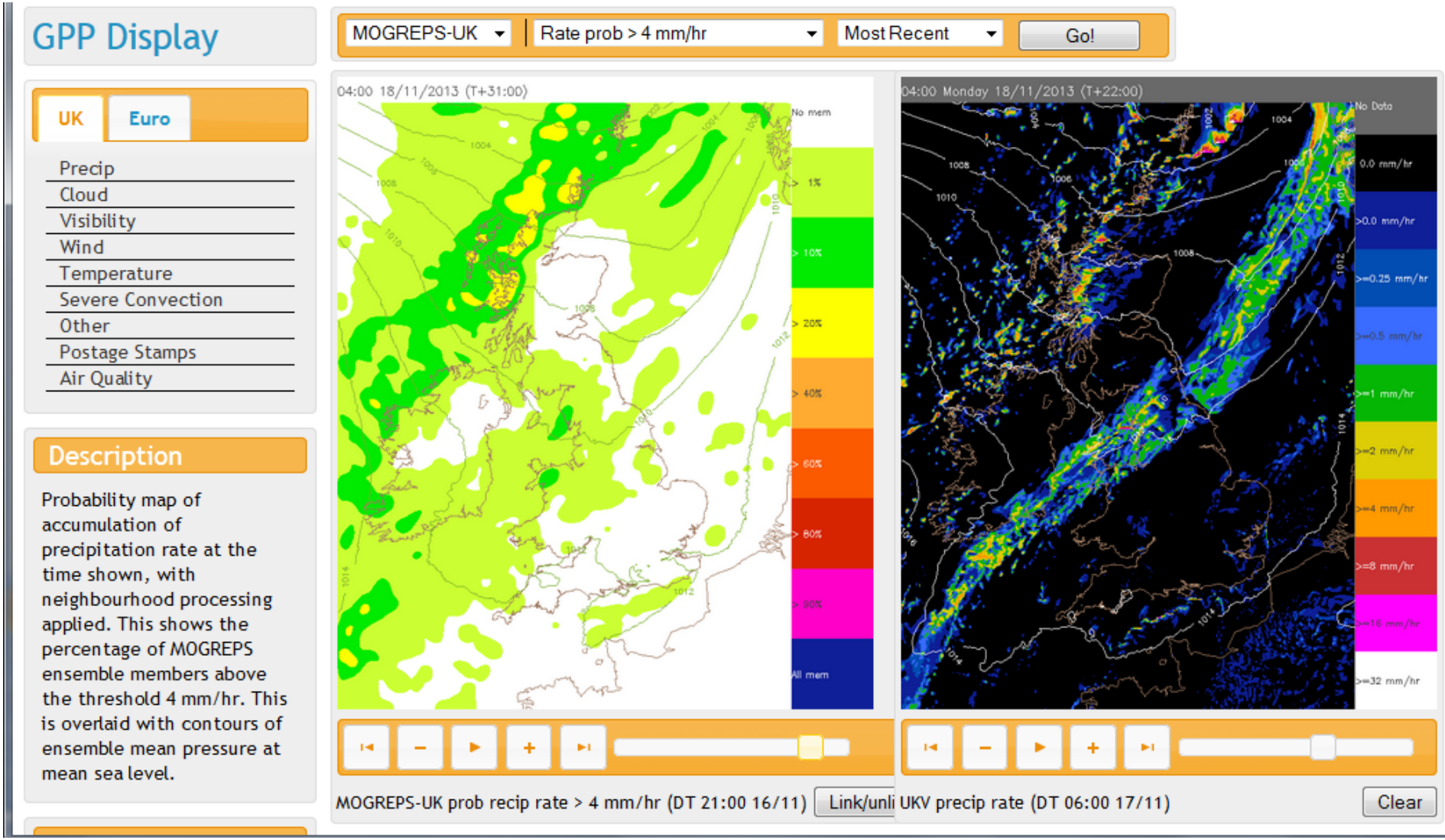
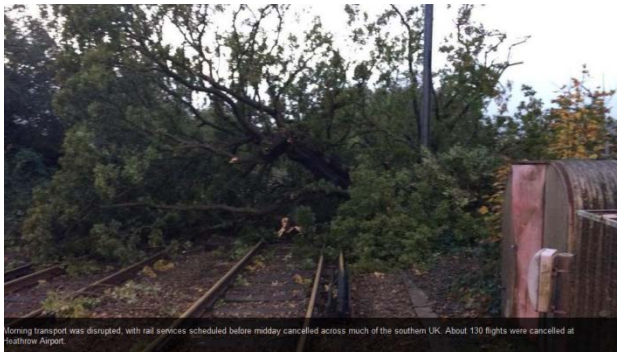
Operational Forecaster Web-display

Includes *seamless* products from Day 1 to Day 15 exploiting different model inputs



St Jude's Storm
Monday 28th October 2013



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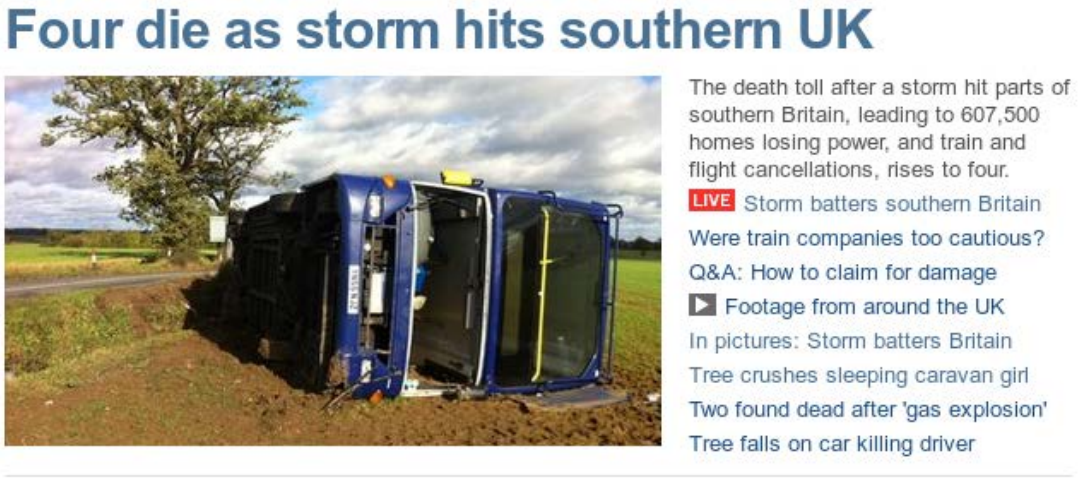
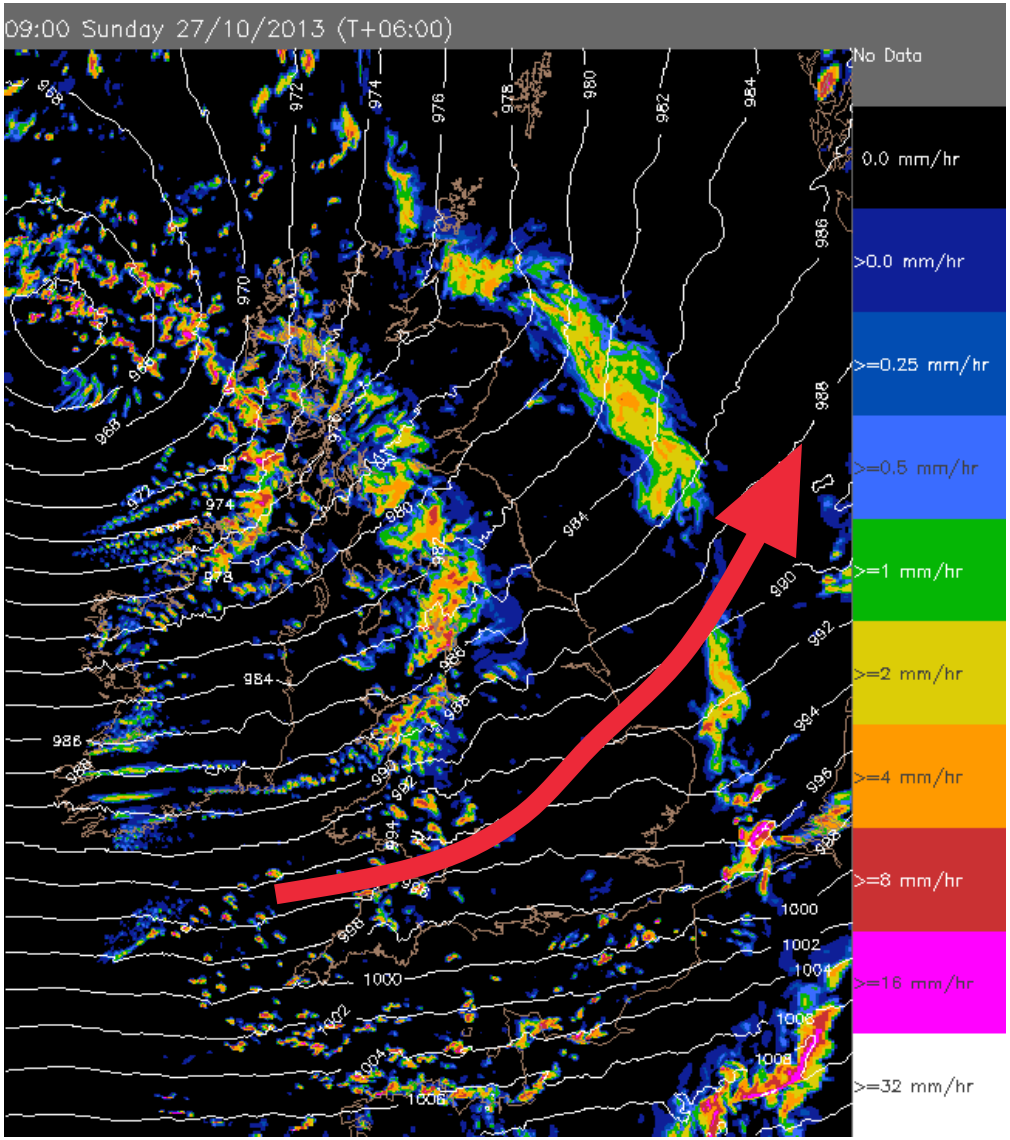


Above: The BBC news website on Monday 28th October 2013

- "Warnings about today's storm were first given a week ago, giving people and emergency services time to prepare... More advanced technology has made predicting the weather far more reliable" *BBC News 10:00pm, 28 Oct 2013*

UKV 1.5km forecast
03Z run on 27th October



Observed track shown in red

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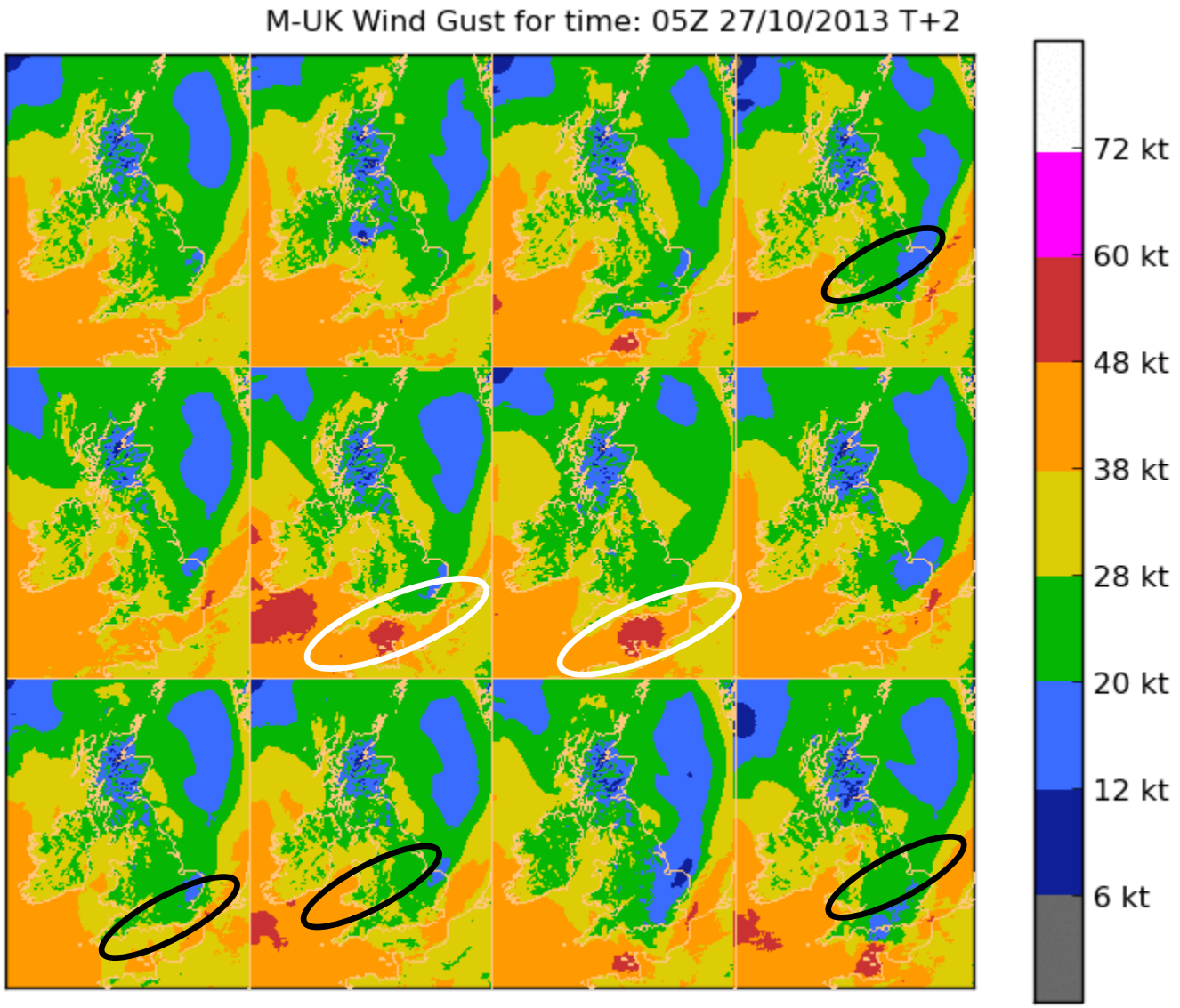
St Jude's Storm: MOGREPS-UK wind gust postage stamps (**03Z run** on Saturday 27th October 2013)



72kt gusts on S flank of main low

72kt gusts on wrap-around – sting-jet?

Note: gusts over North Sea after leaving UK not highlighted

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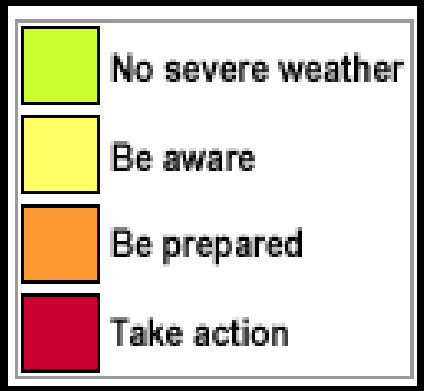
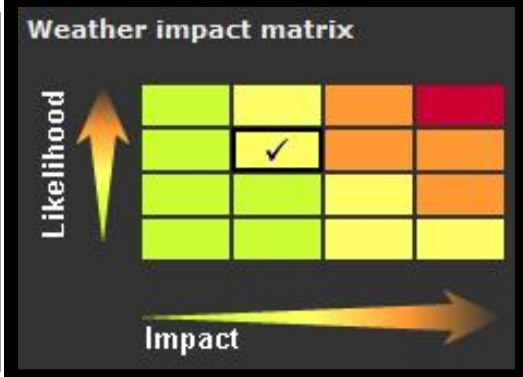
The UK National Severe Weather Warning Service (NSWWS)

- Alerts/warnings based on **likelihood** and **impact**
  - **Alerts** - issued more than 24 hours ahead
  - **Warnings** - issued up to 24 hours ahead
- Regionally varying impact thresholds
- Alerts/warnings presented by shape areas on a map rather that just by county area





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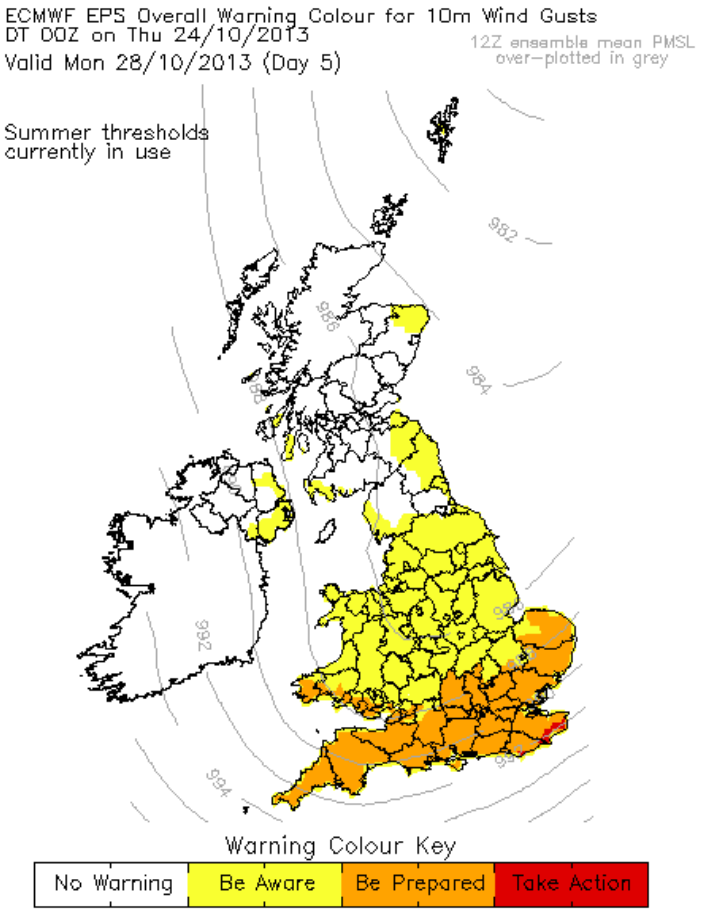
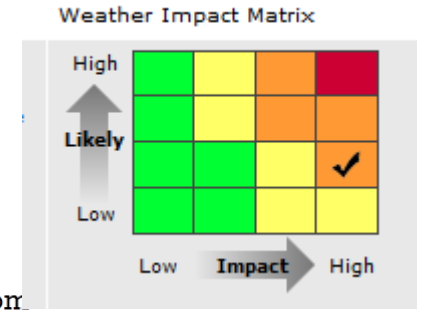
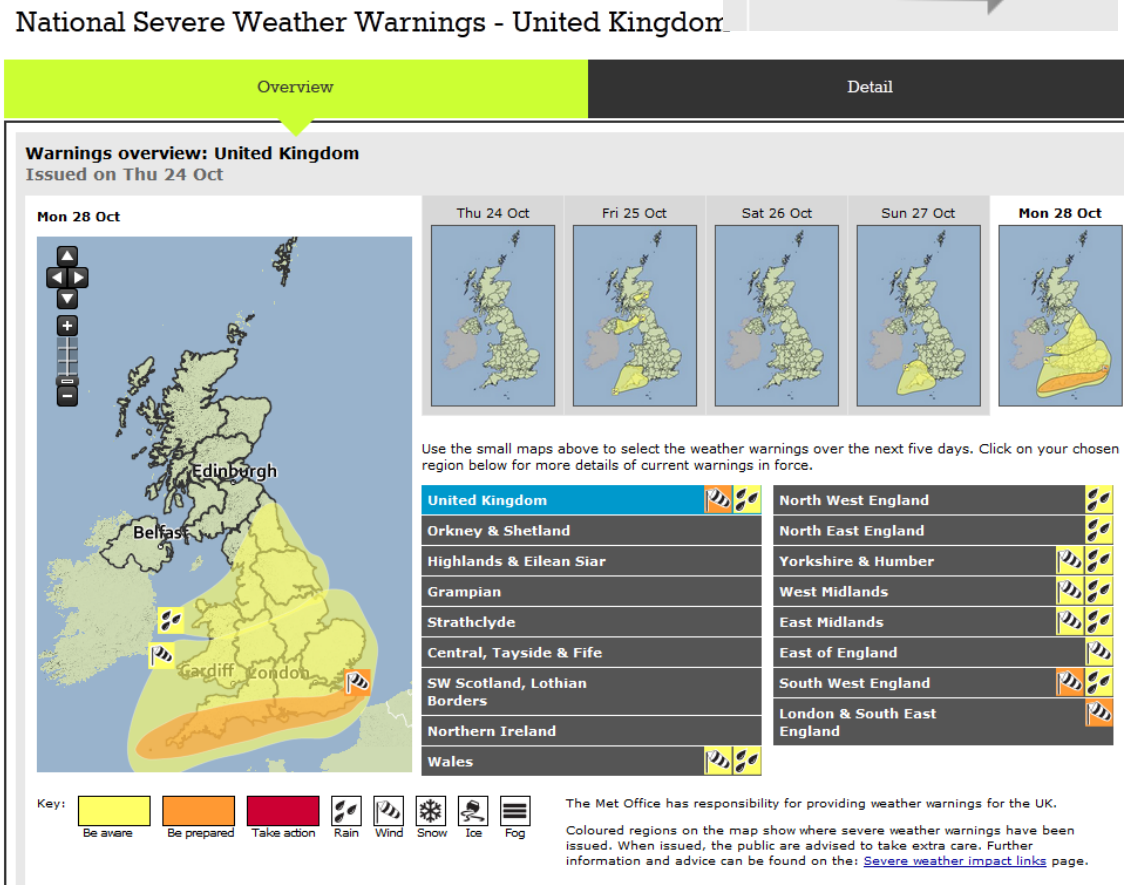
Day 5 Amber warning

- First-guess warning based on ECMWF EPS and issued warning







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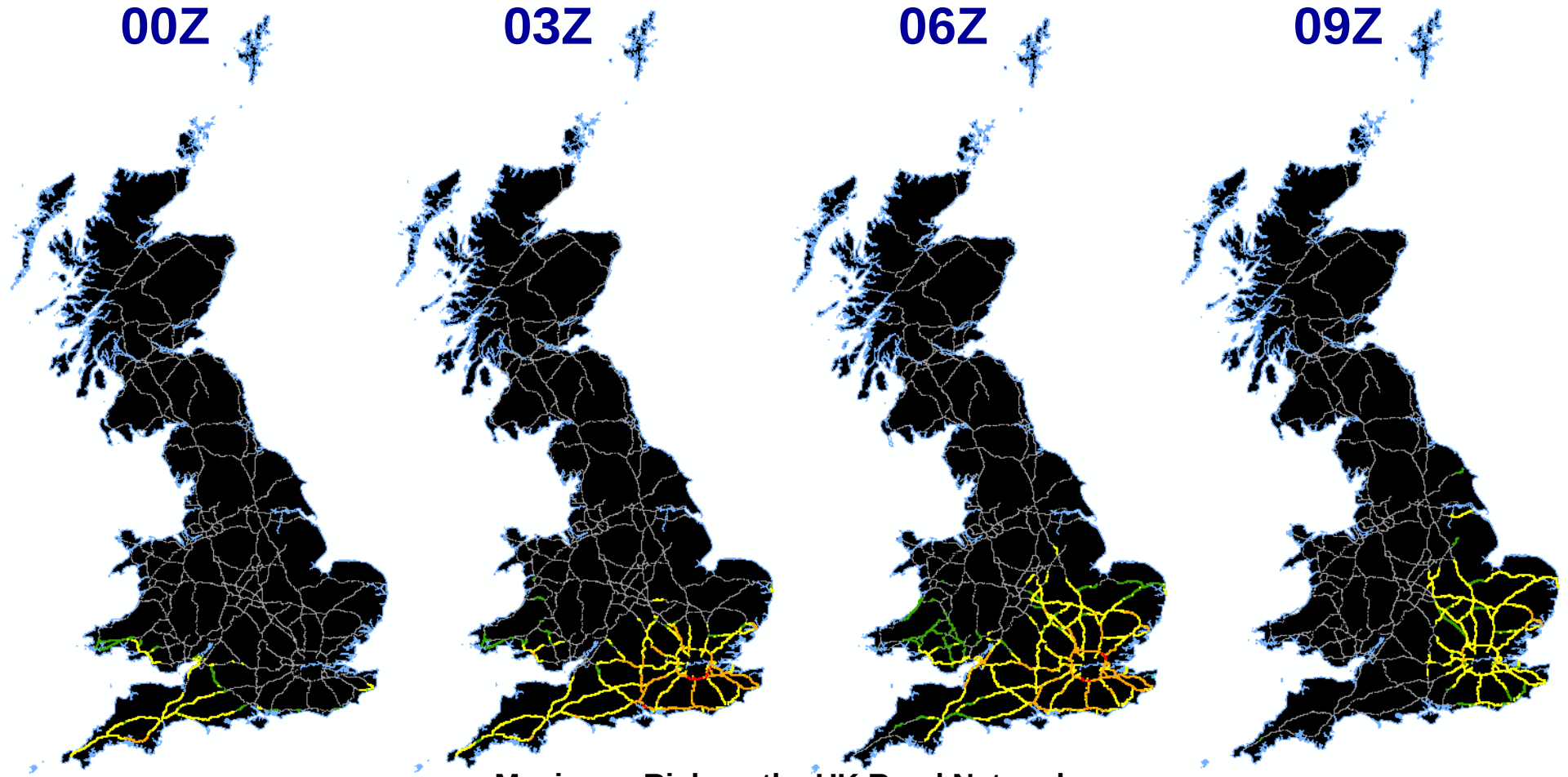
Vehicle OverTurning (VOT) Model

St Jude's Storm 28th October 2013

Met Office



Maximum Risk on the UK Road Network

Low Risk | Low - Medium Risk | Medium - High Risk | High Risk

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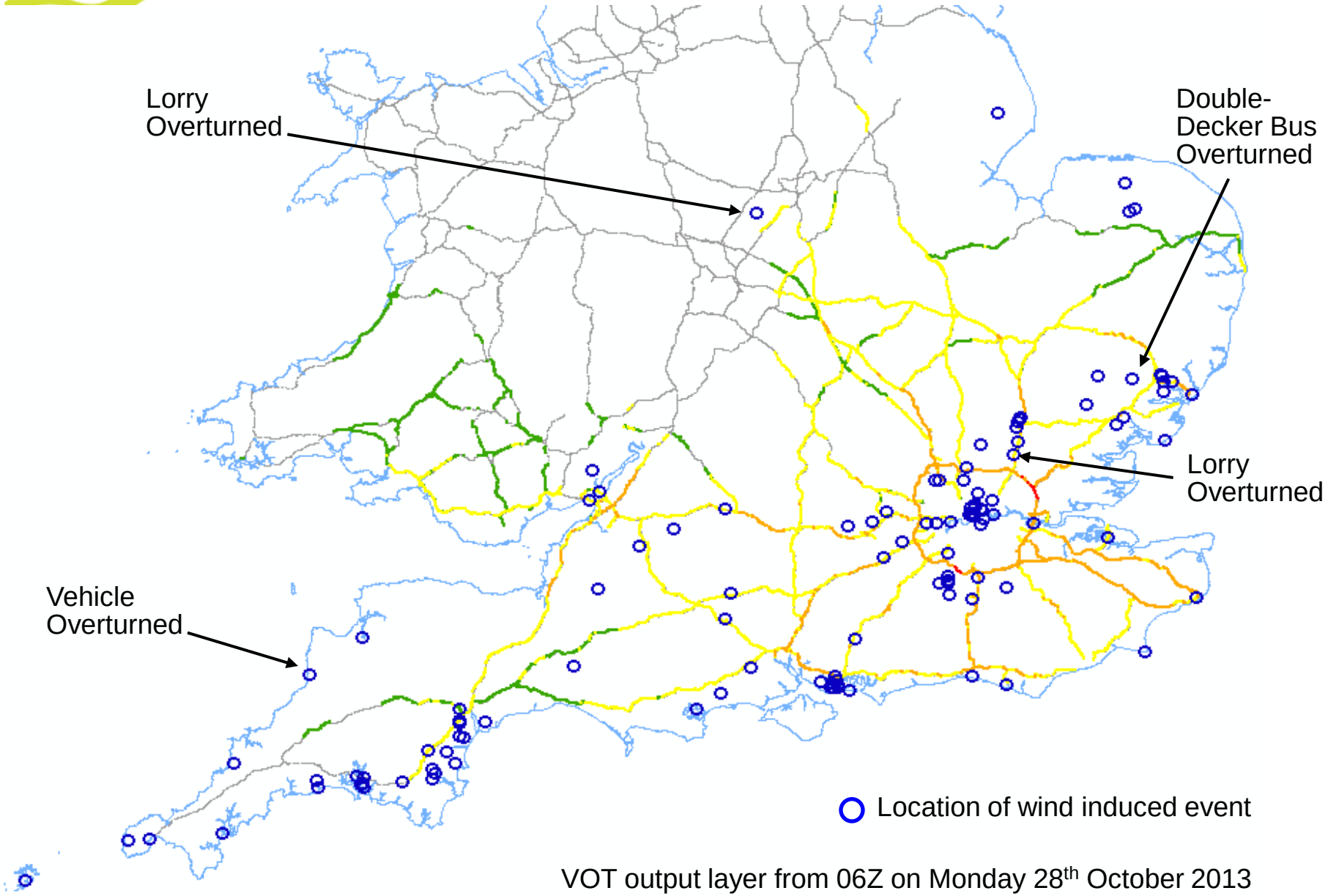
Location of Impacts – St Jude's Day Storm



VOT output layer from 06Z on Monday 28th October 2013

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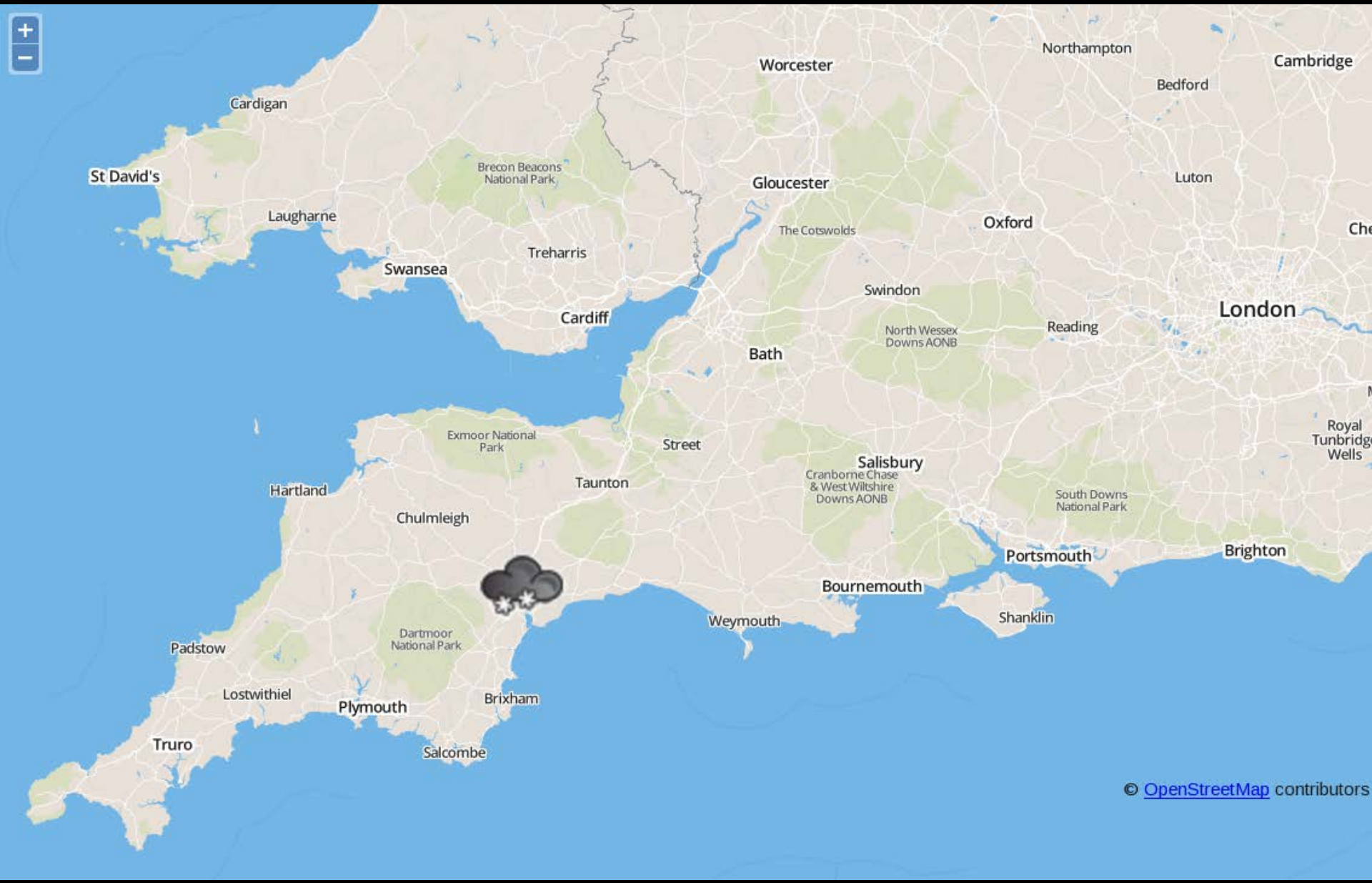

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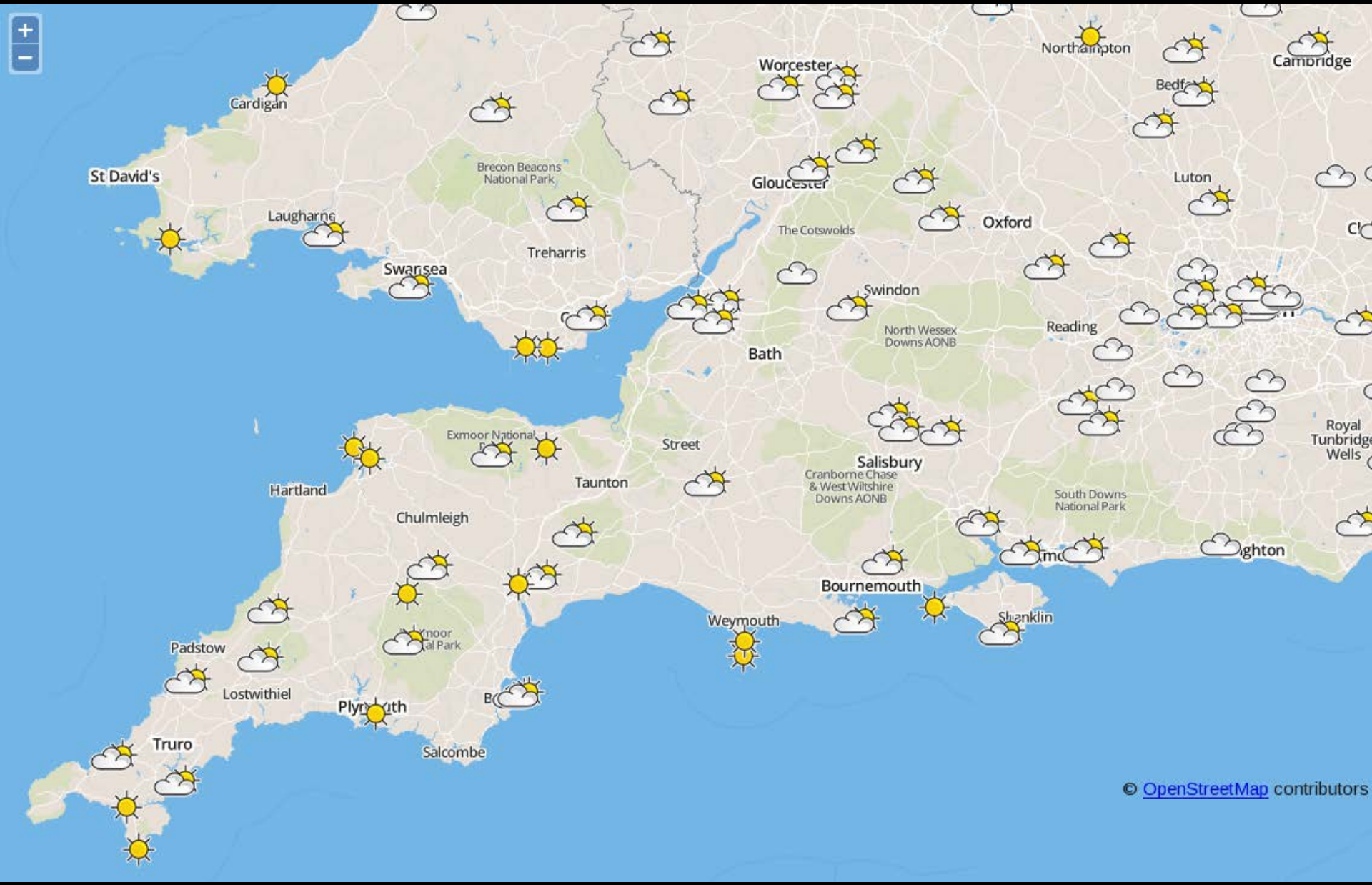

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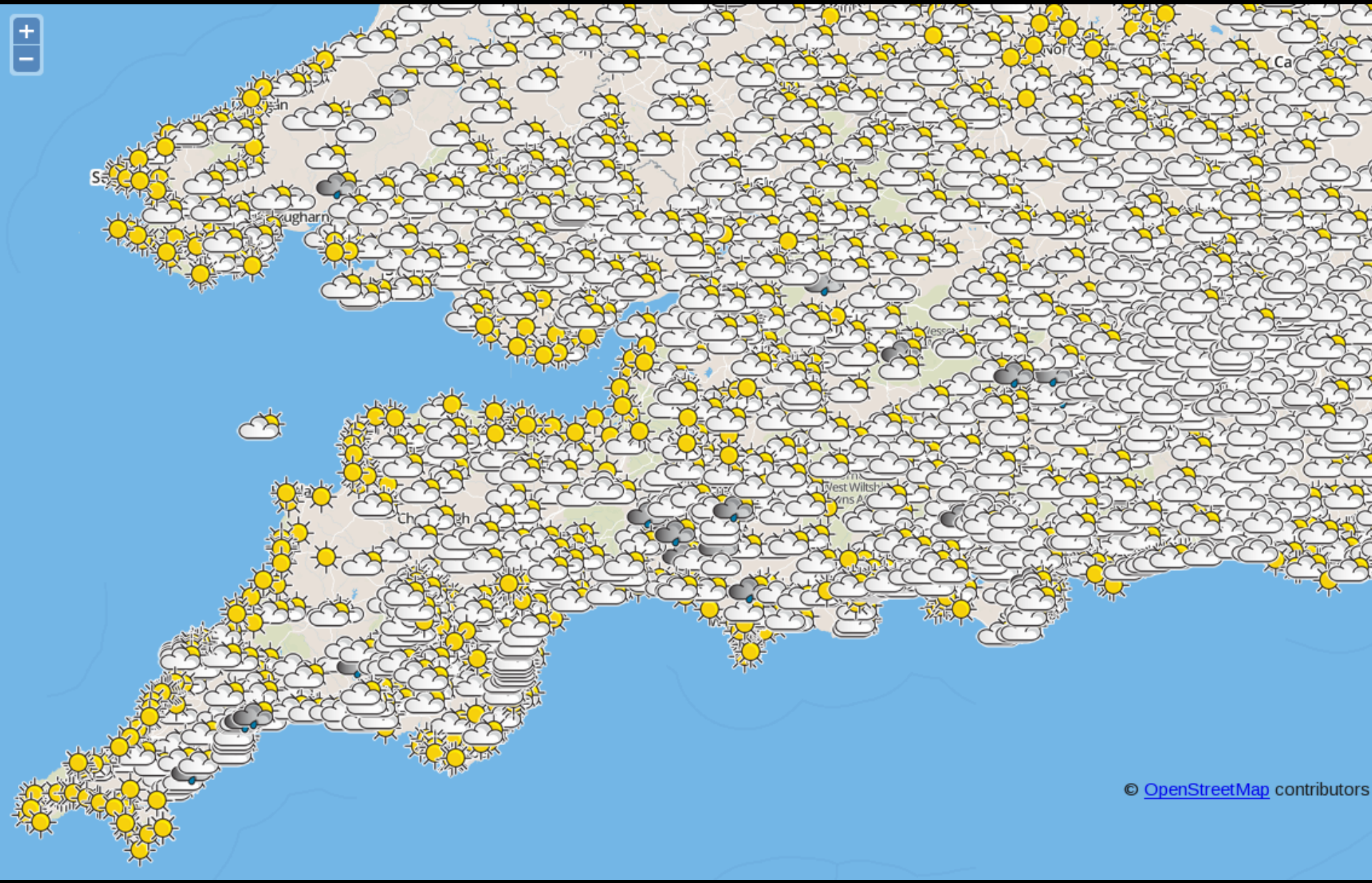

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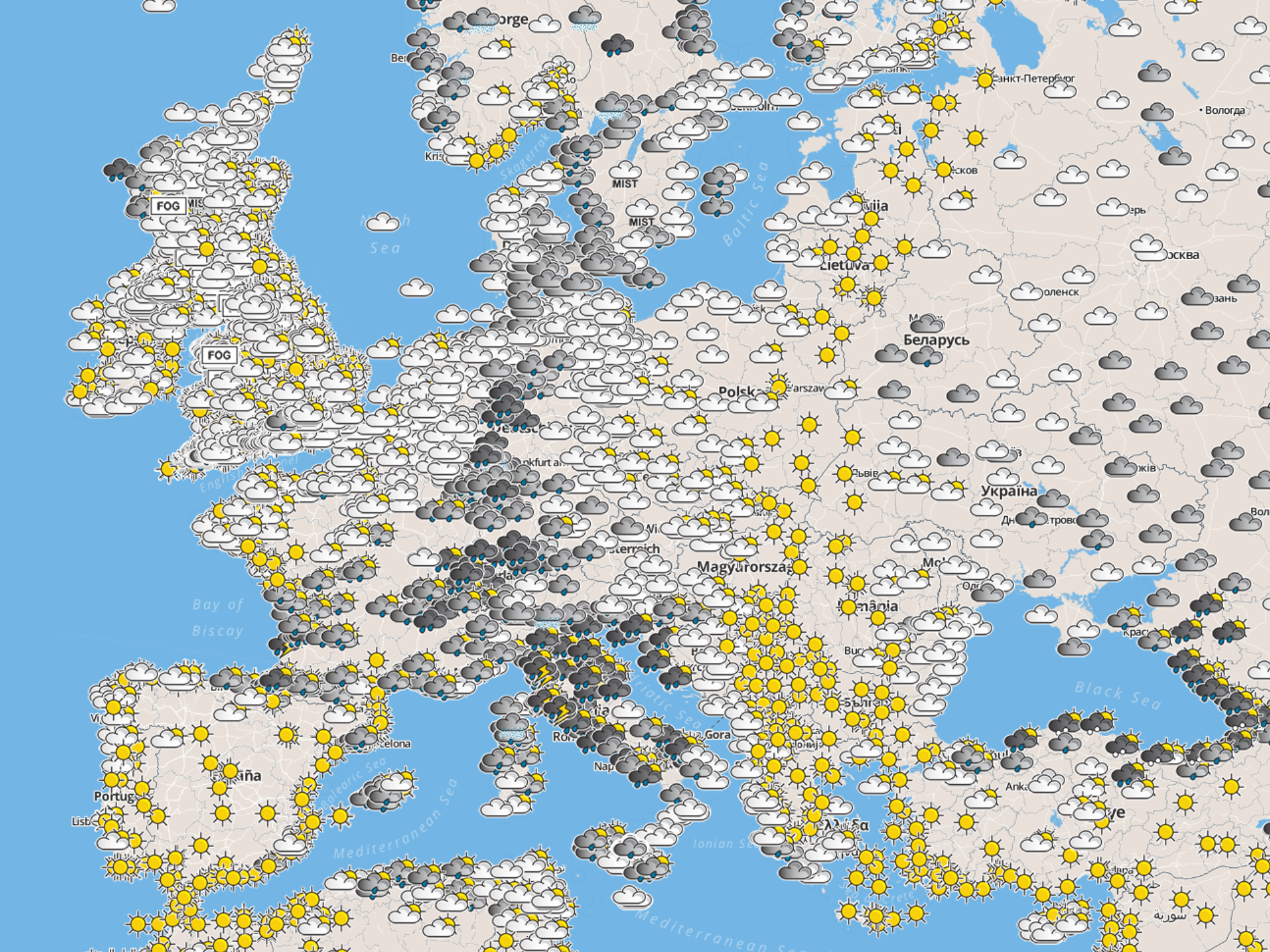
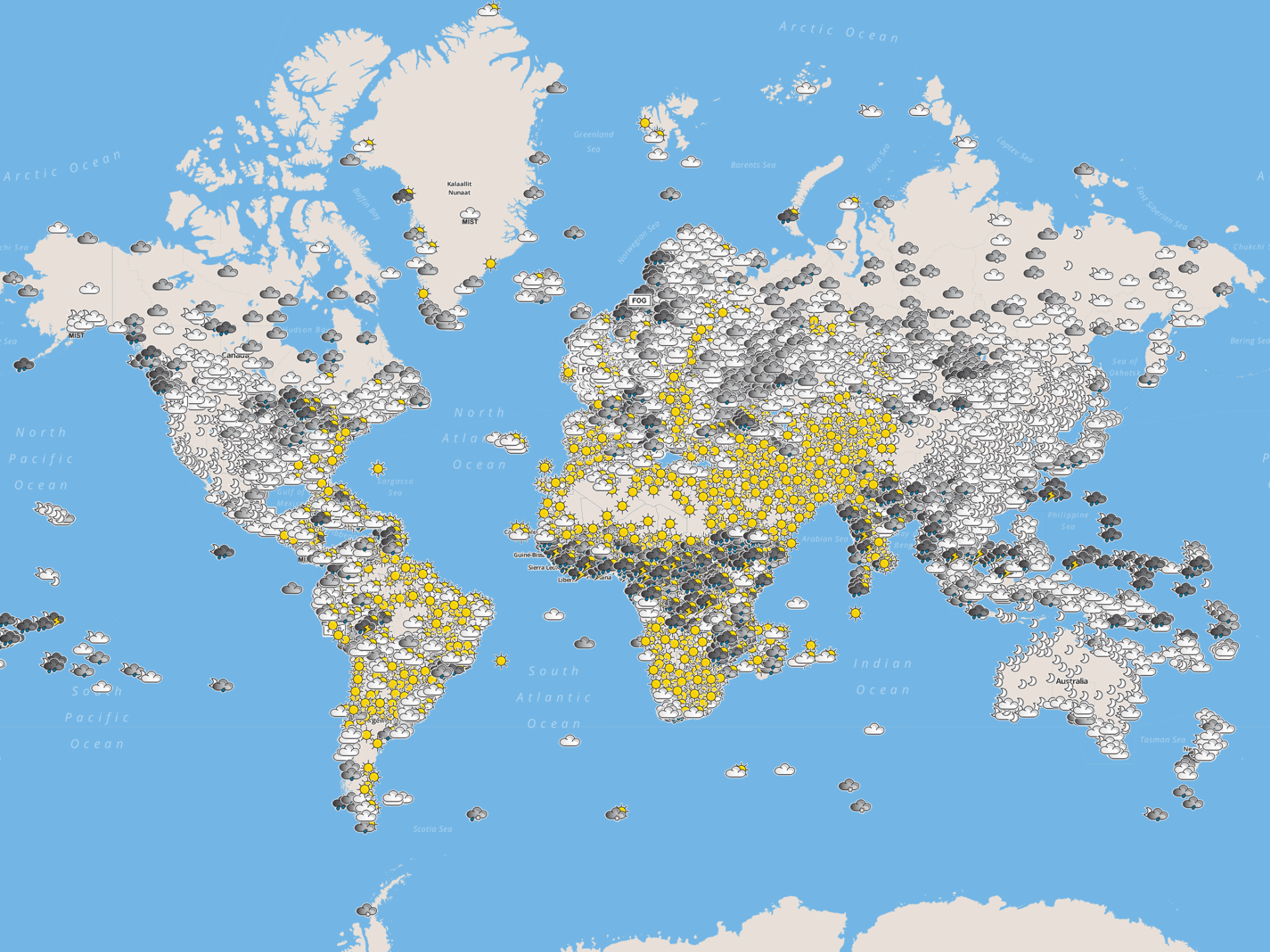

FOG
FOG
MIST
MIST
Беларусь
Україна
Polska
Magyarország
Санкт-Петербург
Вологда
Lietuva
Bay of Biscay
Mediterranean Sea
Black Sea
Baltic Sea


Arctic Ocean
Greenland Sea
Barents Sea
Kara Sea
Laptev Sea
East Siberian Sea
Chukchi Sea
Bering Sea
Kalaallit Nunaat
MIST
FOG
Baffin Bay
Norwegian Sea
Hudson Bay
Canada
North Pacific Ocean
North Atlantic Ocean
Sargasso Sea
Gulf of Mexico
Sea of Okhotsk
Philippine Sea
Arabian Sea
Guinea-Bissau
Sierra Leone
Liberia
South Pacific Ocean
South Atlantic Ocean
Indian Ocean
Australia
Tasman Sea
Scotia Sea

Best Data Blending

Each day we receive:

- 24x hourly nowcasts
- 8x UKV runs
- 4x MOGREPS-UK ensembles (12 members each)
- 4x Euro 4km runs
- 2x Global model runs
- 4x MOGREPS-G ensembles (12 members each)
- 2x MOGREPS-15 ensembles (24 members each)
- 2x ECMWF Deterministic runs
- 2x ECMWF ensembles (51 members each)

Each new forecast produced by updating previous by weighted blending approach

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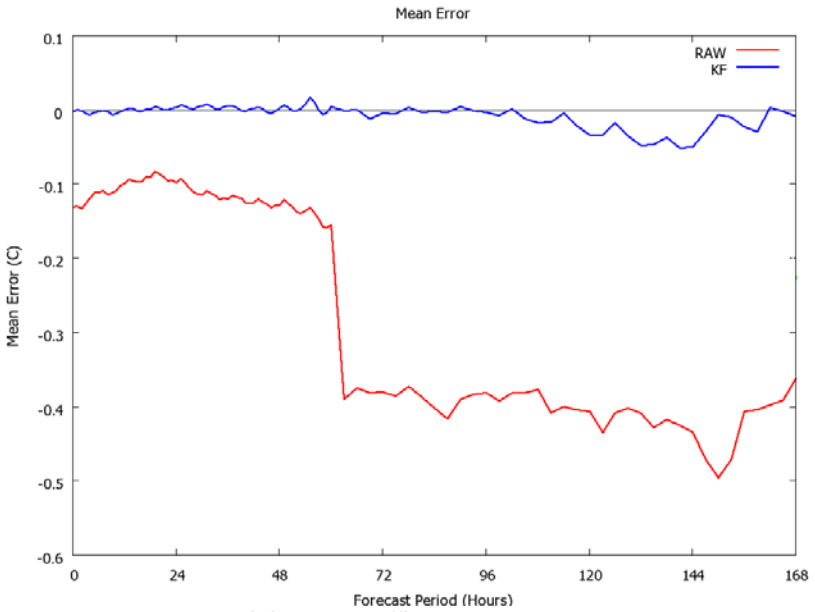
Processing site data

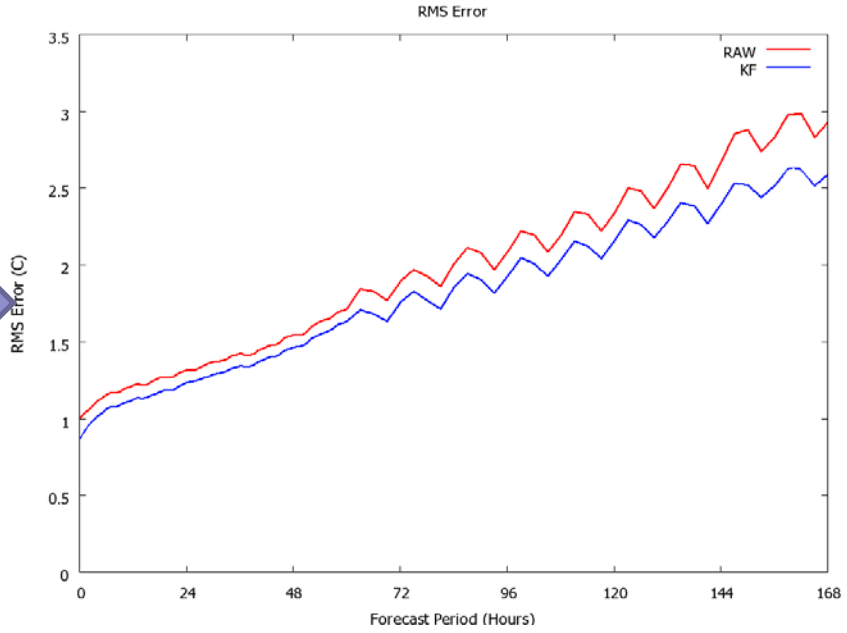
Site Specific Processing System (SSPS)

- Grid Point selection
- Orographic, coastal, etc. corrections
- Derived Parameters

Kalman filter corrects systematic biases where observations available:

- Minimises error differences between model inputs





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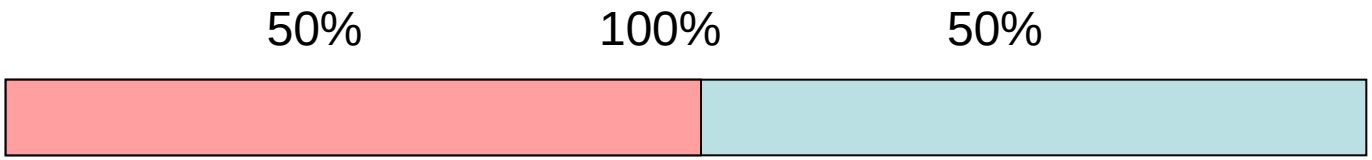
Blending Example



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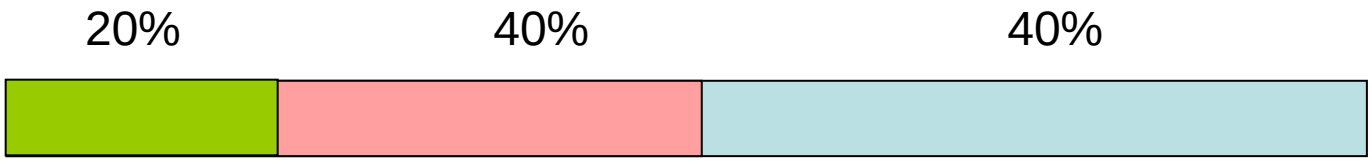

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Blending Example

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Questions?

Thanks to very many people who contributed to this work, notably:
Rob Neal, James Canvin, Becky Hemingway, Piers Buchanan, Matt Bano