"A New Method for the Characterization and Verification of Local Spatial Predictability for Convective Scale Ensembles"

S. Dey
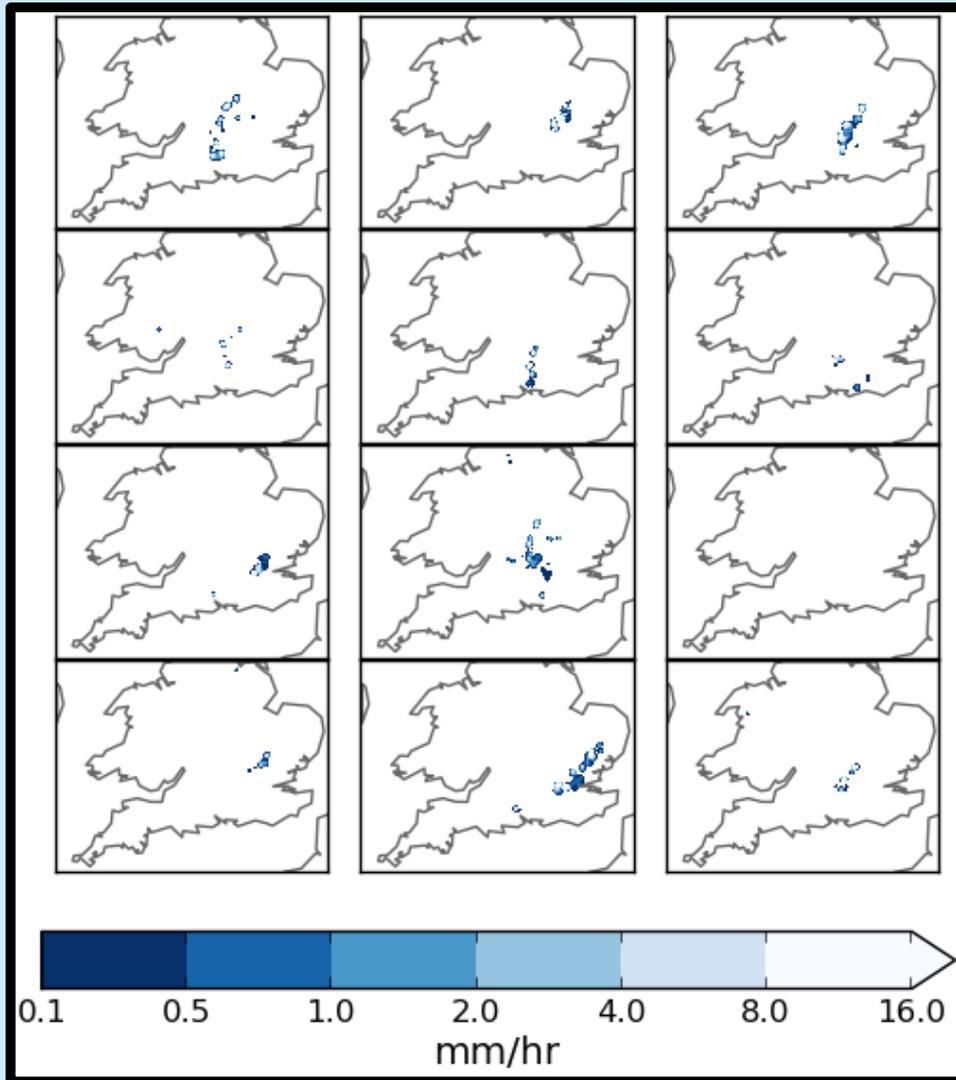## R. Plant, N. Roberts and S. Migliorini

AMS NWP conference

Session 10A: Ensemble Techniques and Communication of Forecast Uncertainty
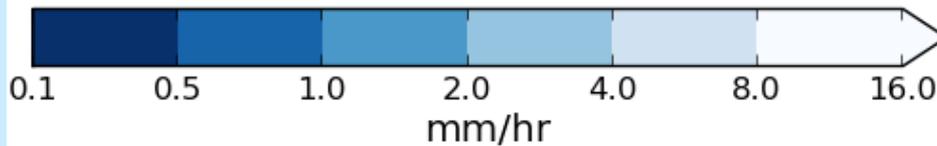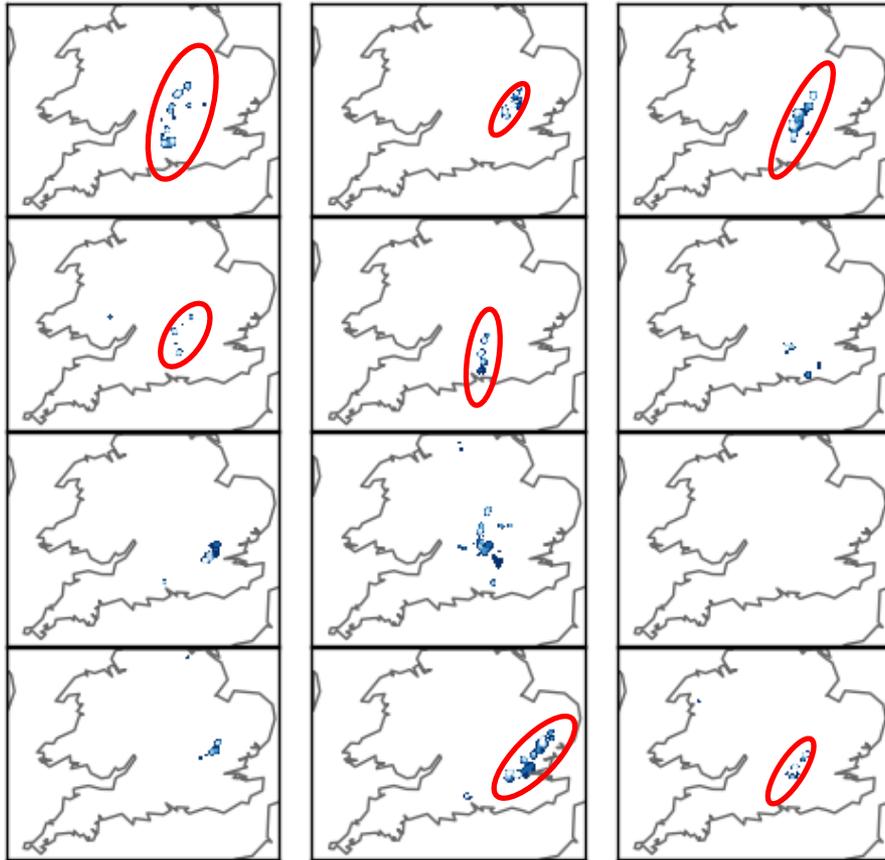
01/07/2015

Overview

Convective scale ensembles give information on the spatial characteristics of storms

– How best to extract this information?
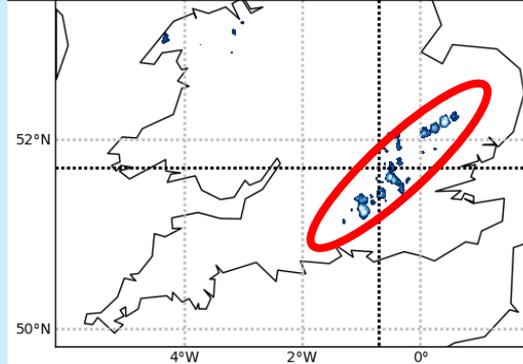
– Is this information any good?

Present a new method for the characterization and evaluation of the local spatial agreement between ensemble members.
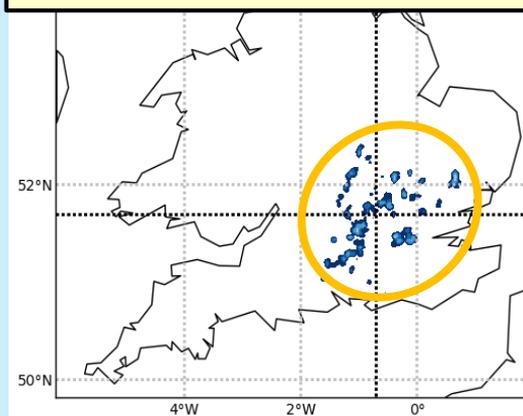
Ensemble mean?

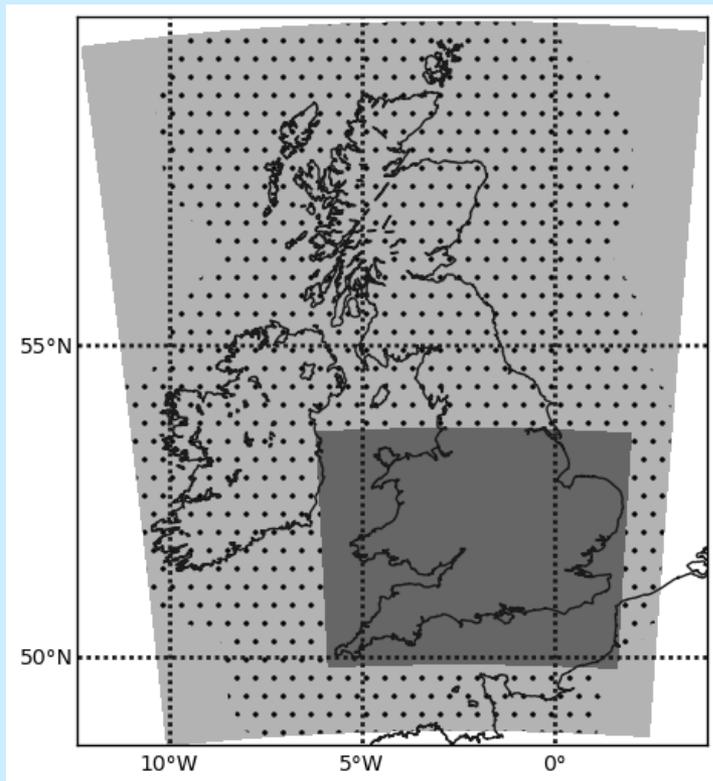**Ensemble members**

Radar derived rain rates

Spatially aligned cells

Ensemble mean

Scattered showers

0.1   0.5   1.0   2.0   4.0   8.0   16.0
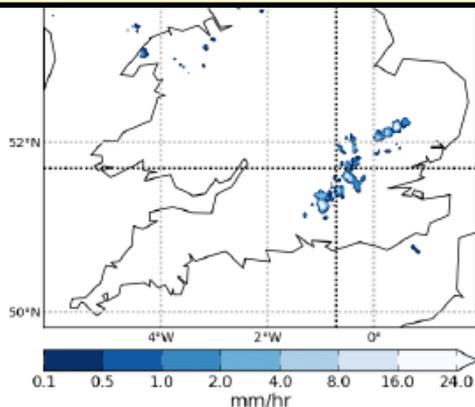
mm/hr

Ensemble system

MOGREPS-UK

- 2.2 km grid over UK

- 12 members

- Directly downscaled from global ensemble
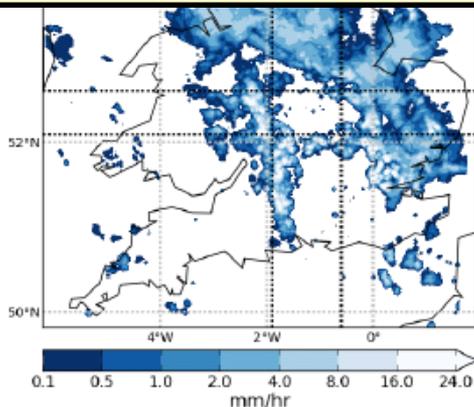
- Operational since June 2013

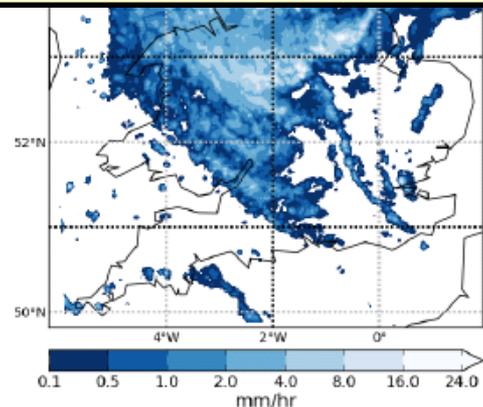# Convective case studies from Summer 2013

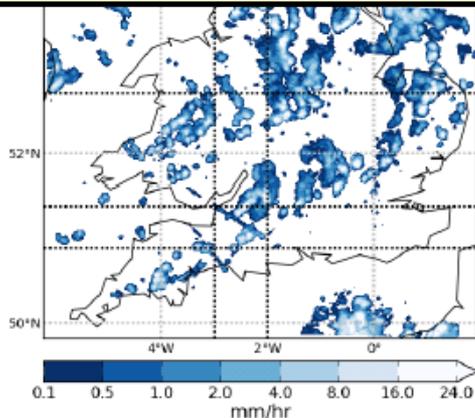**Radar derived instantaneous rain rates**

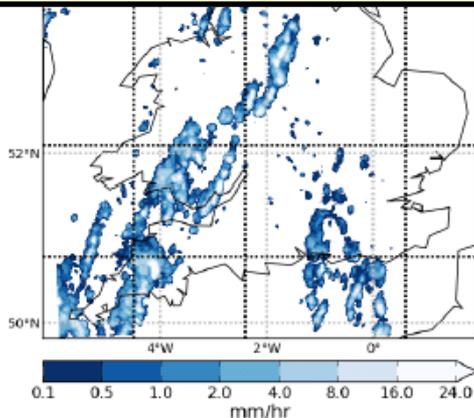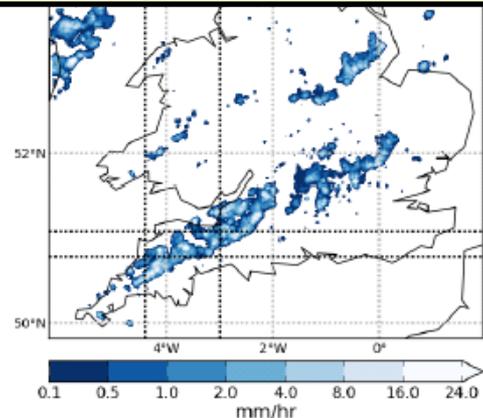| 17th July 17Z Line of cells	23rd July 17Z Bands of storms	27th July 17Z MCS

29th July 15Z Scattered convection	2nd August 18Z Mixed convection	3rd August 18Z Organised band

Method

Over what spatial scales are the forecasts acceptably similar?
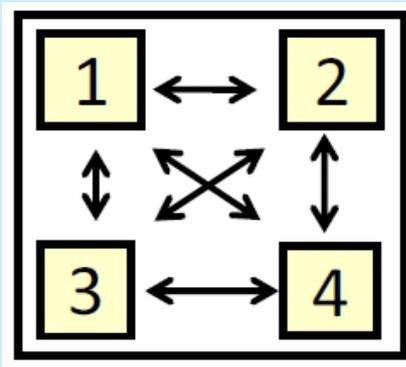

A ? = B

→ L
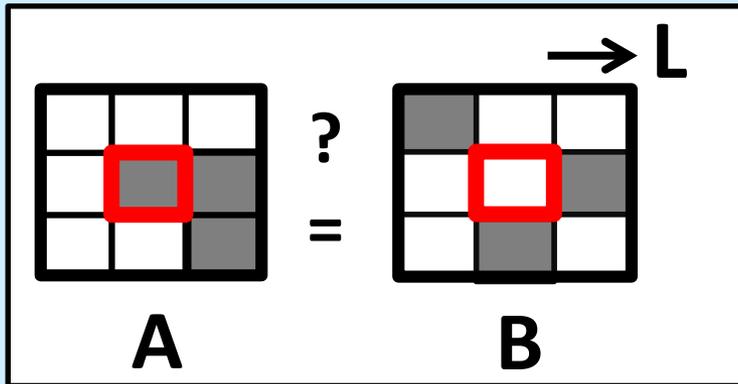
1. Compare forecasts at grid point
2. Are they suitably similar?

Yes   no

This is the scale

Increase the neighbourhood size
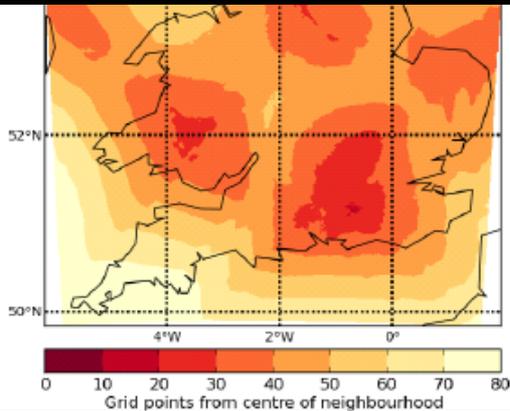

Consider all member-member pairs
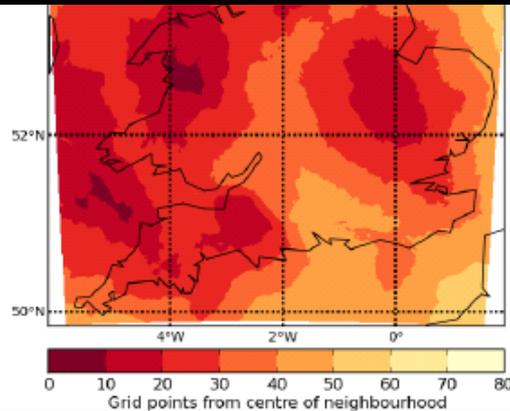
member-member Ensemble Agreement Scales
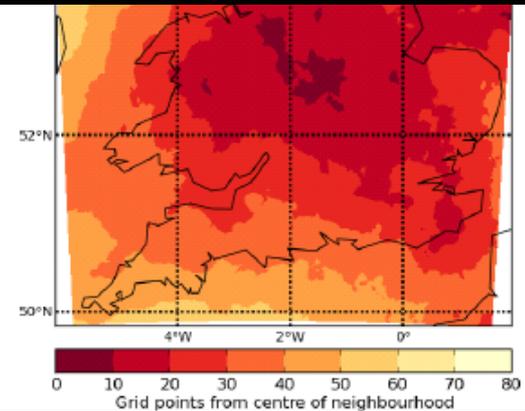

17th July 17Z
Line of cells

23rd July 17Z
Bands of storms
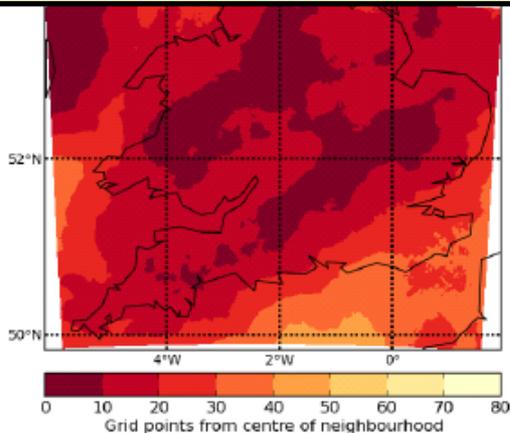
27th July 17Z
MCS

29th July 15Z
Scattered convection

2nd August 18Z
Mixed convection

3rd August 18Z
Organised band
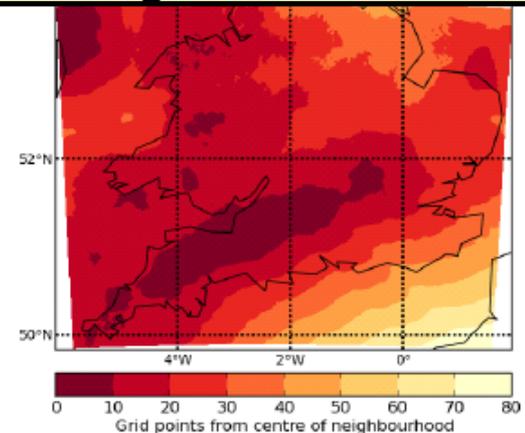
Background: ensemble mean?

Ensemble members
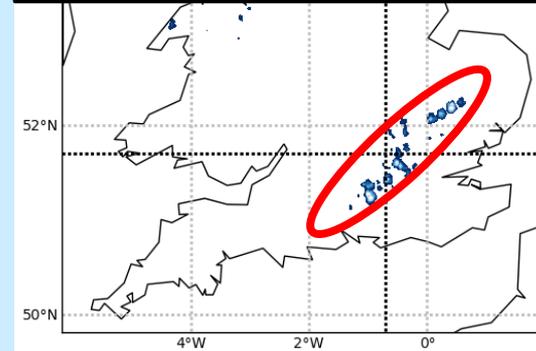
Radar derived rain rates

Ensemble Agreement Scales
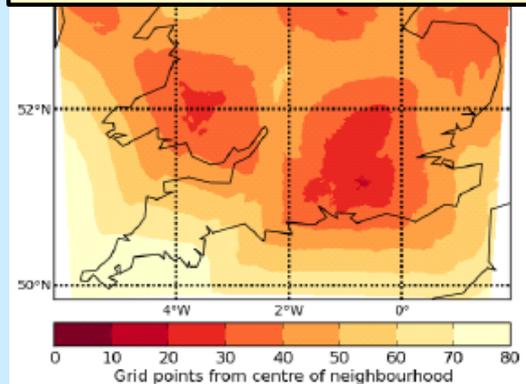
Grid points from centre of neighbourhood

0.1   0.5   1.0   2.0   4.0   8.0   16.0

mm/hr

member-member Ensemble Agreement Scales

17th July 17Z
Line of cells
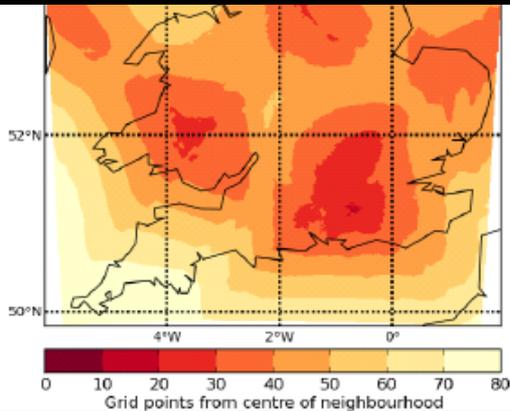
23rd July 17Z
Bands of storms
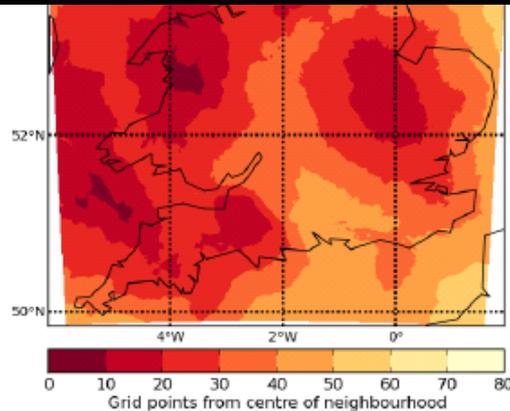
27th July 17Z
MCS
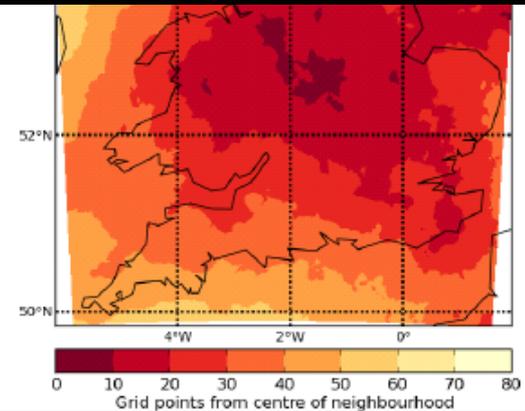
29th July 15Z
Scattered convection
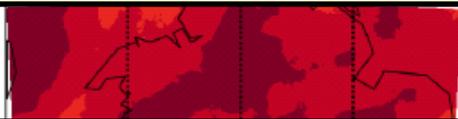
2nd August 18Z
Mixed convection

3rd August 18Z
Organised band
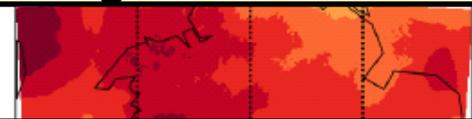
Are these representative of reality?
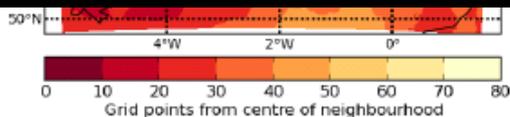
member- radar Ensemble Agreement Scales

- Mean over member-radar pairs

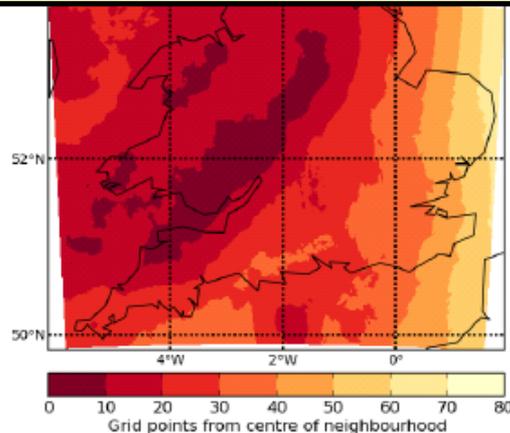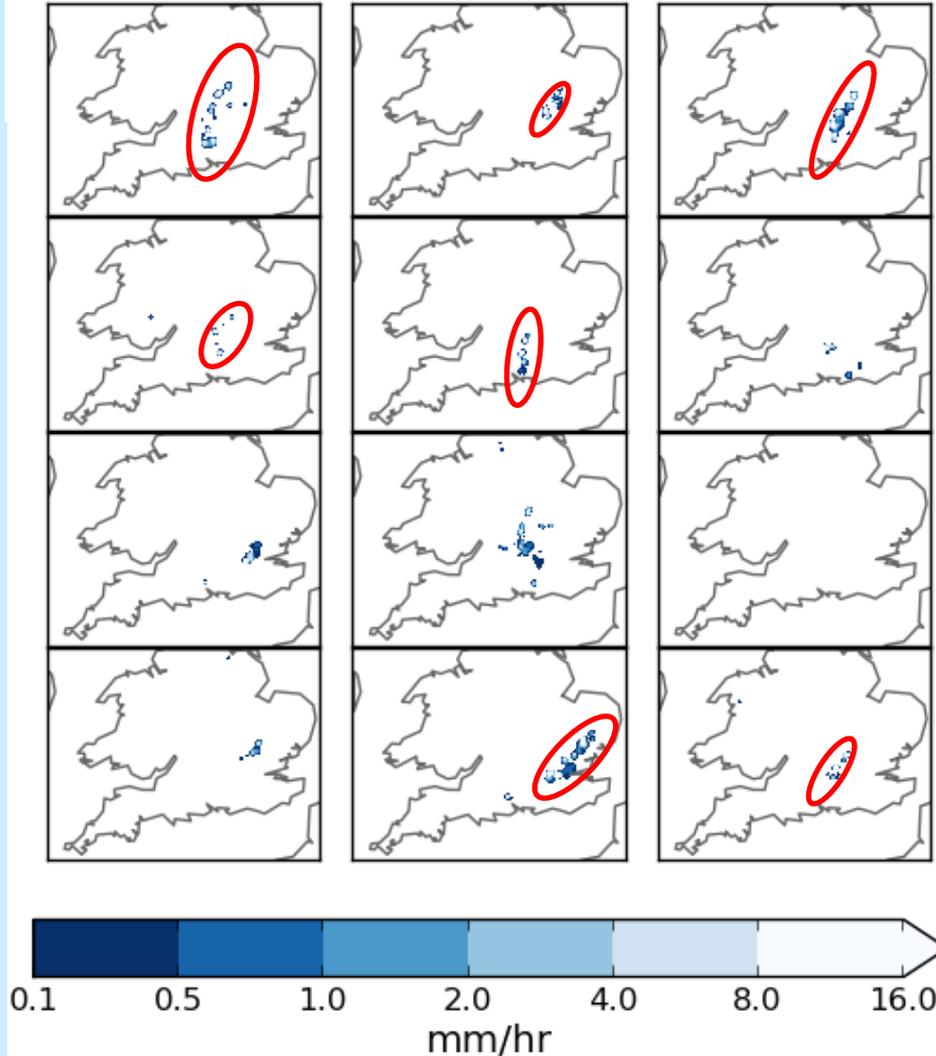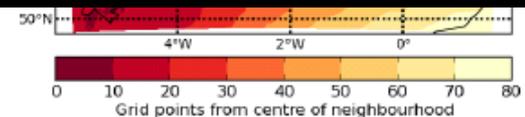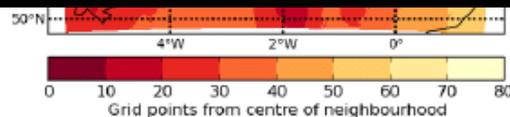| 17th July 17Z Line of cells	23rd July 17Z Bands of storms	27th July 17Z MCS	

member-radar EAS
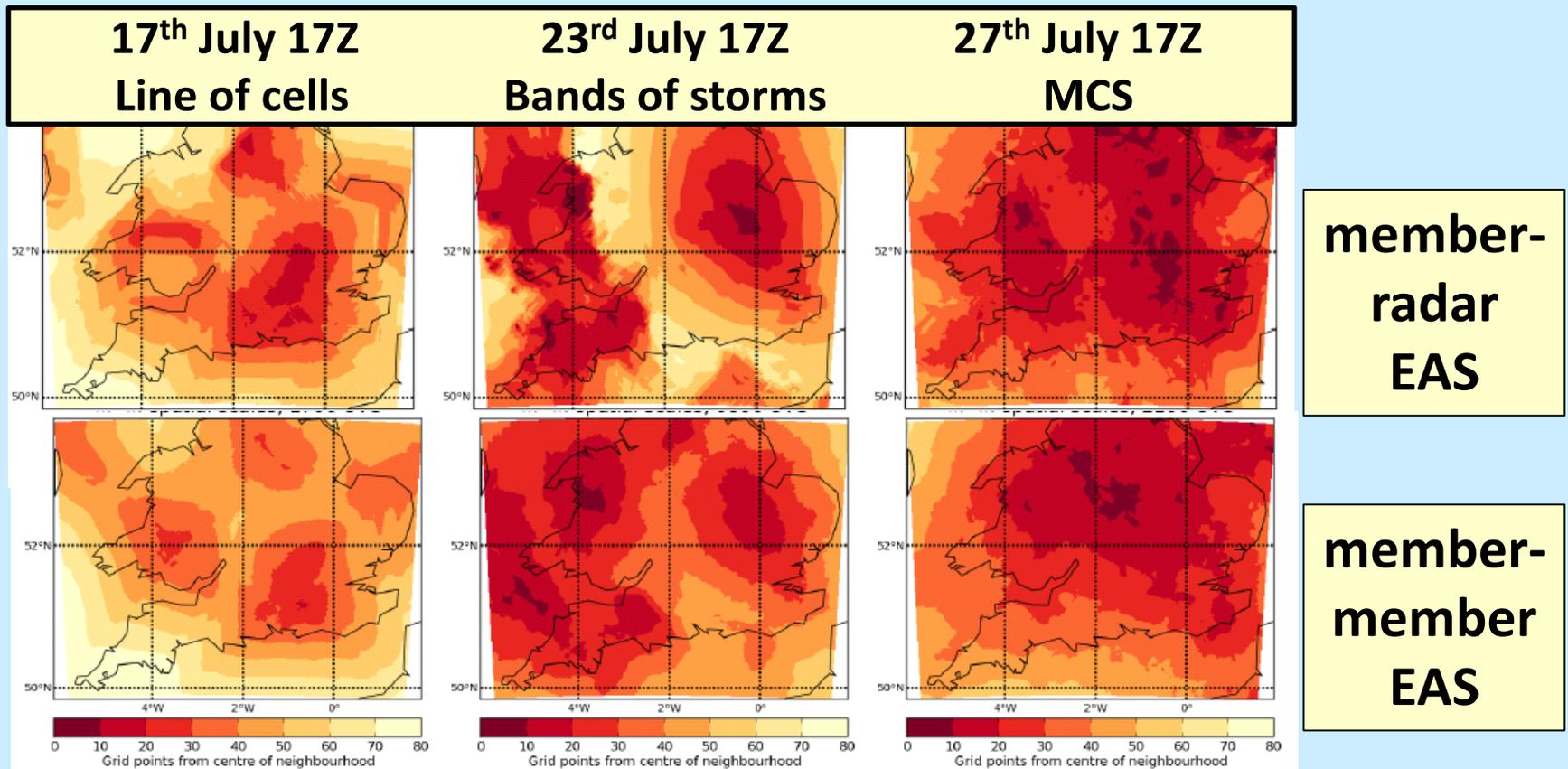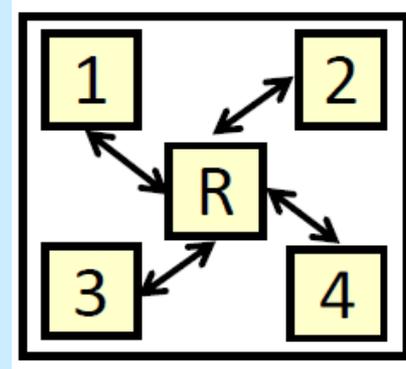
member-member EAS

Binned Scatter Plot

Quantitative comparison of member-member EAS and member-radar EAS

MOGREPS-UK, hourly instantaneous rain rates, three months of data (June, July, August 2013)

- Overall doing a reasonable job

- Slightly spatially under spread

- Useful tool for evaluating spatial predictability from ensemble

Conclusions

New method of characterising spatially varying ensemble spread (Ensemble Agreement Scales -EAS)

- – Spatial predictability variations across the domain
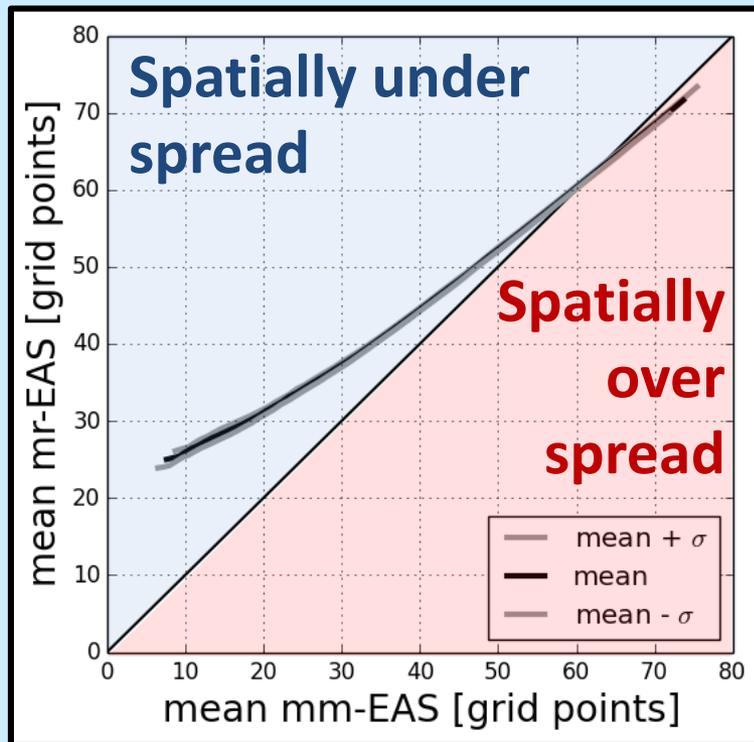
- – Spatial spread-skill

- – Can be applied to other variables and other ensembles

Physically meaningful, useful for forecasting and verification

Dey et al 2015 (Quarterly Journal of the Royal Meteorological Society, Under review)

Spatial analysis: similarity criterion

Acceptable Bias at grid scale

L = **Distance from centre to edge of neighbourhood**

Squared error

$$\frac{[A_{i,j} - B_{i,j}]^2}{A_{i,j}^2 + B_{i,j}^2} \leq \alpha + (1 - \alpha)\frac{L}{L_{max}}$$

Normalisation factor

L_{max} = **Maximum L**

- α = 0.5
- L_{max} = 80 grid points
- **No conversion to binary**