



# Use of a radar quality index to improve the accuracy of the UK rain rate composite

Caroline Sandford, Nicolas Gaussiat  
6<sup>th</sup> August 2012



# Overview

- Context:
  - Radar composites
  - Quality framework
- Development:
  - RADARNET IV processing
  - Rain rate errors and the quality index
- Evaluation



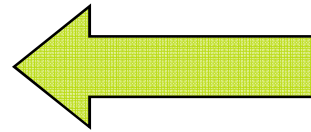
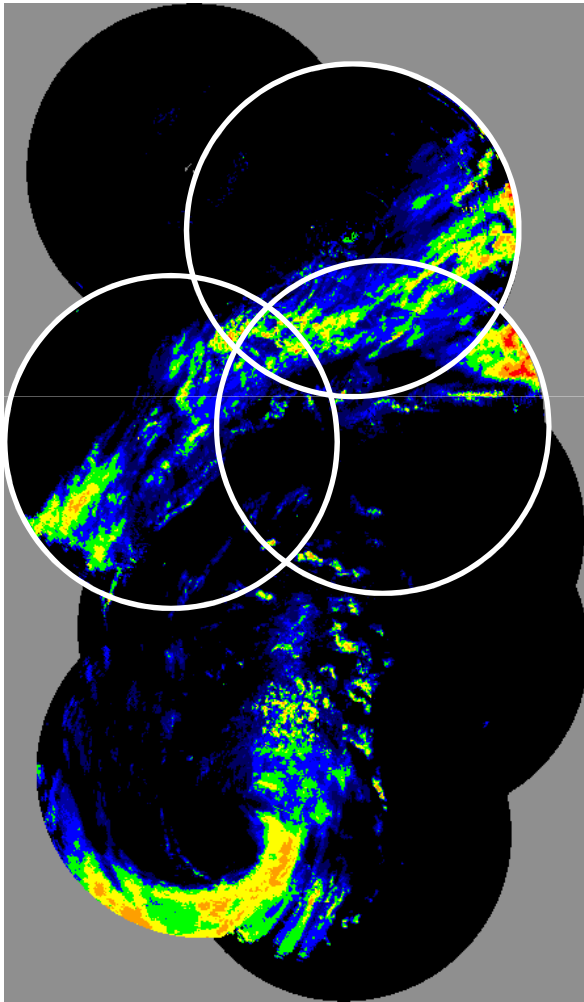
Met Office



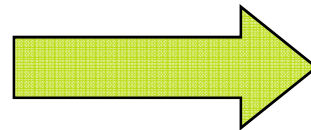
# Context

Radar composites and the quality framework

# Introduction



Volume scans  
Network overlap



- ✓ Nowcasting
- ✓ Flood forecasting
- ✓ NWP



*Product errors*



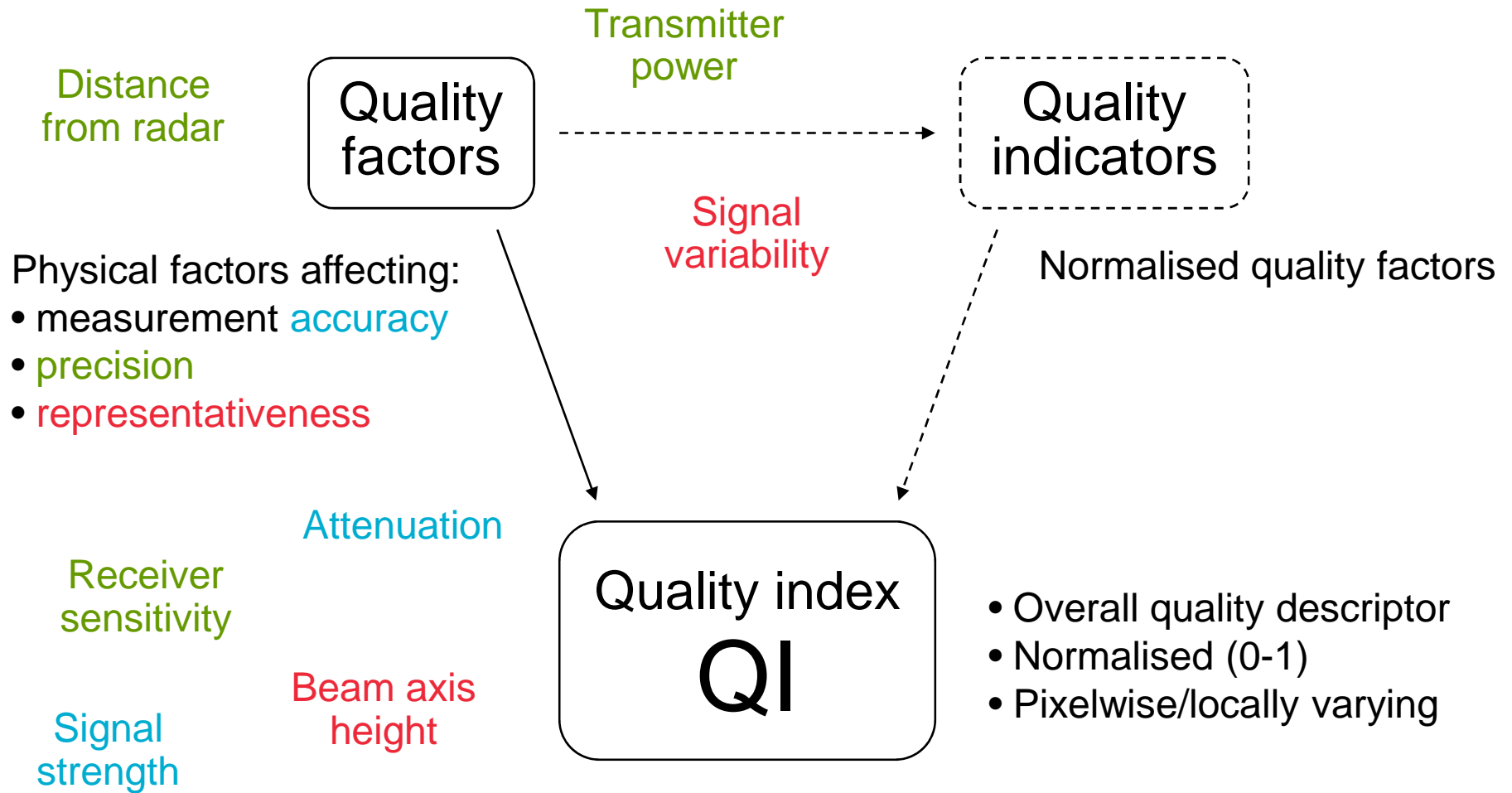
# Compositing

- Single scan or weighted average
- Data selection criteria:
  - Nearest radar
  - Lowest beam height
  - Highest reflectivity
- We use **single scan** at **lowest height**
- **Can we do better?**





# Quality Framework





Met Office

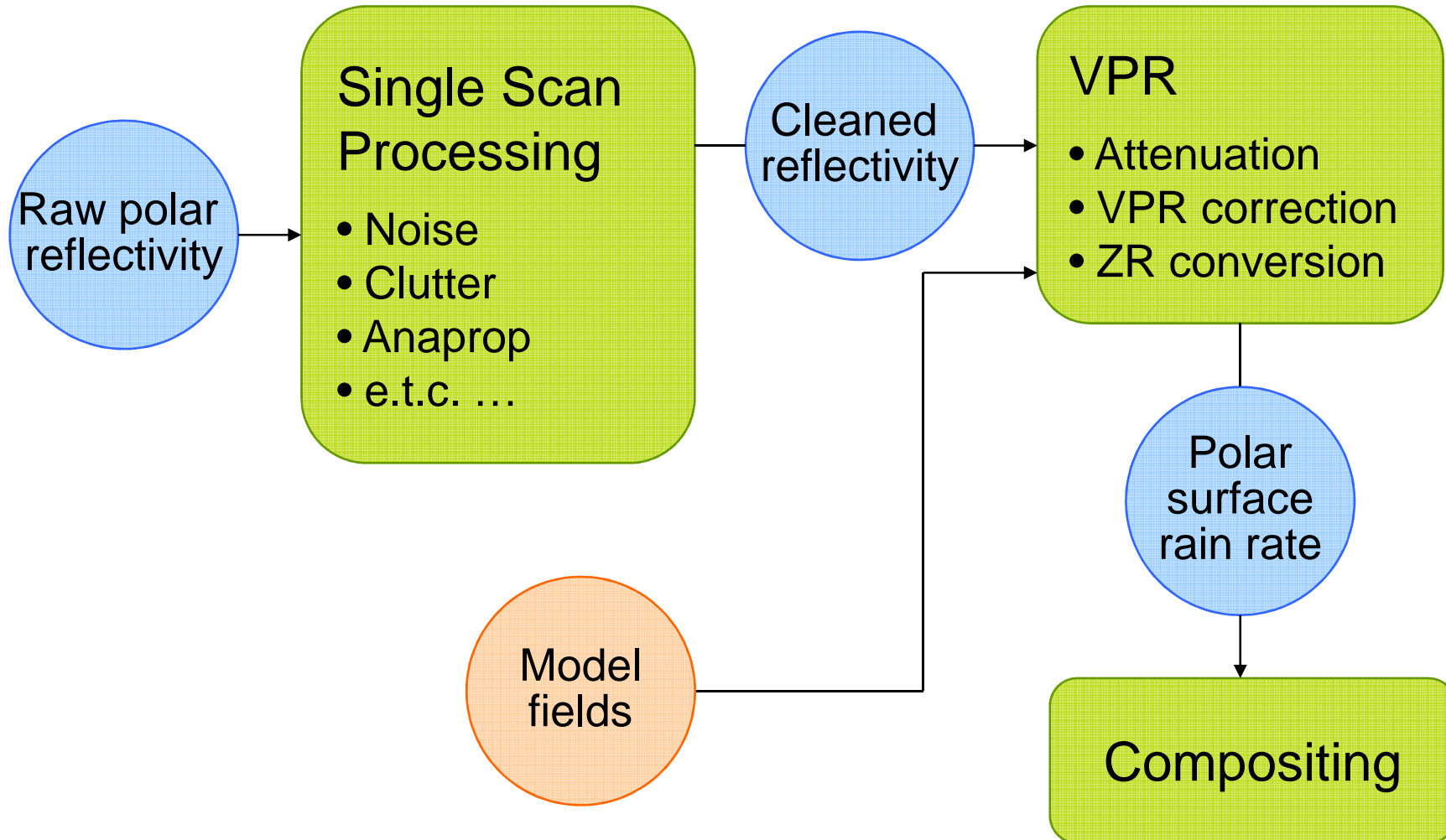
# Development

An error-based quality index for RADARNET IV





# RADARNET IV Processing





# Rain Rate Errors

- Attenuation estimate
- Attenuation correction
- VPR correction
- ZR conversion

$$A = \sum \alpha Z_{ei}^{\beta} \times r_b$$

$$Z_m = Z_e \times 10^{-\frac{A}{10}}$$

$$Z_s = k \times Z_m$$

$$Z_s = aR^b$$

$$Z_{true} = \nu(h, r) \times Z_s$$

$$\left(\frac{\Delta R}{R}\right)^2 = \left(\frac{\zeta_R}{R}\right)^2 + \left(\frac{\xi_R}{R}\right)^2$$

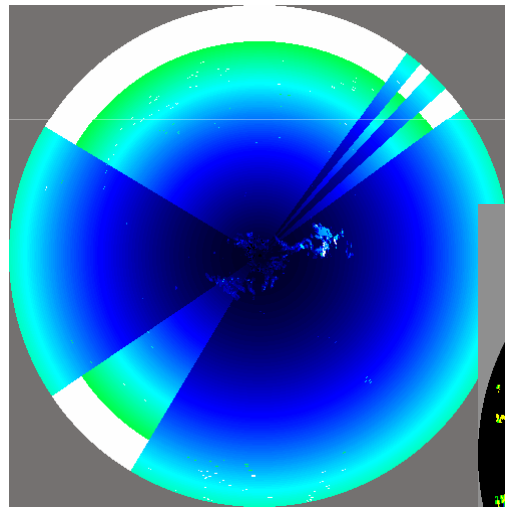
$$\left(\frac{\zeta_R}{R}\right)^2 = \left|1 - \nu^{\frac{1}{b}}\right|^2$$

$$\left(\frac{\xi_R}{R}\right)^2 = \left(\frac{\nu}{b}\right)^2 \left[ \left(\frac{\ln 10}{10}\right)^2 \beta^2 A^2 + 1 \right] \left(\frac{\ln 10}{10}\right)^2 \Delta Z_{dB}^2$$

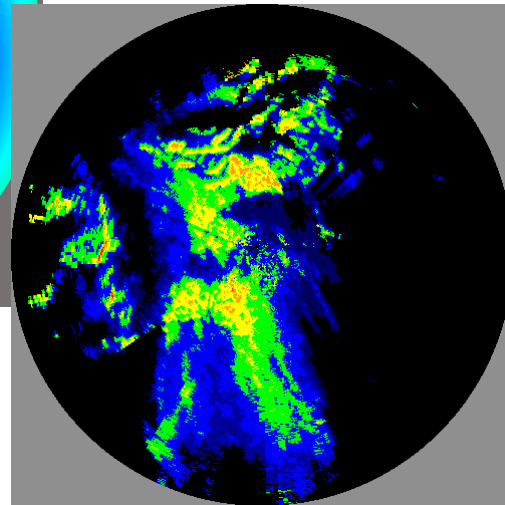


# Quality Index

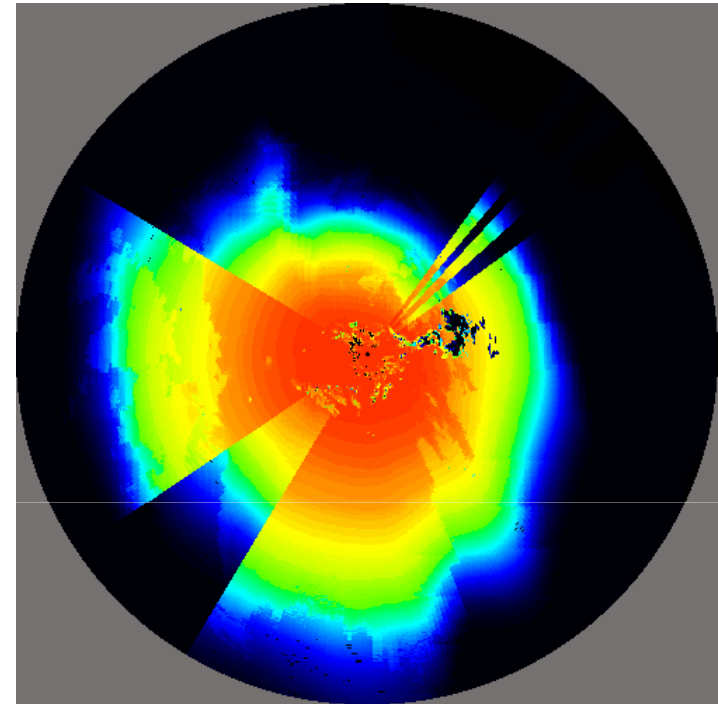
$$\left(\frac{\Delta R}{R}\right)^2 = \left(\frac{\zeta_R}{R}\right)^2 + \left(\frac{\xi_R}{R}\right)^2$$



Beam height



Rain rate



Quality index

$$QI = \exp \left[ - \left( \frac{\Delta R}{R} \right)^2 \right]$$



Met Office



# Evaluation

Criteria and outcomes

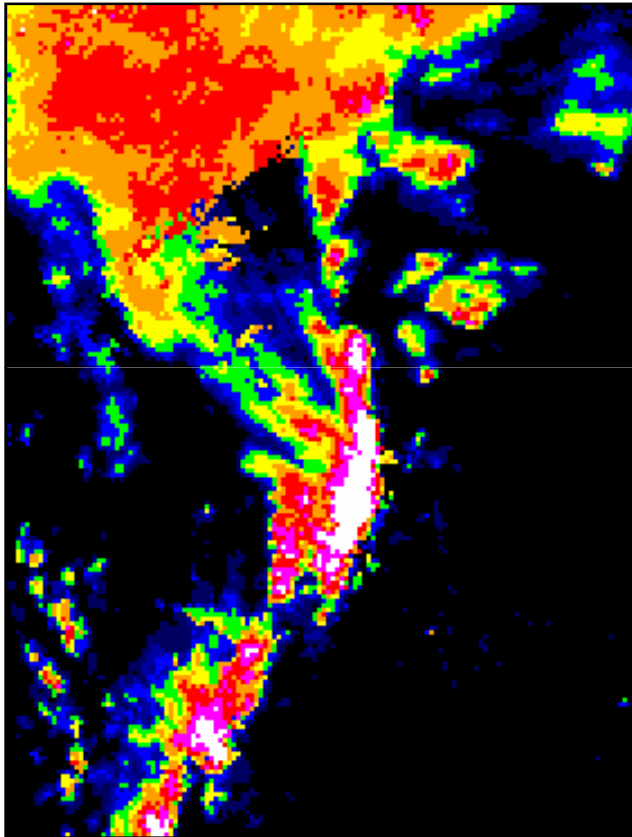


# Evaluating the Quality Index

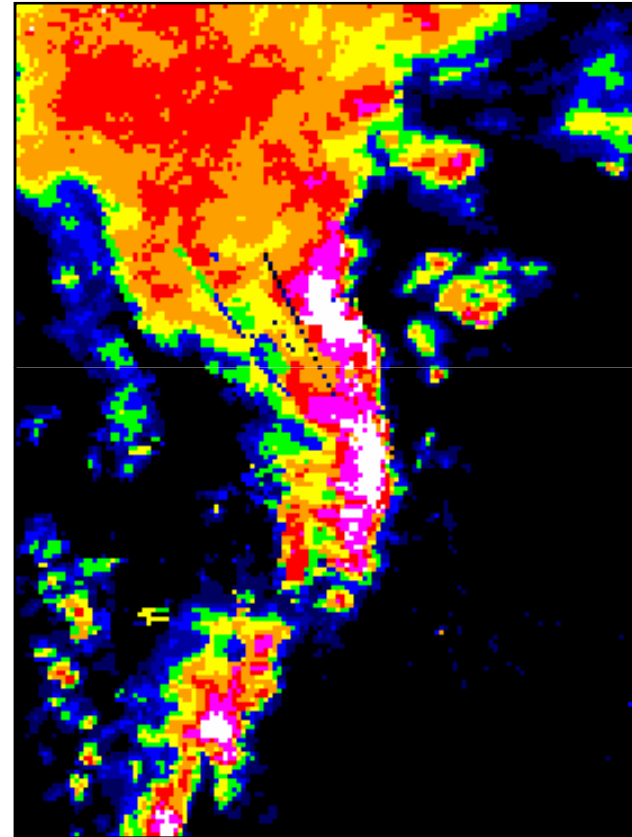
- Visible improvements in attenuated cases
- Gauge-radar comparison statistics:
  - RMSE, RMSF, bias, POD, FAR
  - Contingency analysis: Heidke Skill Score
- Statistics for 3x 24hr UK datasets:
  - 16<sup>th</sup>-17<sup>th</sup> November 2010
  - 7<sup>th</sup> August 2011
  - 29<sup>th</sup> April 2012



28-06-2012, 15:00, Alnwick



Control method  
(beam height only)



Quality index method



# Summary and Conclusions

- Quality index based on rain rate error estimate
- Evaluation by:
  - Visible improvements
  - Gauge comparisons
- Quality index has **better compositing skill than height alone:**
  - Visible improvements: infilling attenuated regions, smoothing at radar field boundaries
  - Gauge-radar errors less than or equal to those of operational composite



Met Office



Questions?