Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB

A high-resolution C-band radar composite for urban hydrological modelling

Caroline Sandford, Timothy Darlington, Selena Georgiou, Jacqueline Sugier, Katie Norman

EGU Meeting 2014, Vienna

Overview

Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB

- RainGain project overview
  - Aims, sponsors and contributors
  - London regional catchments
- Prototype 100m rainfall rate product
- Input data and signal processing
  - Radial resolution
  - Azimuth sharpening
- Wind drift correction
- Future developments

RainGain

Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB

"The RainGain project seeks to obtain detailed rainfall data at an urban scale, to use these data to analyse and predict urban flooding and to implement the use of rainfall and flood data in urban water management practice to make cities more resilient to local rainfall-induced floods."

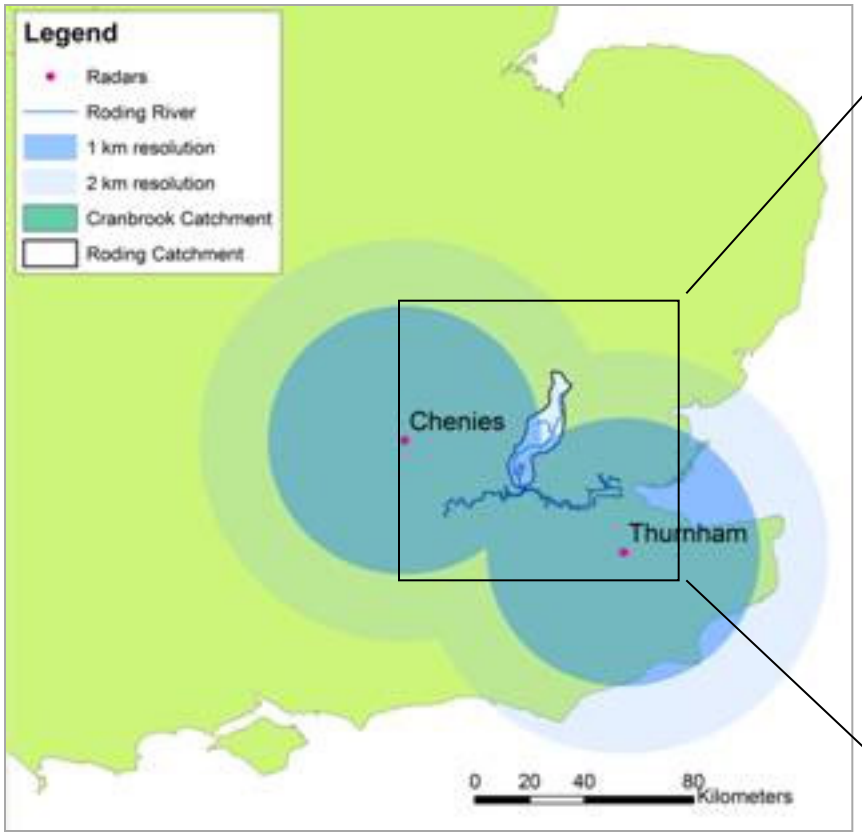
Leuven | Paris
London | Rotterdam

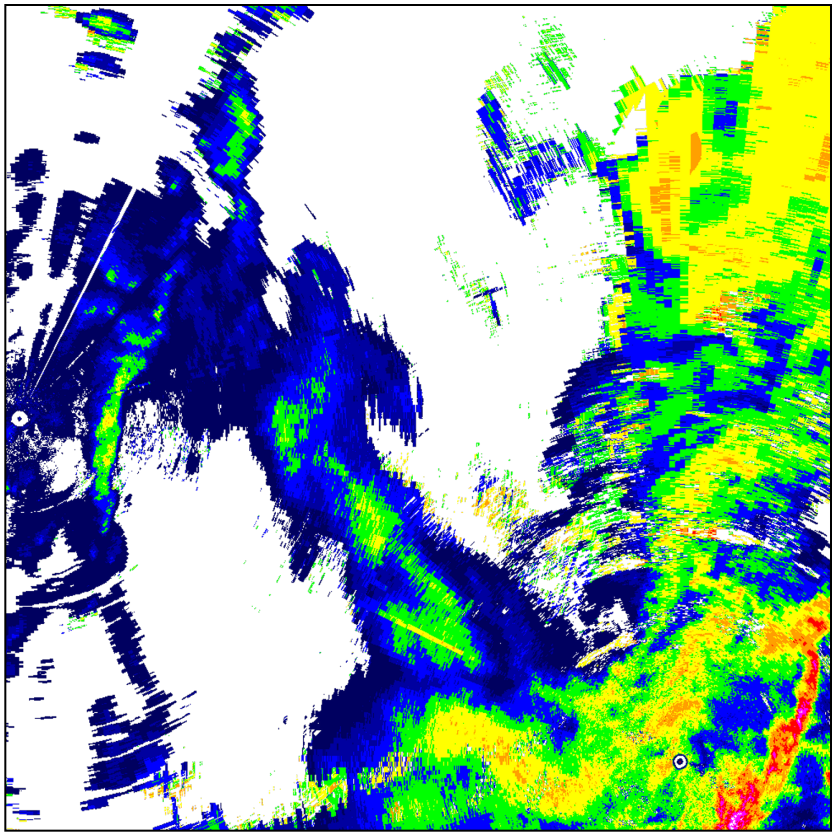
Delft University of Technology

Local Government Flood Forum

London pilot region

Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB





100m test product
7th April 2014
09:20 UTC

Current test composite

Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB

Using 75m short-pulse data: 3rd-24th April 2014:

	> 0.5mm/h: 100m London	> 0.5mm/h: 5km UK	> 4mm/h: 100m London	> 4mm/h: 5km UK
POD	0.86	0.66	0.59	0.21
FAR	0.44	0.31	0.55	0.55
HSS*	0.67	0.67	0.51	0.28
Bias (mm)	0.33	-0.47	-0.52	-3.03
RMSE (mm)	2.29	1.46	2.77	5.81

**Heidke Skill Score*

- Greater overall POD [*range effects*]
- Greater skill (HSS) at moderately high rain rates
- High false alarm rate [*QC*]
- Low bias at moderately high rain rates

Prototype statistics acceptable from an operational perspective

Input data resolution

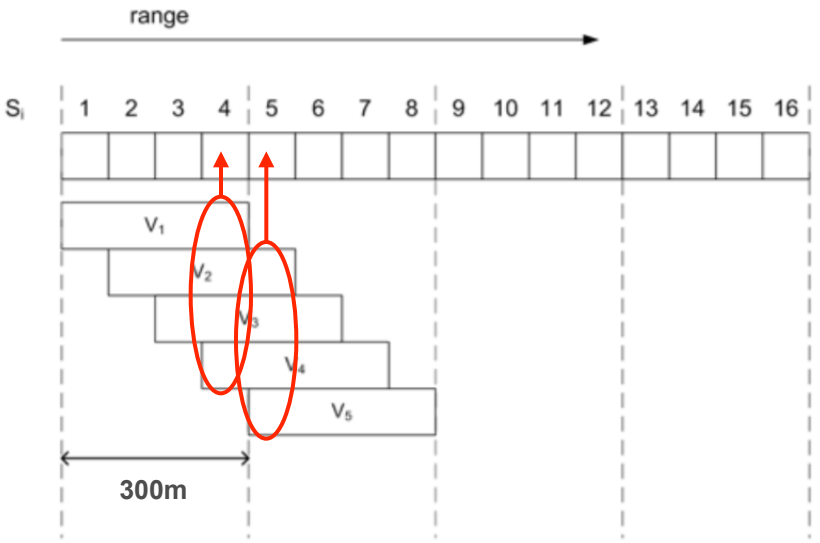
Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB

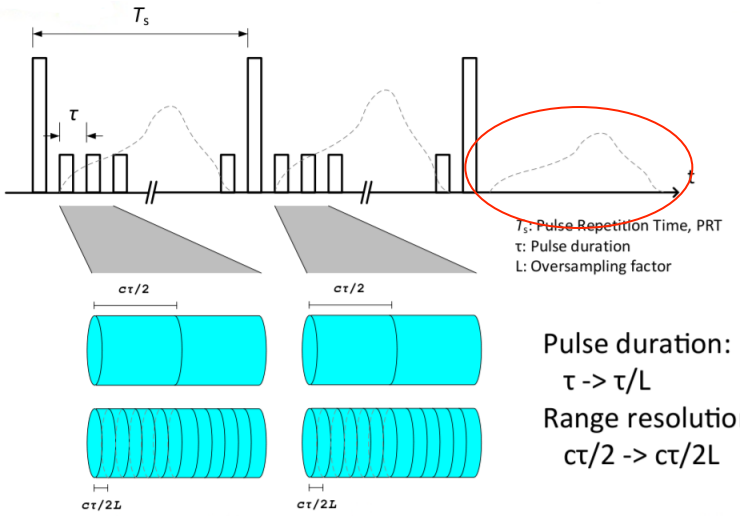
Standard (**LP**): 300m pulse => 300m

Short-pulse (**SP**): 75m pulse => 75m

OS: 4x oversampled 300m pulse averaged to 75m

RETRO: 4x oversampled 300m pulse deconvolved to 75m (accounting for beam shape)





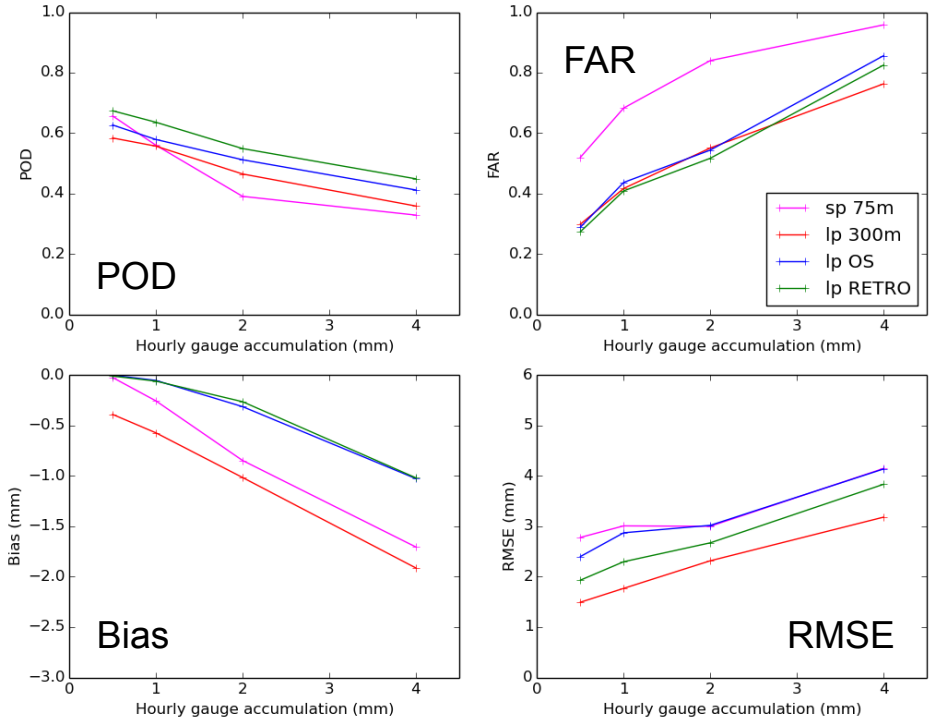
Pulse duration:
τ -> τ/L

Range resolution:
cτ/2 -> cτ/2L

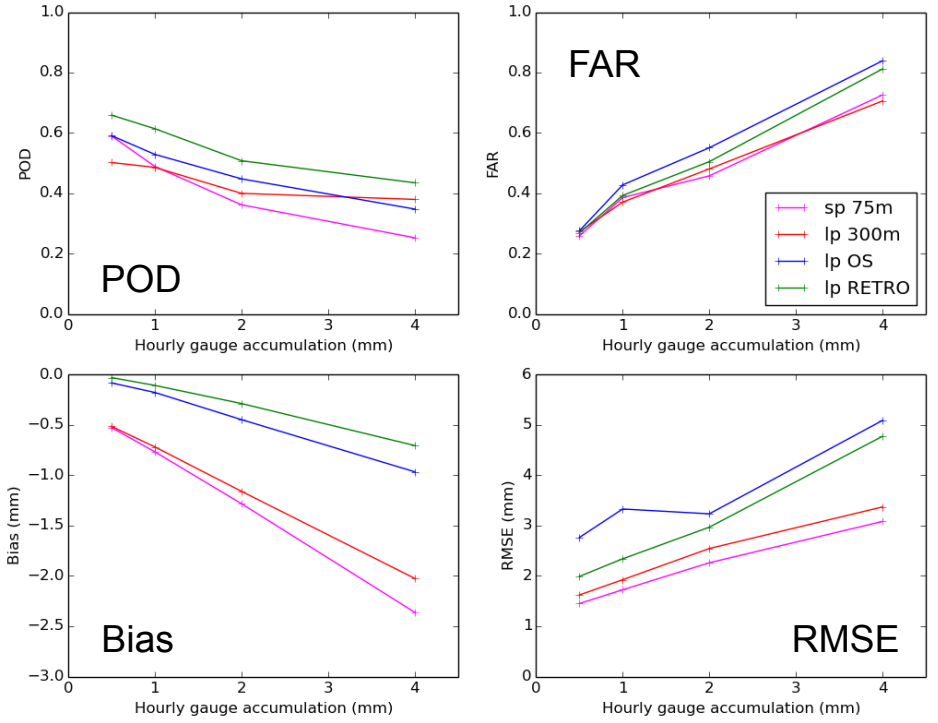
Input data results

Wardon Hill research radar, Dec. 2013 to April 2014

Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB



1km gridded product

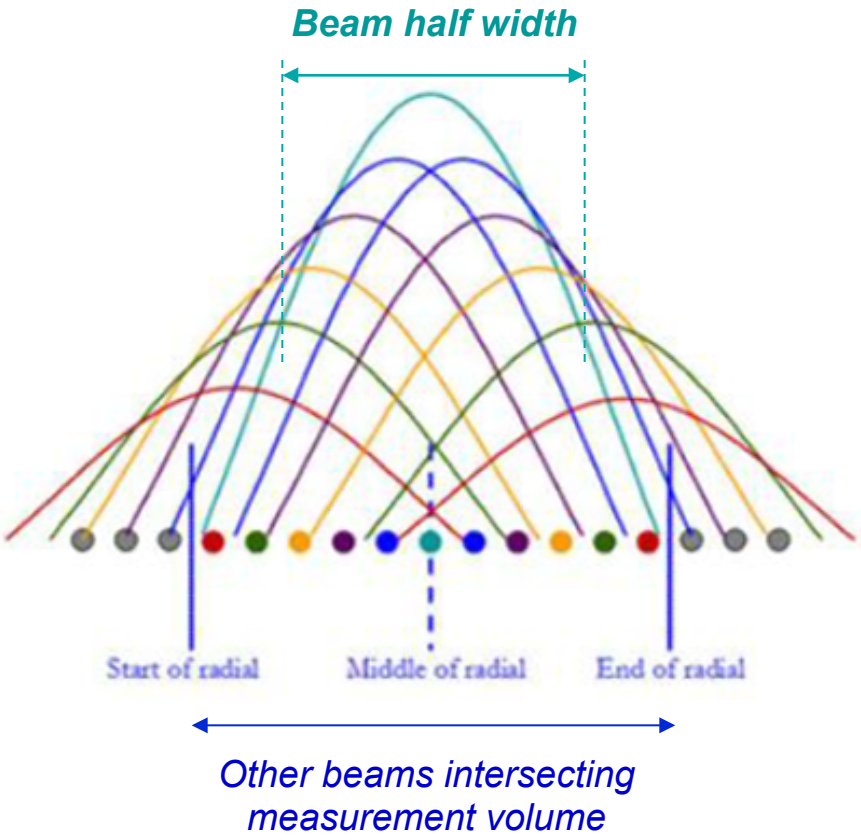


100m gridded product

- SP data unsuitable due to low POD
- Both LP and SP data have large negative bias
- RETRO method outperforms simpler OS
- RETRO performs best for POD and bias

RETRO method is most suitable for RainGain product

Azimuth sharpening



Use information from neighbouring beams to increase azimuthal resolution – 30% reduction in beam width can be achieved.

Pros: sharper apparent resolution

Cons: loss of information through averaging

Test on short-range clutter: can we resolve smaller targets using azimuth sharpening?

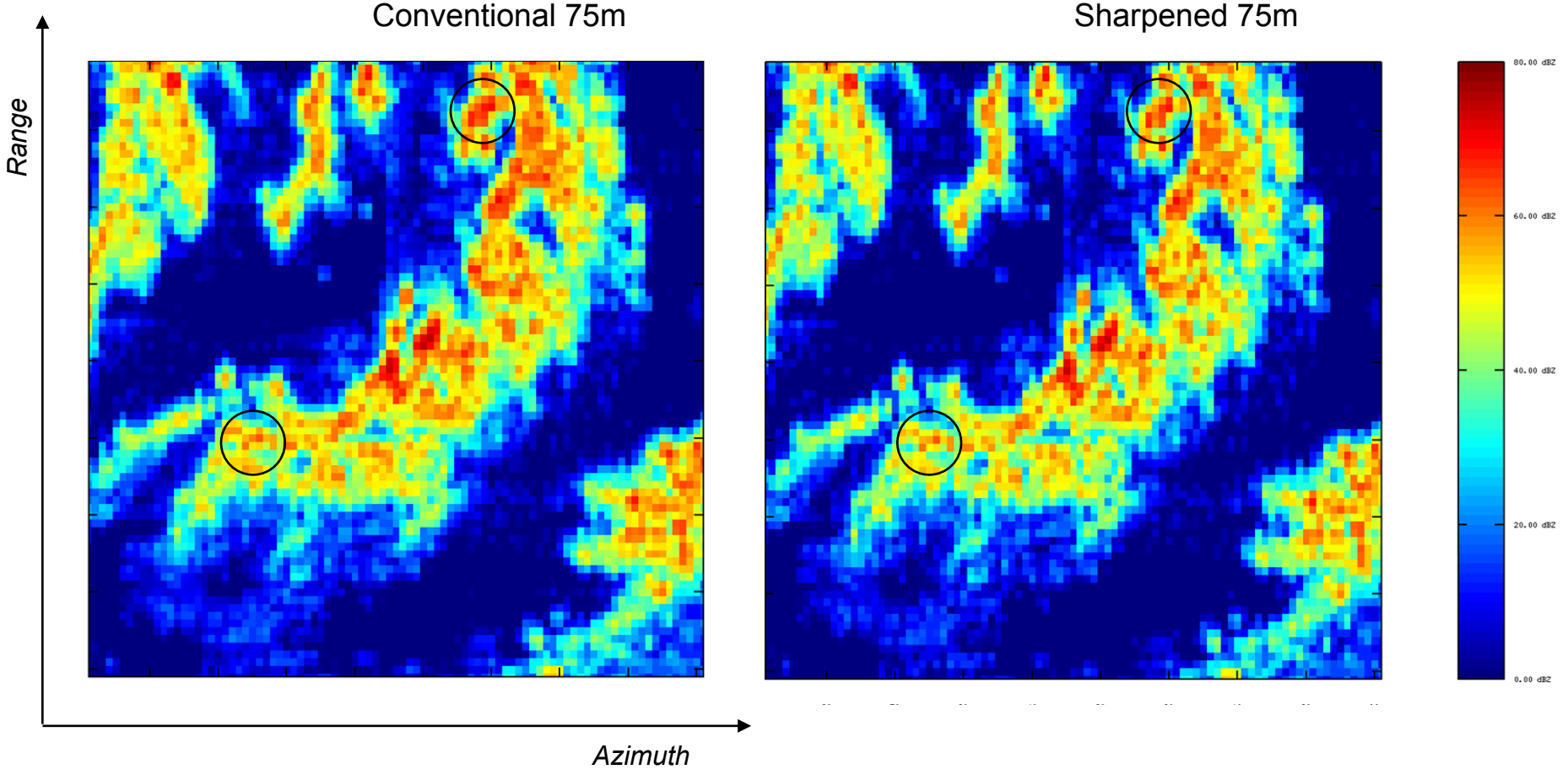
Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB

Azimuth sharpening

Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB

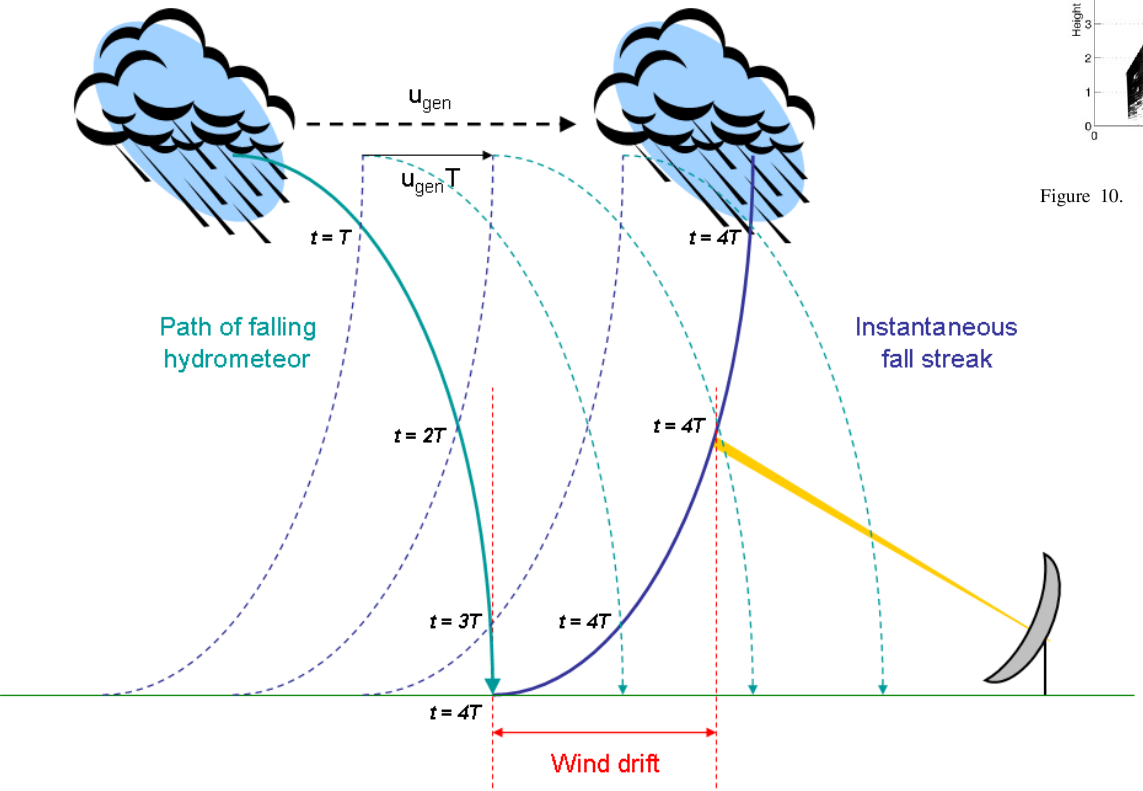
Conventional 75m

Sharpened 75m



Wind drift

Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB



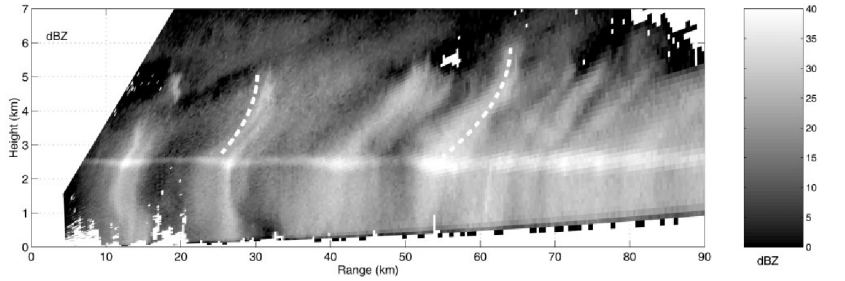


Figure 10. RHI for 1340 UTC on 18 August 2000 at 25° azimuth showing clear fall streaks. Fall-streak trajectories calculated using Eq. (4) are superimposed.

Assumptions:

- Constant vertical wind shear *
- No significant updrafts/downdrafts
- Constant generation rate

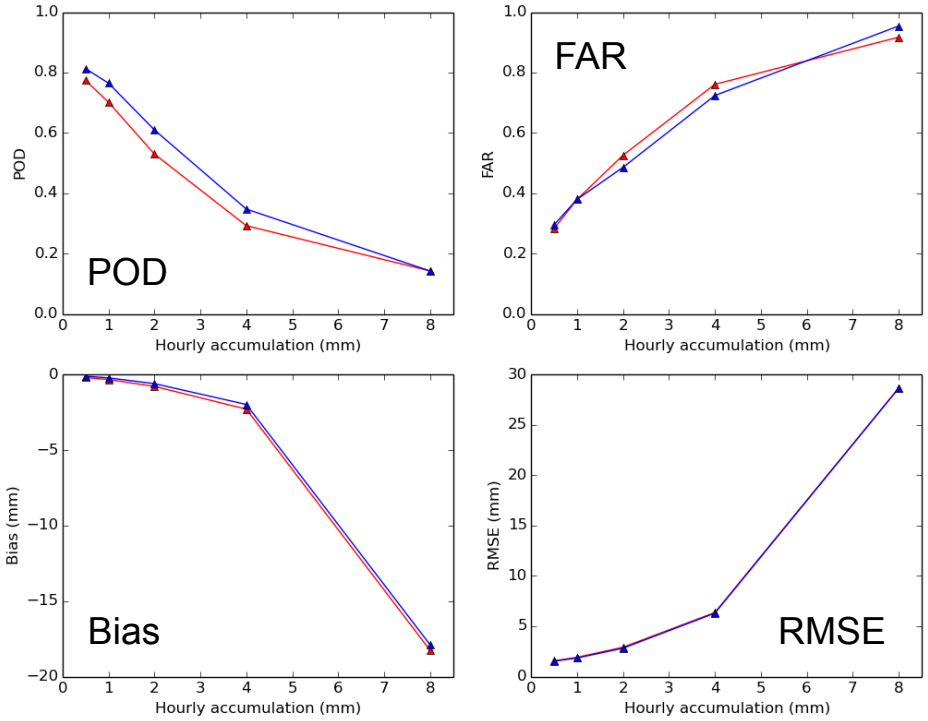
* Resultant uncertainty **~1km** in wind drift displacements below freezing height (simulation study)

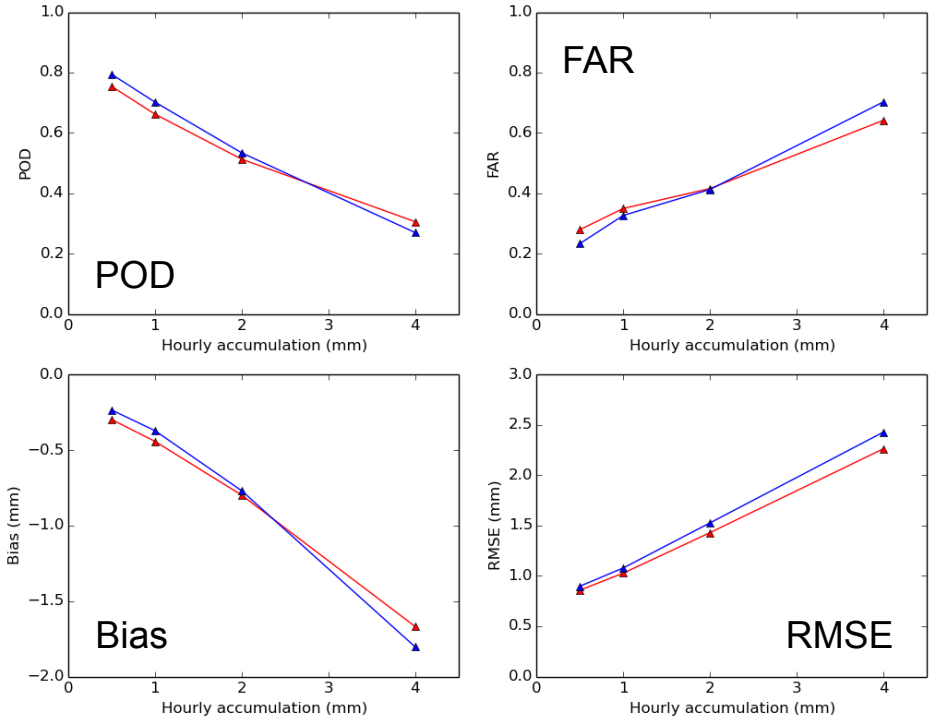
RHI courtesy of: Mittermaier, M. P., R. J. Hogan, and A. J. Illingworth, 2004: Using mesoscale model winds for correcting wind-drift errors in radar estimates of surface rainfall. *Quart. J. Roy. Meteor. Soc.*, **130**, 2105–2123.

Wind drift results

Control: red; drifted: blue; wrt rain gauge accumulations

Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB





1km Cartesian products (15 radars, 4 months)

- Improved POD and FAR up to 8mm/h (moderate)
- Slightly improved bias
- No change in RMSE

Has skill at 1km resolution

100m Cartesian products (3 radars, 2 months)

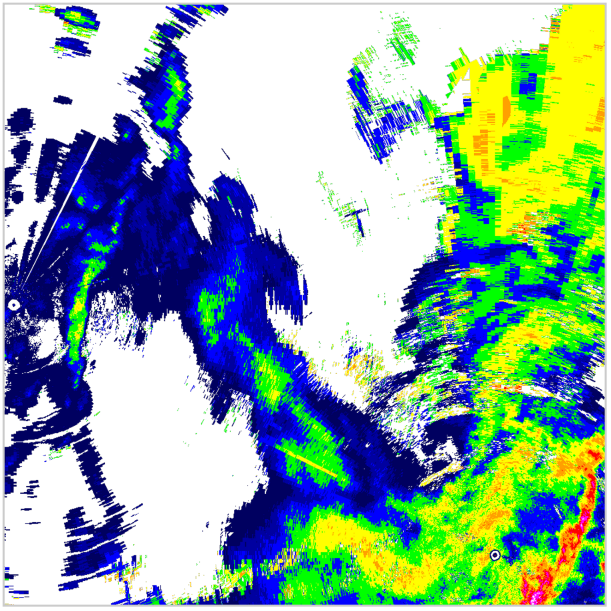
- Improved POD and FAR below 1mm/h
- Loss of skill above 2mm/h (low)
- Increased RMSE

No skill on a 100m grid

Future plans

Investing in Opportunities
This project has received European Regional Development Funding through INTERREG IV B.
INTERREG IVB

- Implementation of RETRO method
- Dual-polarisation naïve Bayesian echo classification scheme
  - Tuning for chosen input data
- Advected accumulation product
  - 15min accumulations from data interpolated to 1min frequency
- Gauge merged accumulation product?
- Alternative compositing scheme?



Questions?

Contact email: caroline.sandford@metoffice.gov.uk