UK radar data processing

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RAINGAIN Project Meeting,

21-22 October 2013, Paris

UK Radar Network

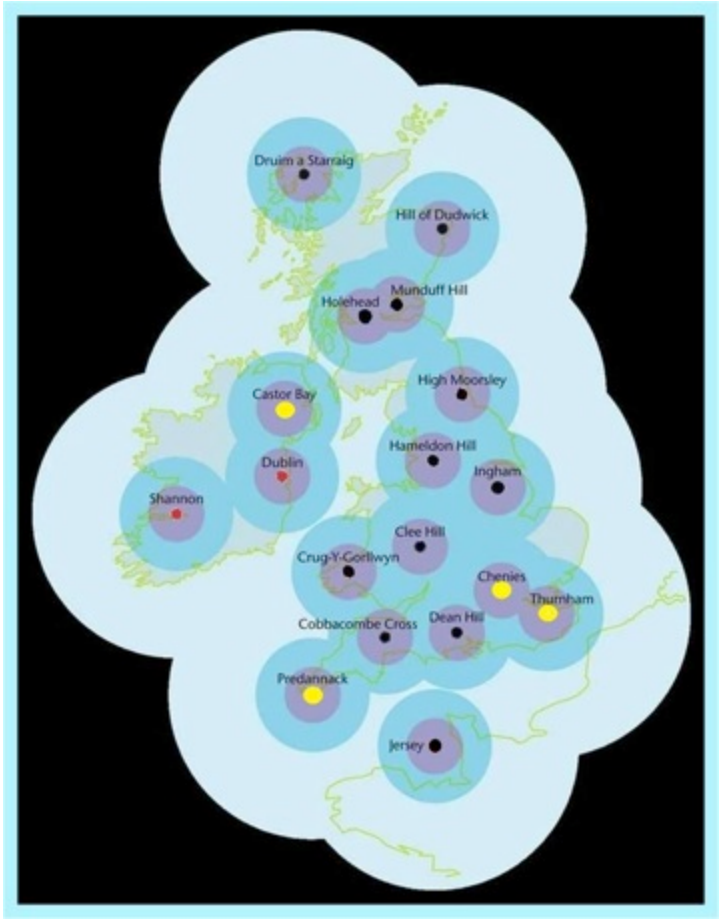
Status October 2013

UK radar network is comprised of 15 radars:

- Doppler radars
- 4 Doppler radars with dual polarisation capability (yellow dots).

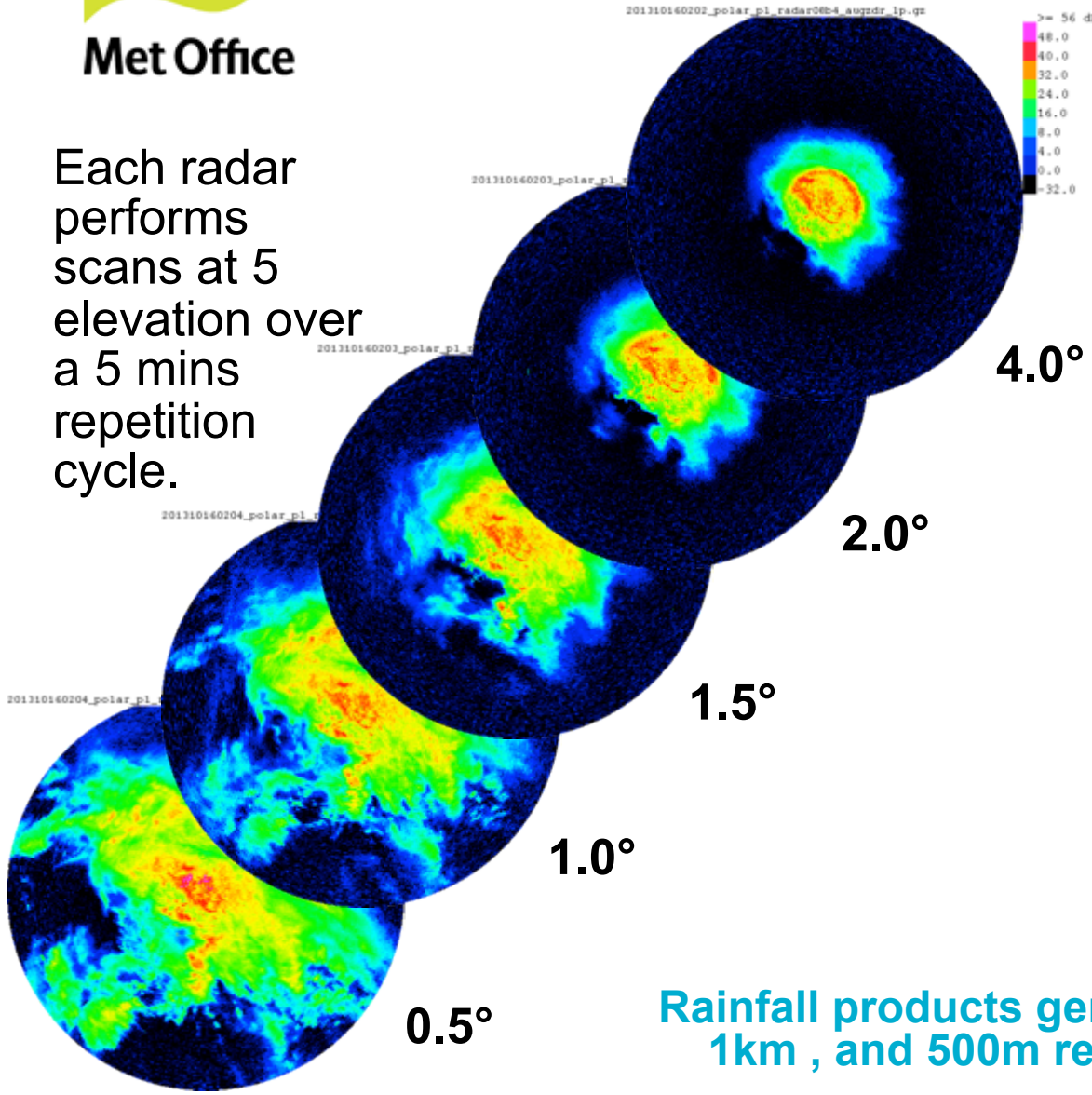
All UK radars are capable of:

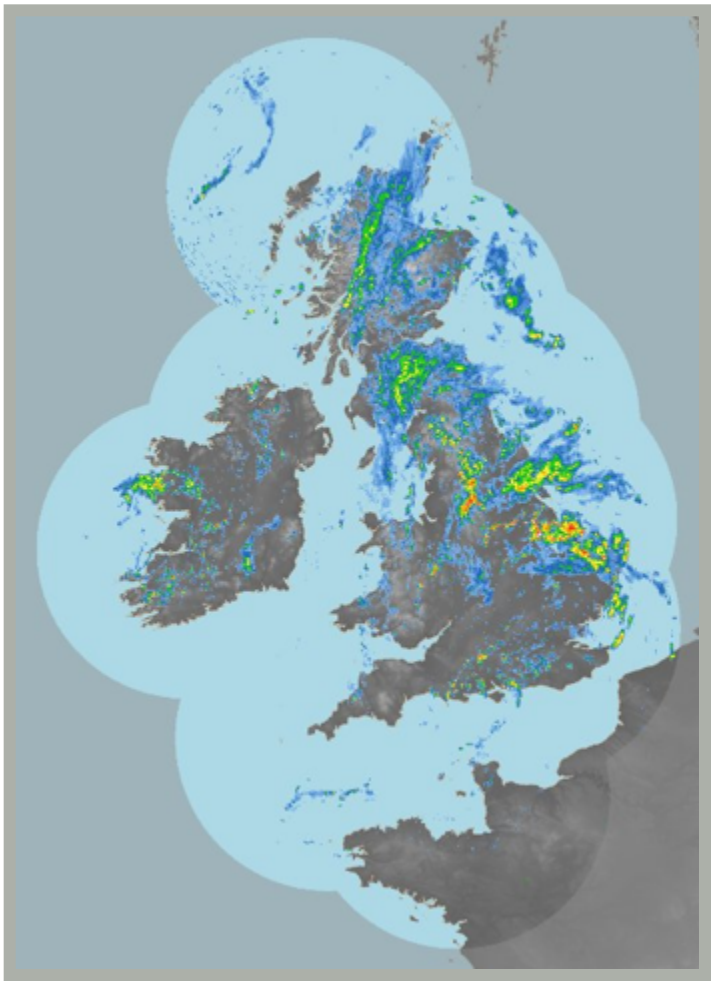
- Detecting and monitoring precipitation up to 255km from the radar,
- Collecting data at up to 75m x 1° resolution,



Rainfall rate products

Each radar performs scans at 5 elevation over a 5 mins repetition cycle.

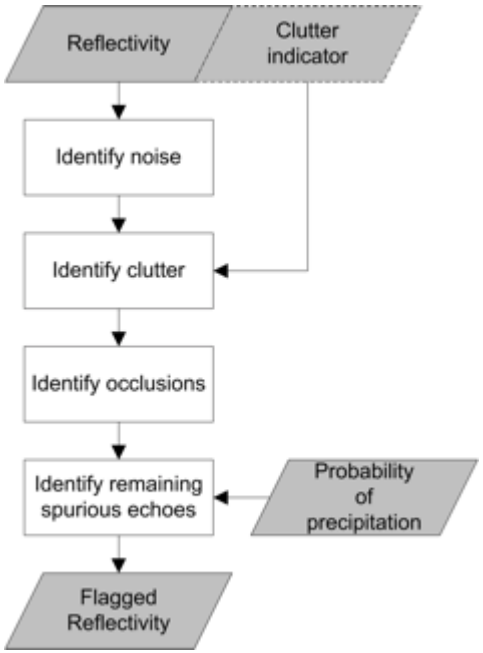




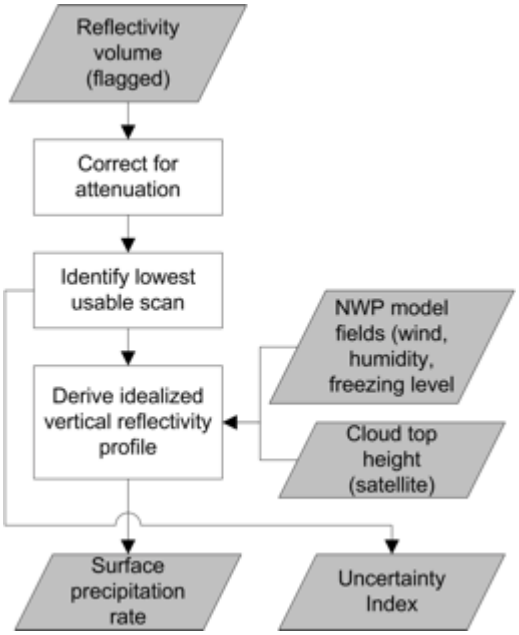
Rainfall products generated every 5 mins at 5km, 1km , and 500m resolution.

Rainfall products – Radarnet processing

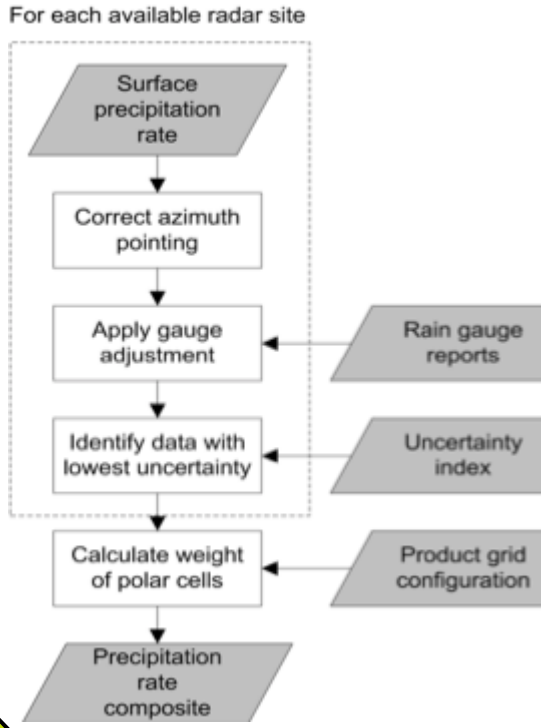
Flagging of Raw Data



Single Site Rain Rate



Compositing

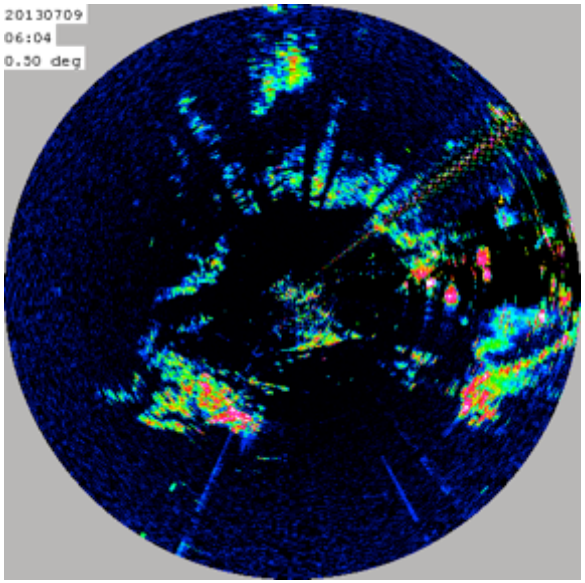


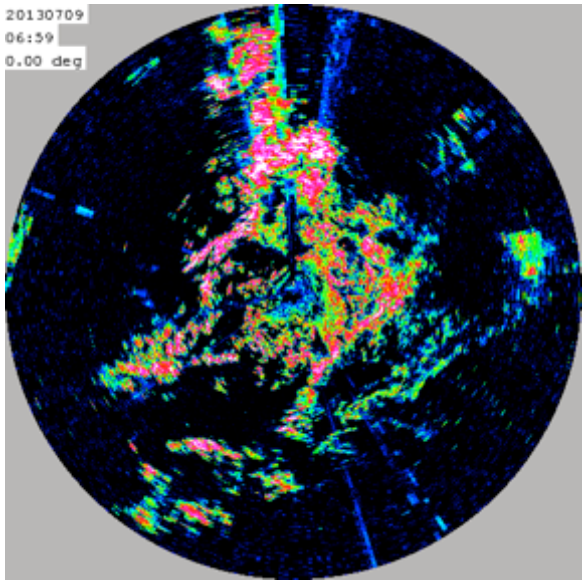
NWP (DA, STEPS, VER)

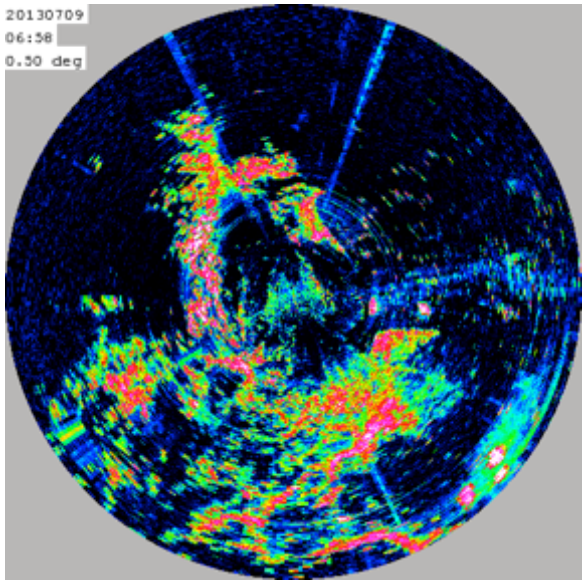
FSD EA/FFC

Spurious echo identification

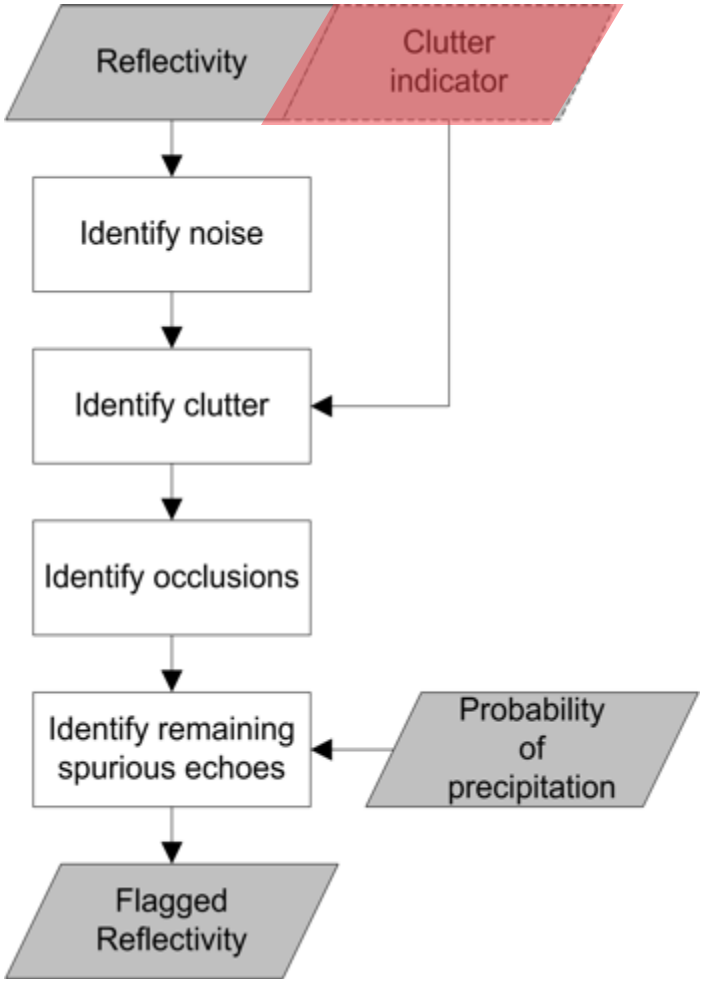
Problem: A major limitation to assimilating radar products into NWP and hydrological models is the presence of non-precipitation echoes in the data.



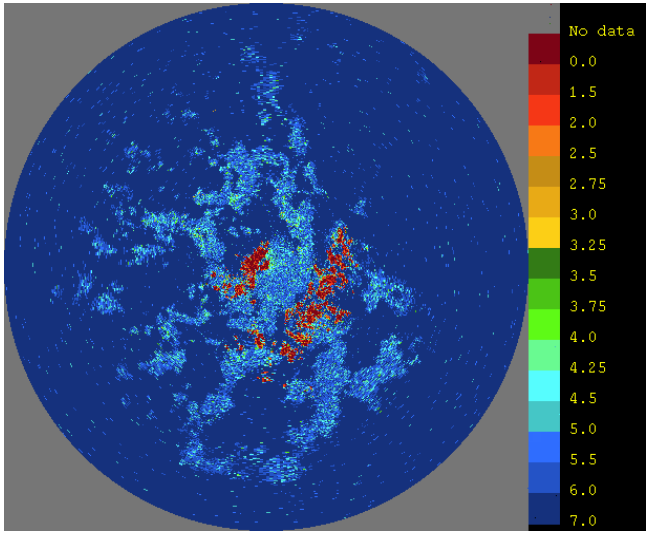


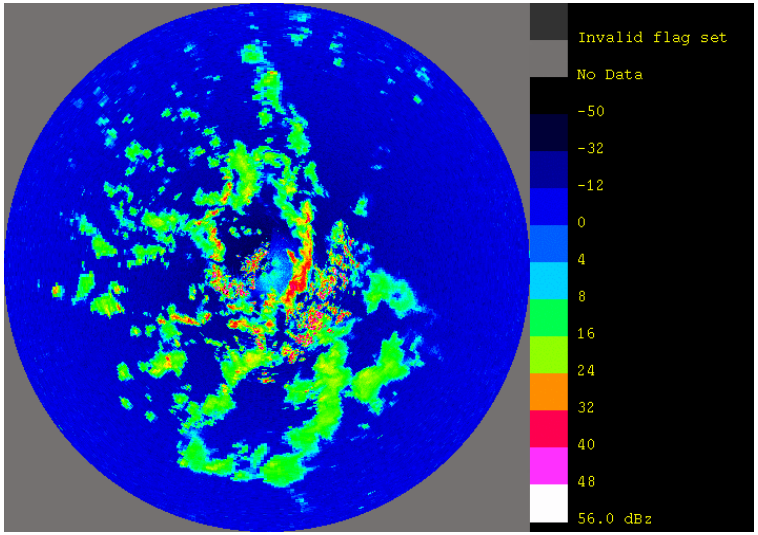


Spurious echo Identification.

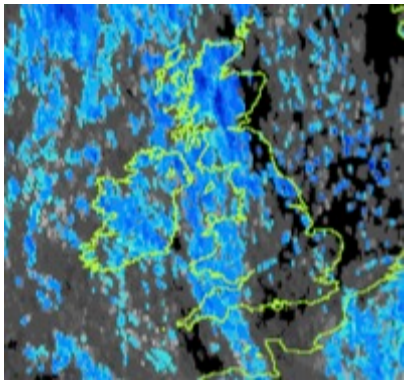


CPA: Clutter phase alignment

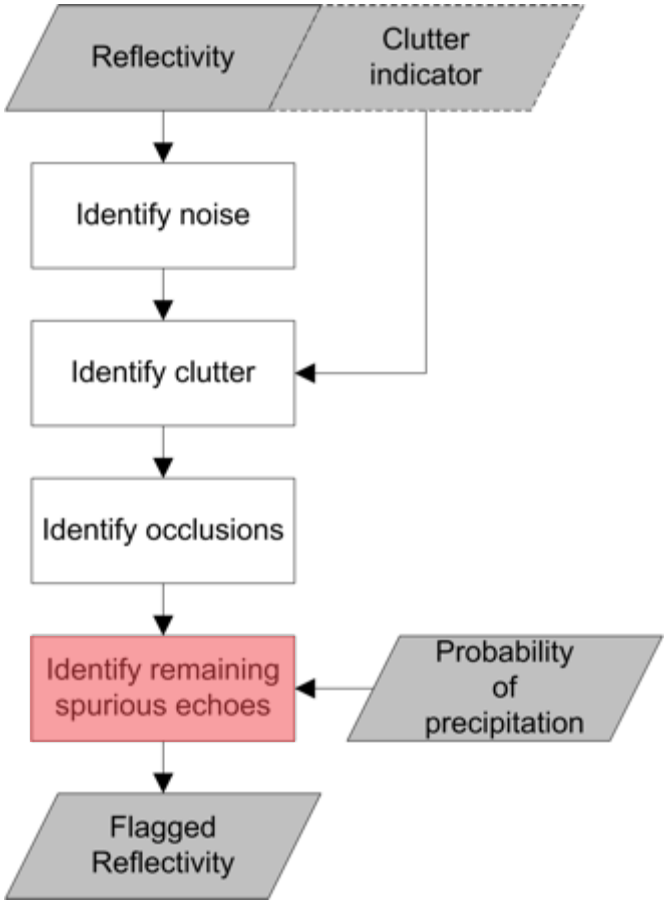


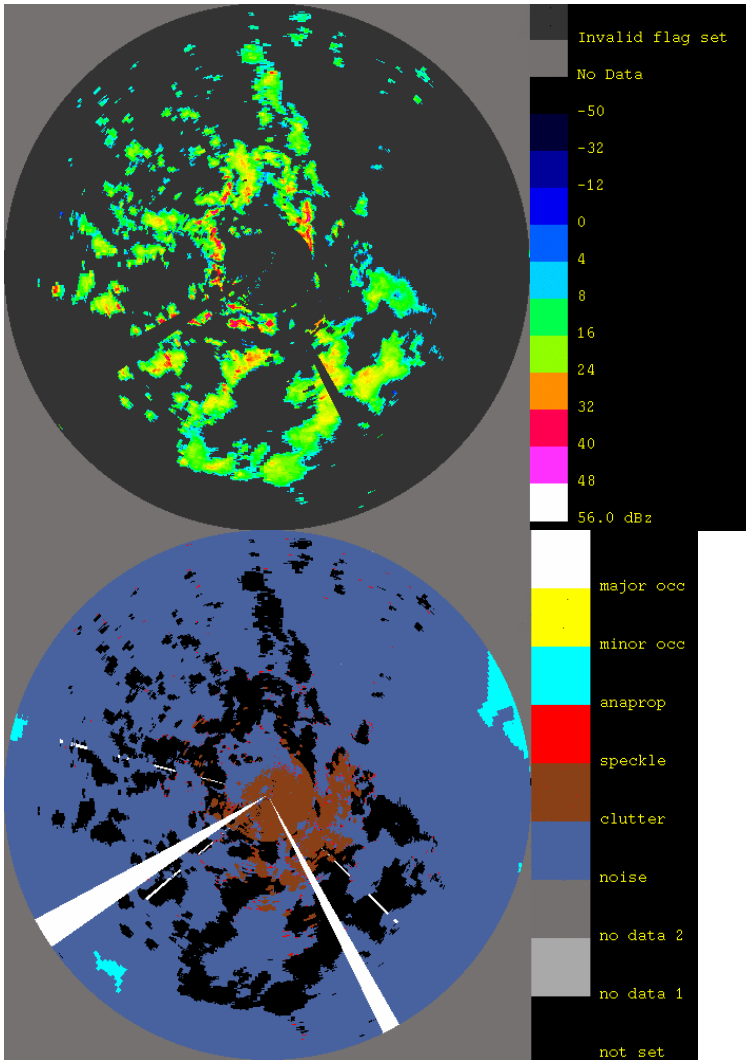


Identifying Spurious Echoes

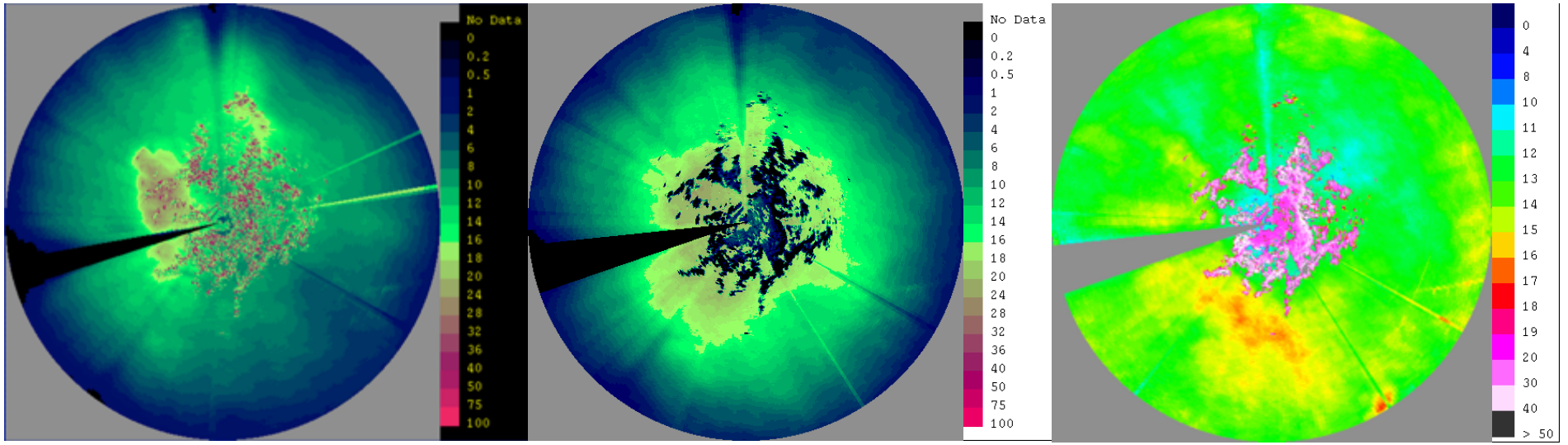


- Use Laplace filter for speckle
- Use MSG satellite data to decide if radar echoes are likely to be a return from precipitation
- Scheme is cautious: needs to strike right balance between anaprop removal/ rain deletion
- Don't work well when: in convective showers, fog or low cloud conditions





Spurious echoes identification

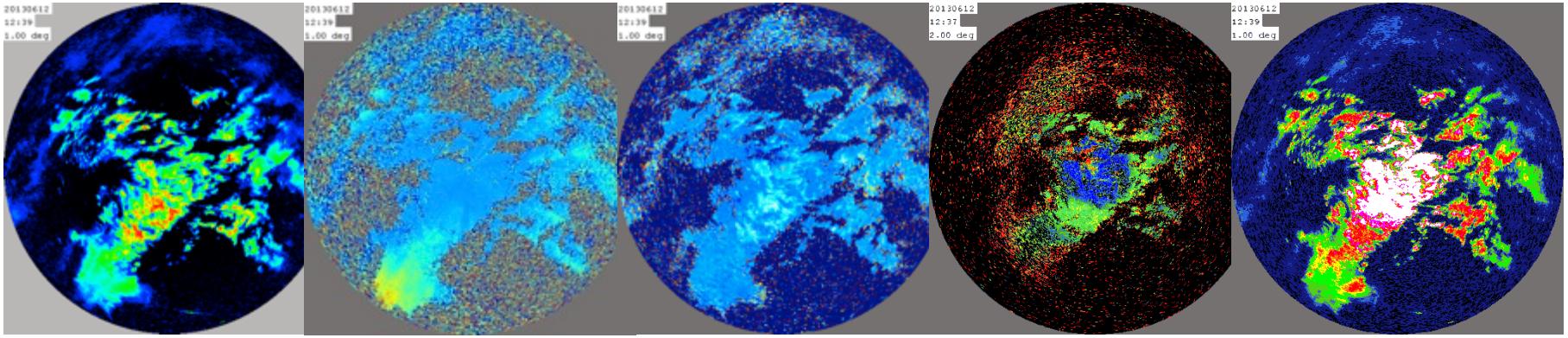


POD Jan 2012 **POD Jan 2013** **Average dBZ Jan 2013**

Improved scheme was introduced last year based on Nicol et al (IAHS Publ 2012). This technique show clear improvement to the data; however some limitations with sea clutter and RLAN interference.

Going forward: use dual polarisation parameters to improve this scheme further.

Spurious echoes identification



“ Fuzzy Logic Algorithm for the Separation of Precipitating from Nonprecipitating Echoes Using Polarimetric Radar Observations ” by Jonathan J. Gourley,* Pierre Tabary, and Jacques Parent du Chatelet
Météo-France, Direction des Systèmes d’ Observation, Trappes, France

“ Weather Radar Ground Clutter. Part II: Real-Time Identification and Filtering ”, by J. C. Hubbert , M. Dixon , and S. M. Ellis, National Center for Atmospheric Research, * Boulder, Colorado

“ Classification of ground clutter and anomalous propagation using dual-polarization weather radar “ by Rico-Ramirez, MA; Cluckie, ID. In: IEEE Transactions on Geoscience and Remote Sensing, Vol. 46 (7), 07.2008, p. 1892 - 1904.

New development with dual polarisation Identifying Spurious Echoes

By Nawal Husnoo

Built initial database of radar echoes

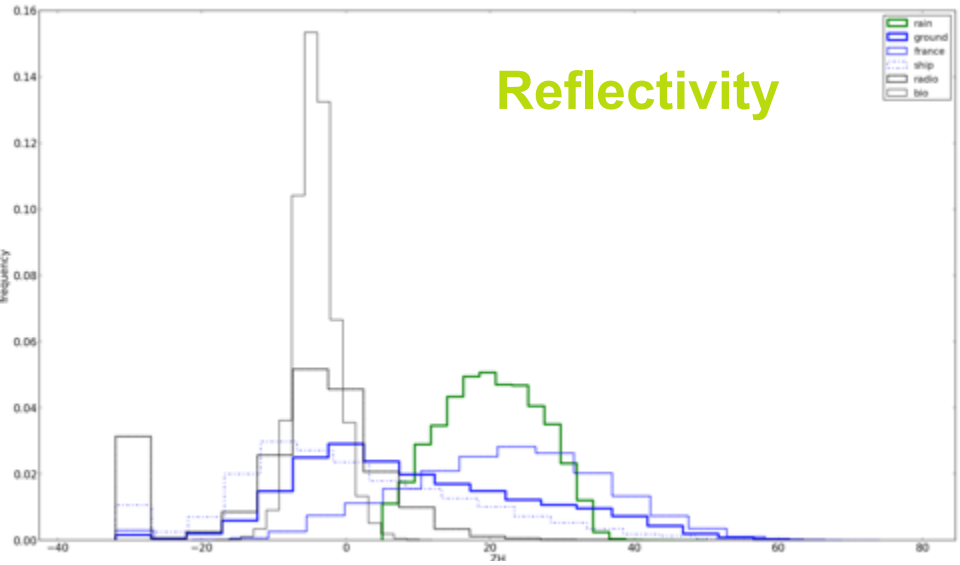
- Viewed 191 individual radar images
- Drew 1600 little boxes

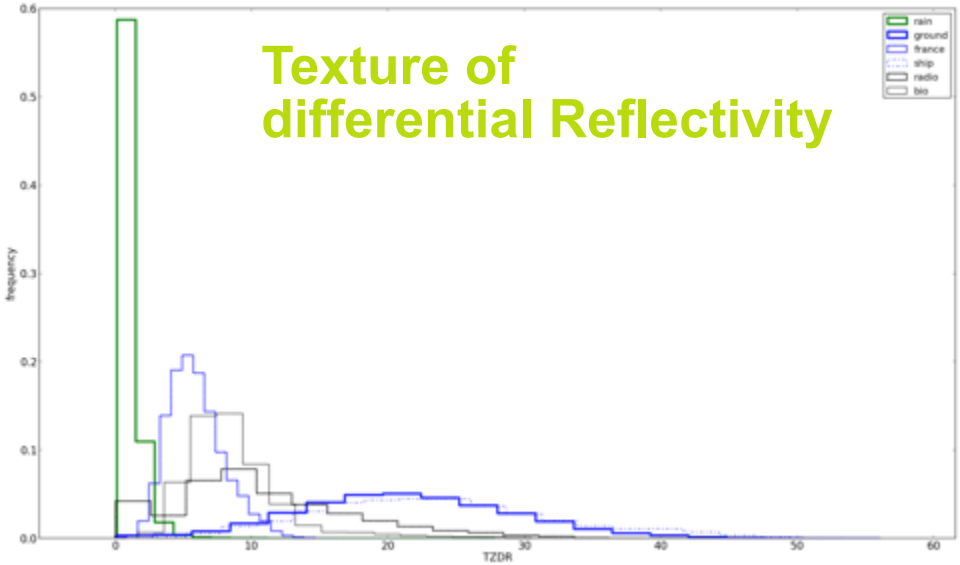
Breakdown:

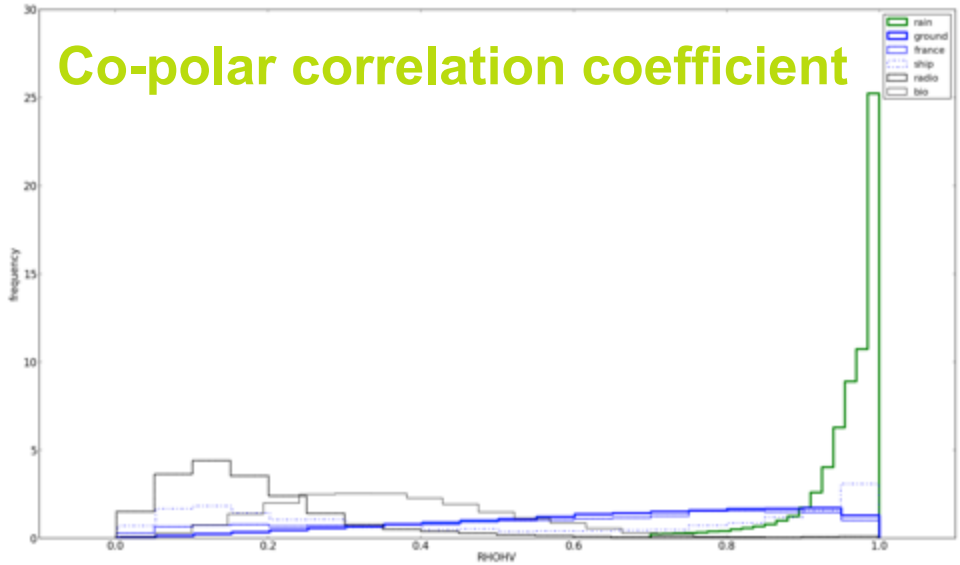
Biological	20 boxes	5 files	15,049 pixels
Noise	71 boxes	28 files	652,674 pixels
Precipitation	311 boxes	42 files	250,283 pixels
France	103 boxes	18 files	31,063 pixels
RF interference	348 boxes	48 files	22,859 pixels
Sea clutter	71 boxes	20 files	44,272 pixels
Ship	280 boxes	24 files	3,682 pixels
Ground Clutter	396 boxes	34 files	95,693 pixels

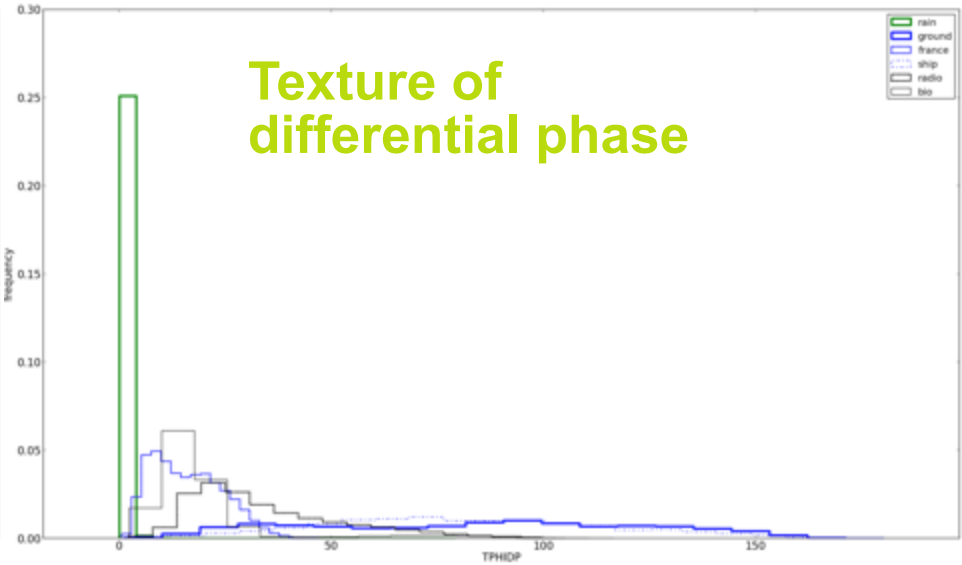
New development with dual polarisation Identifying Spurious Echoes

By Nawal Husnoo



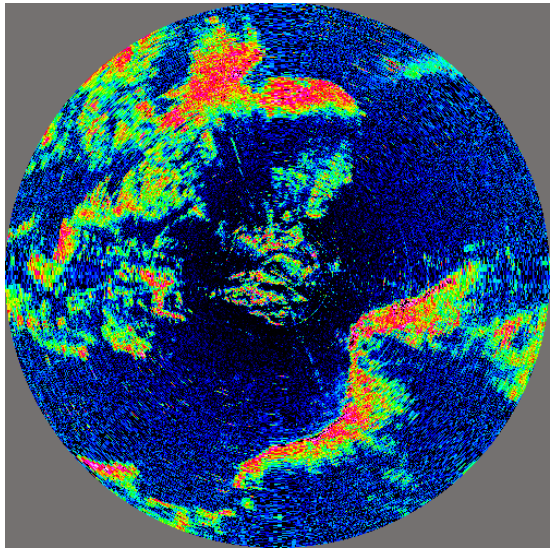




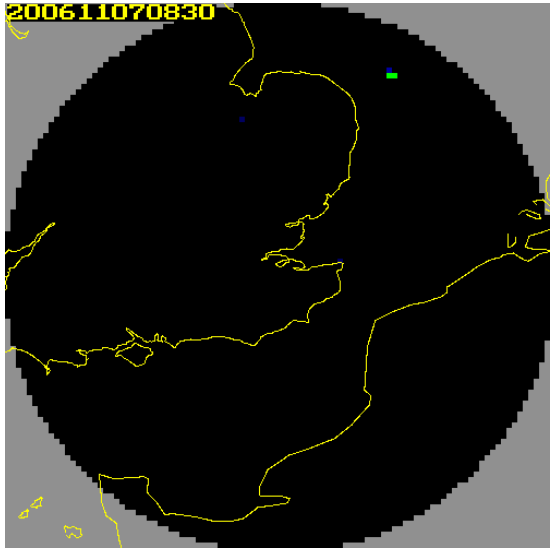


Spurious echoes identification

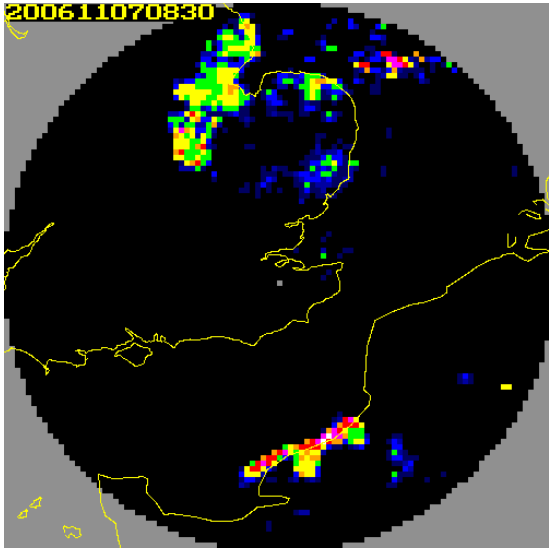
Raw Reflectivity (dBZ)



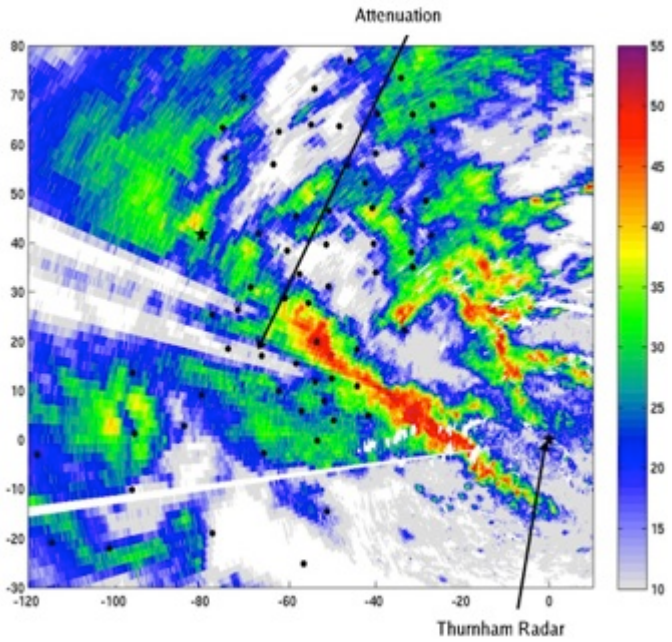
Rainfall estimate using DP



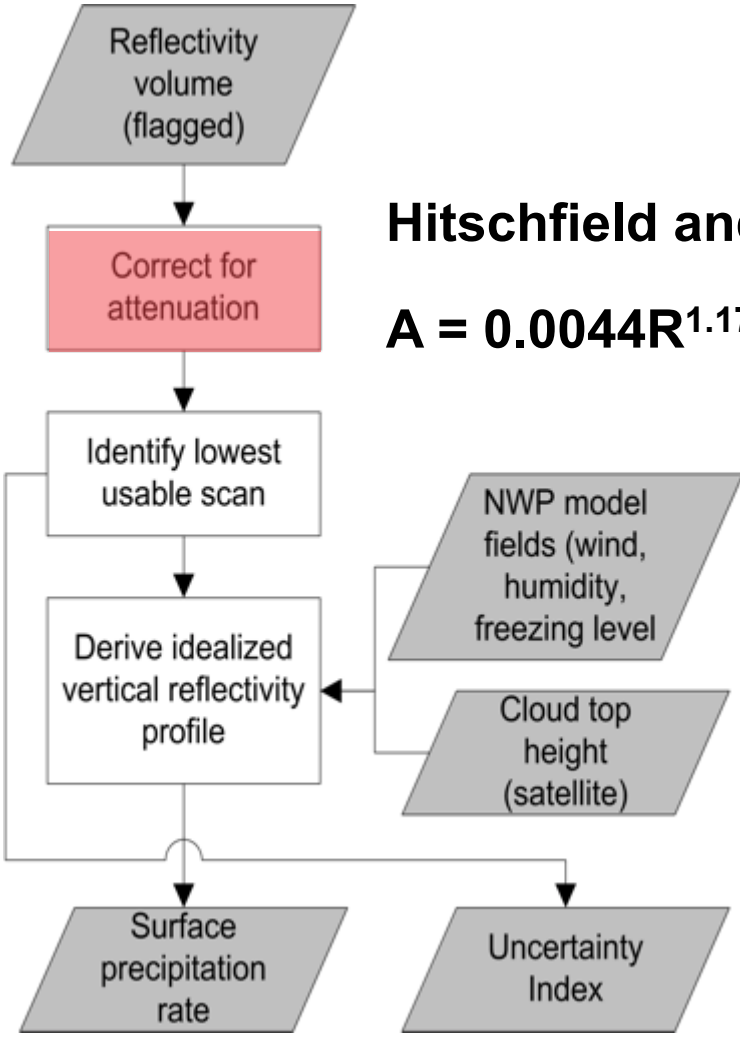
Rainfall estimate without DP



Attenuation correction



The radar signal is degraded as power from pulses is absorbed and scattered by precipitation itself.

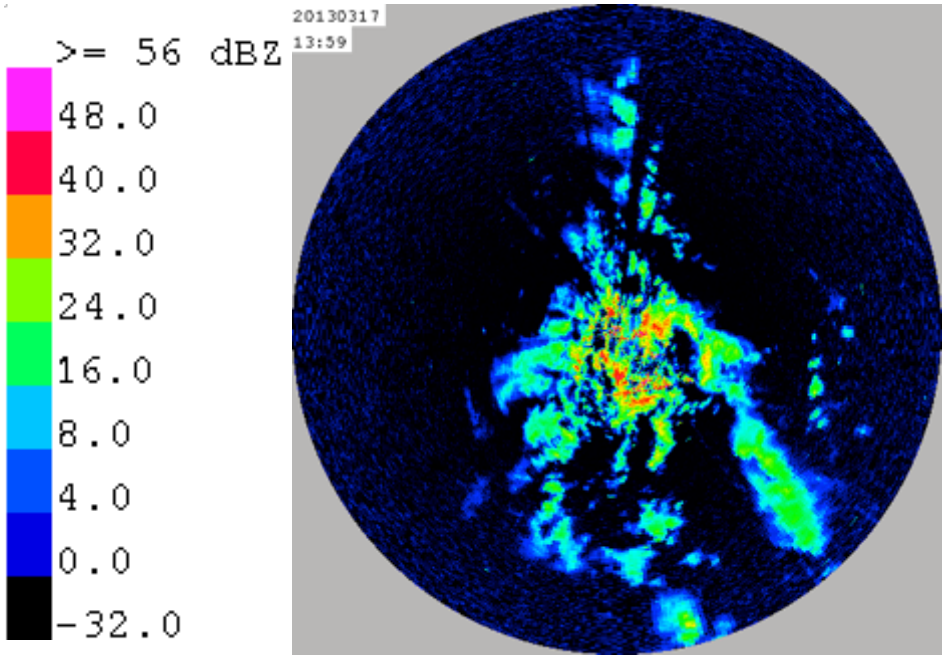


Hitschfield and Bordan

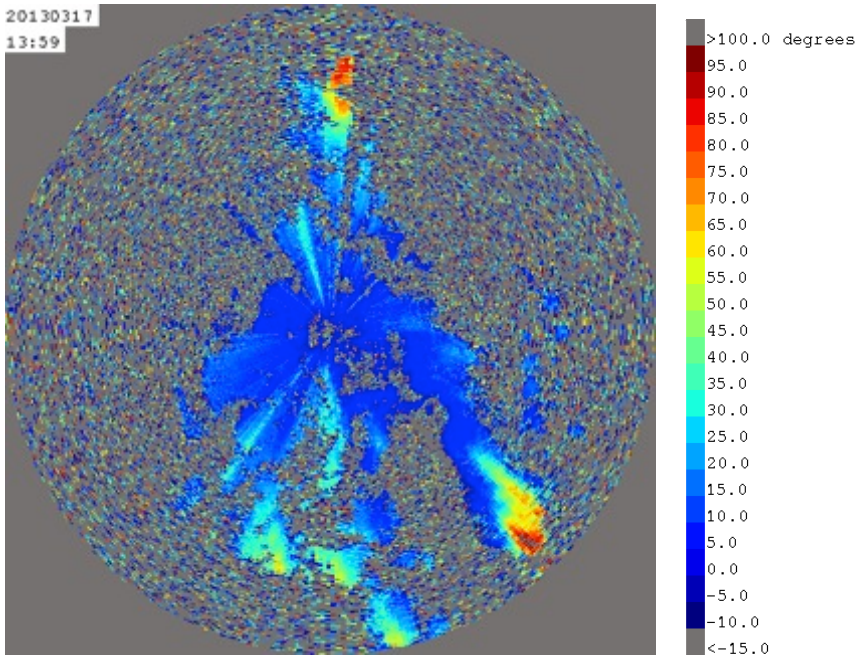
$$A = 0.0044R^{1.17}$$

Example of Differential Phase, ϕ_{DP} Chenies – 17 Mar 2013

Reflectivity, dBZ



Differential Phase Shift, degree



As rain becomes heavier raindrop become oblate. The horizontally polarised wave will be more affected by more water than the vertically polarized wave.

$$\phi_{DP} = \phi_H - \phi_V$$

ϕ_{DP} Indicates the relative delay between the Horizontal and Vertical wave
→ Increase in differential phase related to attenuation of the radar signal.

Questions & answers