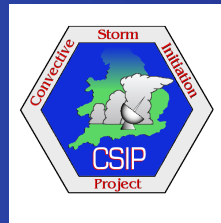


CSIP: Convective Storm Initiation Project (UK)



Alan Blyth, Lindsay Bennett, Barbara Brooks, John Marsham, Doug Parker; University of Leeds

Keith Browning, Cyril Morcrette; University of Reading

Pete Clark, Nigel Roberts; Joint Centre for Mesoscale Meteorology, Met Office

Karen Bozier, Fay Davies, Chris Collier; University Salford

Emily Norton, Geraint Vaughan; University Wales, Aberystwyth

Charles Kilburn, Darcy Ladd; Rutherford Appleton Laboratory

Motivation

- Flooding is the highest-impact natural disaster world-wide
- One of the largest uncertainties in predicting flooding due to convective storms is in modelling the initiation of convection
- For example, a recent event in Boscastle highlights the damage and disruption that can be caused by heavy precipitation



Boscastle flooding, 16 August 2004.

Photos from <http://news.bbc.co.uk>

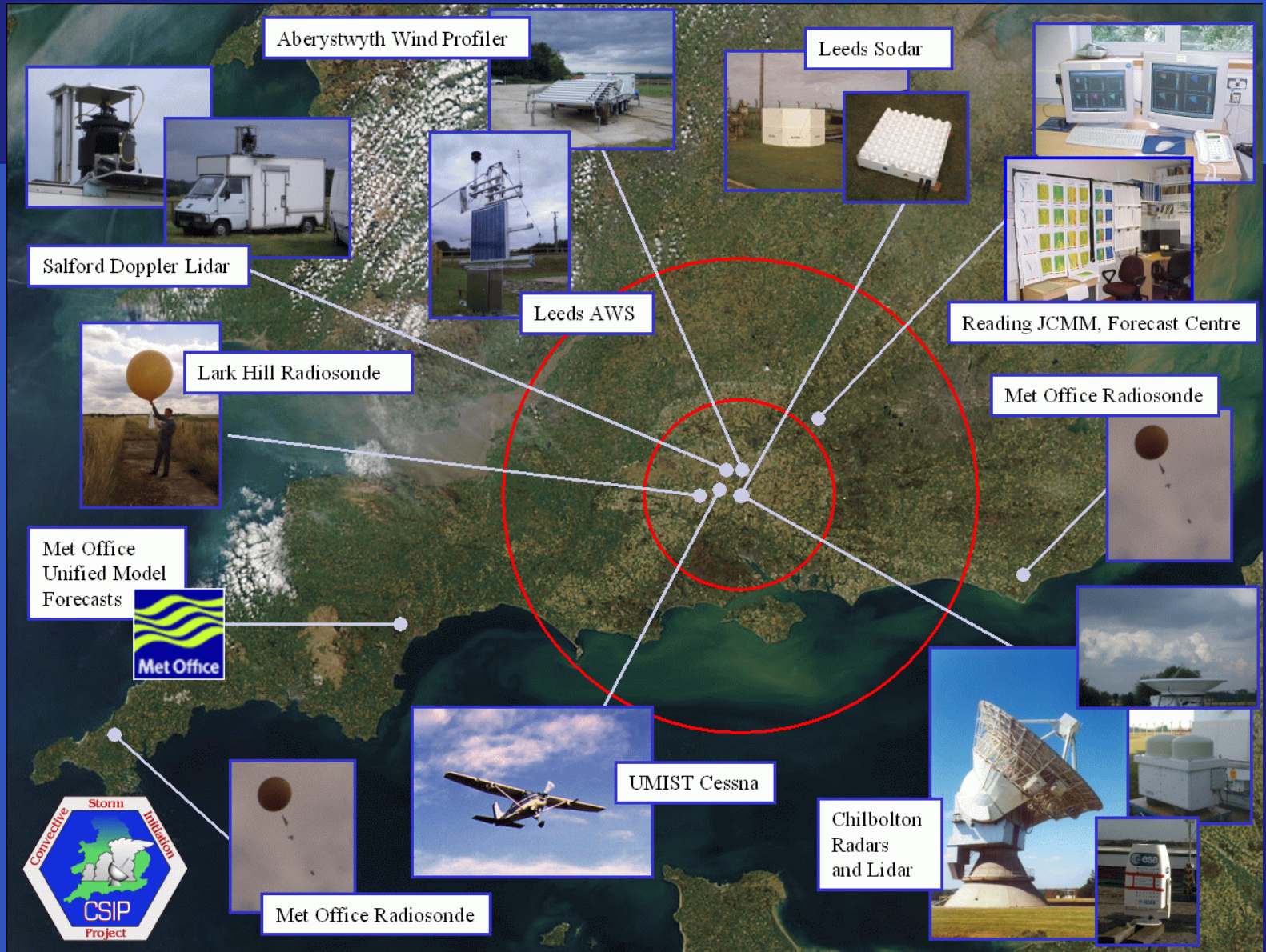


Cyril Morcrette, University of Reading, October 2004

Scientific Goals of CSIP

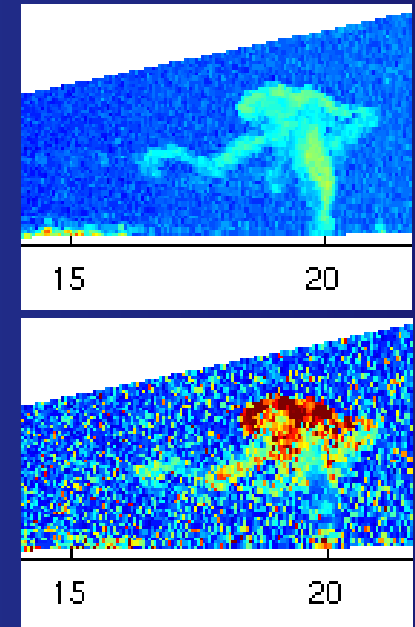
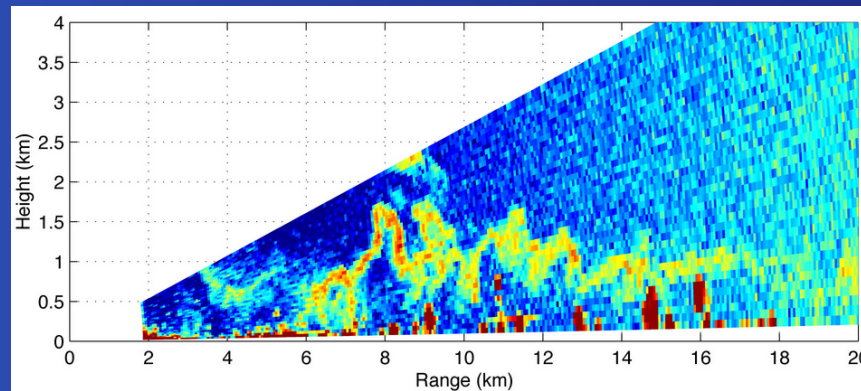
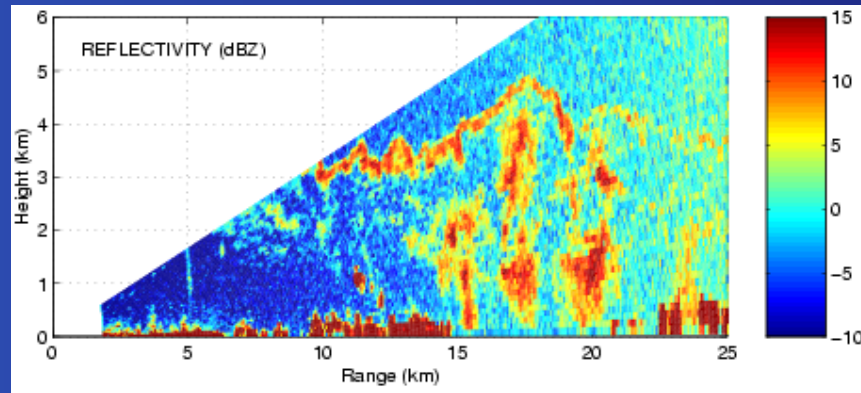
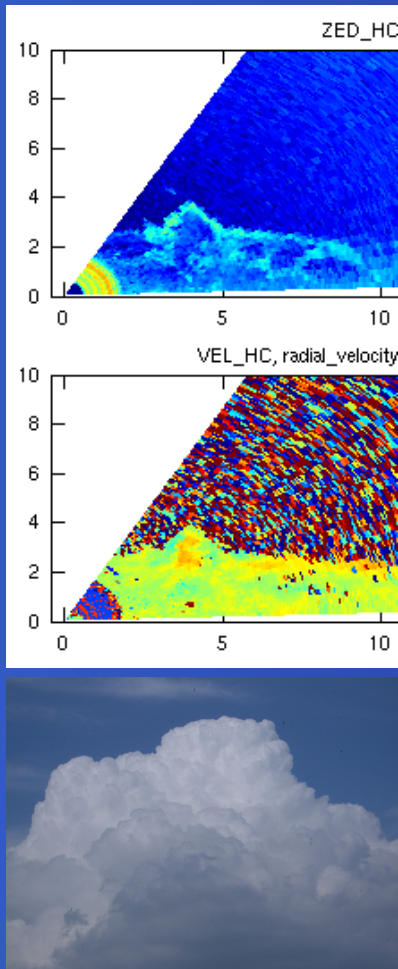
The overall goal: to improve understanding of processes responsible for initiation and development of precipitating convection

- What are localized perturbations in the BL that trigger new convective cells?
 - horizontal convergence and locally enhanced uplift associated with orography, land/sea contrasts, and land-use heterogeneity.
- What are mesoscale forcing processes in troposphere that create regions sensitive to triggering?
 - mesoscale vortices and dry intrusions leading to split frontal structures and regions of conditional instability
- How do local modifications of the atmosphere by previous convective cells influence or even dominate over the other perturbations?
 - convective clouds produce cold pools with associated lifting, as well as tropospheric moisture anomalies and transient static-stability variations.



Instrument layout *Cyril Morcrette*

A key instrument - 1275 MHz radar



Ed Pavelin

Summary of CSIP pilot (2004)

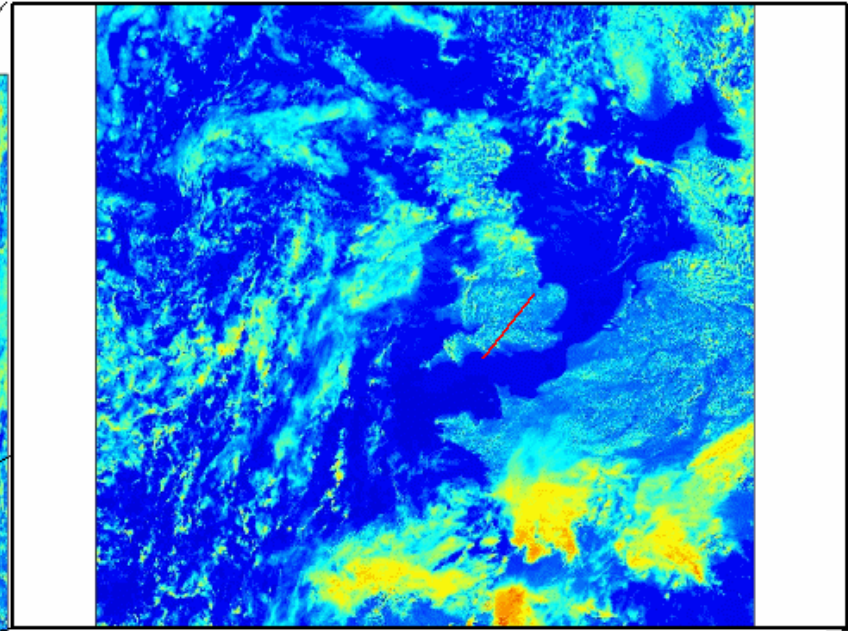
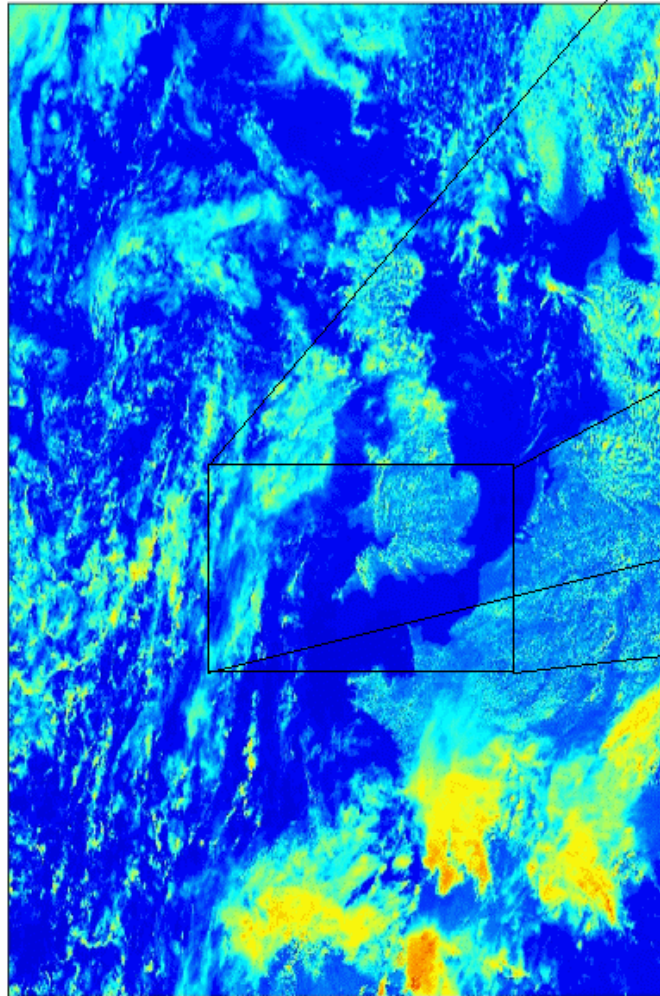
- 6 July: Cloud streets from coastal headlands
- 8 July: Rainbands - not as relevant for CI
- 10 July: Cold pool, density current, gust front, gravity waves
- 20 July: Lids observed by Acrobat and sondes. Aircraft flight.
- 22 July: Heavy thunderstorm in Midlands.

6, 10, 20, 22 July cases being studied in more detail



Case 1:
6 July 2004

2004-07-06, 1200Z High-resolution visible MSG.

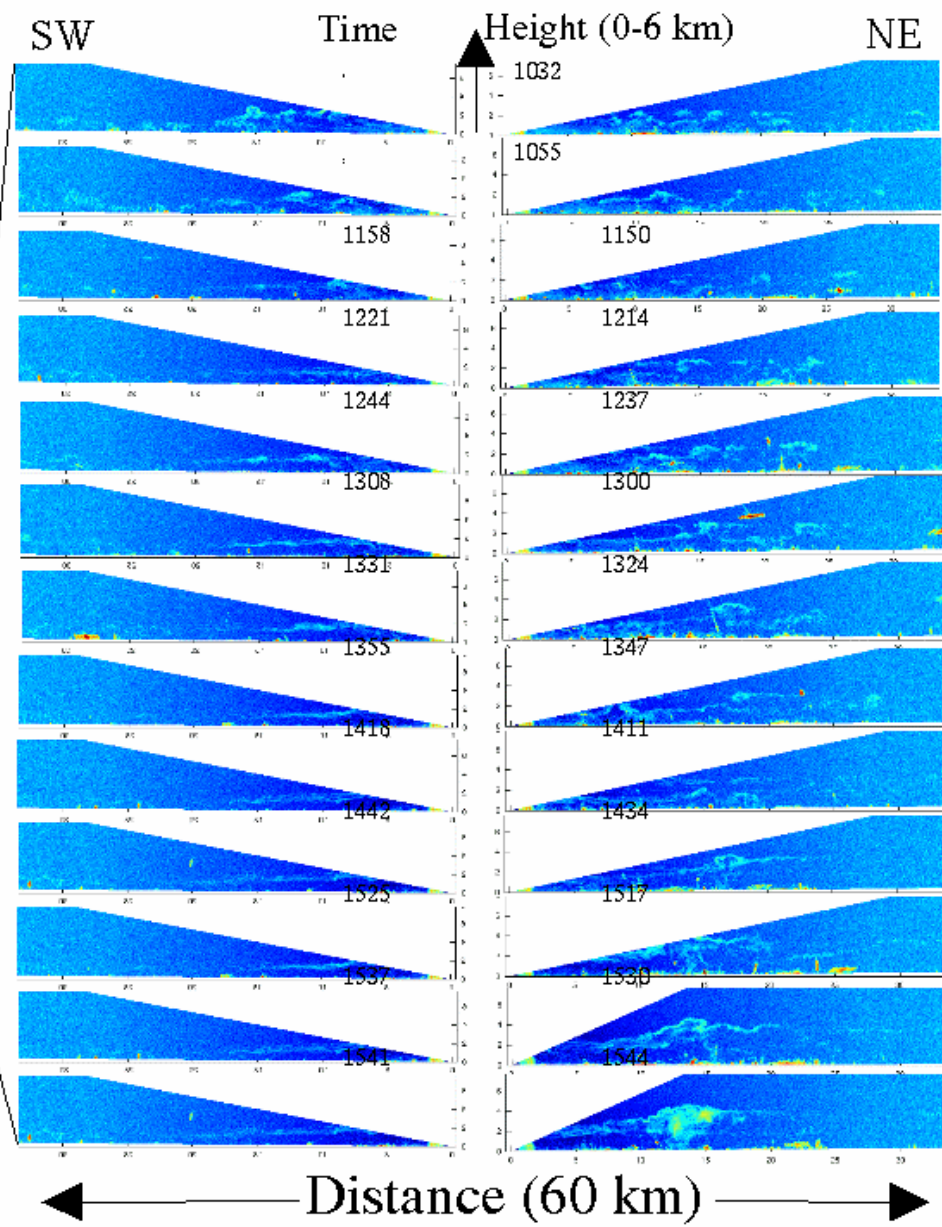
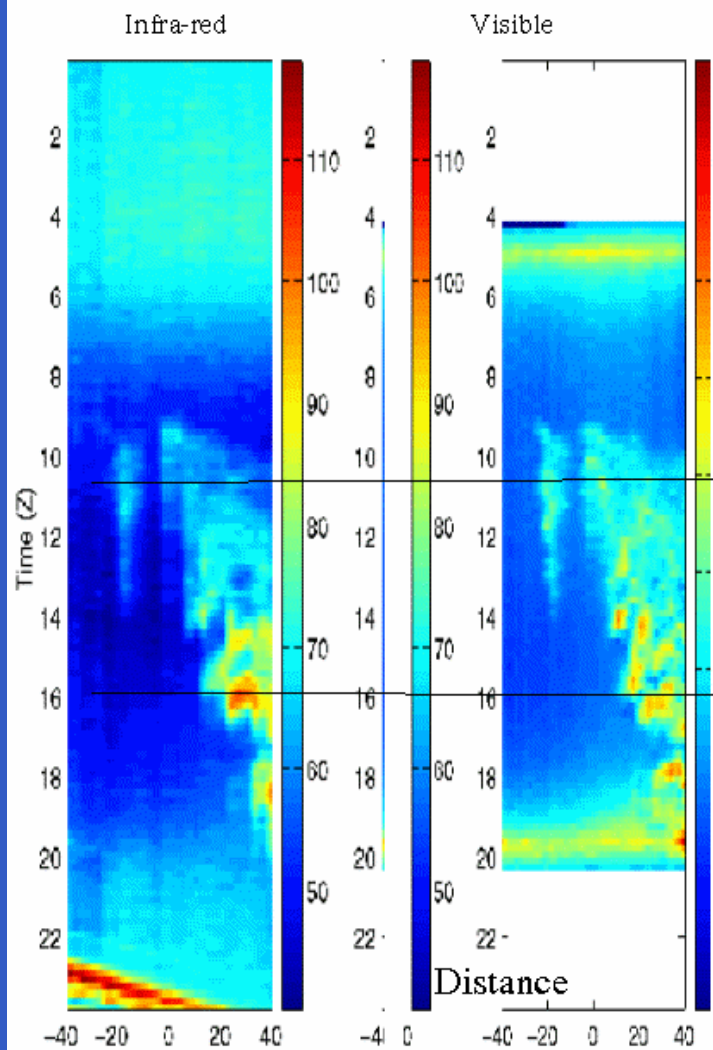


Look at time series of **clear-air radar** along this cross-section, perpendicular to cloud streets.

Compare with similar cross-section constructed from rapid-scan **satellite** data.

Cyril Morcrette, University of Reading, October 2004

6 July 2004: Acrobat RHIs and Meteosat rapid scan



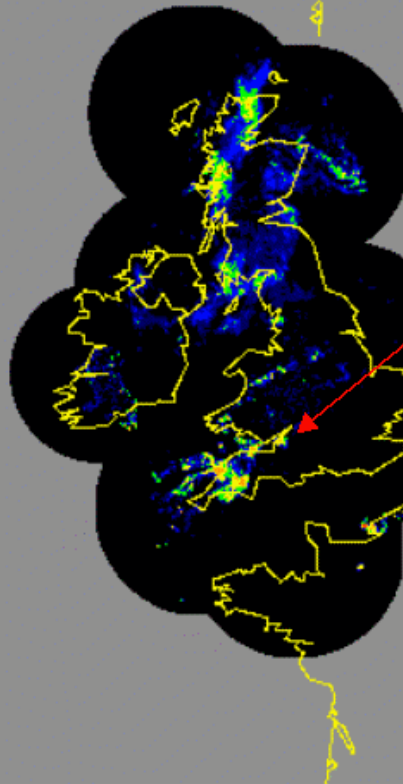
Cyril Morcrette, University of Reading, October 2004



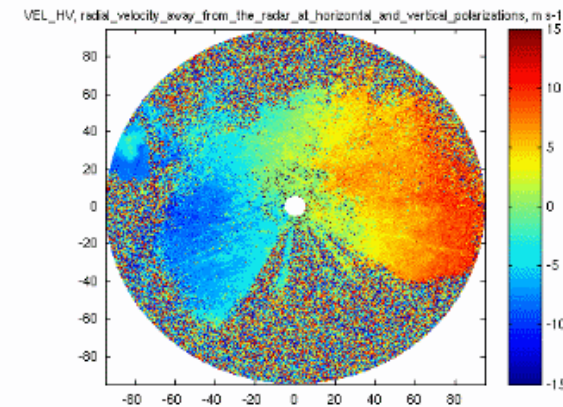
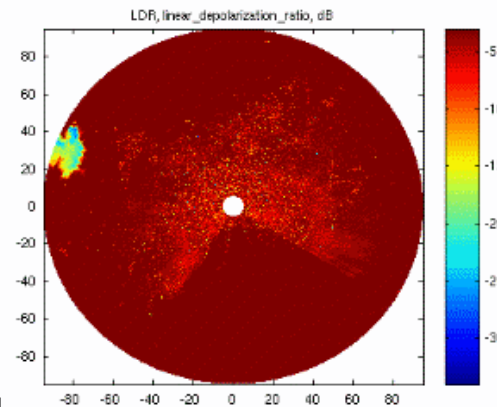
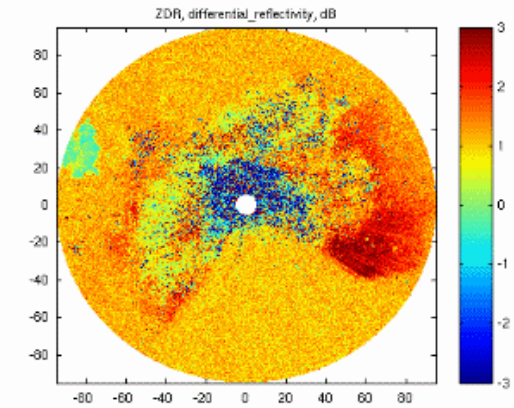
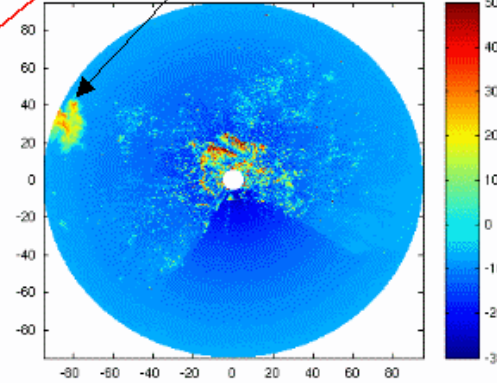
Case 2:
10 July 2004

08:15 10/07/2004

Mendip Storm

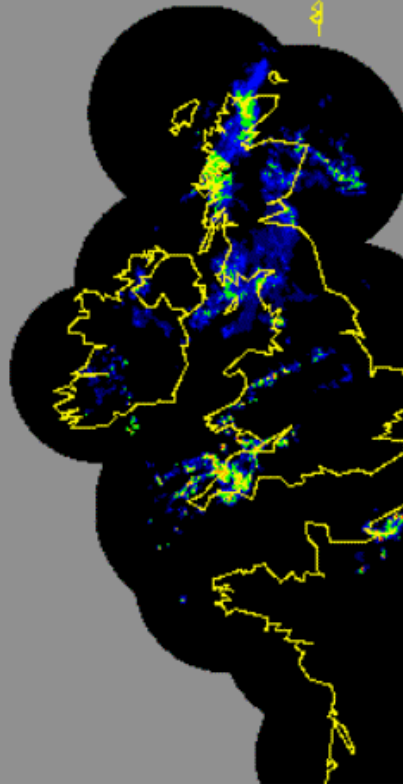


radar-camra_20040710090549_ppi-raw.nc, el: 0.54167
ZED_H, radar_reflectivity_factor_at_horizontal_polarization, dBZ



Cyril Morcrette, University of Reading, October 2004

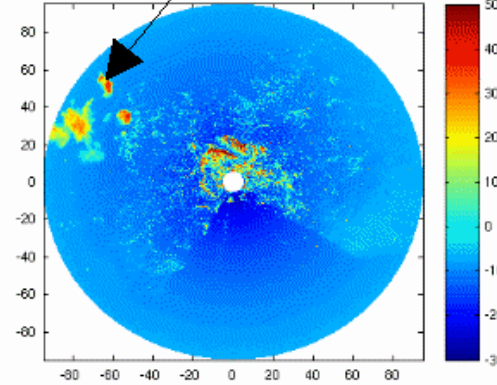
08:30 10/07/2004



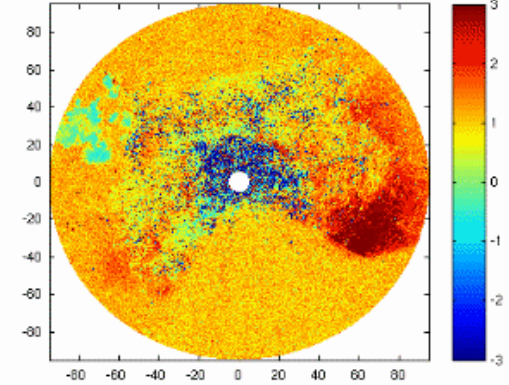
Arc 1

radar-cmr_20040710093215_ppi-raw.nc, el: 0.54583

ZED_H, radar_reflectivity_factor_at_horizontal_polarization, dBZ

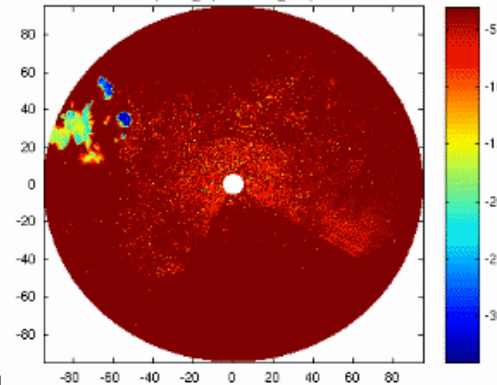


ZDR, differential_reflectivity, dB

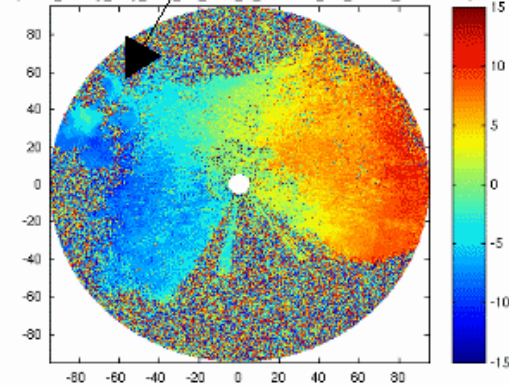


Arc of shear

LDR, linear_depolarization_ratio, dB

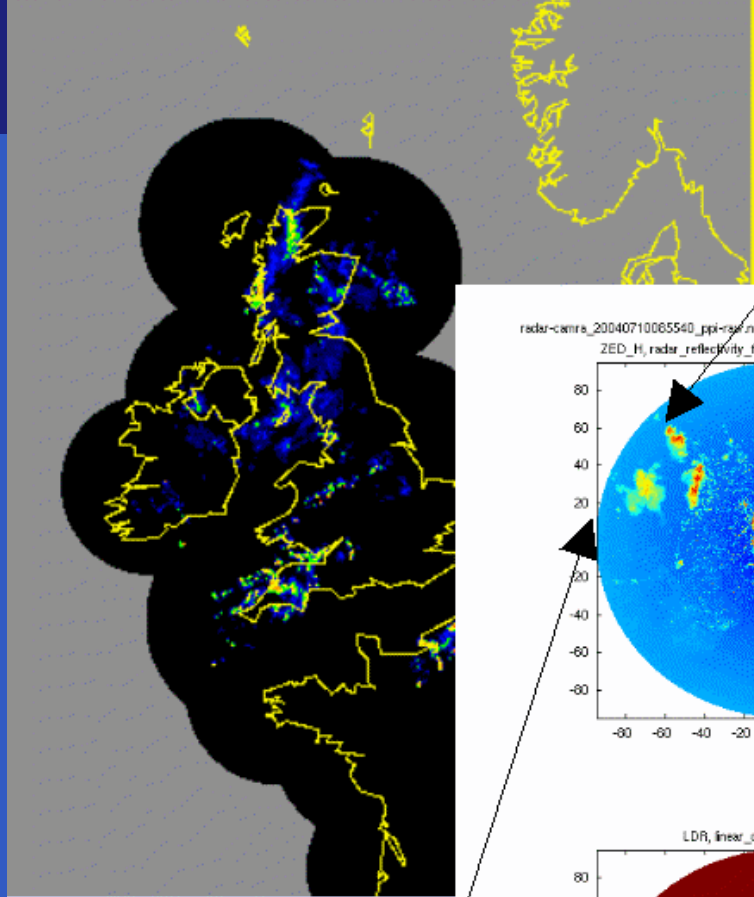


VEL_HV, radial_velocity_away_from_the_radar_at_horizontal_and_vertical_polarizations, m s-1



Cyril Morcrette, University of Reading, October 2004

09:00 10/07/2004



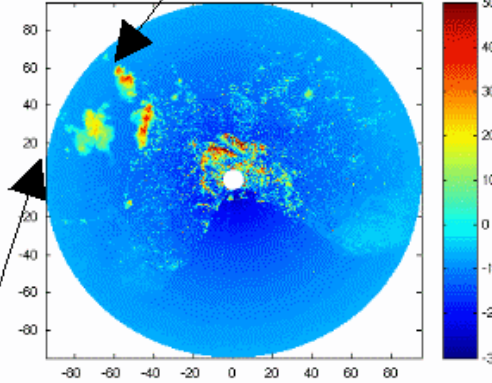
Mendip Storm

Cyril Morcrette, University of Reading, October 2004

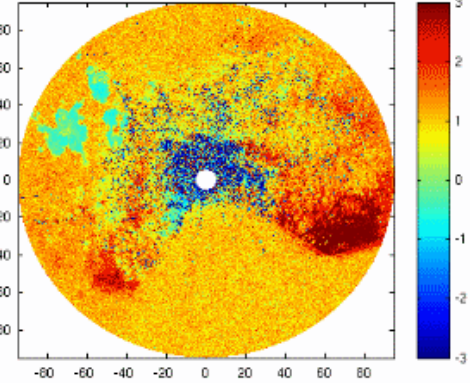
Arc 1

radar-camra_20040710065540_ppi-rad.nc, el: 0.53953

ZED_H_radar_reflectivity_factor_at_horizontal_polarization, dBZ

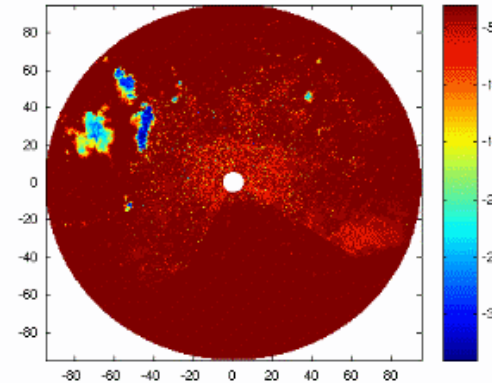


ZDR, differential_reflectivity, dB

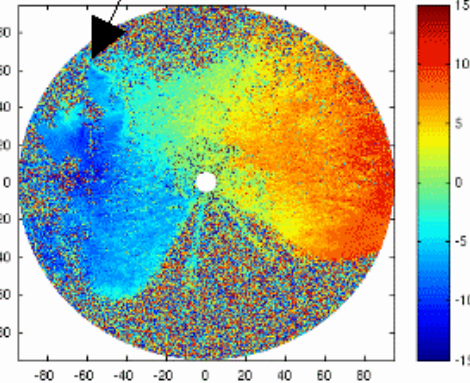


Arc of shear

LDR, linear_depolarization_ratio, dB

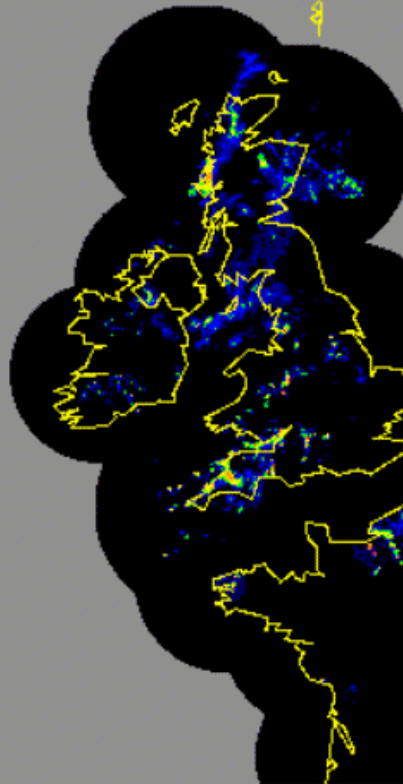


VEL_HV, radial_velocity_away_from_the_radar_at_horizontal_and_vertical_polarizations, m s-1



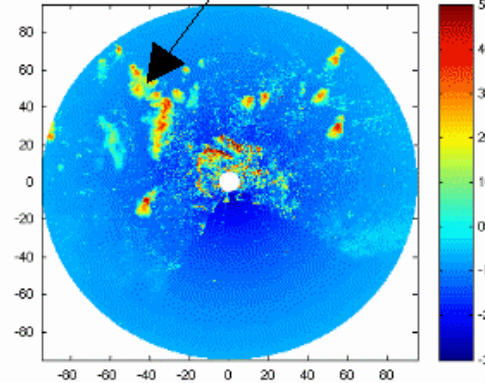
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Arc 1

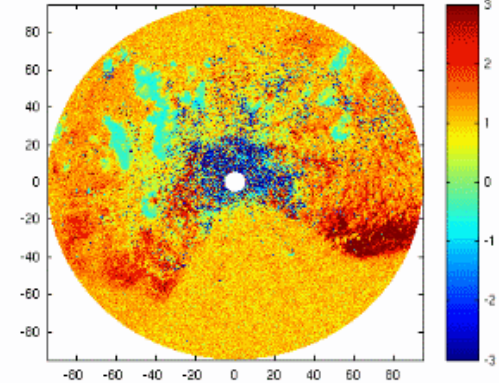


radar-camra_20040710091906_ppi-raw.nc, el: 0.53953

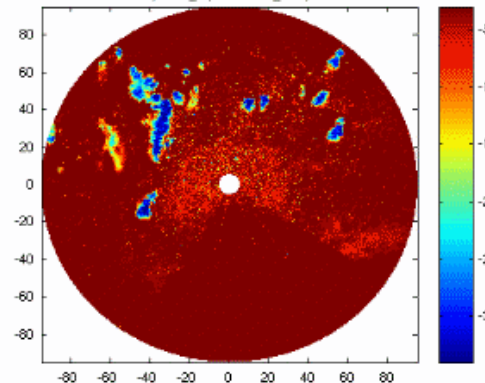
ZED_H, radar_reflectivity_factor_at_horizontal_polarization, dBZ



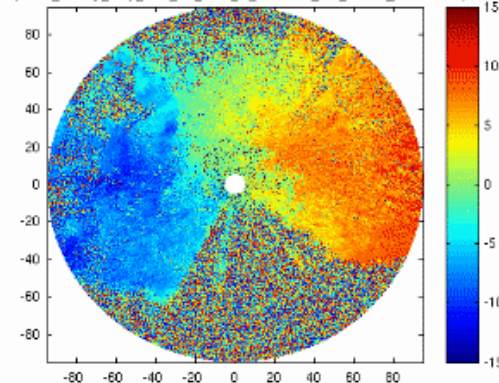
ZDR, differential_reflectivity, dB



LDR, linear_depolarization_ratio, dB

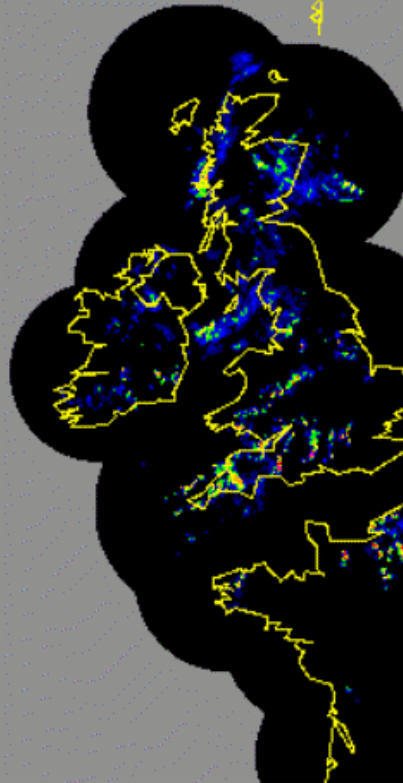


VEL_HV, radial_velocity_away_from_the_radar_at_horizontal_and_vertical_polarizations, m s-1



Cyril Morcrette, University of Reading, October 2004

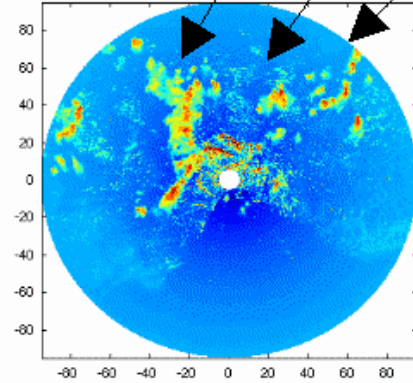
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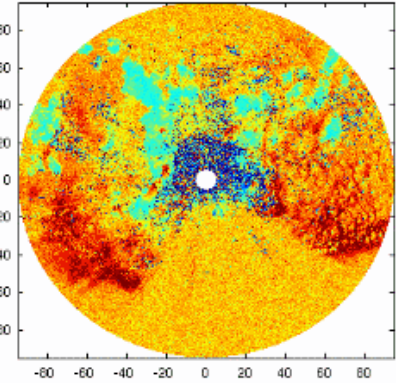
Arcs

1 2 3

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ZED_H, radar_reflectivity_factor_at_horizontal_polarization, dBZ

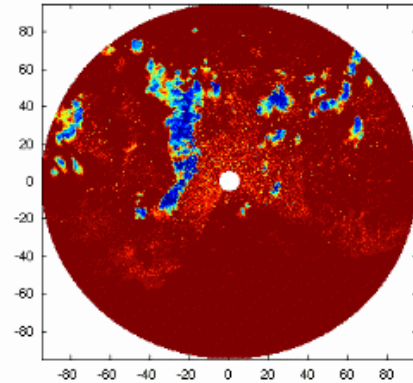


ZDR, differential_reflectivity, dB

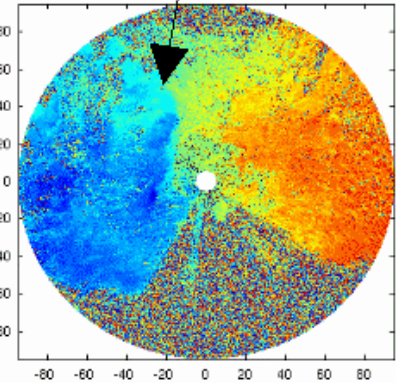


Arc of shear

LDR, linear_depolarization_ratio, dB

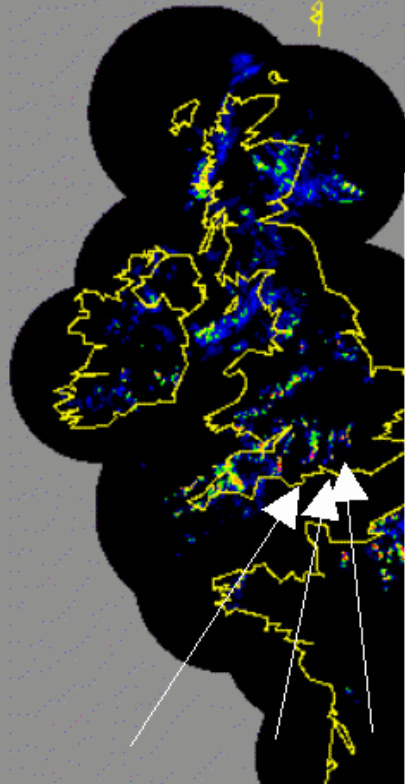


VEL_HV, radial_velocity_away_from_the_radar_at_horizontal_and_vertical_polarizations, m s-1



Cyril Morcrette, University of Reading, October 2004

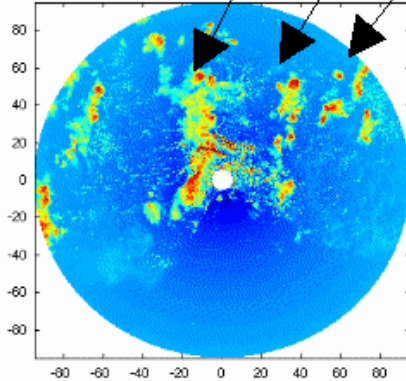
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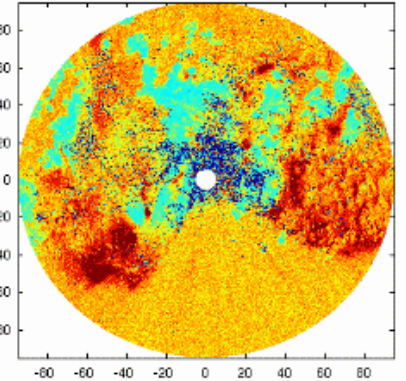
1 2 3

1 2 3

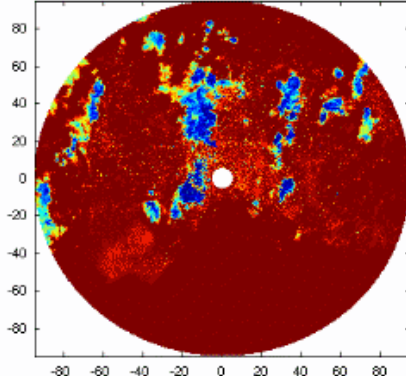
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ZED_H_radar_reflectivity_factor_at_horizontal_polarization, dBZ



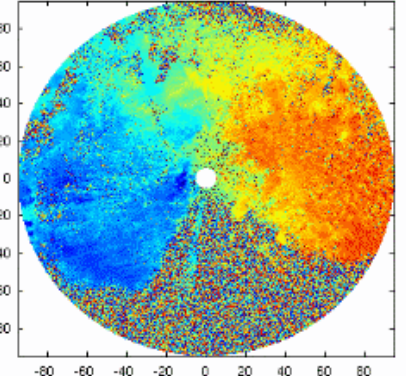
ZDR, differential_reflectivity, dB



LDR, linear_depolarization_ratio, dB



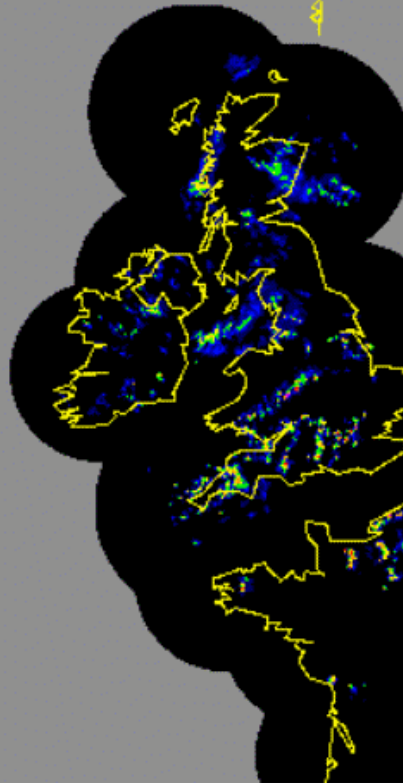
VEL_HV, radial_velocity_away_from_the_radar_at_horizontal_and_vertical_polarizations, m s-1



Cyril Morcrette, University of Reading, October 2004

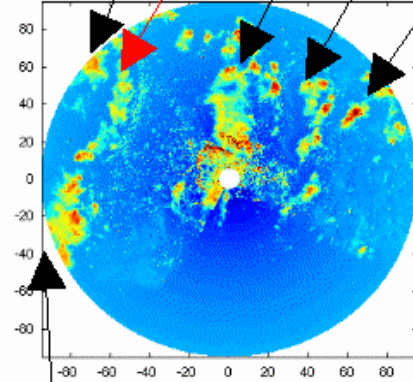
10:30 10/07/2004

Clear-air arc echo

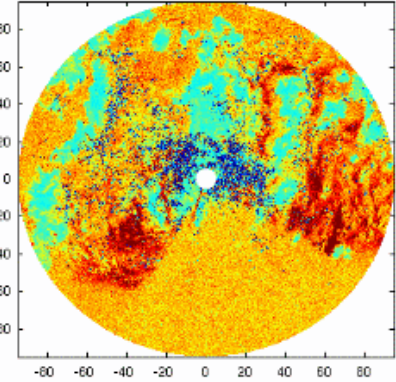


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ZED_H, radar_reflectivity_factor_at_horizontal_polarization, dBZ

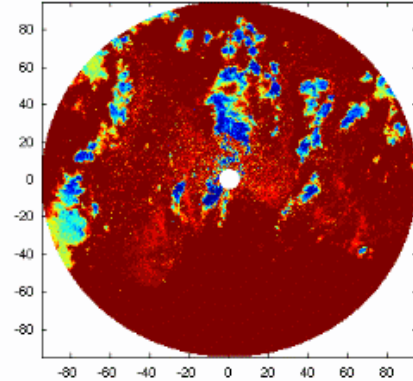


ZDR, differential_reflectivity, dB

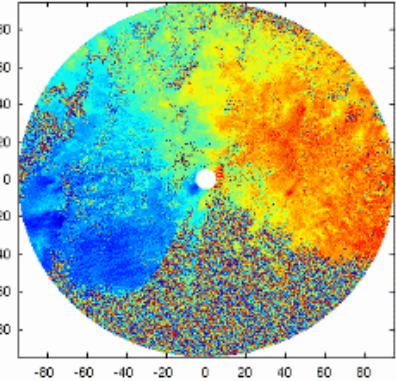


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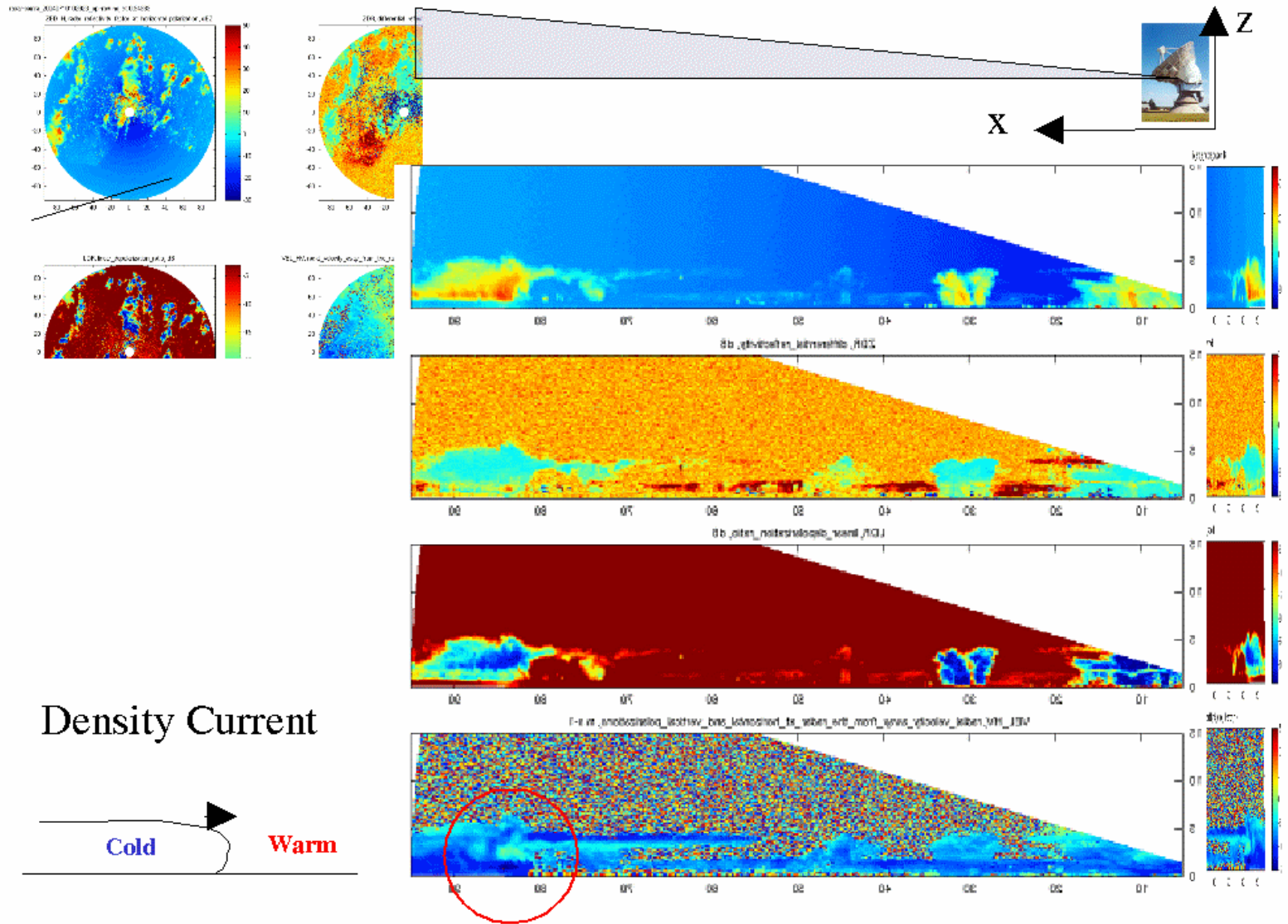
LDR, linear_depolarization_ratio, dB



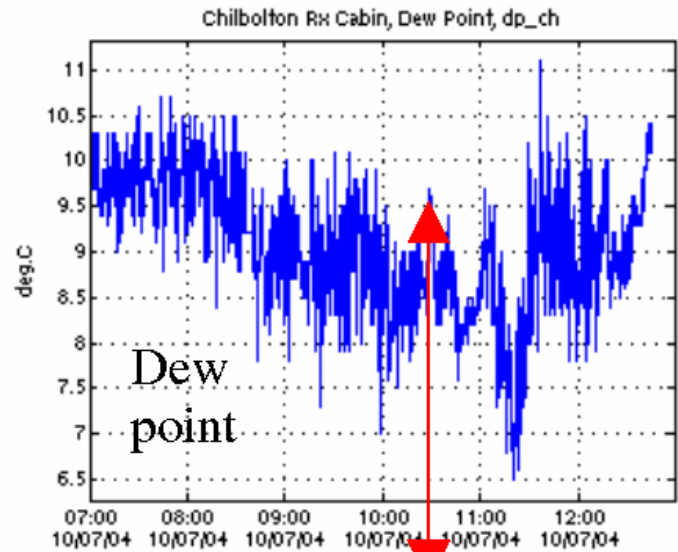
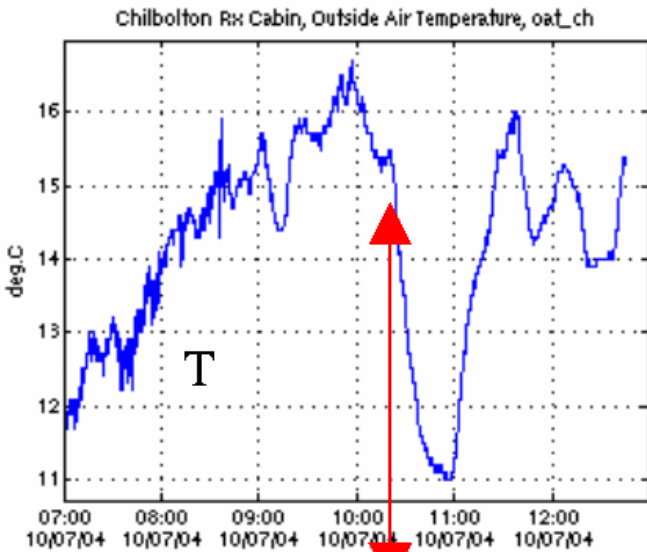
VEL_HV, radial_velocity_away_from_the_radar_at_horizontal_and_vertical_polarizations, m s-1



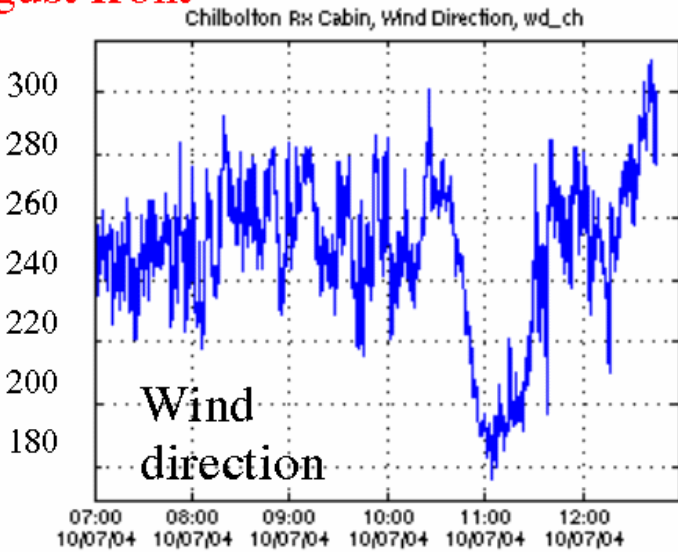
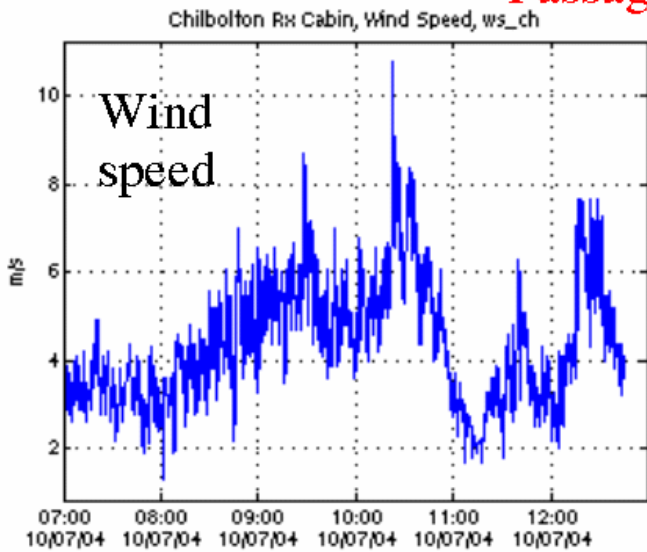
Cyril Morcrette, University of Reading, October 2004



Cyril Morcrette, University of Reading, October 2004

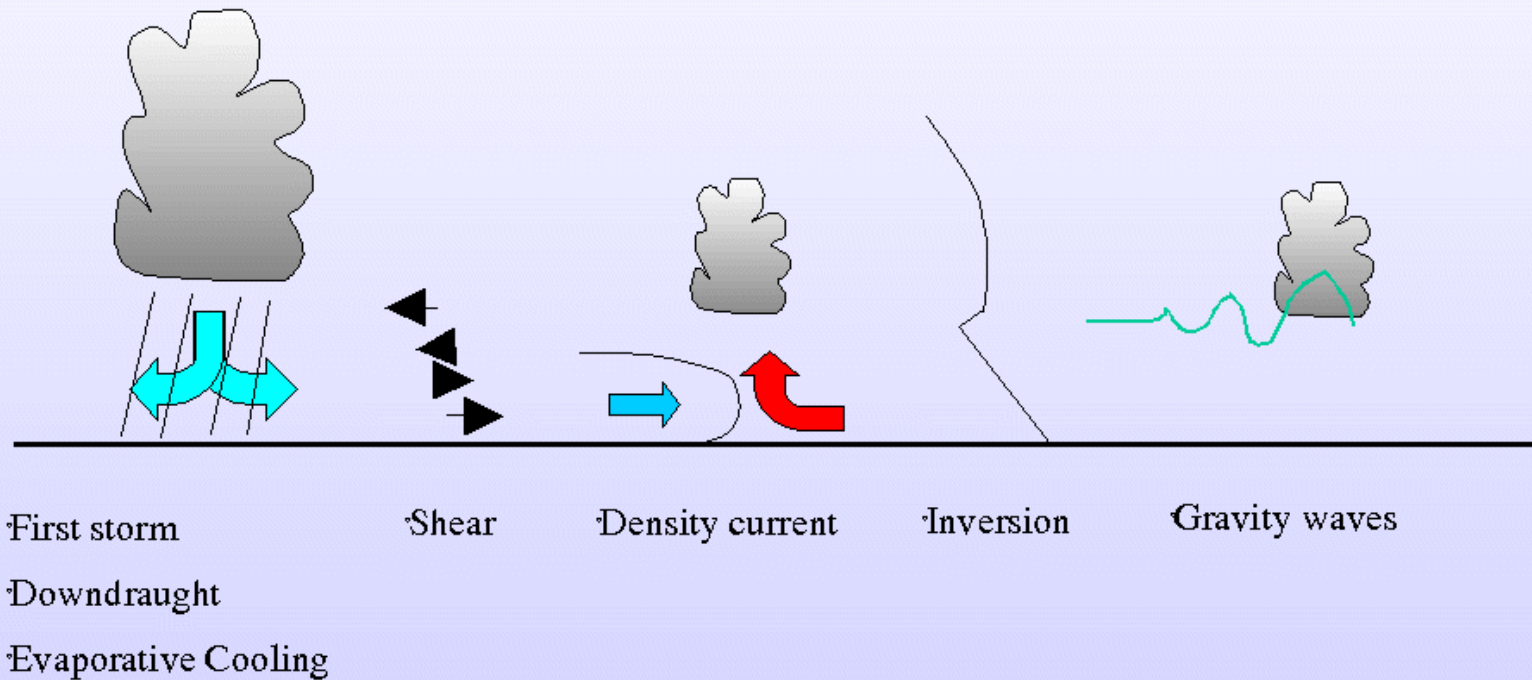


Passage of gust front



Cyril Morcrette, University of Reading, October 2004

Cartoon sketch of possible explanation for events on 10 July 2004

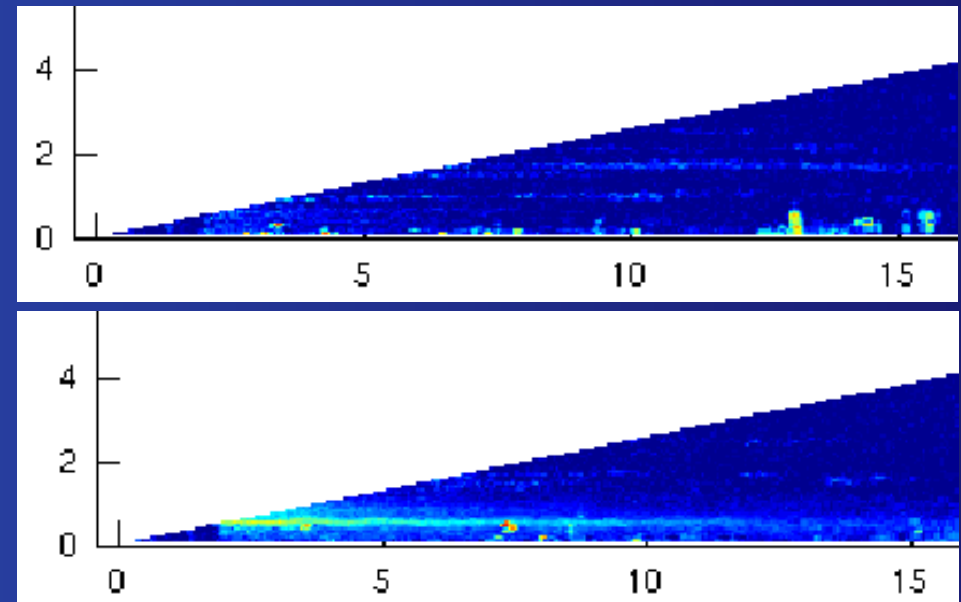
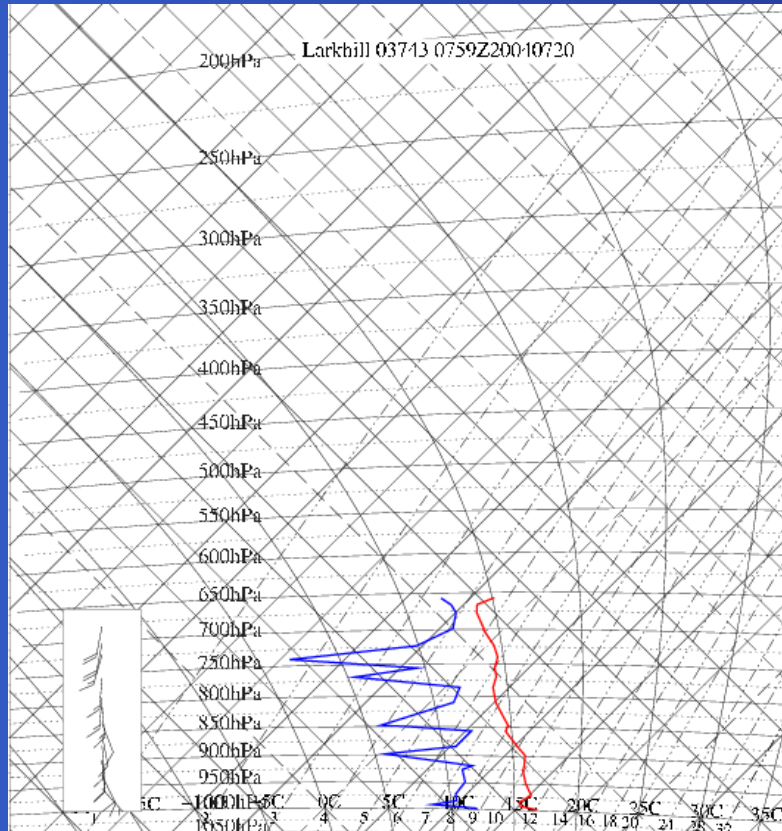


Cyril Morcrette, University of Reading, October 2004

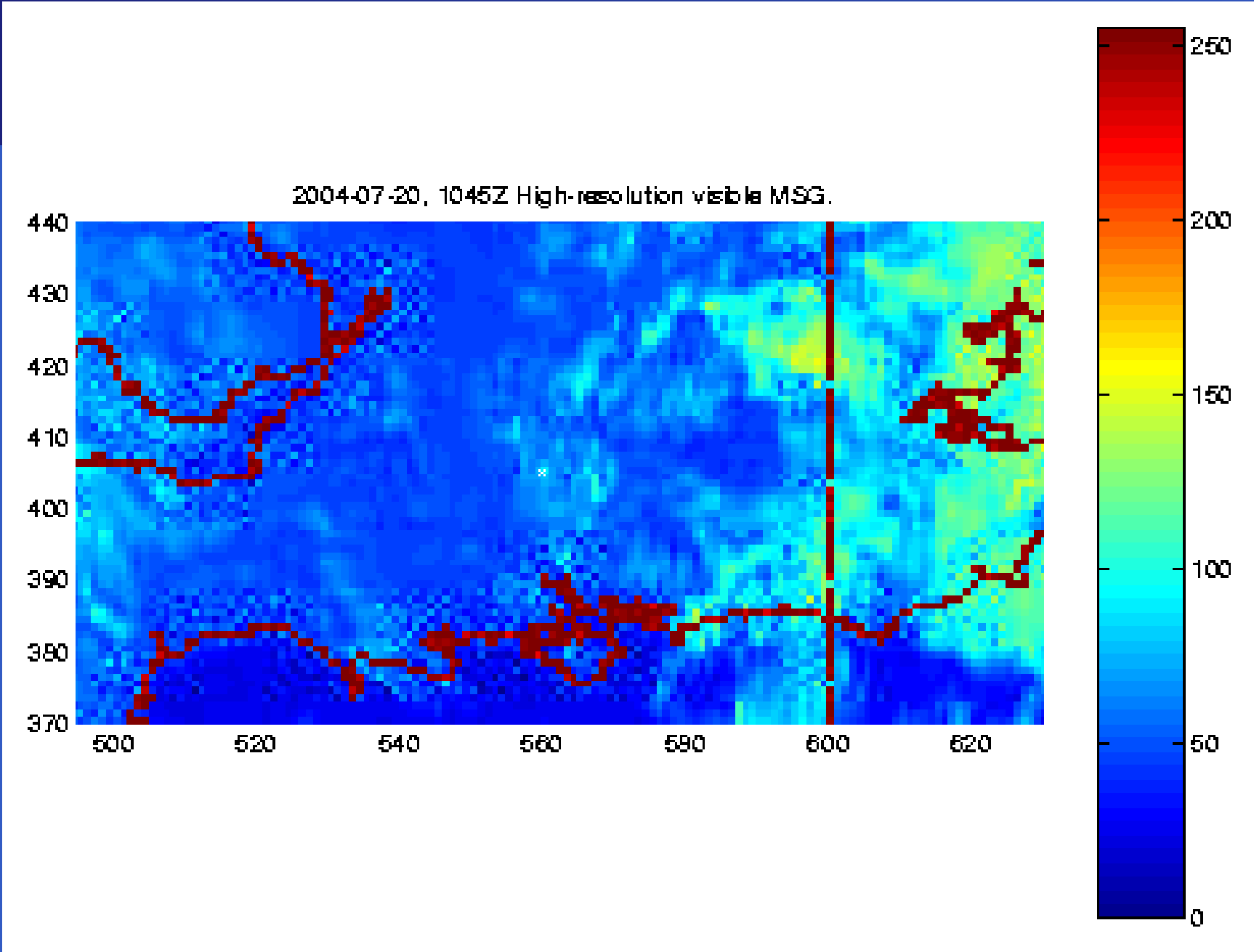


Case 3:
20 July 2004

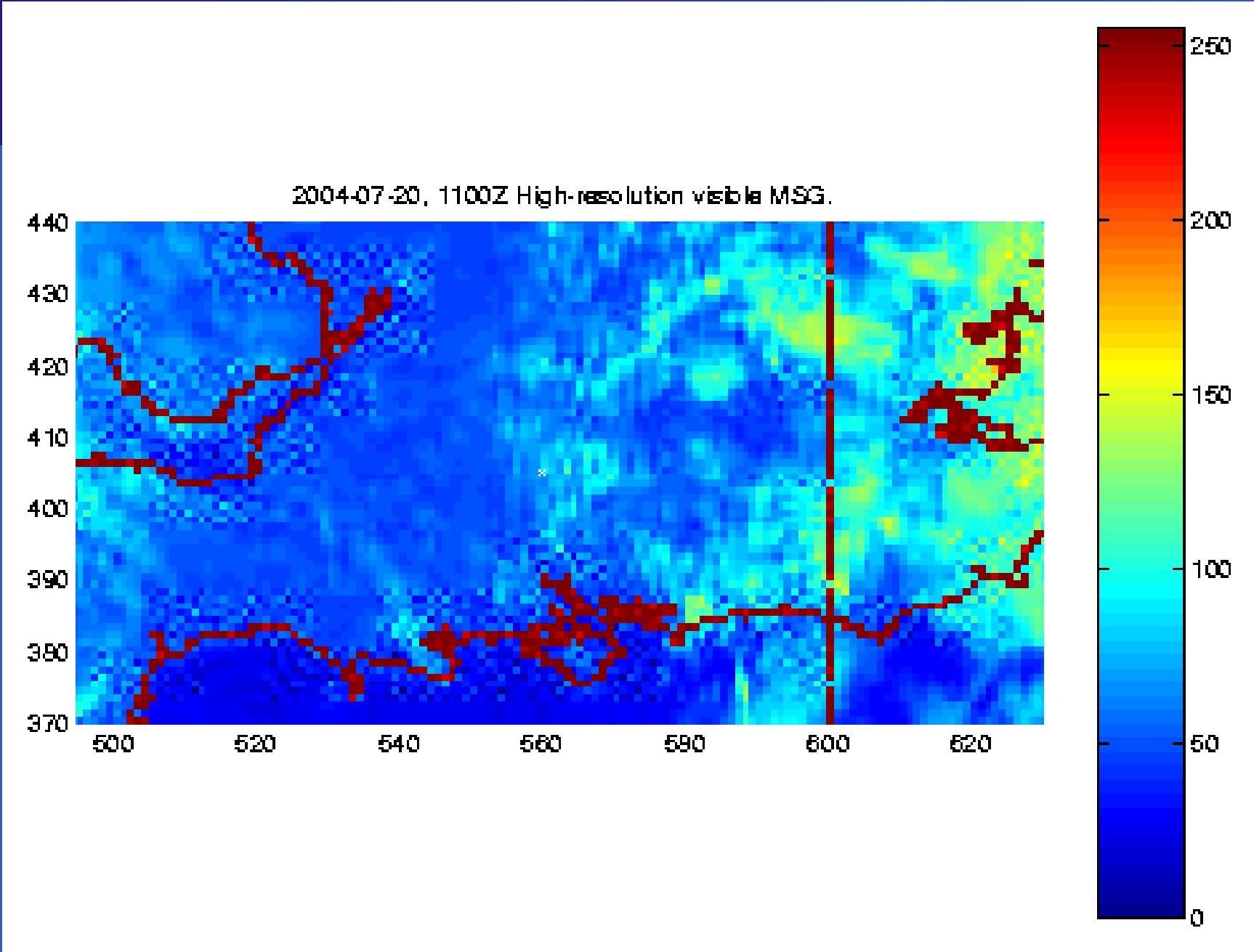
Several lids coincident with decrease in humidity



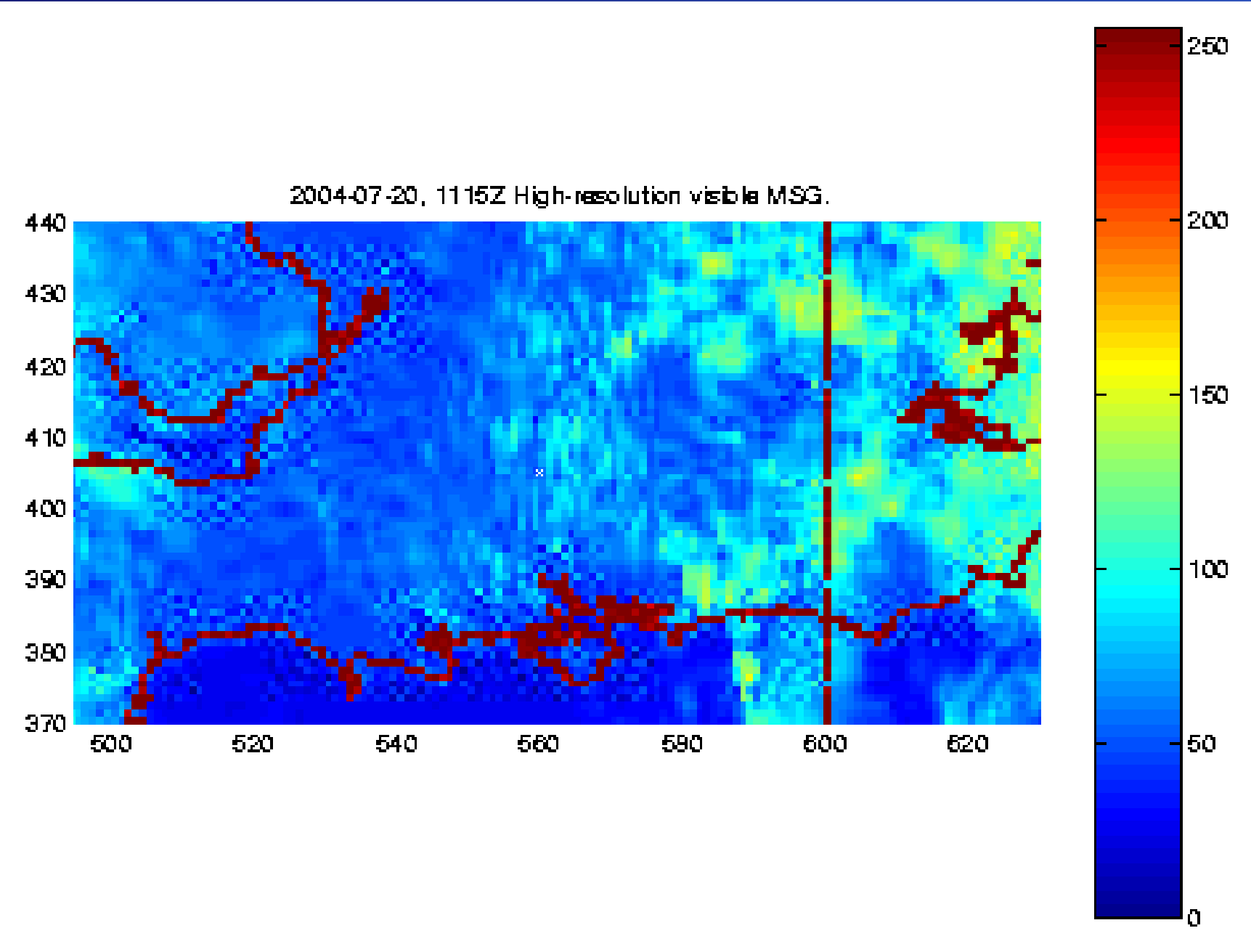
Advancing "wave" of convective initiation from SE - NW



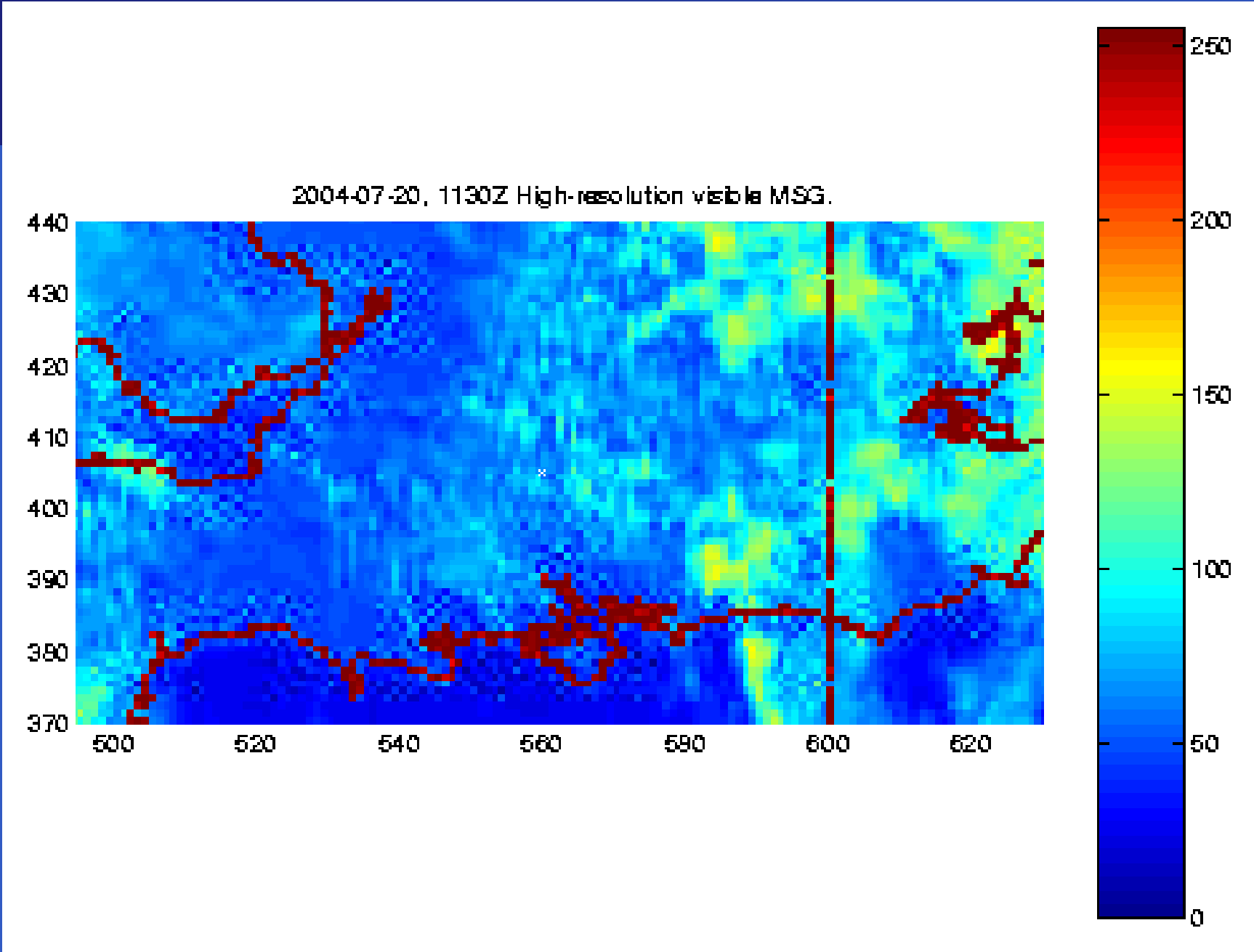
Advancing "wave" of convective initiation from SE - NW



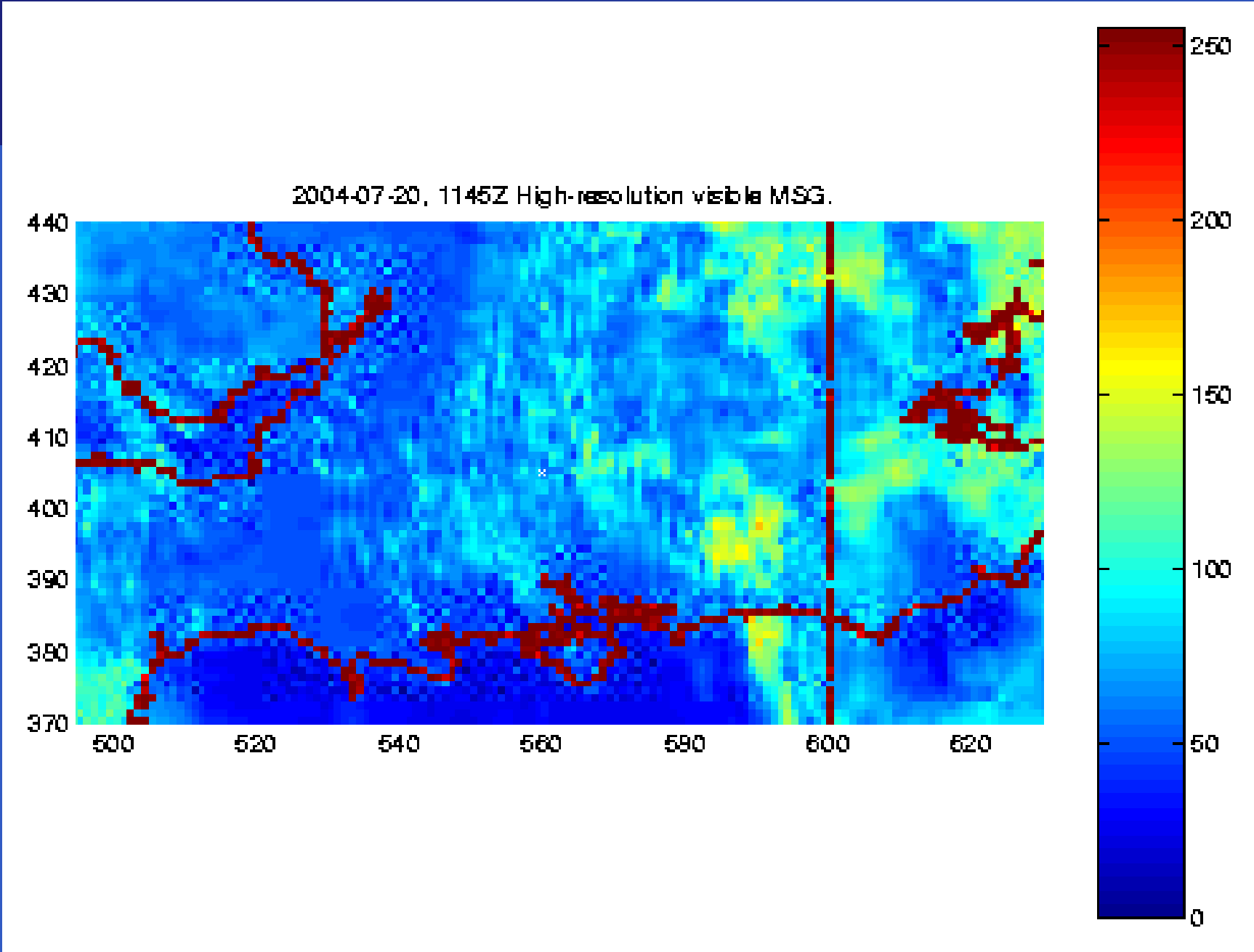
Advancing "wave" of convective initiation from SE - NW



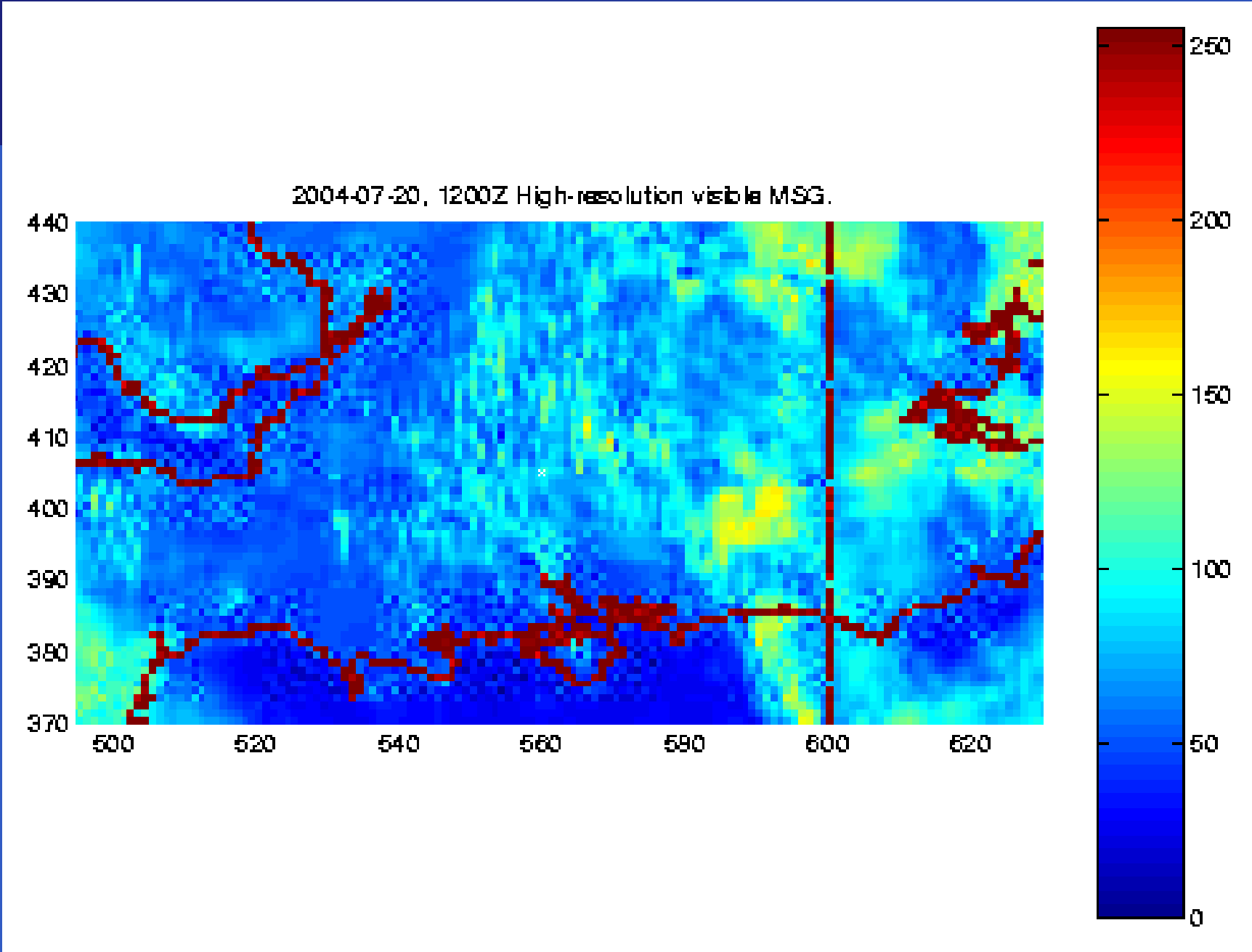
Advancing "wave" of convective initiation from SE - NW



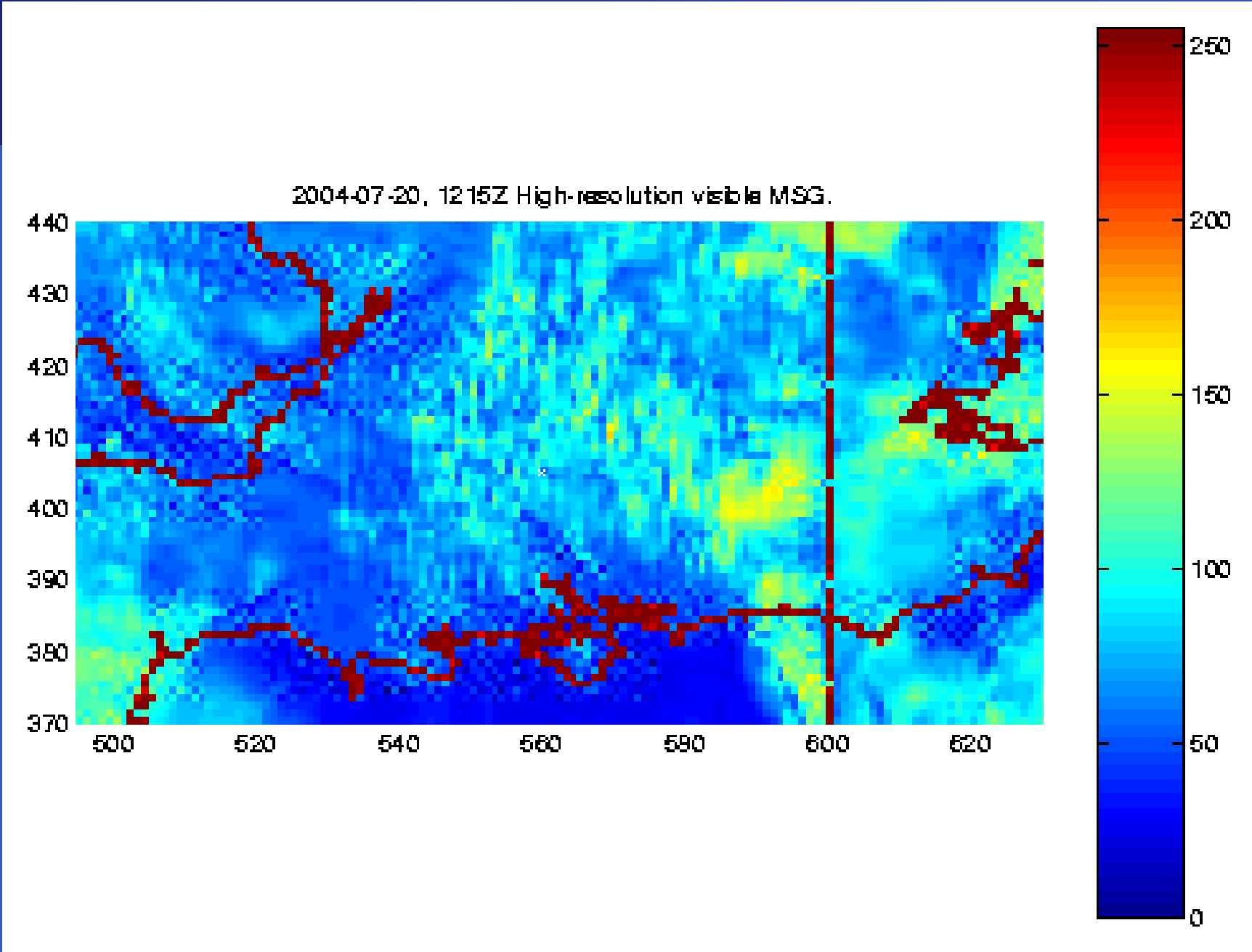
Advancing "wave" of convective initiation from SE - NW



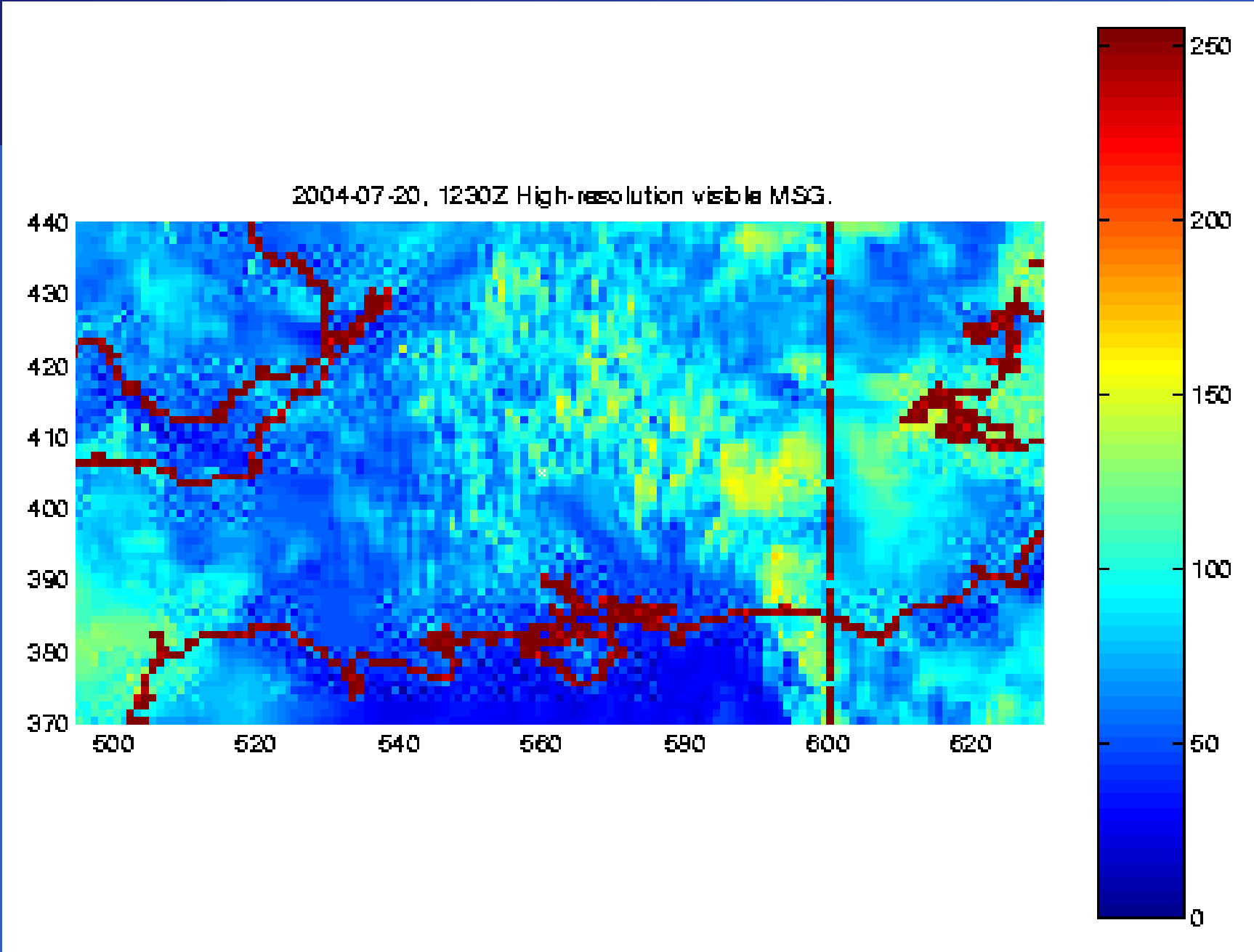
Advancing "wave" of convective initiation from SE - NW



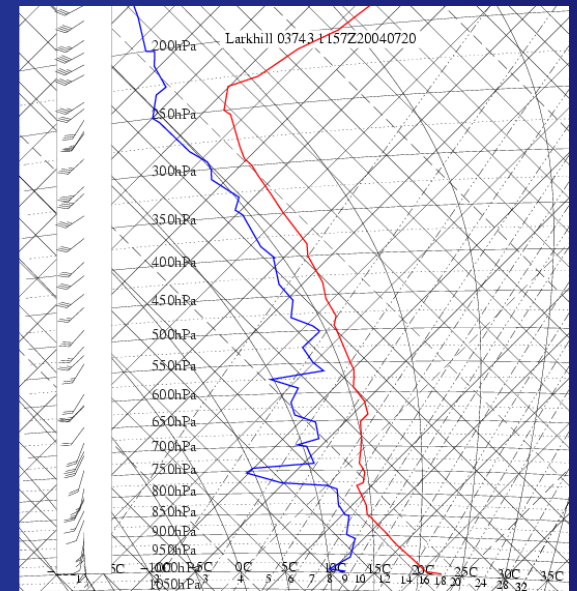
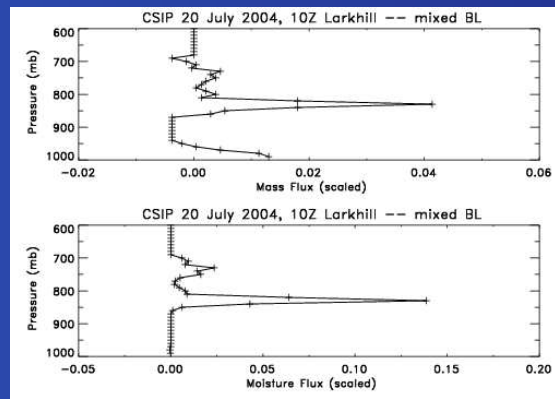
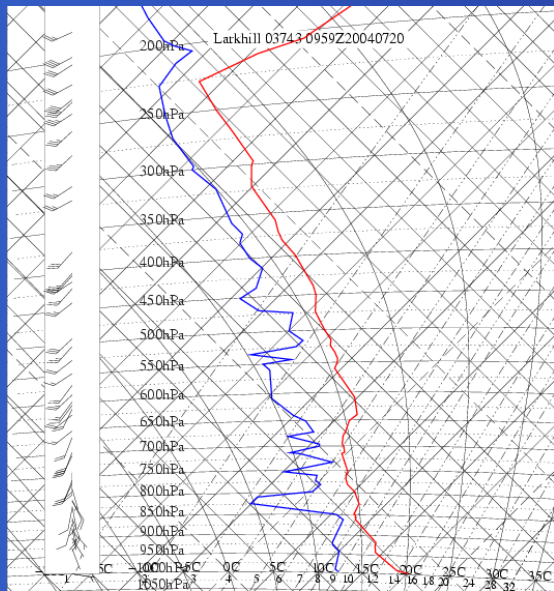
Advancing "wave" of convective initiation from SE - NW



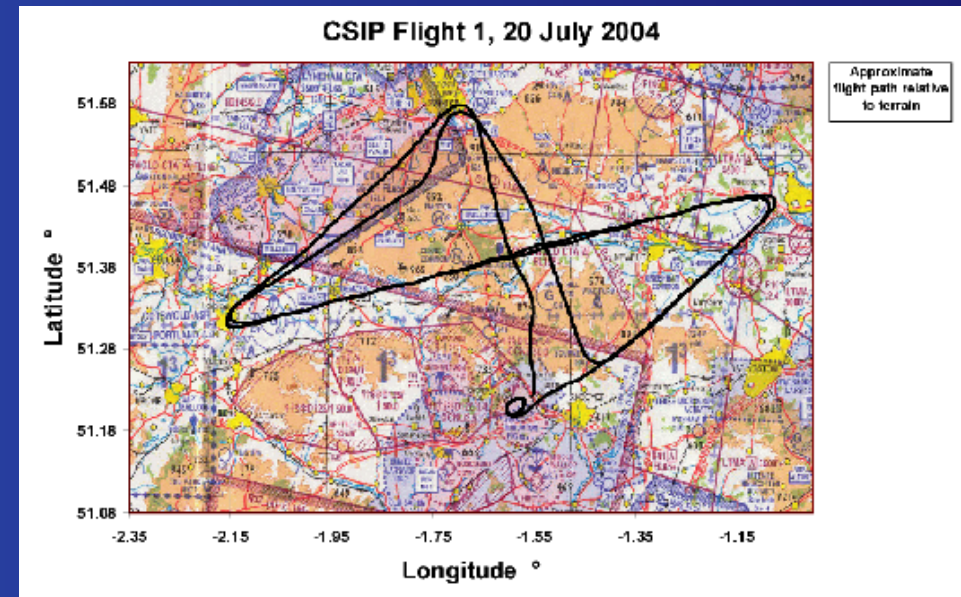
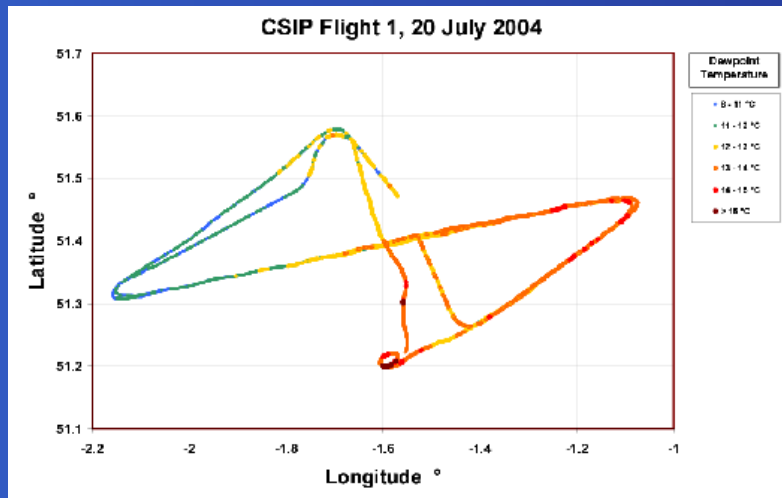
Advancing "wave" of convective initiation from SE - NW



- Initiation of slightly deeper convection (to 3.5 km) occurs because dry layer is lifted and inversion destroyed between 10Z and 12 Z sounding
- This could be a result of strong detrainment from clouds to the SE – consistent with “wave”



Cessna flight



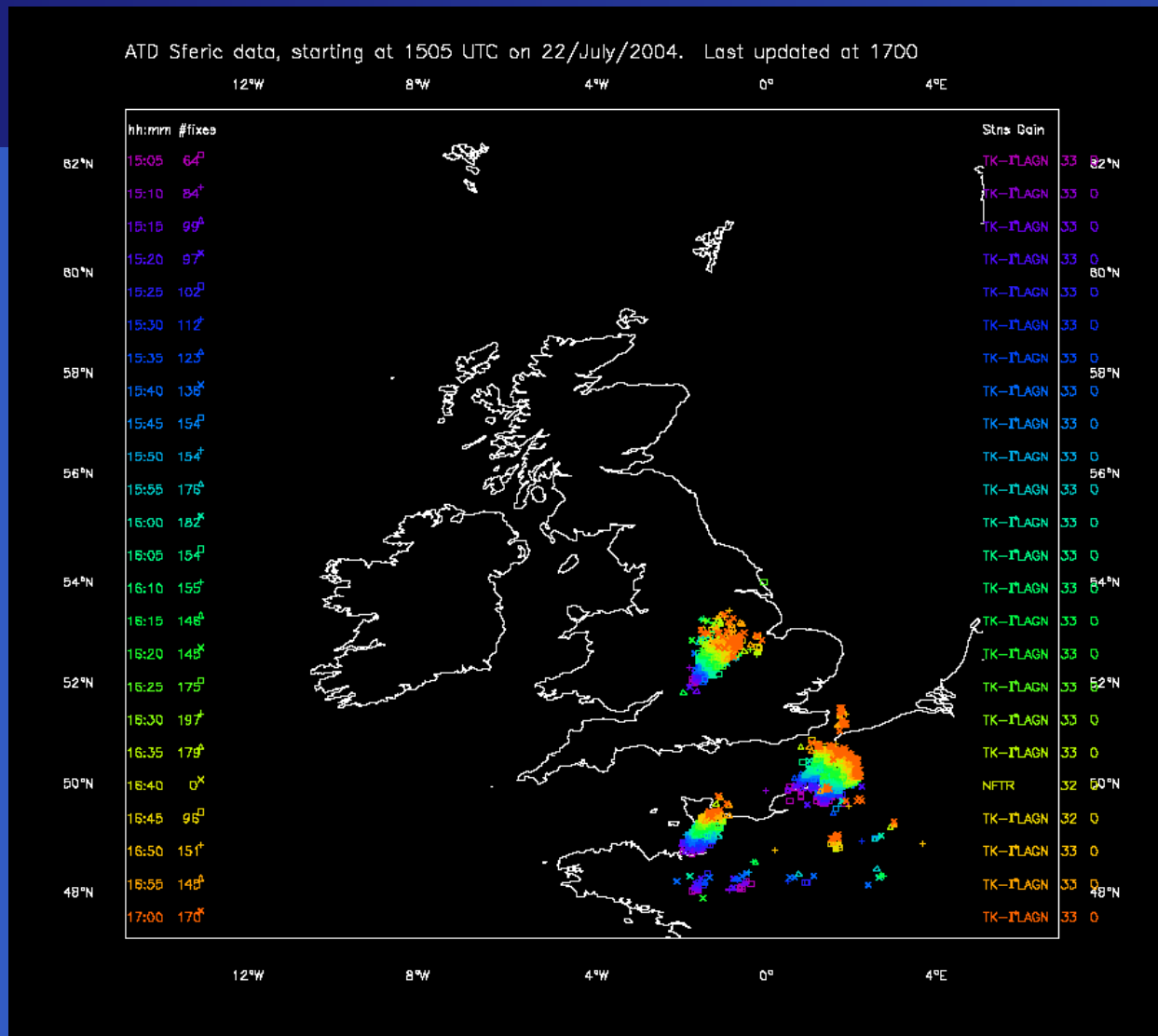
Karl Beswick

Higher dew-point to the east

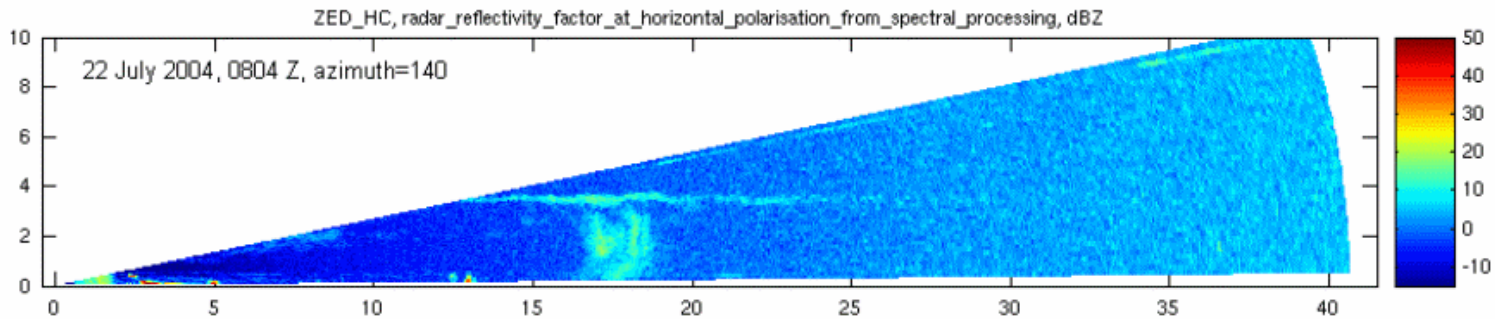


Case 4:
22 July 2004

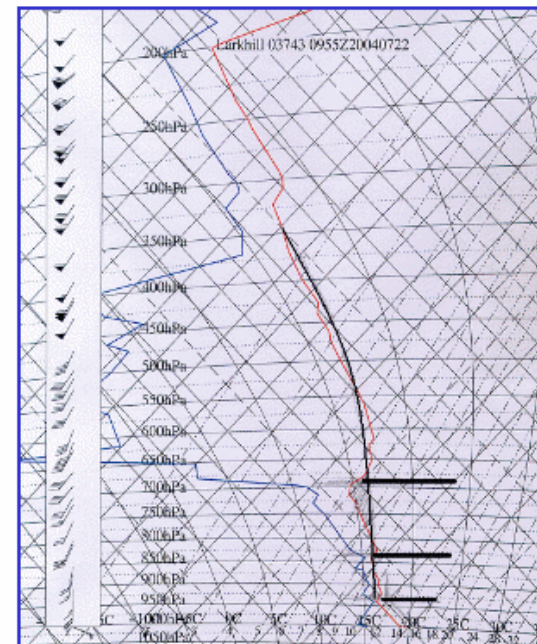
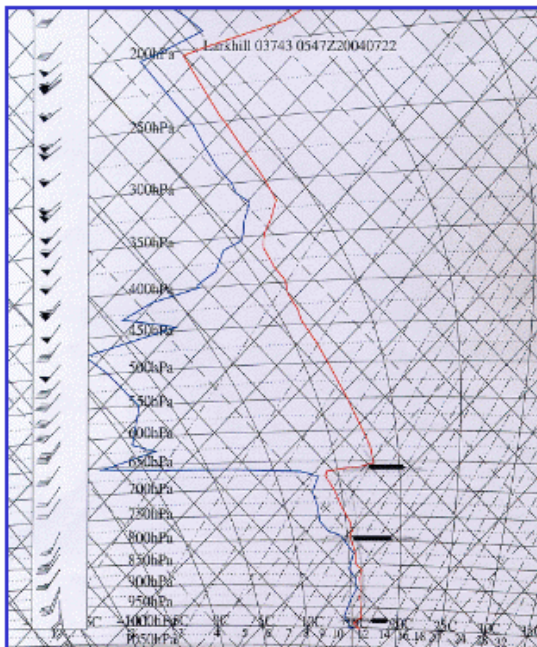
Location of lightning strikes



Major storm developed at the end of a convergence line – formation of line observed west of Chilbolton



Stable lid caps
convection at ~4km



Storm develops as
lid is reduced

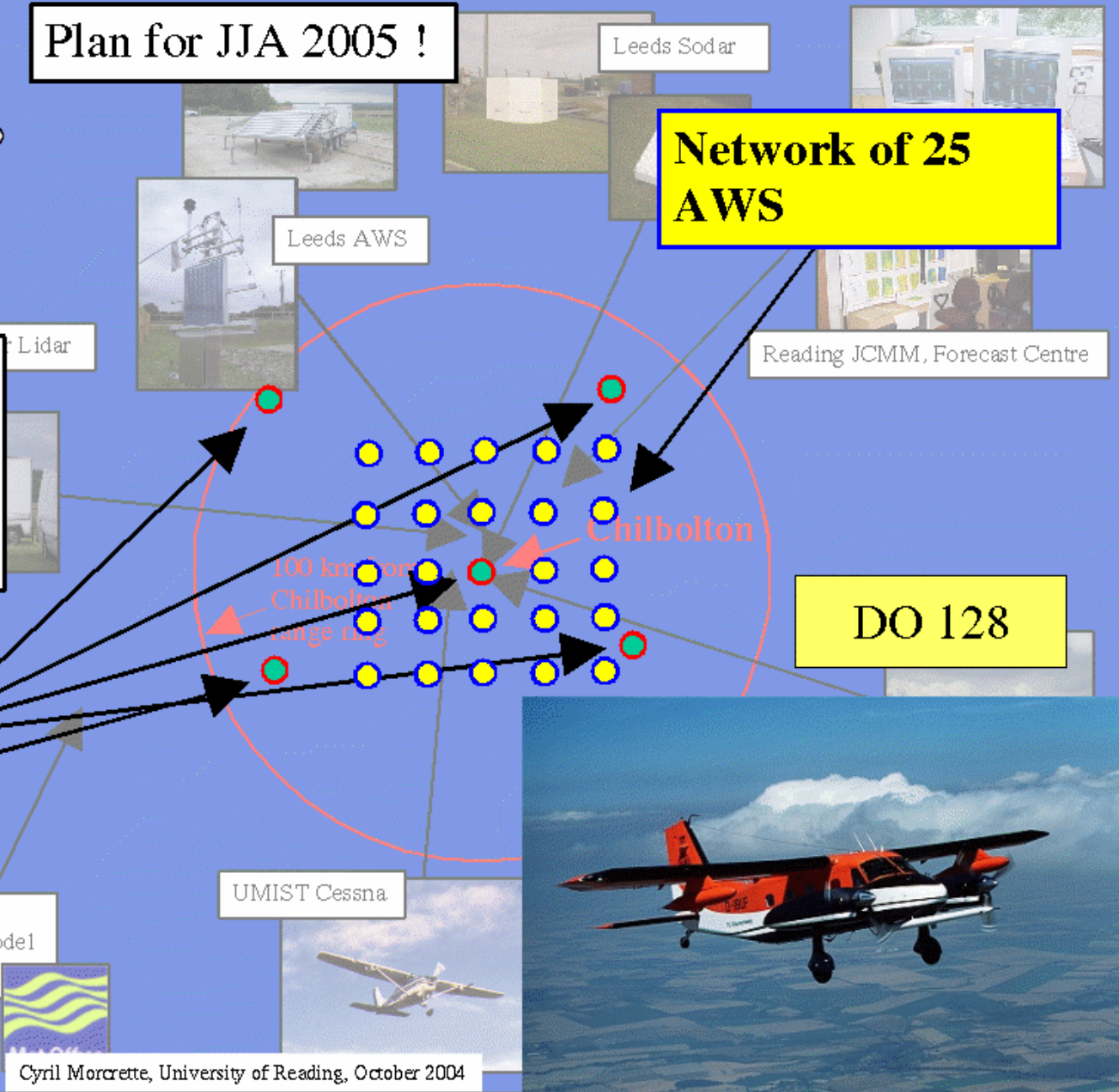
Cyril Morcrette, University of Reading, October 2004



Plan for JJA 2005 !

Network of 25 AWS

5 extra radiosonde launching stations



Cyril Morcrette, University of Reading, October 2004