C-Pol and Lightning Data

Peter May and Hartmut Hoeller

BMRC DLR

Polarimetric radar

Type of weather radar

Change polarisation between pulses:

Measures: Reflectivity
Differential Reflectivity - oblateness
Correlation between signals - mixed phase
Differential phase on propagation -
attenuation
rain rates

Applications – QPE, Hydrology, Storm microphysics

BMRC
Bureau of Meteorology
Research Centre

Scan Strategy every 10 minutes

1) Long range low elevation scan
2) 17 tilt Volume scan up to 45^{o}, range 150 km
3) RHI Scan over ARCS, Profiler sites (high vertical resolution)
4) Vertical mode

From 2 derive:

Gridded reflectivity and microphysical type product

Rainfall maps

Data Sets

"raw data" – Z, Z_{DR}, Φ_{DP}, $\rho_{HV}(0)$, V, σ, $[K_{DP}]$

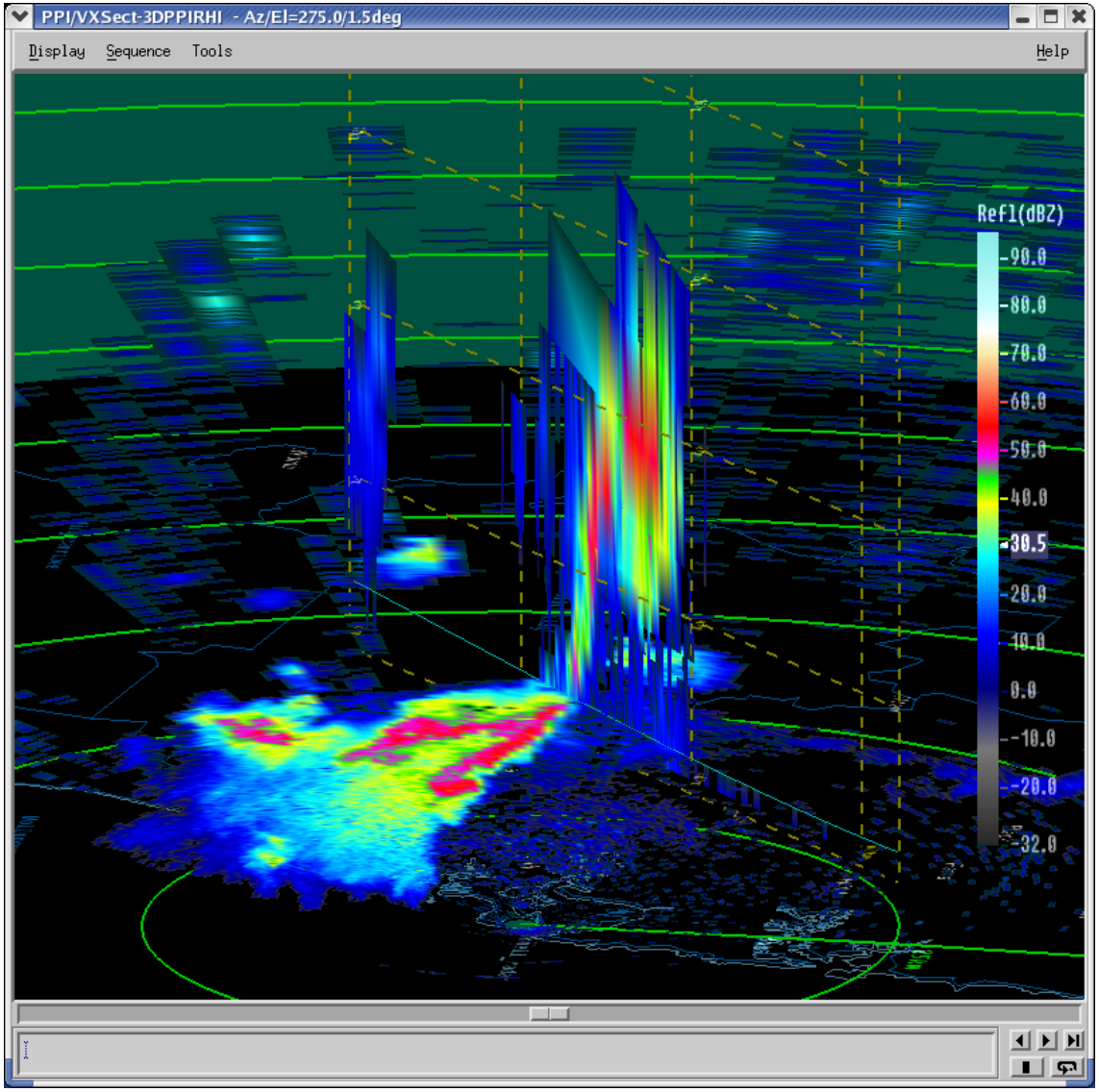
- 300 m resolution
- Aliasing issues – high speeds and special case for high rainfall

Volumes and vertical scan available on request

Gridded data sets

- 2.5 km horizontal grid, Z, microphysical type
- Available, being reprocessed at present
- Rainfall (10 min, hourly)

New: Area statistics



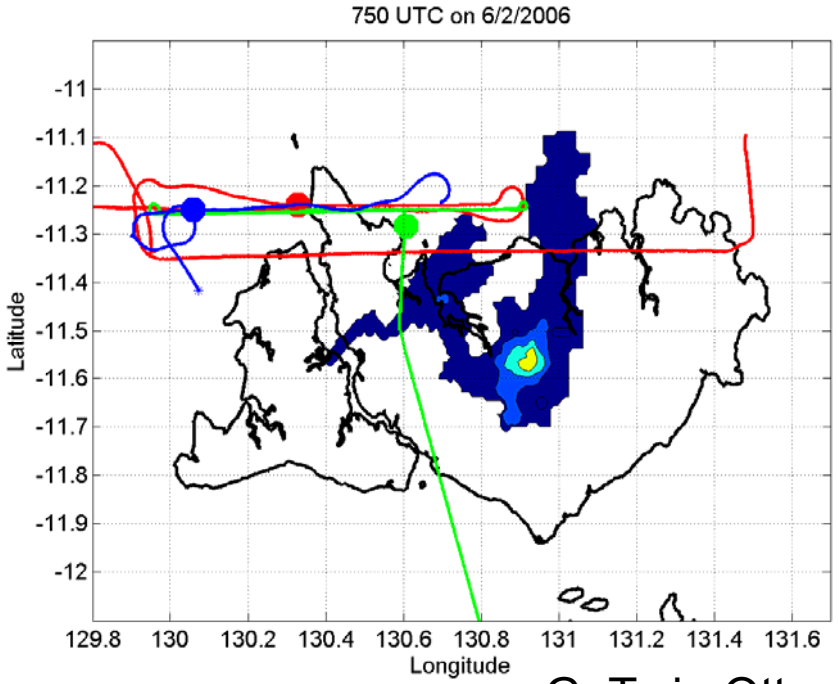
Visualisation

3DRAPIC

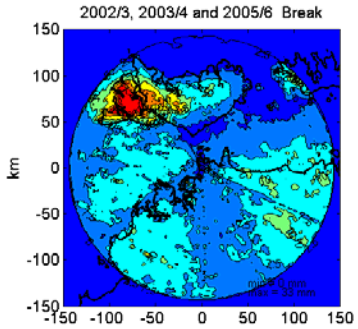
OVERLAYS INCLUDING AIRCRAFT LOCATIONS, TRACKS, Z, v_r, VIL, Rainrate

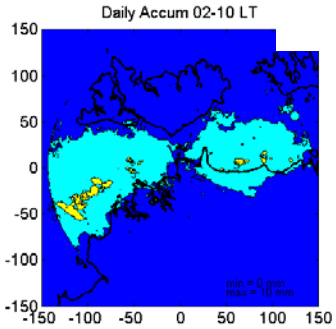
Applications 1: rain estimation

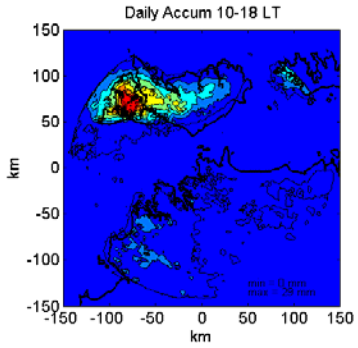
Rain maps (with overlay of aircraft tracks)

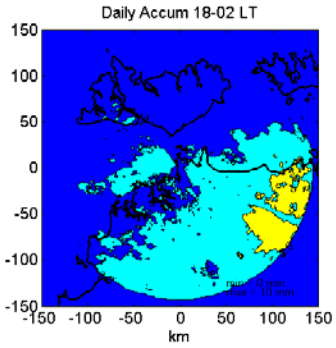


G: Twin Otter
B: Proteus
R:Egrett



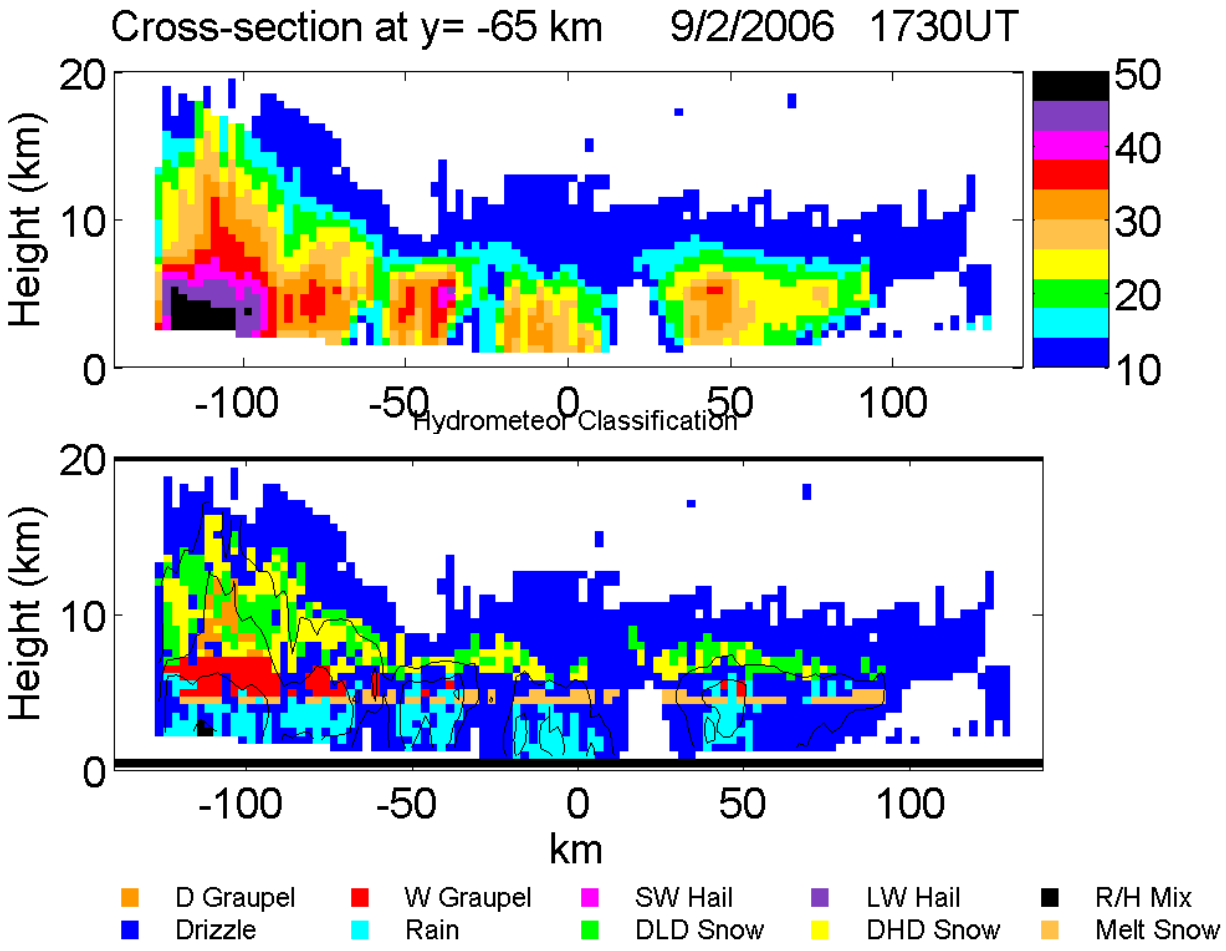






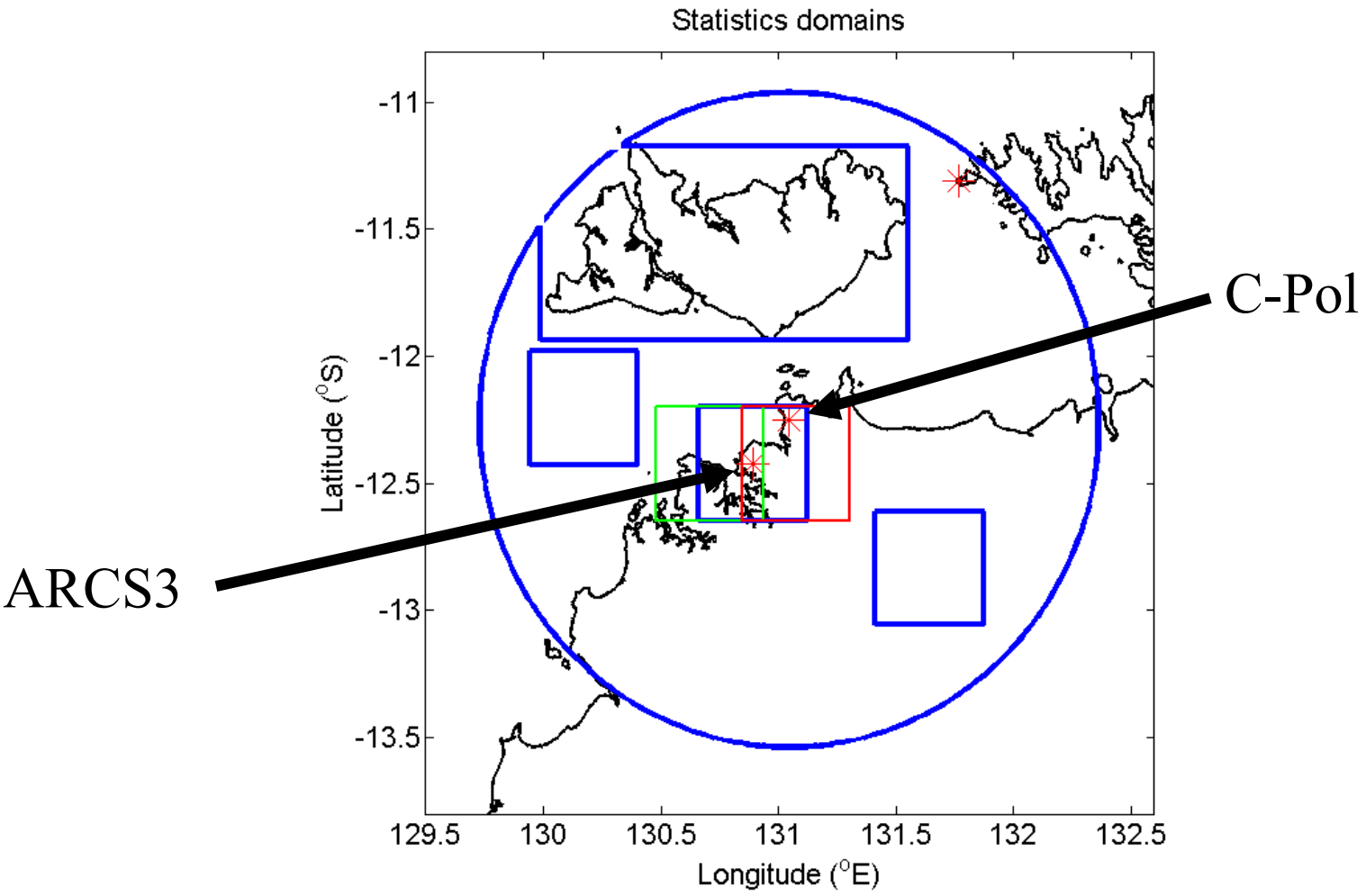
Seasonal and diurnal variations
This is for the break and build up periods.

Cross-section of gridded microphysical data

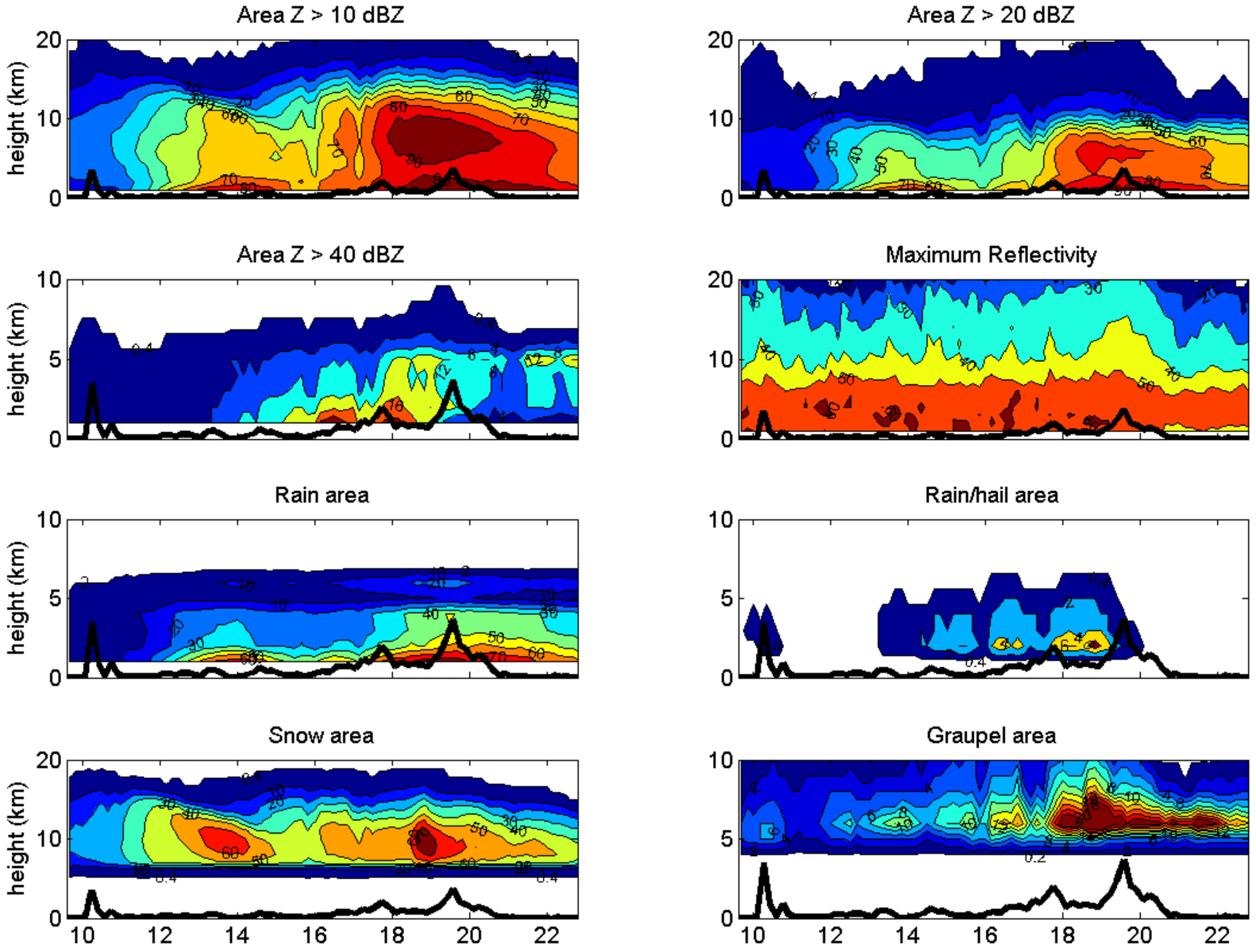


New Products – Statistical summaries for regions

Taking grids and calculating areal statistics as a function of height and time, e.g. area Z > 10 dBZ, snow area etc
Metrics of cloud cover, convective activity …

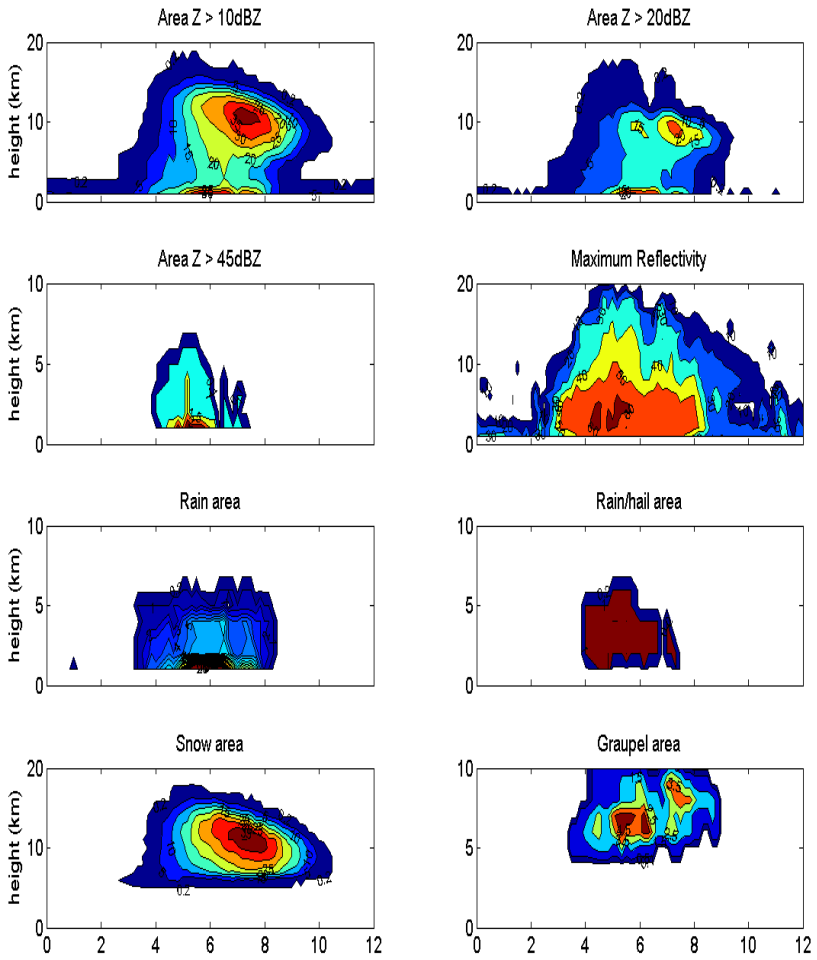


Example MCS – has been reprocessed because of impact of short soundings



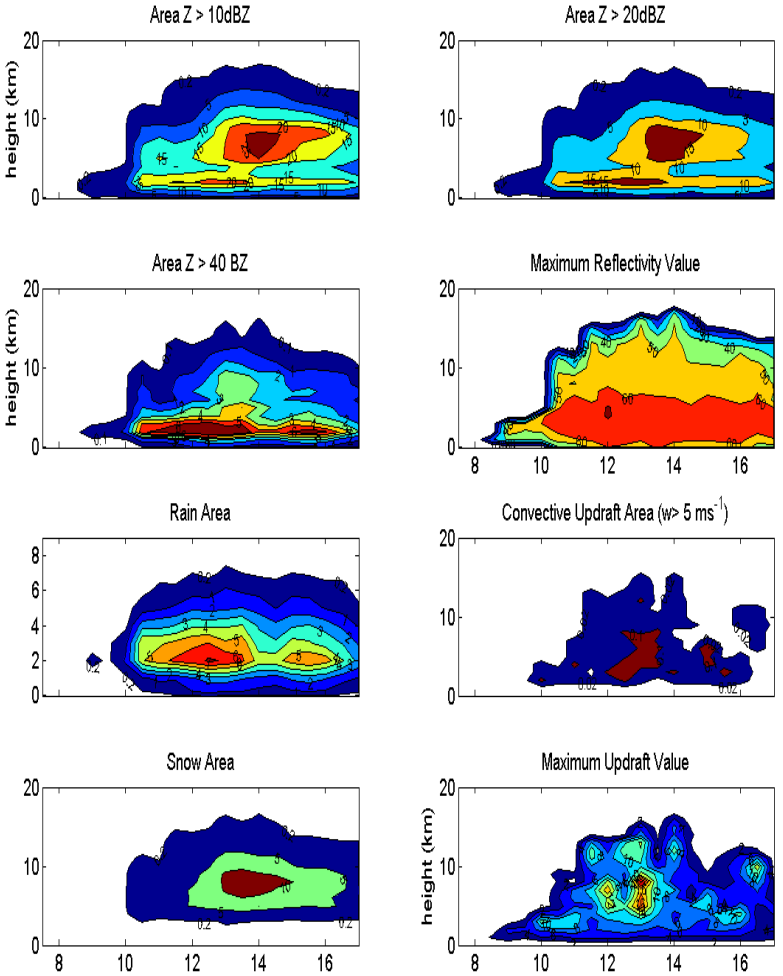
Applications 5: Model validation

Observations over Tiwi Is Nov 30, 2005



Time UTC

Todd Lane CRM of Hector



Local Time (UTC+9.5)

Lightning data from DLR Network

Cases available from Hartmut Hoeller

Location (3D)
Cloud-ground or cloud-cloud
Polarity
Current

Plans for availability?

Proxy for intensity, updraft strength

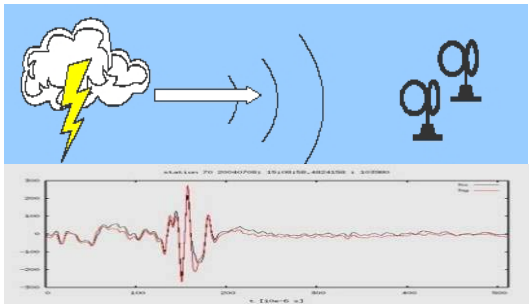
The LINET system

Installation at Araraquara/Brazil

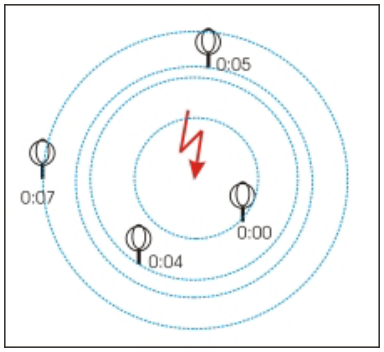
- LINET is a 6 station network for VLF/LF lightning detection
  - magnetic antenna
  - GPS antenna
  - PC for data recording
  - real time operation
- constructed by LMU, Sferics Research Group, Betz et al.
- Operation and data evaluation cooperation DLR - LMU
- since 2003 operational in S-Germany
- in 2005 deployed for field experiments

LINET System Characteristics

– Measurement of magnetic field
  - no dead time
  - no signals rejected

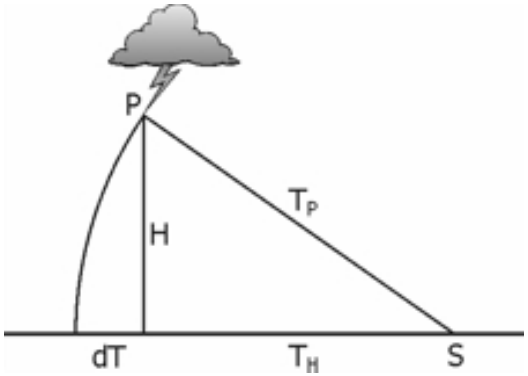


– TOA Method for lightning location



IC - CG discrimination

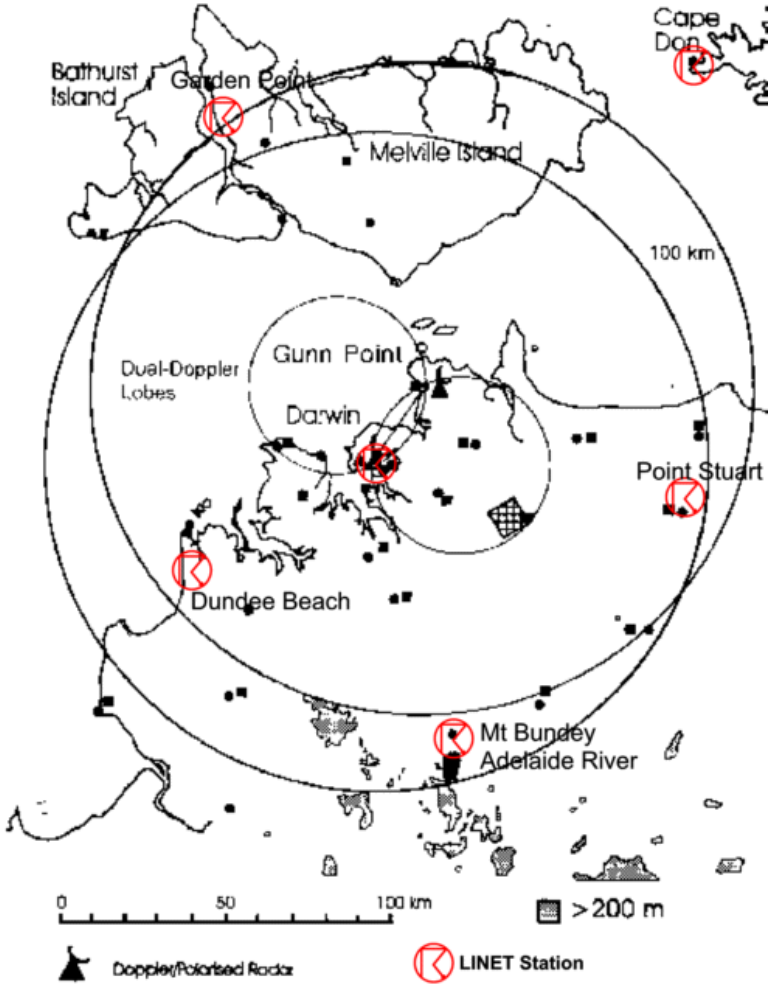
– Height of IC events



Network Configuration Nov 05 - Feb 06

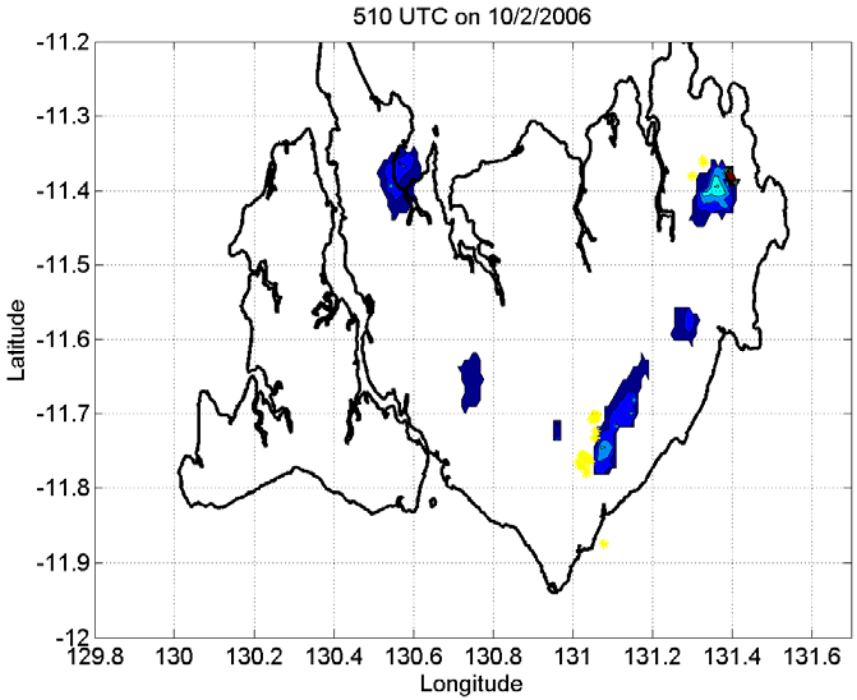
BoM C-POL and Berrimah radar

DLR LINET lightning detection



C-POL and LINET sites
SCOUT-O3 in Australia 2005

- C-POL at Gunn Point
- LINET station at Darwin


510 UTC on 10/2/2006
Latitude
Longitude
-11.2
-11.3
-11.4
-11.5
-11.6
-11.7
-11.8
-11.9
-12
129.8
130
130.2
130.4
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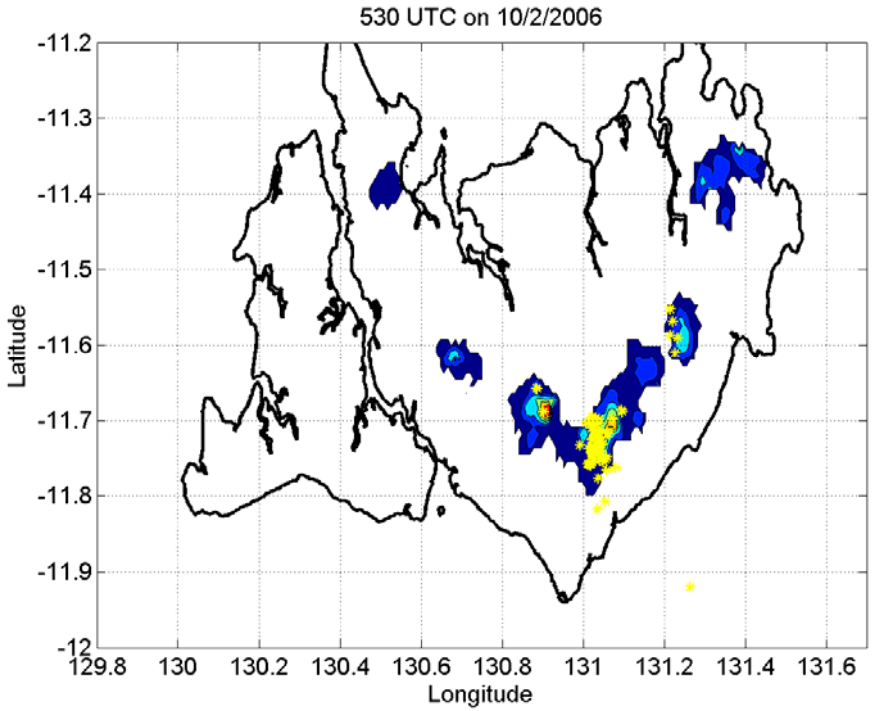
130.8
131
131.2
131.4
131.6


530 UTC on 10/2/2006
Latitude
Longitude
-11.2
-11.3
-11.4
-11.5
-11.6
-11.7
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-11.9
-12
129.8
130
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130.8
131
131.2
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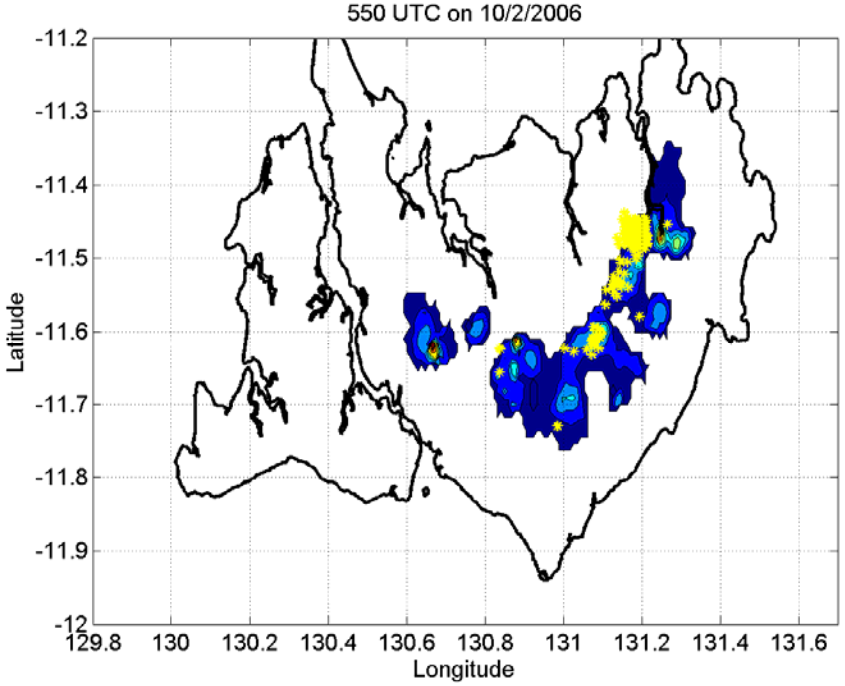
550 UTC on 10/2/2006
Latitude
Longitude
-11.2
-11.3
-11.4
-11.5
-11.6
-11.7
-11.8
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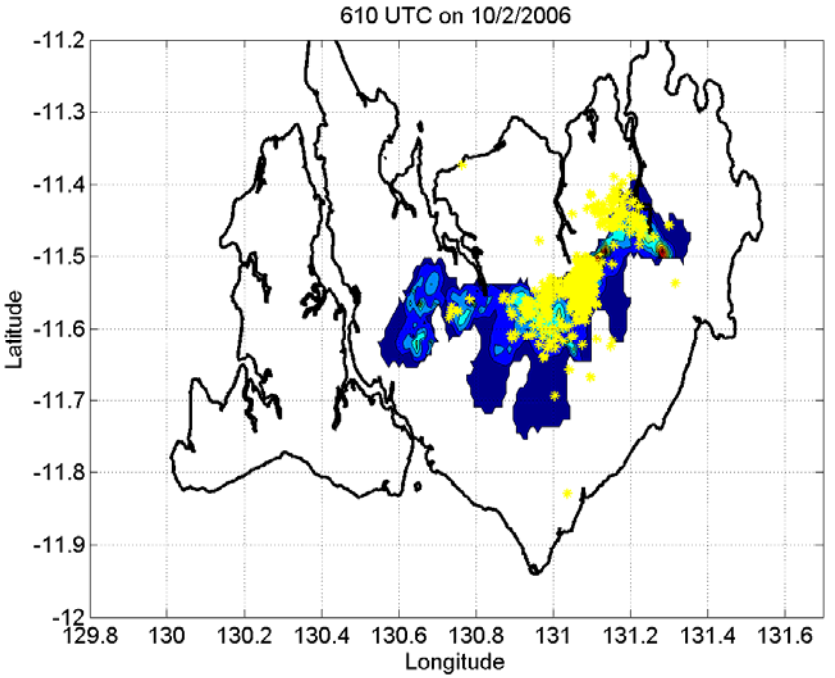
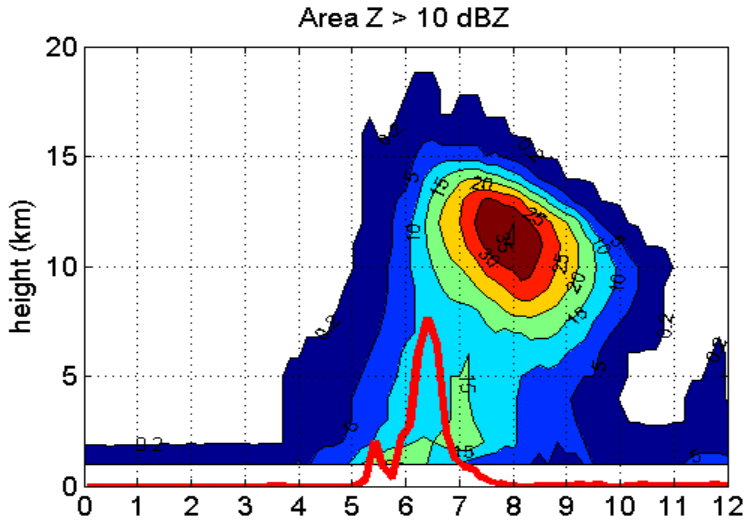
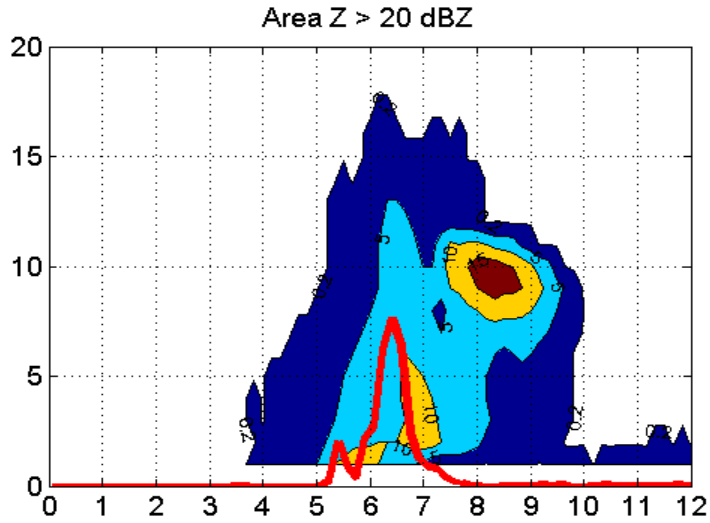
131.4
131.6

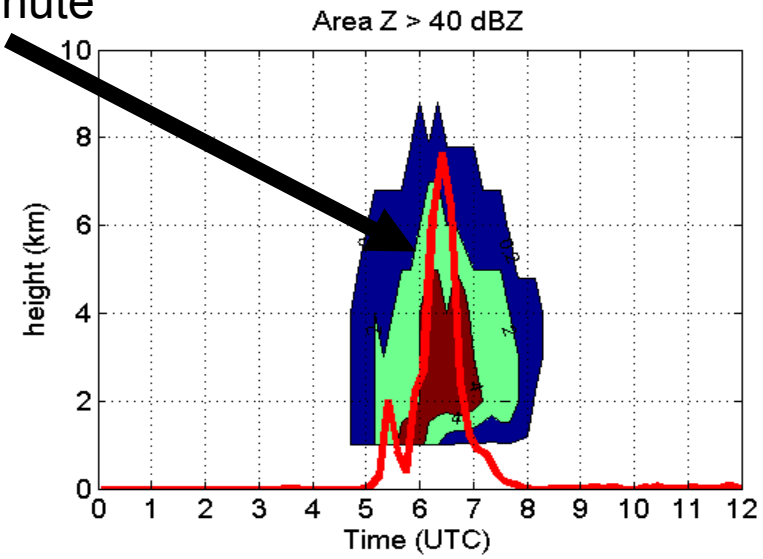

610 UTC on 10/2/2006
Latitude
Longitude
-11.2
-11.3
-11.4
-11.5
-11.6
-11.7
-11.8
-11.9
-12
129.8
130
130.2
130.4
130.6
130.8
131
131.2
131.4
131.6

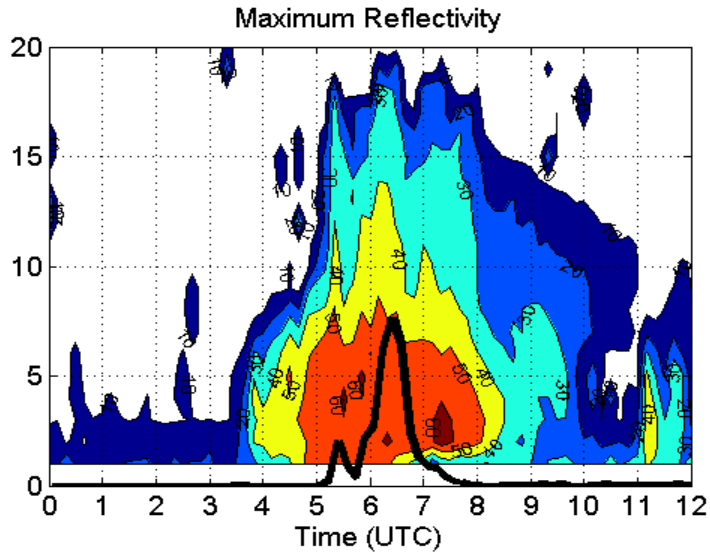
Time series of fractional coverage and lightning





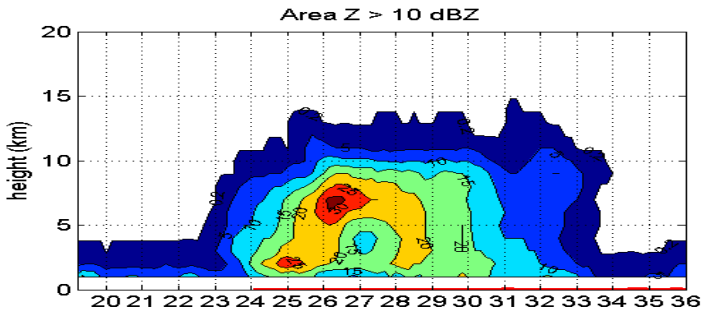
#strokes per minute

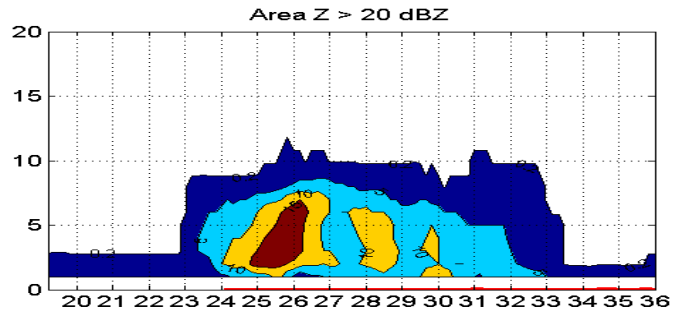


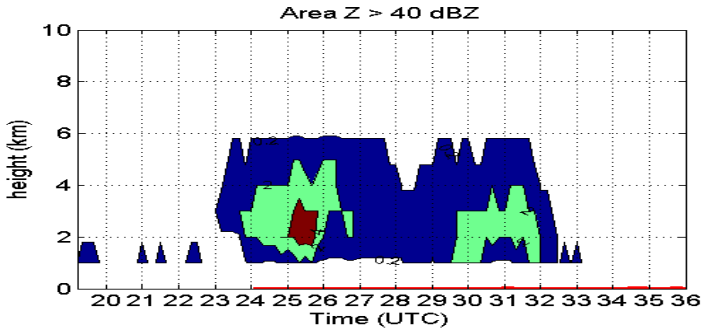


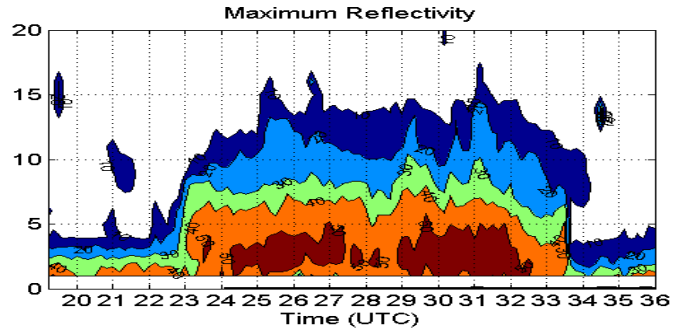
(multiply by 10 for strokes rate/min so max is about 78 flashes/minute for 10 min average

Monsoon

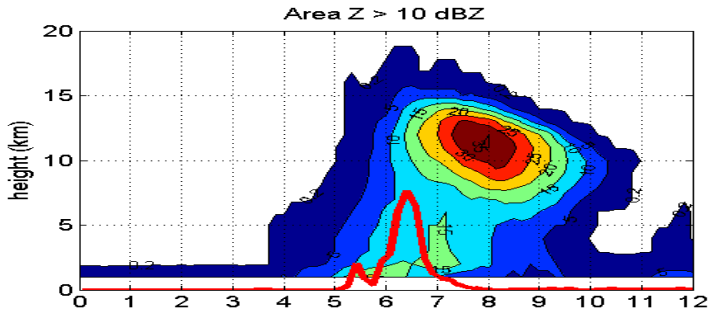


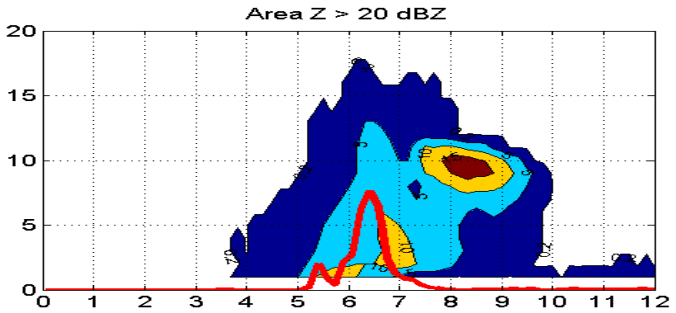


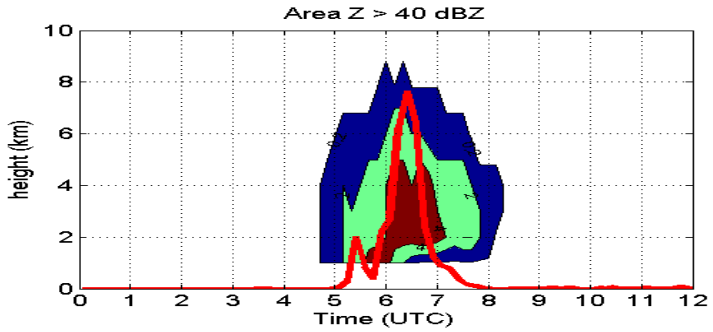


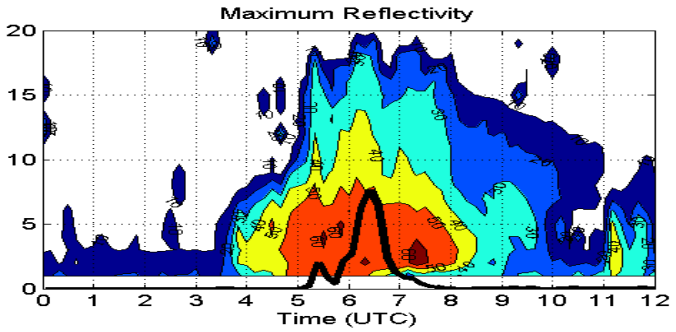


Break
"Hector"

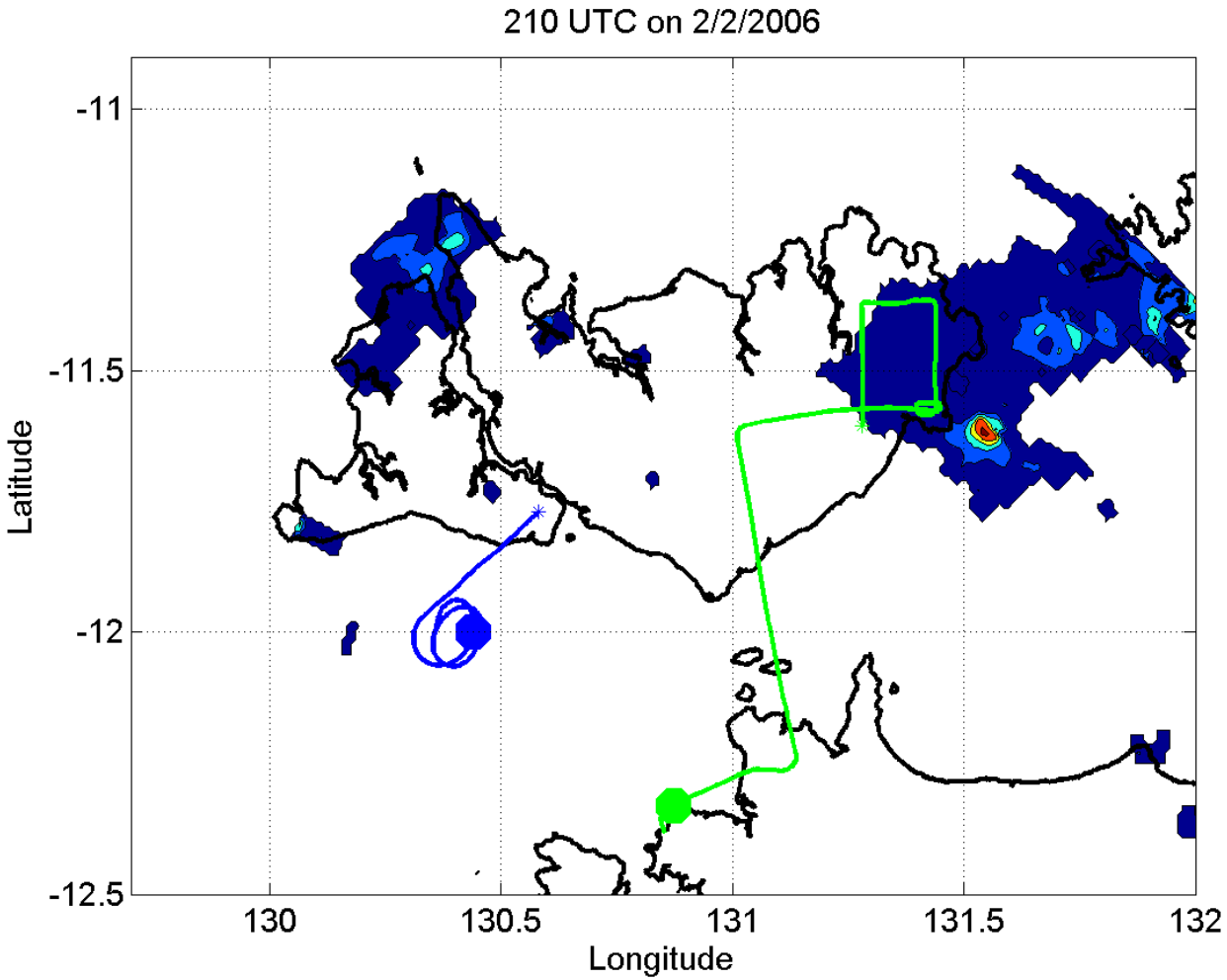


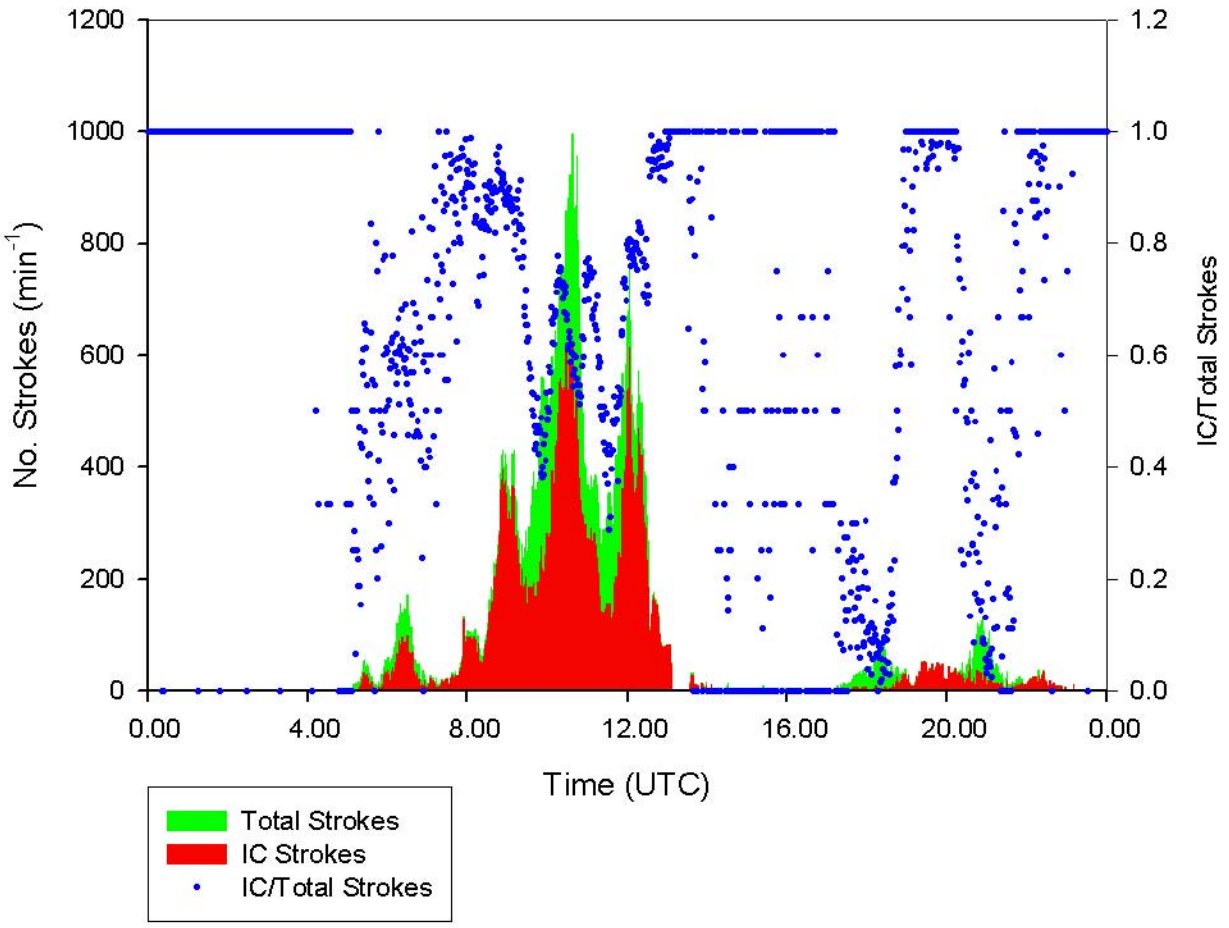


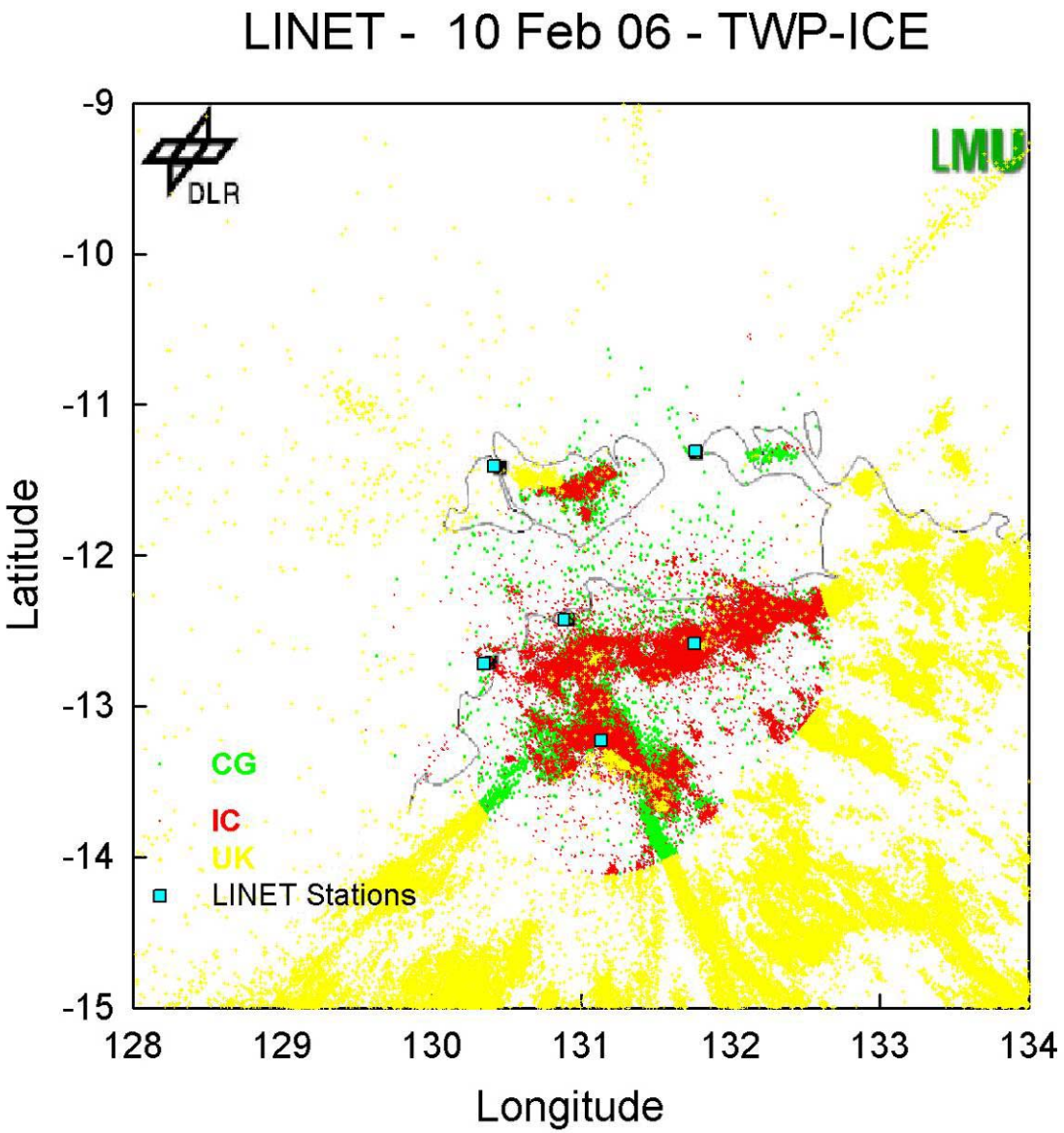




Break season storms had day to day increase in intensity in terms of storm heights
Lightning. Contrast the Hector with the monsoon convection – almost no lightning




LINET Stroke History, 10 Feb 06, Darwin
No. Strokes (min-1)
IC/Total Strokes
Time (UTC)
0
200
400
600
800
1000
1200
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0.00
4.00
8.00
12.00
16.00
20.00
0.00
Total Strokes
IC Strokes
IC/Total Strokes


LINET - 10 Feb 06 - TWP-ICE
DLR
LMU
-9
-10
-11
-12
-13
-14
-15
Latitude
128
129
130
131
132
133
134
Longitude
CG
IC
UK
LINET Stations