DOC 11

[redacted]

From: [redacted]
Sent: Friday, 12 March 2010 9:02 PM
To: [redacted]
Cc:
Subject: RE: Call for parties interested in performing a case study into the March 6 Melb Supercell [SEC=UNCLASSIFIED]
Attachments: radar_noaa20100306_0415.png

Hi [redacted] and [redacted]

IRRELEVANT MATERIAL REMOVED - s.22.

Finally, I noticed that one of your Synoptic Discussion radar scans (through the supercell's BWER) nicely coincided with an NOAA-AVHRR scan. The attachment to this email includes your scan, and an inset showing 2 different IR colour enhancements of the storm top. There are some pleasing similarities/consistencies here:
(1) the V-shaped configuration of the highest reflectivities (on radar) and coldest radiances (on satellite imagery), and
(2) the very strong reflectivity gradient on the northeast side of the storm nicely corresponds with the head blocking (of the strong upper-level ambient airflow) signature. Of course, the BWER on the radar scan represents an additional blocking signature (caused by the intense updraft).

Regards,

[redacted]

[redacted]

Sent: Thursday, March 11, 2010 10:47 AM
To: [redacted]
Subject: Call for parties interested in performing a case study into the March 6 Melb Supercell [SEC=UNCLASSIFIED]

The March 6th event provides a great target for a case study. It is not the intensity of the storm that makes it unique it is the time (with respect to its life cycle, particularly when producing hail) that it spent over a densely populated area. This, coupled with the prevalence of modern media (facebook, you tube and the like) has produced a great "time series" of hail reports of varying quality.

As the cell entered the greater Melbourne area it was strong but unremarkable it intensified and became hail bearing and as it approached the CBD (with corresponding reports of flash flooding) as it passed over the CBD it became (in the words of an experienced weather guru) "truly feral". So what we have is a series of time steps with which to verify various decision support algorithms (Hail nomograms (reflectivity and VIL), TITAN and WDSS). From a personal perspective (and perhaps SREP perspective) I am interested in attempting to extract a time series of updraft

intensities from the Laverton data (there has been some good work done on single Doppler wind retrievals) and link this to the hail data.

IRRELEVANT MATERIAL REMOVED - s.22.

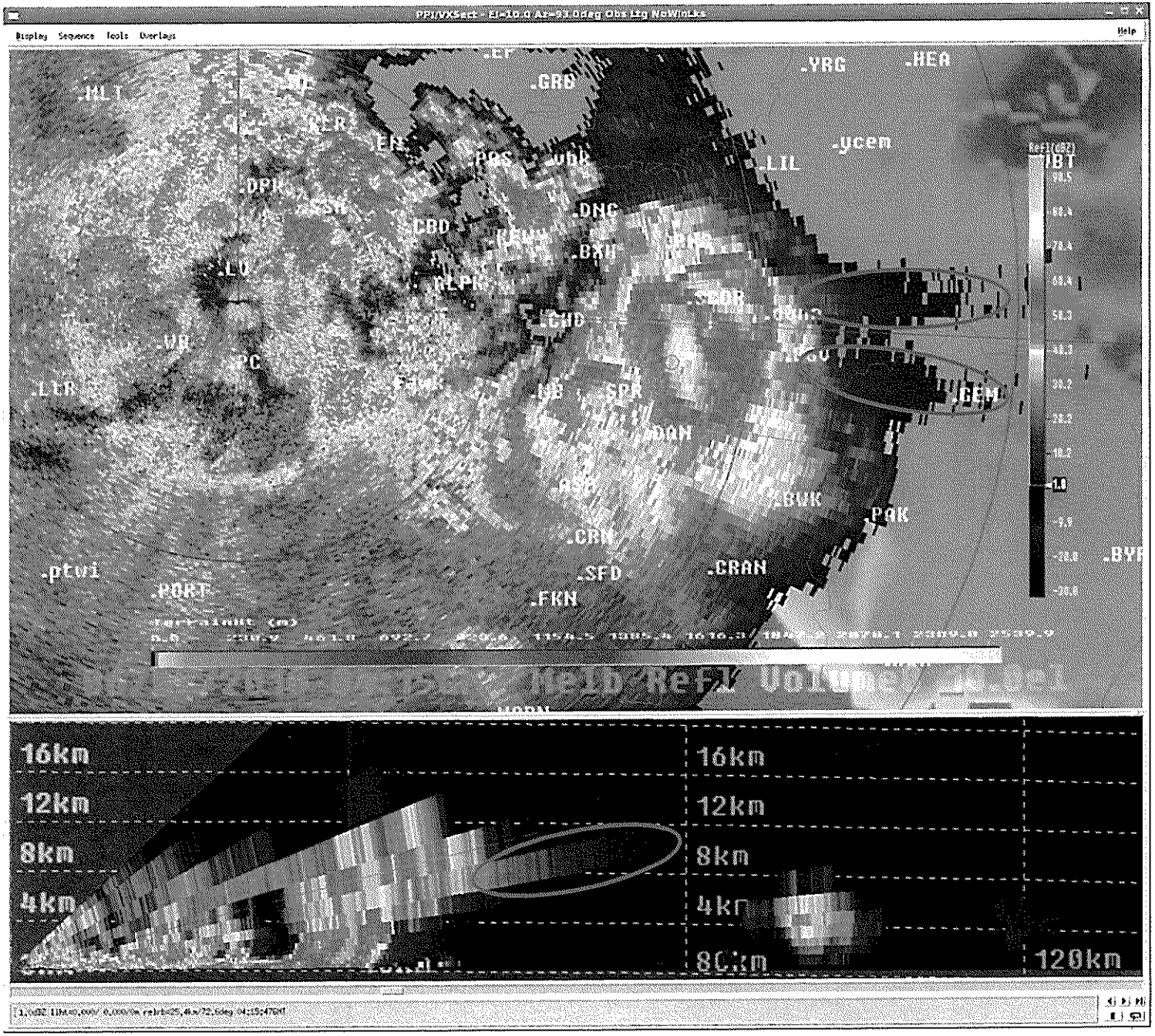
And this list is by no means exhaustive so please feel free to distribute further.

Cheers,

[redacted]

[redacted]
Postdoctoral Researcher
Centre for Australian Weather and Climate Research (CAWCR)
Desk: [redacted]
MB: [redacted]
Please note: From May 1st this email account will cease to be active. Please use [redacted]

DOC 11A


Display Sequence Tools Overlays Help
.MLI
.GRB
.YRG
.HEA
.ycem
.LIL
.DPK
.DNC
.BXU
.LO
.VR
.PC
.LTR
.JGEM
.DAN
.ASP
.BUK
.P0K
.CRN
.SFD
.CRAN
.FKN
.ptvi
.PORT
16km
12km
8km
4km
80km
120km

DOC 12

[redacted]

From: [redacted]
Sent: Saturday, 13 March 2010 1:19 PM
To: [redacted]
Cc:
Subject: RE: Call for parties interested in performing a case study into the March 6 Melb Supercell [SEC=UNCLASSIFIED]

Hi [redacted]

Thanks for your reply. There are at least 2 reasons why a V shape may appear in (enhanced) IR imagery, in association with the cold storms top of a convective system. In each case, it is assumed to be an indication of an intense storm. Firstly, the V shape may merely be a reflection of the diffluence in the near-tropopause flow. However, for so-called enhanced-V systems (which feature a cold storm top, a warm wake, and the V arms), the V is attributed to strong upstream near-tropopause winds being blocked by an overshooting top, then forced to flow around it, carrying some of the cold dtorm top debris downstream in a V-shape.

Sorry for not including a brightness temperature legend in my images, but the Vs actually correspond to the coldest (diances (i.e. the deep purple colour in the top inset, and the black colour in the bottom one).

Regards,

[redacted]

From: [redacted]
Sent: Friday, March 12, 2010 9:51 PM
To: [redacted]
Cc: [redacted]
Subject: RE: Call for parties interested in performing a case study into the March 6 Melb Supercell [SEC=UNCLASSIFIED]

G'day [redacted]
A very simple answer to the most pertinent of your questions, when did the storm become "truly feral: When the storm passed over the CBD.
(ıree characteristics I use to make this assertion are:
1) The storm was already slightly deviant from the mean motion of other cells in the area, once the cell of interest passed over the CBD it took a dramatic (~20-30 degrees) turn to the left, after going past the Dandenongs it tended towards the steering flow
2) Development of a Meso cyclone: No apparent rotation in the storm until it approached the CBD and then weak at best, after passing the CBD the intensity of the radial velocity couplet intensified dramatically and it became very apparent on quite a few scans of the Laverton radar (indicative of deep rotation).
3) While still open to debate, images posted to Synoptic of 10cm hail along the longest axis of the stone. I would regard as "truly feral". And this is the key, a range of observed hail sizes from an event, allowing the testing of algorithms. And they do not need to be limited to radar based ones!

IRRELEVANT MATERIAL REMOVED - s.22.

The AVHRR image is fantastic, now please correct me if I am incorrect but a "V" is due to the outflow of a storm being interrupted by a strong updraft.Fascinating that the top of the updraft is so opticically thin that it does not show the lowest brightness temperatures (I assume the colour scale is 1/T_br)...

IRRELEVANT MATERIAL REMOVED - s.22.

[redacted]
Postdoctoral Researcher
Centre for Australian Weather and Climate Research (CAWCR)
Office: [redacted]
Mobile [redacted]
www: http://www.bom.gov.au/bmrc/wefor/staff/[redacted]

REMAINDER OF EMAIL THREAD DUPLICATED ON DOC 11.

DOC 13

[redacted]

From: [redacted]
Sent: Monday, 15 March 2010 5:12 PM
To: [redacted]
Cc: [redacted]
Subject: Intensification of the 6 March southern Vic MCS (Part 2) [SEC=UNCLASSIFIED]
Attachments: intensity2.ppt

Hi all,

A sequence of high resolution GFS Model upper-tropospheric wind/height fields encompassing the MCS development (slides 1-4 + notes in attached PowerPoint) reveals the following:

1. Two initially parallel strong jet streaks adopt an increasingly divergent orientation over Victoria, with an associated increase in the diffluence of the intermediate flow;
2. A corresponding rapid decrease in the minimum strength of the intermediate winds (till at least 06Z) implies a strong increase in horizontal shear on the western (eastern) flank of the leading (trailing) jet streak, which in turn, implies a dramatic change in the associated vorticity field;
3. The most intense convection coincides with the classically favoured (developing) right exit zone of the leading jet streak.

The corresponding 300 hPa absolute vorticity (AV) fields (slides 5-8 + notes) indicate:

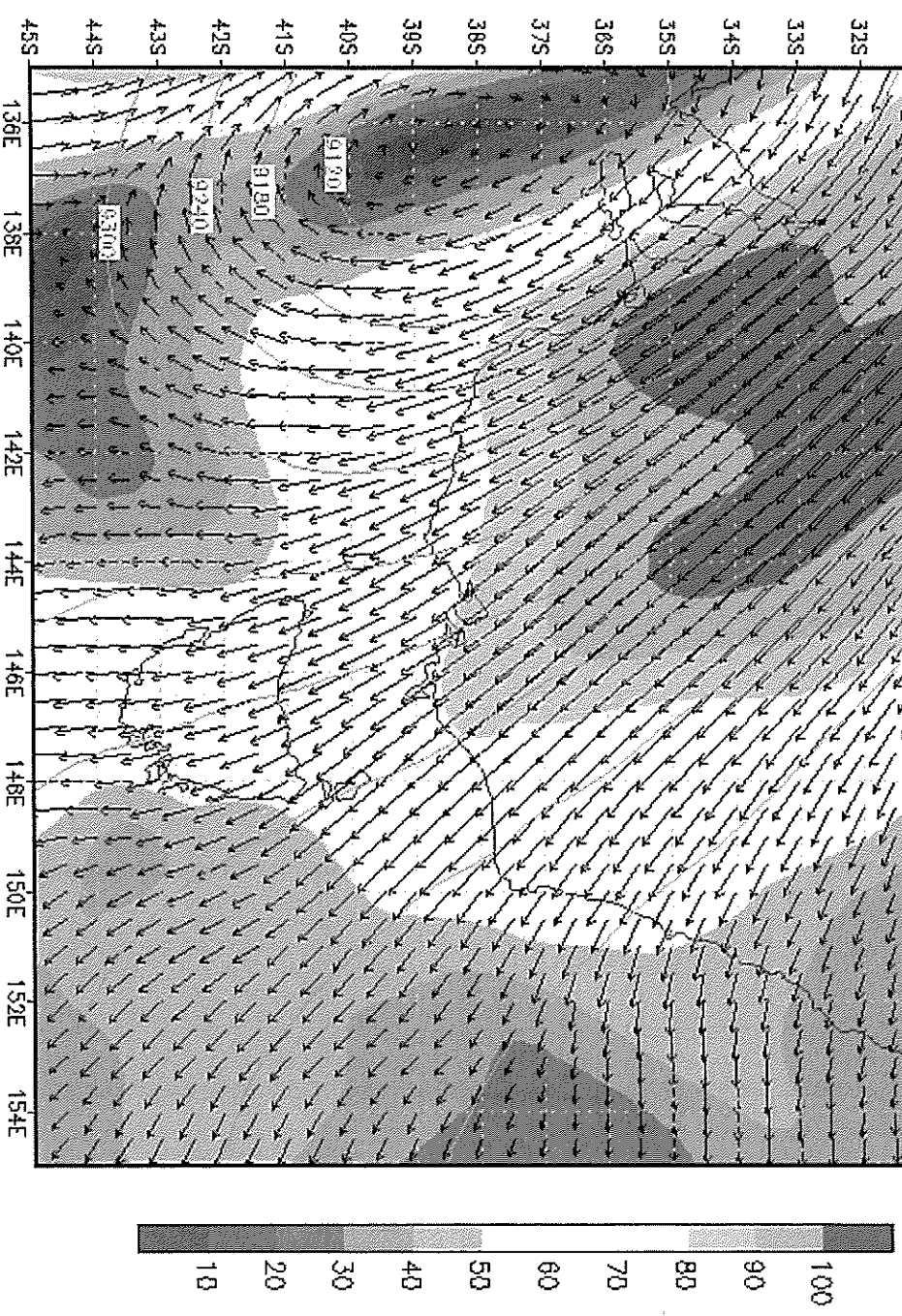
1. The initially nondescript AV field undergoes a rapid transition between 00Z and 03Z, as a strong CAV/AAV couplet develops;
2. This development, including the couplet's location/orientation with respect to the region of strongest (convective) 00-03Z ascent, is consistent with horizontal vorticity (associated with NW to SE-orientated vertical wind shear) being tilted into the vertical;
3. Accordingly, by 03Z the strongest convection (which is commencing its main phase of intensification) has become located downstream of an intensifying CAV maximum (- i.e. a location favourable for ascent and upper-level divergence);
4. Further amplification in the magnitudes of the CAV anomaly and the the downstream CVA (cyclonic vorticity advection) occurs by 06Z, in phase with the strongest convection;
5. Previous discussion has understandably focussed on the Melbourne region supercell. However, near the midpoint of the 03-06Z period, and just prior to the largest hail reports, a new (downstream) supercell developed explosively just west of Noojee, then tracked through the Latrobe Valley. This development coincided with a strong increase in the magnitude of the overlying upper-tropospheric CAV;
6. 24hr rainfall totals to 9am on 7 March of ~60mm were recorded along the Noojee-Latrobe Valley track, but the full ferocity of this cell was indicated by the 1-minute AWS Latrobe Valley observations around 06Z. In addition to a 54 kt wind gust and 10 degree temperature drop in 10 minutes, the station recorded an extraordinary 25.6mm of rain in just 8 minutes!;
7. The convection was less intense by 09Z, by which time the upper-level CVA signal had also weakened;
8. It appears that in this event the vertical wind shear made a much stronger contribution to the intensity of the vorticity tilting than was the case for The Gap Storm. Thus, maximum winds of ~140 kt were almost twice the magnitude of those for the 16/11/08 event, producing underlying wind shears as strong as 26 kt/1000 ft! Additionally, in the 6 March event the strong CAV/AAV couplet formed at an earlier stage of the convective development.

Thanks to [redacted] for assisting in the above explanations.

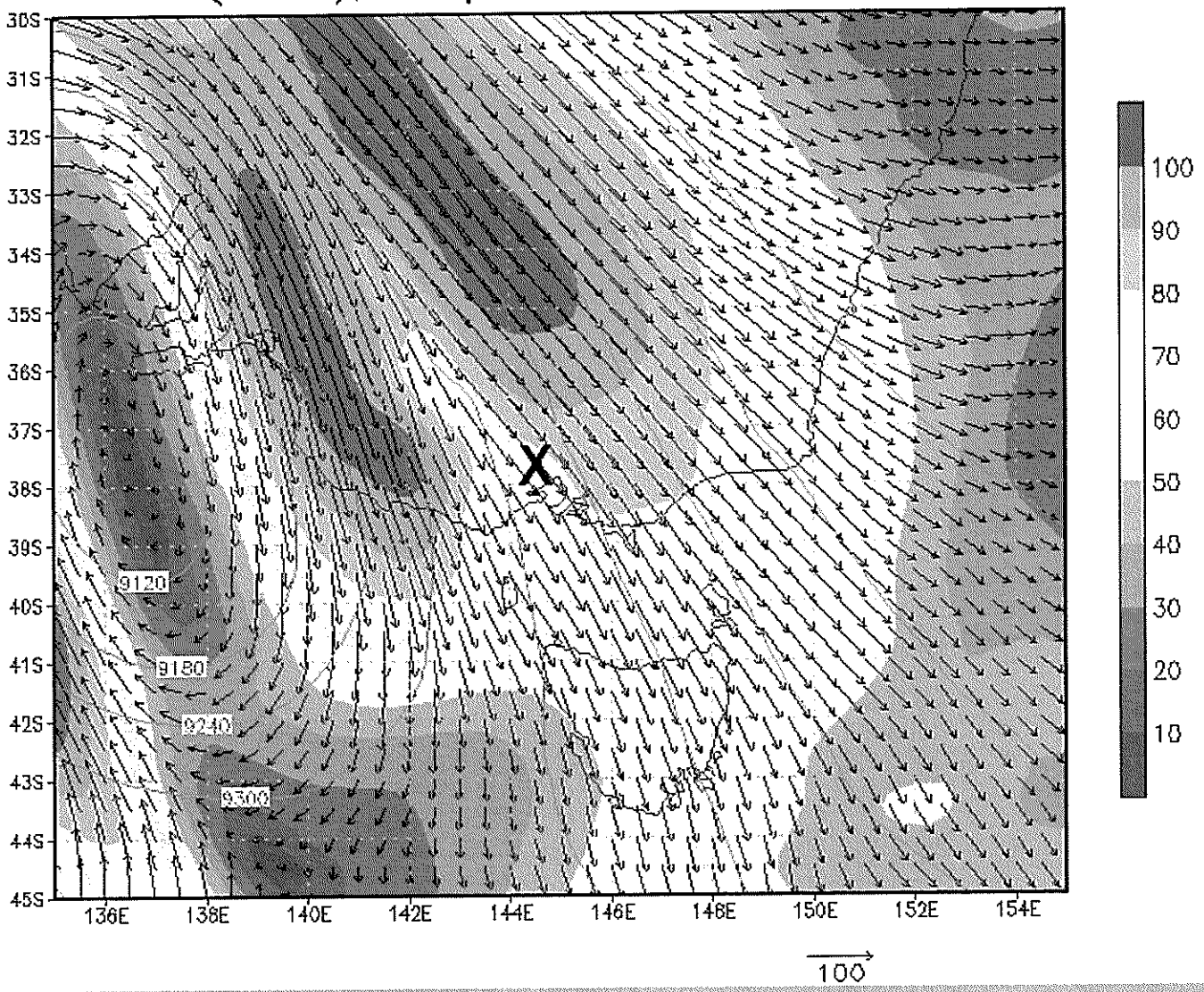
Finally, it seems that although the amplifying upper-level CAV anomaly developed in the vicinity of a tropopause fold (see slide 9), there doesn't appear to be evidence to indicate that a stratospheric extrusion of PV-rich air into the upper troposphere provided an additional contribution to the CAV development. Additionally, a superficial examination of the GFS thermal advection diagnostics suggests nothing present to have offset the impact of the strong vorticity advection forcing.

[redacted]

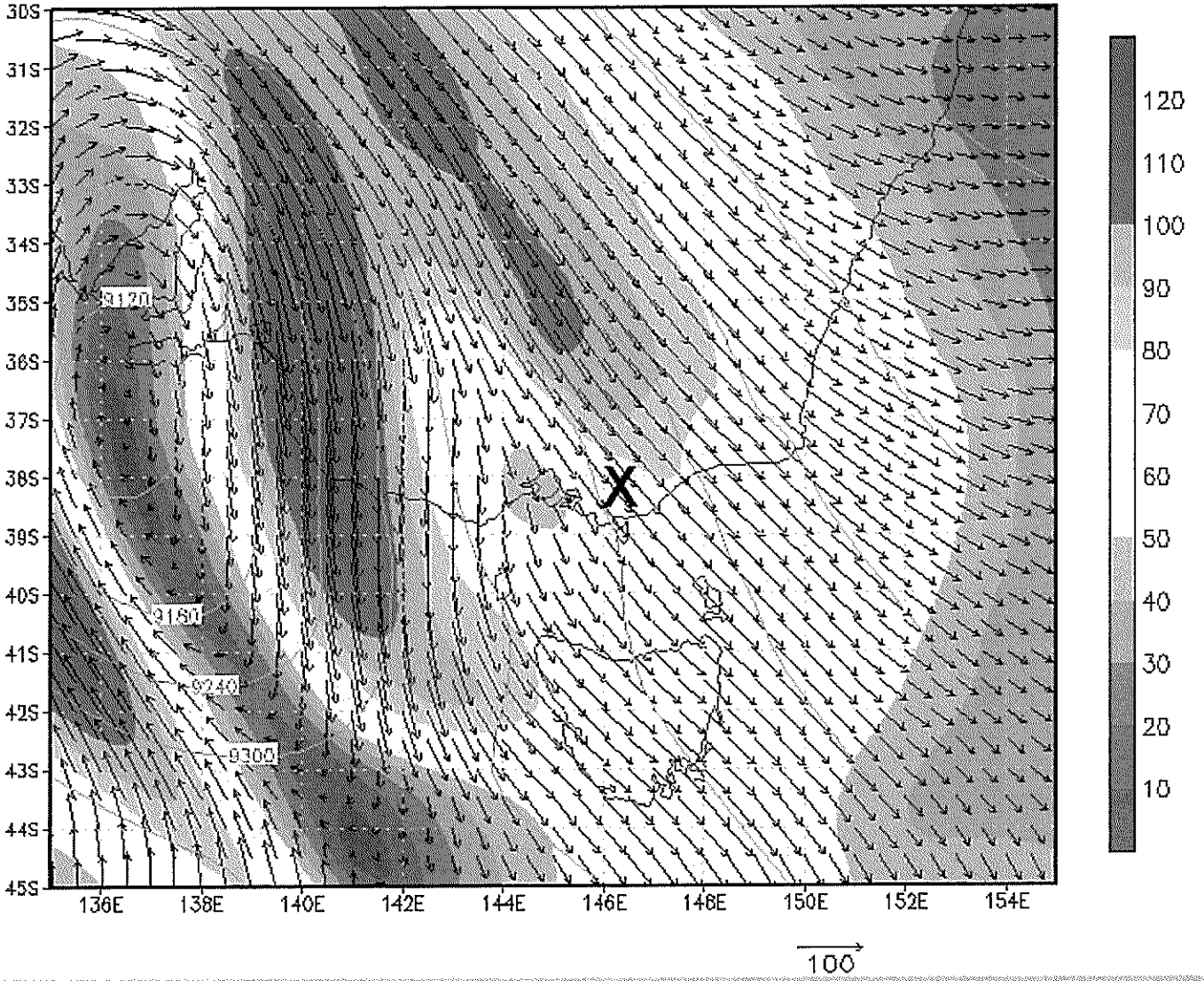
DOC 13A


300 hPa winds (knots), HGTprs at 00Z Sat 06mar2010
30S
31S
32S
33S
34S
35S
36S
37S
38S
39S
40S
41S
42S
43S
44S
45S
136E
138E
140E
142E
144E
146E
148E
150E
152E
154E
9180
9180
9240
9300
100
10
20
30
40
50
60
70
80
90
100

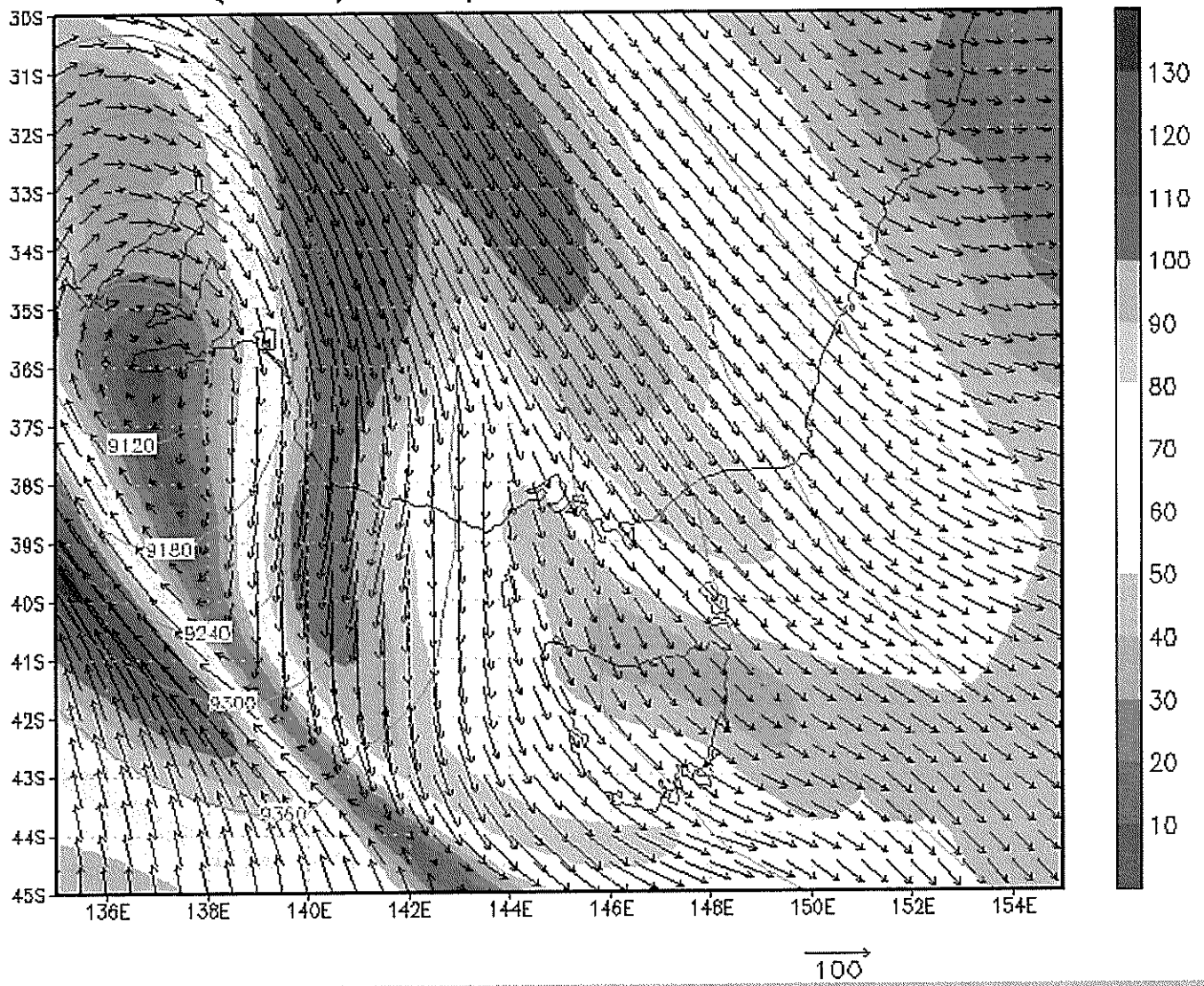
300 hPa winds (knots), HGTprs at 03Z Sat 06mar2010



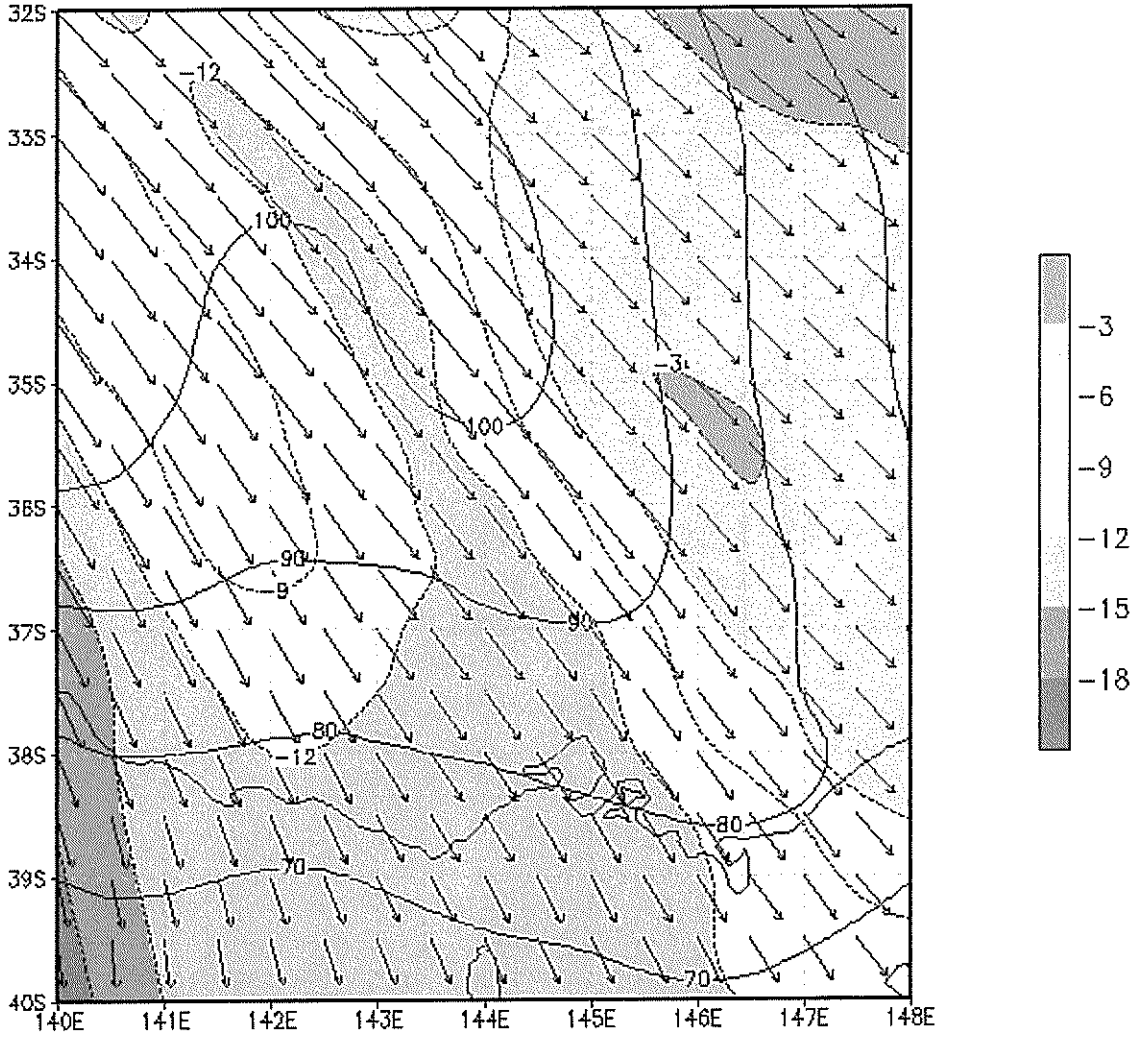
300 hPa winds (knots), HGTprs at 06Z Sat 06mar2010



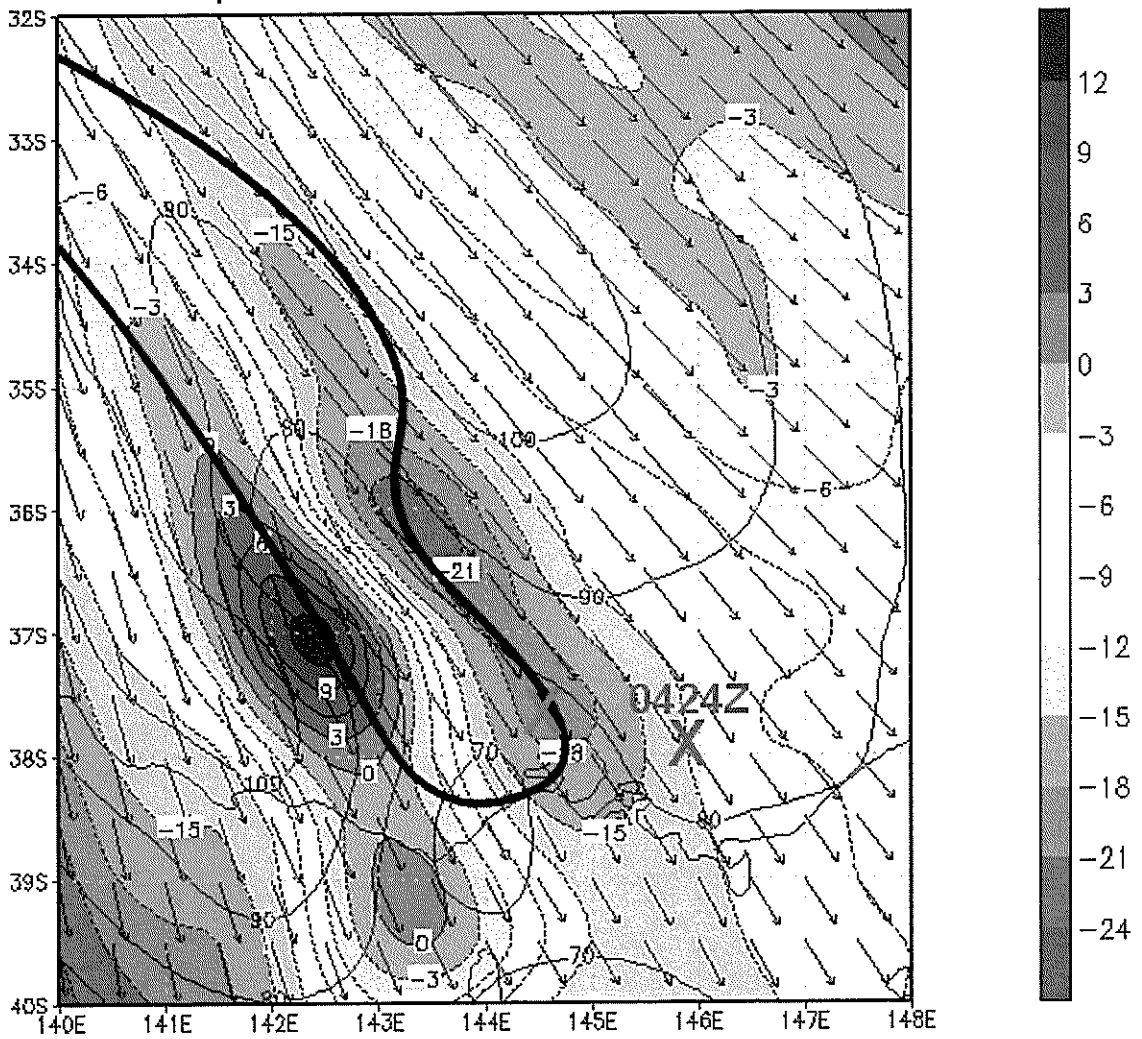
300 hPa winds (knots), HGTprs at 09Z Sat 06mar2010



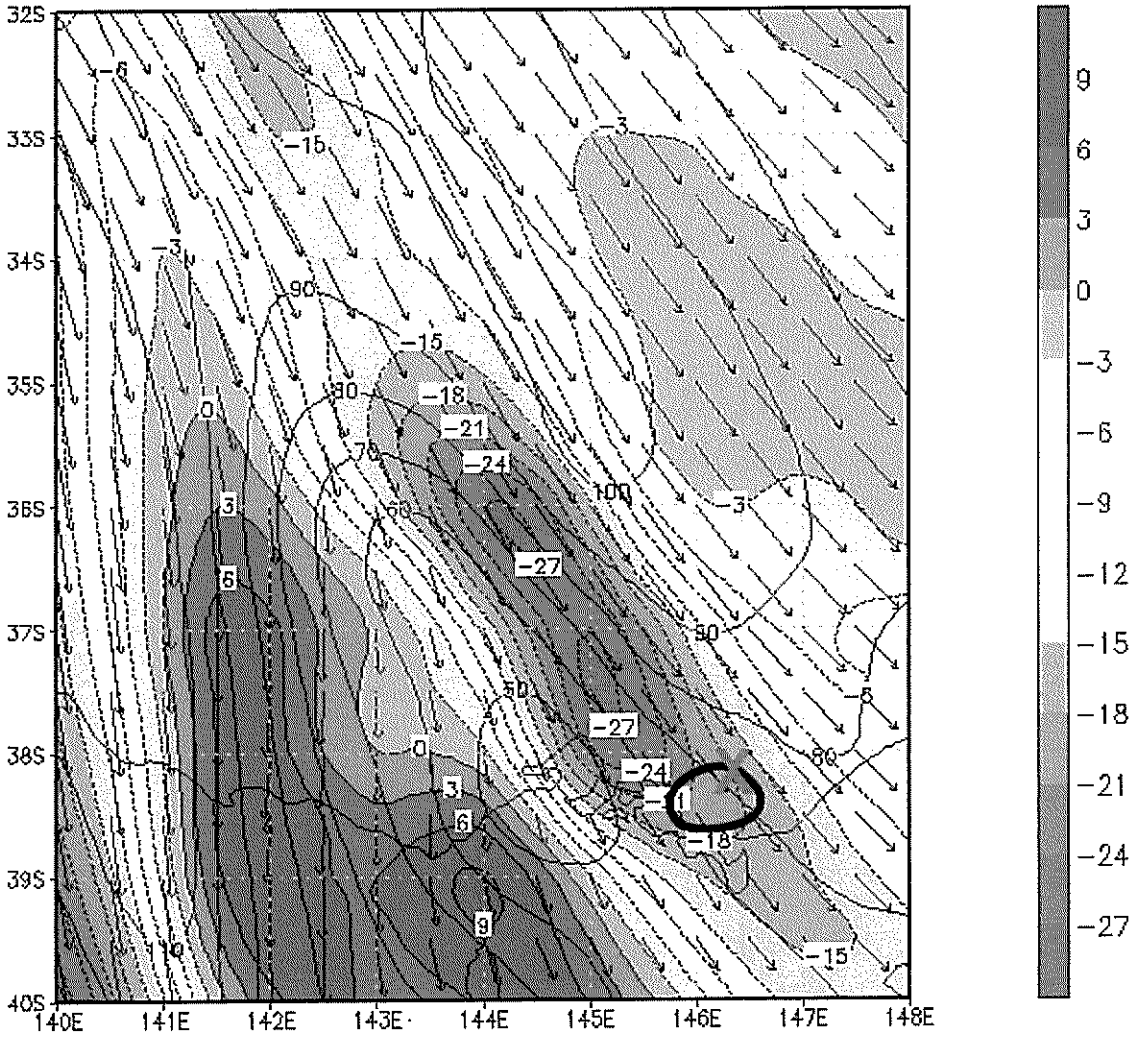
300 hPa ABSVprs at 00Z Sat 06mar2010



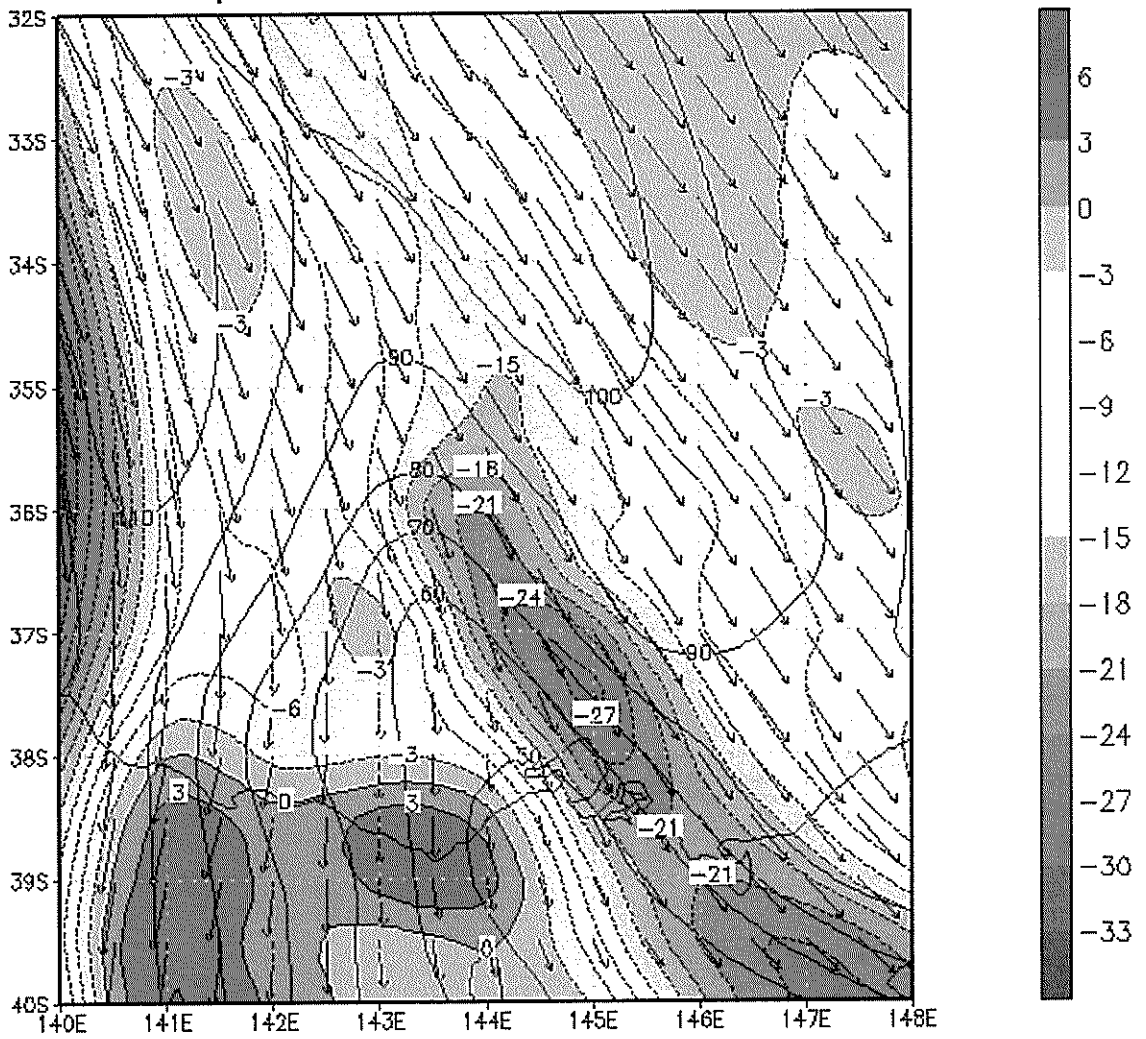
300 hPa ABSVprs at 03Z Sat 06mar2010

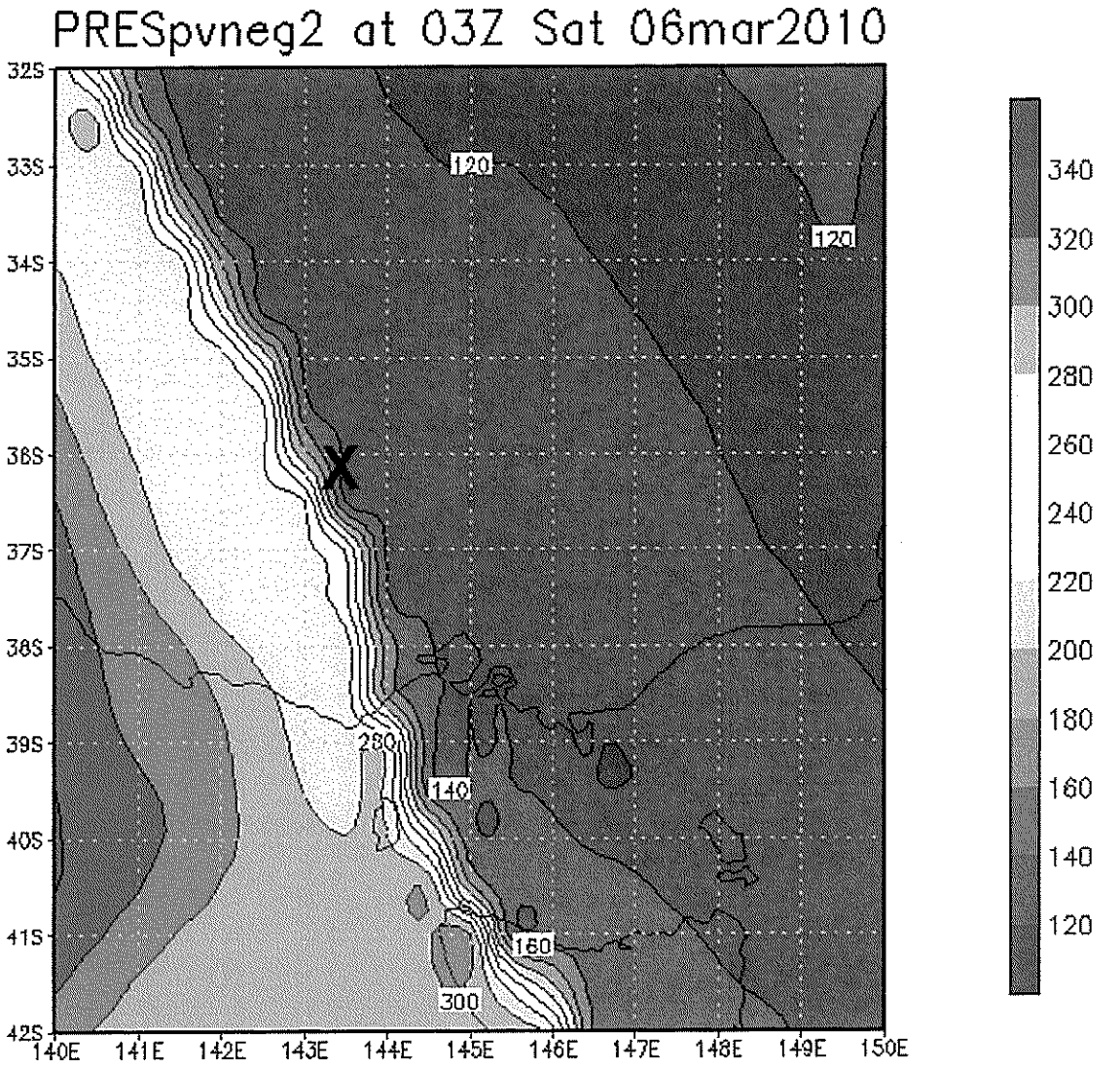


300 hPa ABSVprs at 06Z Sat 06mar2010



300 hPa ABSVprs at 09Z Sat 06mar2010




PRESpvneg2 at 03Z Sat 06mar2010
32S
33S
34S
35S
36S
37S
38S
39S
40S
41S
42S
140E
141E
142E
143E
144E
145E
146E
147E
148E
149E
150E
120
120
280
140
160
300
340
320
300
280
260
240
220
200
180
160
140
120

DOC 14

[redacted]

From: [redacted]

Sent: Monday, 15 March 2010 3:53 PM
To: [redacted]
Subject: RE: [synoptic_discussion] Melbourne severe TS - Sat 6 March 2010 [SEC=UNCLASSIFIED]

Hi [redacted] et al.,

I am imagining that the storm's intensity is strongly influenced by its discrete propagation behaviour. As I have seen with many other storms before, the
6 March HP flollows a pattern of leftward propagation, followed by intensification, followed by a core collapse stage.

Some notable leftward jumps of the storm occurred before it hit Melton, another before the CBD. The most spectacular step occurred around 3:30z over Box Hill, followed by the storm producing its most intense upper-level core near Scoresby at 4:10z, followed by the largest hail reports ESE from there as that max. dBZ core starts descending.

[redacted]

> -----Original Message-----
> From[redacted]
> Sent: Monday, 15 March 2010 14:32
> To:[redacted]
> Subject: [synoptic_discussion] Melbourne severe TS - Sat 6 March 2010
> [SEC=UNCLASSIFIED]
>
> Folks
> I have attached some images that folks may find of interest.
> These show the '60dBZ-storm' track from TITAN for the storm from when
> it was first detected to the north of Ballarat until there was an
> apparent weakening to the west of the city and again as it moved
> across the SE suburbs. This is based on Melb radar data.
> I believe the apparent weakening near the city was most likely a
> result of heavy rain (and possibly hail) on the radome.
> There are two images for each annotated with the 'hail mass aloft' and
> the max-vil. It should be noted the latter is not a vertical
> integration but is calculated using the max refl at each level.
> One interesting observation is that the vil and 'hail mass aloft' is a
> max in the Knox/Rowville area consistent with observations.
> Regards
>[redacted]
>
>
>
>--

[redacted]

> Centre for Australian Weather and Climate Research (CAWCR) A
> partnership between CSIRO and the Bureau of Meteorology GPO Box 1289
> Melbourne VIC 3001 Australia T[redacted] | F[redacted]

DOC 15

[redacted]

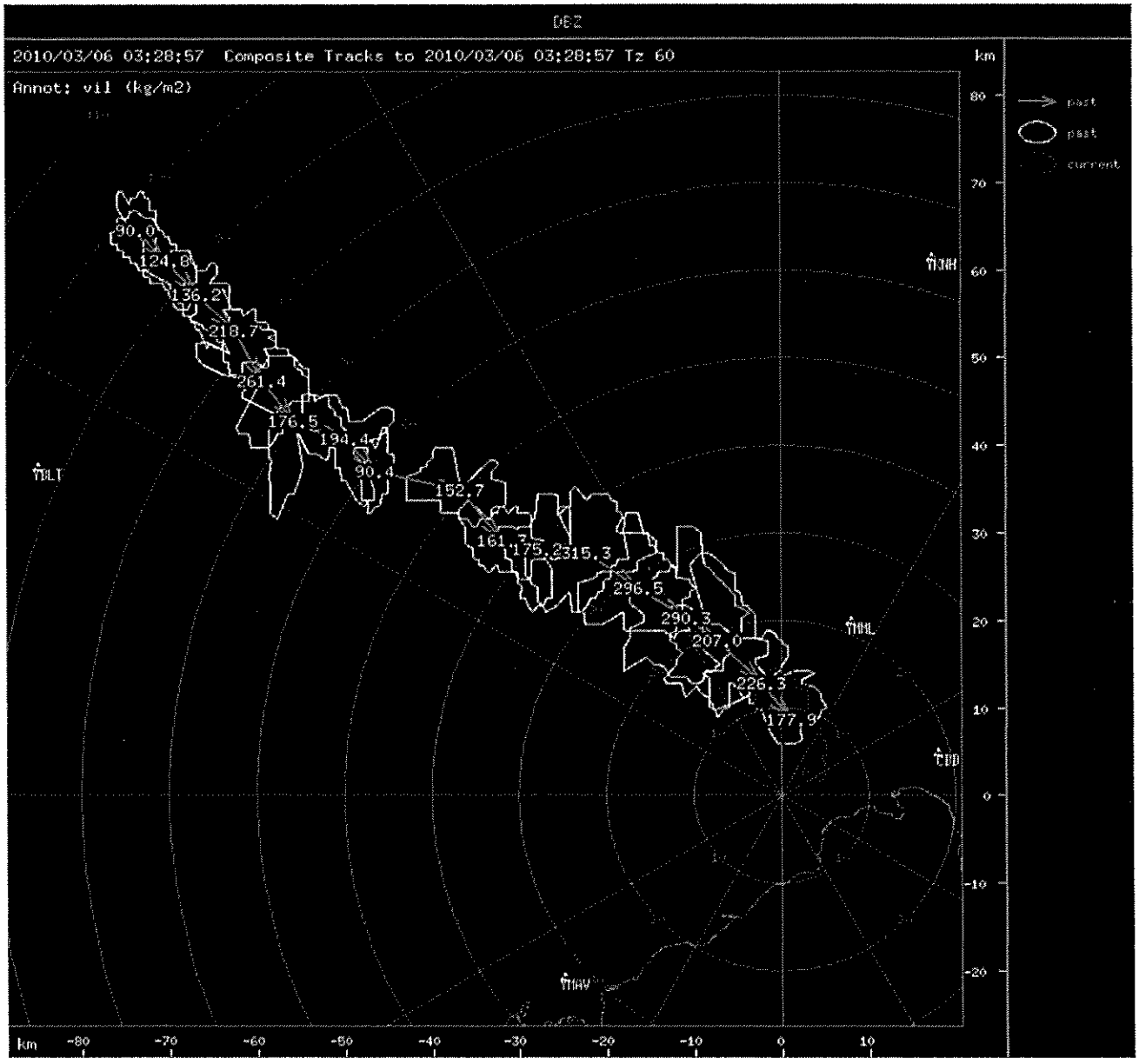
From: [redacted] on behalf of [redacted]

Sent: Monday, 15 March 2010 2:32 PM
To: [redacted]
Subject: [synoptic_discussion] Melbourne severe TS - Sat 6 March 2010 [SEC=UNCLASSIFIED]
Attachments: 20100306_032857_DBZ_vil.gif; 20100306_032857_DBZ_hma.gif; 20100306_054059_DBZ_vil.gif; 20100306_054059_DBZ_hma.gif

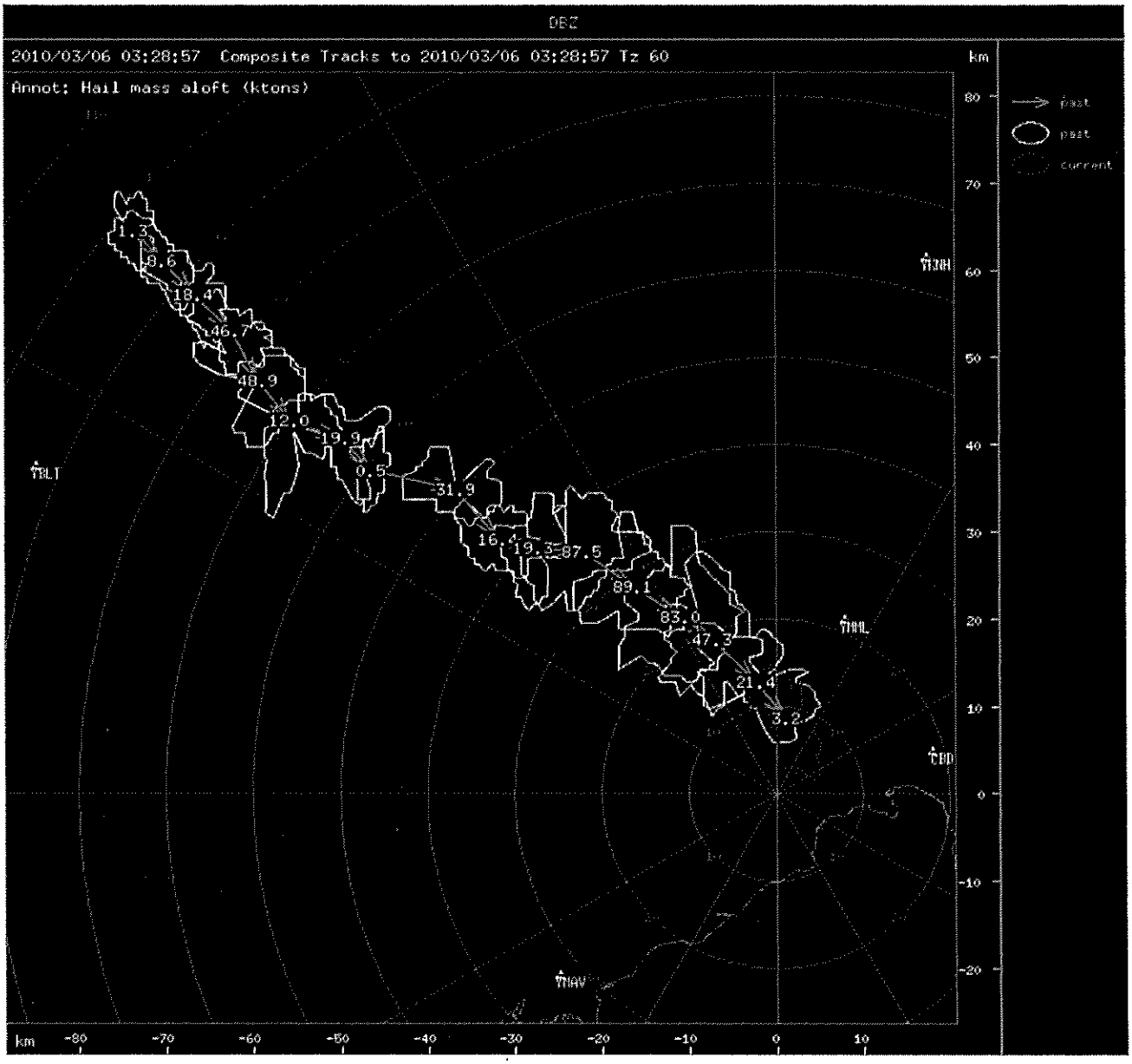
Folks
I have attached some images that folks may find of interest.
These show the '60dBZ-storm' track from TITAN for the storm from when it was first detected to the north of Ballarat until there was an apparent weakening to the west of the city and again as it moved across the SE suburbs. This is based on Melb radar data.
I believe the apparent weakening near the city was most likely a result of heavy rain (and possibly hail) on the radome.
There are two images for each annotated with the 'hail mass aloft' and the max-vil. It should be noted the latter is not a vertical integration but is calculated using the max refl at each level.
One interesting observation is that the vil and 'hail mass aloft' is a max in the Knox/Rowville area consistent with observations.
Regards
[redacted]

--
[redacted]
Centre for Australian Weather and Climate Research (CAWCR) A partnership between CSIRO and the Bureau of Meteorology GPO Box 1289 Melbourne VIC 3001 Australia T [redacted] | F [redacted]
[redacted]

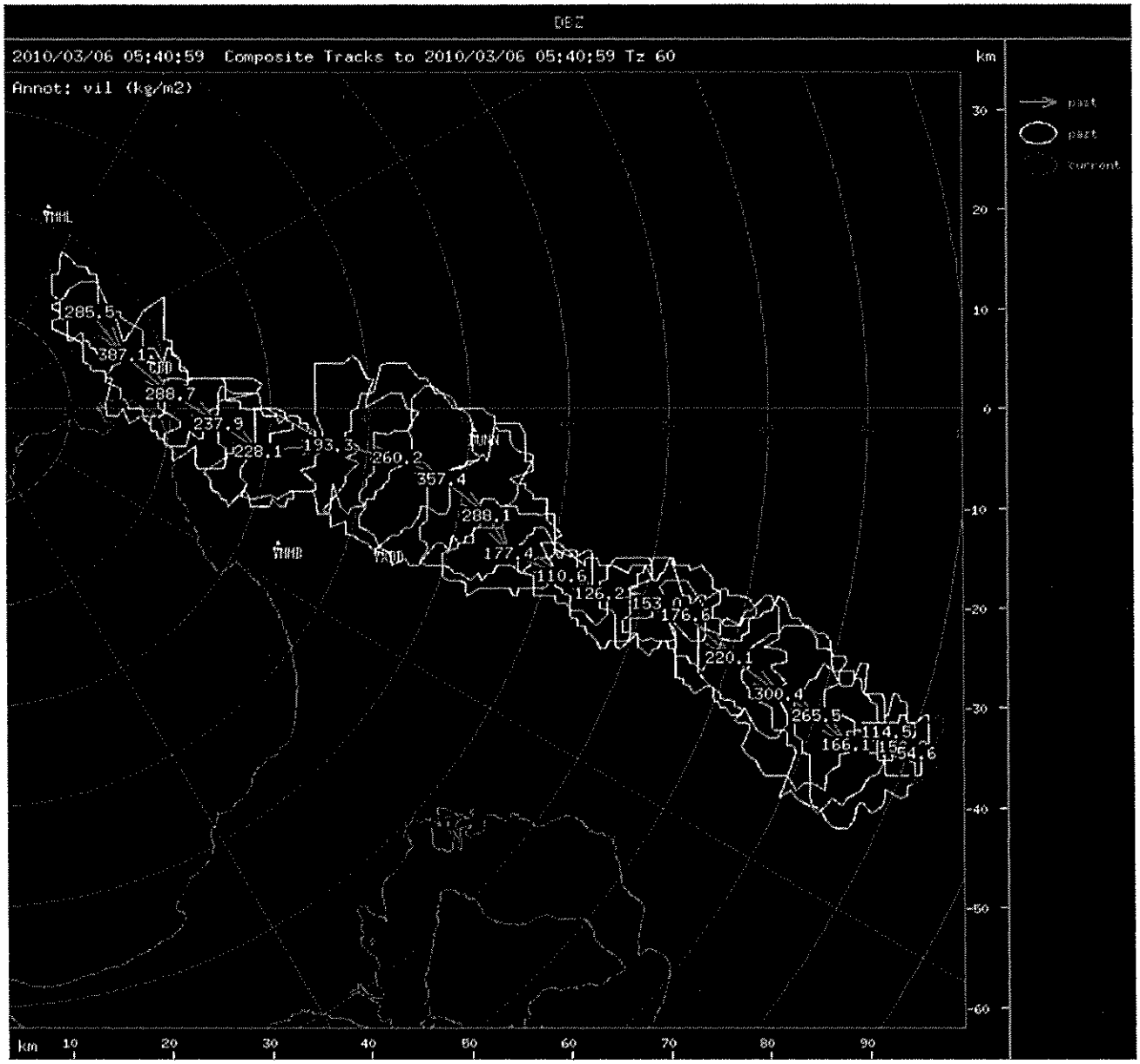
DOC 15A


DEZ
2010/03/06 03:28:57 Composite Tracks to 2010/03/06 03:28:57 Tz 60
Annot: vil (kg/m2)
km
past
past
current
90.0
124.8
136.2
218.7
261.4
176.5
194.4
90.4
152.7
161.7
175.2
315.3
296.5
290.3
207.0
226.3
177.9
TNH
TBLT
TBBL
TDD
TMAV
km -80 -70 -60 -50 -40 -30 -20 -10 0 10
80 70 60 50 40 30 20 10 0 -10 -20

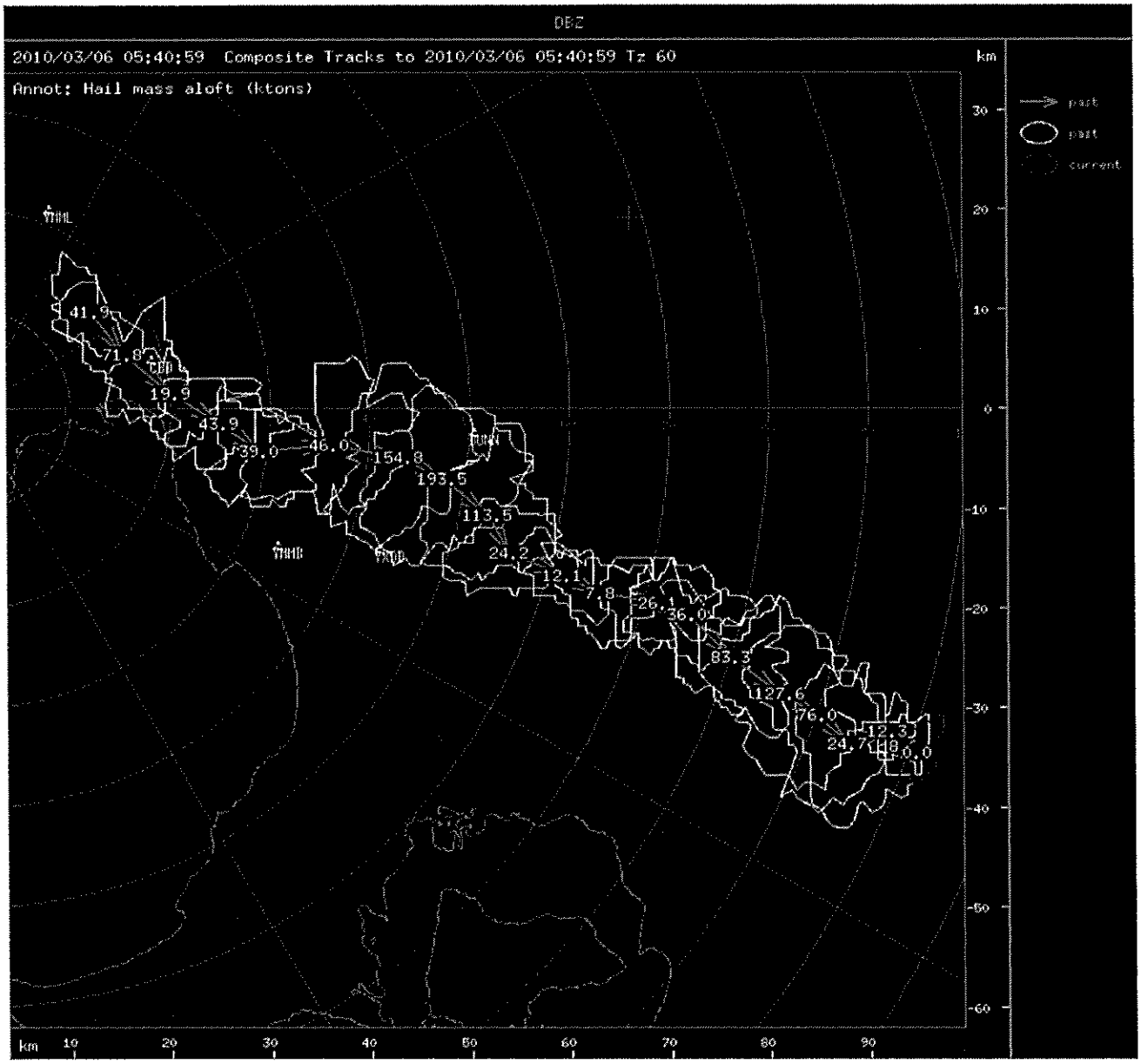
DOC 15B


DBZ
2010/03/06 03:28:57 Composite Tracks to 2010/03/06 03:28:57 Tz 60
Annot: Hail mass aloft (ktons)
km
past
past
current
1.3
8.6
18.4
46.7
48.9
12.0
19.3
0.5
31.9
16.4
19.3
87.5
89.1
83.0
47.3
21.4
3.2
TBLT
TJDH
TMAL
TBRO
TNAV
km -80 -70 -60 -50 -40 -30 -20 -10 0 10
80 70 60 50 40 30 20 10 0 -10 -20

DOC 15C


DBZ
2010/03/06 05:40:59 Composite Tracks to 2010/03/06 05:40:59 Tz 60
Annot: vil (kg/m2)
km
past
past
current
285.5
387.1
288.7
237.9
228.1
193.5
260.2
357.4
288.1
177.4
110.6
126.2
153.0
176.6
220.1
300.4
265.5
166.1
114.5
54.6
km 10 20 30 40 50 60 70 80 90

DOC 15 D


DBZ
2010/03/06 05:40:59 Composite Tracks to 2010/03/06 05:40:59 Tz 60
Annot: Hail mass aloft (ktons)
km
past
past
current
41.9
71.8
19.9
43.9
39.0
46.0
154.8
193.5
113.5
24.2
12.1
7.8
26.1
36.0
83.3
127.6
76.0
12.3
24.7
8.0
km 10 20 30 40 50 60 70 80 90

DOC 16

[redacted]

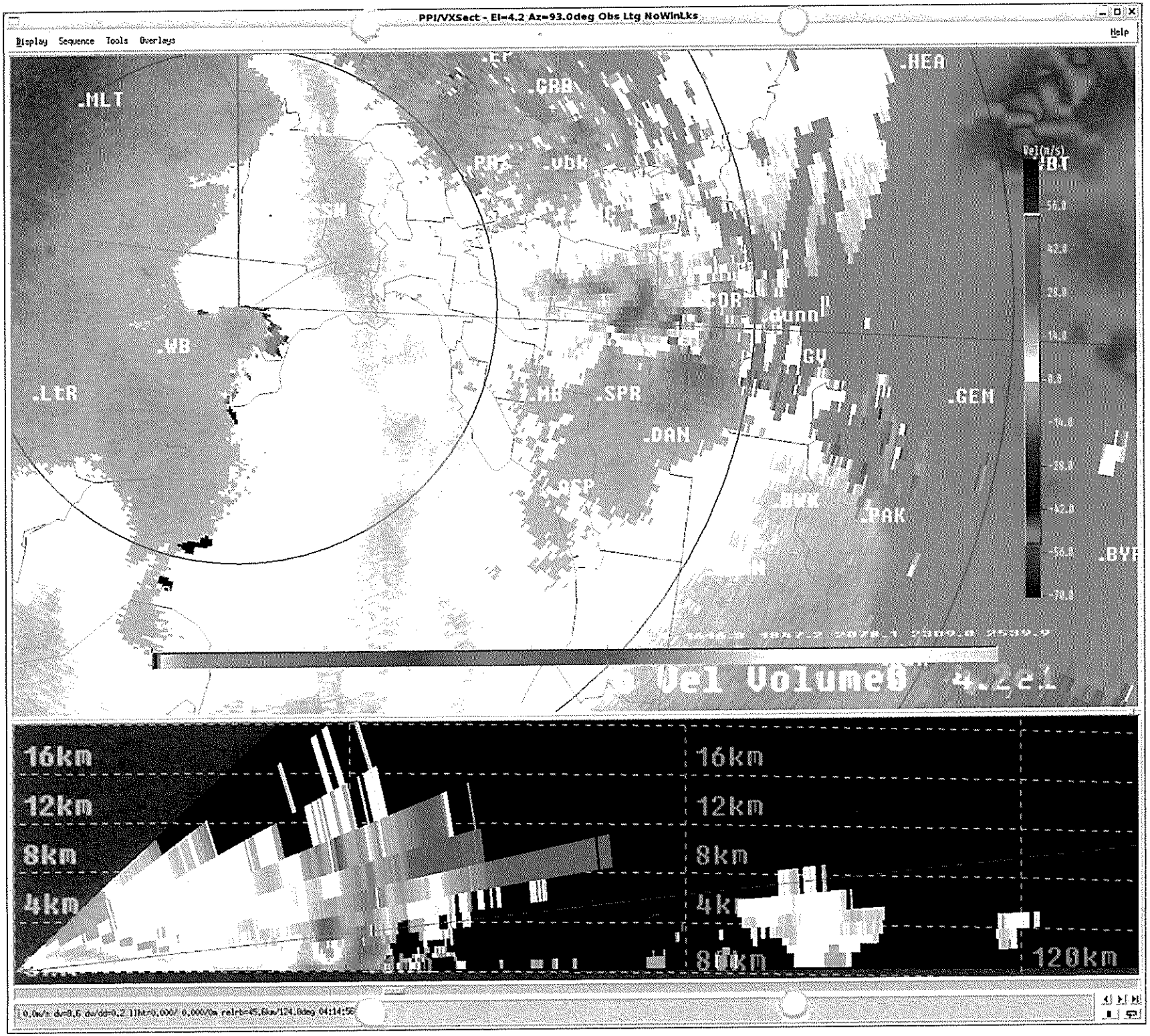
From: [redacted] on behalf of [redacted]

Sent: Tuesday, 9 March 2010 9:47 AM
To: [redacted]
Subject: [synoptic_discussion] further images [SEC=UNCLASSIFIED]
Attachments: cappiatminus10_20100306_0415.png; midlevel_meso_20100306_0415.png

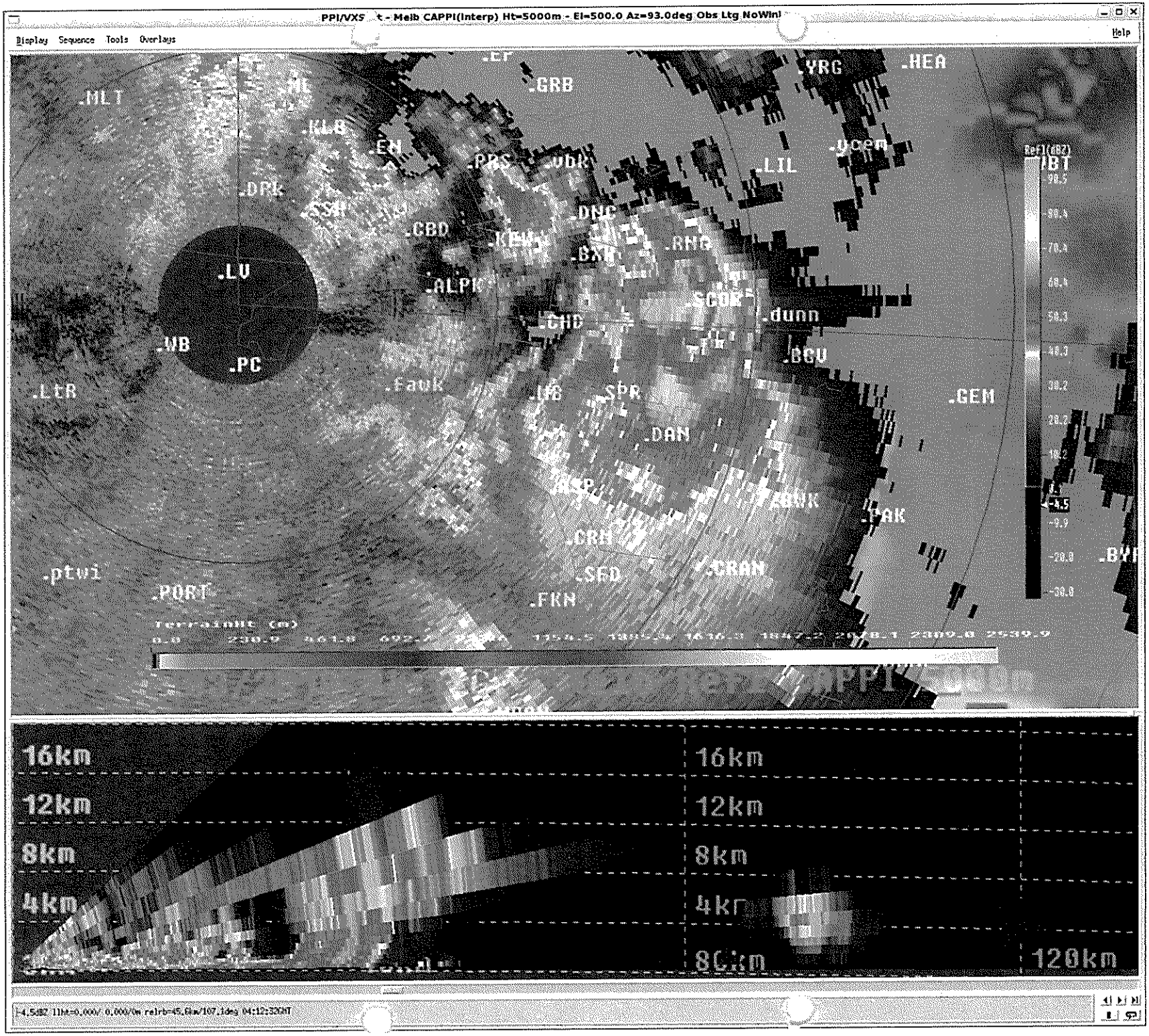
Midlevel_meso: Rotation in the midlevels

Cappiatminus10: Constant altitude slice at a height the corresponds to -10 degrees, 5km.. To see 70dBZ here is pretty amazing.

Cheers,
[redacted]


PPI/VXSect - El=4.2 Az=93.0deg Obs Ltg NoWinLks
Display Sequence Tools Overlays
Help
.MLT
.GRB
.HEA
.MPX
.ABR
.FSD
.MB
.LtR
.SPR
.GEM
.DAN
.OAX
.PAH
.BYR
Vel(m/s)
50.0
42.0
28.0
14.0
-0.0
-14.0
-28.0
-42.0
-56.0
-70.0
Vel Volume 4.2el
16km
12km
8km
4km
120km

DOC 16A


PPI/VXS t - Melb CAPPI(Interp) Ht=5000m - El=500.0 Az=93.0deg Obs Ltg NoWin
Display Sequence Tools Overlays
Help
.MLT
.GRB
.YRG
.HEA
.KLB
.EN
.PRS
.UDR
.LIL
.Ucem
.DRK
.SWH
.DNC
.CBD
.KEW
.RNB
.BZA
.LV
.ALPK
.SCDR
.dunn
.CHD
.WB
.PC
.BCV
.LtR
.fauk
.SPR
.GEM
.DAN
.PAK
.ptwi
.PORT
.FKN
.SED
.CRAN
Refl(dBZ)
16km
12km
8km
4km
120km

Doc 16 B