CHARACTERIZATION OF STORM TYPES DURING A 30-HOUR PERIOD OF RADAR OBSERVATIONS DURING THE "DRY-TO-WET ATMOSPHERIC MESOSCALE CAMPAIGN" OF THE LBA IN 2002

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BACKGROUND & OBJECTIVES

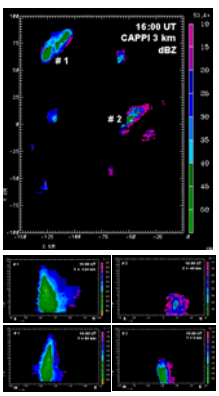
- The objective of RaCCI/LBA Subproject SG4 is to investigate spatial and temporal characteristics of convection and associated dynamic processes;
- IPMet was invited to participate in the co-ordination of the radar operations during part of the experimental period;
- On 7 and 8 October 2002, several different storm types, ranging from isolated severe complexes, through a microburst storm to a Mesoscale Convective System (MCS), were observed during a 30-hour period and the 3-dimensional structure of radar reflectivity and radial velocities, as well as their behavior has been analyzed.

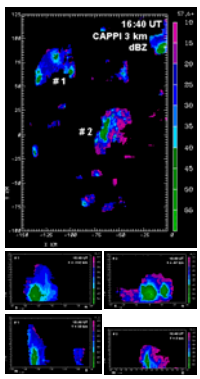
Radar Installation near Ouro Preto (Photo: LBA)

RADAR CHARACTERISTICS and METHOD OF ANALYSIS

- S-band Doppler radar (TECSAT), located about 40 km south of Ouro Preto do Oeste, Rondônia
- Beam width 2°, PRF 400 Hz (1 km range gates) and 750 Hz (375, 250, 125m range gates, as elevation increased), respectively
- 375 km surveillance & 150 km Volume scan mode, every 10 min (24 elevations from 0° to 50°)
- GAMIC raw data Volume PPI scans were converted to Universal radar data Format (UF)
- UF Volume scans were processed with NCAR's SPRINT program to convert from polar coordinates to Cartesian coordinates
- The azimuth was corrected by +22° (to compensate for an erroneous magnetic declination setting until 12 October)
- The reflectivity (dBZ) was corrected for a bias offset of –6.89 dB
- CAPPIs and vertical cross-sections were produced, using NCAR's CEDRIC program

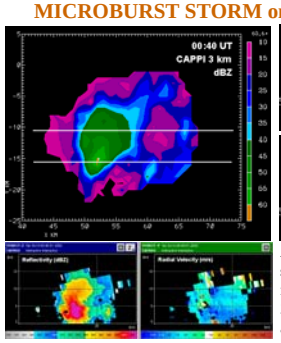
SEVERE ISOLATED STORMS on 07:10:2002





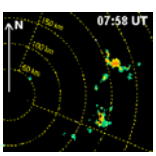
- The First Echo (FE) of Storm 1 was detected at 14:50 at 4.5 km;
- It rapidly developed within 10 min, with 30 dBZ reaching 8 km and tops (10 dBZ) up to 10 km, maximum reflectivity 50 dBZ, but remained stationary;
- By 15:20, the 50 dBZ contour had already reached 11 km, 30 dBZ 14 km and tops at 16 km;
- By 15:30 its tops had reached 20km, 30 dBZ up to 18 km and heavy precipitation began to fall (50 dBZ at ground level);
- The FE of Storm 2 was detected at 15:40 between 3.0 - 6.5 km;
- While Storm 1 split into two cells, basically remaining stationary, Storm 2 rapidly grew to 8.5 km, with 50 dBZ already going up to 6 km (15:50). Although intense, it never exceeded 14 km during its life cycle. Once the initial cell had reached maturity, it began to move towards WNW at 25 km.h^{-1}, with new development on its northern flank. Some of the new cells displaced at 30 km.h^{-1}, all towards WNW and lasting more than twice as long as Storm 1;
- The cross-sections show that Storm 1 had an upright echo core, while the one of Storm 2 was tilted towards south-west, possibly explaining the different life times of the two storms;
- Large stratiform areas developed aloft after 17:00 in the wake of the storm complexes, leading to further isolated convection.

MICROBURST STORM on 07/08:10:2002

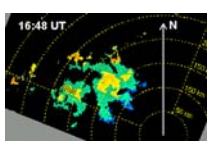


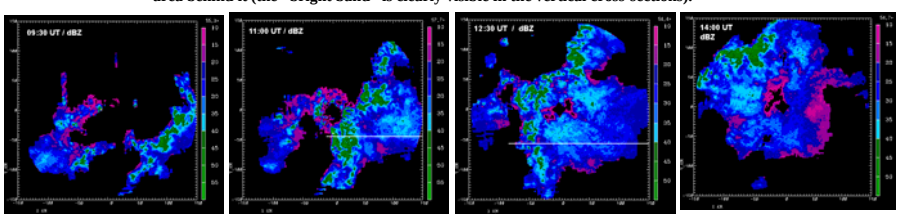
A moderate isolated storm developed at 22:40, moving towards WNW at 26 km.h^{-1}. Echo tops were about 15 km, maximum reflectivity 50-60 dBZ for most of the time and 30 dBZ mostly up to 12.5 km. Just before this cell dissipated, it developed a microburst, clearly visible in the radial velocity field above at 00:40. The storm propagated through development at the leading edge.

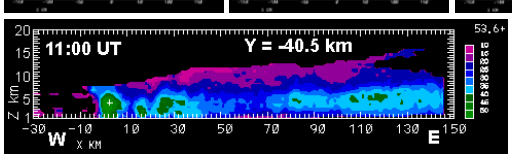
MESOSCALE CONVECTIVE SYSTEM on 08:10:2002

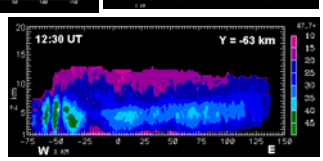


A Mesoscale Convective System (MCS) developed about 300 km east of the radar, first in form of isolated, far spread cells, at about 06:30 UT, which eventually merged into larger complexes (07:58), moving west-north-westwards at ±45 km.h^{-1}. It crossed the whole radar range, as shown in the CAPPIs and finally decayed in western Rondônia after 16:48 UT. The leading edge comprised continuously developing severe storm complexes with a diameter of about 50 km and echo tops of up to 15 km, trailing a >150 km stratiform rain area behind it (the "bright band" is clearly visible in the vertical cross-sections).









CONCLUSIONS

Storm Structure

- The majority of echo cores in Rondônia is upright;
- Very few tilted cores were observed;
- This could be the reason for rapid development of very tall cells (convective systems), as well as their relatively short life time, since a vertical updraft would shut itself down quickly;
- Storm complexes in Rondônia are considerably taller (±20 km) than their São Paulo counterparts and frequently penetrate the tropopause;
- Large stratiform rain regions developed after the scattered storms on 07:10:2002, incorporating new convective cells;
- The MCS seems to have perpetuated due to a significant wind shear at ±10km (clearly visible in the radial velocity fields). Rapid propagation was due to strong updrafts at the leading edge, leaving extensive stratiform regions of >150 km behind it. The bright band (melting of ice) is clearly visible in the vertical cross-sections.

Radar Data and Programs

- The sun calibration, performed by IPMet on 20:10:2002, needs to be evaluated, in order to determine the exact correction for the azimuth and also to provide a check for the reflectivity measurements;
- The radar logbook should be available on the LBA Website;
- This is the first attempt to convert GAMIC radar data to UF and currently there is still a problem with the conversion of radial velocities to UF;
- The "oversampling" by the LBA radar (24 elevations) causes problems with SPRINT, which only accepts the first 16 PPI elevations (thus, ignores all PPIs above 11° elevation). This results in a "data hole" near the radar in the Cartesian data set;
- The analysis of all storms will be re-run as soon as the above problems have been corrected and the conversion programs finally tested (especially for the radial velocities).

ACKNOWLEDGEMENTS

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- The LBA Project Coordinators, as well as the radar operators, are thanked for their support during the field experiment.

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