THE USE OF A RADAR NETWORK TO DETERMINE THE CHARACTERISTICS OF MESOSCALE CONVECTIVE SYSTEMS IN THE STATE OF SÃO PAULO

Ana Maria Gomes, Gerhard Held, Marcelo Moreira Medeiros[1] and Jonas Teixeira Nery[1]

Instituto de Pesquisas Meteorológicas, UNESP, Bauru, S.P., Brazil

[1] Department of Geography, Unidade Experimental de Ourinhos, UNESP, Ourinhos, SP

INTRODUCTION

The State of São Paulo is situated in the south-eastern region of Brazil and is, in general, characterized by a transition region between a tropical climate, typical of low latitudes and the mesothermal climate, typical of middle latitudes (Nimer, 1979). The region is under the influence of both tropical and mid-latitude, large-scale synoptic systems and convective activity is mostly concentrated during the summer period, where most of significant weather occurs between October and March, when the supply of solar energy and humidity is greatest. The Meteorological Research Institute (IPMet) of the São Paulo State University (UNESP) has been monitoring the three-dimensional structure of thunderstorms, including the radial velocities inside and near these storms, since 1992 and 1994, respectively, using two S-band Doppler radars in the central and western part of the State of São Paulo. One of the tools used presently for monitoring and warning of storm systems is the latest version of NCAR's (National Center for Atmospheric Research) TITAN (Thunderstorm Identification Tracking Analysis and Nowcasting) Software, which had been implemented at IPMet and adapted for local requirements in 2006. A research version, in *Archive mode* is deployed for pos-fact analysis.

IPMET's RADAR CHARACTERISTICS

The main characteristics of both radars are: 2° beam width, 450 km range for surveillance mode and 240 km in volume scan mode, with 16 elevations (0.3° to 45°), 250 m radial and 1° azimuthal resolution, and a temporal resolution of 15 minutes or less, recording and archiving reflectivity, radial velocity and spectral width.

OBJECTIVES

- To study morphological characteristics of mesoscale convective systems (MCS) in the State of São Paulo,
- To determine storm parameters such as the area, the duration, their observed convective portion and its temporal evolution, as well as their initiation, intensification and decaying phases.

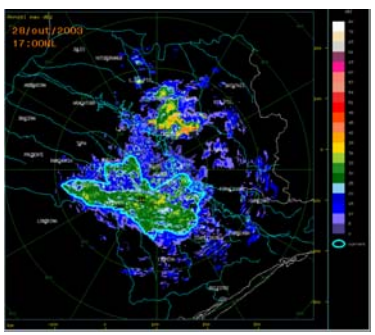
RADAR DATA FOR THIS STUDY

- CAPPIs from Bauru radar (BRU), covering a quantitative 240 km range,
- Reflectivity values for a nominal radar cell of 1 km x 1 km composed the CAPPIs,
- For 3.5 km amsl heights, generated about every 7.5 min,
- TITAN system is used to identify and track the MCS by setting a minimum area threshold of 1250 km^2,
- Reflectivity threshold of 20 dBZ, lasting at least 1 hour and observed in 3,5km CAPPIs.
- The analysis presented here is based on the rainy season of 2003-2004.

MCS MAIN CHARACTERISTICS

The identification and tracking of the MCS was done considering the following parameters:

- Mininum area of at least 1250km^2, for a reflectivity threshold >20 dBZ observed on CAPPIs (Constant Altitude Plan Position Indicator) at 3,5 km.
- Lasting at least 1 hour



Automatic Identification, by TITAN, of the MCS following the criteria defined previously, and applied to the Bauru radar data (BRU), for October, 28 2003 at 17 HL (Local Time = GMT – 3h))

- It was identified 470 MCS, based on the selected parameters.
- Approximately one-third of these systems were initiated during the late afternoon and early evening, between 17:00 and 20:00 LT (Local Time; LT = UT-3h), with the majority having been observed during the months of December and February.
- From all observed MCS during the analysis period, 67 of these had a lifetime of between 4 and 15 hours. The observed mean area was between 3 and 25x10^3 km^2 with maxima between 5 and 75x10^3 km^2. So far, one event was analyzed taking into account the temporal distribution of the percentage of the 40 and 50 dBZ areas embedded in the MCS.

Acknowledgments

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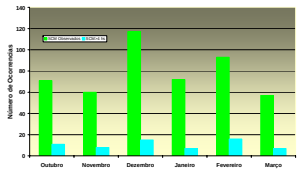
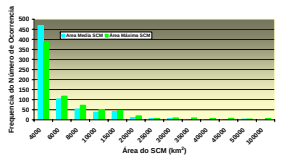
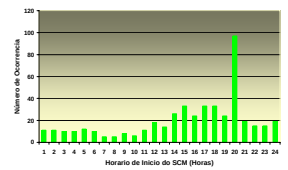


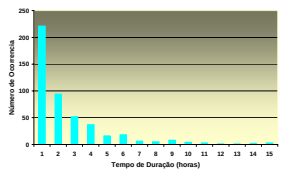
Frequency distribution of the MCS during summer 2003-2004.
Total of identified MCS(green) and MCS with duration >4 hours (blue).



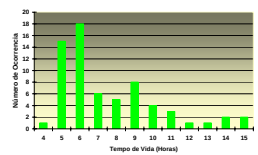
Frequency distribution of the mean (blue) and maximum area(green) for the identified MCS during summer 2003-2004.



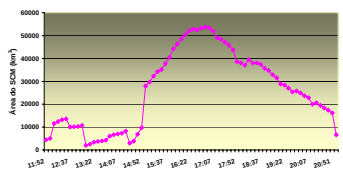
Frequency distribution of the initiation for all identified MCS, during summer 2003-2004.



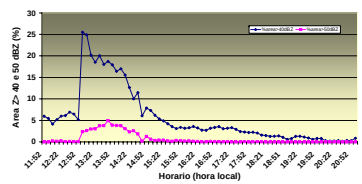
Frequency distribution of duration, in hours, of the identified MCS during summer 2003-2004.



Frequency distribution for the identified MCS with duration >4 horas



Temporal evolution of the MCS observed on October 07,2003 showing its initiation time at 11:52 LT, its mature stage reaching the maximum precipitation area, and the decaying stage at about 21:00 LT.



Frequency distribution of the 40 e 50 dBZ areas during the different lifetime stages of the MCS observed by the Bauru radar on October 7, 2003.

This work is an ongoing research that will be extended by using 15 years of radar data available at IPMet, aiming to contribute for a better understanding of the spatial and temporal behaviour of the MCS and the impact of its produced precipitation by the MCS in the State of São Paulo.