

# Rainfall Short-Term Forecast in the Surveillance Area of São Paulo Weather Radar

JOSÉ FELIPE DA SILVA FARIAS  
AUGUSTO JOSÉ PEREIRA FILHO



August 2012

# INTRODUCTION

The forecast of rain the very short term is very important especially in very populated areas, helping to reduce fatalities caused by tornadoes, storms and floods, and prevent major damage to different sectors of society as the private, industrial, transportation and agriculture.

## OBJECTIVE

Evaluate of the rainfall nowcasting within the surveillance area of São Paulo weather radar for different types of precipitating systems, mainly the are associated to floods and landslides in Metropolitan Area of São Paulo, was carried out with an 2D wind advective scheme and rainfall rates estimated by radar. The third-order upstream numerical scheme was used with a uniform wind vector.



- **Urbanization**
- Soild cover
- Heat Island
- Deeper convection over MASP



Source: [www.oesteinforma.com.br](http://www.oesteinforma.com.br)



lat: 23° 36' 00" S  
lon : 45° 58' 20" W  
alt: z = 916 metros

Geographical location of the of São Paulo weather radar.

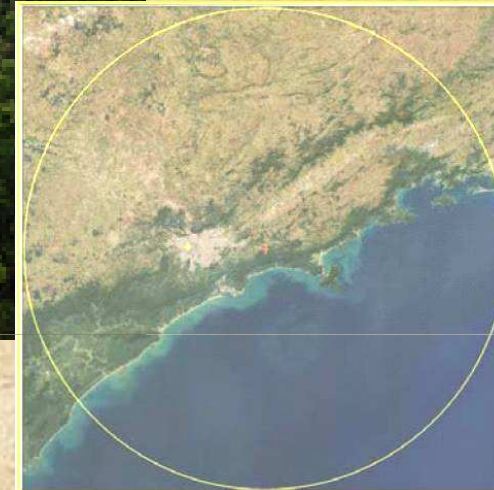


Image of the State of Sao Paulo with satellite ACQUA obtained. A circle indicates the area of coverage of the radar. Source: Santos Filho and Pereira da Silva (2006).

- 240 Km
- 33 elevations every 5 minutes
- Horizontal resolution of 2 km x 2 km
- Band S (10 cm)
- Relation  $Z=200R^{1.6}$  of Marshall & Palmer (1948)

## RAINFALL SHORT-TERM FORECAST

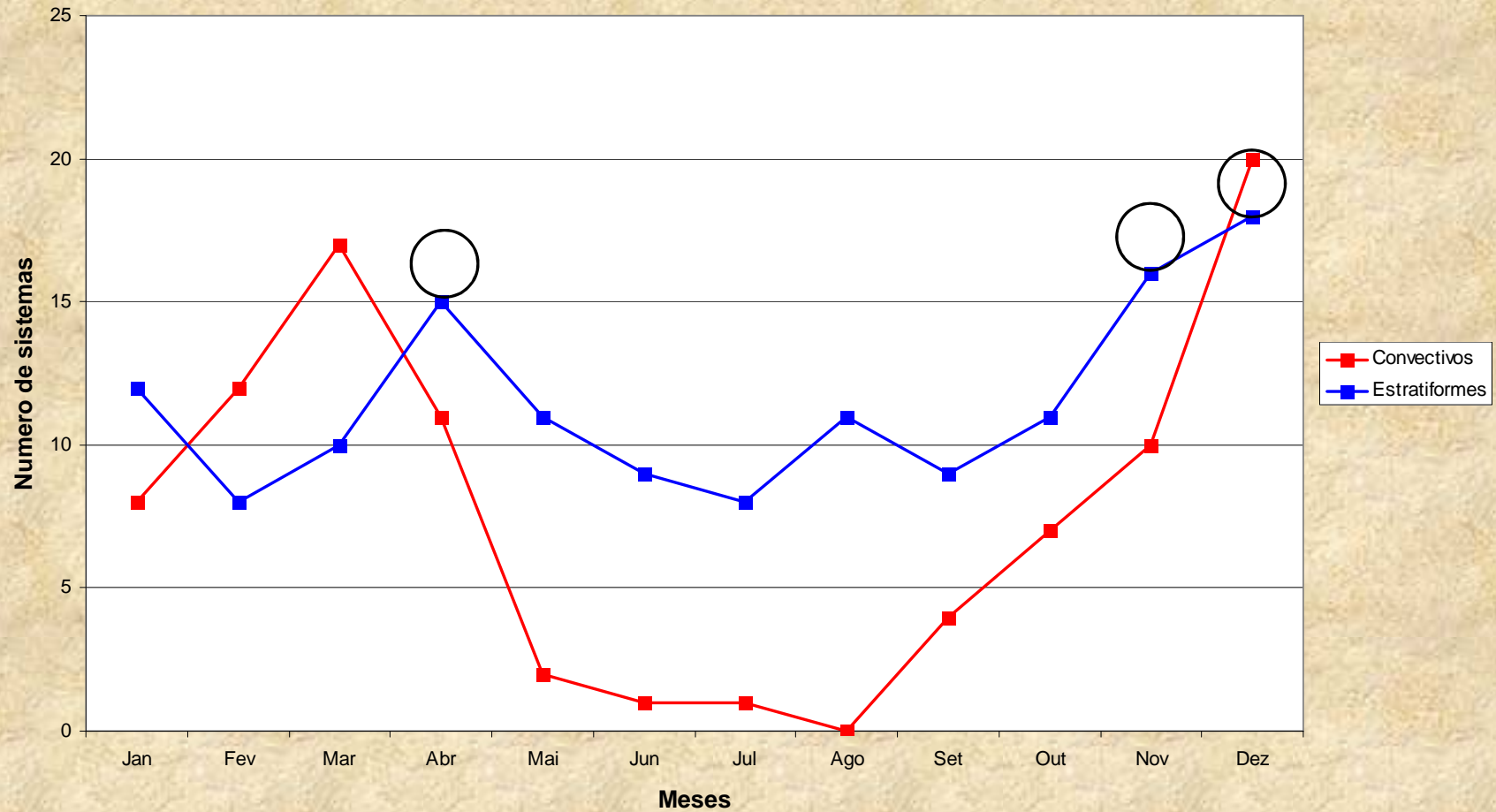
The rainfall short-term forecast was made from the displacement vector of the precipitating system, obtained by the method SHARP (Short - Term Automated Radar Prediction) developed by the group of meteorology at McGill University and also used by the Sao Paulo Weather Radar.

Linear extrapolation of radar echoes for up to 3 hours of constant displacement vector prediction with keeping the same structure of precipitation.

# PRECIPITATING SYSTEMS

Weather Systems	Ocurrence
Cold Fronts	May to October
Disperse Bands	November to December
Squall lines	February, October and November
Ordinary Convection	December and April
Sea Breeze	December e March

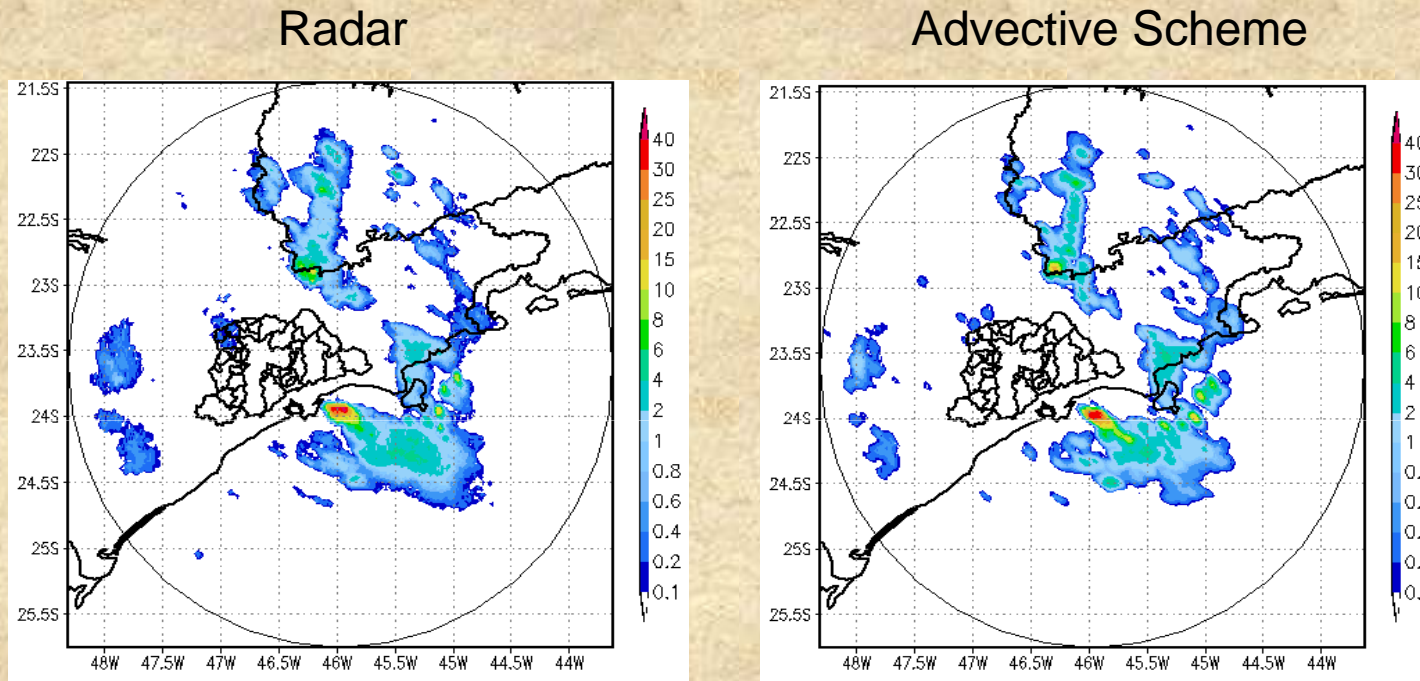
# Rainfall rate treshoud 20 mm/h



Number of convective e e stratiform events between 2004 - 2005.



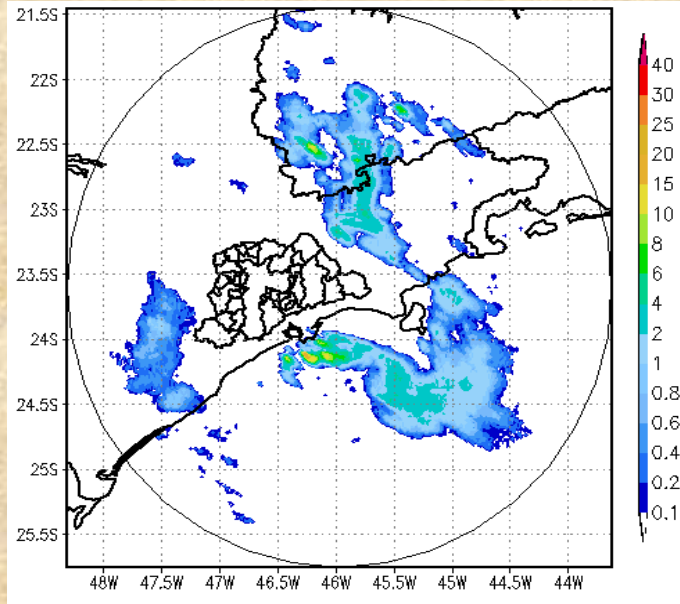
# Comparison between radar and advective scheme



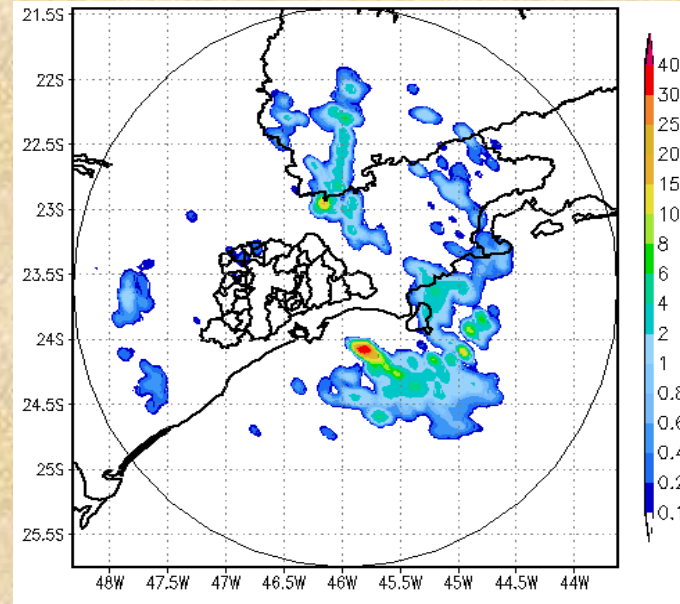
30 minutes

Field of precipitation accumulated by of São Paulo weather radar (left) and predicted by advective scheme (right) for 30 minutes, for an event Dispersed Bands of April 21, 2005 at 07:47 (UTC). Latitudes, longitudes and geographic contours including the Sao Paulo Weather Radar and Metropolitan Region of São Paulo MRSP and municipalities are indicated. The color scales indicate the rate of precipitation (mm).

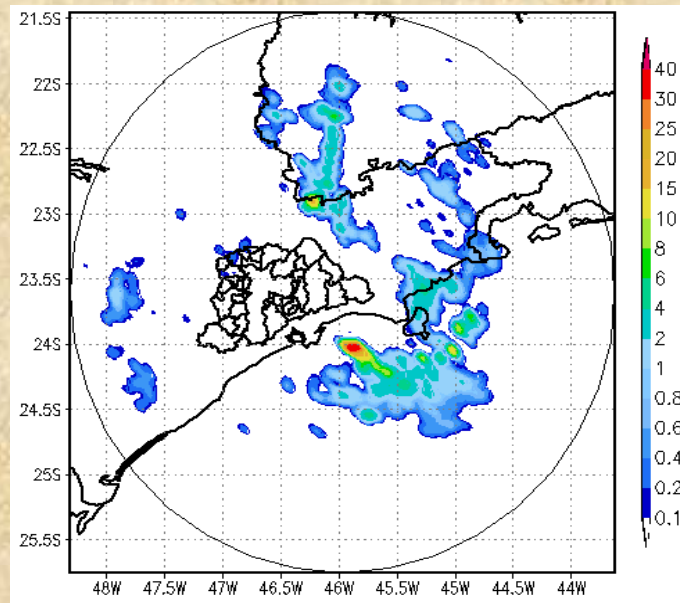
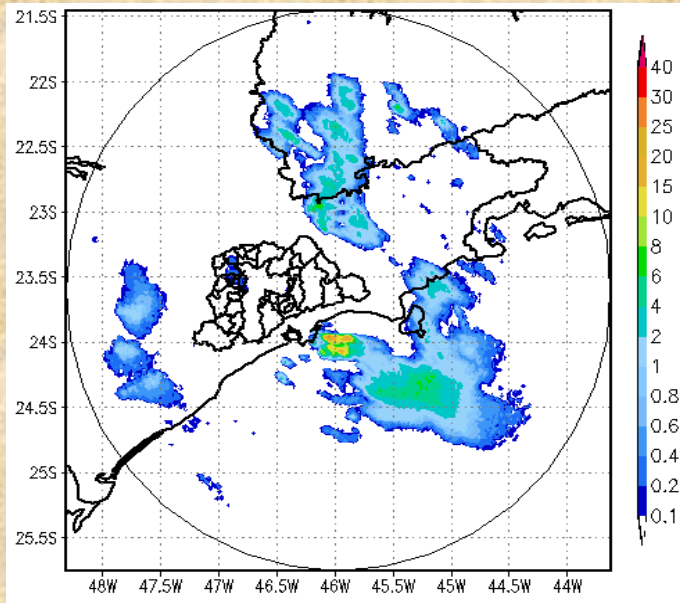
Radar



Advection Scheme

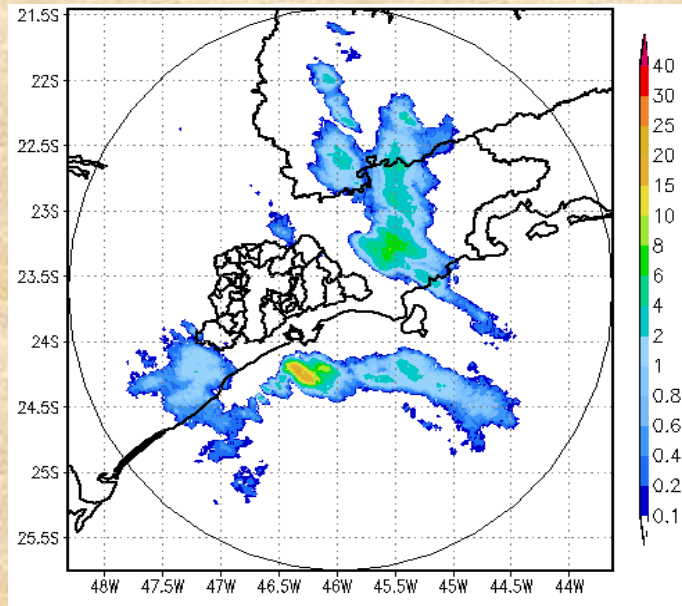


60 minutes

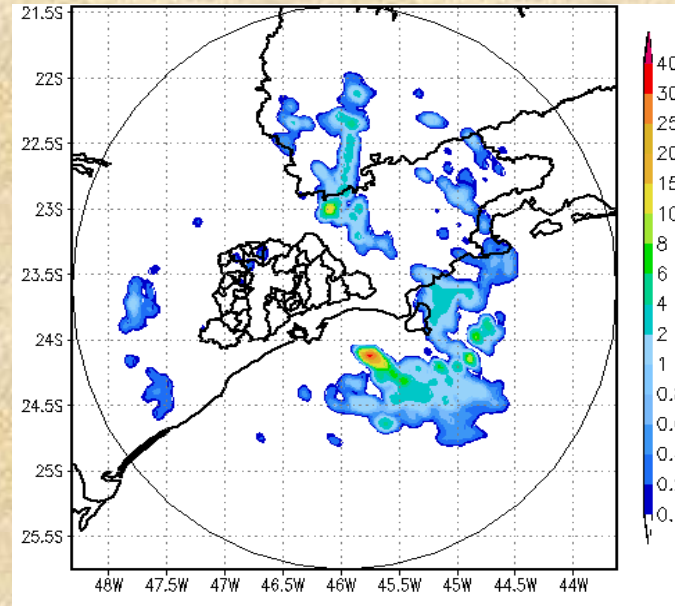


90 minutes

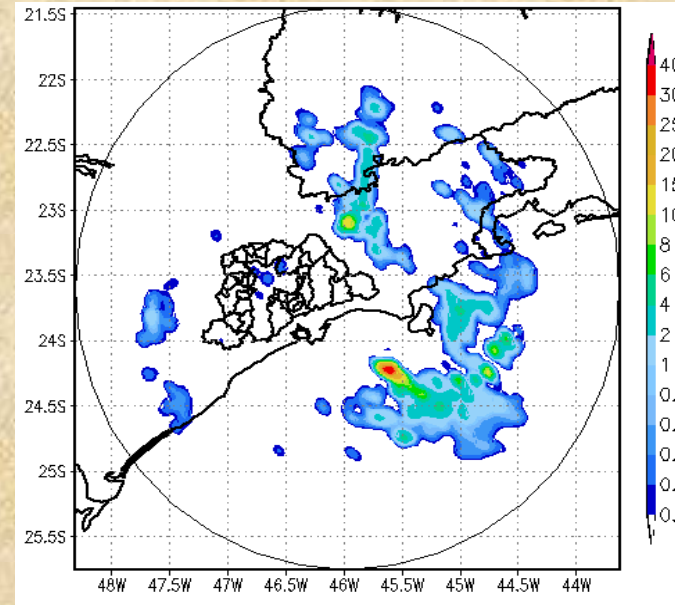
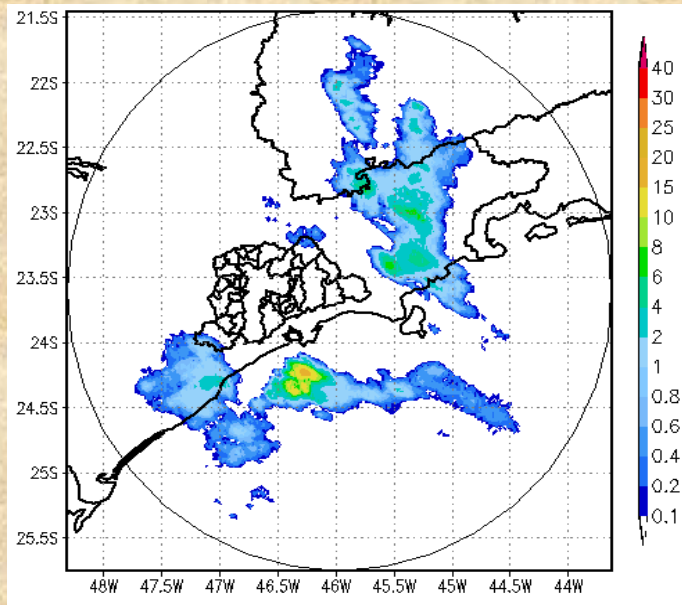
## Radar



## Advection Scheme

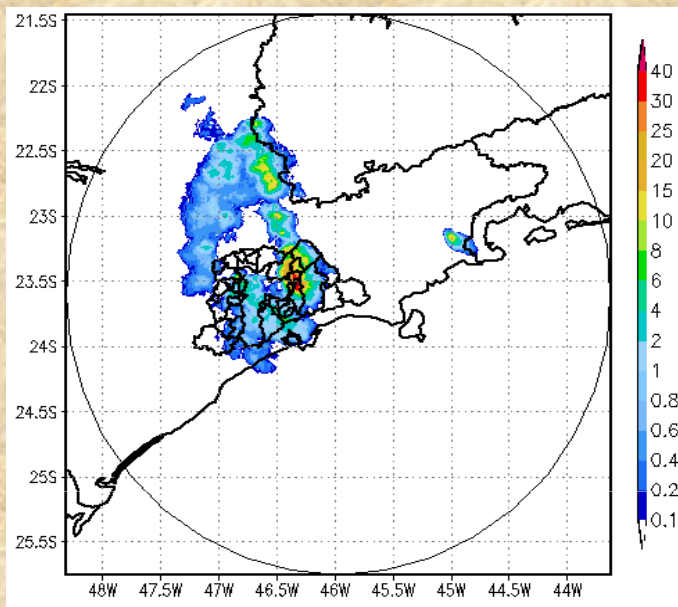


120 minutes

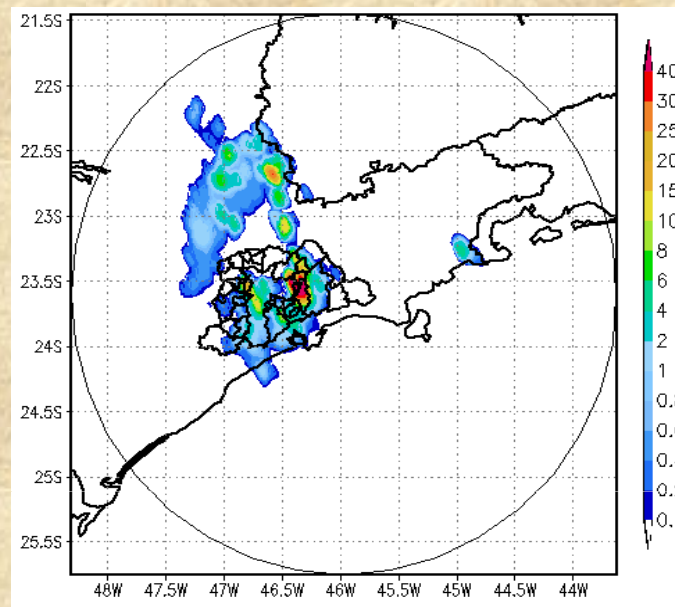


180 minutes

Radar



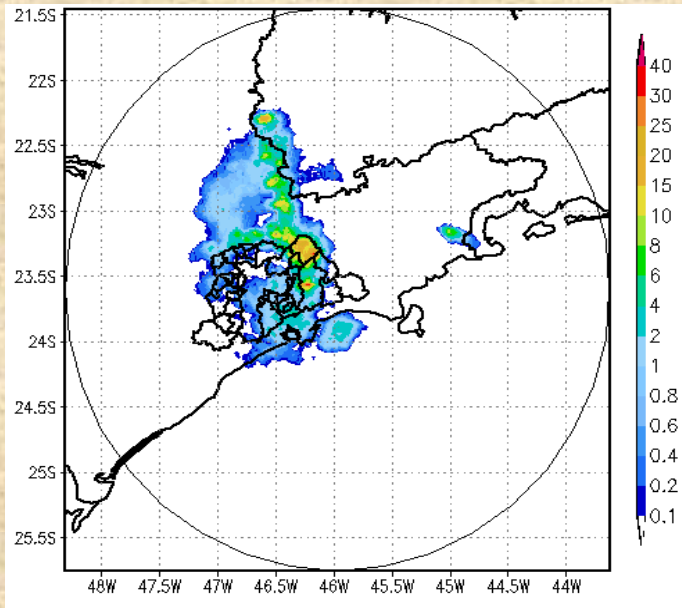
Advective Scheme



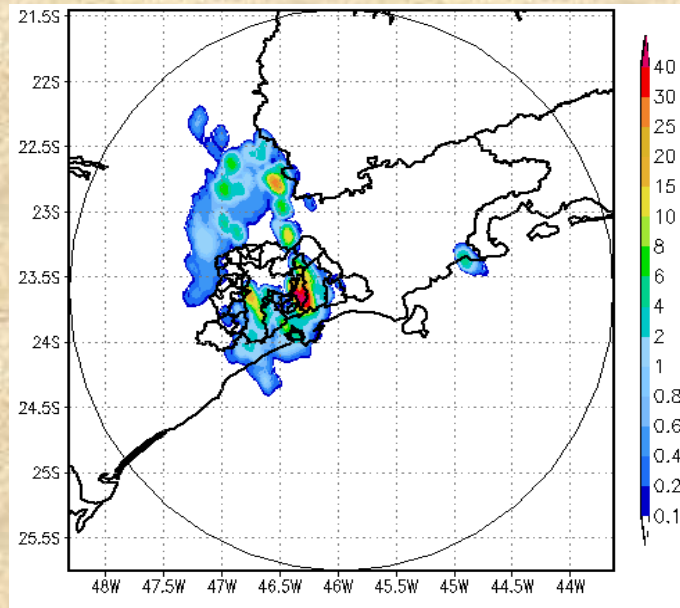
30 minutes

Field of precipitation accumulated by of São Paulo weather radar (left) and predicted by advective scheme (right) for Squall lines of September 19, 2004 at 20:47 (UTC) for 30 minutes.

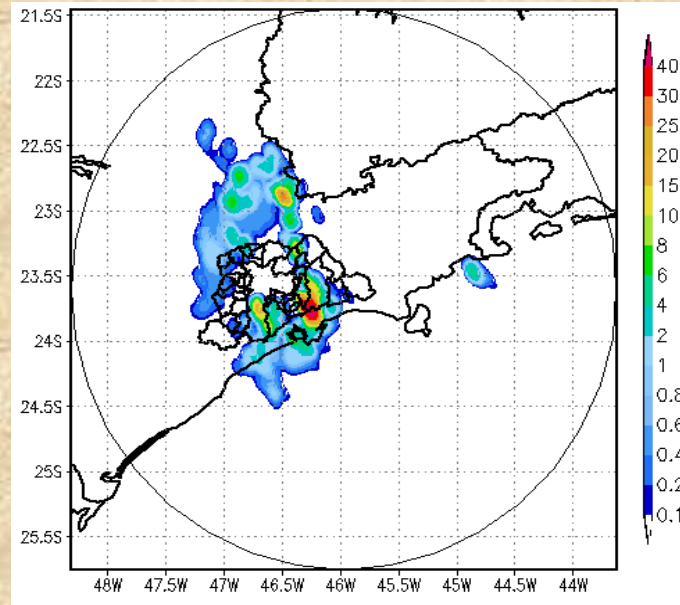
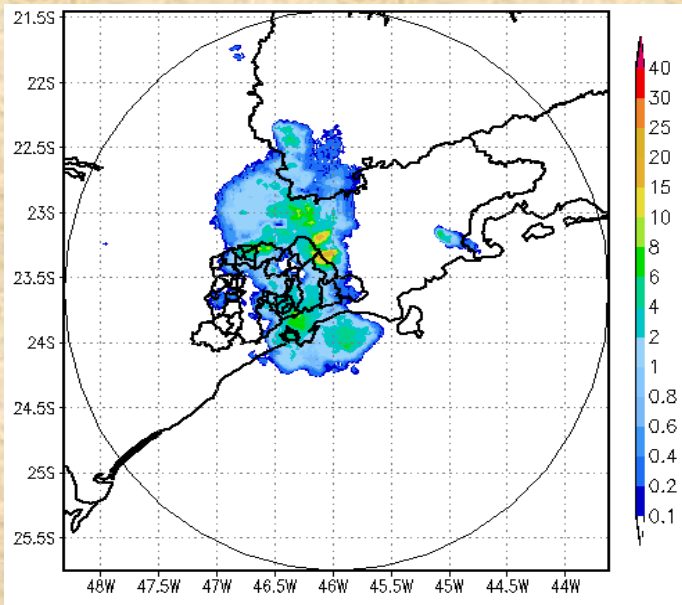
Radar



Advective Scheme

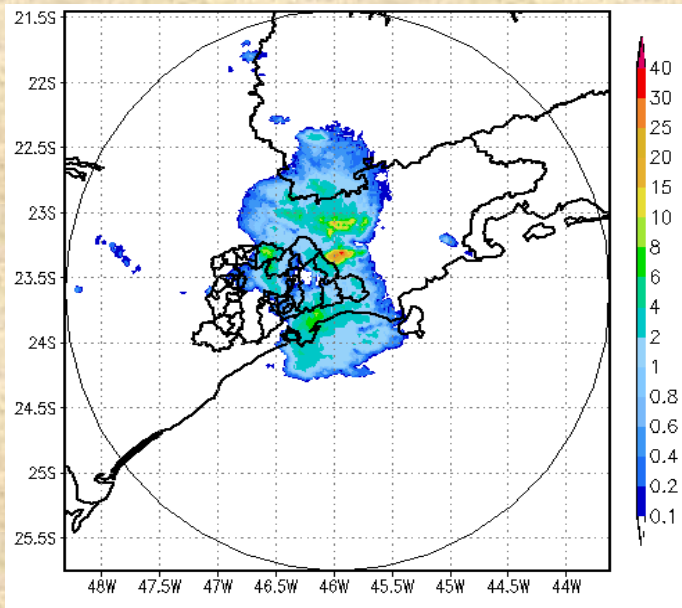


60 minutes

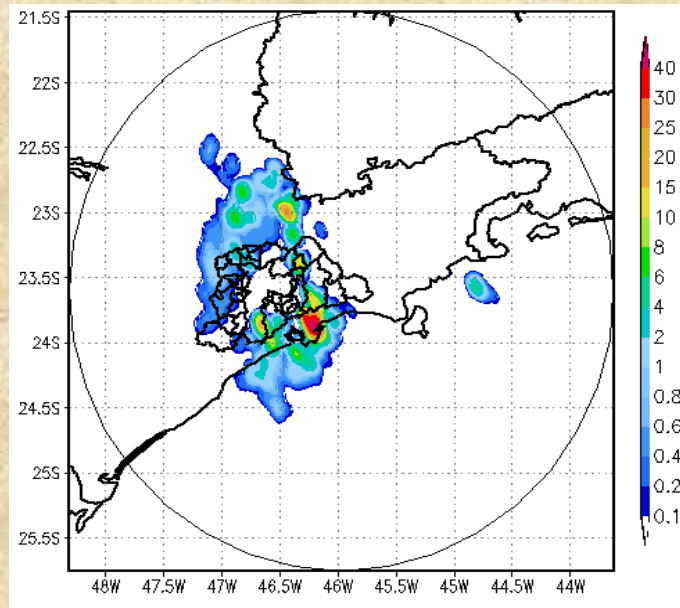


90 minutes

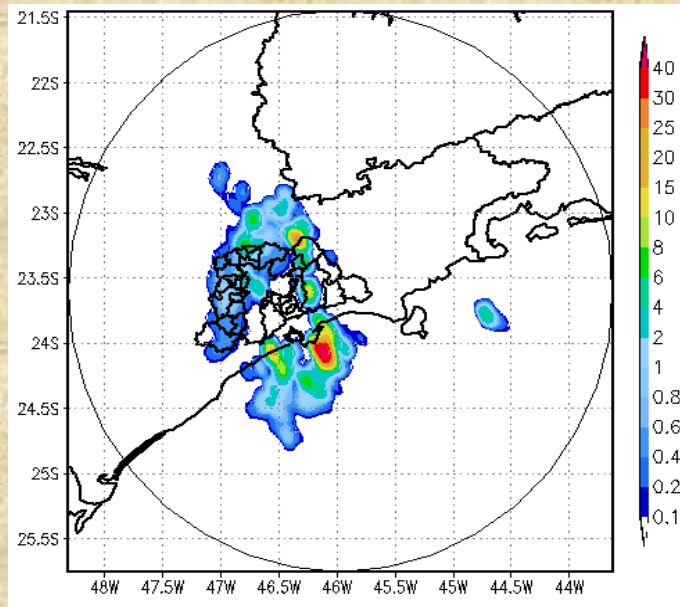
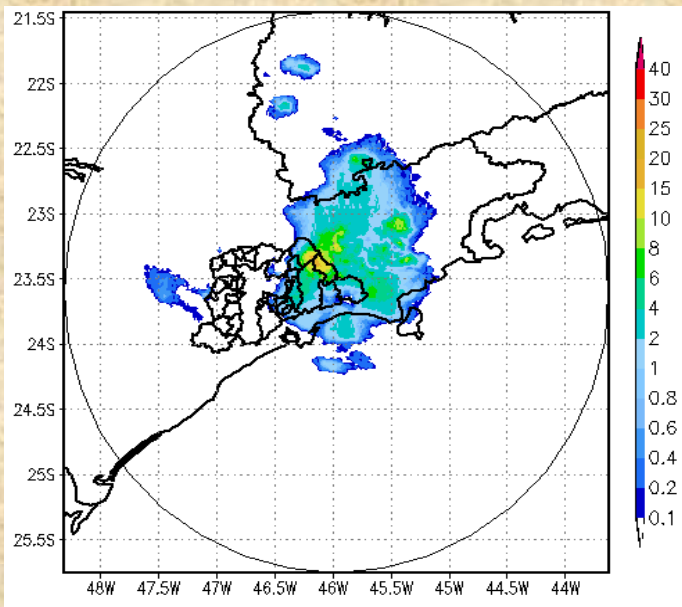
Radar



Advective Scheme

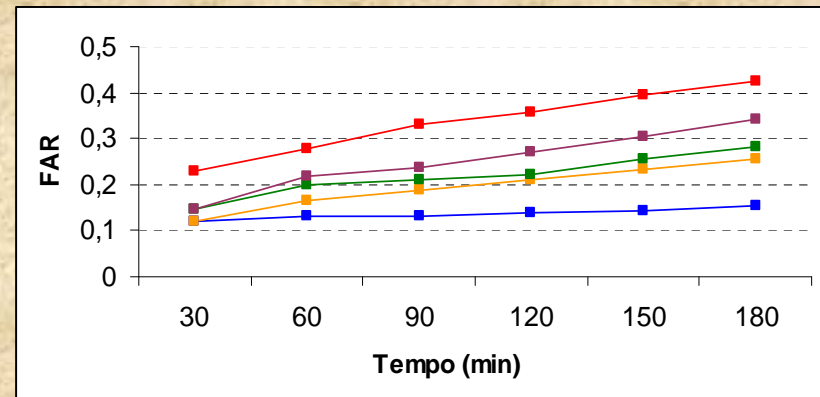
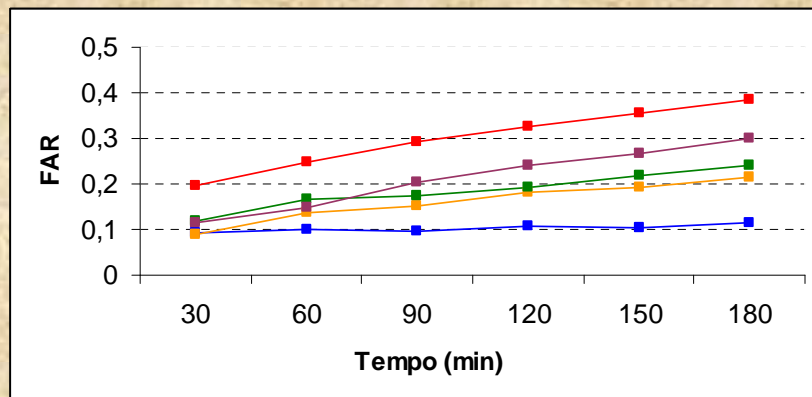
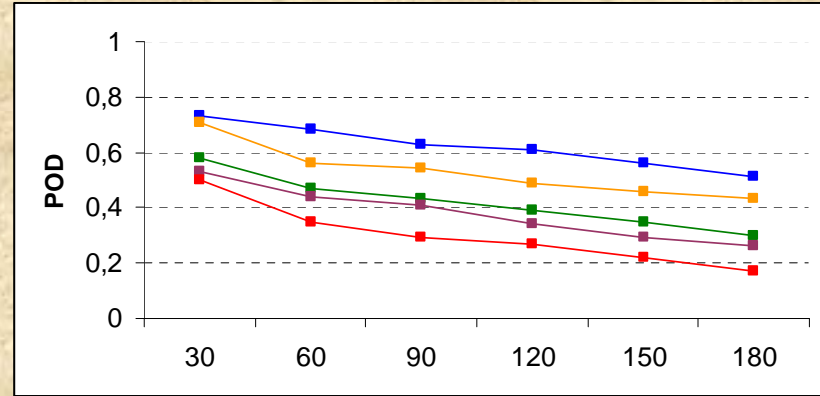
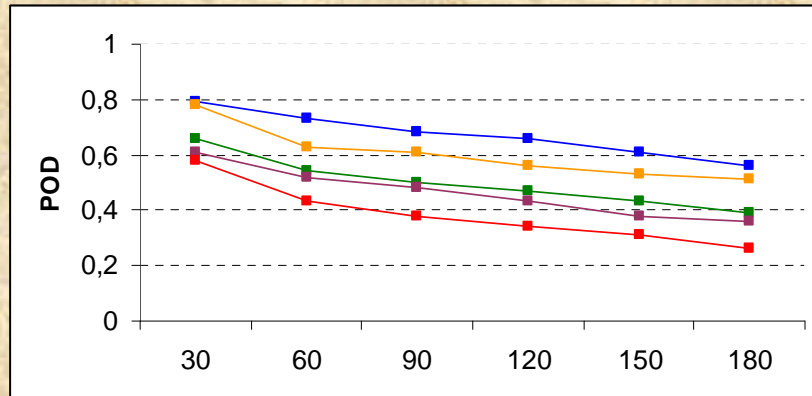
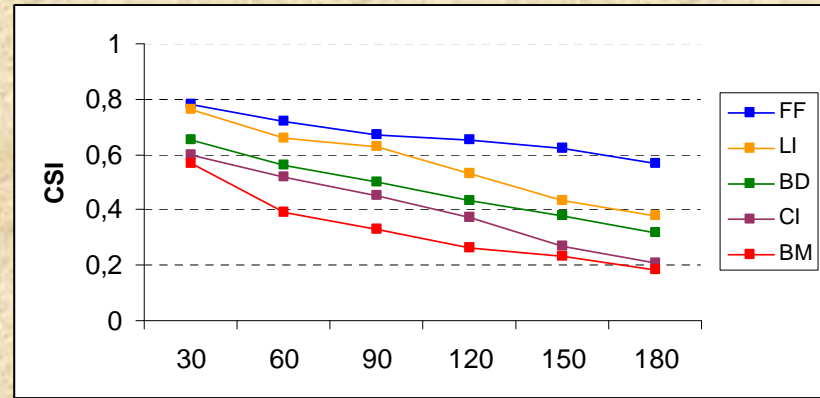
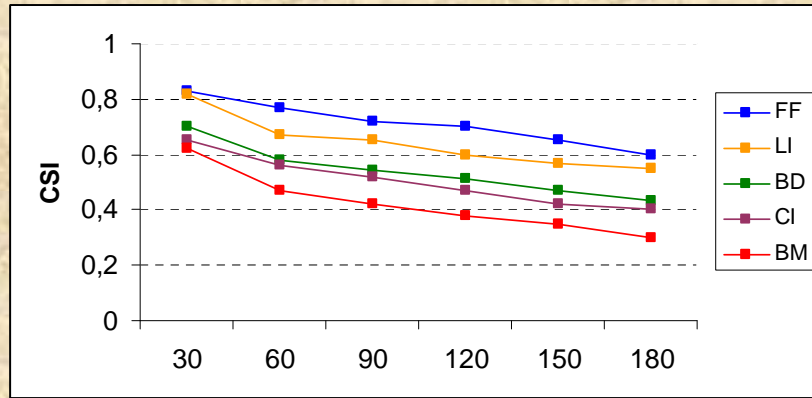


120 minutes



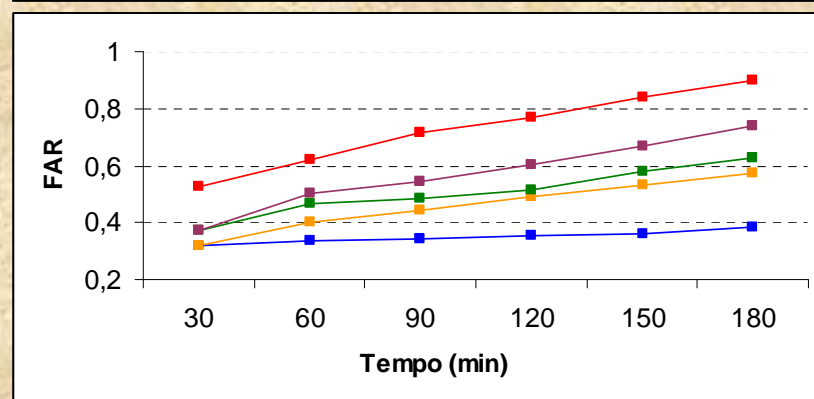
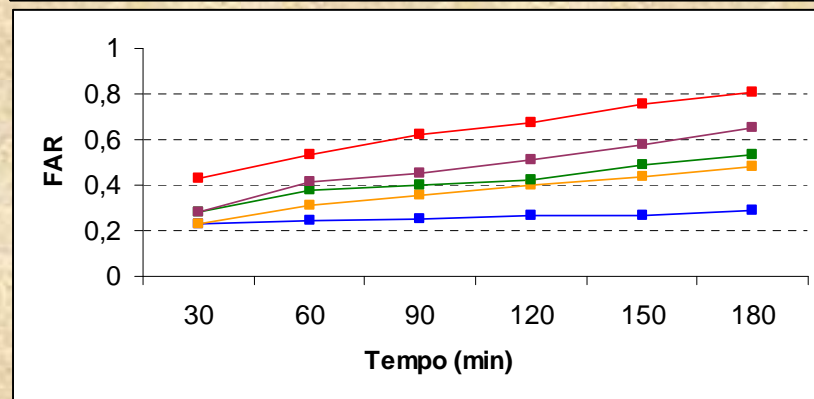
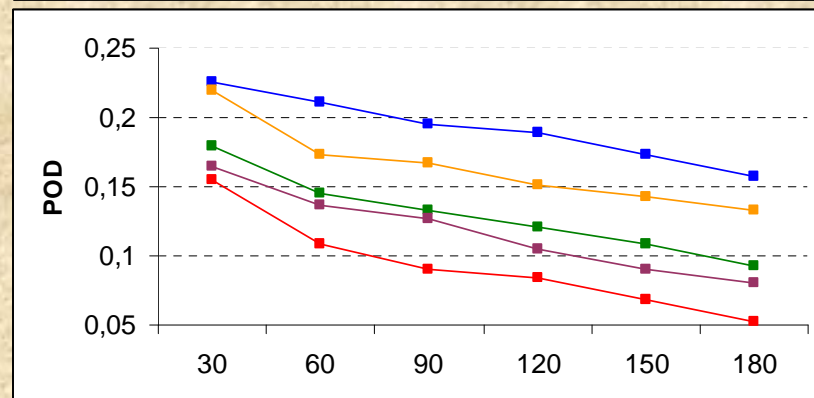
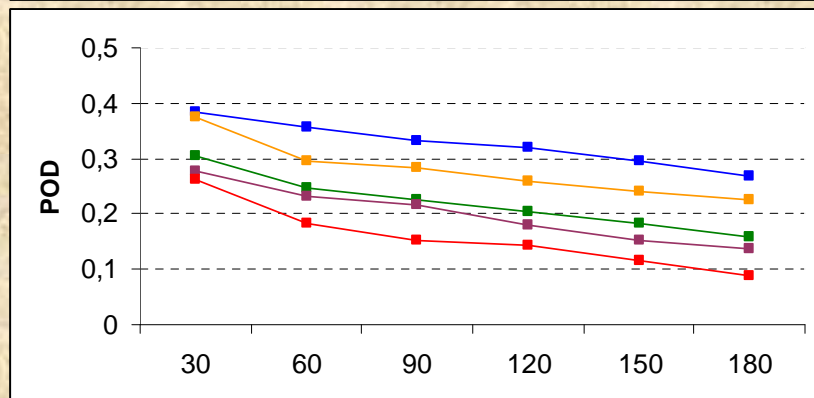
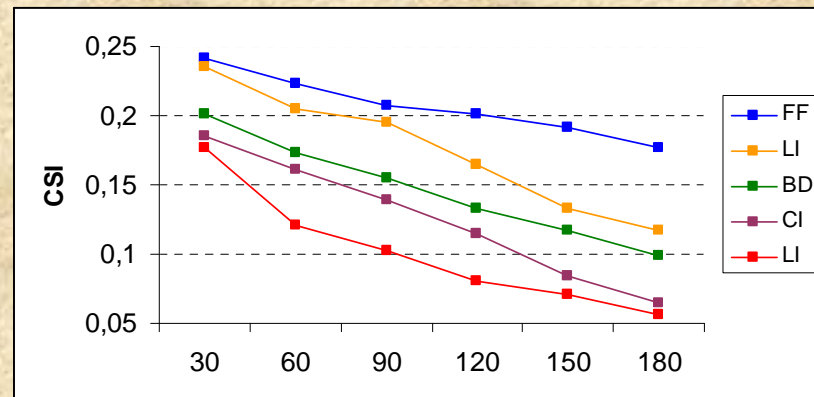
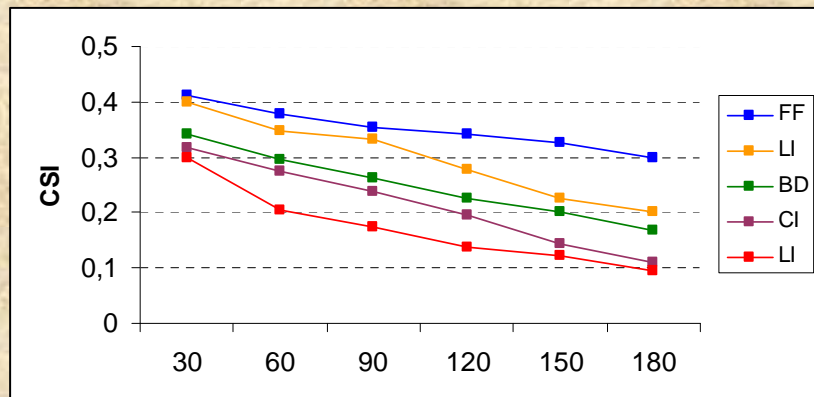
180 minutes

# RAINFALL FORECAST SKILL



0.2 mm

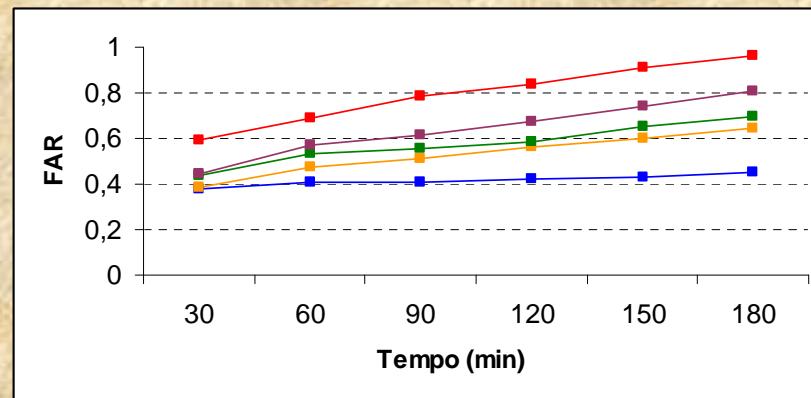
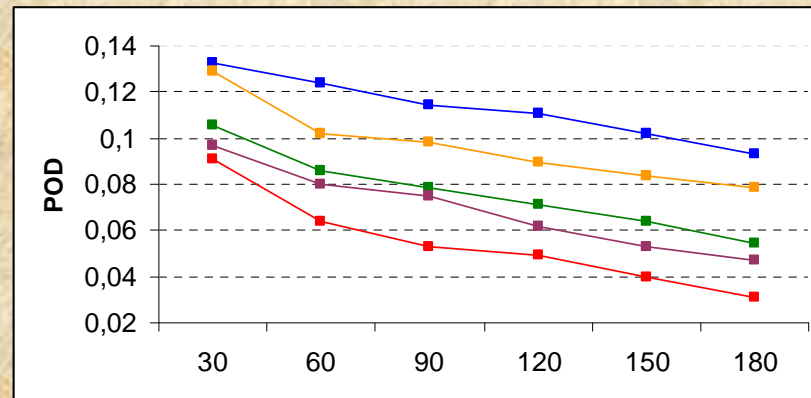
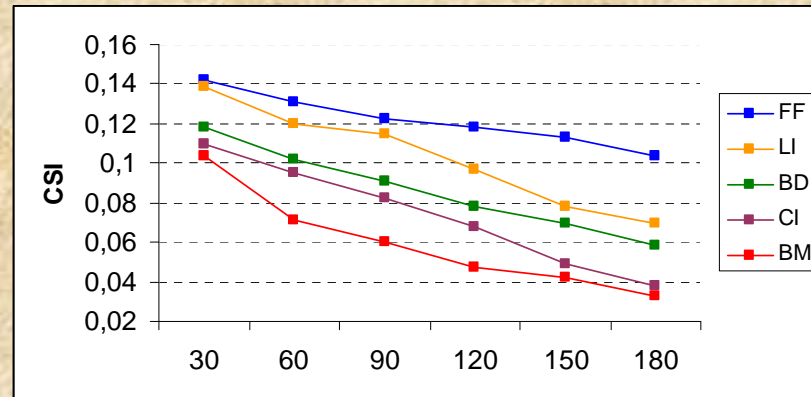
2.0 mm



4.0 mm

8.0 mm





16.0 mm

# CONCLUSIONS

- The advective scheme showed better performance of the lowest to the highest accumulations of precipitation. As for systems with more organized structure of precipitation (LI) or stratiform (FF);
- Systems with morphological structure more homogeneous and more organized precipitation can be advectados for a period exceeding 90 minutes. And convective systems 60 and 90 minutes (in the case of convection organized).

**THANK YOU!**