The Use of Satellite Data for Nowcasting: The ForTraCC Technique

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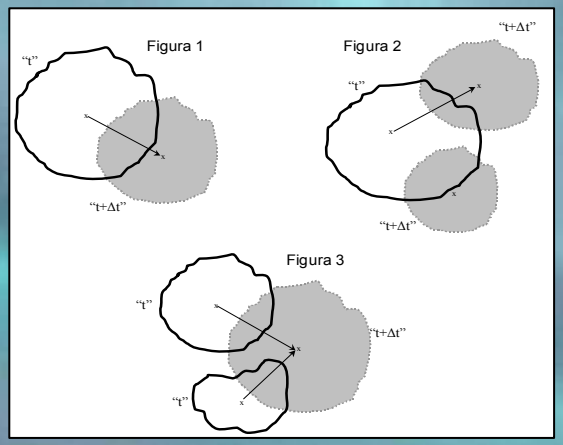
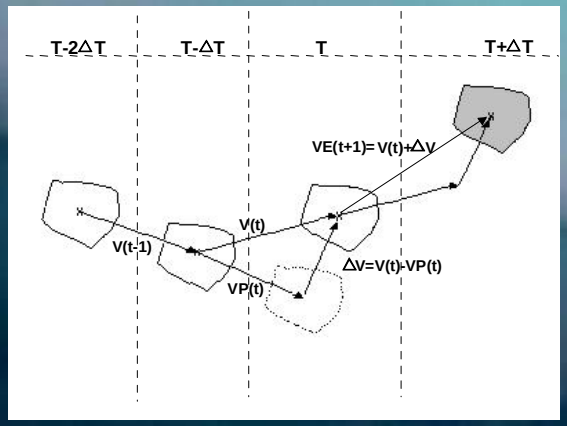
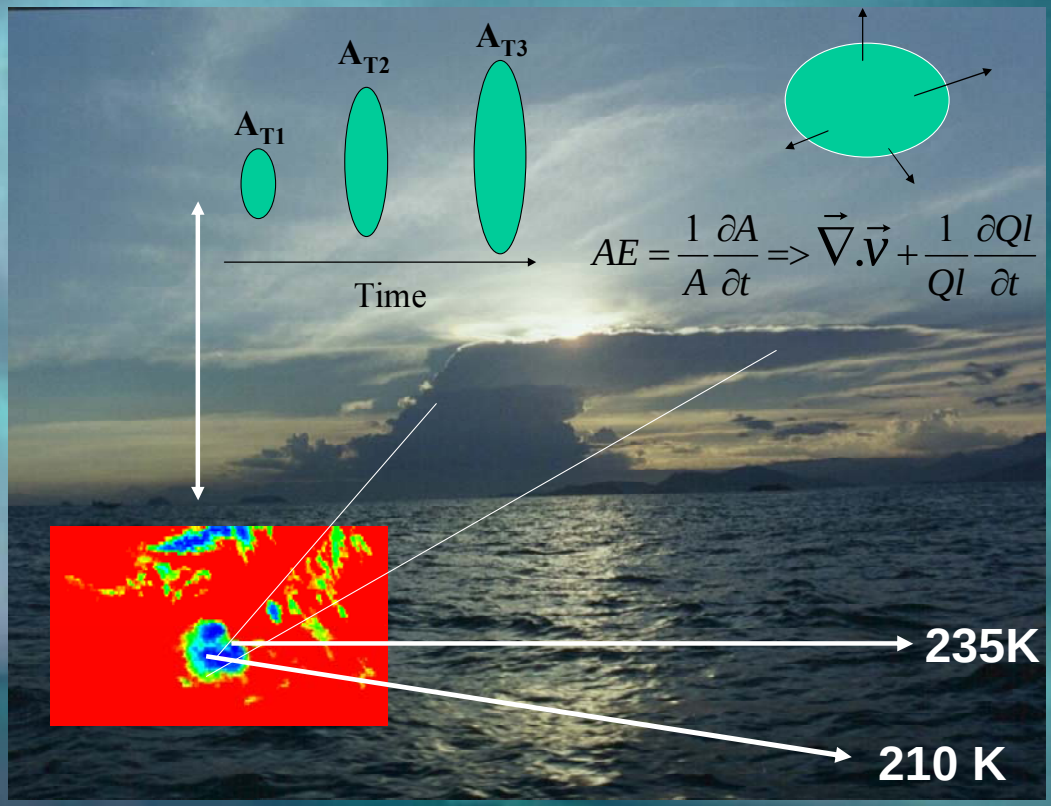
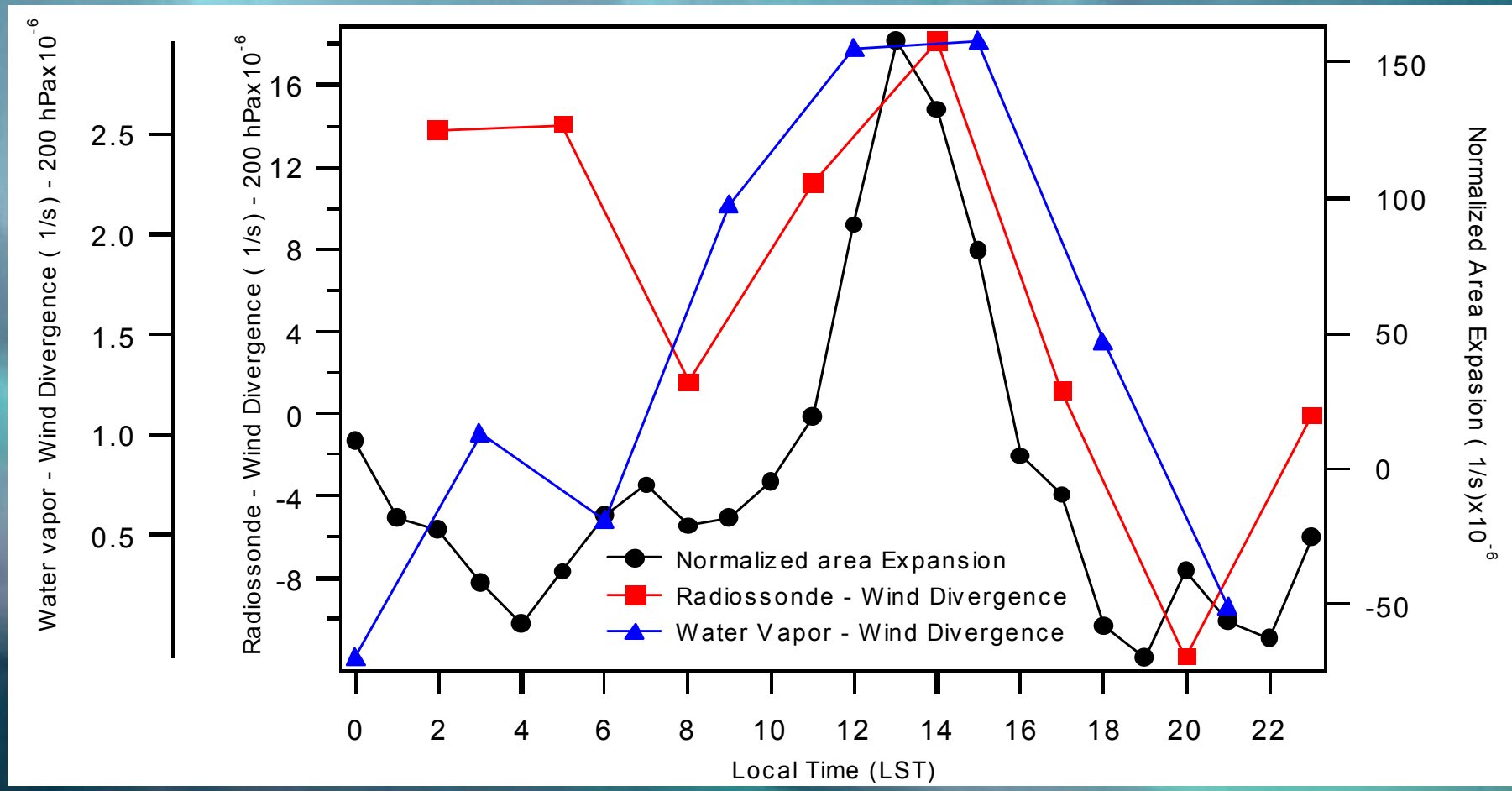
This study presents the ForTraCC (Forecasting and Tracking of Cloud Cluster) technique using satellite or radar data. ForTraCC is an algorithm for tracking and forecast the physical characteristic of mesoscale convective systems through its whole life cycle

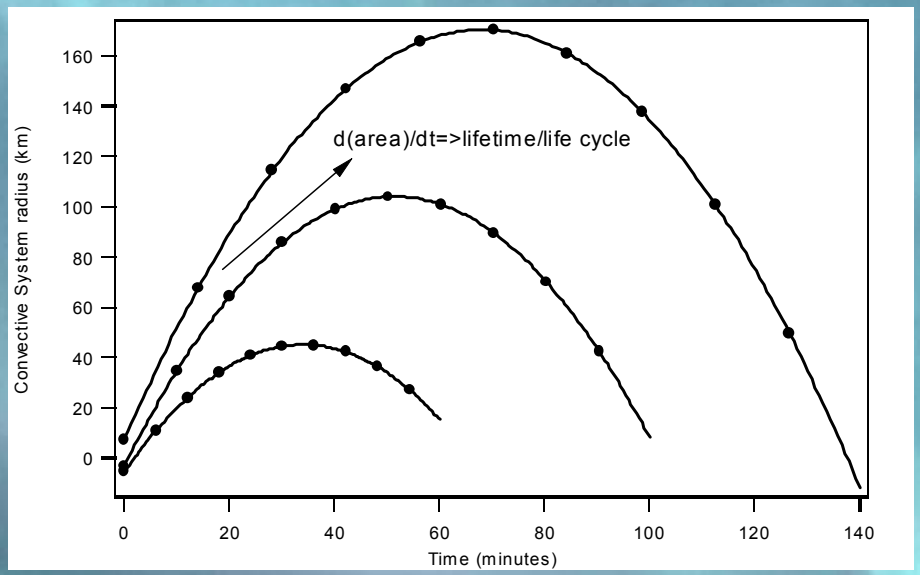




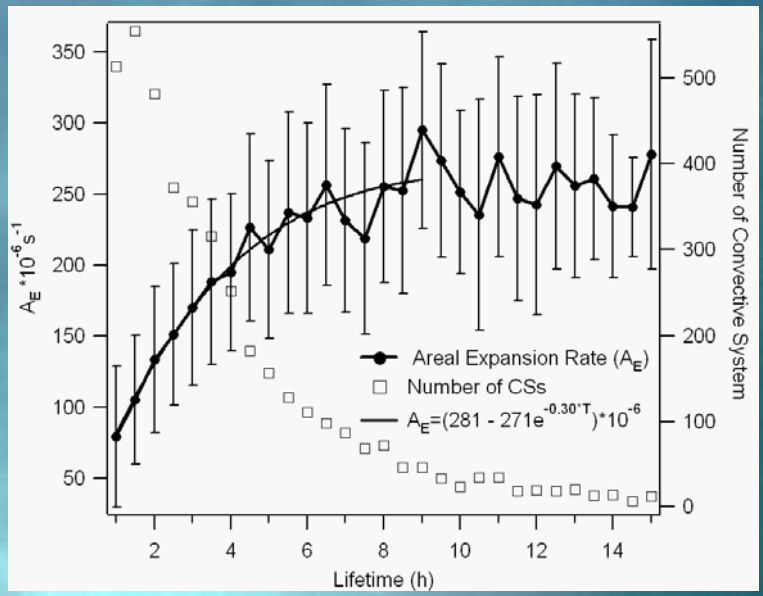


Hourly average area expansion, water vapor wind divergence and wind divergence from radiossonde for 200 hPa level at WETAMC/LBA region.

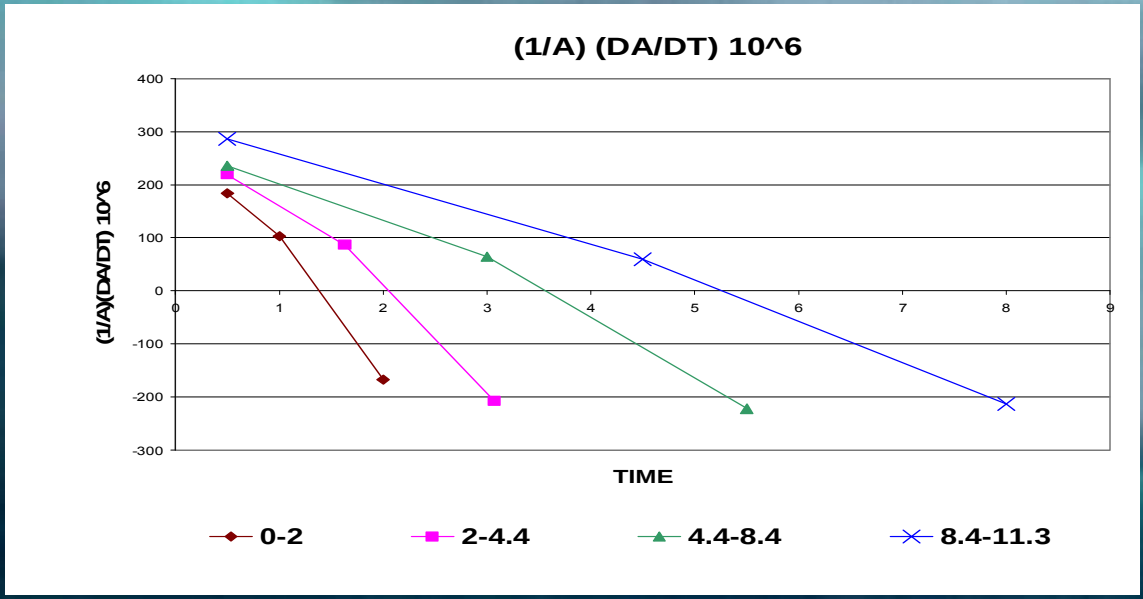


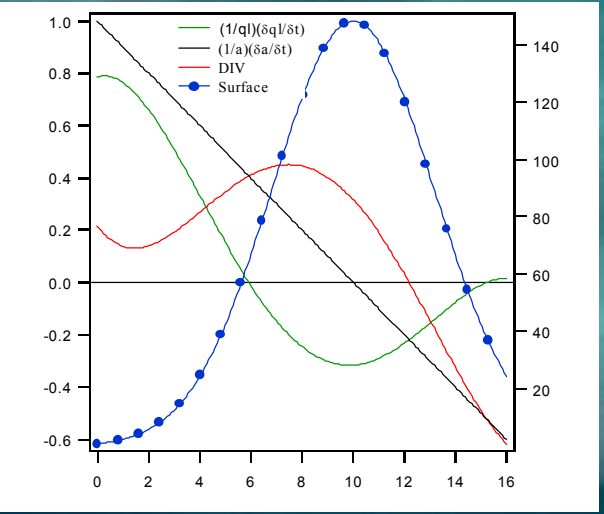


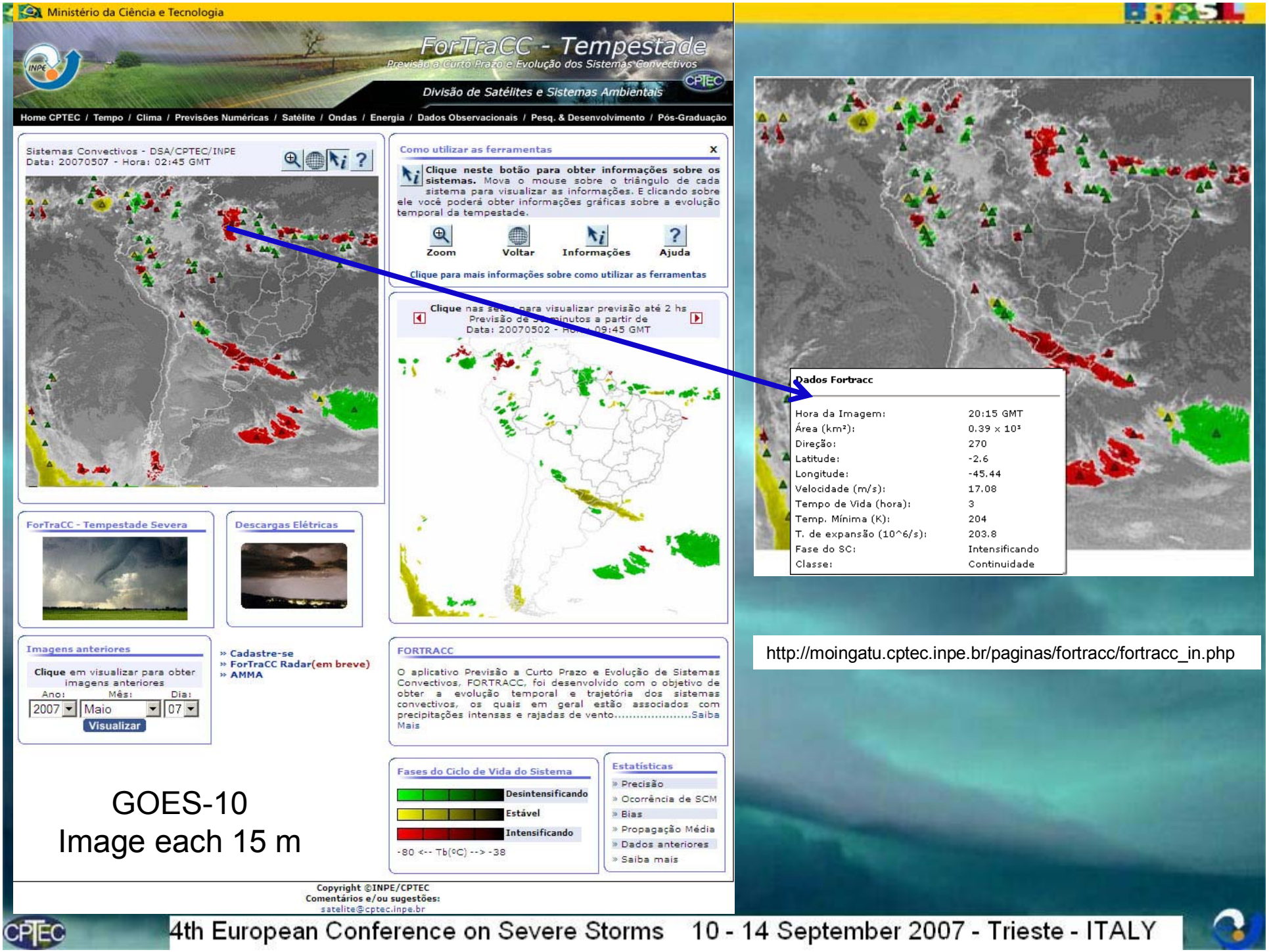
Machado and Laurent 2004

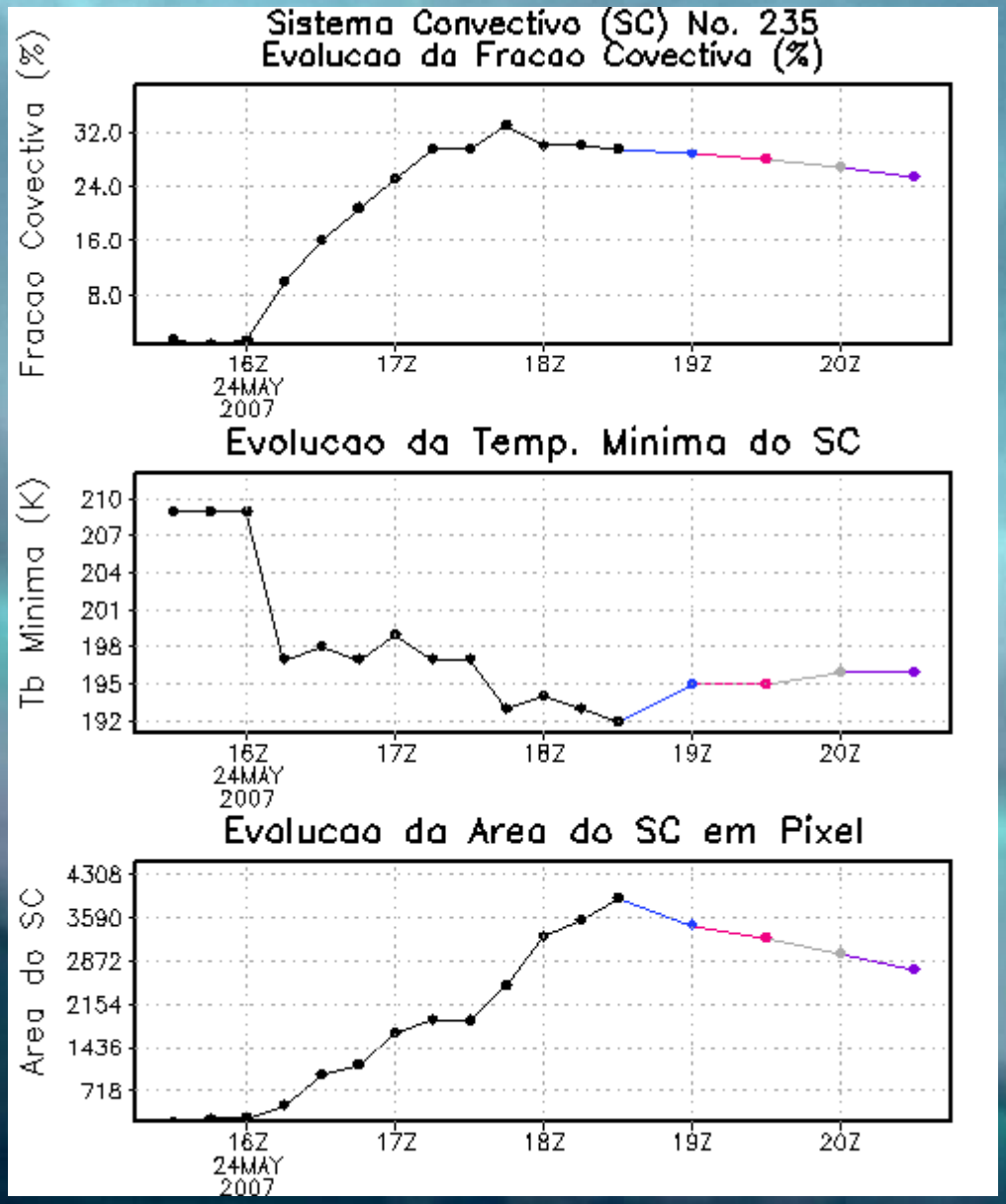


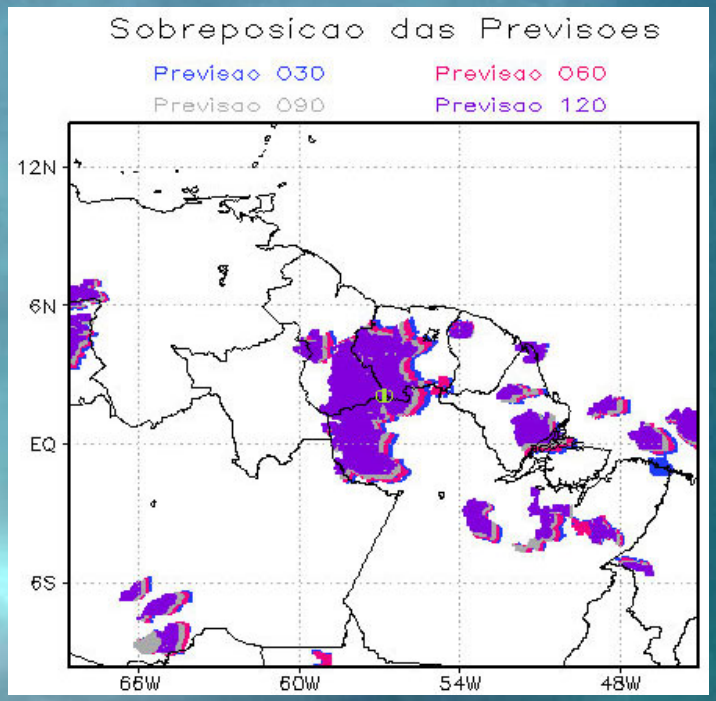
$$AE = \frac{1}{A}\frac{\partial A}{\partial t} \Rightarrow \vec{\nabla}.\vec{v} + \frac{1}{Ql}\frac{\partial Ql}{\partial t}$$



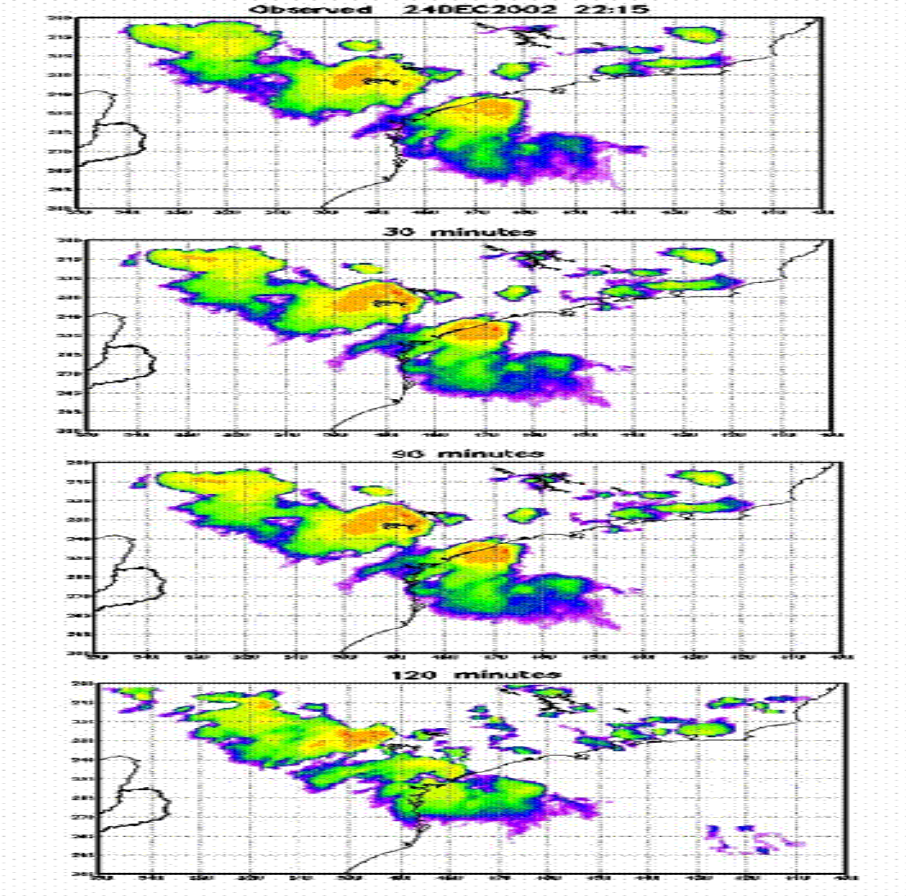



Ministério da Ciência e Tecnologia
ForTraCC - Tempestade
Previsão a Curto Prazo e Evolução dos Sistemas Convectivos
Divisão de Satélites e Sistemas Ambientais
Home CPTEC / Tempo / Clima / Previsões Numéricas / Satélite / Ondas / Energia / Dados Observacionais / Pesq. & Desenvolvimento / Pós-Graduação
Sistemas Convectivos - DSA/CPTEC/INPE
Data: 20070507 - Hora: 02:45 GMT
Como utilizar as ferramentas
Clique neste botão para obter informações sobre os sistemas. Mova o mouse sobre o triângulo de cada sistema para visualizar as informações. E clicando sobre ele você poderá obter informações gráficas sobre a evolução temporal da tempestade.
Zoom
Voltar
Informações
Ajuda
Clique para mais informações sobre como utilizar as ferramentas
Clique nas setas para visualizar previsão até 2 hs
Previsão de 30 minutos a partir de
Data: 20070502 - Hora: 09:45 GMT
ForTraCC - Tempestade Severa
Descargas Elétricas
Imagens anteriores
Clique em visualizar para obter imagens anteriores
Ano: 2007
Mês: Maio
Dia: 07
Visualizar
» Cadastre-se
» ForTraCC Radar(em breve)
» AMMA
FORTRACC
O aplicativo Previsão a Curto Prazo e Evolução de Sistemas Convectivos, FORTRACC, foi desenvolvido com o objetivo de obter a evolução temporal e trajetória dos sistemas convectivos, os quais em geral estão associados com precipitações intensas e rajadas de vento.....Saiba Mais
Fases do Ciclo de Vida do Sistema
Desintensificando
Estável
Intensificando
-80 <-- Tb(°C) --> -38
Estatísticas
» Precisão
» Ocorrência de SCM
» Bias
» Propagação Média
» Dados anteriores
» Saiba mais
Copyright ©INPE/CPTEC
Comentários e/ou sugestões:
satelite@cptec.inpe.br
Dados Fortracc
Hora da Imagem: 20:15 GMT
Área (km²): 0.39 x 10³
Direção: 270
Latitude: -2.6
Longitude: -45.44
Velocidade (m/s): 17.08
Tempo de Vida (hora): 3
Temp. Mínima (K): 204
T. de expansão (10^6/s): 203.8
Fase do SC: Intensificando
Classe: Continuidade
http://moingatu.cptec.inpe.br/paginas/fortracc/fortracc_in.php
GOES-10
Image each 15 m


Sistema Convectivo (SC) No. 235
Evolucao da Fracao Covectiva (%)
Fracao Covectiva (%)
32.0
24.0
16.0
8.0
16Z 24MAY 2007
17Z
18Z
19Z
20Z
Evolucao da Temp. Minima do SC
Tb Minima (K)
210
207
204
201
198
195
192
16Z 24MAY 2007
17Z
18Z
19Z
20Z
Evolucao da Area do SC em Pixel
Area do SC
4308
3590
2872
2154
1436
718
16Z 24MAY 2007
17Z
18Z
19Z
20Z


Sobreposicao das Previsoes
Previsao 030
Previsao 060
Previsao 090
Previsao 120
12N
6N
EQ
6S
66W
60W
54W
48W

Validation process for 24th December 2002 – 22:45 UTC.



Observed
24th December 2002 – 22:45 UTC

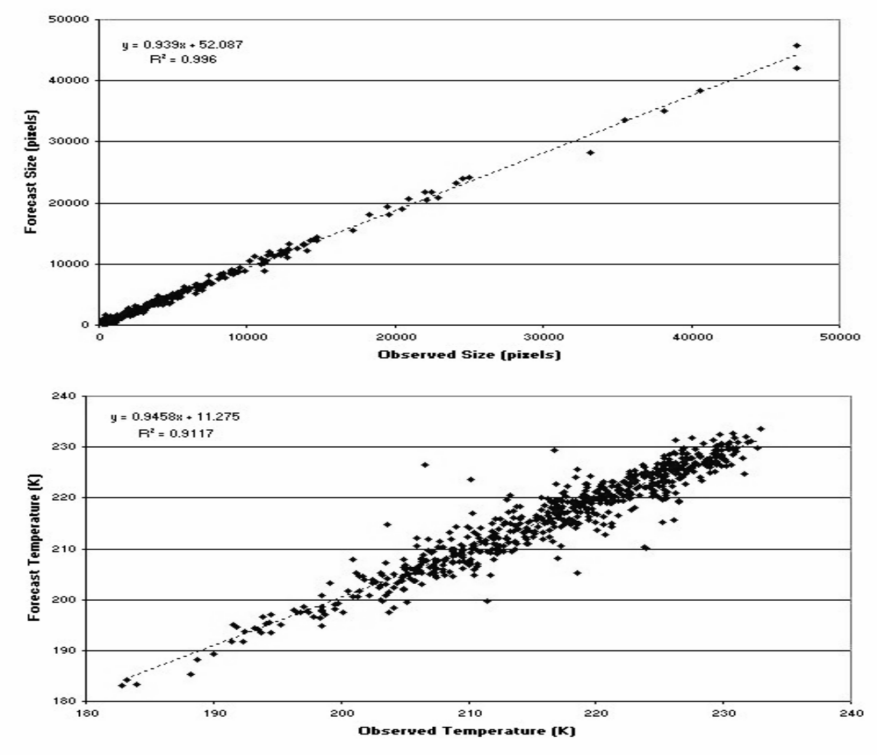
30 minutes – Forecast
initiated on 24th December 2002 – 22:15

90 minutes – Forecast
initiated on 24th December 2002 – 21:15

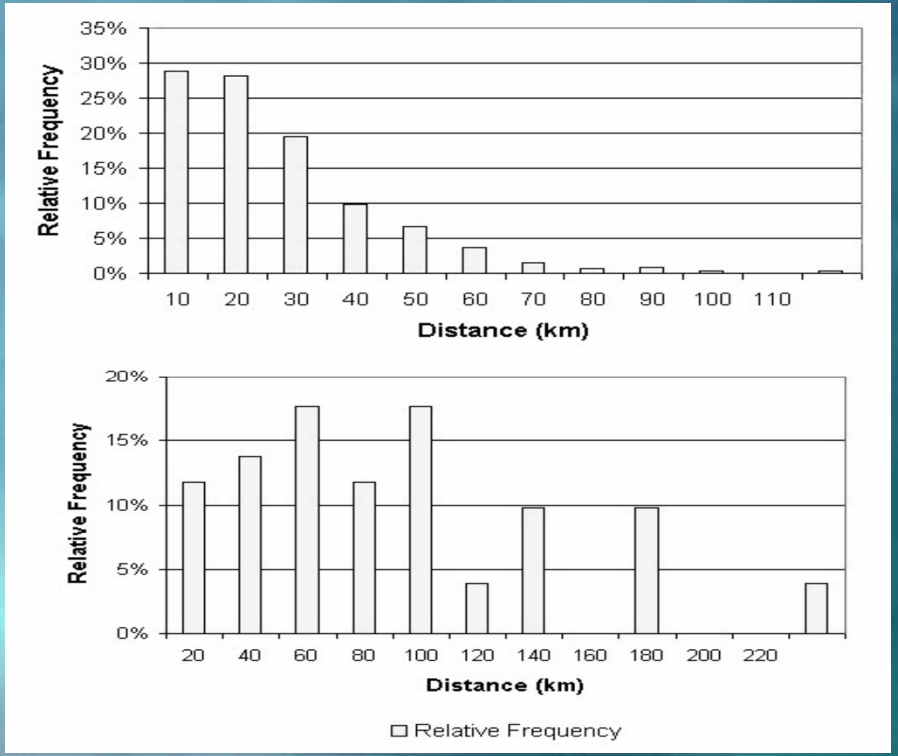
120 minutes – Forecast
initiated on 24th December 2002 – 20:45

	30 min	60 min	90 min	120 min
ACU	0.98	0.98	0.97	0.96
BIAS	0.96	0.95	0.91	0.87
POD	0.77	0.64	0.54	0.44
FAR	0.20	0.32	0.41	0.49

ACU, BIAS, POD and FAR for 30, 60, 90 and 120-minutes forecast time lead for the period 6 to11 January 2003.



Observed and forecasted MCS size and minimum temperature. 30-minutes forecast



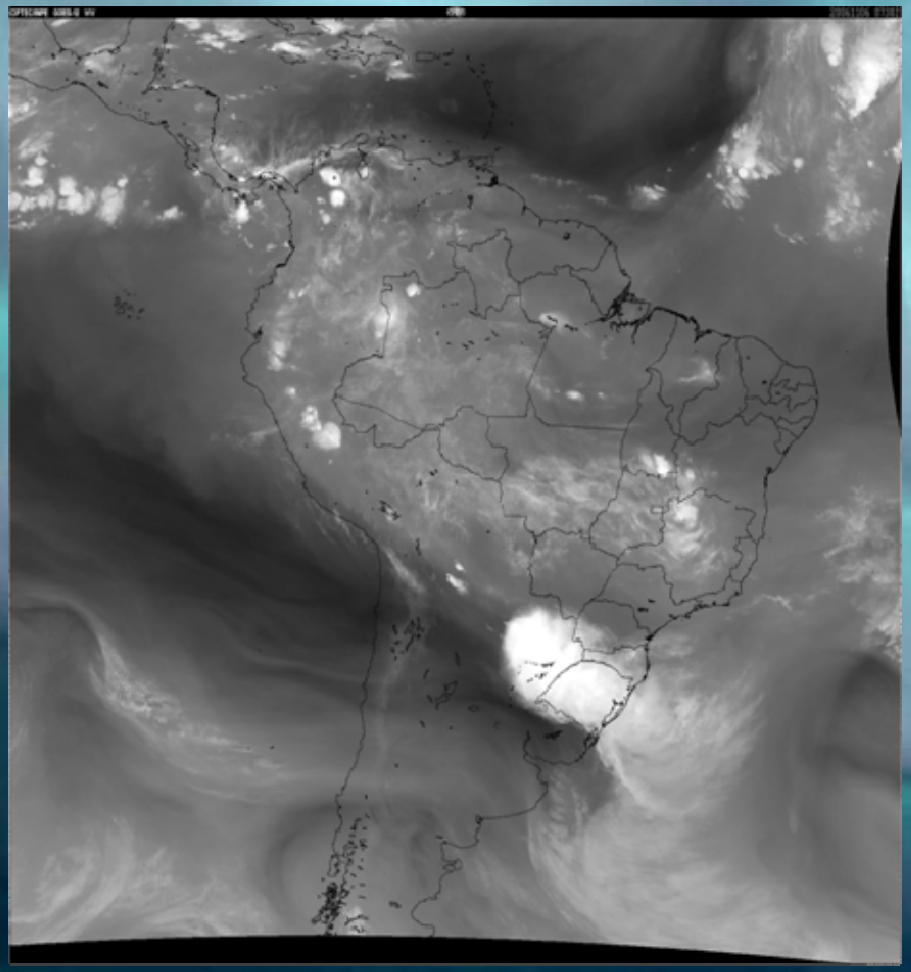
Relative frequency of distance classes between observed and forecasted mass center. 30-120 minutes forecast

Time	Forecast			Non-Forecast		
	Δ Size (in %)	Δ Tmed (in K)	Δ Tmin (in K)	Δ Size (in %)	Δ Tmed (in K)	Δ Tmin (in K)
30	-1.87%	0.25	0.35	-3.17%	0.34	0.46
60	-4.20%	0.59	0.66	-8.24%	0.50	0.62
90	-7.80%	0.75	0.52	-23.50%	0.79	0.93
120	1.81%	0.75	-0.35	-28.80%	1.00	0.88

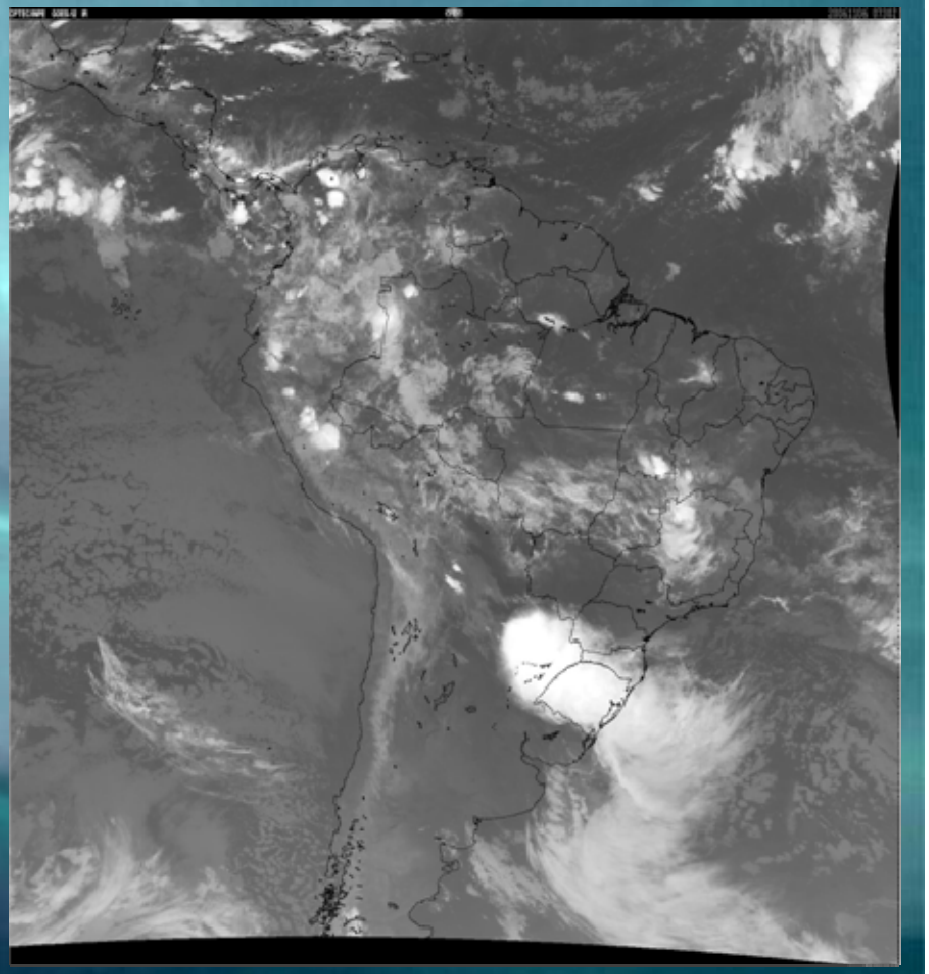
Mean bias (Δ) of the size (expressed in % to express the relative variation in size) and minimum temperature for forecast and non-forecast (conservative situation).

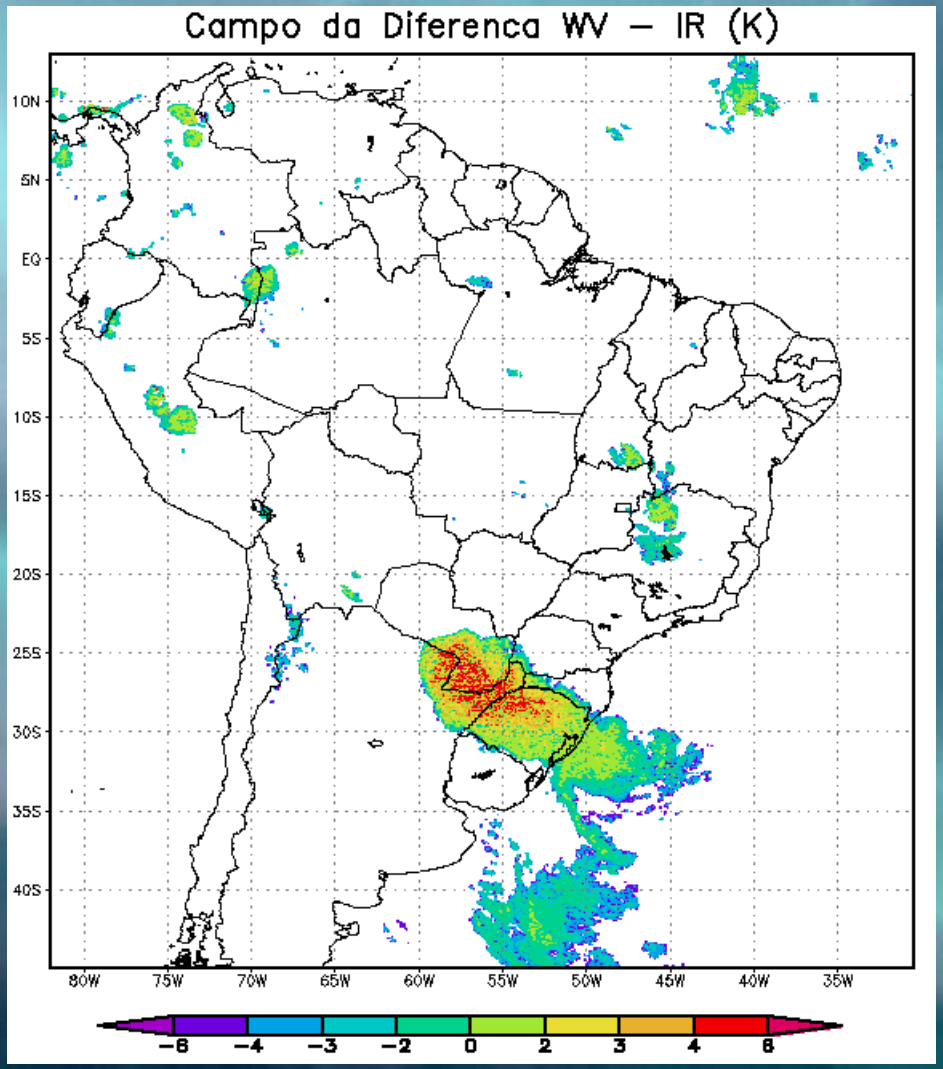
WV – IR Channel Difference

CANAL WV

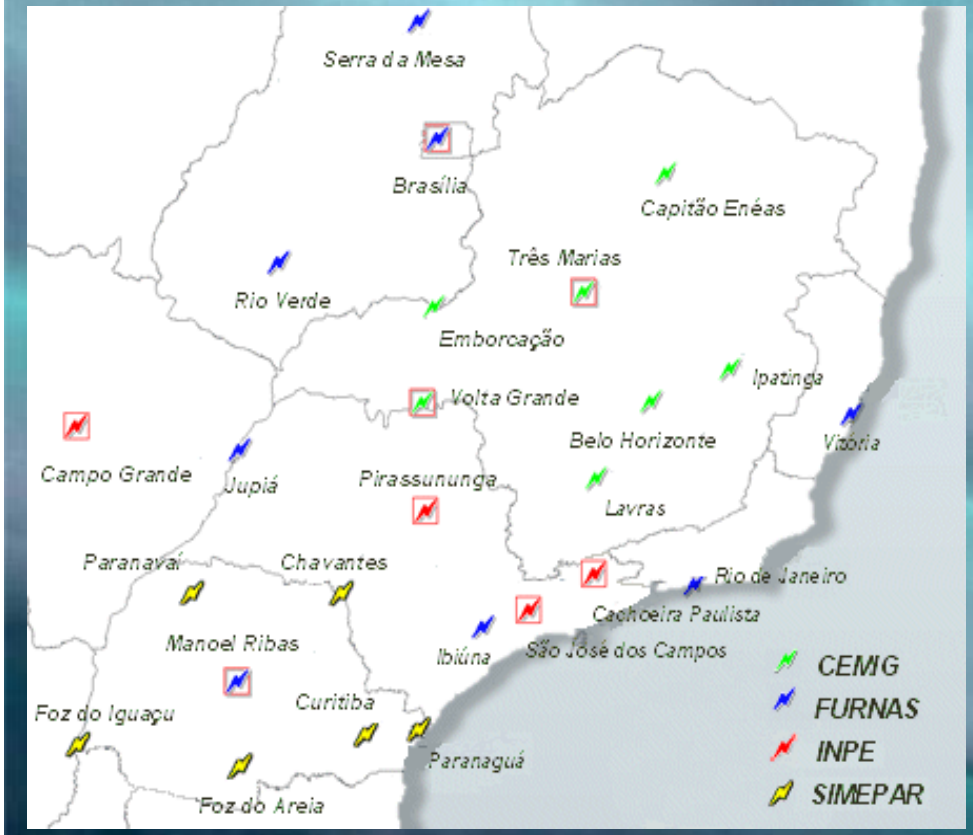


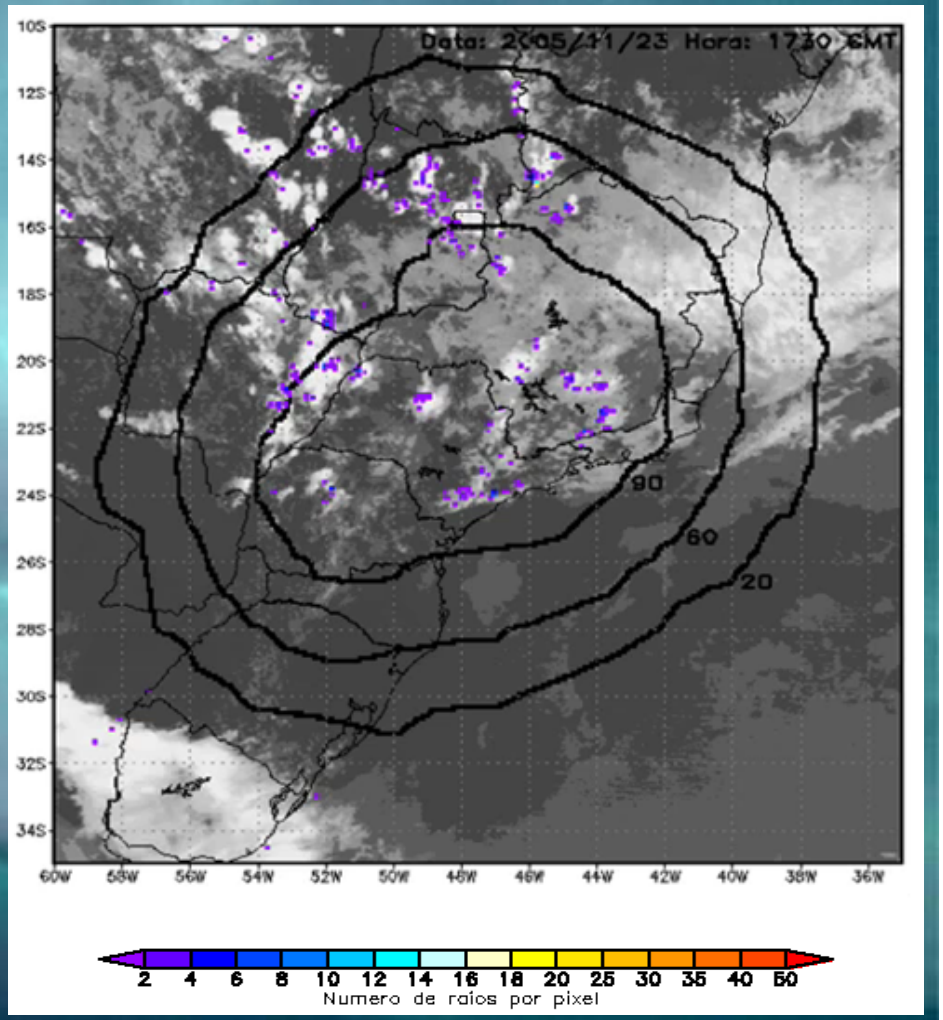
CANAL IR




Campo da Diferenca WV – IR (K)
10N
5N
EQ
5S
10S
15S
20S
25S
30S
35S
40S
80W
75W
70W
65W
60W
55W
50W
45W
40W
35W
−6
−4
−3
−2
0
2
3
4
6

Ground Lightning Network

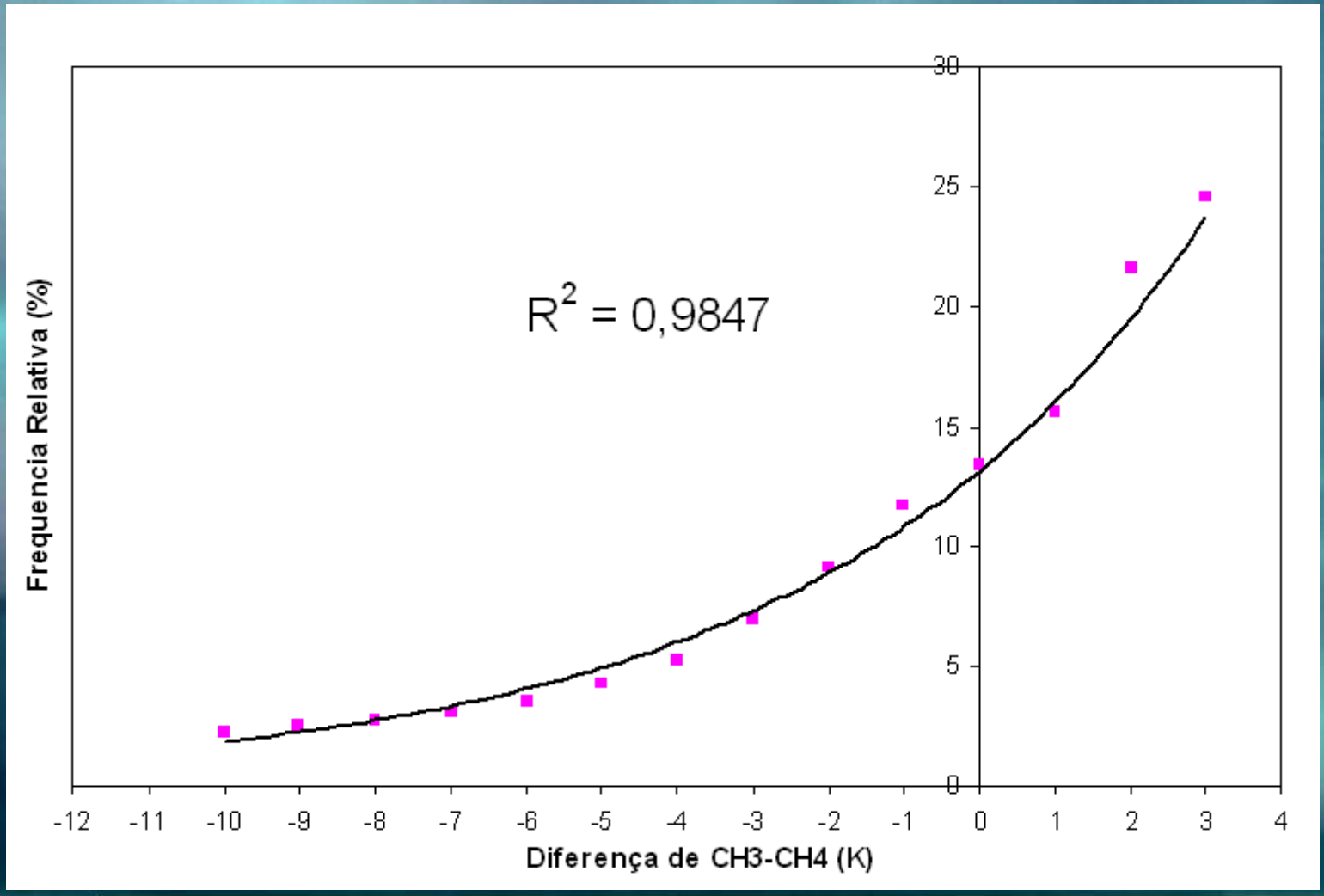




movie

ΔT = Tb3- Tb4

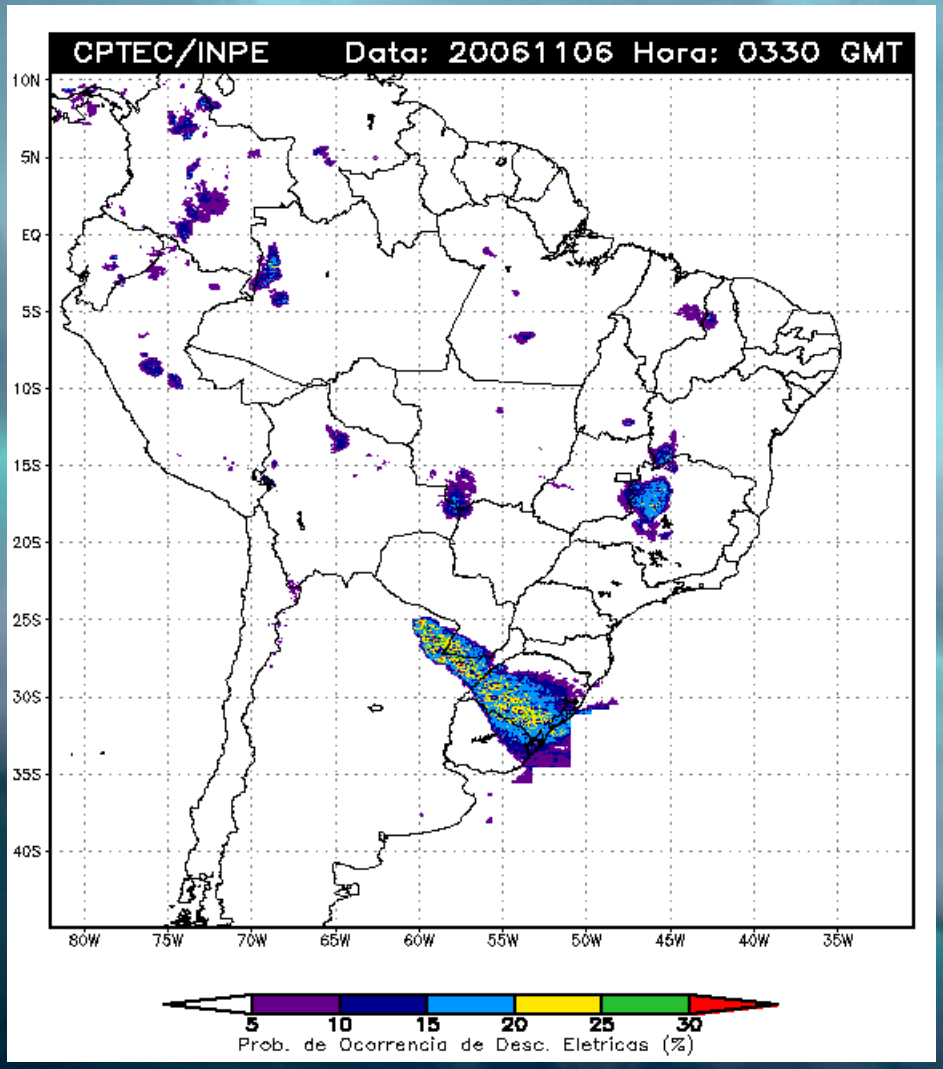
ΔT ≥ - 2.0, >~10% Probability to have Lightning
Classify as Penetrative Clouds

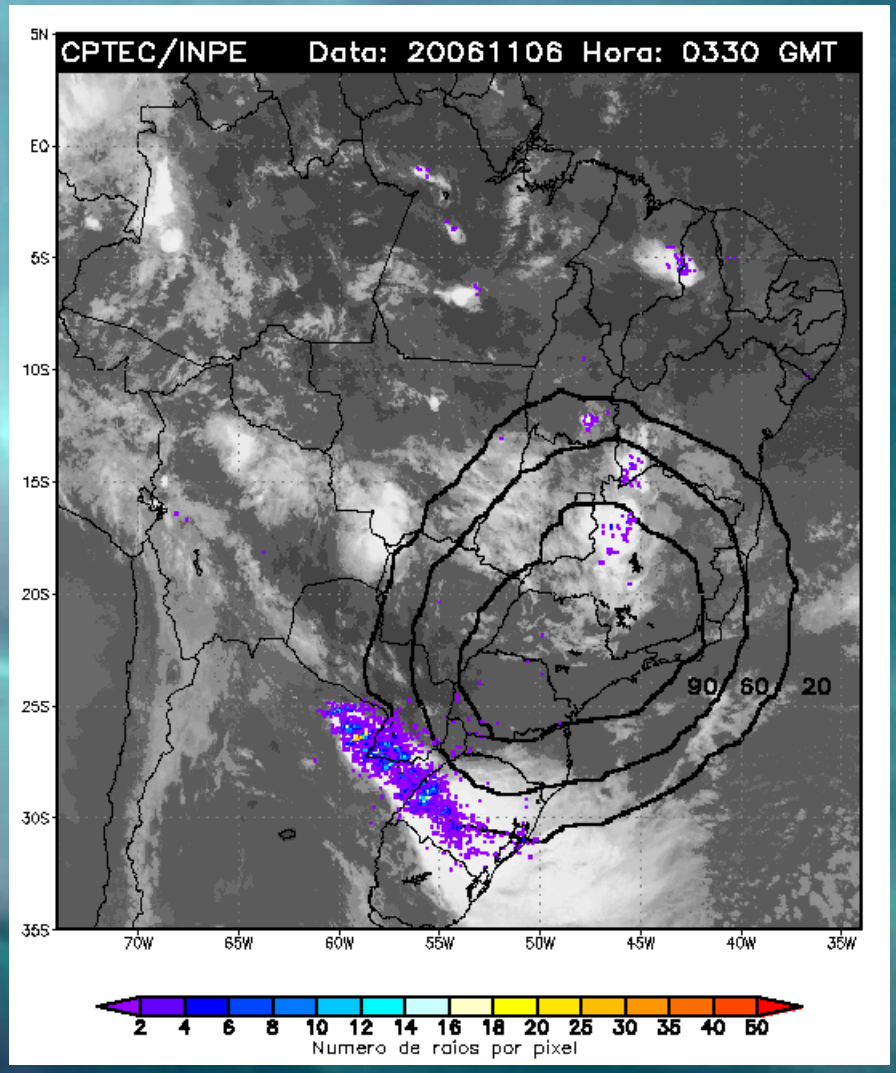


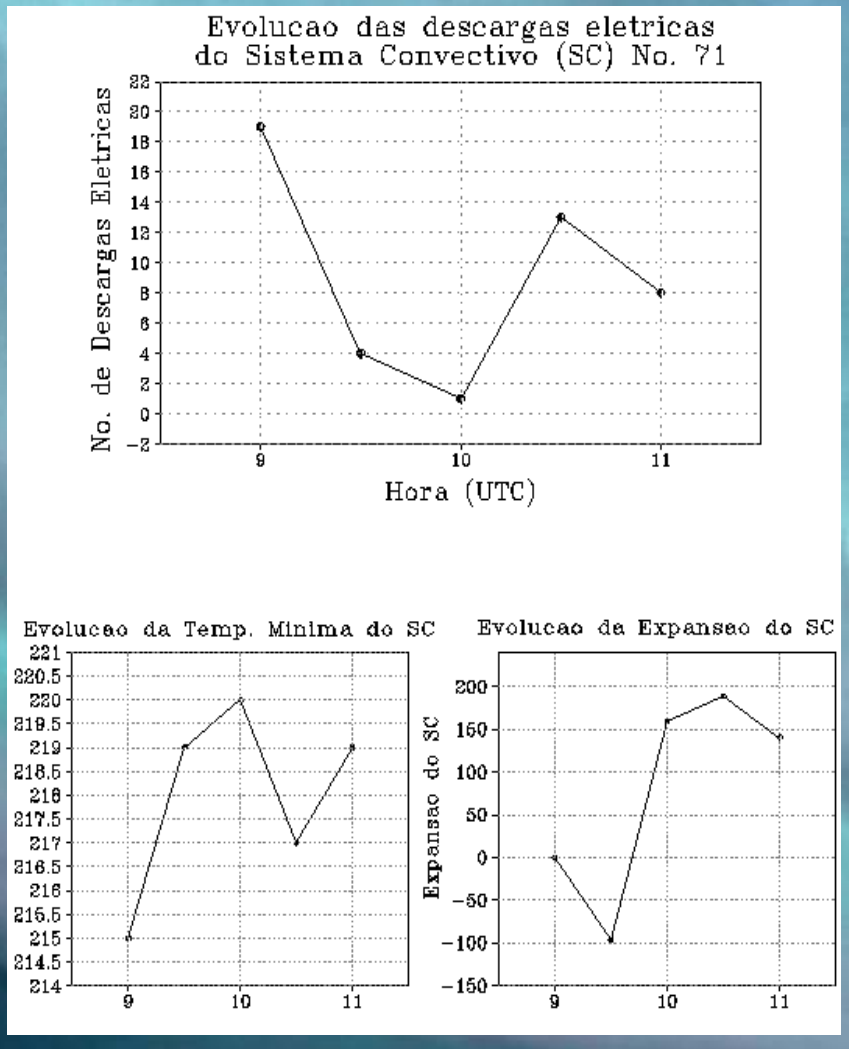
Descargas Elétricas

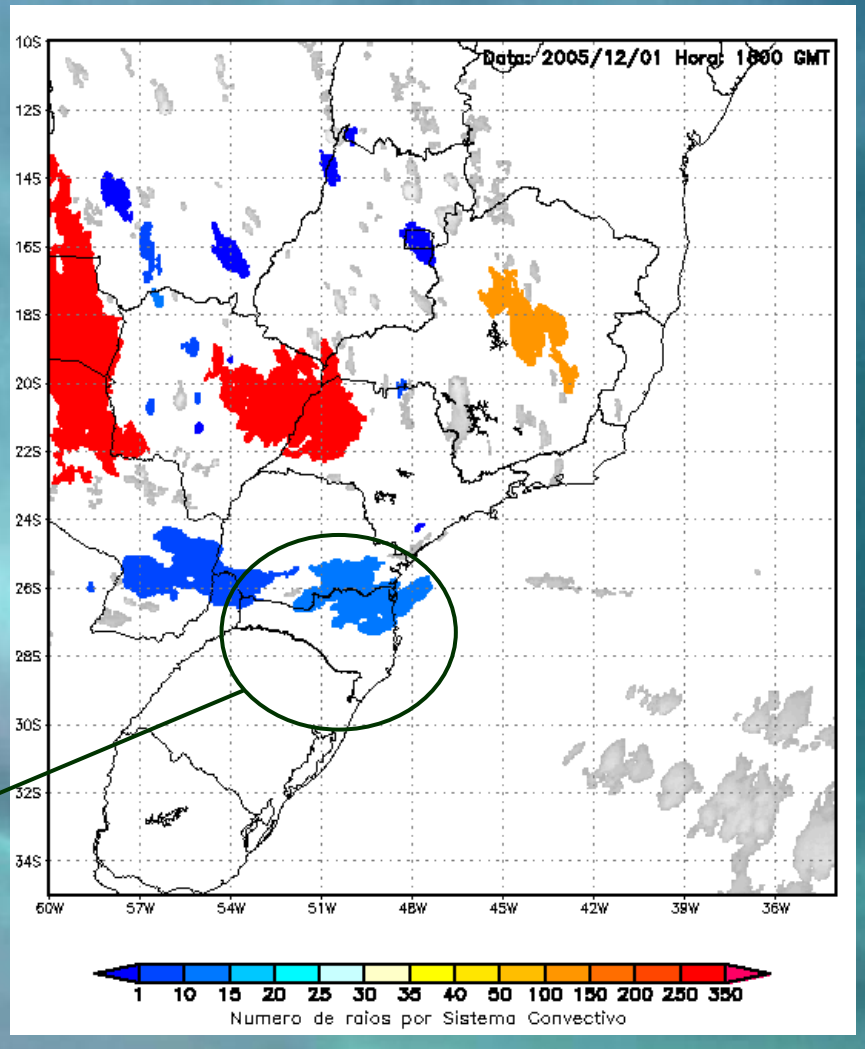
Rede Rindat

Divisão de Satélites e Sistemas Ambientais

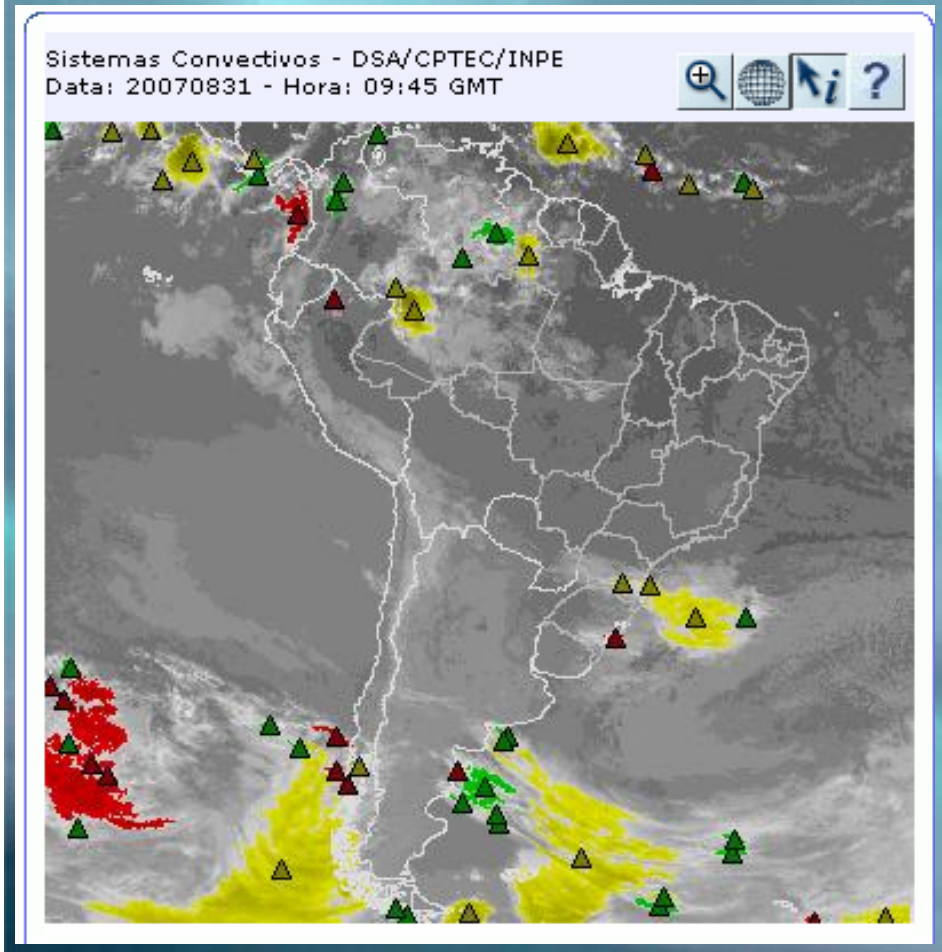


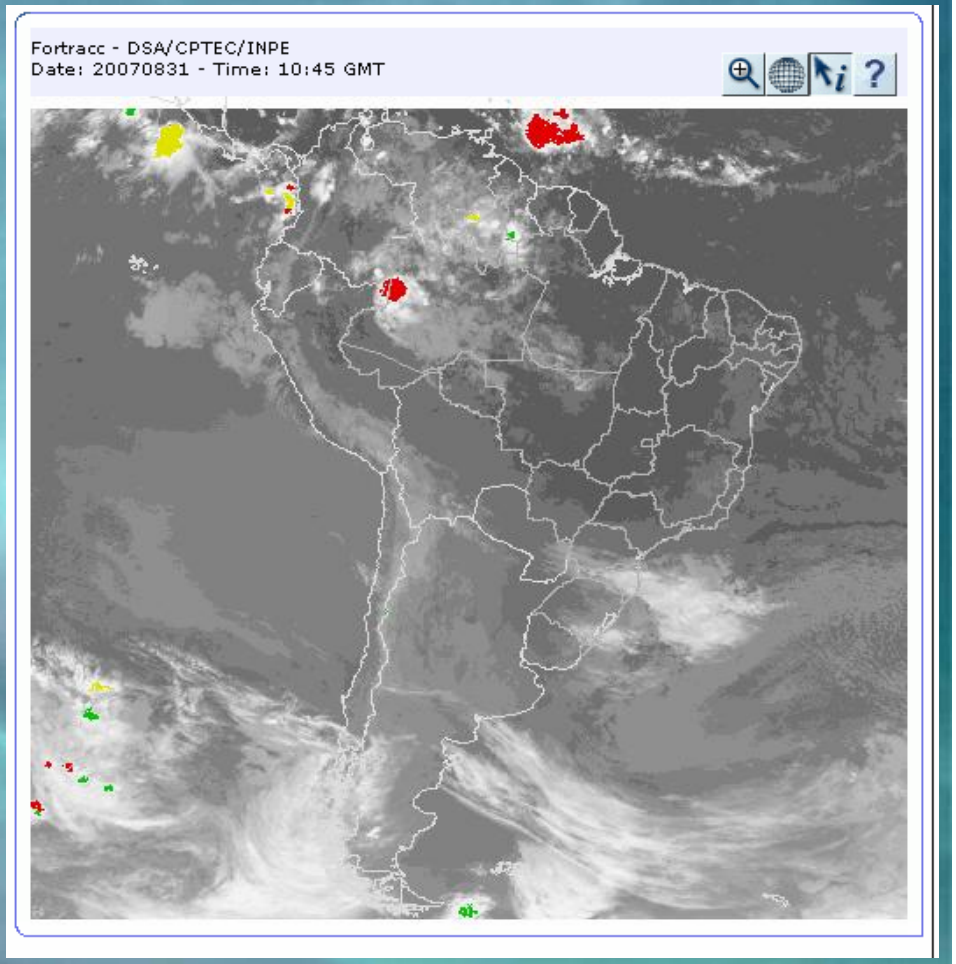




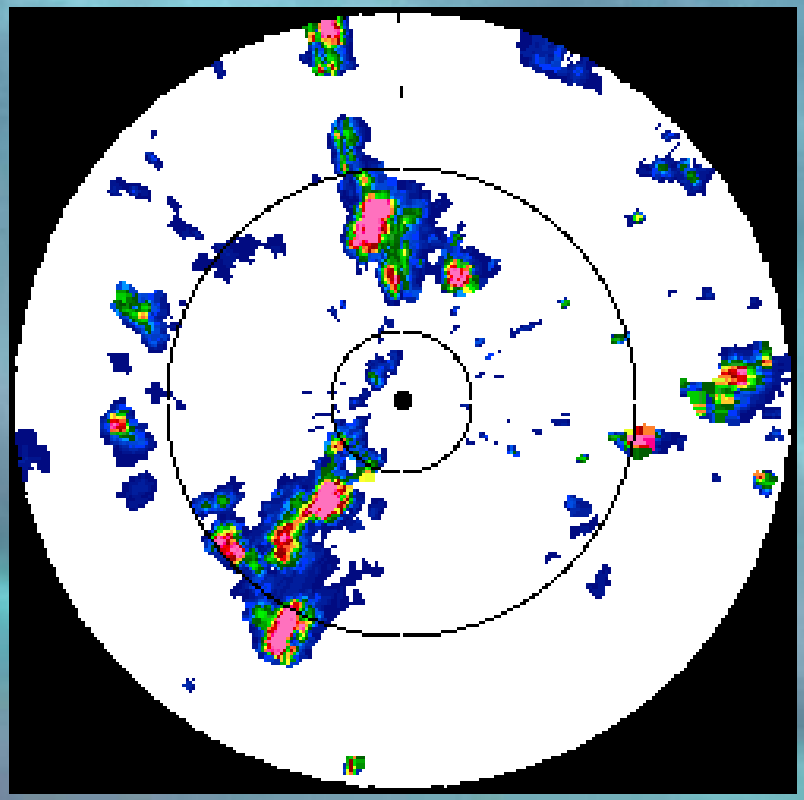


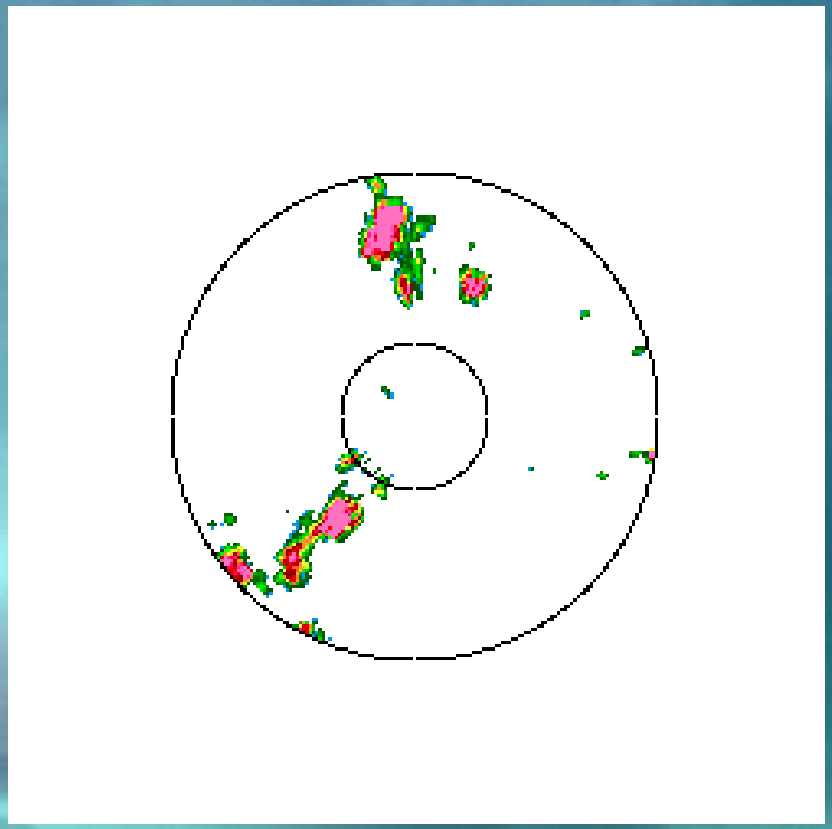
Outptst of ForTraCC combined with the lightning information. Left side shows the time evolution of the number of lightning due to the MCS (No de Descargas Elétricas) and the time evolution of the Minimum Brightness temperature (Temp. minima) and the Area Expansion (Expansão).The right side shows the number of lightning occurrences in the MCS, color means the number of lightning per MCS


Sistemas Convectivos - DSA/CPTEC/INPE
Data: 20070831 - Hora: 09:45 GMT


Fortracc - DSA/CPTEC/INPE
Date: 20070831 - Time: 10:45 GMT

< 235K → >-2K

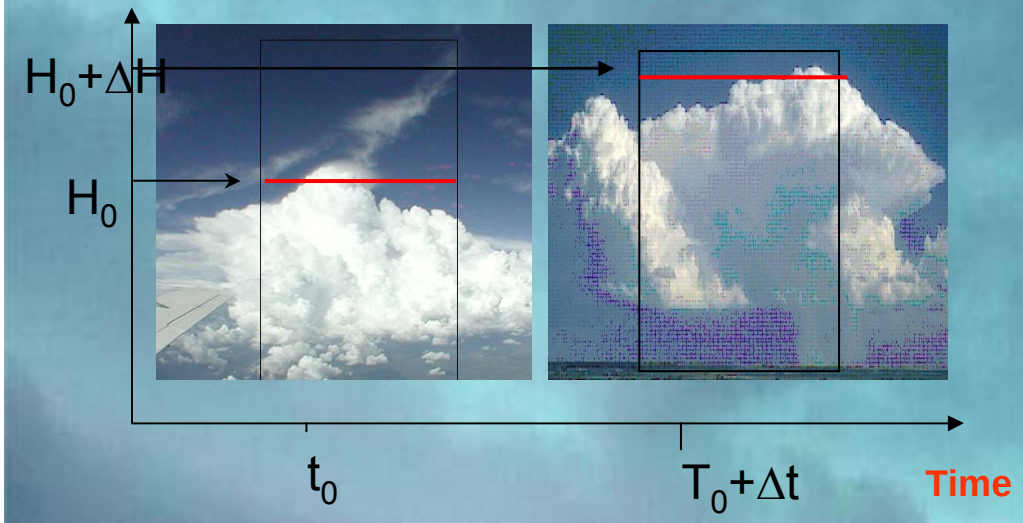




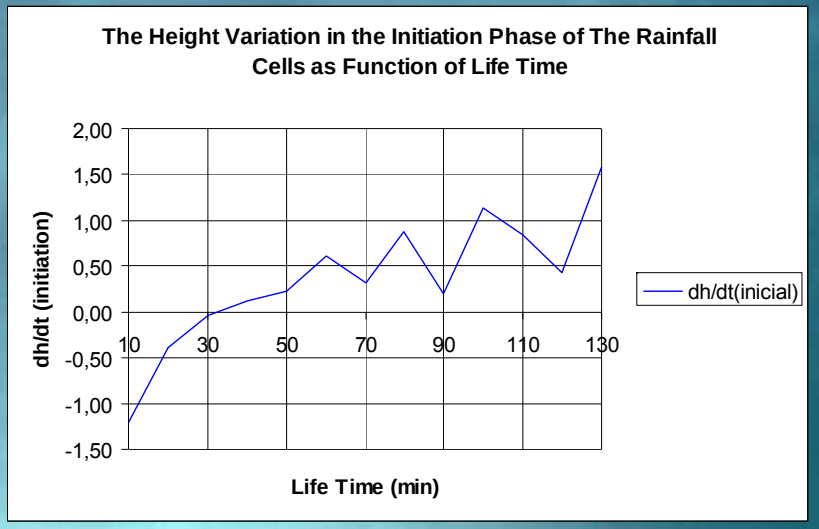
CAPPI – 3 km 20 dBz

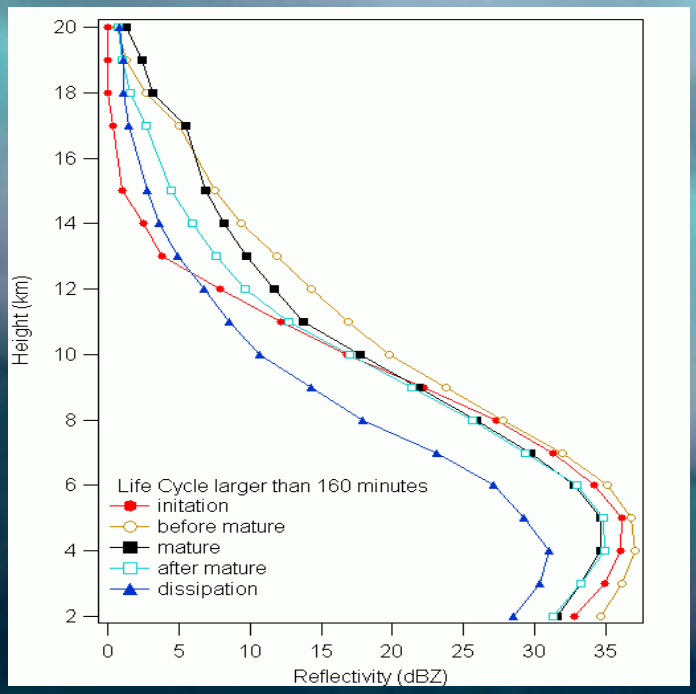
VIL > 10 kg/m²

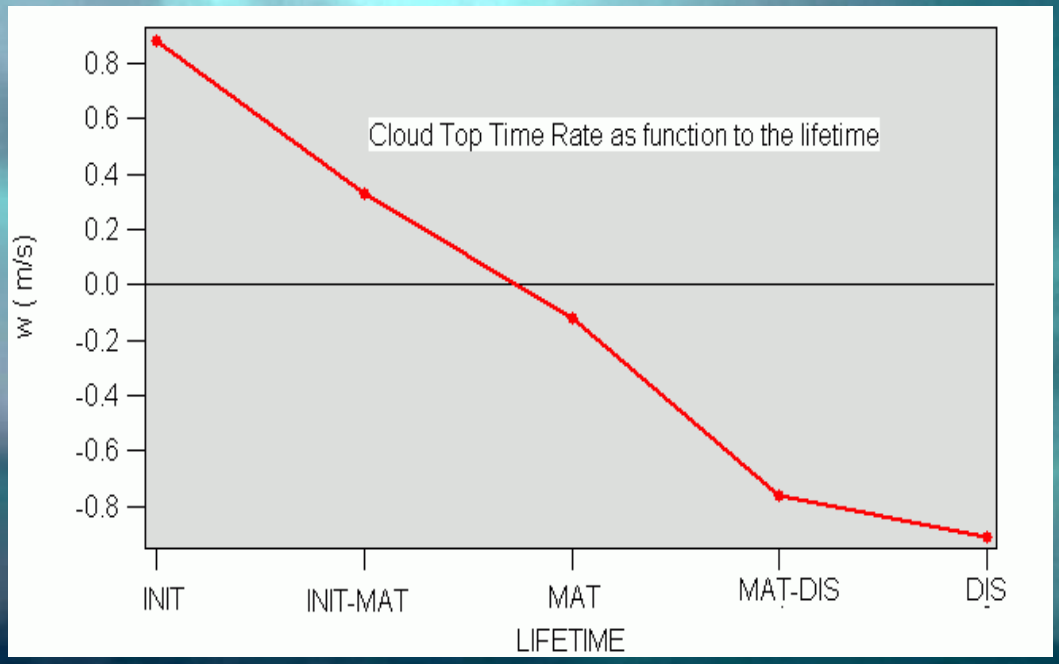
ForTraCC Using Radar Data

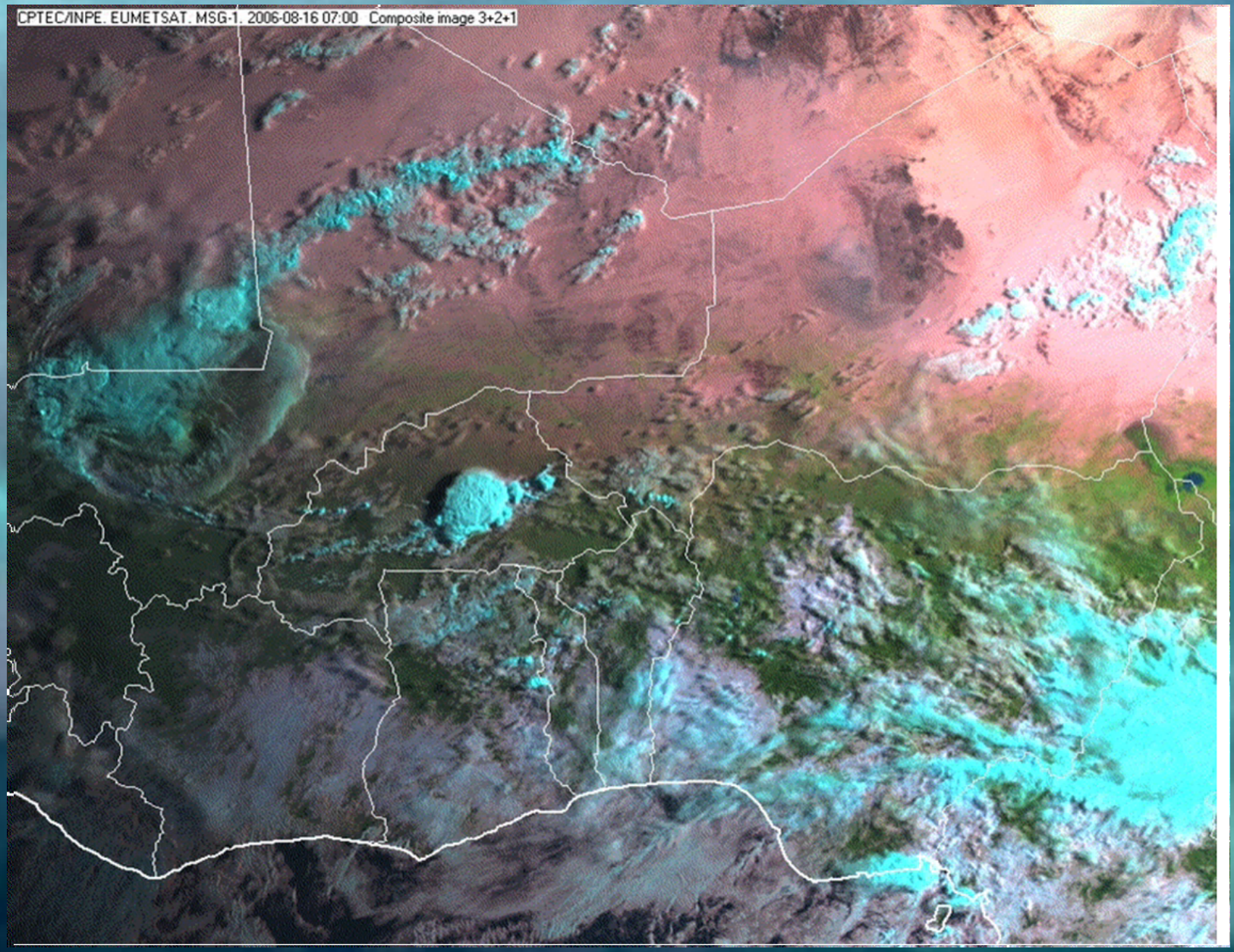


$$W=dH/dt= \{H(t_0)-H(t_0+\Delta t)\}/\Delta t$$

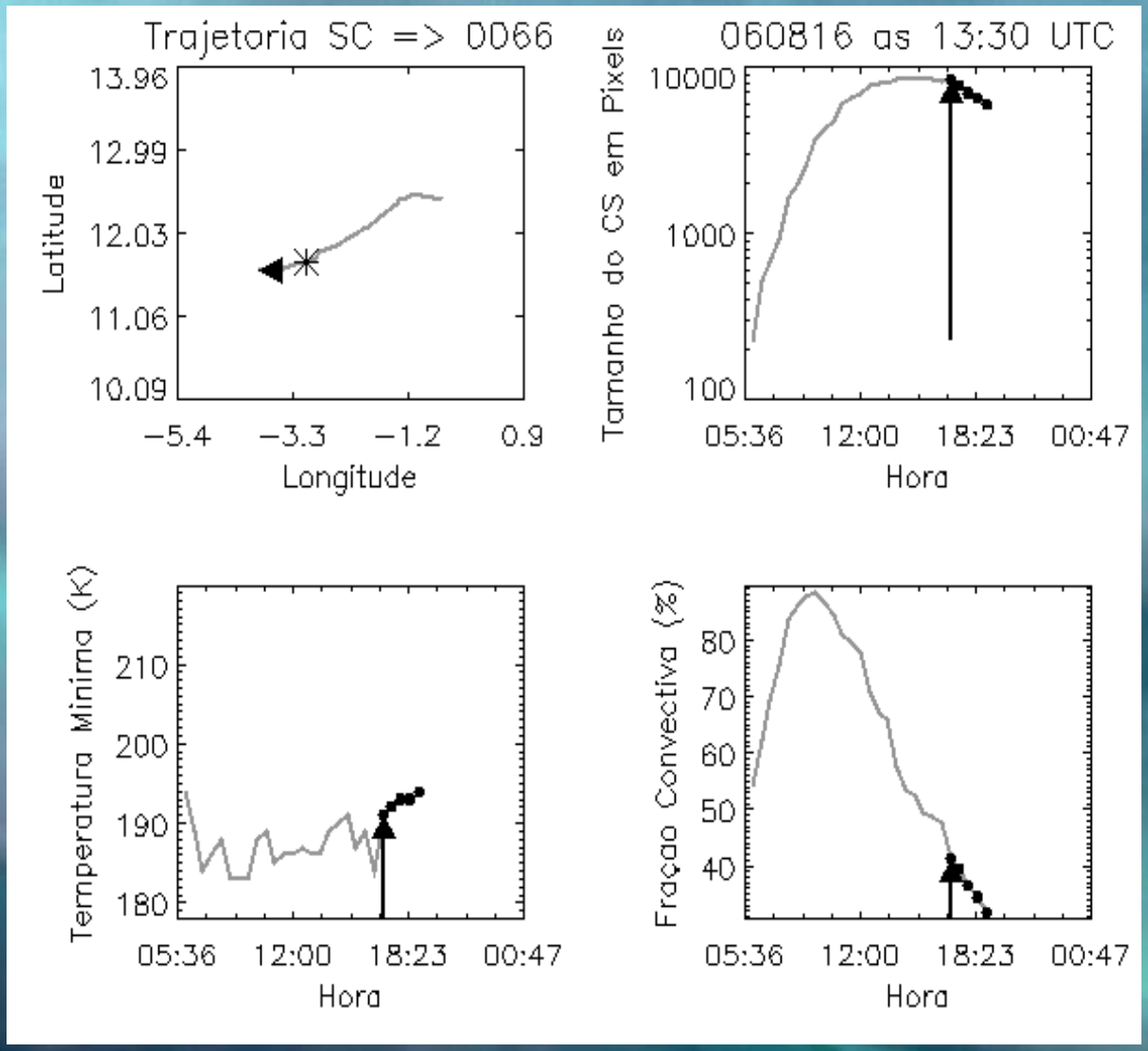







CPTEC/INPE. EUMETSAT. MSG-1. 2006-08-16 07:00 Composite image 3+2+1

movie


Trajetoria SC => 0066
Latitude
13.96
12.99
12.03
11.06
10.09
−5.4
−3.3
−1.2
0.9
Longitude
060816 as 13:30 UTC
Tamanho do CS em Pixels
10000
1000
100
05:36
12:00
18:23
00:47
Hora
Temperatura Minima (K)
210
200
190
180
05:36
12:00
18:23
00:47
Hora
Fraçao Convectiva (%)
80
70
60
50
40
05:36
12:00
18:23
00:47
Hora

Conclusions

- The area expansion is closely linked to the phase of the convective system's life. At the beginning of its life the convective system presents a large positive area expansion. The area expansion becomes close to zero during the mature stage of the system and negative in the dissipation stage.

- The results demonstrate the ability to predict the lifetime of a convective system from its initial area expansion. The physical explanation for this result is founded on the principle that this parameter measures the vigor of the convective forcing indicating the time/space scale of the convective cloud organization.

- Large values of cloud top increase are associated with a clear increase of ice phase (ice particles aloft)

- The rate of cloud top increase can be approximately related to the average vertical velocity of the convective core. The time variations of this variable can also be used as a proxy for the stage, intensity and lifetime duration of the convective activity.

- ForTraCC is an operational utility for nowcasting available on line, using 15 minutes GOES 10 images.