

**SPATIAL AND TEMPORAL ACTIVITY ANALYSIS IN EAST COAST OVER NORTHEAST BRAZILIAN REGION THROUGH MM5 MODEL PARAMETRIZATIONS AND SATELITE IMAGES.**

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**1 - INTRODUCTION**

Analyzed extreme precipitation events origin on Brazilian Northeastern (NEB) East Coast, occurrences during 2004, June month, with objective to improve knowledge on operating meteorological systems over region to evaluate similarities between MM5 parametrizations analyses using references to search weather and geographical points similarities to establish a comparison over weather systems to verify high resolution models basic dynamic and thermodynamic variables sensibility which were adequate and satisfactory to simulated brazilian equatorial region using some midlatitudes aspects like geography, precipitation, wind components, divergence and cloud patterns. Trying identify similarities between aspects inside references and Brazilian regional weather systems. Analises were made from National Centers Environmental Prediction (NCEP) data Reanalysis and Centro de Previsão de Tempo e Clima/Instituto Nacional de Pesquisas Espaciais (CPTEC/INPE) satellite images. Brazilian Northeastern its a region marked by long droughts periods but also severe rain fast episodes with origin in many scales systems producing high variability, among many examples its June month/2004, were selected, specifically in 1st. June day, detailing regional systems: Which Intertropical Convergence zone (ITZC), frontal

systems, upper tropospheric cyclonic vortex, wavy disturbances inside trade winds, important land/sea breezes systems, and its aspects in severe convective storms formation seems to be better understanding over events with intense rains.

**2 - METHODOLOGY**

Dealing a setting events occurred in June/2004 period, where studied, specifically 01june, MM5(PSU/NCAR) Model data, developed by Pennsylvania State University(PSU) in National Center for Atmospheric Research(NCAR) by Anthes and Warner (1978) of Reanalysis project (Kalnay et al, 1996). Were used to simulated coarse domain were Atlantic Ocean tropical region and nested domain Brazilian northeast region(FIG-1) including Atlantic Ocean extensive region with 45 and 15km resolutions coarse and nested domains, respectively and 34 sigma levels, using classic parametrizations used on Table 1:

PARAMETRIZATION	SCHEME
EXPLICIT MOISTURE SCHEMES(IMPHYS)	GRAUPEL-REISNER2
CUMULUS CLOUDS	KAIN&FRISH2-KF2
PLANETARY BOUNDARY LAYER	MRF
MULTI-LAYER TEMPERATURE	SOIL NOAH-LSM
RADIATION	RRTM
SHALLOW CONVECTION	NO

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PARAMETRIZATION	SCHEME
FDDA	ACTIVE

TABLE 1 - MM5 PARAMETRIZATIONS.

### 3 - RESULTS

During investigation were observed a set of hourly satellite images and uses to explain at daily conditions chosen 2004, 1st. June, 1800Z hour, to represents a real locally synoptic pattern day conditions and destaching South American and brazilian northeastern region (Fig.1.(a)) with regional systems observed with Intertropical convergence zone (ITCZ) on equatorial portion, subtropical trough on south and southeast, and cloud cluster format Fig.1. ((b), (c) and (d)) by upper tropospheric cyclonic vortex modeled by wind field Fig.2. ((b) and (d)) on northeast, in axis northern-southeastern still weakly South Atlantic Convergence Zone (SACZ) to establish an agreement between modeled MM5 and observed (NCEP) situation, despite factor scales differences, there still observed in Fig.1. ( (a), (b), (c) and (d) ) and Fig.4. ( (a) and (c) ) were clear observed points (1: lon=34°W, lat=10°S), and (2: lon=38°W, lat=13°S)) and at mid level near Alagoas state region(point 1) pointed central convection. Clearly also observed in Fig.2(c), where many convergence points are located at South American region to destach (1: lon=30°W, lat=5°S), (2: lon=35°W, lat=12°S)) and (3: lon=48°W, lat=18°S) also observed northeastern coastal transversal (east-west) wind direction at north coast during all day been a good indicus of narrow cumulus cloud clusters like satellite images.

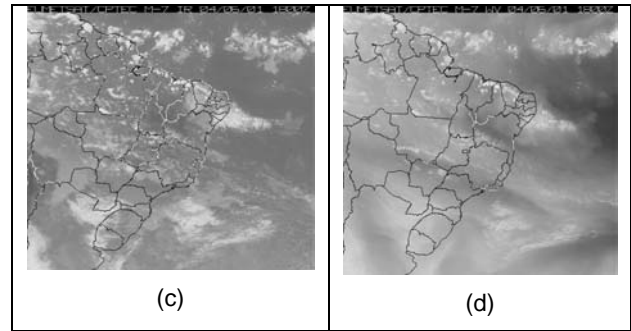
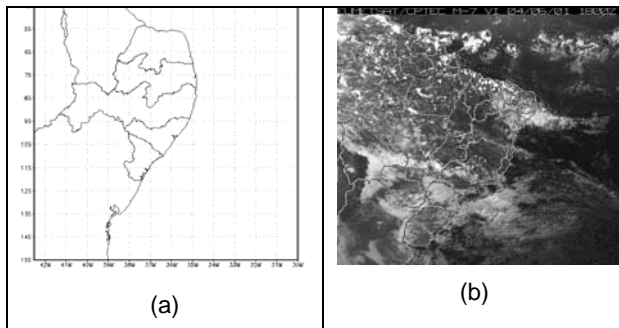


FIGURE 01 – (a) NORTHEAST BRAZILIAN REGION, SATELITE (b) VISIBLE, (c) INFRA-RED AND (d) WATER VAPOR GOES/CPTEC-INPE IMAGES.

Karoly and Vincent(1998) apud Kousky(1980), that analyzed diurnal rainfall variations on brazilian northeastern (1961-1970) long period and observed most coastal areas (100-300km) inland advance with daytime maximum rainfall associated to convective systems triggered by sea-breeze convergence, producing narrow convective cloudness band in different development stages over north and northeastern coast moving inland ones behaving like squall lines, with showed by satellite images.

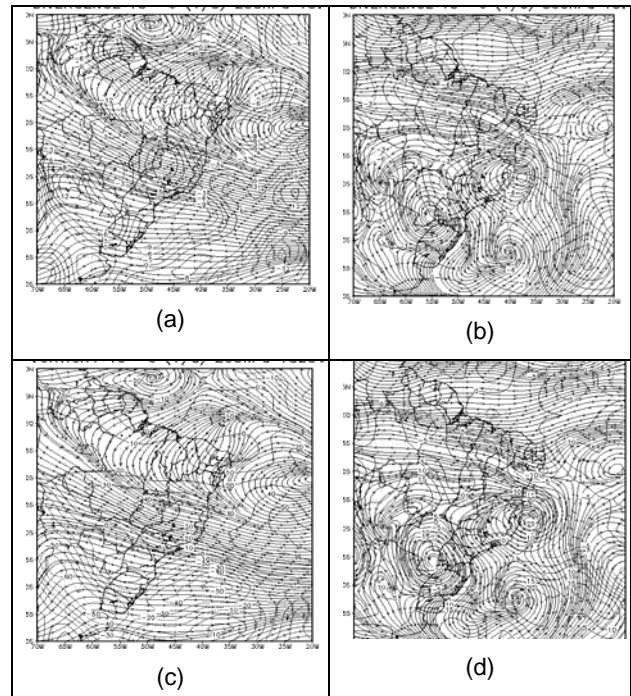


FIGURE 02 – HORIZONTAL DIVERGENCE (a) 200hPa, (b) 850hPa AND HORIZONTAL VORTICITY(c) 200hPa, (d) 850hPa – NCEP ( $10^{-6}$  (1/s)).

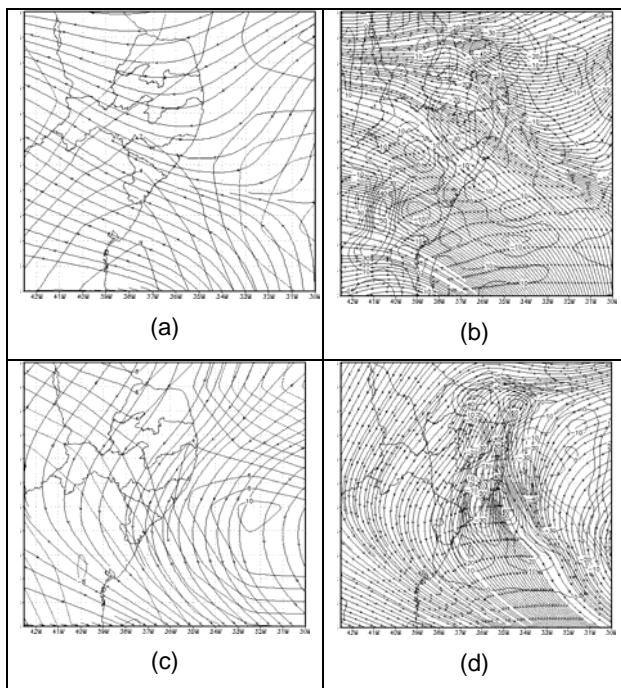


FIGURE 03 – HORIZONTAL DIVERGENCE 850 hPa (a) NCEP, (b) MM5, AND 200 hPa (c) NCEP, (d) MM5 ( $10^{-6}$  (1/s)).

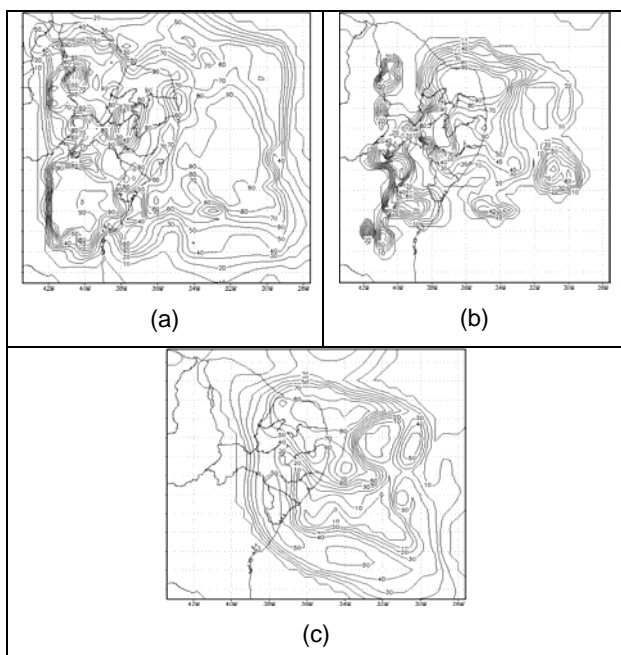


FIGURE 04 – CLOUD COVER (a) LOW, (b) MID AND (c) HIGH LEVEL -MM5.

Vertical profiles (figure6), shows an agreement between observed and modeled horizontal wind over low, middle and upper levels, bearing in mind, that lower levels has topography influence while middle and upper levels became important divergence and vorticity influenced by pressure and temperature yet destaching middle(0.5-

0.7/500-700hPa) where winds suffer weakening and lost direction definition at 16-12°S.

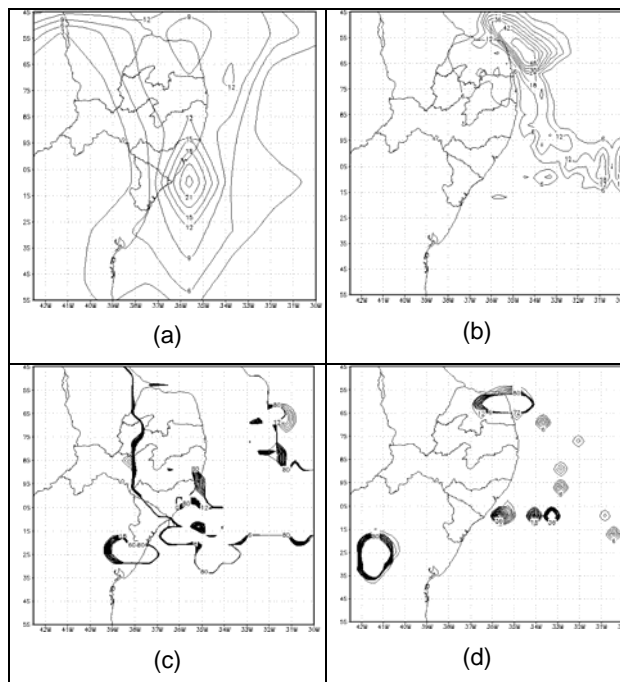


FIGURE 05 – TOTAL PRECIPITATION RATE (a) NCEP, (b) MM5 AND (c) CONVECTIVE, (b) NON-CONVECTIVE PRECIPITATION – MM5.

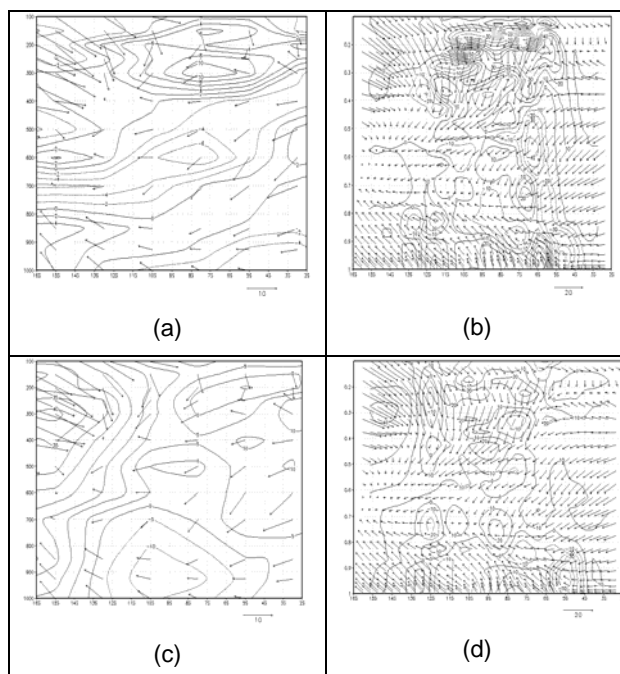


FIGURE 06 – VERTICAL DIVERGENCE PROFILE (a) NCEP (FACTOR SCALE 10m/s), (b) MM5 (FACTOR SCALE 20m/s) AND VERTICAL VORTICITY PROFILE (c) NCEP (FACTOR SCALE 10m/s), (b) MM5 (FACTOR

SCALE 20m/s). HORIZONTAL WIND COMPONENTS, ARROWS AT FIXED LONGITUDE 35°W ( $10^{-6}$  (1/s)).

#### 4 - CONCLUSIONS

Kousky (1979) apud namias (1972) proposed that cyclonic activity enhances Hadley cell circulation thereby enhancing northeast trade winds. Hastenrath and Heller (1977) discuss that northeastern north coast is closely linked to meridional displacement and equatorial trough zone strength citing Namias about Newfoundland area, an upper tropospheric trough over USA (70°W) east coast and (35°W) downstream ridge position. Observed similarity over central north Atlantic near Northeast Brazilian eastern coast. And still Yamazaki and Rao (1977), observes Extreme precipitation events genesis over East coast Northeast Brazilian (NEB) region in June 2004 were used to better understanding objective to analyzed producing rainy systems acting over region, evaluating their causes, consequences and skill forecast. Analyses were made using MM5 model, developed for Pennsylvania State University (PSU) in National Center Atmospheric Research (NCAR). During initial study over June month, were selected intense precipitation episodes over NEB coast, choose on 1st. day by intensified precipitation event, using divergence flux charts for selected levels, horizontal and vertical motions by specific parametrization options to explicit moisture schemes – graupel (reisner2), cumulus schemes – Kain&Fritsch 2(KF2) and Shallow Convection (activated). MM5 sensitivity still initial study using divergence and vorticity standards performance to characterize accumulated convective and non-convective precipitations. Through sea surface temperature like source to atmospheric humidity were studied regional phenomenologic analysis based on MM5 model and observed satellite images descriptions to indicate convective motions importance over continental and oceanic regions where near coast convergence and precipitation patterns showing a good agreement. Were observed near Alagoas, Pernambuco, Paraíba and Rio Grande do Norte states strong convective activity probable due to trade winds.

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