TROPICAL ATLANTIC HURRICANES ORIGINATING FROM WEST AFRICAN MESOSCALE CONVECTIVE SYSTEMS

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Abstract

This study focuses on the relationship between Mesoscale Convective Systems (MCSs) initiated in West Africa and subsequent cyclogenesis in North tropical Atlantic Ocean. MCS data are obtained from a convective cloud cluster tracking algorithm (FORTRACC) using Meteosat observations. We argue about a continuing propagation of fragmented stratiform parts of MCSs after their dissipations in the ocean. Ten occurrences during 2004-2005 of time lags and distances between MCS dissipations and hurricane initiations fairly agree with easterly wave propagations at a mean celerity of 9.7 m/s. It is shown that such a relationship occurs during a persisted SST anomaly dipole marked by a strong positive event in the Northern tropical Atlantic and a rather cold event in the Guinea Gulf.

Infrared temperature used as dynamical threshold

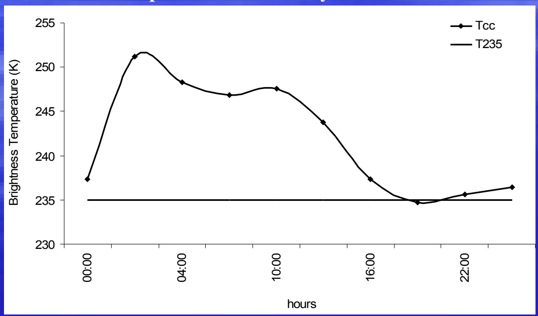

Figure 1. During its life, a MCS can move, grow, decrease, change a form, split or merge in one or more systems. In order to take into account this pattern evolution we use an adaptive version of the Tracking Convective Clusters model (FORTRACC) operational at INPE/CPTEC. Here, the used dynamical threshold temperature (continuous curve) which serves to define the MCSs is modulated by the diurnal cycle over the ocean. The horizontal line represents the 235 K threshold generally used in the FORTRACC model.

Trajectories of four MCSs which dissipated just before hurricane initiations in 2004 (top) and 2005 (bottom)

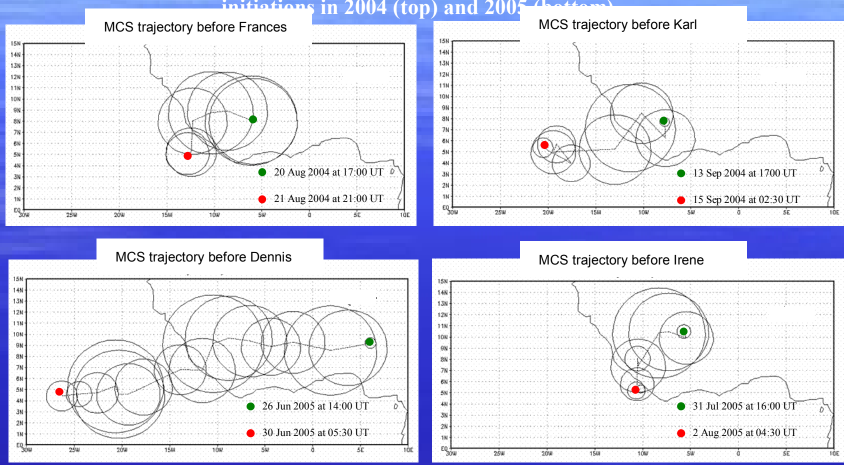

Figure 2. Green (resp. red) dots indicate dates and positions of initiations (resp. dissipations) of four MCS centres of mass selected among ten MCS-before-Hurricane occurrences. MCS patterns are considered quasi-circular with disc surfaces proportional to real areas.

Instantaneous atmospheric circulations during selected MCSs

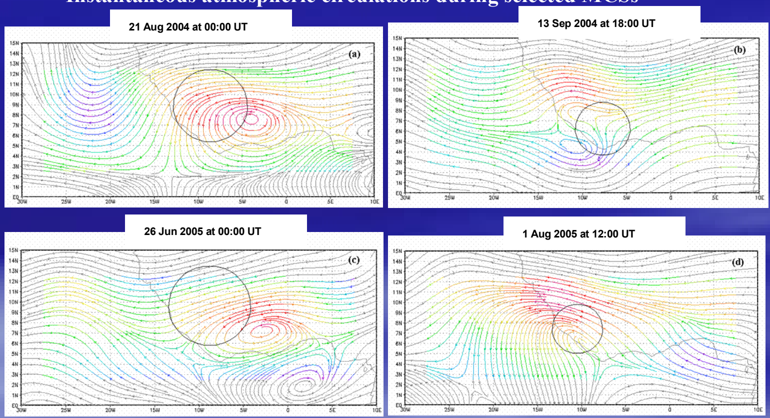

Figure 3. About mature phases of the four MCSs (circles) illustrated on Fig. 2 with concomittent 700-hPa wind streamlines (coloured contours). Cyclonic vortices are observed close to the stratiform systems.

Distances between MCS dissipations and hurricane initiations and SST anomalies averaged from June to September

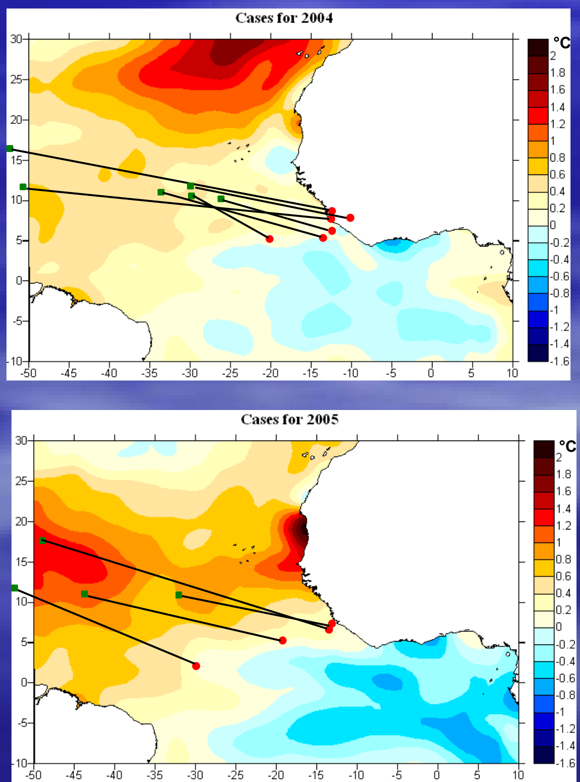

Figure 4. Red dots (resp. green squares) indicate positions of MCS dissipations (resp. hurricane initiations): 6 occurrences in 2004 (top) and 4 occurrences in 2005 (bottom). SST anomaly patterns (shaded) are averaged from June to September of each year. That shows that the MCS-hurricane relationship identified here is associated with a clear persisting positive SST anomalies in the Northern tropics and rather cold conditions in the Gulf of Guinea.

Hurricane Names *2004 - 2005*	Distance (km)	Time lag (days)	Velocity (m/s)
Charley	*4616*	*5.7*	*9.5*
Frances	*2317*	*3.1*	*8.6*
Ivan	*1545*	*1.9*	*9.3*
Jeanne	*4804*	*5.7*	*9.8*
Karl	*1147*	*1.2*	*11.5*
Lisa	*2205*	*2.8*	*9.2*
Dennis	3532	4.0	10.2
Emily	2594	3.7	8.1
Irene	2452	2.6	11.1
Maria	3752	4.7	9.3
Average	**2896**	**3.5**	**9.7**

Table 1. Distances and time lags between 10 MCS dissipations and 10 hurricane initiations selected in 2004 and 2005. The computed averaged velocity (9.7 m/s) suggests that these events relate to easterly wave propagations. That implies that one may found an African origin for at least some hurricanes in the North tropical Atlantic.

References

- Mathon, V., A. Diedhiou and H. Laurent, 2002: Relationship between easterly waves and mesoscale. *Geoph. Res. Letters*, Vol. 29, No. 0, 10.1029/2001GL014371.
- Vila, D. A., L. A. T. Machado, and I. Velasco, 2007: Forecast and tracking the evolution of cloud cluster (ForTraCC) using infrared imagery: Methodology and Validation. Submitted to *Weather and Forecasting*.
- SST data set from: http://iridl.ldeo.columbia.edu/SOURCES/.IGOSS/.TOPEX/.NOAA/.dataset_