Micro Squall Line in Belem region

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The squall Lines that occur in Amazon Basin represent one of the most important atmospheric systems in production of precipitation (Garstang et al., 1994, Cohen et al, 1995), whose trigger is associated with the sea breeze circulation (Kousky, 1980). These squall lines have large dimensions of about thousands kilometers and therefore is easily viewed in satellite image and it can be classified having a space scale like a system of the synoptic scale. According to Kousky (1980), when the cumulonimbus develops from sea breeze in the coast it organize as a line of convective clouds, it can propagate inside the land as a squall line.

The CHUVA Project (*Cloud processes of the main precipitation systems in Brazil: http://chuvaproject.cptec.inpe.br/portal/br/index.html*) realized a campaign in Belem during the period June, 7 to 30 2011, during the period of maximum squall lines activity and it was possible to measure several squall lines. In despite of the traditional squall lines as already reported in several studies (Garstang et al, 1994, Cohen et al, 1995) through the X-band radar, installed by Chuva Project in Belem, it was possible to identify a new type of squall line, which also showed a high intensity of rainfall. For the purpose of this work we call this new type of Squall line as Micro-Squall Line (MSL). Therefore, the aim of this paper is to study this new type of squall Line, trying to find its morphology and to understand the relationship of such convective band with the classic Squall Line in nearly sinoptic scale.

We used the images of satellite GOES-12 to catalog every cases of classic squall line that occurred during the whole period of the Chuva Project in Belem. Posteriorly, the reflectivity data of the X-band radar was utilized to identify the formation of this new type of squall lines as well as their relationship with the classic cases of Squall Line. The micro-squall lines were classified as function of its orientation to the Bay Marajo, length, velocity of propagation and time of formation, maximum activity and dissipation.

The Micro-Squall Lines whose orientation was parallel to the Bay Marajó were called Micro-Squall Lines Parallel (MSLP), and those whose the orientation were transverse to the Bay Marajó were called Micro-Squall Line Transverse (MSLT) (Figure 1).

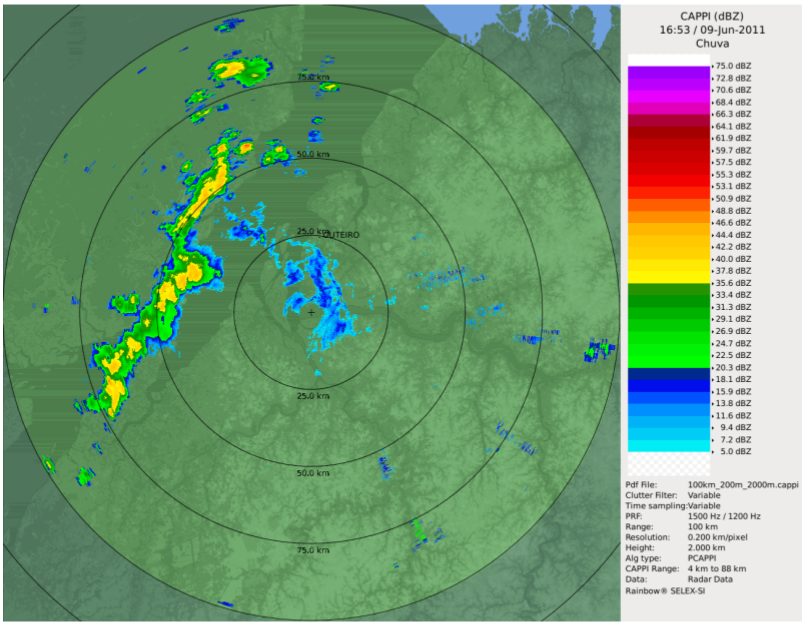
Figure 2 shows the distribution of MSLP and MSLT for whole period of the CHUVA project in Belem, when 21 cases of MSL were observed, being 5 MSLP and 16 MSLT. Most of the MSL was associated to the the classical squall lines, however, three cases of MSL were not associated to the synoptic Squall Lines. It is notable that on days 8, 9, 19, 21 and 27, were observed the formation of two cases MSL, being MSLP and MSLT on June 8, 9, 19 while in the other days formed only MSLT.

In general MSLP had its formation earlier (from 15 to 19:30 UTC) than MSLT (between 17:30 and 23UTC),additionally, it was observed the formation of a case of the MSLT overnight (04UTC). Figure 3 shows the lifetime of these systems. The average lifetime for MSL was 1h:50minutes, being 50 minutes for MSP and 2h:20min for MSLT.

Figure 4 shows the speed of all cases of MSL, where the average speed was 7:55 m/s. Finally the distance traveled by different MSLs is shown in Figure 4. The mean distance traveled by MSL was 57.63km

Generally, these systems are embedded in clouds that belong to classical Squall Lines which are observed on satellite image as a single convective organization, moreover seem to have a series of pulses of precipitation, giving an idea of existence of another scale internal of the organization. This small scale of cloud organization can be the main factor of the large squall line initiation, this small scale effect when integrated in synoptic sacle can be the mechanism to generate the large scale gust front that maintain the synoptic system.

(a) MSLP on June, 09 2011 16:53 UTC



(b) MSLT on June, 21 2011 21:44 UTC

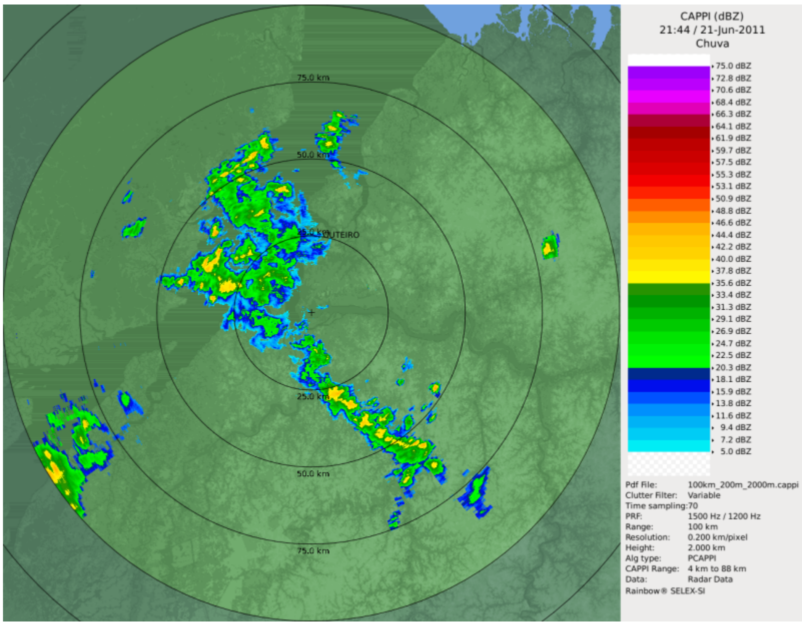


Figure 1 – Radar X band for: (a) Micro-Squall Lines whose orientation was parallel to the Bay Marajó (MSLP); (b) Micro-Squall Line whose the orientation were transverse to the Bay Marajó (MSLT).

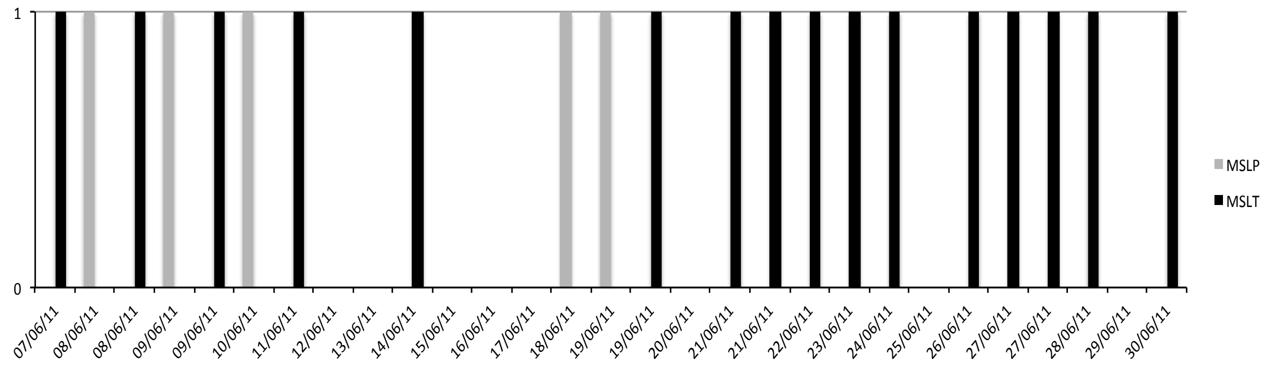


Figure 2 – Distribution of Micro-Squall Lines, which were Transversal to Marajo Bay (MSLT) and parallel to the Marajo Bay (MSLP) during the CHUVA Project in Belem.

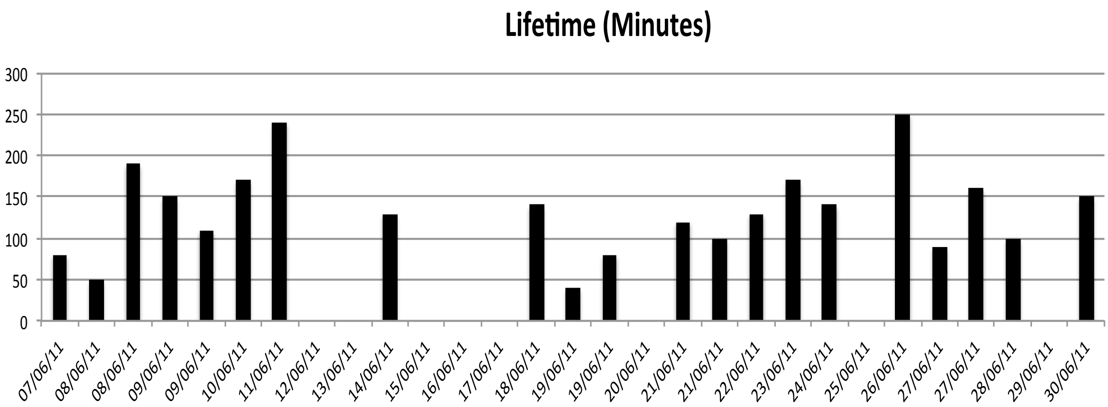


Figure 3 – Lifetime (minutes) of the Micro-Squall Lines during the CHUVA Project in Belem.

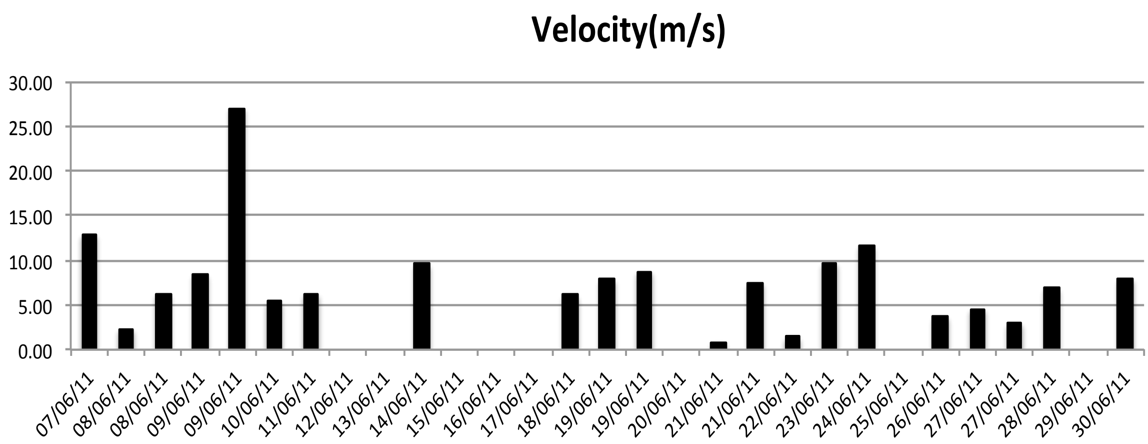


Figure 4 – Propagation velocity (m / s) of the Micro-Squall Lines during the CHUVA Project in Belem.

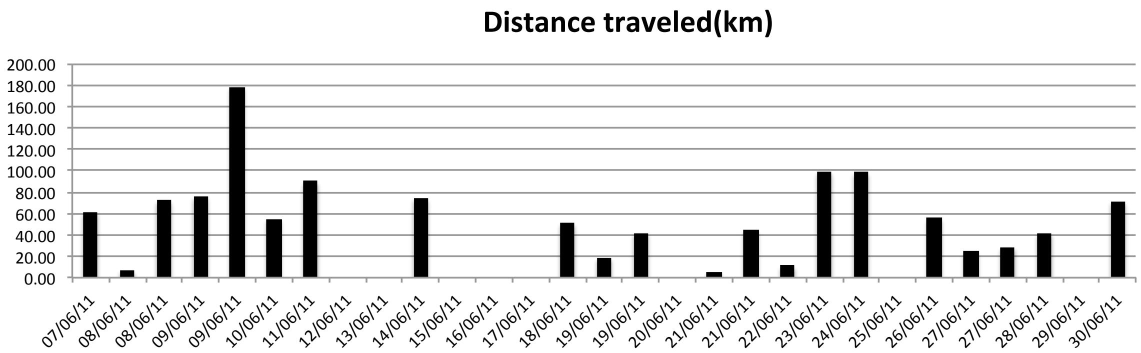


Figure 5 – Distance (km) traveled by the Micro-Squall Lines during the CHUVA Project in Belem.