Intraseasonal variation of tropical convection over the Mozambique Channel and possible link with extra tropical circulation.

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1- Introduction

In the last decade, several studies have investigated the features of tropical convection over East Asia and western north –pacific monsoon regions. These studies have shown that tropical convection in these regions is well organized on intraseasonal (summer) time scale ranging in period from 10 to 25 days (Fukutomi and Yasunari 1999). Such studies are at the beginning stage in the south western Indian Ocean region and especially over the Mozambique Channel.

The analysis in this study is focused on the identification of the convection features. We will study the space time evolution of the convection and large scale circulation on the 6-25day intraseasonal time scale over the Mozambique channel. In section 2 the data and method used for the present analysis are described. In section 3 characteristics of convection on the 6-25day intraseasonal time scale are shown. In section 4, composite relationships between the 6-25day convection events and large scale circulation ore presented. The paper concludes with summary and discussion in section 5.

2- data and methodology

The datasets used in this study are the outgoing long wave radiation (OLR) from the NOAA and the horizontal wind on a 2.5°x2.5° grid at 200 and 850hPa from the ECMWF archive. Data from 23 southern summer (November to April) from 1979-1980 to 2001-2002 were used in this study.

To show the importance of convection over the Mozambique Channel, the percentage of summer OLR standard deviation is computed. Figure 1 shows that in the Mozambique Channel we can identify an area of high percentage of summer OLR standard deviation. A time series was constructed from daily values of an area- averaged OLR over the Mozambique Channel box. This is then the reference zone.

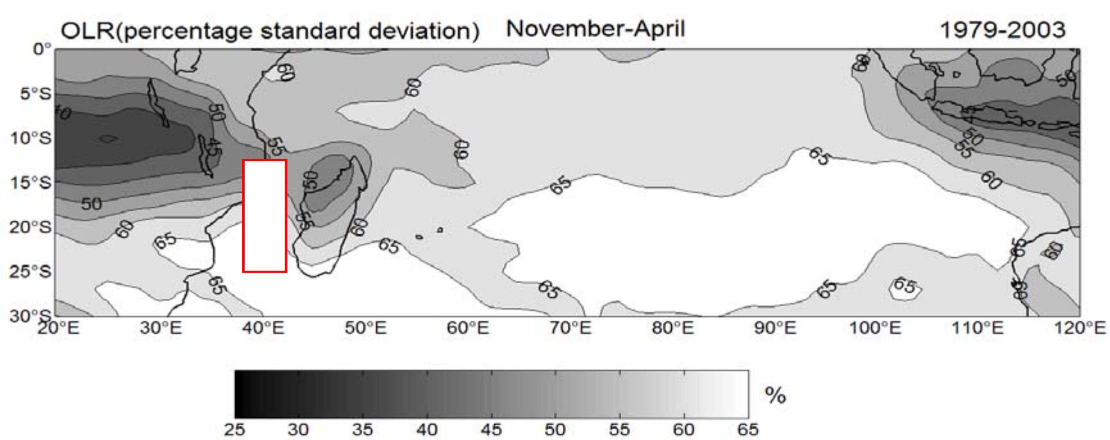

Figure 1. Percentage of total standard deviation

We applied a spectral analysis by the Fast Fourier Transform (FFT) method to this time series to find out the prominent period range of fluctuation in the reference zone. The primary datasets (OLR and wind at 200 and 850hPa) were passed through a pass-band filter in order to obtain time series in the prominent intraseasonal timescale.
The composite technique was then used to examine the typical structure of the convection and large scale circulation.

3- Typical features of the convection

a- Power spectrum of OLR

Power spectrum of OLR was performed to the daily OLR time series of the reference zone in order to determine the optimal filtering band for later analysis. In figure 2, significant power spectra is found at 6 to 25 days. Those spectra exceed the 95% confidence curve. It demonstrate the existence of the prominent 6-25day oscillation of convection in the Mozambique Channel.

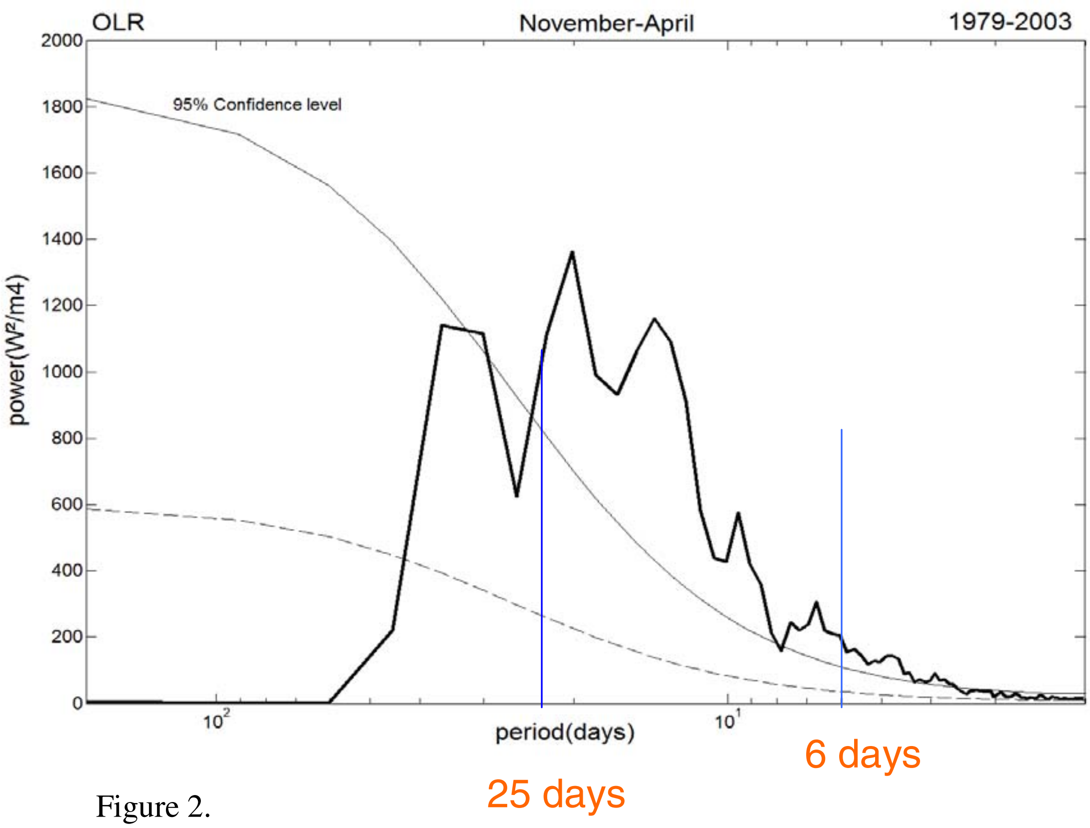

Figure 2.

b- Composite procedure

A sample of time space evolution of 6-25day filtered OLR time series of the reference zone is shown in figure 3. We divide complete cycle of filtered OLR anomalies; witch include convection events, into eight phases. A total of 116 cycles like in figure 3 were selected for the composite technique.

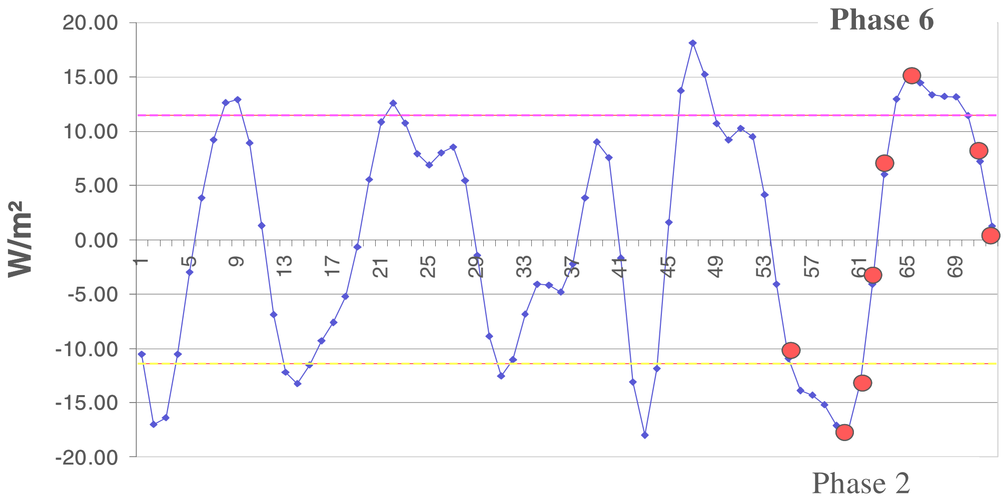

Figure 3. Time series of 6-25day OLR anomalies and an example of selected cycle. The dots represent the selected active convection events for the composite analysis

A typical composite variation of the convection index is over the Mozambique Channel is given in figure 4. This cycle is divided into eight phases. Phase 2 (minimum of anomaly) correspond to the active phase of convection; phase 6 (maximum of anomaly) correspond to the inactive phase of convection. Phases 4 and 8 are the transition phases; Phases 1, 3,5 and 7 are assigned to intermediate phases.

Composite maps of OLR and winds were made referring to these phases in order to examine the behavior of convection (OLR) and large scale circulation (horizontal wind).

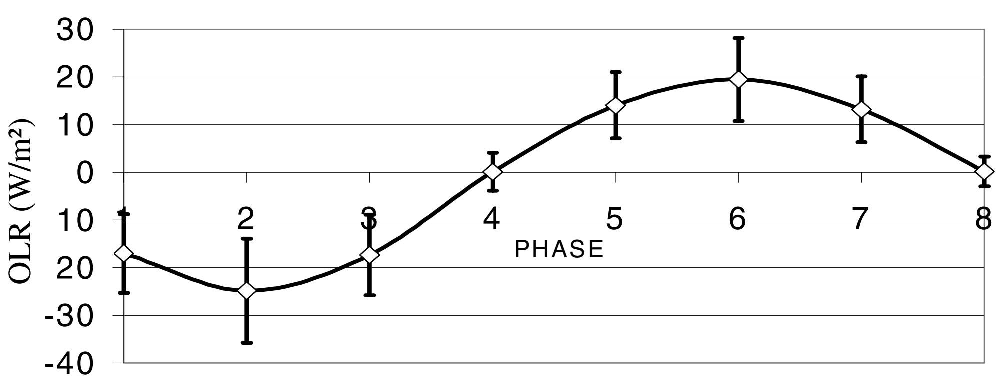

Figure 4. Composite variation of the 6-25day filtered OLR anomalies in the reference zone.

4- Relationship between convection and large scale circulation

Figure 5a to 5d represent the composite maps of OLR and wind of the 6-25day component for phase 2 and phase 6 at two pressure levels (200 and 850hPa). Study of large scale circulation associated with OLR anomalies in each phases shows that structures like waves train are often observed over the Indian Ocean.

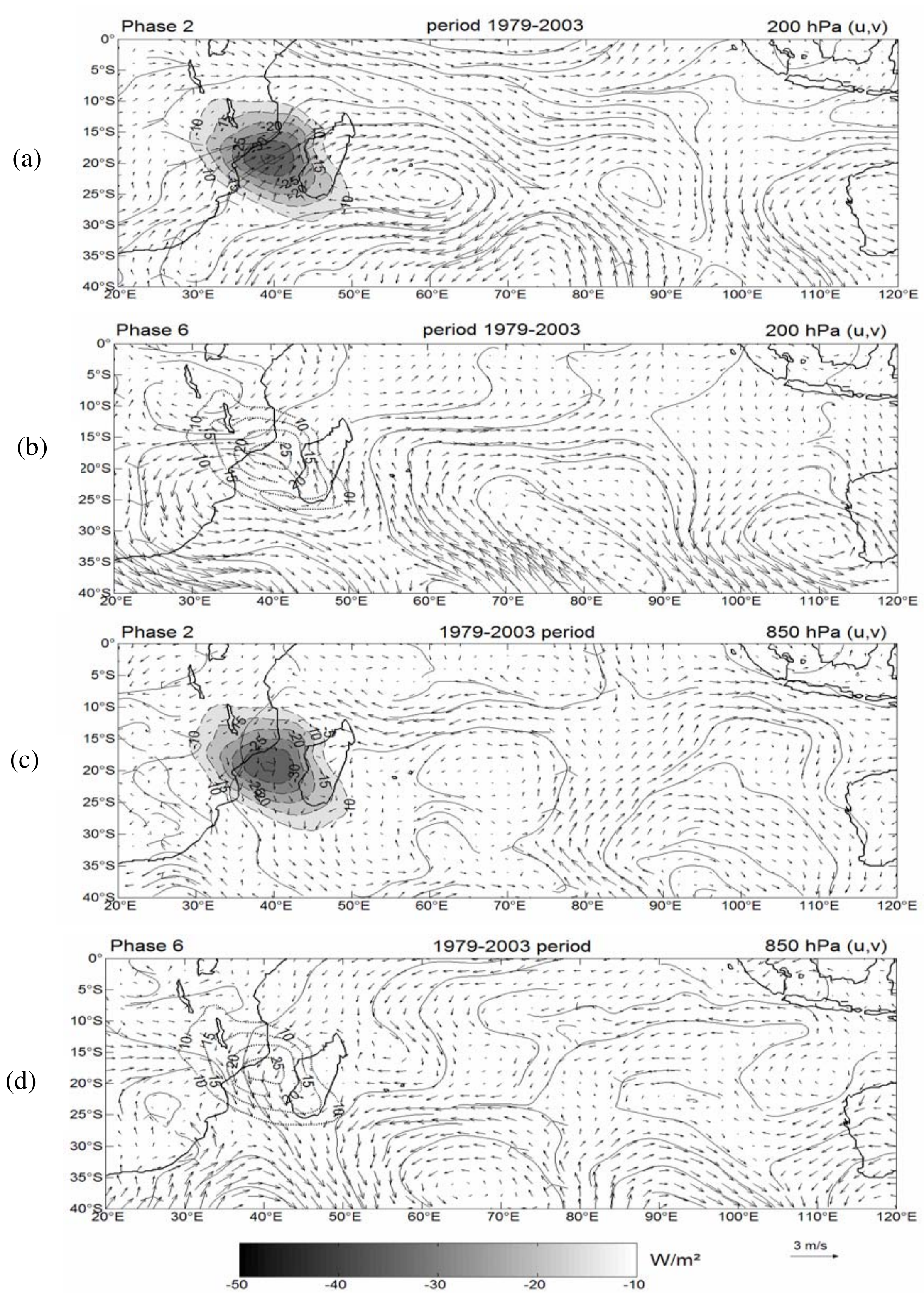

Figure 5. Spatial distribution of OLR and vector wind anomalies in the 6-25day band for phase 2 and phase 6. OLR anomalies less than ***–10w/m²*** *are shaded.*

5- Summary and discussion

In the present study, we examine some features of the convection events in the Mozambique Channel occurring in the 6-25day range during the southern summer. Firstly, it is found that there is a quasi-periodic oscillation of the convection in the Mozambique Channel. Secondly, this convection pattern seems to be connected to the large scale circulation in the whole Indian Ocean.

The oscillation of the convection in the Mozambique Channel is divides in eight phases including phase 2 (maximum of convection) and phase 6 (minimum of convection); the others phases are assigned to intermediate and transition phases. In the larger scale, over the Indian Ocean, succession of cyclonic and anticyclonic circulation is often observed. This wave train is probably interpreted as a Rossby mode response to the anomalous heating over the Mozambique Channel (Hoskin and Ambrizzi 1993). This fact suggest that there is an interaction between convection over the Mozambique channel and extra tropical circulation.

This proposed interaction of the Rossby waves activities and convection oscillation in the Mozambique Channel will need to be verified by diagnosing others parameters such as the total stationary wave number (Ks), Elianssen-Palm Flux (Hoskin *et al*. 1983) and the Perturbation Kinetic Energy (PKE).

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