Impacts of the Madden Julian Oscillation (MJO) on Rainfall in Sri Lanka

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INTRODUCTION

- The Madden-Julian Oscillation (MJO) is the dominant component of the intraseasonal (30 – 90 days) variability in the tropical atmosphere (Madden and Julian 1972, 1994).
- It consists of large-scale coupled patterns in atmospheric circulation and deep convection, that influences on global weather and climate as its convection center moves from the tropical Indian Ocean into the Pacific.
- The agricultural activities, water resources management, hydropower generation and reservoir management in the country are highly susceptible to rainfall variability.
- Therefore, understanding of rainfall variability and identification of possible predictive source in this timescale is essential to improve the quality of climate forecasting to reduce the risk of natural disaster and make better strategic decisions in agricultural sectors.

OBJECTIVE

The main objective of this paper is to investigate the impact of the MJO on rainfall variability as well as on extreme rainfall events in SL for four climatic seasons.

DATA & METHODOLOGY

- Daily rainfall data from 44 stations in Sri Lanka covering the period of 1981–2010.
- Real-time multivariate MJO (RMM) index developed by (Wheeler and Hendon 2004)
- Outgoing Longwave Radiation (OLR),
- 850 hPa winds from NCEP Reanalysis data
- Composites of rainfall anomaly are computed for each of the eight phases of the MJO category, and separately during each season such as two monsoon seasons and two inter-monsoon seasons.

RESULTS

First Inter Monsoon (FIM) –(Mid Mar to Mid May)

Convection during the FIM period is often isolated and localized predominately over land, generally initiated by sea breezes and other local circulations and orography.

- Positive rainfall anomalies in Phase 1 and 2
- Negative rainfall anomalies in phases 5 to 7.

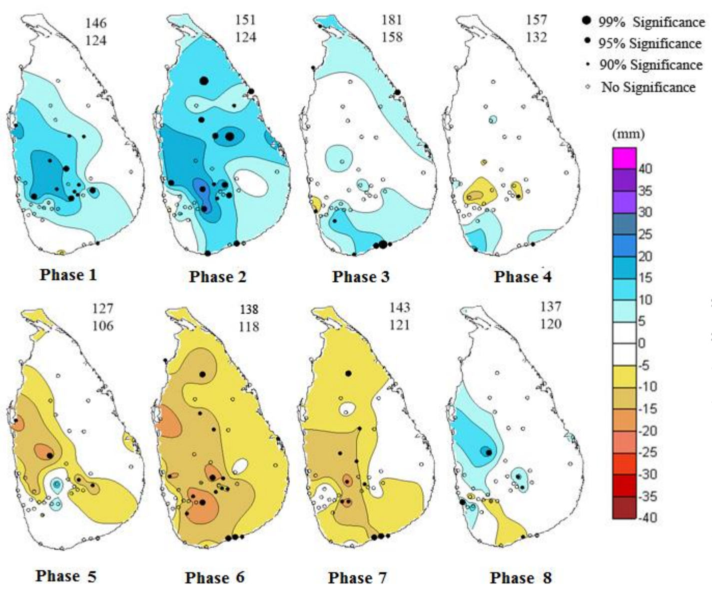

Figure 1a: Composite Maps of weekly rainfall anomaly during FIM for phases 1–8.

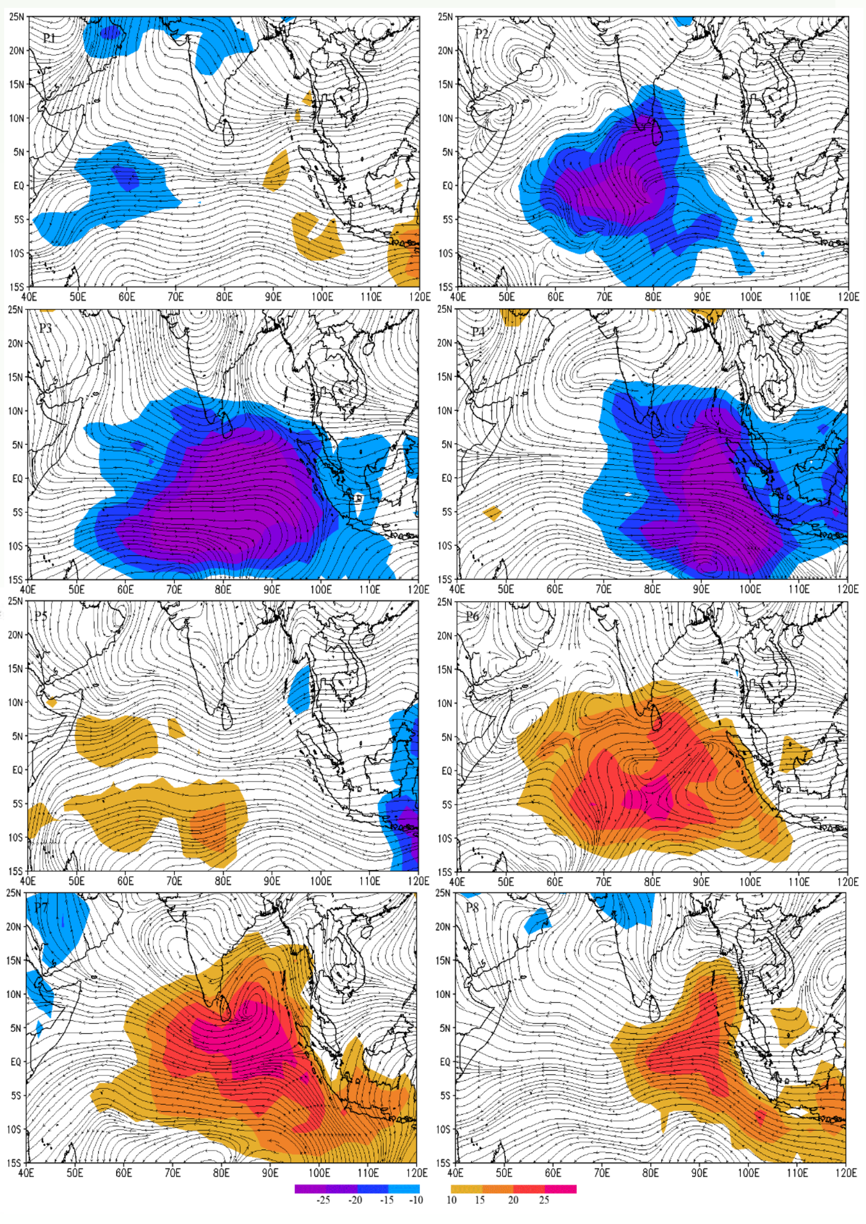

Figure 1b: Composite OLR (shaded) and 850-hPa wind (streamlines) anomalies for MJO phases during FIM.

Southwest Monsoon (SWM) –(Mid May to Mid Sept)

- Positive rainfall anomalies in phase 2
- Positive rainfall anomalies in southwest quarter in phase 3, and 4

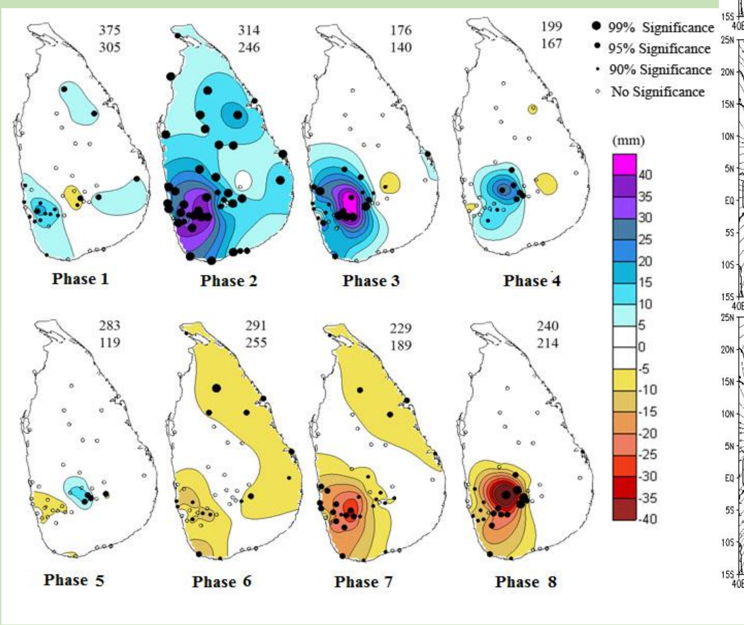

Figure 2a: Composite Maps of weekly rainfall anomaly during SWM for phases 1–8.

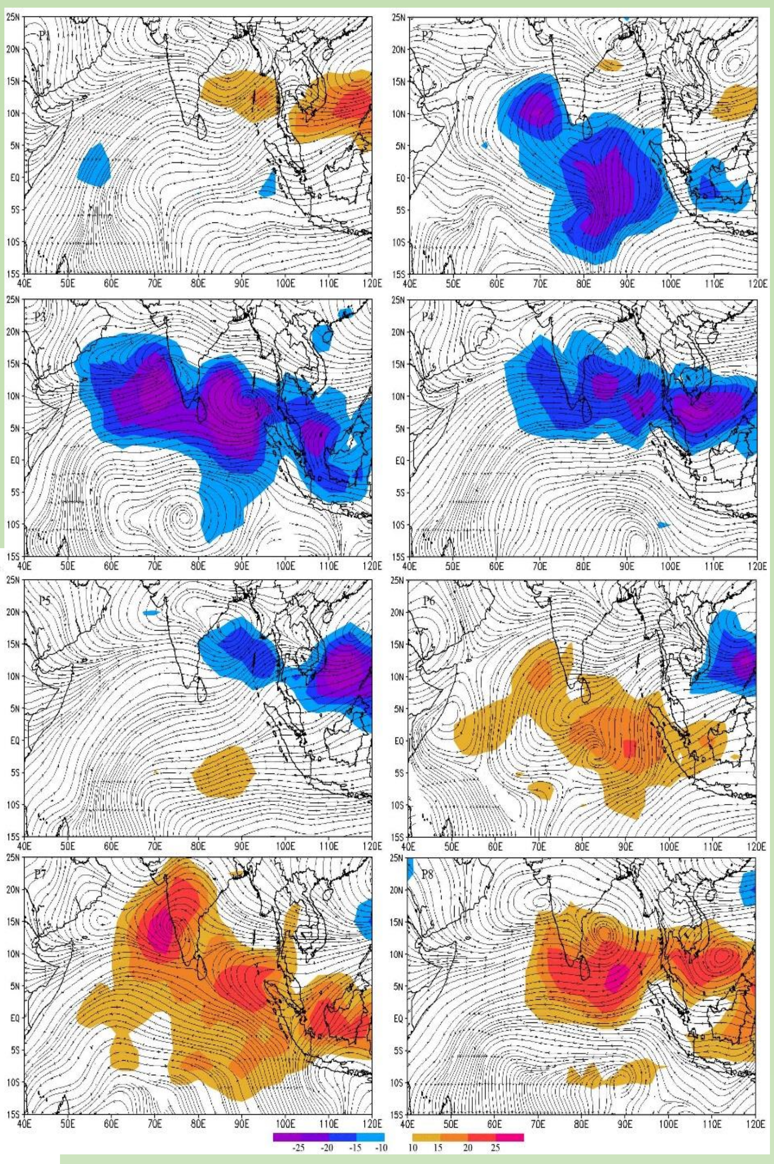

Figure 2b: Composite OLR (shaded) and 850-hPa wind (streamlines) anomalies for MJO phases during SWM.

- Negative rainfall anomalies in phase 6, 7 and 8
- During Phase 7 and 8 the strengthening of negative anomalies over Western slopes of Central hills are apparent

Second Inter Monsoon (SIM) –(Mid Sept to Nov)

It is clearly evident that during MJOs life cycle, strongest signal can be seen during SIM.

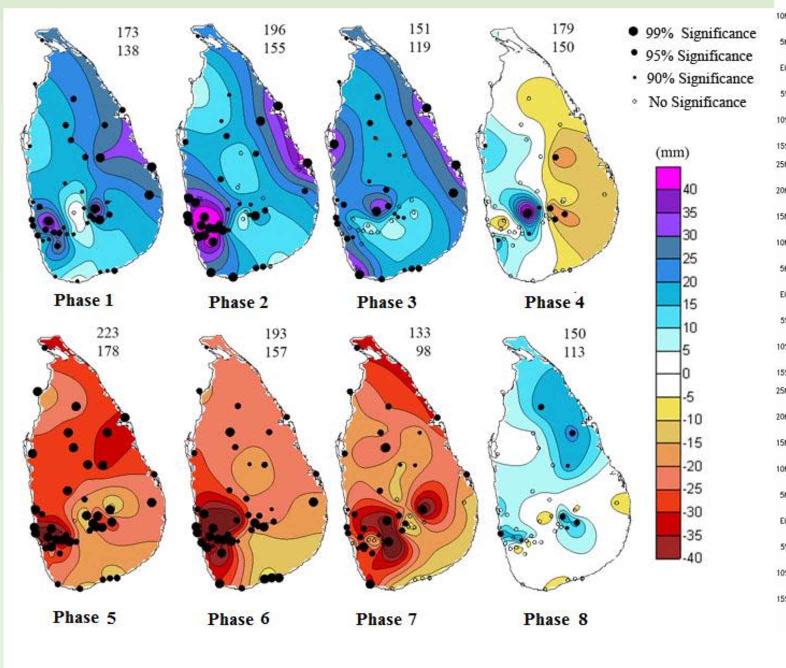

Figure 3a: Composite Maps of weekly rainfall anomaly during SIM for phases 1–8.

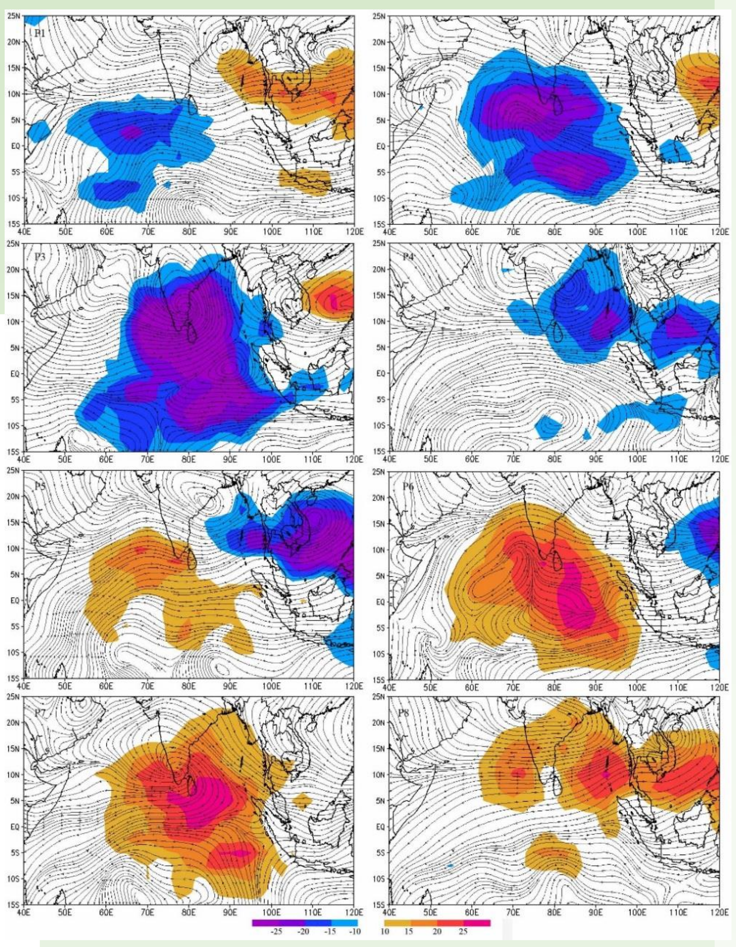

Figure 3b: Composite OLR (shaded) and 850-hPa wind (streamlines) anomalies for MJO phases during SIM.

- Positive anomalies in phase 1 to 3
- Negative anomalies in phase 5 to 7.

Northeast Monsoon (NEM) –(Dec to Mid March)

- Positive anomalies in Phase 2 and 5
- Negative anomalies in phases 5 to 7.

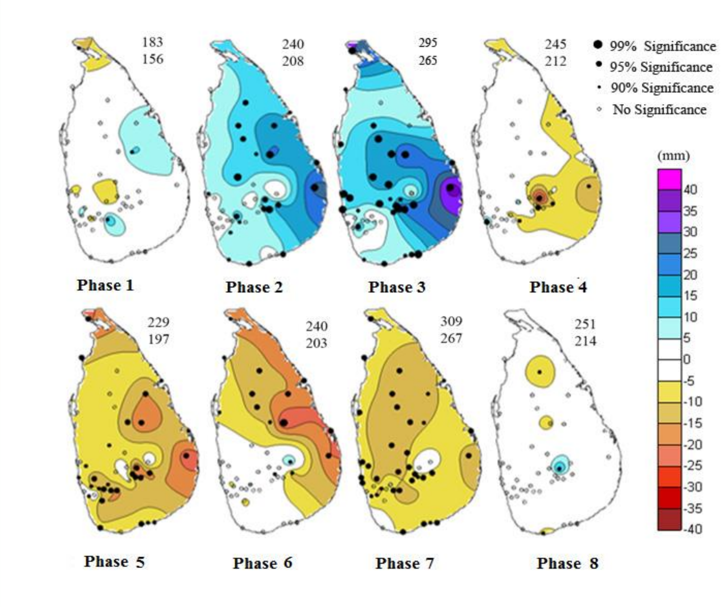

Figure 4a: Composite Maps of weekly rainfall anomaly during NEM for phases 1–8.

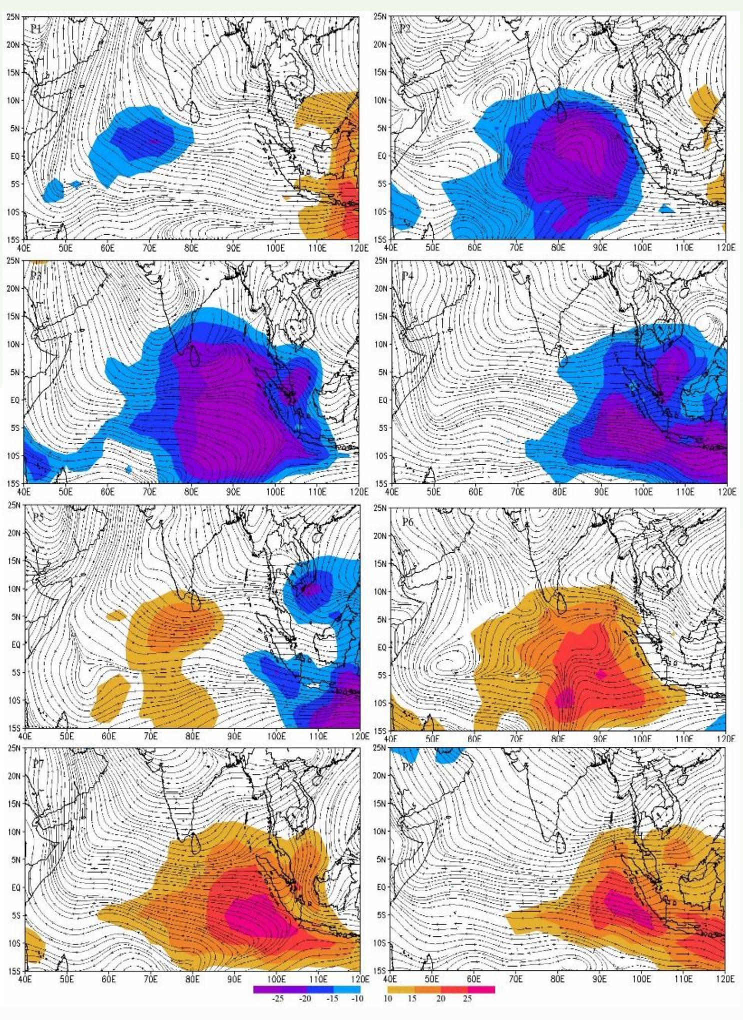

Figure 4b: Composite OLR (shaded) and 850-hPa wind (streamlines) anomalies for MJO phases during NEM.

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- Madden, R. A., and P. R. Julian, 1971: Detection of a 40-50 day oscillation in the zonal wind in the tropical Pacific. *J. Atmos. Sci.*, 28, 702–708.
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