

## Introduction

The onset of Indian Summer Monsoon (ISM) over the southern coast of India (Kerala) coinciding with the beginning of monsoon rain occurs in early June. It further advances northward and covers most part of the country by middle of July. There are, however significant variations is seen in its onset and withdrawal of monsoon. Prediction of monsoon onset (beginning of rainy season) and also the withdrawal of monsoon are crucial in India since it is connected to water-resource management and agricultural planning.

## Objectives

This study discussed the operational capability of real-time forecast of onset of ISM in extended range period using an objective method. Here, we analyzed the rainfall over Kerala, the strength of Low-Level Jet (LLJ) associated with the monsoon current and the depth of westerlies up to 600 hPa from ensemble members of ERF for the onset date. The onset of monsoon over Kerala as predicted in the operational extended range forecast (ERF) modeling system of IMD is analyzed for last 17 years from 2003 to 2019.

## Data & Methodology

The operational ERF system of IMD is based on the CFSv2 coupled model, run once in a week based on every Wednesday initial condition. The forecast with 16 ensemble members is run for 32 days based on each initial condition.

Parameters/conditions considered for defining Onset of Monsoon:

- (1) Rainfall averaged over  $8^{\circ}$ - $12^{\circ}$ N,  $74^{\circ}$ - $78^{\circ}$ E exceeds 80% of their mean;
- (2) Zonal wind at 850 hPa averaged over  $5^{\circ}$ - $12^{\circ}$ N,  $55^{\circ}$ - $75^{\circ}$ E exceeds 70% of their mean;

## Results & Discussion

(3) Zonal wind at 600 hPa over  $5^{\circ}$ - $12^{\circ}$ N,  $55^{\circ}$ - $75^{\circ}$ E exceeds zero.; Onset of monsoon defined on the first day, if all three conditions satisfied for consecutive five days.

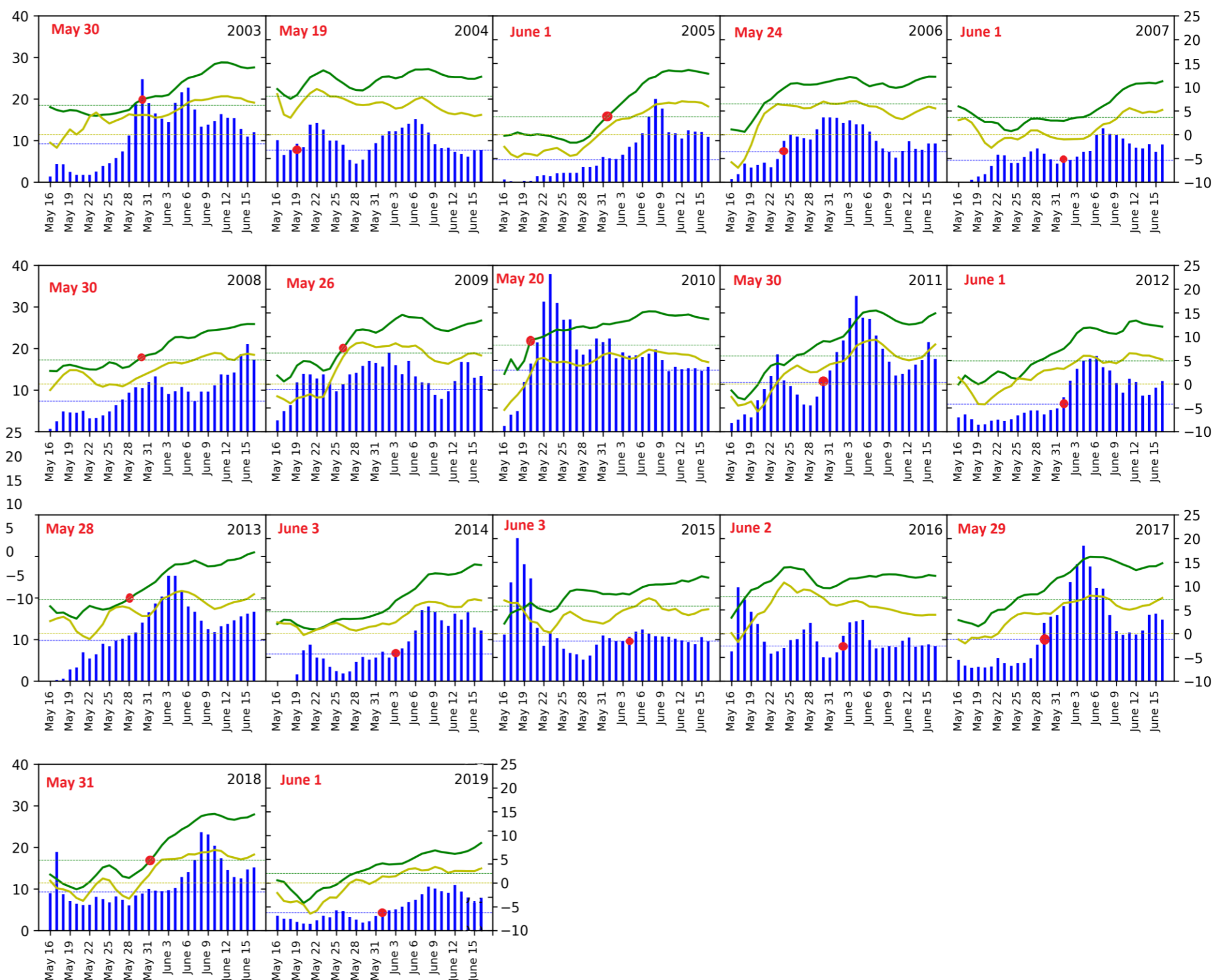


Figure. 1: Development of definition for onset of monsoon . 80% of average rainfall is shown in blue dashed line, 70% of 850 hPa average zonal wind is shown in green dashed line. Onset date is marked in red circle.

Year	Observed	Predicted	±Days
2003	June 08	May 30	9
2004	May 18	May 19	-1
2005	June 05	June 01	4
2006	May 26	May 24	2
2007	May 28	June 01	-4
2008	May 31	May 30	1
2009	May 23	May 26	-3
2010	May 31	May 20	11
2011	May 29	May 30	-1
2012	June 05	June 01	4
2013	June 01	May 28	3
2014	June 06	June 03	3
2015	June 05	June 03	2
2016	June 08	June 02	6
2017	May 30	May 29	1
2018	May 29	May 31	-2
2019	June 08	June 01	7

Table. 1: Observed and predicted dates of onset of monsoon.

## Summary/Conclusion

The results indicated that the real-time ERFs have capability to predict the onset of monsoon objectively about two-three weeks in advance. About 77% (13 out of 17) cases are closely matches with observed dates of on set of monsoon over Kerala.

## Acknowledgements & References

Susmita Joseph, S., et al (2015), Journal of Climate

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