SEASONAL AND INTERNANNUAL VARIATIONS OF INDIAN SUMMER MONSOON WINDS – A STUDY USING INDIAN MST RADAR

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I. INTRODUCTION:

The perspective of possible influence of global climate change on monsoon and its variability remains a major issue of concern for the large population of developing country like India where the agriculture and thus economy is closely linked with the behavior of the monsoons during which most of the annual rainfall occurs.

Precipitation patterns in the Indian sub-continent are characterized by dry conditions in the early summer and relatively moist conditions in late summer. The Indian Summer Monsoon, which is part of a large scale circulation pattern known as the Asian Summer Monsoon, develops in response to the large thermal gradients between the warm Asian continent to the north and cooler Indian Ocean to the south. Indian summer monsoon is characterized by few important features in the troposphere such as seasonal wind reversal in the lower level, upper level Tropical Easterly Jet stream (TEJ) [Reiter, 1961], humidity variations, wind shear etc,. The study of these features is important as they reveal the strength of the monsoon and its variability from year to year. In the past, investigations were carried out on monsoon features with different data sets of Radiosondes [Koteswaram, 1958], which have poor height resolution. Since TEJ is relatively stationary around 15^0 N for few days and the MST Radar site is nearer to 13^0 N it is possible to study its characteristics.

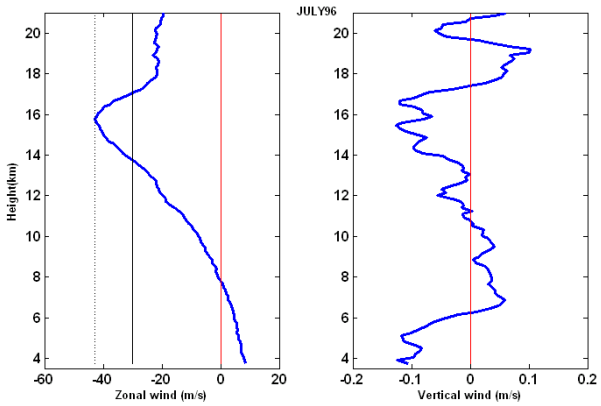
II. PRESENTATION OF RESEARCH

(a) DATA

Using Indian MST Radar with its good vertical height resolution, an attempt has been made first time to study statistically the monsoon characteristics such as Monsoon winds, Tropical Easterly Jet and its variation, and vertical circulation over Gadanki (13.5˚ N; 79.2˚ E) using nearly 9 years of data. Rain gauge data over Gadanki and India meteorological department (IMD) rainfall data over Andhra pradesh is taken to observe the relation with rainfall occurrence and monsoon wind characteristics.

(b) RESULTS AND DISCUSSIONS

Few important features are observed during the evolution and progress of the monsoon. The average depth of westerlies during monsoon period is found to be around 7.8 km. The mean core height of the Tropical Easterly Jet (TEJ) is around 16.2 km. The average jet speed is observed to be 39.2 ms^{-1} and attained values up to 55 ms^{-1} on few individual days.



FIG(1): Zonal and vertical wind variations during Monsoon season

The profiles of monthly mean vertical velocity show direction reversal from downward to upward at two regions, one around zonal wind reversal height and another at around jet core height (fig 1). The mechanism of this vertical velocity reversal is thought to be due to horizontal convergence and instabilities associated with the jet streams respectively. Similar feature was noted by Jagannadha Rao et al (2001) with 3 years of data set using Indian MST Radar. The mean meridional winds, although magnitudes are small, show northward motion above and southward motion below jet core height. The vertical wind shear above jet core height is observed to be greater than below jet core height. Daily accumulated rainfall data over observation site and IMD rainfall data over Andhra Pradesh state are compared with the variation of wind reversal height during monsoon season. Here it is observed that there is a negative correlation between the rainfall

occurrence and wind reversal height (Fig 2), which shows that as the wind reversal height is more the rainfall is less and vice versa. Further study is being carried out to observe weather the correlation is same through out the country or not.

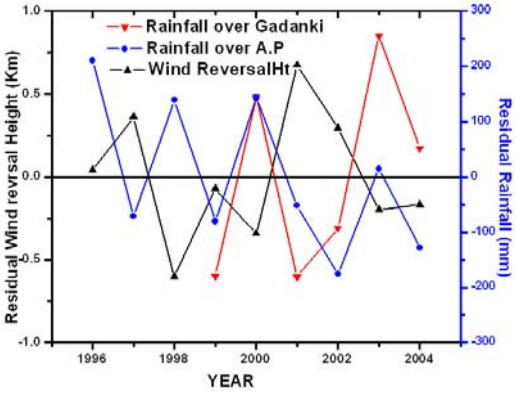


FIG (2): The Correlation between rainfall and wind reversal height.

III. AKNOWLEDGMENTS

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