New insights into the convective system characteristics over the Indian summer monsoon region using space based passive and active remote sensing techniques

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Abstract

The characteristics of convective systems over Indian summer monsoon (ISM) region derived by using a unique combination of four satellites such as IR T_b, TRMM, COSMIC and CloudSat comprising of both active and passive remote sensing sensors are discussed for the first time. Six years (206-2011) of observations during ISM brought out the preferential geographical regions and time for formation of shallow, deep and very deep convective systems. The COSMIC observation showed relatively high CAPE values are reasonably associated with large amount of rainfall, though their maxima are not exactly collocated at the same geographical locations such as IGP. It has been observed that shallow, deep and very deep convective clouds are abundant over ISM region and their distributions show relatively high frequency of occurrence over BoB compared other regions. The probability of occurrence of shallow convective systems and deep convective systems are relatively high over northeast BoB, while the maxim probability of occurrence of very deep convective systems is observed over north BoB (Figure 1). The mean vertical structure of clouds are also been studied using CloudSat observations over several latitudinal belts. These observations revealed that their spatial structure evolution can be used as a proxy for the convective organization. The CloudSat observations also suggested the eastward propagation of convective activity over few latitudes. The time of maximum occurrence of convective type cloud systems are also quantified using the present observations. This analysis suggested that the deep and very deep convective cloud systems peak during late afternoon hours over many parts of the Indian landmass except few exceptions such as over foot hills of the Himalayas, where it peaks during early morning hours. Over BoB and Arabian Sea, these systems peak during afternoon and morning hours respectively. Thus the present study for the first time, by combining active and passive remote sensing techniques characterized the convective systems occurring over ISM region and identified their preferential formation regions and local time. The significance of the present results lie in providing new insights in to the characteristics of convective systems, which in turn play a vital role in understanding the internal dynamics of ISM.

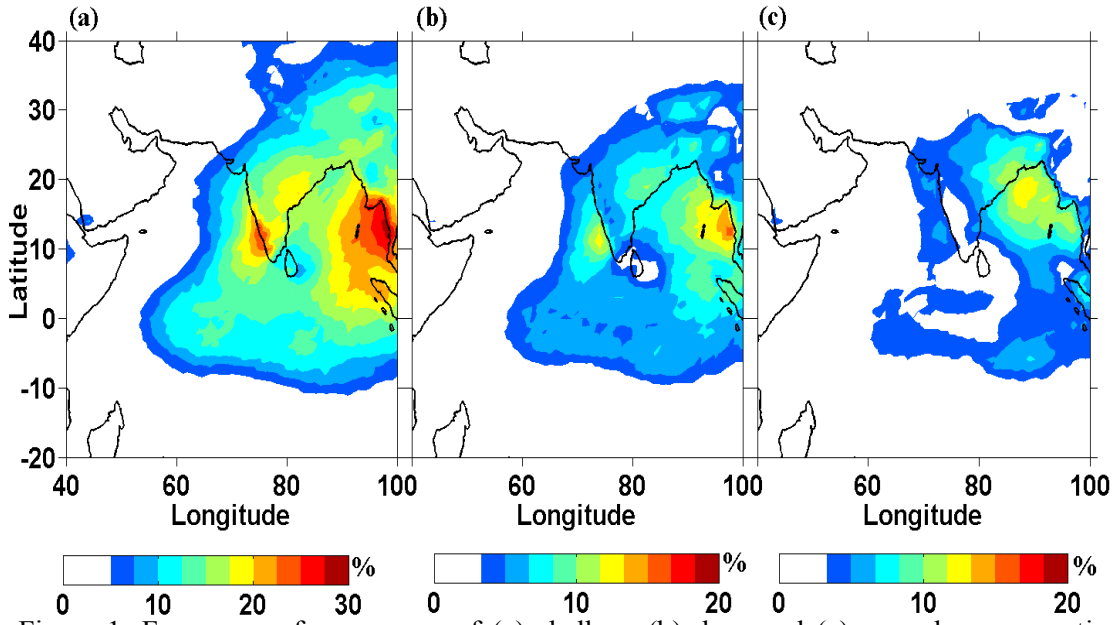

Figure 1: Frequency of occurrence of (a) shallow, (b) deep and (c) very deep convective systems over ISM region