Classification of Indian summer monsoon rainfall patterns

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The space-time variability of seasonal (June through September) monsoon rainfall over India has been studied by using the statistical tool of pattern recognition. Spatial patterns of seasonal percentage departures from normal rainfall over India have been classified by objective cluster analysis techniques such as map-to-map correlation (MM) , K-means (KM) and Empirical Orthogonal Function (EOF) method as well as Fuzzy C Means (FCM) method utilizing the data for 135 years , 1871-2005.These methods bring out the most dominant, recurring spatial patterns of Indian monsoon.

MM , KM and EOF methods are hard clustering procedures which force each pattern to get classified into one cluster only or keep it unclassified. FCM method classifies all patterns in one or more clusters with varied probabilities. Thus no pattern remains unclassified in FCM. The marginal patterns lying on the boundary get classified in more than one cluster. So FCM is more appropriate in climate research.

By objective methods six dominant patterns were obtained while FCM brings out four dominant patterns. The most dominant pattern is a drought over the Indian subcontinent. It is seen that the dominant patterns are similar irrespective of the method applied. By FCM , the spatial patterns associated with extreme (deficient/excess) All-India monsoon rainfall get very high membership in one cluster only. The spatial patterns during El Nino/ La Nina episodes show high preference to a particular cluster. Possible dynamic causes leading to these dominant clusters are examined. Merits and demerits of these statistical cluster analysis methods are also discussed. Using the analogues of these patterns an attempt has been done to forecast the spatial pattern of Indian monsoon.