Verification of short range forecasts of extreme rainfall during monsoon

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ABSTRACT. The daily rainfall over India during the monsoon season (June-September) is governed by the interplay of the large-scale, synoptic and mesoscale disturbances, many of which are sporadic rainfall spells and extremely intense. These spells often bring extreme amounts of rain over only a few days, which can have sizable impacts on the estimated seasonal mean rainfall. The record rainfall of over 100 cm/day in Mumbai on 26th July, 2005 is an outlier/extreme at over 20 standard deviations for activity of typical June-September average rainfall of 18 mm/day with daily standard deviation of 28 mm/day.

While such outliers are not uncommon in India during the monsoon season, they pose serious challenge to even the high resolution forecast models. The statistics of these outlier events are examined both for observed and model-forecast daily rainfall for recent seven monsoon seasons (2007-2013). Some of the extreme one day rainfall events (over the plains of eastern India) contribute up to 30% of the seasonal total rain. This study presents rainfall verification over India using traditional verification scores such as Probability of Detection (POD), Equitable Threat Score (ETH), Critical Success Index (CSI) etc. for various categories. Further, the statistical challenges associated with the verification of the extreme events are discussed. A brief review of the new methods suggested in literature for verification of the extreme events, such as Odds Ratio (OR), Extreme Dependency Score (EDS), Symmetric Extreme Dependency Score (SEDS), Extremal Dependence Index (EDI) and Symmetric EDI (SEDI) is provided with example application to Indian context.

Key words – Rainfall, Observed rainfall, Unified model (UKMO), Observed and forecast mean, Forecast verification.