All-India Heavy Rainfall Alerts and Cloudburst Potential Alerts (UK and HP)

A satellite based nowcasting method has been developed to provide heavy rainfall alerts over the whole Indian region and additional cloudburst potential alert over Uttarakahnd and Himachal Pradesh. The technique is based on computing probability distribution functions for cloud top cooling rates. The main objective of this document is to provide step wise algorithm, inputs and outputs from the All India Heavy Rainfall Alerts and the cloudburst alerts provided through MOSDAC webportal.

Theoretical Background

The updraft speeds of growing convective clouds which are regarded as the most direct measure of the strength of a convective storm can be measured from satellites as the ***Cloud Top Cooling Rate (CTCR)*** . Earlier studies have shown that rate of change of BT, a proxy for CTCR is an important precursor information to storm initiation and could be useful for identifying vigorous cloud growth.

The determination of thresholds is very crucial to the success rate of the model. Fitting of probability distribution functions (PDF) and deriving thresholds from the density curves are more physically representative methods for approaching the problem. In order to compute CTCR, a gross cloud temperature test is applied, followed by computation of the drop in temperature of the cloudy pixel. Next is the important step of delineating each cluster of potential pixels and finding its centroid and area of influence.

The underlying terrain plays a very important factor in triggering torrential rain episodes. The distribution of extreme rain events is observed to be very dense over Western Himalayan terrain covering the Indian states of Himanchal Pradesh and Uttarakhand. In particular, when extreme rainfall events over Uttarakhand over past years are analyzed, it is found that there is a recurrence of the events at certain locations. These locations are necessarily more vulnerable to a torrential rain event owing to the configuration of their terrain and are thus assigned a higher vulnerability quotient.

Flow diagram for Heavy Rainfall alerts

Description of Output

Output	Unit	Resolution	Domain
Heavy Rain Alert Locations	Lat-long (degrees)	0.1degree	All -India
Heavy Rain Centroid location	Lat-Long (degrees)	-	All-India
Heavy Rain Radius of Influence	Km	-	All-India
Cloudburst Alert Locations	Lat-long (degrees)	0.1degree	U.K. And H.P.
Cloudburst Centroid location	Lat-Long (degrees)	-	U.K. And H.P.
Cloudburst Radius of Influence	Km	-	U.K. And H.P.

Limitations

1. Multi-level clouds can be a major source of error.

2. It is more applicable to convective systems that advective ones

Reference Paper

Bipasha Paul Shukla , C. M. Kishtawal and P.K. Pal (2017): Satellite-Based Nowcasting of Extreme Rainfall Events Over Western Himalayan Region,IEEE-JSTARS, VOL. 10, NO. 5,