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Aggradational and Erosional records of Cloud Burst: an example from the 2010 Leh Cloud Burst, Ladakh Himalaya, India

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A major cloud burst and associated flash floods that occurred during 4-6th August 2010 in the Leh valley region of the Ladakh Himalaya developed a set of aggradational and erosional features that are reported here as the unique signatures of a cloud burst in the trans-Himalayan region. Our post facto field survey a month after the event document a combination of signatures on the ground such as boulder alignments, bank-erosion, sharp axial incision of the stream beds and deposition of couplets of slurry from the transverse streams arising from the cloud burst stricken Ladakh batholithic ridge. The entire episode was reconstructed by mapping the distribution of these signatures in upper, middle and lower reaches from the 11 affected streams; producing a three stage model. In the initial stage (I) the cloud burst rapidly recharged the streams, transporting larger boulders (~1m diameter) along with gravel to a downstream distance >6 km, followed by granular flow under some of the highest critical velocities resulting in significant lateral bank erosion in the middle and lower reaches. This was followed by hyper-concentrated stream flows amplified by a funnelling effect, generating a large amount of slurry which developed sheet flood deposits over the valley floor during Stage II. The terminal stage (III) is marked by a unique, narrow (~1.5x2m) axial incision of the stream beds by the post event sediment starved, bank-overfilled waters due to continued torrential rains.

The rapid recharge and discharge from extremely narrow, high gradient streams with entrapped sediment mass and proportionately large deglaciated catchments resulted in the catastrophic mass transfer downstream. Such extreme weather conditions are anticipated during the current trends of climate change and hence a detailed quantitative estimate on the Quaternary deposition and sediments entrapped within the above geomorphic setup is essential. This will enable one to predict the amount and style of mass transfer during future extreme events besides identification of the stable geomorphic surfaces for settlement and infrastructural developments in the Himalayan region.