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Anatomy of a cascading hazard: the flood part of the 7 February Uttarakhand event

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The 7 February Chamoli, Uttarakhand singularity imposed a severe geomorphic crisis. While remote sensing imagery quickly identified a major rock avalanche as its origin, there is a fundamental lack in high precision temporal information on the kinetics of this event about when, how, and why it evolved from a slope failure into a channel-confined mass wasting process, and ultimately into a debris laden flood. Furthermore, while the initial rock slide could be detected and located by global seismic networks, it was the flood which caused most of the destruction and fatalities. Yet, that part of the process cascade remained elusive in global seismic data sets.

Here, we present a detailed anatomy of the hazard cascade, with emphasis on the flood part. Using information from a dense seismic network, we explore the limits of detection and constrain its propagation velocity. By jointly inverting two physical models that predict spectral signal properties of floods, we estimate important hydraulic and sediment transport metrics. These information are key for designing any future early warning infrastructure.