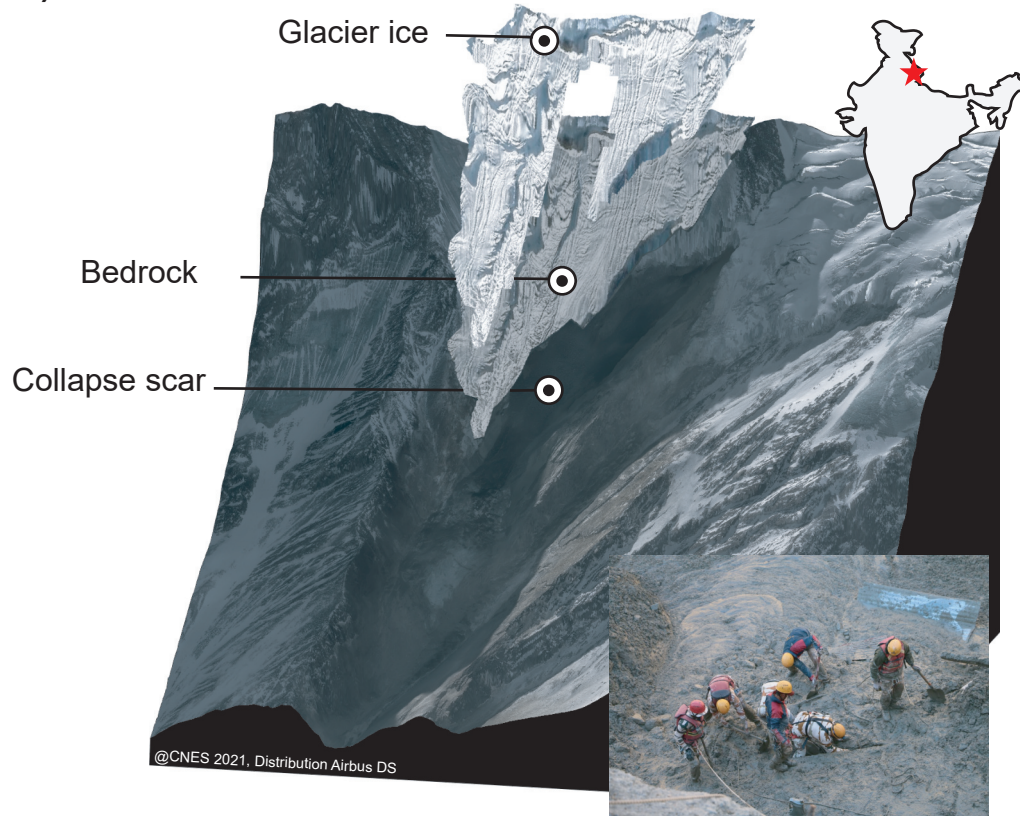


# Resolving pre-collapse slope motion of the February 2021 Chamoli rock-ice avalanche via feature tracking of optical satellite imagery and DEM differencing

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## 1) The 7 Feb 2021 Chamoli disaster



- Highly destructive rock-ice avalanche and debris flow
- Over 200 killed or missing, widespread damage in downstream valley

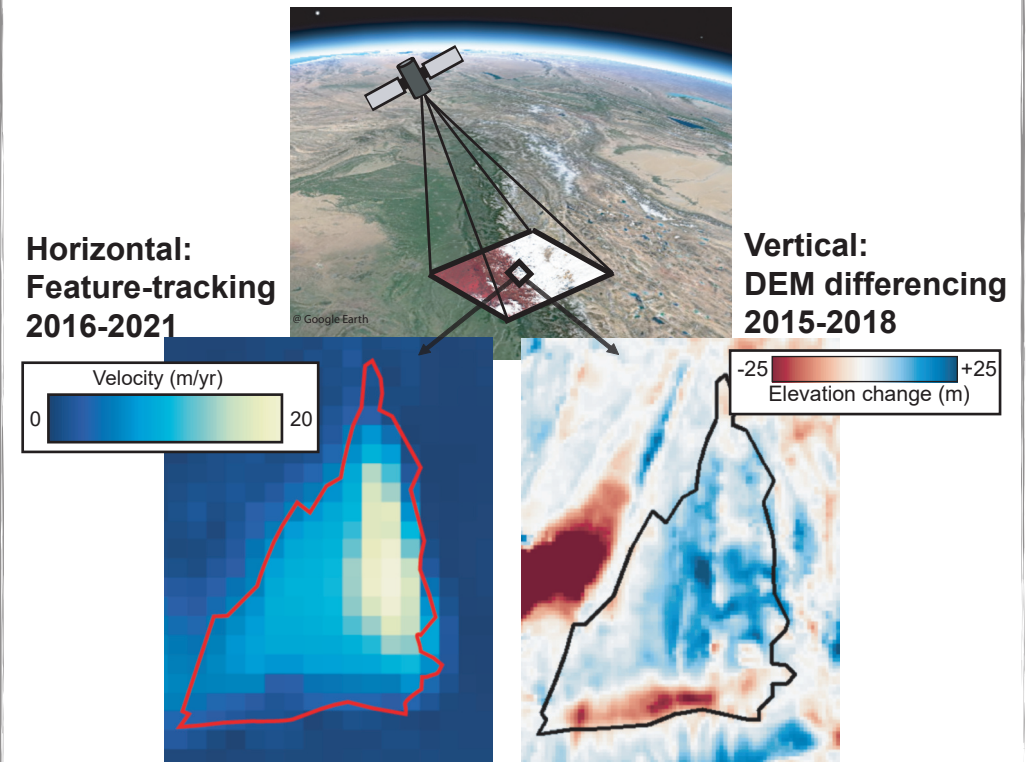
**Question: Was there pre-collapse motion of the avalanche bloc?**

## 3) Key findings

- 1** → Remote sensing shows 10s of metres of horizontal and vertical displacement of avalanche bloc pre-collapse
- 2** → 3D analysis of bloc motion highlights deep headwall crack, and likely snow and debris loading - cause of winter collapse?
- 3** → These methods have potential for regional hazard mapping, but signal to noise ratios remain high in steep terrain

## 2) Feature tracking and DEM analysis

We use optical satellite imagery to measure the **horizontal** and **vertical** movement of the avalanche bloc prior to failure.



- 20 to 50 m of horizontal slip in 5 yr prior to collapse
- 20 m deep crack at headwall, elevation gain of rest of bloc
- Most rapid slip in Summer 2017 & 2018, 2-3 yrs pre collapse