

EGU21-16597

<https://doi.org/10.5194/egusphere-egu21-16597>

EGU General Assembly 2021

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

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On the 7<sup>th</sup> of February 2021, a large rock-ice avalanche triggered a debris flow in Chamoli district, Uttarakhand, India, resulting in over 200 dead or missing and widespread infrastructure damage. The rock-ice avalanche originated from a steep, glacierized north-facing slope with a history of instability, most recently a 2016 ice avalanche. In this work, we assess whether the slope exhibited any precursory displacement prior to collapse. We evaluate monthly slope motion over the 2015 and 2021 period through feature tracking of high-resolution optical satellite imagery from Sentinel-2 (10 m Ground Sampling Distance) and PlanetScope (3-4 m Ground Sampling Distance). Assessing slope displacement of the underlying rock is complicated by the presence of glaciers over a portion of the collapse area, which display surface displacements due to internal ice deformation. We overcome this through tracking the motion over ice-free portions of the slide area, and evaluating the spatial pattern of velocity changes in glaciated areas. Preliminary results show that the rock-ice avalanche bloc slipped over 10 m in the 5 years prior to collapse, with particularly rapid slip occurring in the summer of 2017 and 2018. These results provide insight into the precursory conditions of the deadly rock-ice avalanche, and highlight the potential of high-resolution optical satellite image feature tracking for monitoring the stability of high-risk slopes.