

From satellite image to flagged slope

Short version for media: how Watchberg reads alpine terrain, shown on the Blatten case

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In one paragraph. Free radar images from the European Sentinel-1 satellites, open software and a standard method were used, after the event, to look back at the terrain above Blatten from January 2023 to 26 May 2025, two days before the rock-ice avalanche. Each 640 m unit of terrain was compared with its own movement in 2023. In the final months before the collapse, one unit on the Birch Glacier below the Kleines Nesthorn moved well above its normal rate and would have been flagged for expert review; the slope's own record shows about 25 to 30 mm of extra movement away from the satellite between January and May 2025, after two quiet years. The full method, every number and the limits are in the white paper and the article at watchberg.ch.

Three rules

This is a look-back at a documented past case, computed after the event; it is no assessment of any slope today. The colours show a change in the rate of movement compared with the terrain's own past; they never predict when or whether something will fall. The processing follows published, standard methods with every parameter recorded, and nothing was tuned to make the known outcome appear.

The case

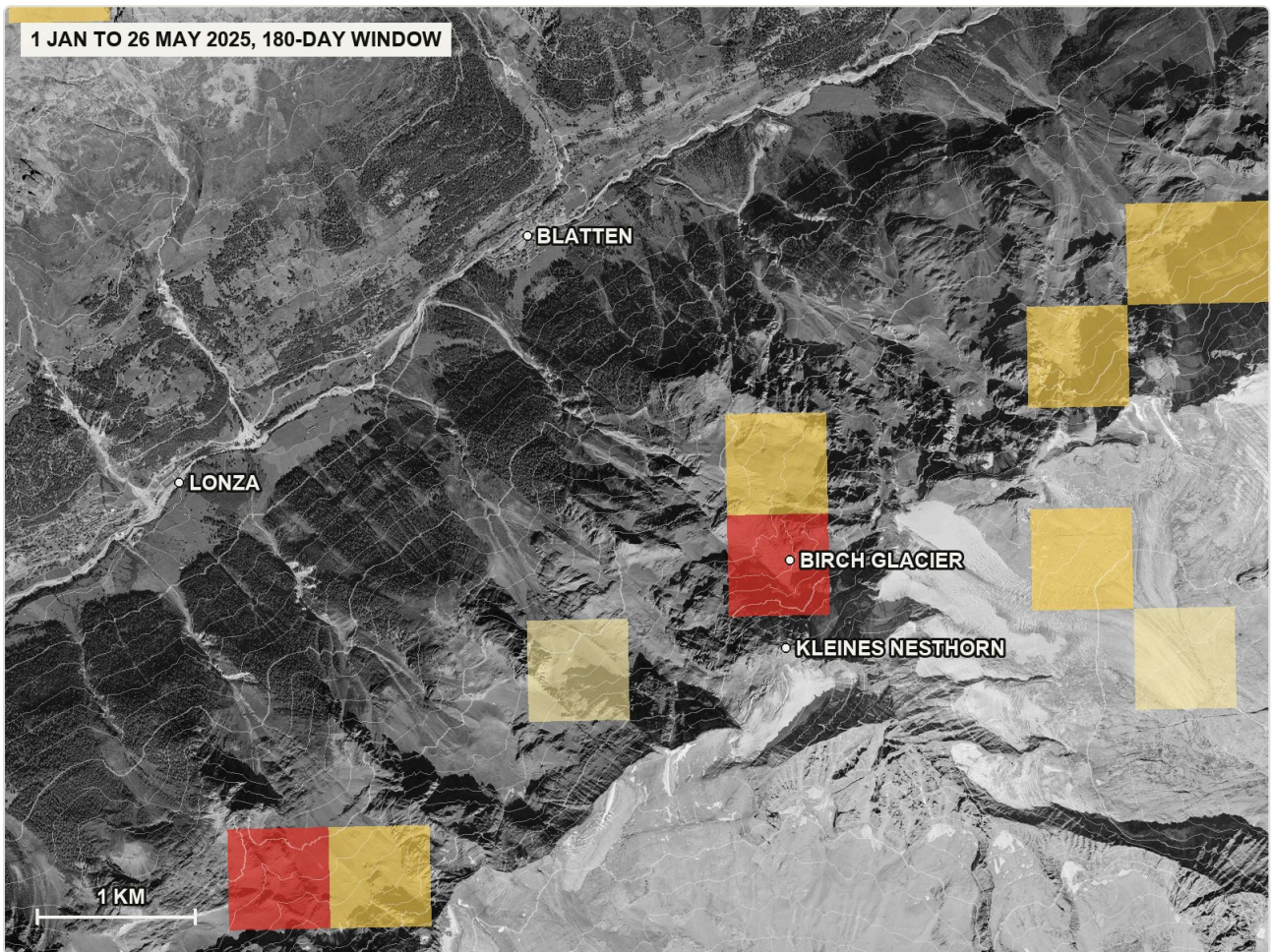
On 28 May 2025 about 10 million cubic metres of rock and ice broke away from the Kleines Nesthorn and the Birch Glacier and buried most of Blatten in the Lötschental. About 300 residents had left nine days earlier after a local observer raised the alarm. Afterwards, researchers found in satellite archives that the slope had been moving for years. Most of those archives are not open. The Sentinel-1 data are free to anyone.

How the method works, in five steps

1. **Terrain.** The maps are drawn on the Swiss elevation model and aerial image from swisstopo, with contour lines: the closer the lines, the steeper the ground.
2. **Radar images.** A radar satellite sends out radio pulses and records what comes back, every 12 days from the same position in orbit. Sentinel-1 uses a short wavelength that is sharp but easily disturbed by snow and fast movement; the new NISAR satellite uses a long wavelength that sees through dry snow. For the look-back only Sentinel-1 exists.
3. **Comparing images.** Two images of the same place, days apart, reveal movement: if the ground moved by a fraction of the wavelength, the returning wave is out of step. Where snow or vegetation changed the surface too much, the comparison fails and the area is marked as "no

usable signal". Four Sentinel-1 tracks pass over Blatten; a test chose the one that kept the best signal on the slope.

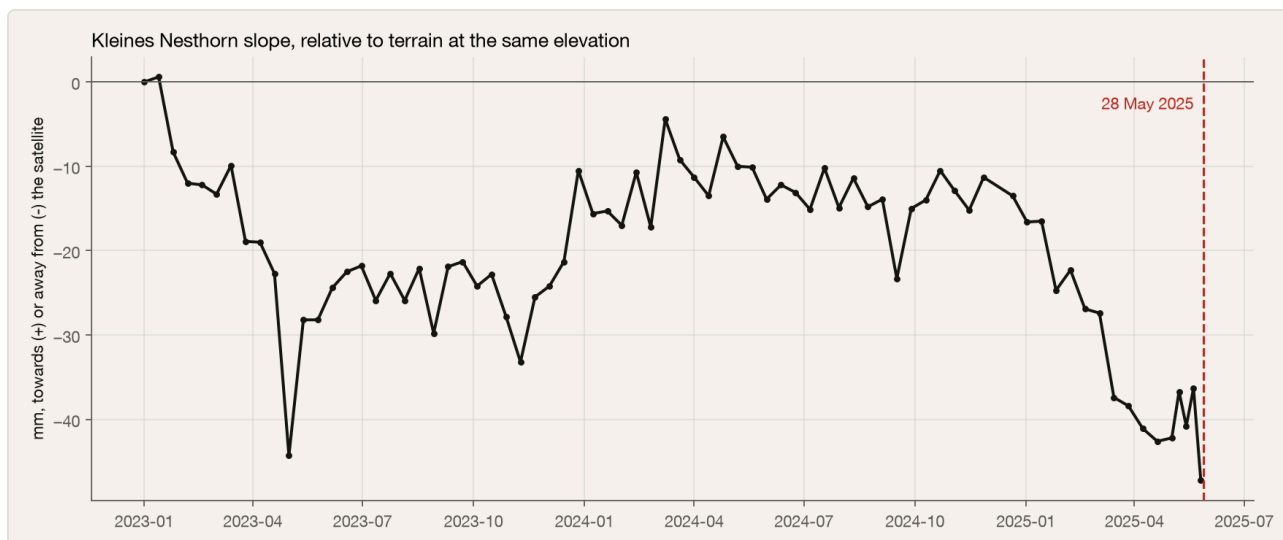
4. **A movement history.** 149 image pairs were chained into a continuous record for every 40 m pixel, with corrections for the atmosphere and with the winter pairs that carry no signal set aside. About half of the window is usable; the fastest part of the Kleines Nesthorn and the glacier are not.
5. **Normal versus now.** Each 640 m unit is compared with its own 2023 rate. A unit only receives a colour when the change is statistically clear and holds for two consecutive quarters: pale yellow for above normal, orange for well above, red, called "flagged for expert review", for more than three times its normal rate.



The final quarter of the look-back, 1 January to 26 May 2025, on the swisstopo aerial image. The red unit sits on the Birch Glacier and the rock slope below the Kleines Nesthorn, the slope that failed four days after the last image. Yellow: above normal. Hatched: no usable radar signal.

What it found

In every quarter from mid-2023 to early 2025 at most a handful of units in the whole window were flagged, and winters showed only pale yellow. In the final quarter, one unit at the Birch Glacier turned red. The slope's own record, measured on the part of the slope with a usable signal and relative to terrain at the same altitude, stayed within about 10 mm of its surroundings through 2023 and 2024 and then moved 25 to 30 mm further away from the satellite between January and May 2025. This agrees in direction and size with the published Sentinel-1 study of the case.



Movement of the usable part of the Kleines Nesthorn slope relative to terrain at the same elevation, one point per satellite image, January 2023 to 26 May 2025. Negative values are movement away from the satellite. The dashed line marks the collapse.

What it does not show

The fastest part of the slope, which only long-wavelength radar can follow, is invisible here. The method gives no date: the final acceleration of a rock-ice mass plays out in hours and belongs to instruments on the ground. And this is a look-back with knowledge of the outcome, which is why every parameter is recorded and why the same method has to be run on data available at the time, without look-ahead, before any lead time is claimed.

About Watchberg

Watchberg is a monitoring platform for alpine terrain under development by Swiss Aerospace Ventures GmbH in Dübendorf. It processes every new satellite image over a region automatically, compares each slope with its own history, ranks the flagged slopes by what lies below them, and shows the responsible experts the evidence on a dashboard. It is decision support for experts and issues no public warnings. A pilot programme with Swiss hazard offices and operators is planned for 2027; all performance figures are projected until then.

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About this document. Prepared by Julian Walder with AI assistance for drafting and processing; every number comes from the processing logs and the sources listed. A documented past case, computed after the event; no assessment of any slope today. Decision support for experts; Watchberg issues no public warnings. Data attribution: contains modified Copernicus Sentinel data 2023 to 2025; NISAR data NASA and ISRO; terrain and aerial image swisstopo. Swiss Aerospace Ventures GmbH, Wangenstrasse 68, 8600 Dübendorf, Switzerland. julian@swissaerospace.ventures