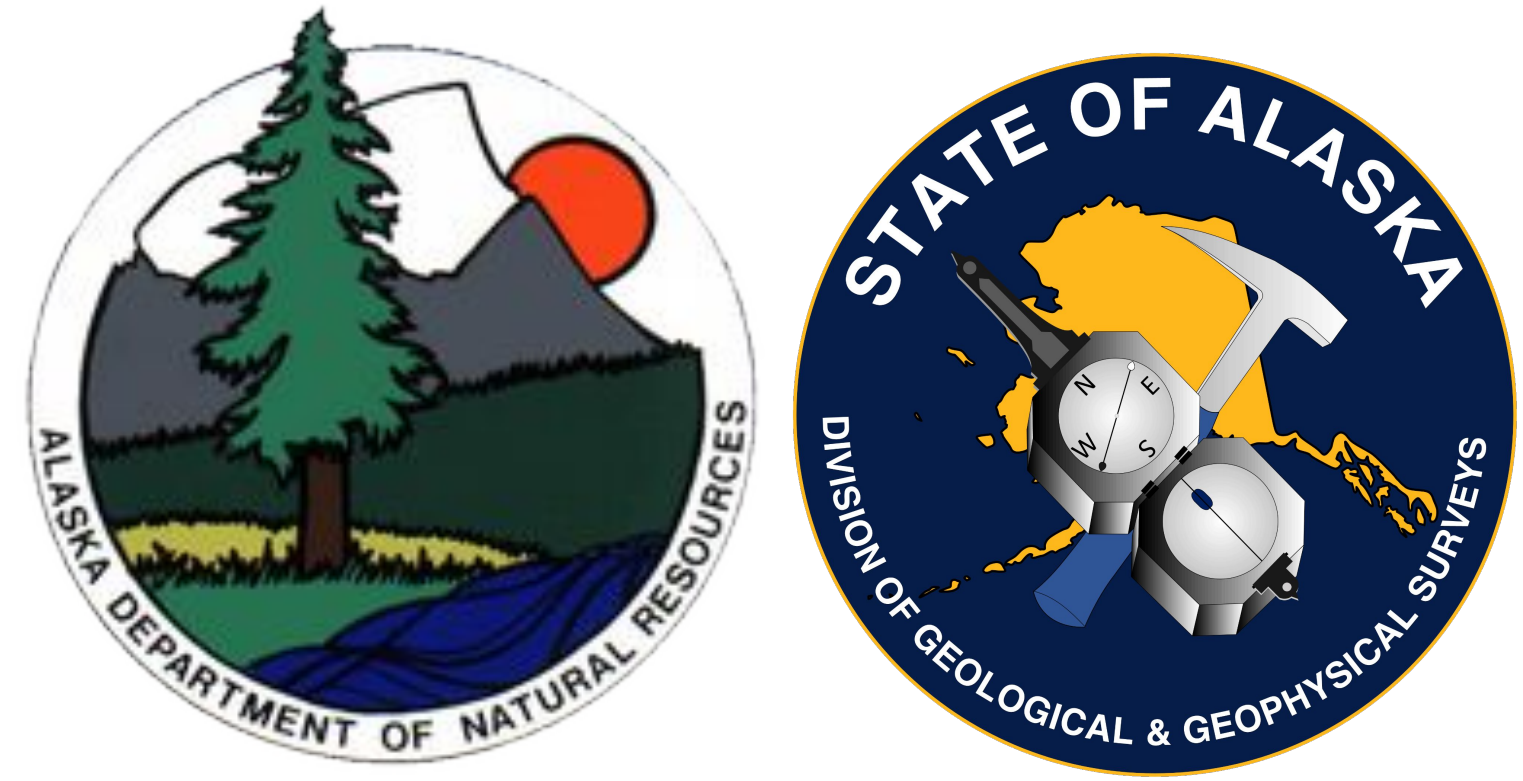




ASSESSING POWDER CLOUD IMPACT ON ELECTRICAL TRANSMISSION LINES AT SNOWSLIDE CREEK AVALANCHE PATH IN SOUTHEAST ALASKA



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Frequent power outages and high maintenance costs in avalanche terrain

Alaska Electric Light and Power(AEL&P)’s transmission line crosses numerous avalanche paths of which Snowslide Creek is the most prominent. **Avalanches here have destroyed power transmission towers and conductors many times in the past (< 10 year reoccurrence interval)**, and larger events often deposit debris on Thane Road, maintained by Alaska Department of Transportation & Public Facilities (ADOT&PF).

On March 4, 2021, an avalanche was artificially triggered in Snowslide Creek. Most of the dense portion of the avalanche stopped within the deflection dam with only a small portion spilling over; however, **the powder cloud snapped the breakaway connections** to the towers and the conductor was carried into Gastineau Channel, resulting in a costly repair for AEL&P (See Figure 1).

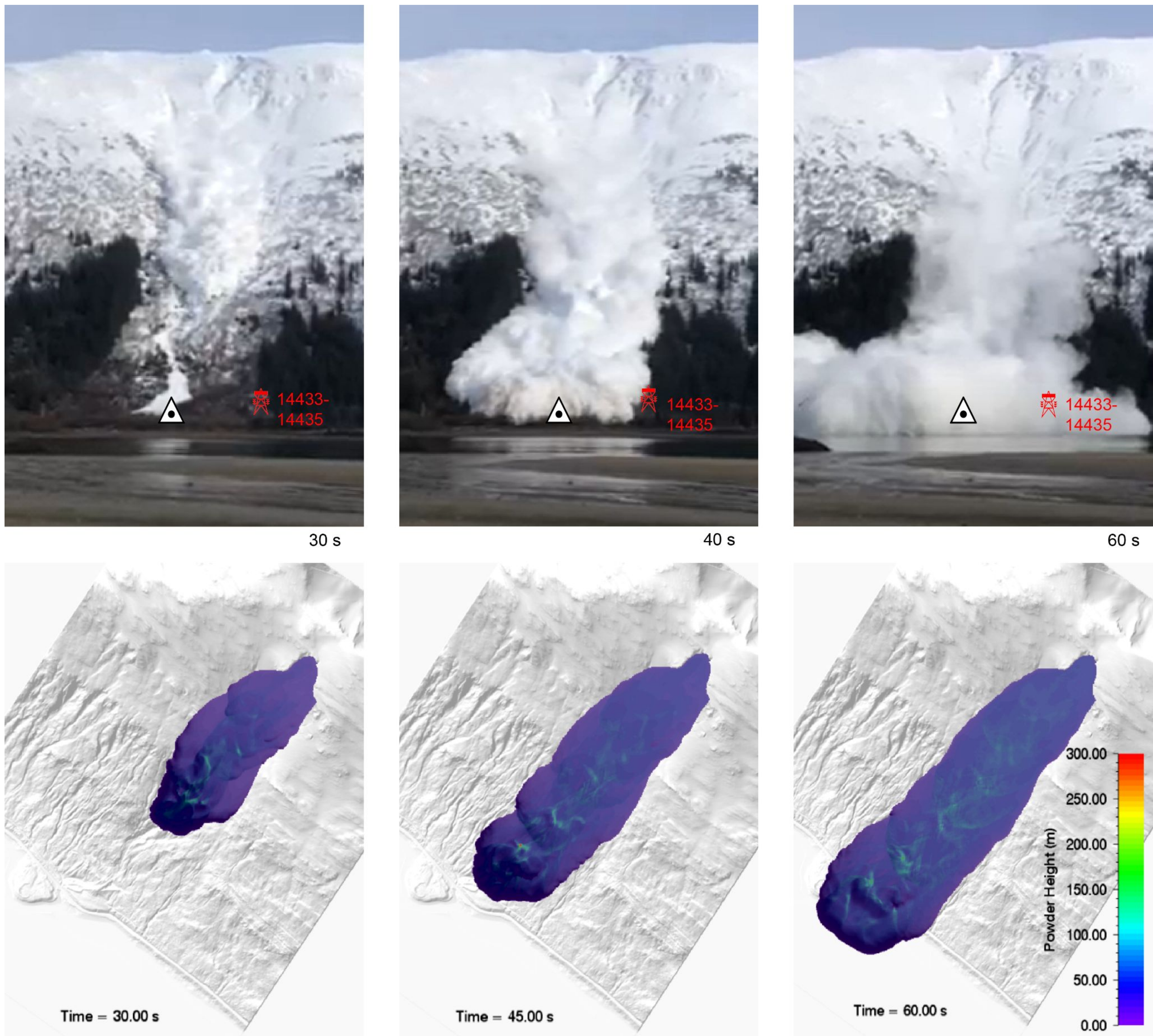
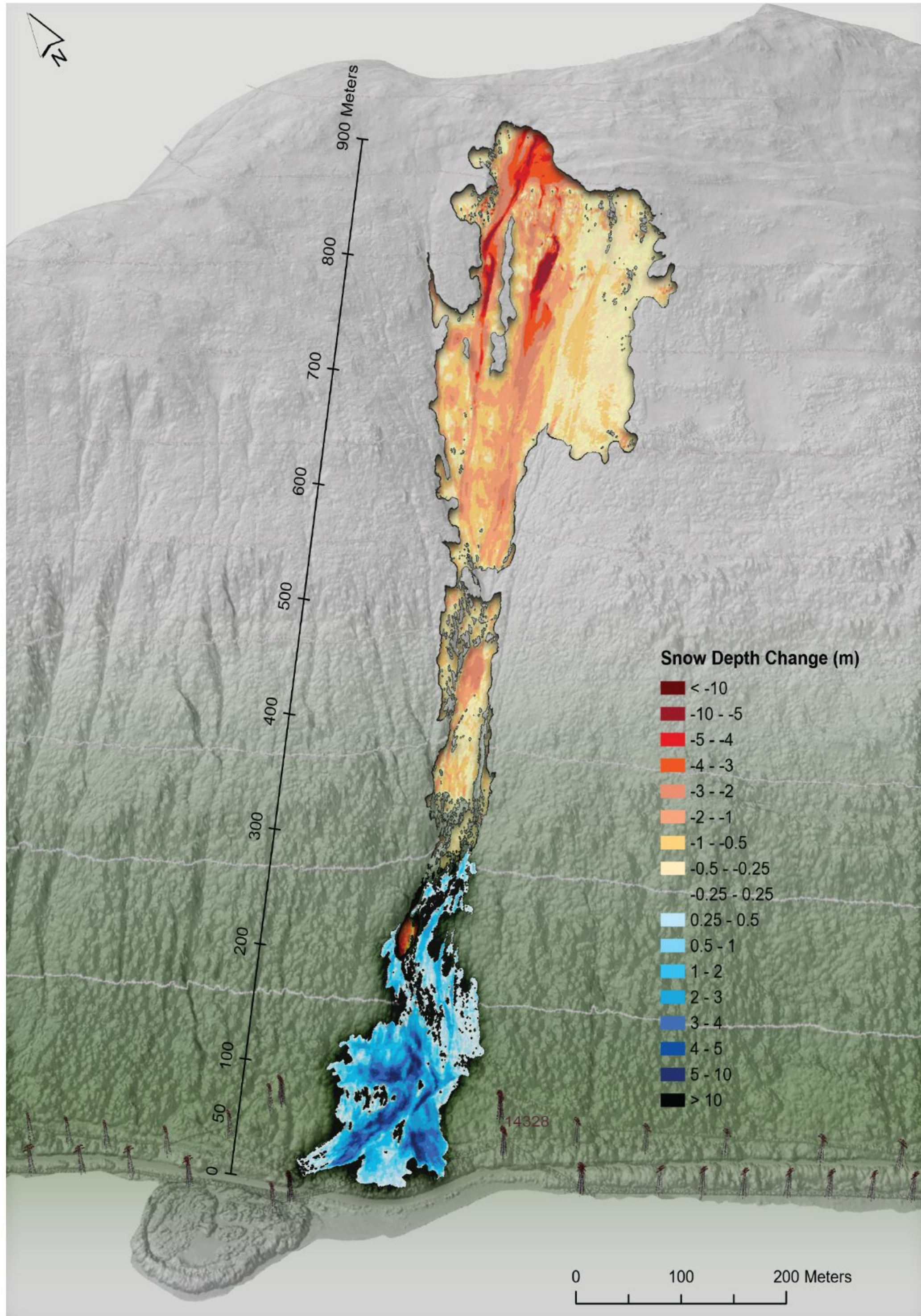


Figure 2: (Upper tri-panel) Photo captures at 20 s, 40 s, and 60 s after explosives visibly hits the snowpack. Location of AEL&P tower set 14433—14434 is marked in red symbol and center path point is marked by a white triangle. Photos: AEL&P.
(Lower) Modeled powder height (m) at 30 s, 45 s, and 60 s.

“Can we reconstruct this event and learn something from it?”

Figure 1: (Top left) Avalanche is triggered by heli-bombing, (Middle left) Powder cloud reaches upper powerline, (Bottom left) Deposition of the dense core which stopped short of Thane Road, and remnant powder cloud debris on the beach (Photos: AEL&P); (Map - right) Lidar-derived snow depth change from March 3 to March 4, 2021, showing areas of release/erosion (yellow-red) and deposition (blue).

What we did:

- Pre-and post-avalanche snow depth mapping using airborne lidar
 - Snow depth distribution map showing erosion and deposition
- Analysis of video footage and photos, snowpit profiles and weather data
- Back-calculated and reconstructed avalanche event in RAMMS:EXTENDED
 - Reviewed velocities, deposition heights and powder impact pressures and compared with engineering documents for the powerline

Modeled vs. observed avalanche

- Modeled core and powder cloud extent and height agreed well with observed, but the powder cloud velocities were slower in sections (See Figure 2).
- Powder impact pressures were low at transmission tower sets but higher in the center of the path where the sag is the largest (closest to terrain) (See Figure 3).
- This finding suggests that air blasts from the powder cloud caused conductor displacements and dynamic loads (--> tensile forces)
- Future work includes installing load cells and tensometers at Snowslide Creek.

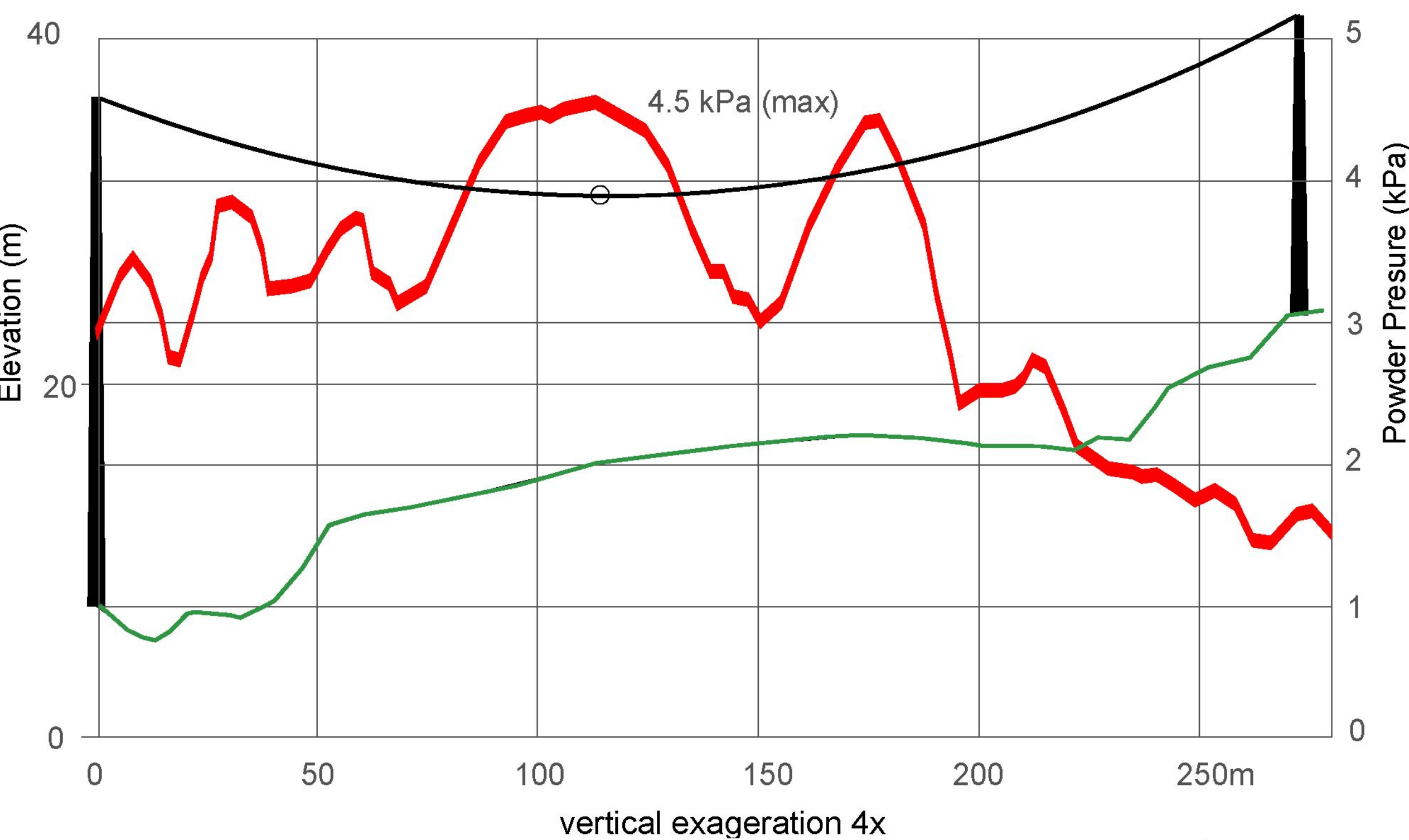


Figure 3: Max powder impact pressure (red line) from modeled avalanche along conductor. Green line is ground.

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