Snow Monitoring Lidar Station

Autonomous slope monitoring, day and night, in any weather

The Snow Monitoring Lidar Station is a permanently installed, autonomously operating lidar platform for monitoring snow-covered and avalanche-prone slopes. Built around one to four **Livox Avia** sensors, it acquires dense 3D point clouds of a slope, registers them over time and detects surface change. It operates **day and night and in any weather**, though range is reduced during heavy snowfall. All raw and processed data are available through an organisation-scoped API and an optional public web dashboard. One unit consists of the **control cabinet** (housing datalogger and modem), one to four lidar sensors, and the required cables.

1 - 4 Livox Avia sensors	**450 m** max. detection range	**2 cm** range precision	**~300,000** points per frame
70.4° × 77.2° field of view per sensor	**10 Hz** raw point cloud rate	**15 min +** configurable scan interval	**Day & night** all-weather operation

Range and Detection

The maximum detection range is **450 m** under low ambient light. The **effective range depends on the geometry of the slope** (angle of incidence, surface, distance) and on snowfall rate. Each Livox Avia sensor covers a **70.4° × 77.2°** non-repetitive field of view; the **combined field of view scales with the number of sensors** (1 to 4), letting a station be tailored to the width of the monitored slope. Range precision is **2 cm**. Individual frames are aggregated to deliver approximately **300,000 points per frame** for dense, low-noise surface models.

For more info on the Livox Avia lidar see https://www.livoxtech.com/avia.

Independent study reference: SLF published results using the same type of lidar sensors: https://nhess.copernicus.org/articles/25/1315/2025/?utm_source=researchgate.net&utm_medium=article

Technical Data

Lidar sensors	1 to 4 × Livox Avia
Max. detection range	450 m ; slope-geometry and snowfall rate dependent
Range precision	2 cm
Field of view	70.4° × 77.2° per sensor (non-repetitive); scales with sensor count
Point density	standard:~300,000 points per aggregated frame; can be adjusted by configuration
Raw data rate	10 Hz
Scan interval	from 15 min, configurable
Scan-to-result latency	about 5 min, depending on connection and processing load
Operation	day and night, all weather; reduced range in heavy snowfall
Power supply	230 V AC (standard); 12 V DC (experimental, in development)
Power management	power-save modes between scans (experimental, in development)
Connectivity	LTE (SIM not included) or Ethernet
Mounting	round or square mast via ball joint
Cable length	max. 5 m from each lidar sensor to the control cabinet

Control cabinet	integrated datalogger and modem; main switch for safe operation
Serviceability	lidars can be replaced without opening the control cabinet
Firmware updates	over-the-air updates supported
Weight	control cabinet about 5 kg; each lidar with mounting less than 1 kg
Auxiliary sensors	Lufft weather station, IR surface temperature (dev preview, time-synchronous), and more planned
Motion data	IMU data recorded and time-synchronised with lidar scans
Coordinate system	local coordinates; approximate georeferencing via roll, pitch, and heading angles; precise georeferencing possible
Difference modes	surface-normal and z-direction; configurable per site
Output formats	MCAP, pointcloudset (Python), CSV, PNG

Mounting

The station mounts on a **round or square mast** using a **ball joint (Kugelgelenk)** for fast, precise alignment of the sensor field of view toward the target slope. The enclosure is rated for permanent outdoor installation in alpine and polar environments. Cable length from each lidar sensor to the control cabinet is **max. 5 m**.

The control cabinet includes a **main switch**. Lidar units can be replaced **without opening the cabinet**, reducing service time in the field.

Connectivity

- **LTE** cellular uplink (SIM card **not included**)
- **Ethernet** for wired sites
- Automatic data sync to the backend while scanning
- **Over-the-air firmware updates** for remote maintenance

Scanning

Scan intervals are freely configurable from **15 minutes** upward. Raw point clouds are streamed at **10 Hz** and recorded

on site before transfer. Between scans the station idles in a power-save mode.

Power

- **230 V AC** mains supply (standard)
- **12 V DC** supply EXPERIMENTAL currently in development
- **Power-save modes** reduce consumption between scans for solar- or battery-backed sites

Additional Sensors

All auxiliary sensors are **time-synchronised** with the lidar data stream.

Lufft weather sensors DEV PREVIEW

Co-located meteorological data (temperature, wind, soil temperature, precipitation and more) aligned to each scan.

Infrared surface-temperature sensor DEV PREVIEW

Custom sensor providing snow surface temperature, time-synchronous with the point cloud for thermal context.

IMU DEV PREVIEW

The IMU of the lidar sensors is recorded and time-synchronised with the point cloud data, providing motion context for advanced processing and analysis.

Camera, Radar, and anything else DEV PREVIEW

Thanks to our modular design, we can integrate a wide range of additional sensors and data sources. Talk to us about your specific needs and we will find a solution together.

Data Output and Formats

Raw point cloud	**MCAP** format at 10 Hz, including IMU data; viewable in tools such as Foxglove Studio
4D history	Complete scan history stored as time-resolved raw point cloud data
Python access	**pointcloudset** package for programmatic loading and analysis
Tabular export	**CSV** for pointclouds compatible with for example QGIS, cloudcompare, and custom analysis
Imagery export	**PNG** plots of computed change and comparisons

API and Web Platform

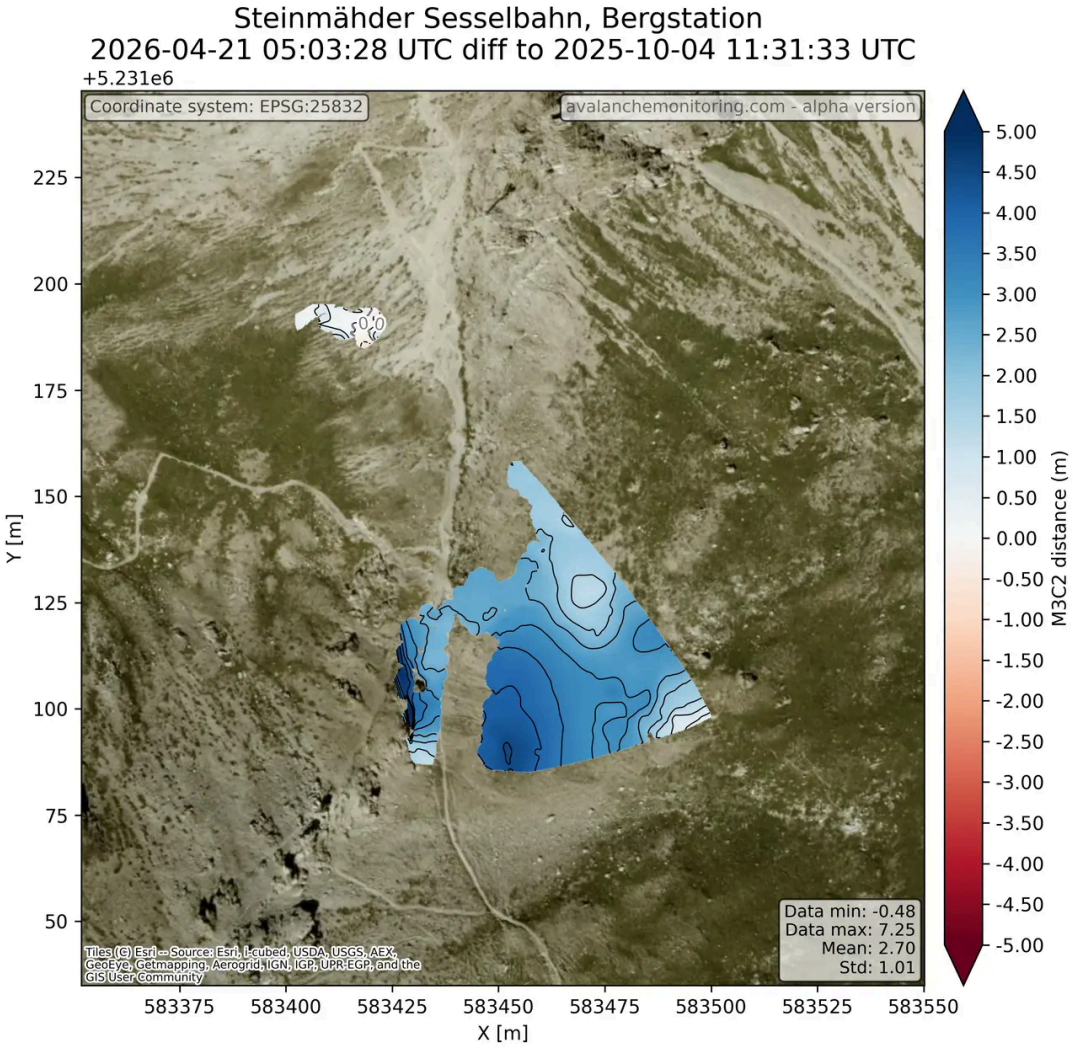
The REST API (`api.avalanchemonitoring.com/schema/swagger`) provides **authorisation scoped per organisation and per user**. Raw and processed data are stored on servers in the **EU**. Through the API you can:

- **Compute and plot change** between arbitrary scans
- **Export** results as **PNG** or **CSV**
- Retrieve raw and processed point clouds for downstream analysis
- Access the **complete history of every scan** in time-resolved raw point cloud format

- Integrate results into **existing workflows** and combine with other tools

An optional **public or private dashboard** can be hosted on your own subdomain, showing slope change over **12 h, 24 h, 48 h and total** intervals for. The platform is under active development and **many additional functions are planned**.

Talk to us about workflow integration and tooling. We are happy to assist.



Comming soon a web app for interactive data exploration and custom visualisation of point clouds and setup of alerts and more.

Contact

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Data sheet v0.1
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