

S-ROX

GNSS-based snow monitoring system



Advanced Navigation Solutions

Applications

The ANavS snow monitoring station S-ROX has various applications: It provides precise SWE and LWC measurements that are important for **run-off predictions** in **hydrology**. Hydro power companies need run-off predictions for the operation of **hydro power plants**. Accurate run-off predictions are the basis for **flood predictions and timely warnings**. **Avalanche risk warnings** and risk-related road closures can also be improved with SWE and LWC.

The **SWE** provides a direct measure of the **weight of snow** per square metre. Thereby, it is an important information for **monitoring the roof load** to trigger timely removal of snow as well as to avoid unnecessary removal of snow.

Technology

The ANavS snow monitoring station includes two receivers of **Global Navigation Satellite System** (GNSS, e.g. GPS and Galileo) signals. One antenna is placed directly on the ground, i.e. below the snow cover. The other antenna is mounted on a mast, i.e. it is above the snow cover and serves as reference. The **GNSS signals** are **attenuated, refracted** and **delayed by the snow cover**. The signal attenuation depends on the LWC and snow height, while the SWE is related to the snow-induced time delay. The GNSS antennas receive the signals from many satellites that scan the snow cover from different azimuth and elevation angles.

S-ROX uses the **ANavS-patented algorithms and methods** to **determine the snow parameters from the GNSS raw data** (carrier phase, pseudorange and carrier to noise power ratio measurements).

System configurations

The S-ROX is very **modular** and can be **configured** regarding power supply, communication, data storage, and mast height to best fit the customer needs:



You can choose between an **internal** and an **external power supply**. The internal power supply is based on solar cells, and typically used in remote locations. The external power supply is favorable for continuous measurements during day and night, as well as in Arctic/ Antarctic regions.

Moreover, you can choose between **mobile and satellite communication**: mobile communication enables the transmission of both snow data and GNSS raw data; the latter ones are beneficial for post-processing. The Iridium satellite communication option is recommended for remote locations without mobile coverage.

The **gitter-mast** consists of **multiple sections**. Each section has a **length of 1,5 m**, which simplifies the transportation and installation of the mast. You can choose the total length as multiple of 1,5 m.

Interfaces

The S-ROX offers various interfaces for the transmission of the snow information. You can **choose between an LTE and an Iridium module** for data transmission. We also support **RS-485 for external data loggers**.

Access to Snow Data

All **snow data** are **accessible via** the ANavS snow-monitoring **website**. The **snow data can be downloaded as CSV-file** for further processing.

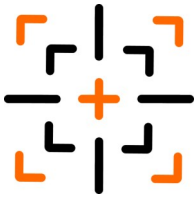
Why choose the S-ROX system?

5 mm

SWE

0,1 %

LWC



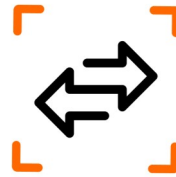
Highly Accurate Snow Parameters

Highly accurate SWE and LWC information



Multi-frequency, Multi-constellation GNSS

Improved accuracy of snow parameters by using all available GNSS signals. The signals scan the snowpack from different azimuth and elevation angles.



Power Supply

Either connect to external power grid or operate off-grid based on solar power and battery. Vertical placement of solar cells prevents snow accumulation on cells.



Easy Transportation and Fast Installation

Low-weight Aluminium mast is shipped in sections of 1,5 m. No need of concrete foundation. No need of helicopters for transportation.



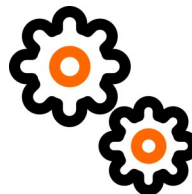
Web App

Web-based user interface with continuous plots for snow parameters as well as CSV file access for automated data processing.



Easy System Integration

Compatible with existing data loggers via SDI12 interface over RS485 connection. Direct access to measurements via web-based user interface and CSV file.



Self-Calibration

Self-calibration on first start of system to determine calibration data (precise absolute and relative positions, signal strength reference values).



Breakthrough Pricing

Best value for your money.



Multi-Layer Snow Pack Model

Multi-layer snow pack model used for description of settling of snow over time.

Technical Specifications

SNOW MEASUREMENT PERFORMANCE

Accurate Snow Information

SWE accuracy	5 mm
LWC accuracy	0.1 %

Snow measurements rate

SWE and LWC	up to 4/ day
Raw GNSS measurement	1 Hz

Measurement duration

Solar-powered station	6 hours
Grid-powered station	24 hours

CONFIGURATION OPTIONS

Mast system

Robust grid mast
Height customizable (3 m, 4,5 m, 6 m)
6-9 guy lines with 4 mm steel cable
Ground anchors: 30 cm ground screws

Solar panel for power supply

Peak output power	60 W
Dimensions	55 x 60 cm

Battery for power storage

Capacity	10 Ah
Weight	8 kg
Provides enough power (*) to bridge 5 consecutive days without sunshine	

External Power Supply

Input voltage range	10 - 36 V, 240 V
Power consumption meas.	7 W
sleep mode	0.01 W

Extendable to multiple measurement points by additional GNSS antennas/ receivers

GNSS FEATURES

Constellations

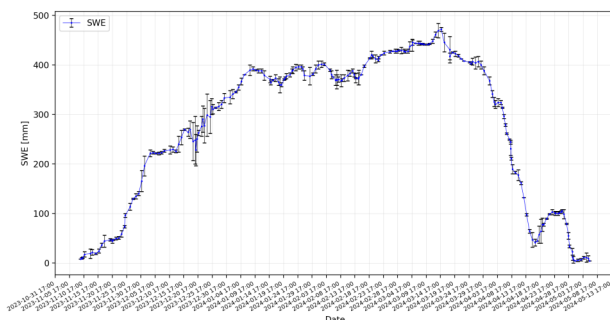
Galileo, GPS, Beidou
SBAS (EGNOS, WAAS, GAGAN)

Frequency bands

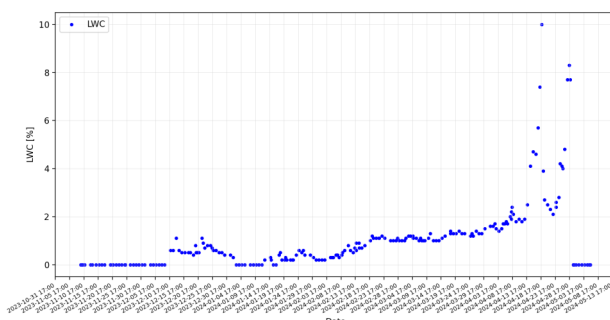
L1C/A, L2C, E1B/C, E5b, B1I, B2I

Exemplary Plots

Snow-water equivalent (SWE)



Liquid water content (LWC)



Interfaces

LTE mobile communication

- access to both snow and all raw GNSS data for post processing
- remote maintenance access

IRIDIUM satellite communication

- data transmission from remote locations
- worldwide availability, excellent connectivity in polar regions

SDI12 over RS485 connection

direct access to snow parameters for existing data loggers

LoRa WAN

Integration into existing sensor network

Technical Specifications

Data output

Output Options

Live plots available on ANavS snow cloud

snow.anavs.de

Data available as CSV file for
automated data processing

Direct access to live data via RS485
for standard data loggers

On-Board RAW GNSS Data Storage

Single frequency mode 12 months

Multi frequency mode 3 months

Snow Data Storage 5 years

PHYSICAL & MECHANICAL

Dimension	Light weight case	30 x 27 x 18 cm
	Industrial case	40 x 33 x 24 cm

Case Weight	Light weight	2 kg
	Industrial	8 kg

Input voltage	Solar	9 - 21 V
	External DC	9 - 36 V
	External AC	110 - 240 V

Power Consumption	Peak	12 W
	Average	7 W

Operating Temperature	-20°C to 65°C
IP-Rating	IP65



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