



ALPINE NATURAL HAZARDS
AVALANCHE AND PERMAFROST
DEVELOPMENT & RESEARCH
MEASURING +WARNING SYSTEMS

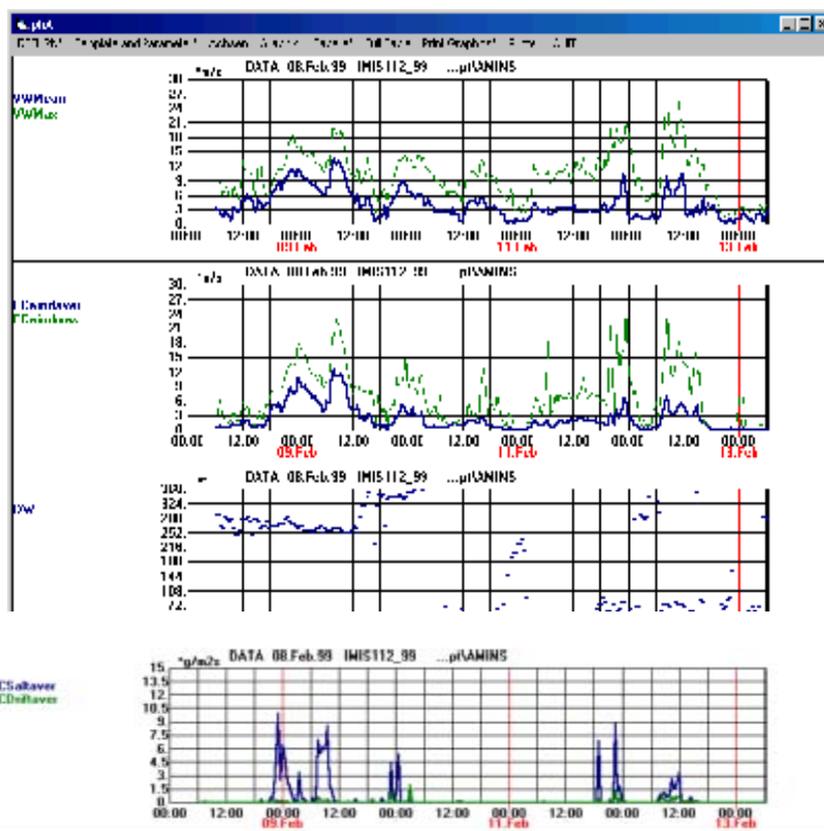
MINI- STATION TO MEASURE LOCAL SNOW TRANSPORT AND ADDITIONAL PARAMETERS

Hansueli Gubler, Richtstattweg 2, CH-7270 Davos Platz, Tel/Fax +41 081 416 10 19
email alpug@alpug.ch, www.alpug.ch



Standard Fcapt station Lukmanier. The station automatically alerts the road maintenance crew in case of snow transport. Measured parameters are: wind, wind direction, air temperature and blowing snow flux. Data and alarms are transmitted by radio or GSM.

The *FlowCapt* is a sensor to measure flux of windblown snow and wind developed by IAV and AlpuG. Blowing snow can significantly increase actual avalanche danger but also stop road traffic. *FlowCapt* measures blowing snow flux and the wind causing snow transport. The sensor improves information on additional snow accumulation in potential release zones by wind, the erodibility of the snow surface, the type of snow accumulating in the release zones, but also on visibility on roads, accumulation of windblown snow on roads, icing of roads, snow redistributions around avalanche and blowing snow defense structures etc. The sensor consists of special tubes, with a diameter of about 3cm and a segment length of about 1m that contain an acoustical measuring system. The tubes are mounted vertically. The measurements are either done for each of the up to six segments separately or integrating over the whole length of the sensor tube. Basically the system measures the momentum of the impinging snow particles and the turbidity of wind flow around the tube. The system

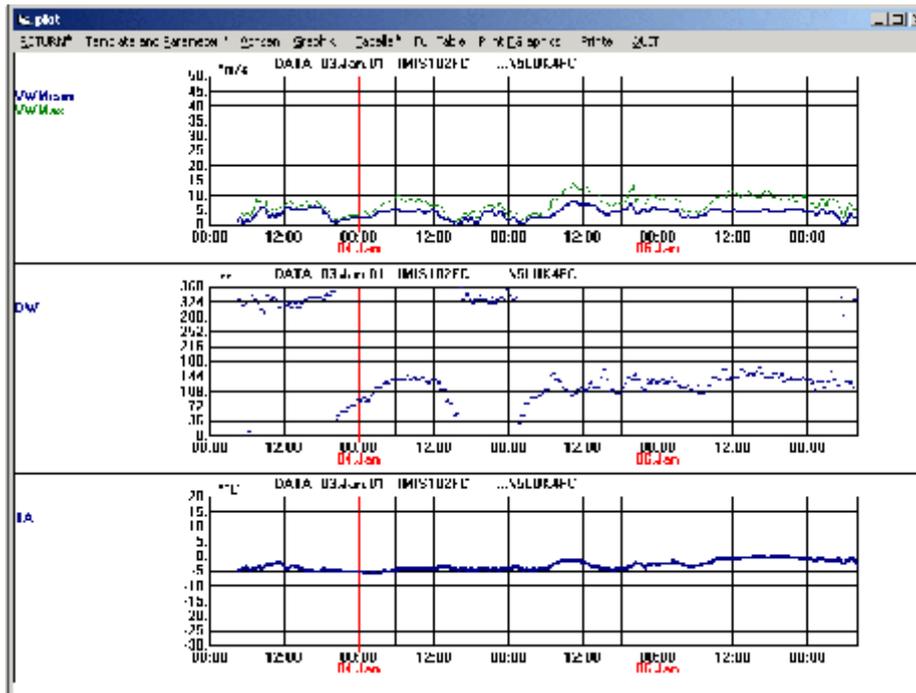


Measurement of snow transport by a standard Swiss snow monitoring station in Aminona, VS. Up to down: mean and max. wind speed measured with a Young propeller anemometer at 6m above ground, 2^d corresponding measurement with *FlowCapt* at 1m above ground, 3^d wind direction, lowest: Flux measurements, high values 0 to 1m, low values 1 to 1.2m above ground.

allows to measure snow flux profiles or more important for practical applications, integrated blowing snow flux independent of actual snow height. The location of measurement should be selected between the zones of erosion and deposition, if possible on a slight crest with little snow deposition. On a crest the sensor can be placed under a jet roof to locally avoid the build up of a cornice. In a standard setup 3 to 5 1m segments are mounted sideward to a pylon. These small towers have a special anchoring system that can be buried or fixed on rock easily. The largest part of total flux concentrates close to

the snow surface, therefore a working sensor height of 2 to 3m is sufficient in most cases to index total flux. Today more than 10 one to four segment devices are operational. Standard *FlowCapt*s include an interface electronic board, a CSI 510X datalogger, a small solar panel and an appropriate communication device, normally radio or GSM. Excluding communication the device runs with less than 2mA mean current at 12V. Portable Mini- *FlowCapt*s are available now too. These rods with integrated displays or miniloggers can be inserted in the snow or bare ground. So far the *FlowCapt*s have been used in different applications: as part of standard snow

monitoring stations, in relations with GAZ-EX installations, to measure blowing snow flux on an experimental snow fence site, to alert road maintenance crews to plow a pass road section, local snow monitoring in a ski area to improve avalanche safety and for research.

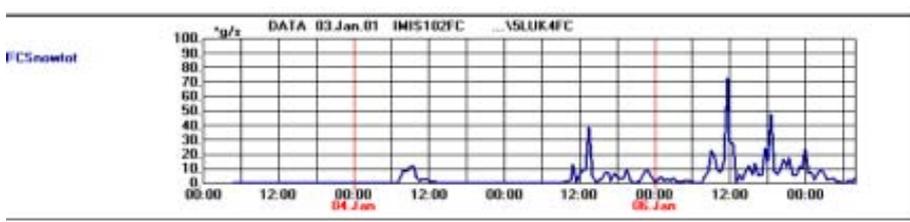


Lukmanier Pass

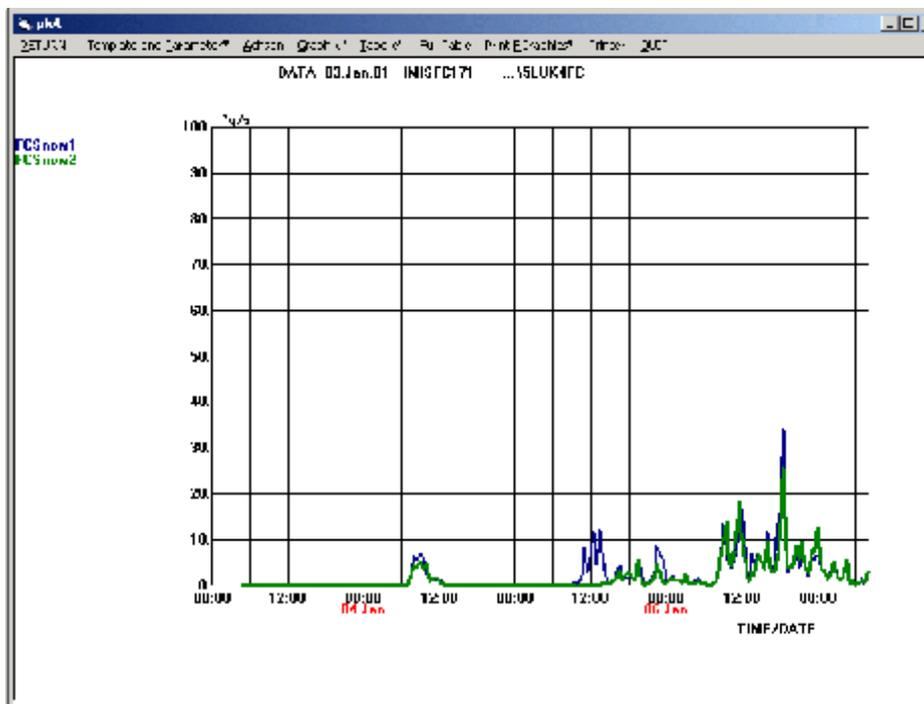
Wind mean and gust

Wind direction

Air temperature



Integrated flux 0 to 2m

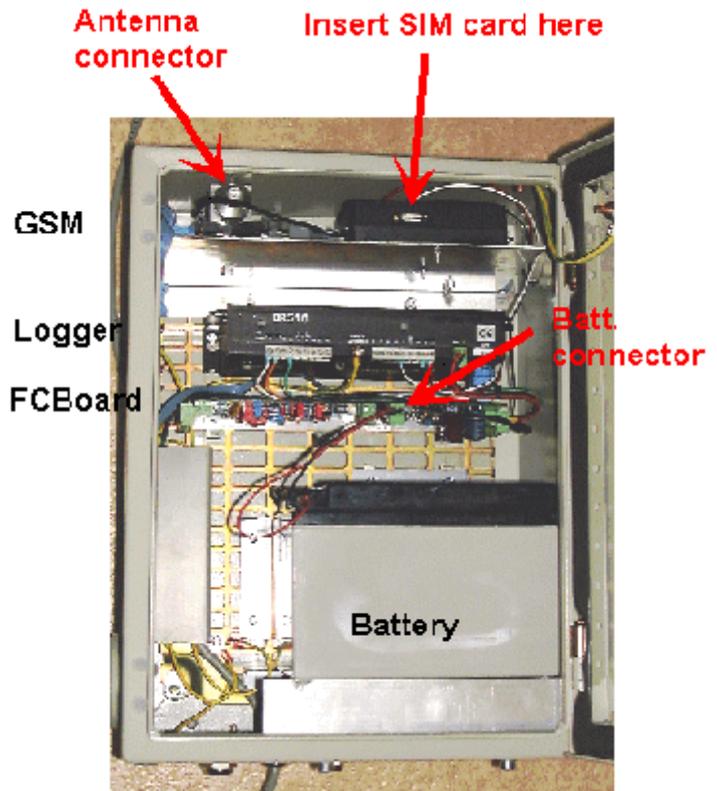


Flux measured between 0 and 1m (FCSnow1) and 1 to 2m (FCSnow2).

On Jan 5. at noon one can see a period of drifting snow very close to the ground only.



Installation at the ski area Rothorn, GR, just above the main release zones.



Logger enclosure with GSM, CR510X, battery

Standard Snow-Station with Options

