

Remote and real time avalanche monitoring with Wi-Fi

Marek Biskupič^{1,2} Milan Lizuch¹ Jozef Richnavský¹ Filip Kyzek¹ Igor Žiak¹

¹ Avalanche Prevention Center of Mountain Rescue Service, Slovakia

² Charles University in Prague, Faculty of Science, Czech Republic

Introduction

- Žiarska valley is one of the most avalanche prone site in the Carpathian mountain range
- Massif Prislop regularly produces large avalanches reaching the valley bottom and hitting the road
- During the season of 2008/2009 several catastrophic avalanches caused large damages on forest, road and infrastructure
- Permanent real time monitoring of avalanche prone slopes is necessary due to the possible evacuations



Fig. 1. In 2009 continuous fracture resulted in multiple avalanches which deposited enormous amount of snow in the bottom of Žiarska valley.

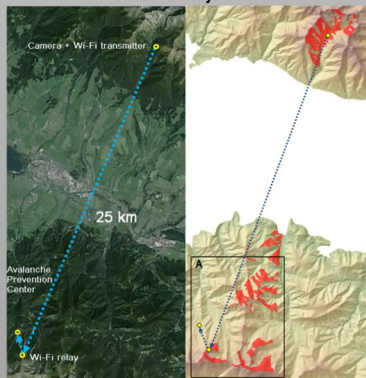


Fig. 2. The signal is transmitted via the Wi-Fi network from the study site through the relay station to the Avalanche Prevention Center. The visibility from the study site marked red.

Establishing the WIFI connection and camera installation

- A private wifi connection with length of 25 km across the valley was established
- Relay station was built up due to the insufficient direct visibility
- Full HD camera was installed pointing at the several avalanche prone slopes

Monitoring system

- The system enables to monitor the slopes in real time 24/7
- The live stream is recorded and stored on the server
- Avalanche forecaster is able to pan, and zoom to view several minor slopes in the valley
- The temperature loggers were installed on the Prislop (1967 & 1727 m a. s. l.) to measure the air temperature and temperature at snow/ground interface in 10 minutes interval

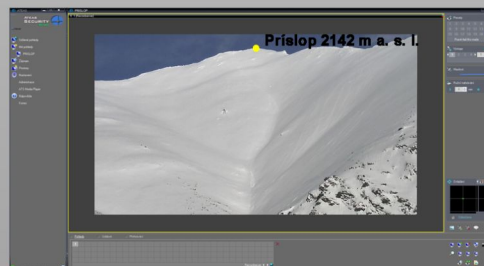


Fig. 3. The forecaster's view on the Prislop. The user interface allows to pan and zoom the view. This gives us an overview about avalanche activity in almost one third of the valley.

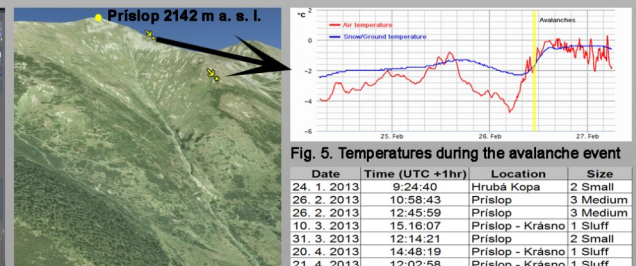


Fig. 5. Temperatures during the avalanche event

Date	Time (UTC +1hr)	Location	Size
24. 1. 2013	9:24:40	Hrubá Kopa	2 Small
26. 2. 2013	10:58:43	Prislop	3 Medium
26. 2. 2013	12:45:59	Prislop	3 Medium
10. 3. 2013	15:16:07	Prislop - Krásno	1 Sluff
31. 3. 2013	12:14:21	Prislop	2 Small
20. 4. 2013	14:48:19	Prislop - Krásno	1 Sluff
21. 4. 2013	12:02:58	Prislop - Krásno	1 Sluff

Tab. 1. Avalanches recorded in 2013.

Avalanches in 2012/2013

- The winter 2012/2013 was poor on avalanches in this region
- Several small avalanches were shot by the camera (see table)
- None of them reached the road
- Most The avalanche were triggered due to the warming
- Exact timing of the avalanche release could be estimated

Conclusions and future outlook

- System proved to be reliable and worked well in harsh conditions for the entire winter
- The real time monitoring was providing valuable feedback for forecasters
- Two AWS are positioned in the valley additional snowdrift measurements are planned and eventually seismic sensors will be installed

Acknowledgement

The project was funded by the Ministry of Interior - Department of Scientific and Technological Development

Contact:

Avalanche Prevention Center
Otupné 111, Demenovská dolina - Jasná, Slovakia
avalanches@hzs.sk

Fig. 8. Data download from one of the two loggers.

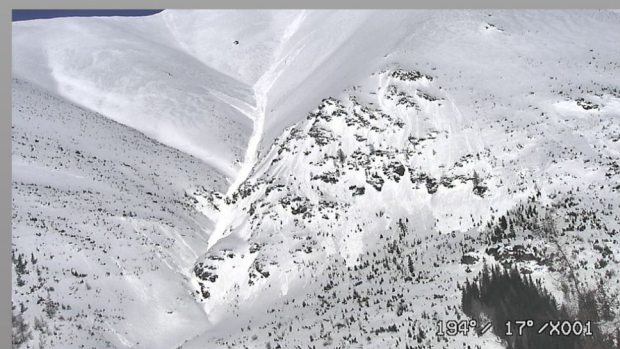


Fig. 6. 26th of February, avalanche falling from Prislop.



Fig. 7. Camera view pointing towards the short south slopes. Several small avalanches slid on the 24th of January.