

# MONITORing Methods Systems behind a safer environment

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## Monitoring

Monitoring is the process of checking, observing and keeping track of something in a certain area, for specific purposes, with defined criteria.

A monitoring system is a combination of devices and sensors, data acquisition protocols and processing procedures.

The selection of the best method depends on the period of interest, the accessibility and visibility of site, the entity of expected movement and the frequency of observation needed.

Within the INTERREG IIIB Project Monitor a decision-support-system was developed which should help defining the best monitoring method for each situation.

## Avalanche Radar: Multireck-avalanche Grimming

**Situation:** On the northeast slope of the Grimming Mountain the Multireck-avalanche endangers an important traffic line.

A radar system and a weather station should make it easier for the avalanche commission to assess the danger and if necessary to stop the traffic by an automatic signal.

### History:

1924: two powder avalanches destroyed the forest; three people lost their lives

1948: avalanche blocked the important a-class road (B145); the snow covered a length of 100 m (height <10 m)

1988: avalanche blocked up the B145 with 200 metres; an avalanche protection system was constructed

1999: avalanche backfilled the gravel pit at the bottom (avalanche protection gallery was too short)



Fig. 01: Multireck Avalanche 1988 (M. Mayerl)



Fig. 02: Multireck Avalanche 1999 (M. Mayerl)

**Pulse-Doppler-Radar:** Short microwave pulses are sent out and the received echoes are measured. A movement in the avalanche track can be detected because of the frequency doppler shift of the echo signal. Out of the frequency doppler shift a velocity of the target is calculated.

### Applications of the pulse-doppler-radar

- permanent road protection
- verification of artificial triggered avalanches
- measurement of dynamic properties of snow avalanches

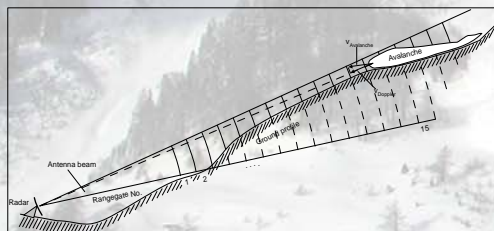


Fig. 05: Scope of the radar system, 2007 (Graz University of Technology)



Fig. 04: Pulse-Doppler-Radar (M. Mayerl)

- ⇒ Installation of a **Pulse-Doppler-Radar** (2004); combination with a traffic light system
- ⇒ Installation of a **Weather Station** (2006)
- ⇒ Extension of the avalanche protection gallery (start 2007)

### Approved monitoring tools:

- Avalanche simulation models (SAMOS, ELBA)
- Digital altitude models, digital terrain models
- Terrestrial measurements
- Air-photo interpretations
- Laserscanning

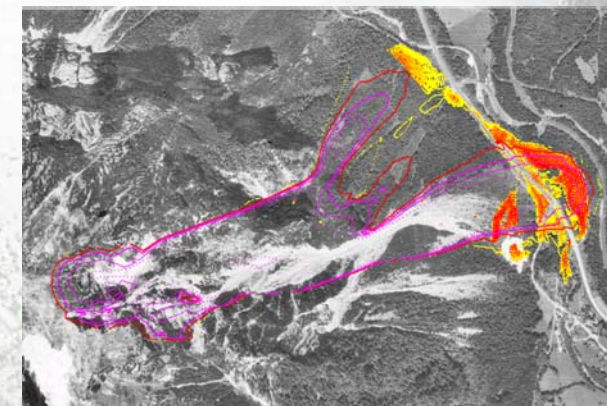


Fig. 03: Avalanche Simulation ELBA, northern part (M. Mayerl)

### Risk Communication:

Communication on hazards and risk depends on a clear and communicable language. Risk communication is realized under integration of all stakeholders through the best combination of information transfer, public participation in hazard zone mapping, identification, analyses of risk as well as the integration of the population in risk management processes.

29 seconds are available for pre-alerting – this is the period between the start of the avalanche and the arrival at the bottom