
Photo: S. Ruggli

Avalanches et al.

risk management in mountain areas

Frank Krumm, WSL

Specific situation in Switzerland (multiple risks on small scales)

- Climate is changing
- Sensitive areas and processes (early recognition)
- Sensitivity of species
- Consequences for managers

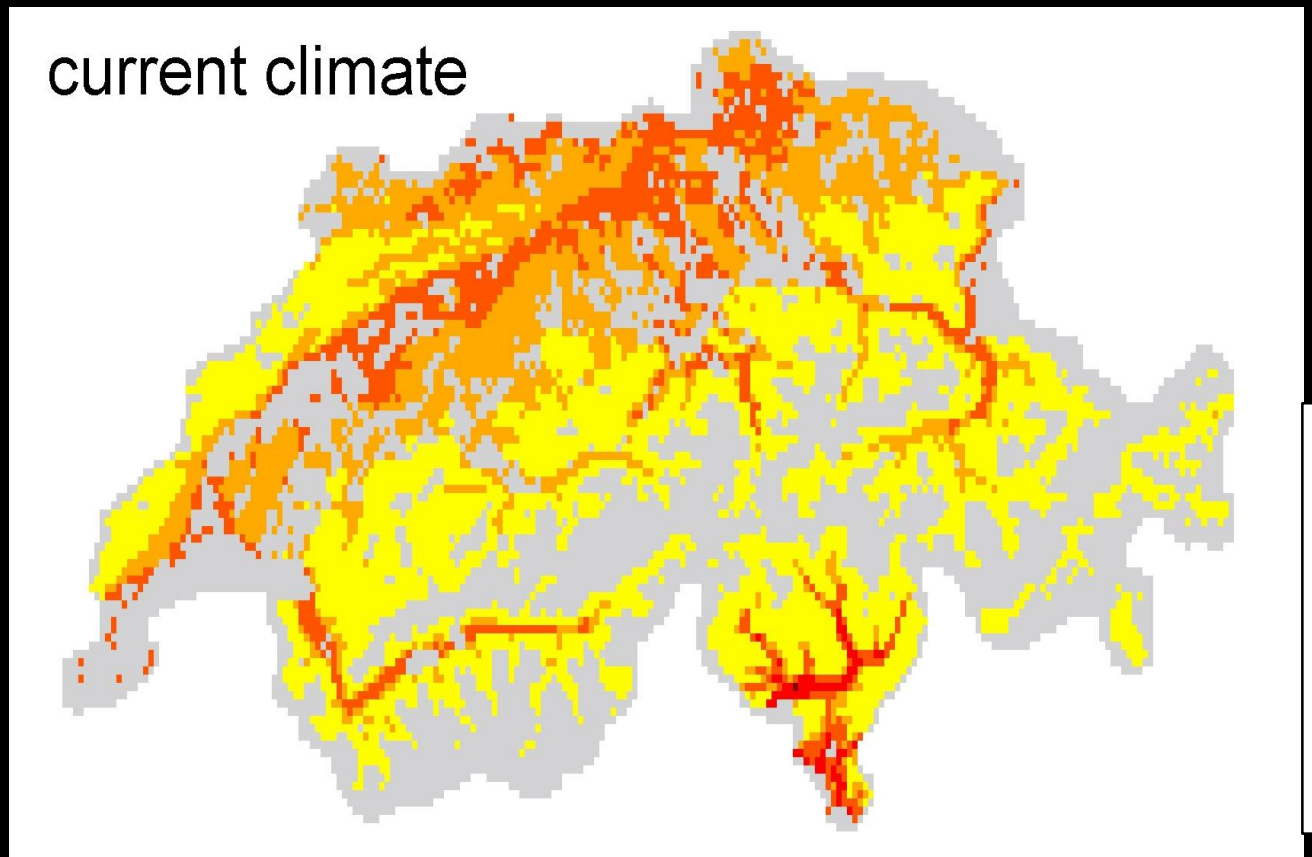
Risk of bark beetle attacks

Swiss climate scenario CH2011

- modifications population dynamics bark beetle

→ increasing number of generations

→ earlier start of activity



Jacoby et al. 2016

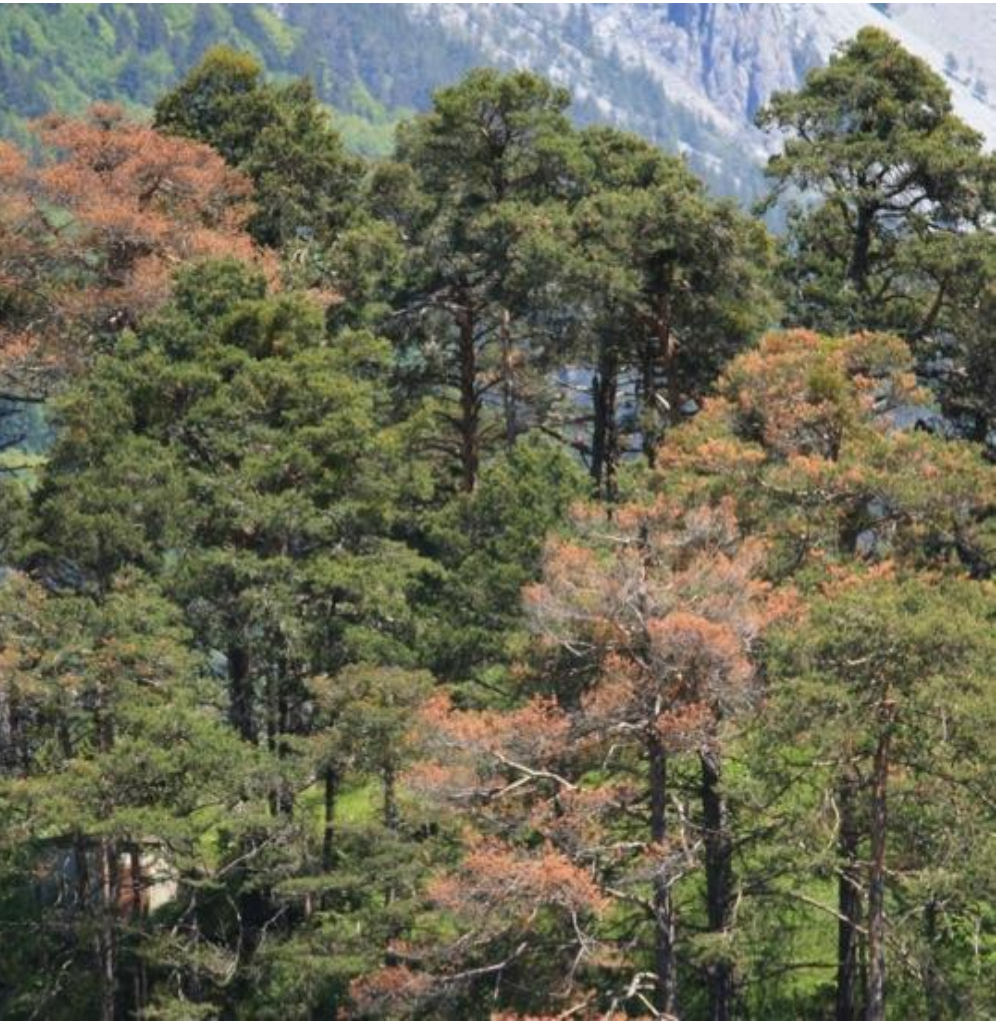
average number of generations

- < 1.00
- 1.00 - 1.49
- 1.50 - 1.99
- 2.00 - 2.49
- 2.50 - 2.99
- >= 3.00

Mortality in Pine forests

Scots pine mortality near Visp, Swiss Alps (1996)

Switzerland – Chur/Domleschg (2004-2006)



Austria – Innsbruck (2003-2007)

France - Region Verdon (2009)

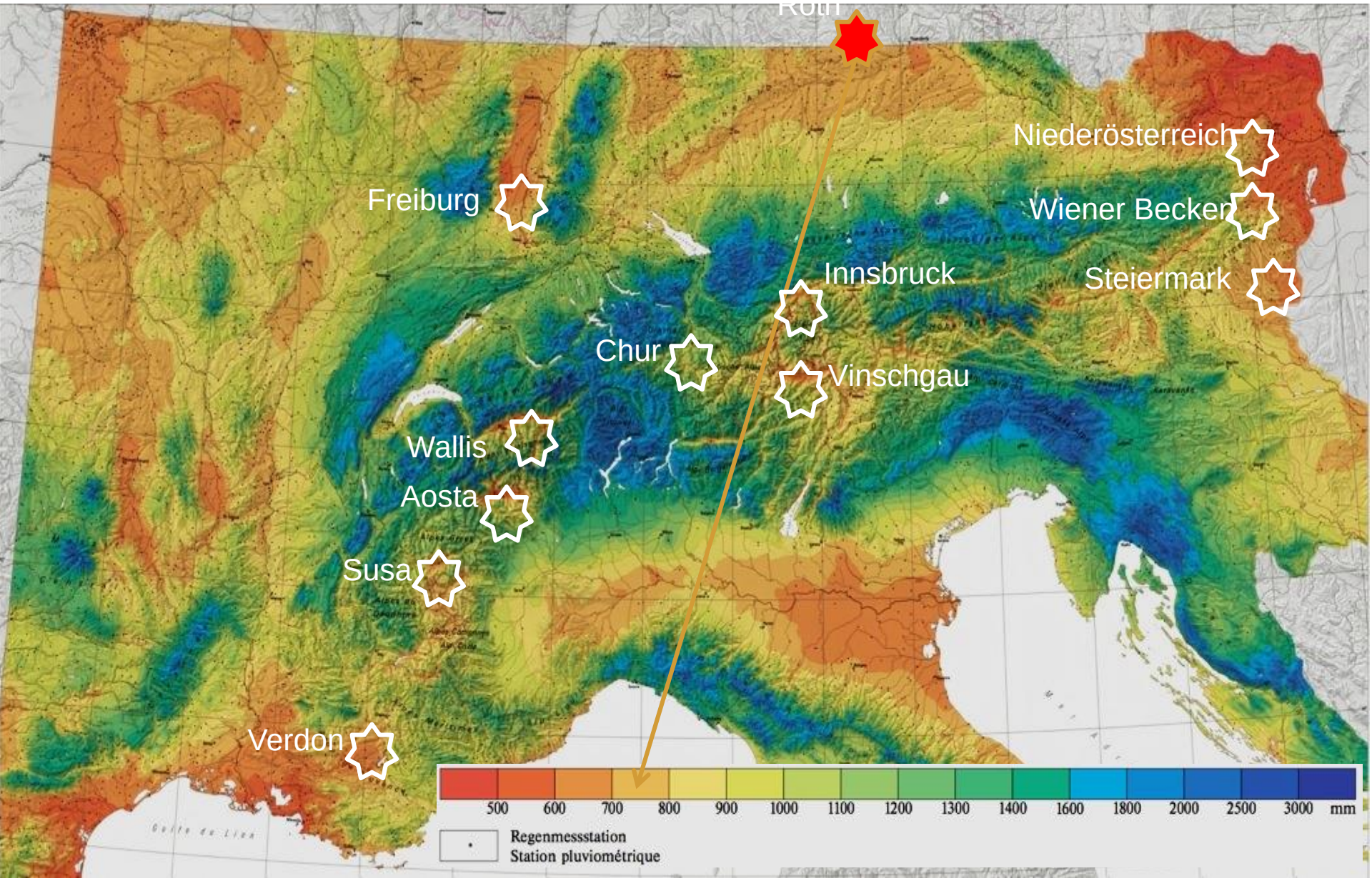
Italy – Aostavalley (2010)

Italy – Vinschgau (2010)

Austria – Kamptal (2015)

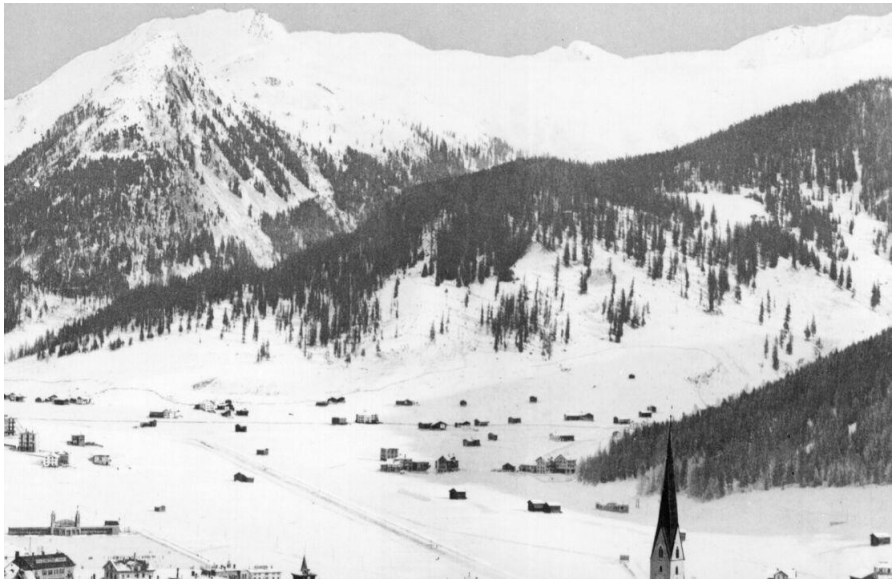
Germany – Roth (2016)

Yearly precipitaion for the Alps



Federal Agency for topography

Land use changes



~ 1900

~ 2000

Basic principles of risk management in Switzerland

- There is no such thing as absolute security. However, damage resulting from natural events must be socially and economically acceptable. Risk-conscious thinking and action are needed to establish adequate Security and to maintain that security over the long term.

- Switzerland is resistant - Being resistant means reducing damage from hazardous natural events to a tolerable level.

- Switzerland is able to recover - Ability to recover means having capability to surmount the negative impacts of natural events in order for society and the economy to rapidly regain functional capacity.

- Risk-oriented management of natural hazards is the only way to ensure that various risks can be compared and comparably managed everywhere, and that the security thus established is preserved over the long term.

Basic principles of risk management in Switzerland

- Switzerland's risk culture is characterised by the recognition of risks, a willingness to improve and maintain security, and open, transparent dialogue on opportunities and risks.

- Integrated risk management encompasses the full range of natural hazards. It applies comparable standards for quantifying risks and comparably manages those risks, involving all stakeholders and affected parties. All aspects of sustainability are considered in the weighing of possible measures.

- Natural hazards can affect everyone in Switzerland so everybody must be involved in dealing with them.

Basic principles of risk management in Switzerland

- Sound scientific principles and their implementation as practical information form the basis for competent management of natural hazards.
- The goal is to achieve a level of security that is ecologically tenable, economically reasonable, and socially acceptable.
- Risk management is an ongoing endeavour that requires resources and prioritising.

Strategy

„Improving Security against natural hazards in Switzerland“

The look back…..

Motion Danioth/Inderkum (Fall 1999) demands for :

- Hierarchial and connected strategy to improve security in the alpine area

- Pilotproject «security in the alpine space“

- Establishment of a long term, interdisciplinary alpine research institute with seperate finances based on the support of national (Federal level) and subnational level (Cantons) and the economy (Foundation)

  ➢ This resulted in a Swiss – wide approach, including all types of risks (also outside of the Alps) -> SLF Institute took this task

Vision

- Societal challenge (Increasing vulnerability, Sustainability, growing infrastructure, mobility, Sociocultural changes, communication…)
- Protection aims (Protecting lives!, defining limits – what may happen?)
- No absolute security (technically, ecologically and financially not feasible)
- Integrated risk management
- Joined action and optimized use of resources (common challenge, common consciousness of risks and the limits of management -> Dialogue, Science and international collaboration)

Vision – Integrated risk management

What may happen?

What may happen?

Riskanalysis

Riskevaluation

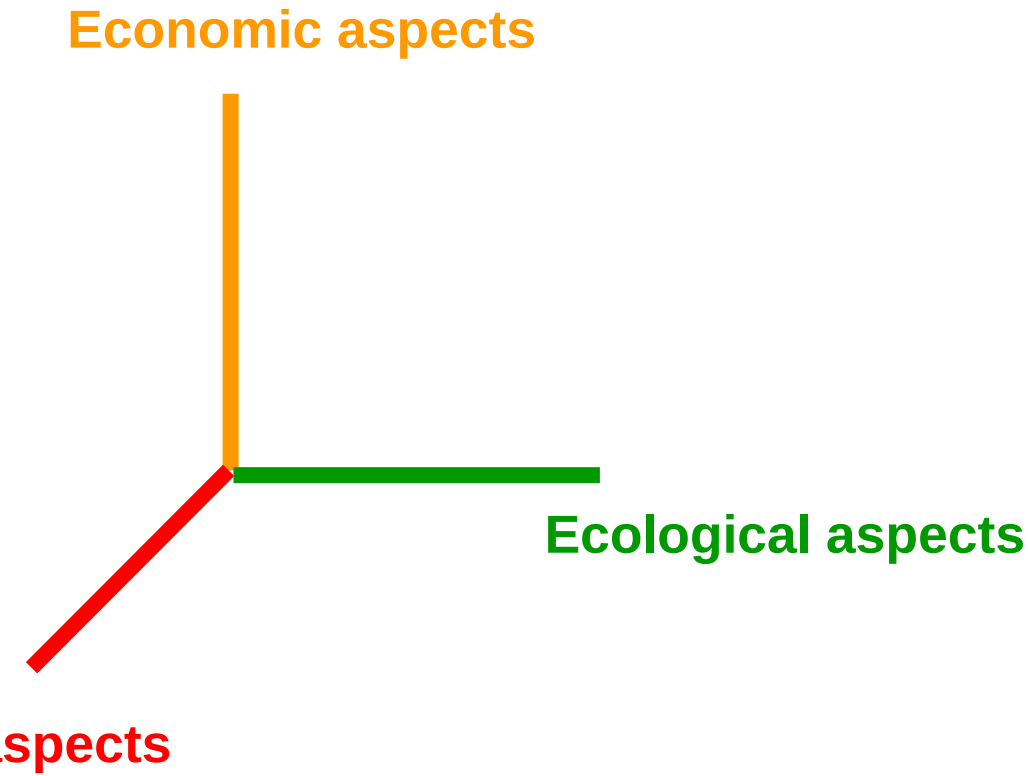
Required action?

Integrated planning

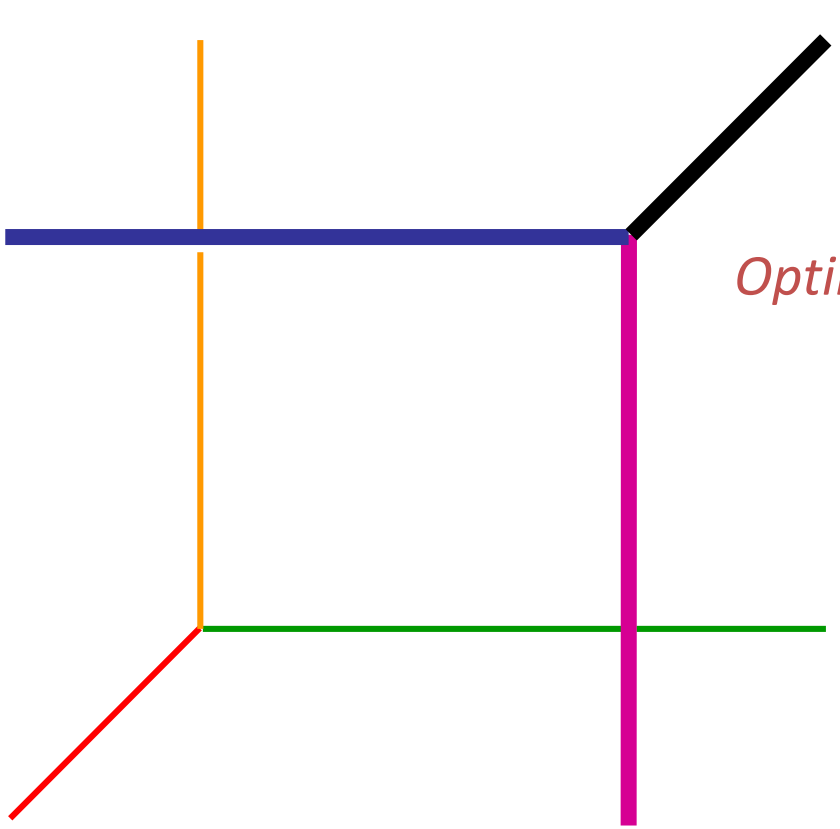
RiskPlan as an application tool

Vision and Strategy - Synthesis

Planning and activities with regards to sustainability

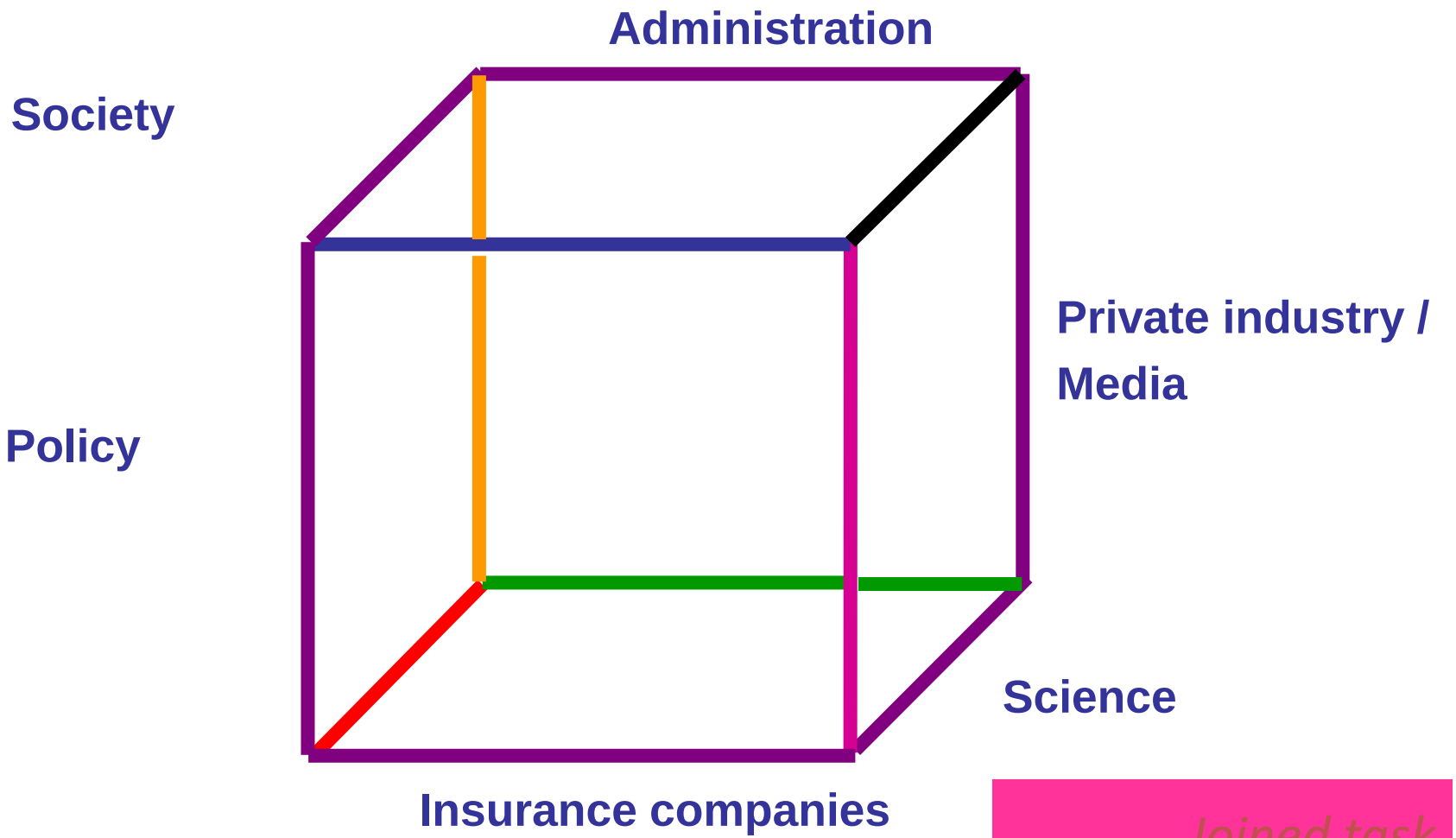


Vision and Strategy - Synthesis

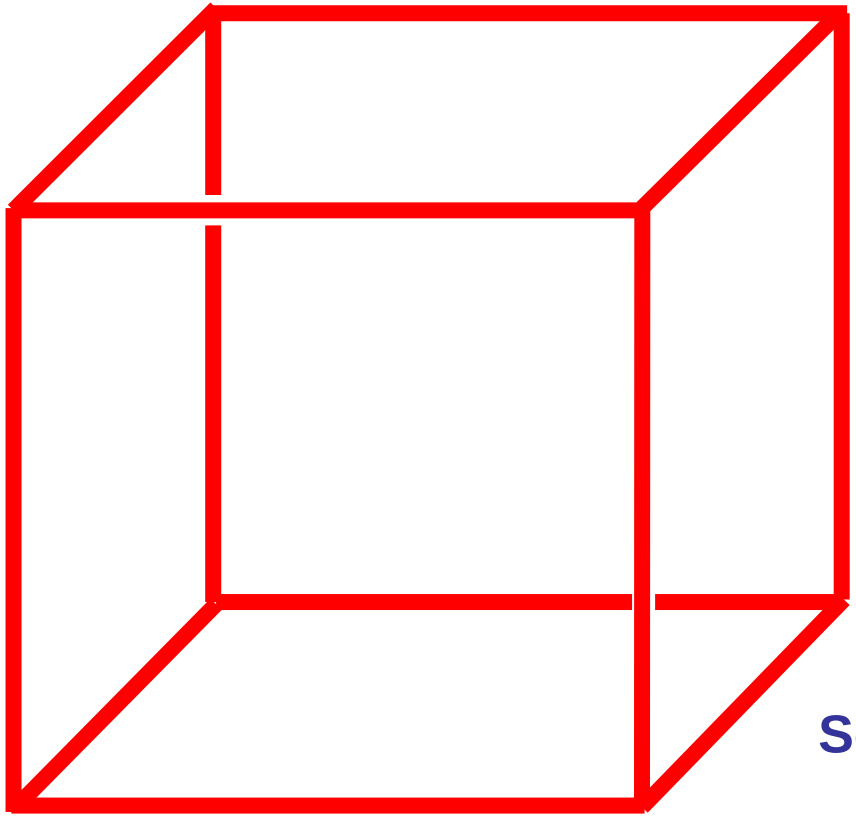


Optimized use of resource in all steps and for all actions

Vision and Strategy - Synthesis

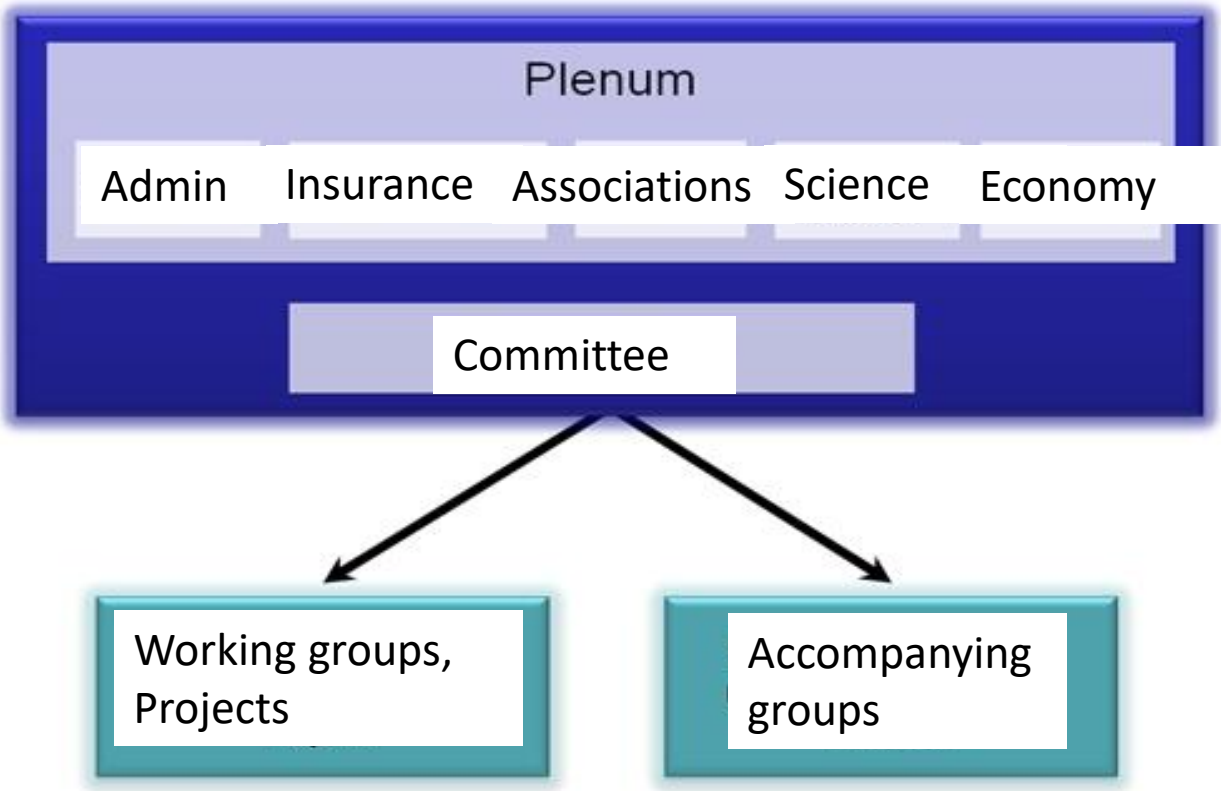


Vision and Strategy - Synthesis



Riskdialogue

Structure Planat



CEO and Secreteriat

alpenkonvention · convention alpine
convenzione delle alpi · alpska konvencija

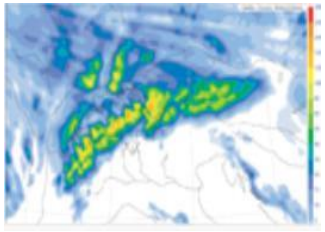
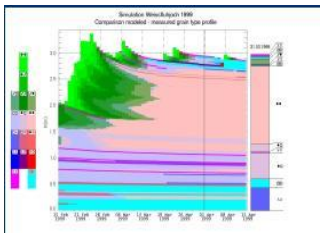
Schweizerischer Wasserwirtschaftsverband
Association suisse pour l'aménagement des eaux
Associazione svizzera di economia delle acque

FAN
Fachleute Naturgefahren Schweiz

SFIG - SCHWEIZERISCHE FACHGRUPPE FÜR INGENIEURGEOLOGIE
GSGI - GROUPEMENT SUISSE DE LA GÉOLOGIE DE L'INGENIEUR
Arbeitsgruppe Geologie und Naturgefahren
Groupe de travail Danger naturel et Géologie
AGN - DNG

Example avalanche warning: Data and information flux



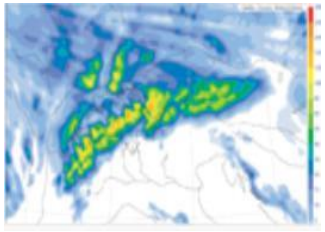
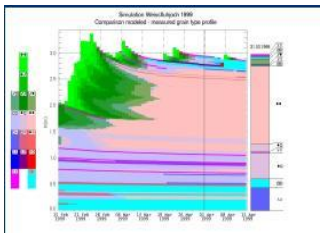
Weather stations Observers Feedback Weather forecast Models

Data base SLF

Avalanche warning

Example avalanche warning: Data and information flux



Weather stations Observers Feedback Weather forecast Models

Data base SLF

Avalanche warning

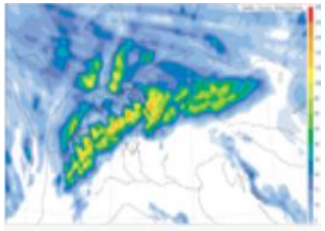
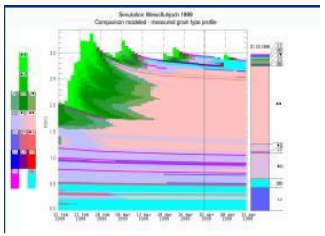
Infomanager

Security services

Security services

Example avalanche warning: Data and information flux



Weather stations Observers Feedback Weather forecast Models

Data base SLF

Avalanche warning

Bulletins, Additional products, website, interviews, media

Infomanager

public

Security services

Security services

Automatic weather stations: measurements during nights and storms

80 IMIS Stations (SLF / Cantons)

11 ENET Stations (SLF / MeteoCH)

ANETZ Stations (MeteoCH)

180 Observers: Multifunctional and reliable

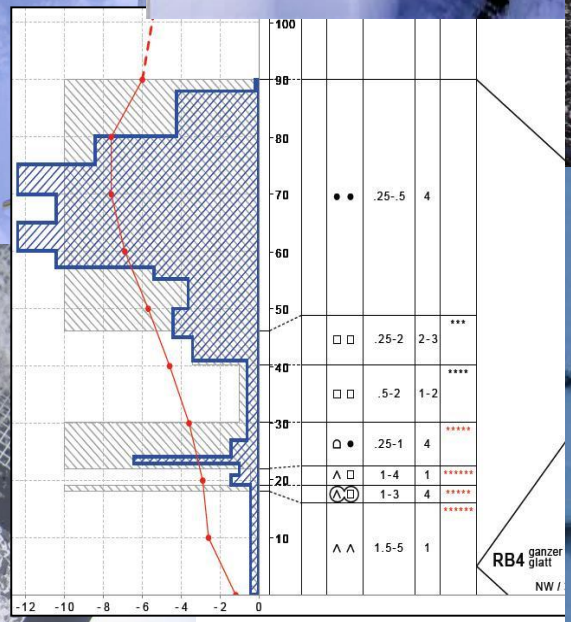
- Inhabitants of high altitude settlements, Owners of alpine and mountain huts, …
- Managers of Ski resorts
- Security services
- mAvalanche

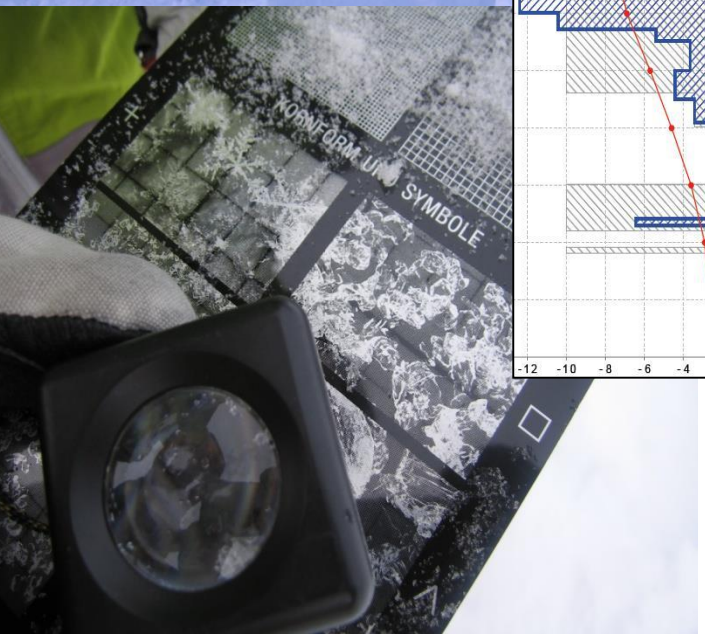
Observers

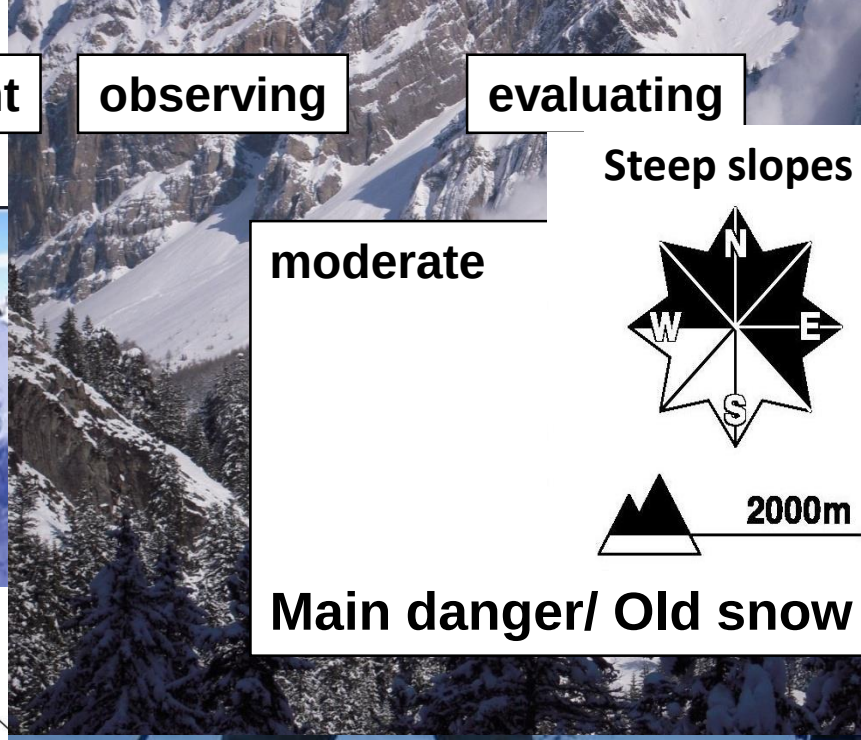
measurment

observing

evaluating







Steep slopes

moderate

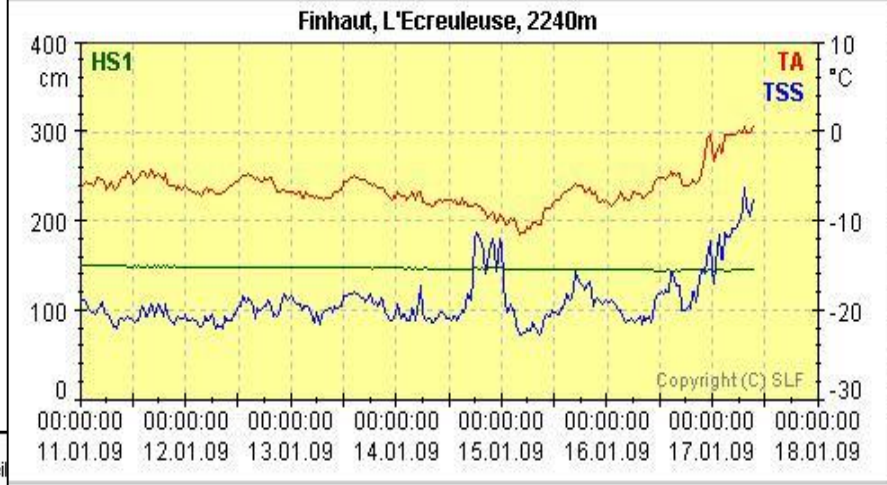
Main danger/ Old snow

mAvalanche: mobile application

Information from the area

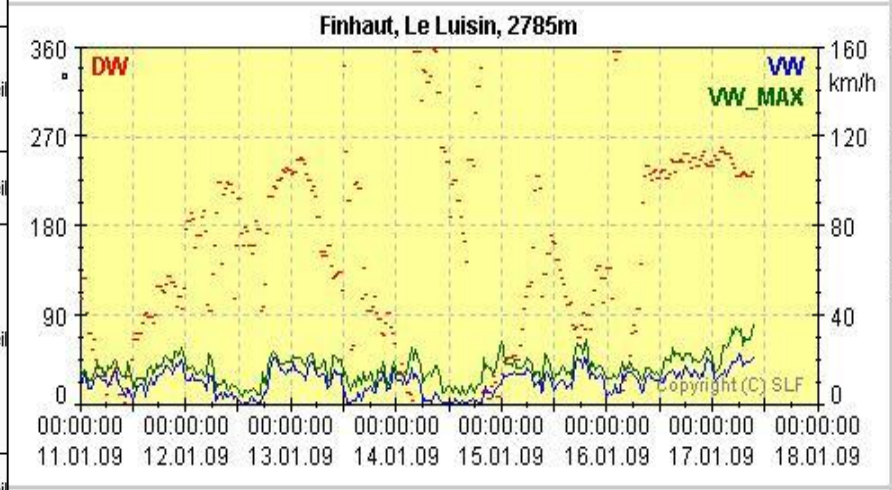
- Input from mountain guides
- mobile → Database
- Uses GPS and maps

5213-nördliche Surselva	13.01.2008 06:28		4	↘	Trocken	N	N	ober	1800	Steil
5214-südliche Surselva inkl. Lugnez, Valser- u. Safiental	13.01.2008 07:11	1820	3+	↗	Trocken	N	N	ober	1400	Steil
5216-Zervreila	13.01.2008 05:32		4	→	Trocken	N	N	ober	1800	Steil
5221-Domleschg / Lenzerheide	13.01.2008 15:39		3-	↘	Trocken	E	SE	ober	1800	Steil
5221-Domleschg / Lenzerheide	13.01.2008 06:45		3+	→	Trocken	N	N	ober	1800	Steil
5221-Domleschg / Lenzerheide	12.01.2008 17:14			↗						
5223-Rheinwald	13.01.2008 07:39	1457	4	→	Trocken	N	N	ober	1800	Steil
5232-Oberhalbstein	13.01.2008 07:53	1770	3-	→	Trocken	N	N	ober	1600	Steil
5233-Avers	13.01.2008 04:53	2117	3+	↗	Trocken	N	N	1600	3000	Triel
6111-Betrettotal	13.01.2008 05:53		4	→	Trocken	N	N	ober	1400	Steil
6112-obere Leventina	13.01.2008 07:48	1412	4	→	Trocken	N	N	ober	1600	Steil



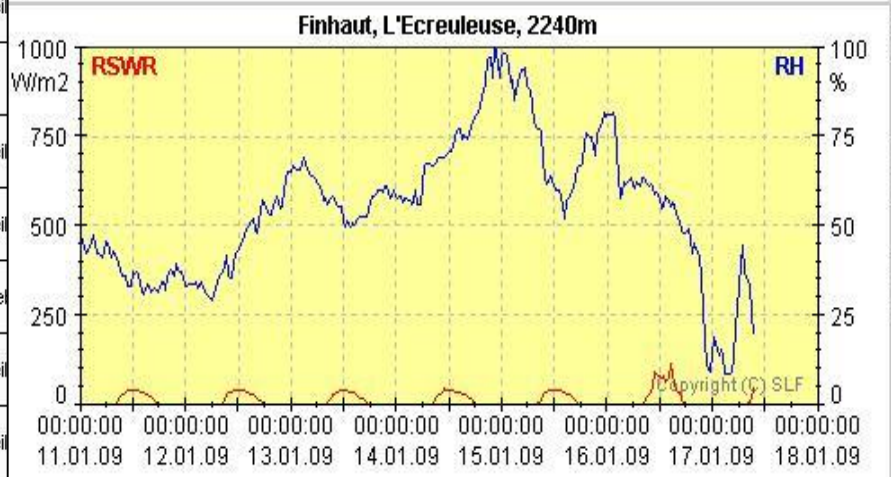
Finhaut 2240m
L'Ecreuleuse
17.01.2009 09:30

		D24h
HS1:	145 cm	0
TA:	0.5 °C	7.4
TSS:	-7.6 °C	13.2
TS3:	-10.7 °C	0
TS2:	-5.7 °C	-0.1
TS1:	-4.9 °C	0
TS0:	-2.3 °C	0
RSWR:	45 W/m2	20
RH:	20 %	-41



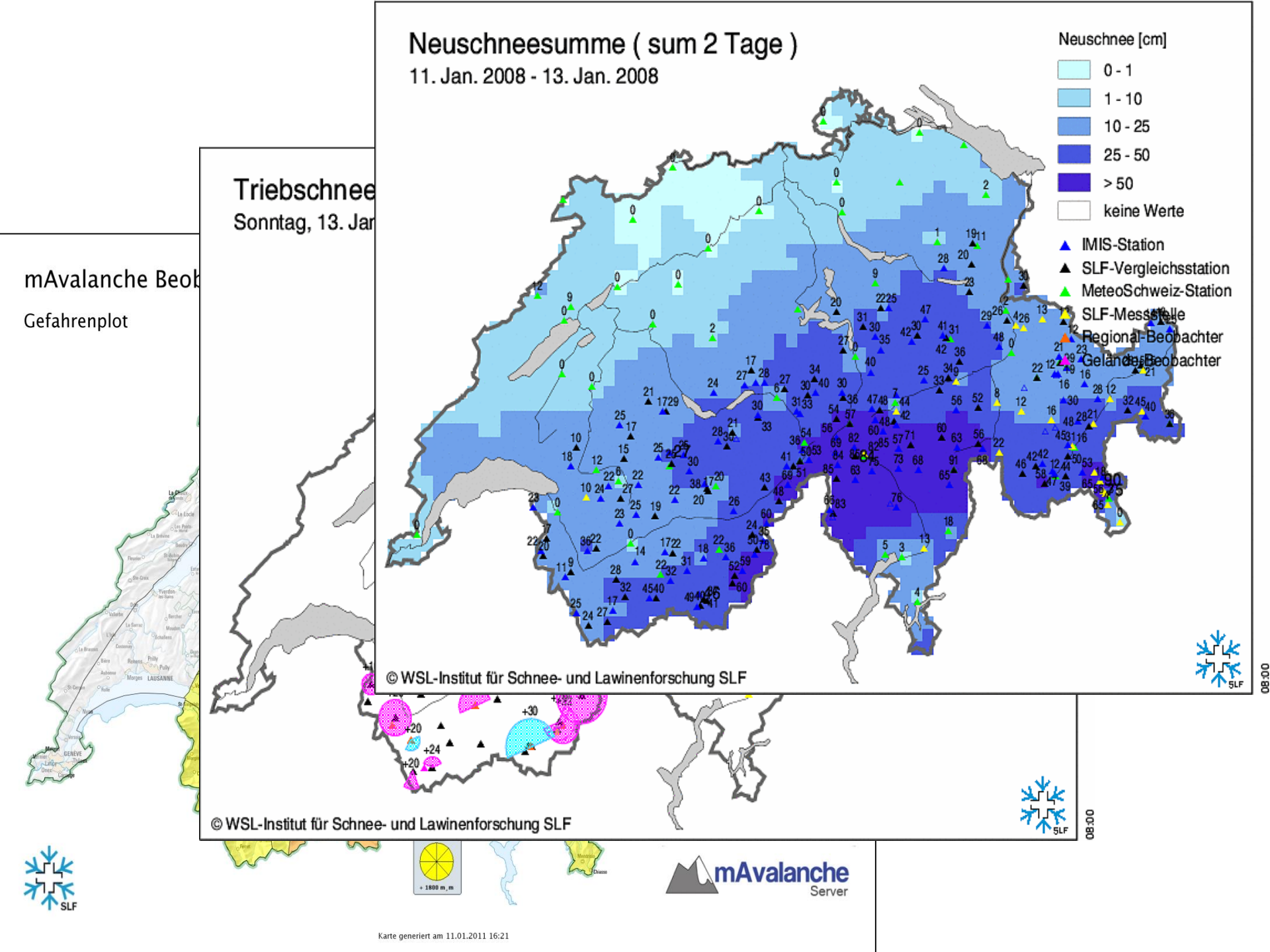
Finhaut 2785m
Le Luisin
17.01.2009 09:30

		D24h
DW:	SW °	
VW:	20.9 km/h	
MAX:	35.6 km/h	
TA:	-3.4 °C	-1.2
RH:	36 %	16

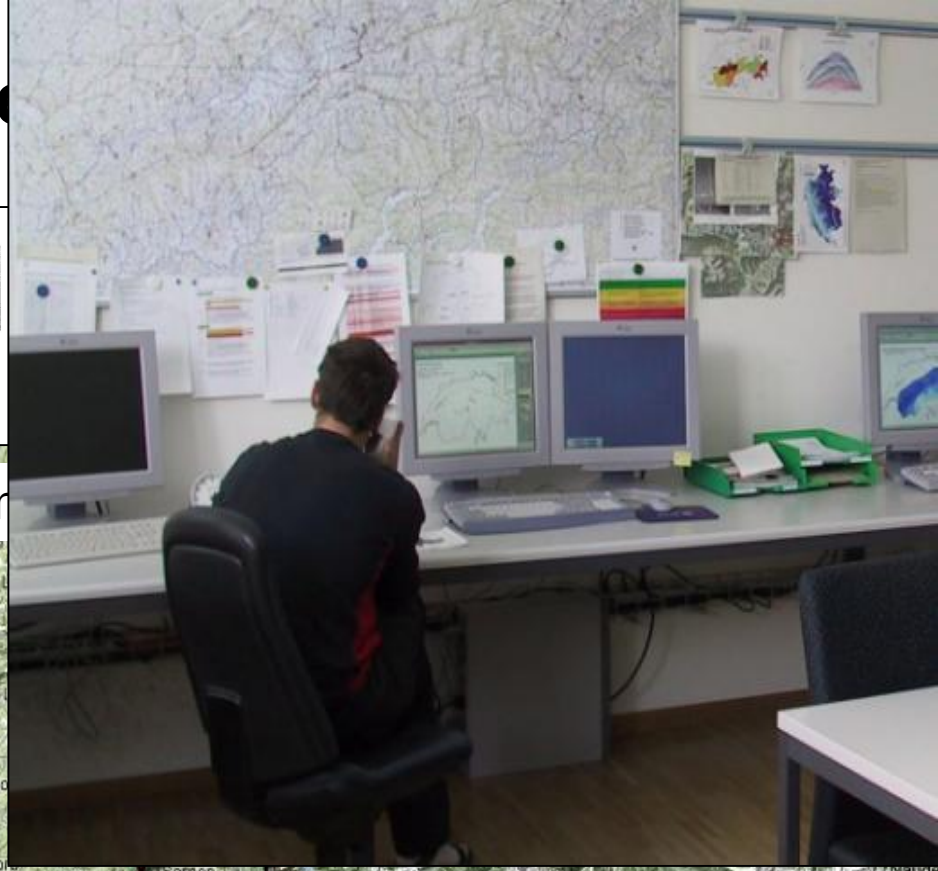


Finhaut 2240m
L'Ecreuleuse
17.01.2009 07:30

HN 24h:	0 cm
HN 72h:	0 cm
HN 3T:	0 cm
HW 24h:	0 mm
REIF:	8 mm
VI 24h:	3 cm


Neuschneesumme (sum 2 Tage)
11. Jan. 2008 - 13. Jan. 2008
Neuschnee [cm]
0 - 1
1 - 10
10 - 25
25 - 50
> 50
keine Werte
IMIS-Station
SLF-Vergleichsstation
MeteoSchweiz-Station
SLF-Messstelle
Regional-Beobachter
Gelände-Beobachter
© WSL-Institut für Schnee- und Lawinenforschung SLF
Triebschnee
Sonntag, 13. Jan
© WSL-Institut für Schnee- und Lawinenforschung SLF
mAvalanche Beob
Gefahrenplot
mAvalanche
Server
Karte generiert am 11.01.2011 16:21

Fe



Eidgenössisches Institut für Schnee- und Lawinenforschung

A Persönli
Bitte per Fa

Name / Vorname: .....
❑ Bergführer ❑ Rettungsdienst ❑ SLF-Beobachter ❑ Arm
Adresse: .....
Telefonnummer für Rückfragen:

gefahrene **Tour oder Variante:** Ca. K
.....
Gebiet / Kanton: .....
Datum und Zeit der Beobachtungen: .....

Beobachtungen im Gelände:
Wichtigste Beobachtung pro Gruppe 1 - 6 für di
Expositionen und Höhenlagen auswählen und in
Grafik eintragen.

1) Schneeoberfläche – Schneeart und -beschaffenh
11 Neuschnee **12** Pulver **13** Harsch
15 traglähig **16** brüchig **17** weich
Zeichnen Sie bitte unten die Neuschneemenge / Ein

0cm 20cm 40cm 60cm 80cm 100cm

2) Schneedecke:
21 locker bis Boden **22** trocken

3) Frische Triebschneeansammlungen: ❑ keine
31 klein (5-20cm) **32** mittel (20-50cm)

4) Wummgeräusche:
41 keine **42** selten

5) Beim Betreten der Schneedecke:
51 Rissbildung **52** Plattenbildung

6) Beobachtete Lawinen: ❑ keine ❑ spontane
klein: Länge und Breite kleiner 50m *mittelgross:*

61 eine kleine **63** eine mittelgrosse
62 mehrere kleine **64** mehrere mittelgrosse
70 Person(en) wurde(n) erfasst / organisierte Rettun

Persönliche Einschätzung der La
Tragen Sie bitte Ihre Gefahreneinschätzung in die
Expositions-Höhenlagen-Grafik ein:

1 gering **2** mässig **3** erheblich **4** gross

zusätzlich besteht eine Gefahr für nasse Schneebret
❑ kleine (Rutsche) ❑ grosse

Entwicklung der Lawinengefahr:
❑ gleichbleibend → ❑ abnehmend ↓
❑ mit tageszeitlicher Erwärmung zunehmend
(Höhenlage: von .....

Bemerkungen (Lawinengefahr, Lawinenbulletin, Wet
.....
.....
.....
.....

Bitte senden an: SLF, Lawinenwarndienst, Flüelastr. 11, 7260 Davos-Dorf

Eidgenössisches Institut für Schnee- und Lawinenforschung

C Lawinen mit erfassten Personen ohne Sachschäden
Bitte per Fax oder Post übermitteln

SLF ENA SNV PNL

→ Falls durch die Lawine ein **Sachschaden** entstanden ist, bitte den Fragebogen **D „Lawinen mit Sach- und/oder Personenschäden"** ausfüllen.

Name / Vorname: .....
❑ Bergführer ❑ Rettungsdienst ❑ SLF-Beobachter ❑ Armee ❑ Lawinendienst ❑ Tourenleiter ❑ andere: .....
Adresse: ..... Plz/Ort: .....
Telefonnummer für Rückfragen: .....

Angaben zu
Datum und Zeit
Ortsbezeichnung
Koordinaten am
Anrisshöhe:
Exposition: ❑ N
Auslöseart:
Lawinenart:

Organisiert
Löste dieser Law
Wurden Persone
Für Auskünfte üb

Tätigkeit de
unterwegs: ❑ a
❑ a
Ort: (To

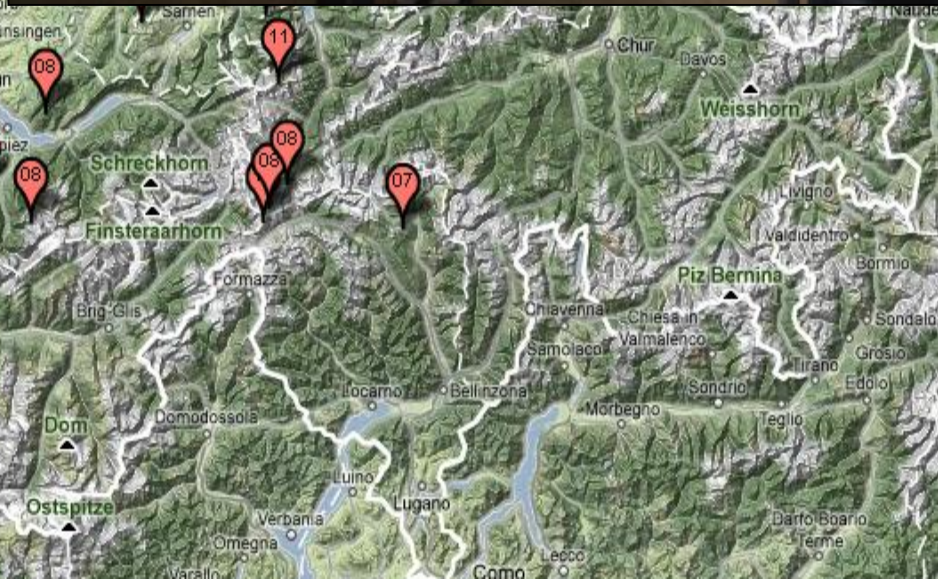
Gruppengrö
erfasste Perso
nicht verschüttet
teilverschüttet
ganz verschüttet
Verschüttungstie
Verschüttungsda
Folgen:
unverletzt
verletzt
tot
Rettung/Bergun
Selbstbefreiung
Kameradenrettu
Organisierte Ret
Suchmittel:
Auge (Verschütt
Ohr (Rufen)
Beobachtung de
Lawinenverschü
Sondieren
Lawinenhund
Transponder (R
Umgraben des U

Wenn möglich
notieren inkl.
Lawine. Falls
Auffindeorte)

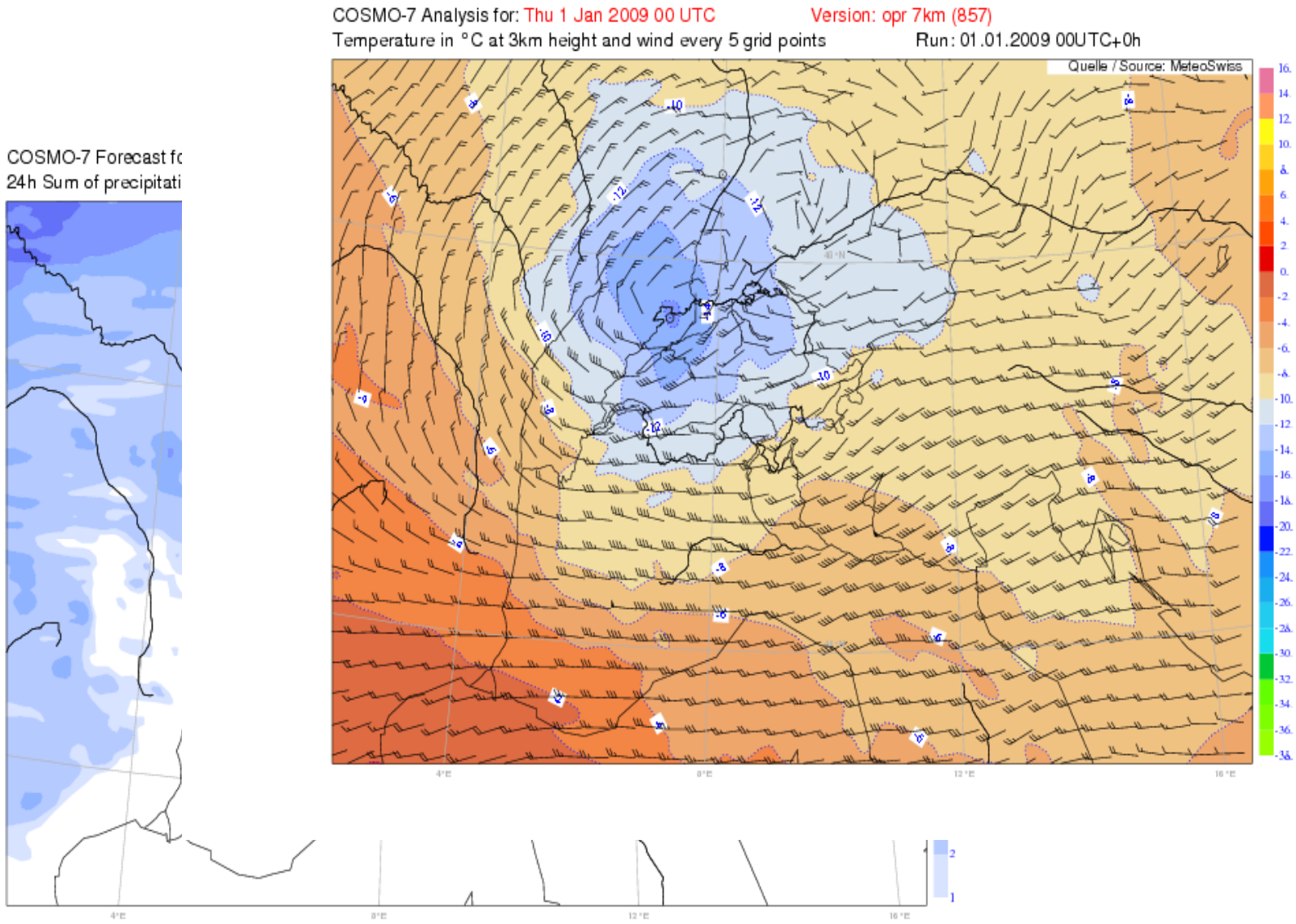
sind Photos vorha
liegt Karte / Skizze

Bitte senden an

"Lawinen-Beobachtungen



Weather forecast / prognosis



Evaluation based on combined informations

Products

Eidgenössisches Institut für Schnee- und Lawinenforschung
Institut Fédéral pour l'Etude de la Neige et des Avalanches
Istituto Federale per lo Studio della Neve e delle Valanghe
Institut Federal per la Perscrutaziun da la Naiv e da las Lavinas

SLF ENA SNV PNL

National avalanche bulletin no. 66

for Sunday, 13 January 2008

issue date 12.1.2008, 18:30 hours

High avalanche danger regionally

Current conditions

On Saturday it snowed heavily down to low altitudes in southern regions and in the eastern part of the northern flank of the Alps. On the Main Alpine Ridge from Zermatt to Bergell and south thereof there was 50 to 70 cm of snowfall. In the region extending from the central and eastern parts of the northern flank of the Alps over central Grisons to the Upper Engadine, there was 20 to 40 cm of snow, elsewhere 10 to 20 cm. Midday temperatures at 2000 m were minus 6 degrees in northern regions and minus 4 degrees in southern regions. Stormy southerl prevailed to begin with, then slackened off and shifted to northerly.
The new snow and the snowdrift are often poorly bonded with the old snowpack. Particularly on the Main A Ridge from the Matterhorn to the Engadine and in Grisons, moreover, the snow overlays a weak old snowpa

Short-term development

By Sunday m
the day it will
3 degrees in th
easterly, then
As the heavy
nevertheless r

Avalanche d

Main Alpine
Misox; s
High aval
The avalan
during the
of transpor
critical co

Remaining r
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On the rem
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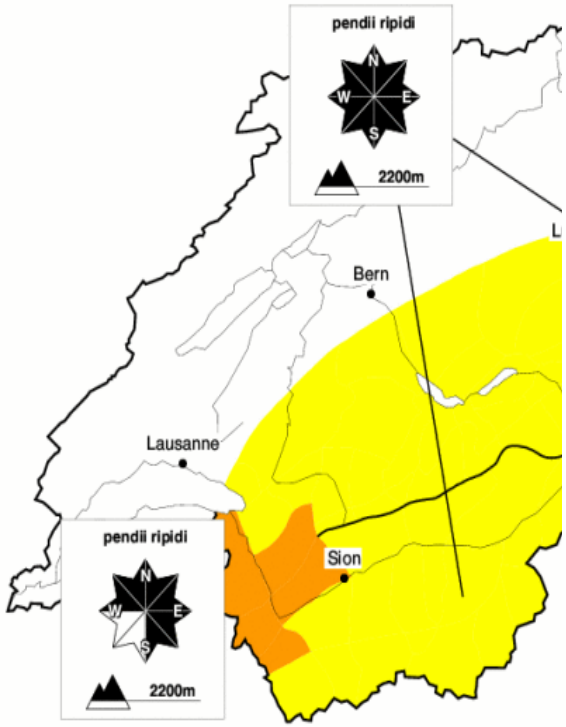
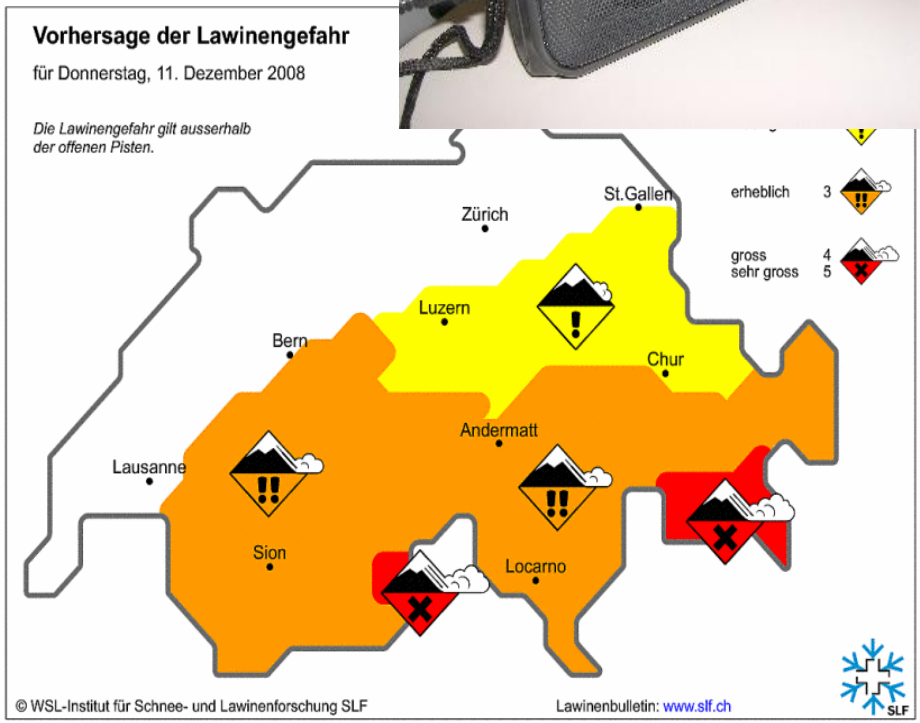
During the
expected.
On the rem
locations a
natural ava
In all regio
Extensive

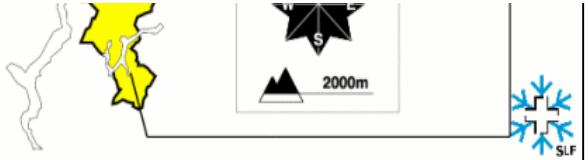
Trend for M

On Monday it
in the afterno
will be variab



© WSL Istituto per lo studio della neve e delle valanghe SLF





Bulletin régional d'
Bulletin No 043 - du
Pour des informations supplém

Dans le manteau neigeux il
métamorphose constructive
une seule personne. En plu
être évitées dans la mesure

Degrés de danger:
1 faible
2 LIMITÉ
3 MARQUÉ
4 fort
5 très fort

Champé
pentes ra

La temps
aujourd'hui sur
Les Attelas à
2733 m:
(Source: MétéoSuisse)

Données d'aujourd'hui de neige et météo

station neige	hauteur de neige	neige fraîc
Les Diablerets 2575m	216 cm	ca. 20

Level of risk

Level of risk

Examples that illustrate “soft factors”

- in ski / fun “hotspots”, the will to take risks is very high
- Freeskiers drive everywhere!
- Avalanches are rare, but might be of medium size

2

Avalanche bulletin: Possibilities and limits

Description of the overall avalanche risk for a certain region

→ Planning should be based on this

No estimation for the certain situation / for the specific slope

→ „Is this slope now too dangerous for me?“

No evaluation of the risk

→ Risk = Avalanche danger + own behaviour!

Thanks!