Risk and rescue

- **Risk acceptance**
- **Risk assessment**
- **Risk/benefit**

Molaupen, Hjørundfjord
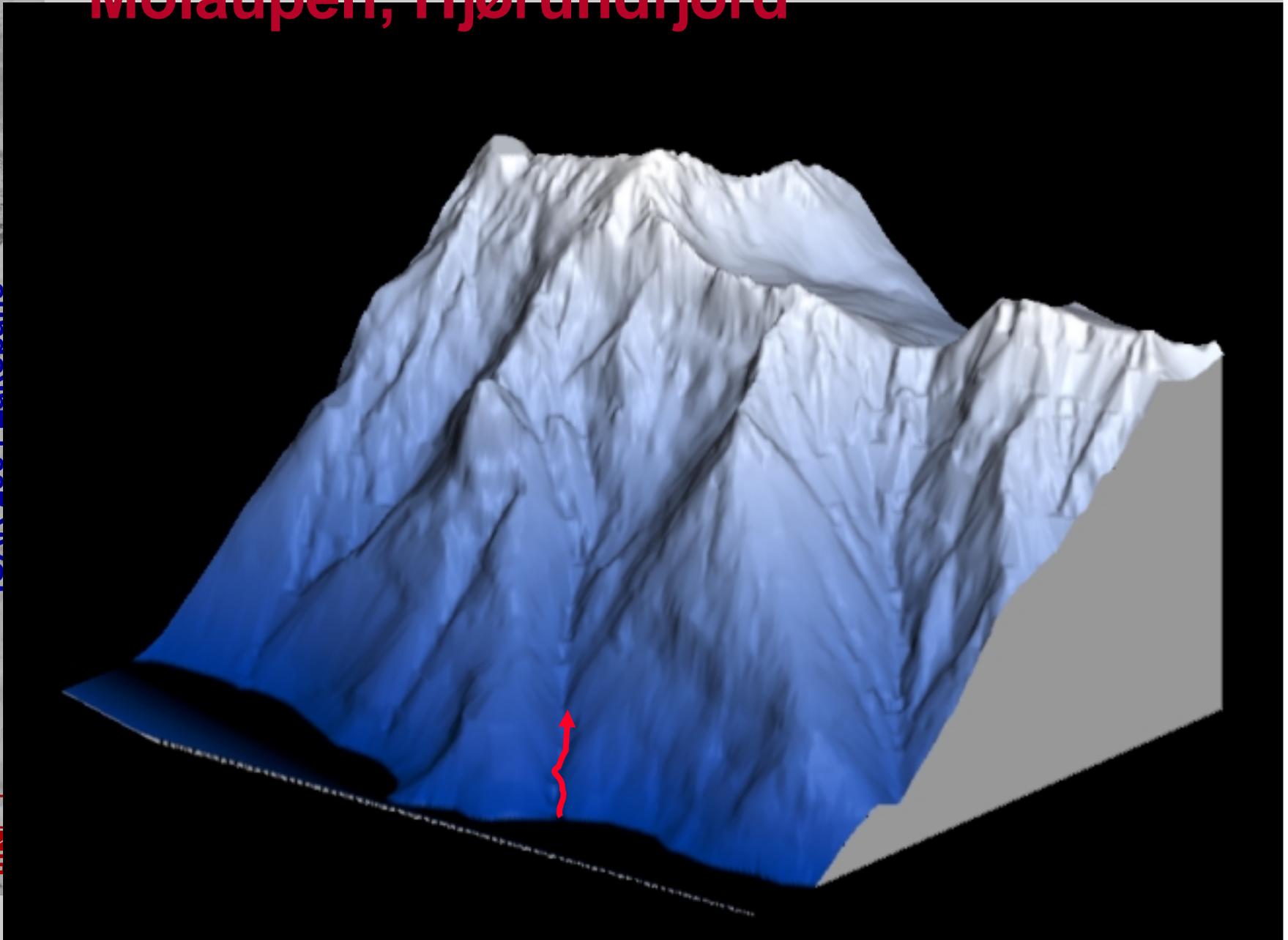
Risk acceptance

- **Risk** is always **non-zero**
- Safety requirements are often ambiguous:

  "Safe" means **"safe enough"**

  or **"ALARP"** (As Low As Reasonably Practicable)
- Risk asymmetry rescuer/victim
- Statistical risk level for alpine rescue?

NGI

Risk assessment

- "Classical" avalanche hazard evaluation
- Terrain analysis:

  Starting zone: Sensitivity for additional load

  Runout zone: Probability of release and exposure (time)

ICAR 2004 Zakopane

NGI
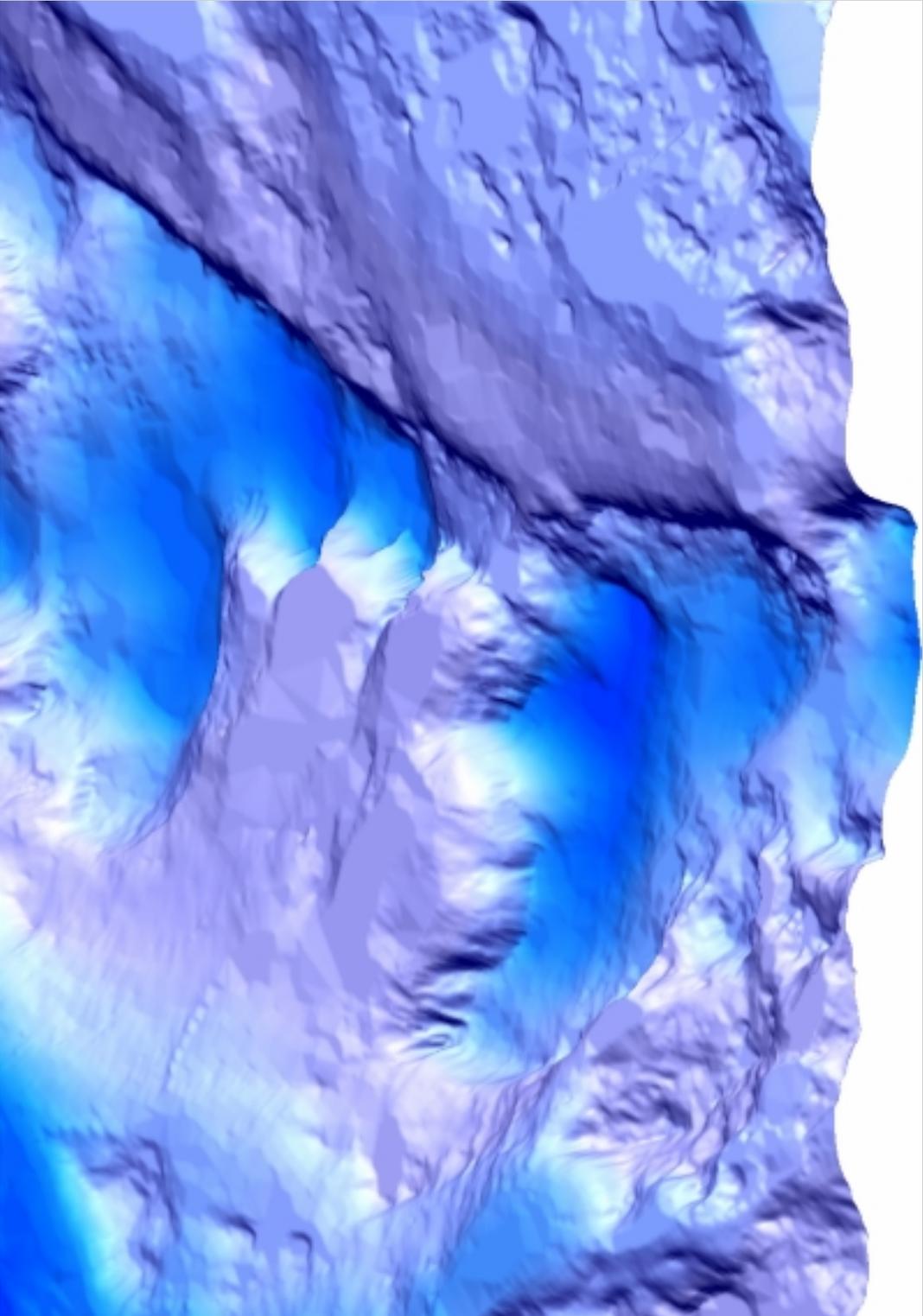
Terrain analysis

Potential avalanche terrain

Potential avalanche terrain

Snow Avalanche Map

This map indicates areas where snow avalanche may occur.

The maps are produced for the Norwegian Military Geographic Service and should not be used for other purposes without reservation.

This map is divided into the following zones:

Zone 1   **Avalanche starting zones.**
Terrain steep enough for avalanche release.
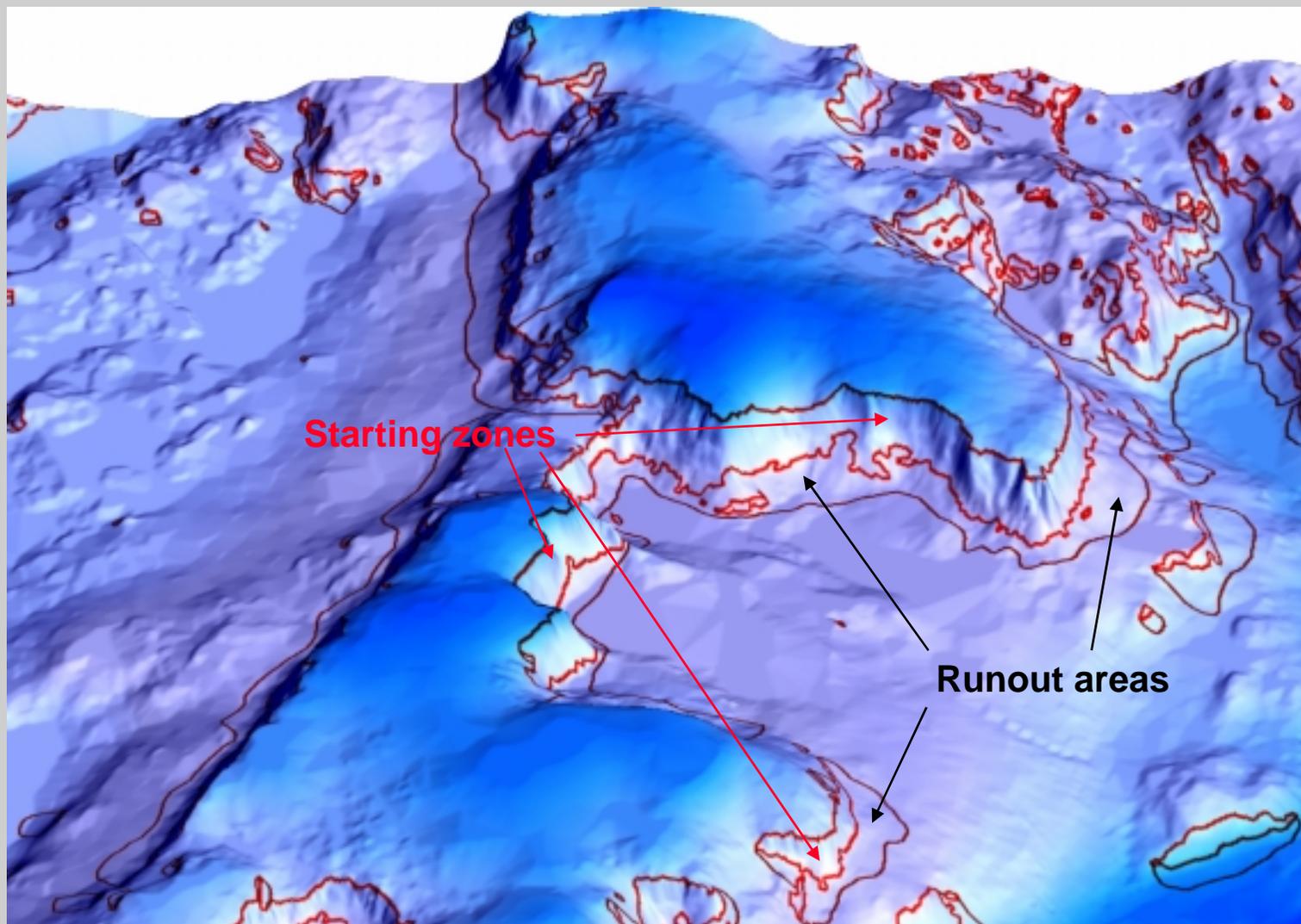
Zone 2   **Avalache run-out zones**
Terrain lying below starting zones, which may exposed to avalanche.
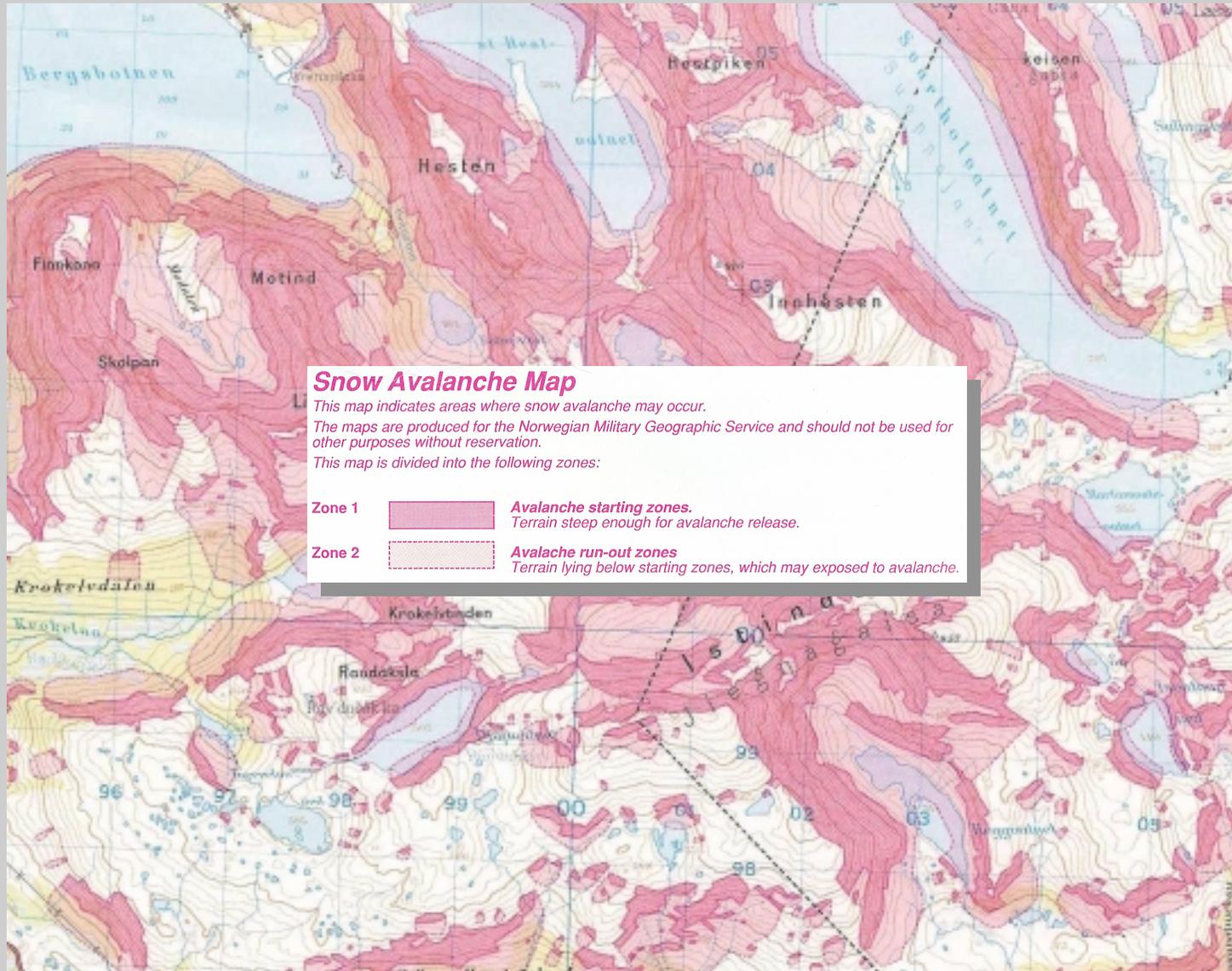
Risk/benefit analysis

1. **Weighs** the risks likely to be taken, against the likely gains
2. **Uncertainty is quantified** by using probabilities

NGI

Risk/benefit analysis

- **Example 1:**
- One person buried >1 h
  Probability of being found alive 20%

- **Example 2:**
- Rescue crew of ten in the runout zone
  Probability of being caught and killed 5%

  Life expectancy 50 years

Risk/benefit analysis

- **Example 1, no search:**

  Loss of life years: 50x0.2=**10**

- **Example 2, search:**

  Loss of life years : 10x50x0.05=**25 (+10)**

ICAR 2004 Zakopane

NGI

Risk/benefit analysis

Purpose:

- Not "**putting a price on human life**"
- An objective **comparison** of options
- A **transparent** decision making tool (as opposed to "romantic heroism")
- A quantitative assessment of the effect of **risk reduction measures**

"Risky" rescues?

May only **appear** risky to the outsider, but:

- Risk reduction measures are taken
- Tactical decision making skills are used
- "Windows of opportunity" are exploited,

which may not be apparent to non-experts

ICAR 2004 Zakopane

NGI

"Real" risky rescues?

High risk operations should require **<u>informed consent</u>** form all involved.

Molaupen, Hjørundfjord

- **One** buried initially
- **Seven** dead as a result of the rescue effort
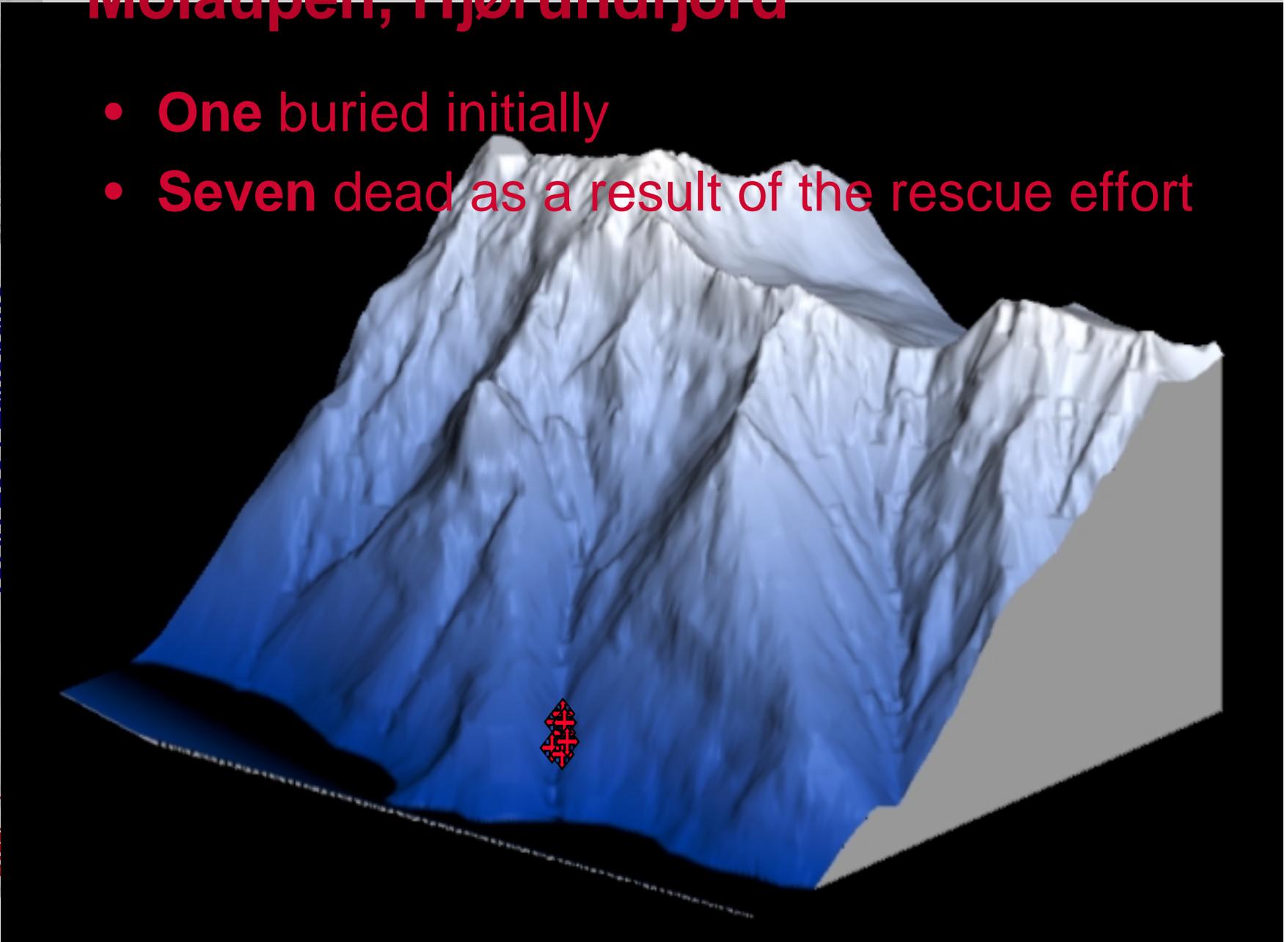
ICAR 2004 Zakopane

Terrengvurdering