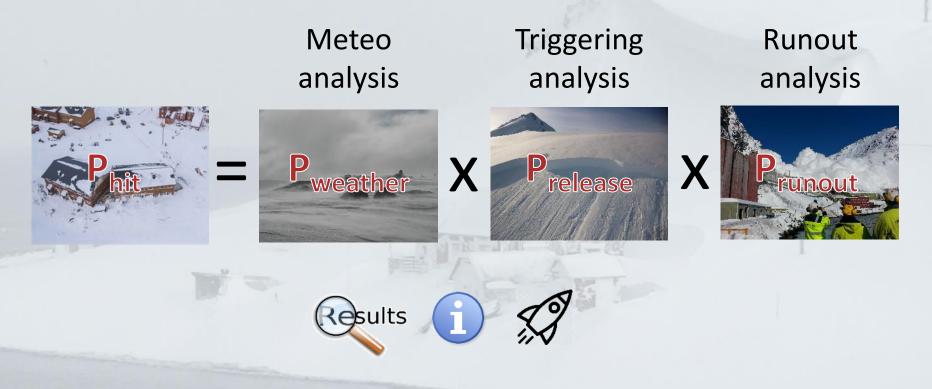What is the probability that the avalanche will hit the house within the next 24 hours?

Want to know the answer? ENTER

NGI

Probabilistic estimation of snow avalanche runout

Meteo analysis   Triggering analysis   Runout analysis

$$P_{hit} = P_{weather} \times P_{release} \times P_{runout}$$

Results

Probabilistic evaluation of snow avalanche runout by Sylfest Glimsdal, Galina Ragulina, Marco Uzielli, and Christian Jaedicke

Motivation for the study

The challenge

⌐ Local avalanche warning

- Probability for avalanche hitting a specific object within 24h
- What is the accuracy of the estimate?

⌐ Avalanche hazard mapping

- Where is the 1/100 or 1/1000 line?
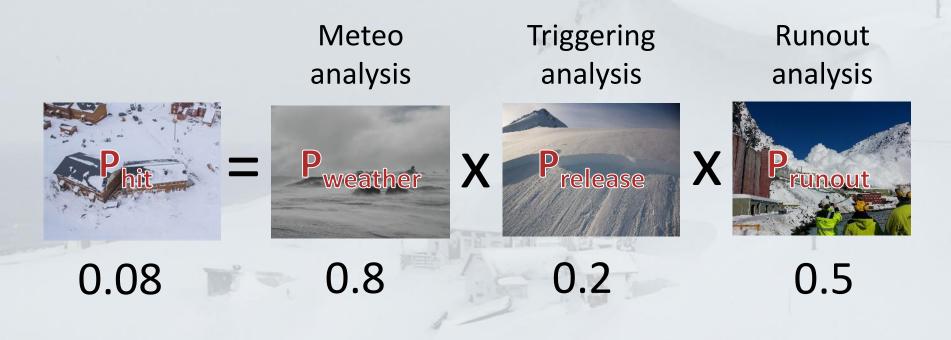- What is the accuracy of the line?

The approach

⌐ Avalanche runout probability ARP

- Address all probabilities individually
- Different approaches for each probability
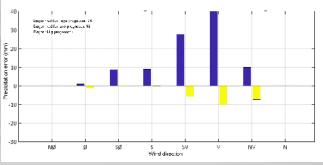- Evaluation of combined probability

weather

release

runout

hit

Exampel

		Meteo analysis		Triggering analysis		Runout analysis

$$P_{hit} = P_{weather} \times P_{release} \times P_{runout}$$

0.08	0.8	0.2	0.5

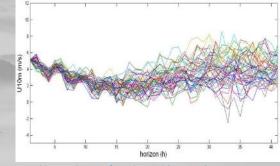# Probability of forecasted weather P_{weather}

The challenge

❝ Quality of the forecast

- How much precipitation at what probability?
- Most likely temperature?
- Dominant wind direction and speed?

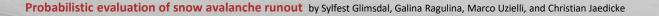Observed error from forecasted precipitaion normalised for wind direction

The approach

❝ Ensemble weather model runs

- Min, max and likely precipitation
- Temperature range
- Wind rose
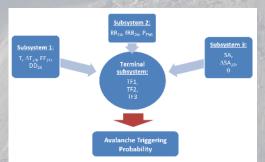- Expert experience

Ensemble simulation of wind speed (ECMWF)

Probability of avalanche release $P_{release}$
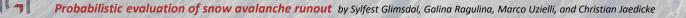
The challenge

❙ Expert judgment

- Lots of relevant factors
- High spatial variability
- Notorious answer: "It depends"

The approach

❙ Fuzzy inference system

- Definition of the problem
- Identification of relevant parameters
- Definition of membership functions
- Definition of fuzzy rules
- Fuzzy calculation of response surfaces

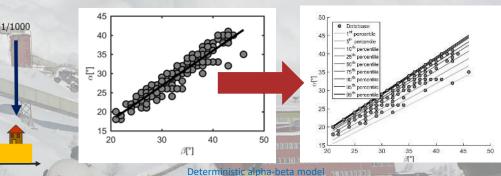# Probability of avalanche runout P$_{runout}$

The challenge

How far does the avalanche run?

- Given weather and snow conditions
- Many avalanches high up
- Few long runouts
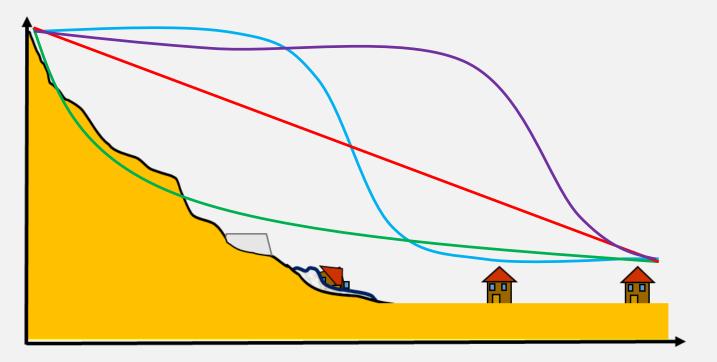- All avalanches recorded in one path?

The approach

Probability dist. along path

- Probabilistic characterization of α-β model
- Bayesian computational approach
- One avalanche from many paths
- Associate probability levels to α given β

Different object have different probabilities of been reached

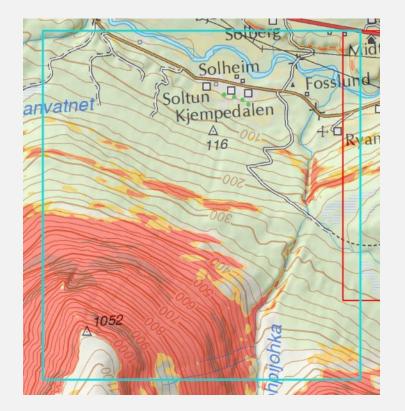Deterministic alpha-beta model

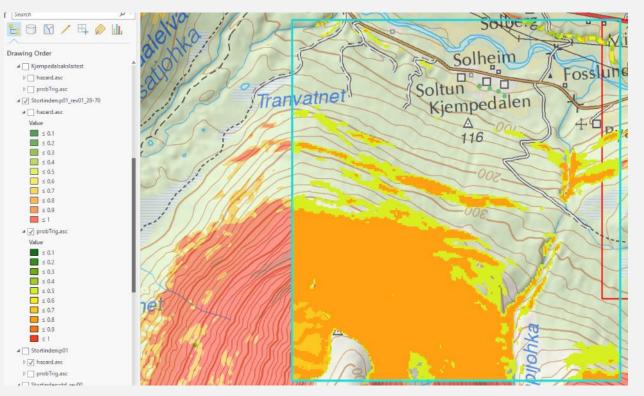# What is the right probability distribution?
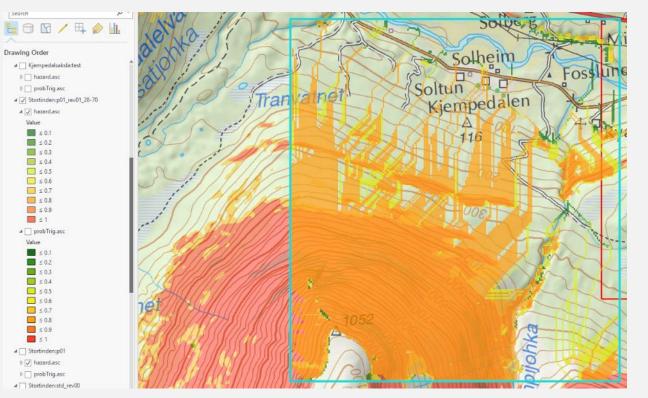
Results

Topography

Results

Probability of release

Results

Probability of runout

Background information

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The Project

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