Avalanche Modelling in Forested Slopes

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Introduction

Part A: Experimental Simulations

Part B: Case Study

Conclusions and Outlook
Introduction

Assess the protection quality of forests in avalanche slopes

- Identify critical parameters: Experimental simulations
- Apply findings: Case Study
Introduction

Site location
Introduction

Avalanche hazard map
Introduction

A: Experimental Simulations

B: Case Study

Conclusions and Outlook
A: Methods

- Material Point Method MPM
- Input Variables
  - Forest configuration: no forest, ordered, random, clustered.
  - Snow types: low density, granular, cohesive
- Response Variables
  - Runout distance
  - Front velocity
  - Percentage of non-released particles
A: Results

No forest (time frame 130)
A: Results

Random forest (time frame 130)
A: Results

Clustered forest (time frame 130)
Avalanche response variables as a function of time [s] and snow type for each tested forest structure.
### A: Results

Cross-correlations of the forest parameters and the avalanche release and flow.
Effect of the forest and snow parameters on the runout length (RL), maximum velocity (MV) and percentage of non-released particles (PS). The dashed line represents the significance level of 0.05.
Introduction

A: Experimental Simulations

B: Case Study

Conclusions and Outlook
B: Methods

Orthophoto and Digital Surface Model
- Data collection: drone mission
- Pix4D: Bundle adjustment

Tree identification
- Position: Variable window filter on CHM
- Crown segmentation: Watershed algorithm

Release area definition
- Sliding window, coverage ratio <50%
Orthophoto of Les Voëttes:
Left: 2015 before fire
Right: 2020 after fire
B: Results

Forest canopy at Les Voëttes:
Left: Tree heights and postions (2015)
Right: Identification of burnt trees (2020)
B: Results

Avalanche release areas in Les Voëttes:
Left: 2015 before fire
Right: 2020 after fire
B: Results

Effect of the forest. Left: forested slope, right: non forested slope.
B: Results

Effect of the snow type in the forested terrain. Left: granular, right: cohesive.
B: Results

Avalanche simulation before the fire (left) and after the fire (right).
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Questions

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