Big Data Analysis for Permafrost Research
Visualization of heterogeneous data from always-on field experiments

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From Field to Screen

What happened?
- Frost cracking?
- Mountaineer?
- Precipitation?
- Rupture?

Wireless Sensor Network

- Matterhorn Hörnligrat 3500m a.s.l.
- Multisensor field experiment
- Seismometer (SM)
- Accelerometer (AM)
- Acoustic sensor (AS)
- Crackmeter (CR)
- Rock temperature
- L1-DGPS (WGPS)
- High-resolution camera
- Weather station
- High data throughput:
  \(~7\,\text{GB/day} \rightarrow ~2.5\,\text{TB/year}\)

Data Management and DB Architecture

- Demanding processing and storage requirements
- Strongly heterogeneous data

Data Storage
Data Fusion
Data Processing

Content-aware data reduction

Data Storage
Webcam Images
GSN Database
Event Database
Event Waveforms

Data Fusion

Web front-end
Multi-year content
Server-side pre-computed waveforms
Responsive interaction (zoom, pan,...)
Data statistics
Single event characterization
- Spectrogram
- Full-resolution waveform
- Feature extraction

Visualization

- Maximum Amplitude [V]
- Duration [s]
- Amplitude [V]
- Event parametrization
- Dynamic data reduction

Analysis

Continuous Data Visualization
- Finding visual correlations and patterns
- Identifying periods of strong activity

Manual Event Detection
- Event/fieldwork labeling
- Catalog for event classification

Event Characterization
- Temporal dependencies
- Feature clustering

http://data.permasense.ch/