



University of Natural Resources  
and Life Sciences  
Department of Structural Engineering  
and Natural Hazards

# *Teaching and research at the* **Institute of Mountain Risk Engineering**

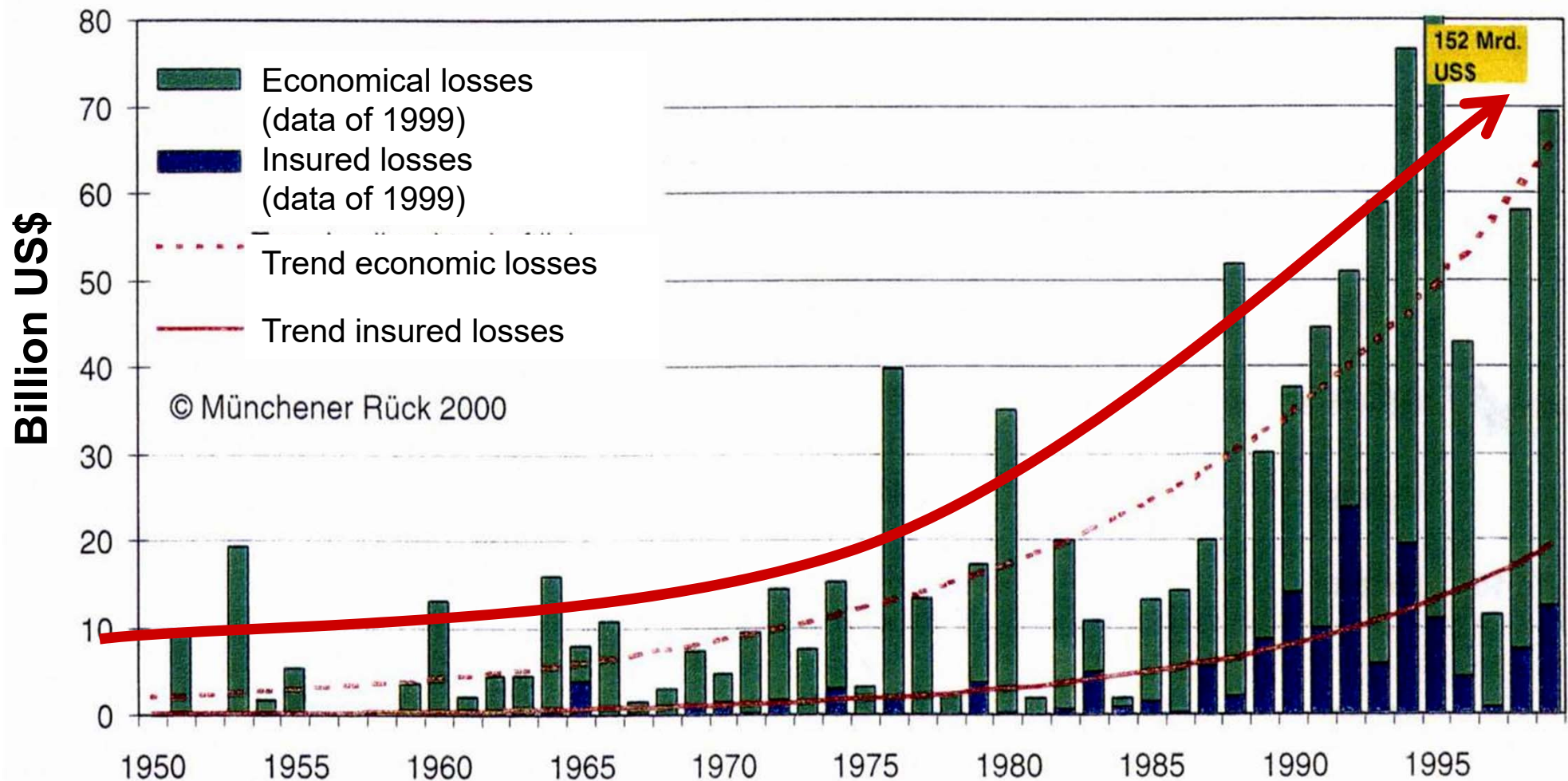
*at the University of Natural Resources and  
Life Sciences in Vienna, Austria (BOKU)*



# Damage due to natural disasters

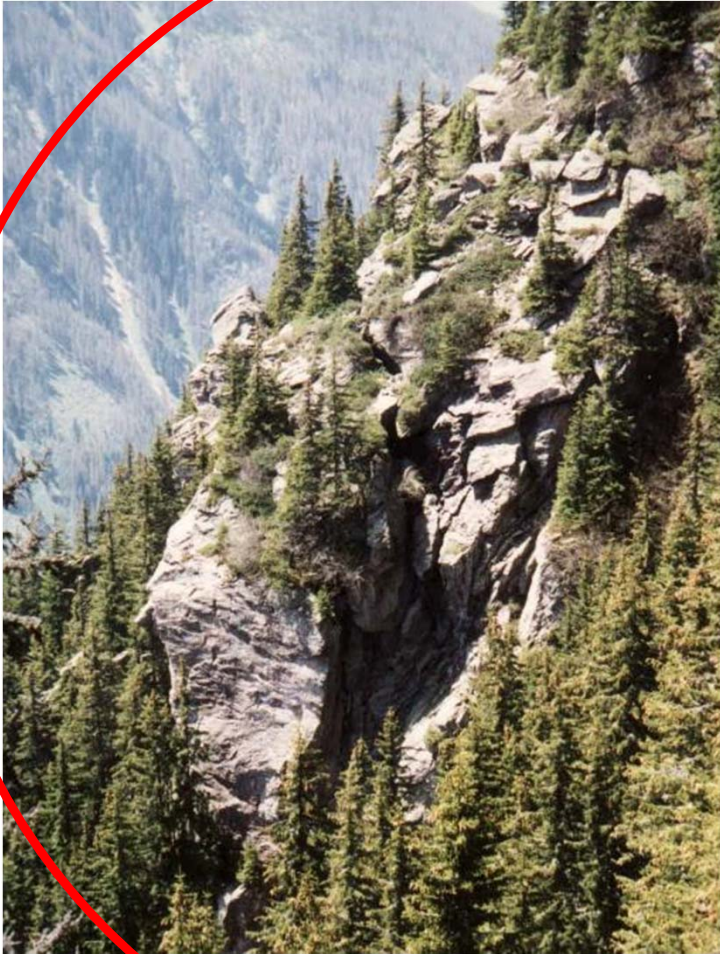


## Global economic losses / insured losses and trends



## Hazard areas (nature)

## Living space (human)



**risks**  
**chances**

# Which hazards?

- Floods, bedload transport



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# Which hazards?

- Landslides, debris flows



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# Which hazards?



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- Rock fall, rock avalanches



# Which hazards?

- Snow avalanches

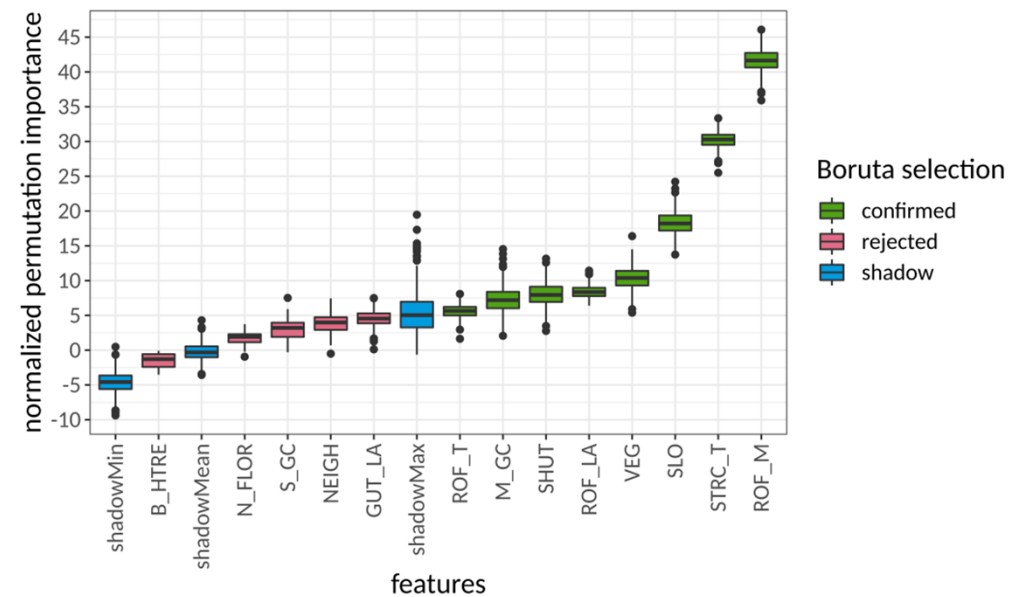
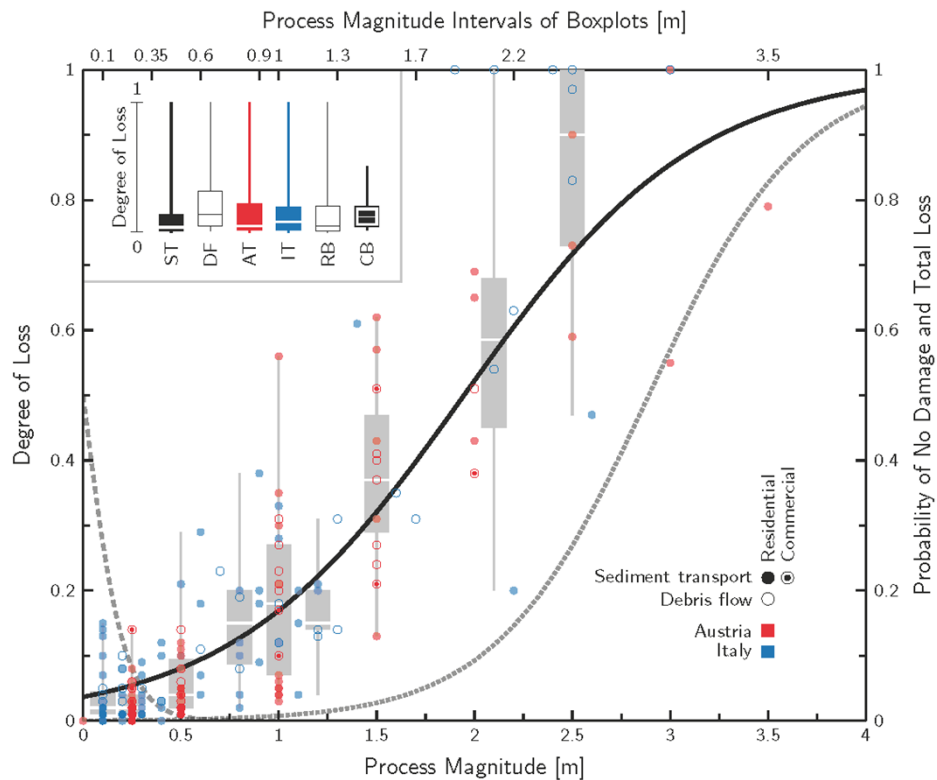


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# Vulnerability, risk and exposure

- Vulnerability curves, indicators





# Risk Analysis

Definition of scales (time, space, profundity of analysis)

## Hazard Analysis

- Analysis of terrain and environment
- Modelling and simulations
- Definition of realistic hazard scenarios
- Event history and statistics
- Hazard register

## Vulnerability Analysis

- Analysis of structural resistance
- Analysis of direct and indirect consequences
- Analysis of human condition

## Analysis of Values at Risk

- Analysis of number and categories of persons
- Analysis of movables and immovables (property)
- Analysis of non-material assets

## Risk Analysis

- Definition of scenarios
- analysis of risk (fault / event tree)
- Event statistics
- Expected value of damage (statistical evaluation)

## Risk Assessment and Evaluation

### Human and Societal Condition

- Responsibility allocation
- Risk culture

### Monetary Assessment

### Risk Awareness and Aversion

- Weighting

### Accepted Level of Risk

- Evaluation of security deficit
- Willingness to pay for risk reduction

## Learning from the Event

- Debriefing
- Various reports

- Event analysis

### Recovery After the Event

- Rehabilitation
- Definitive repair
- Reconstruction
- Strengthening of resilience
- Follow-up documentation
- Insurance

## Event Management

### Provisional Recondition

- Provisional repair
- Supply and removal
- Emergency relief installation
- Initiation of logistic and distribution systems
- Communication
- Psychological support
- Follow-up documentation

### Immediate Response

- Alert
- Evacuation
- Rescue
- Resistance and mitigation
- Instructions
- Safety
- Media
- Follow-up documentation

## Risk Reduction

### Definition of Protection Targets

- Comparing weighted risks

### Capacity Building

#### Preparation

- Early warning systems
- Organisation / coordination
- Allocation of operational resources
- Training and instruction
- Information

#### Preparation for risk transfer:

- Insurance

#### Prevention

- Protective measures:
- Land use planning
  - Technical measures
  - Biological measures



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# Institute of Mountain Risk Engineering (IAN)

- Department of Structural Engineering and Natural Hazards
- Staff:
  - 1 Professor, 2 Assoc. Professors, 2 Senior Scientists
  - ~ 8-12 research employees
  - 2 administrative employees, 1 technician
- Research, teaching and administration
- Field of activities:

*Analysis and mitigation of mountain hazards*

# Examples of current research activities



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- Design standards for structural protection measures
- Experimental investigations of sediment transport over check dams and flow behavior of debris flows
- Development of simulation tools
- Derivation of a vulnerability function mountain hazards
- Effects of climate change on mountain hazards
- Snow cover modeling, triggering of wet snow avalanches
- Event monitoring, documentation
- International consulting (private clients, international organisations, etc.)



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# Teaching with tradition

- First lectures dealing with alpine hazards in 1882 at BOKU
- Situated in the Forestry Faculty
- Specialisation ‘Wildbach- und Lawinenverbauung’ (“torrent and avalanche control”) since the 1970s



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# BOKU master programs related to IAN and natural hazards

...taught in German

- **Alpine Naturgefahren / Wildbach- und Lawinerverbauung (ALPNAT)**
- Forstwissenschaften
- Kulturtechnik und Wasserwirtschaft

...international programs

- Mountain Forestry
- **Water and Environmental Engineering, Diploma supplement Mountain Risk Engineering (MRE)**
- Natural Resource Management and Ecological Engineering (NARMEE)
- Environmental Sciences – Soil, Water and Biodiversity

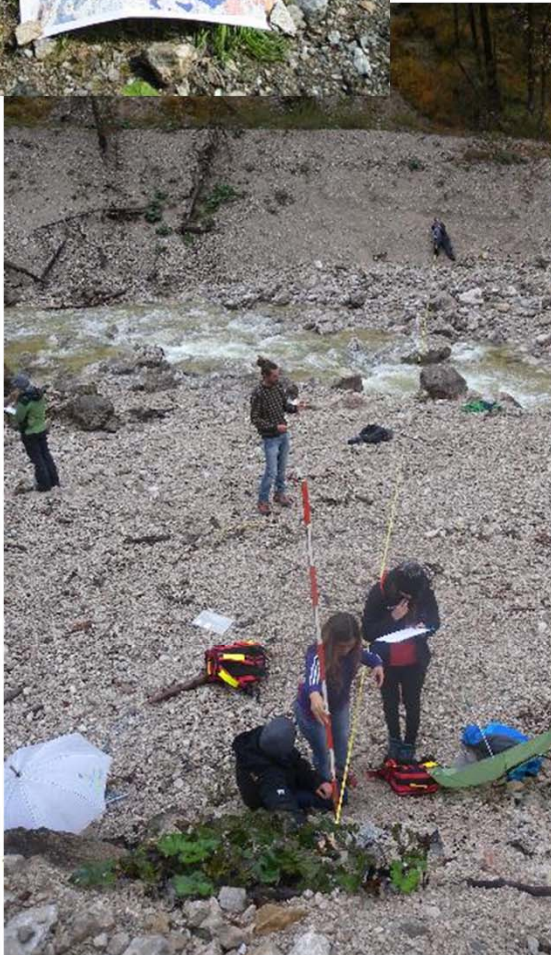
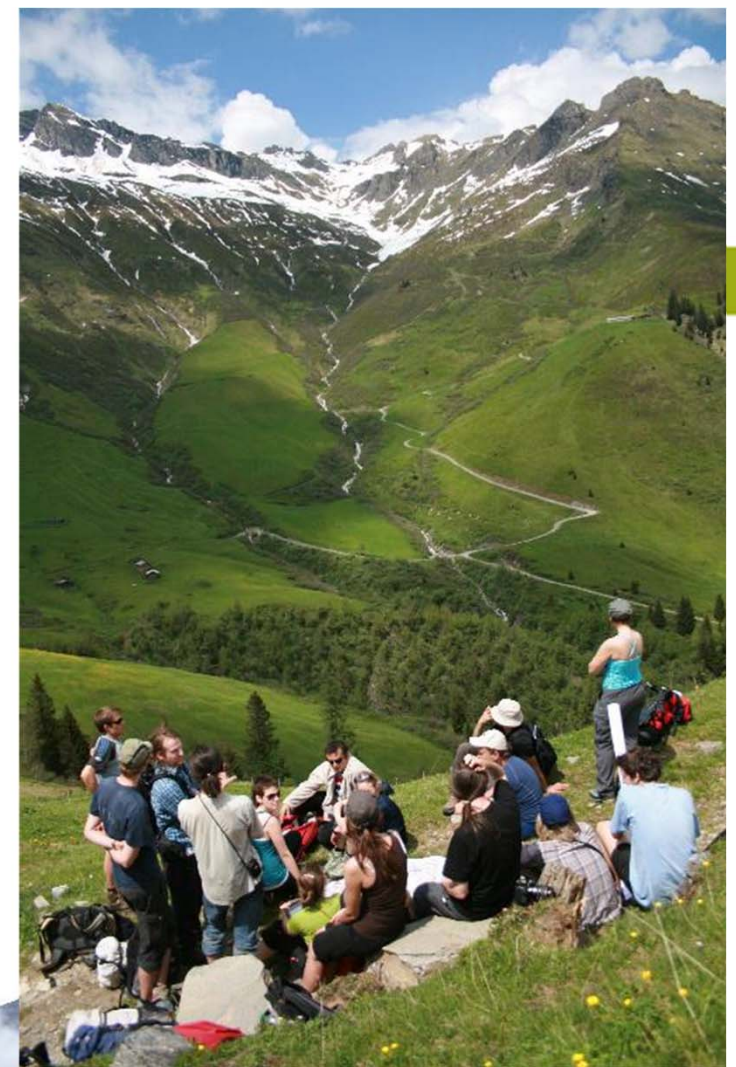


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# WMEE

## Structure overview

- Two year program, 120 ECTS in total
- Finishes with Dipl. Ing. (equivalent to MSc.)
- All courses are taught in English
- Prerequisite for admission: Bachelor/Master's degree or equivalent
- **Two specializations possible (confirmed by diploma supplement):**
  - **Water Management and Environmental Engineering (*WMEE*)**
  - **Mountain Risk Engineering (*MRE*)**
- Target group are people with an academic degree in civil/environmental engineering, forestry, earth science or similar
- Work field: engineering company, consulting, research, public institutions, development agencies, international organizations (EU)



# Water & Env. Eng. / Mountain Risk Eng.

Basic subjects, complementary subjects, engineering project

Choice of 6 out of 11 of sectoral subjects (moduls)

Sanitary engineering

Rural water management

Hydrology / water  
management

Hydraulic engineering /  
river basin management

Aquatic ecology and  
wetland management

Water management in  
developing countries

Waste management

Economy and law

Mountain hazard  
processes

Mitigation measures for  
mountain hazards

Risk management

Elective subjects, master thesis





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**Institute for Mountain Risk Engineering:**

**[www.boku.ac.at/ian](http://www.boku.ac.at/ian)**

**[www.alpine-naturgefahren.at](http://www.alpine-naturgefahren.at)**

**Contact:**

**[ian@boku.ac.at](mailto:ian@boku.ac.at)**