EGU 2018 - Costs of Natural Hazards

Estimating flood damage potentials by linking paleoflood records and empirical loss data

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09.04.2018, Vienna

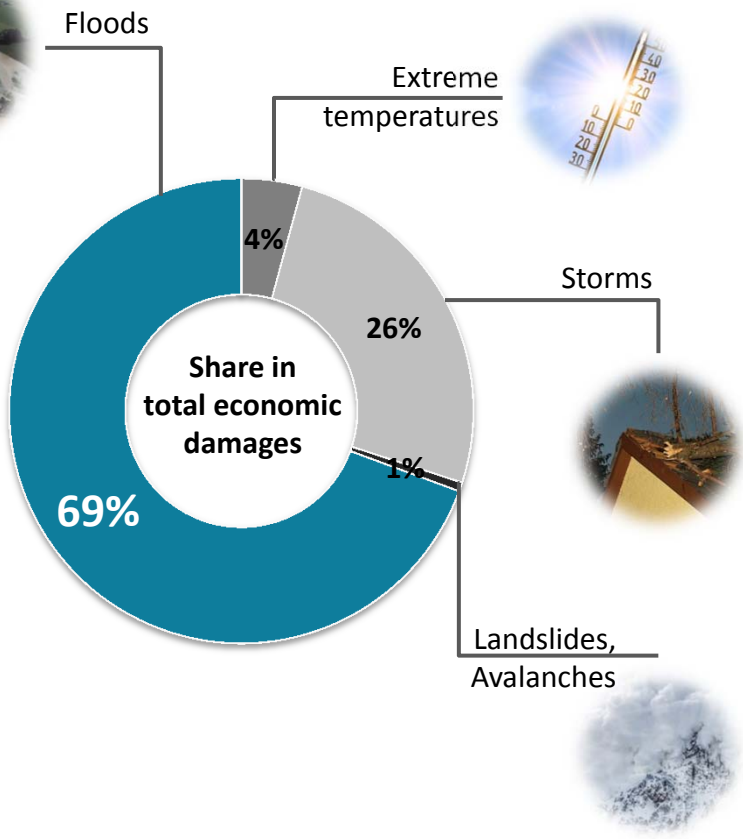
Motivation

- **Floods** are the leading cause of economic damages from natural disasters in Austria

- Estimations on current and future damage potential are of **high importance**

BUT

- Uncertainty is high – amongst others due to **short time series** on damage experience



Data source: EM-DAT; 1990-2016

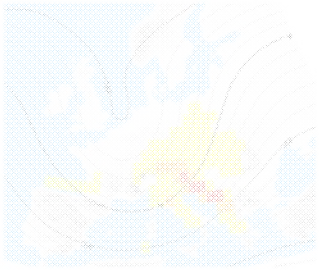
Objective & Methodology

Improve estimations on past, current and future flood damage potentials by making use of and merging different kinds of data sets (Focus: Northern Austria)

Paleoflood records
~7000 years of Lake Mondsee sediments

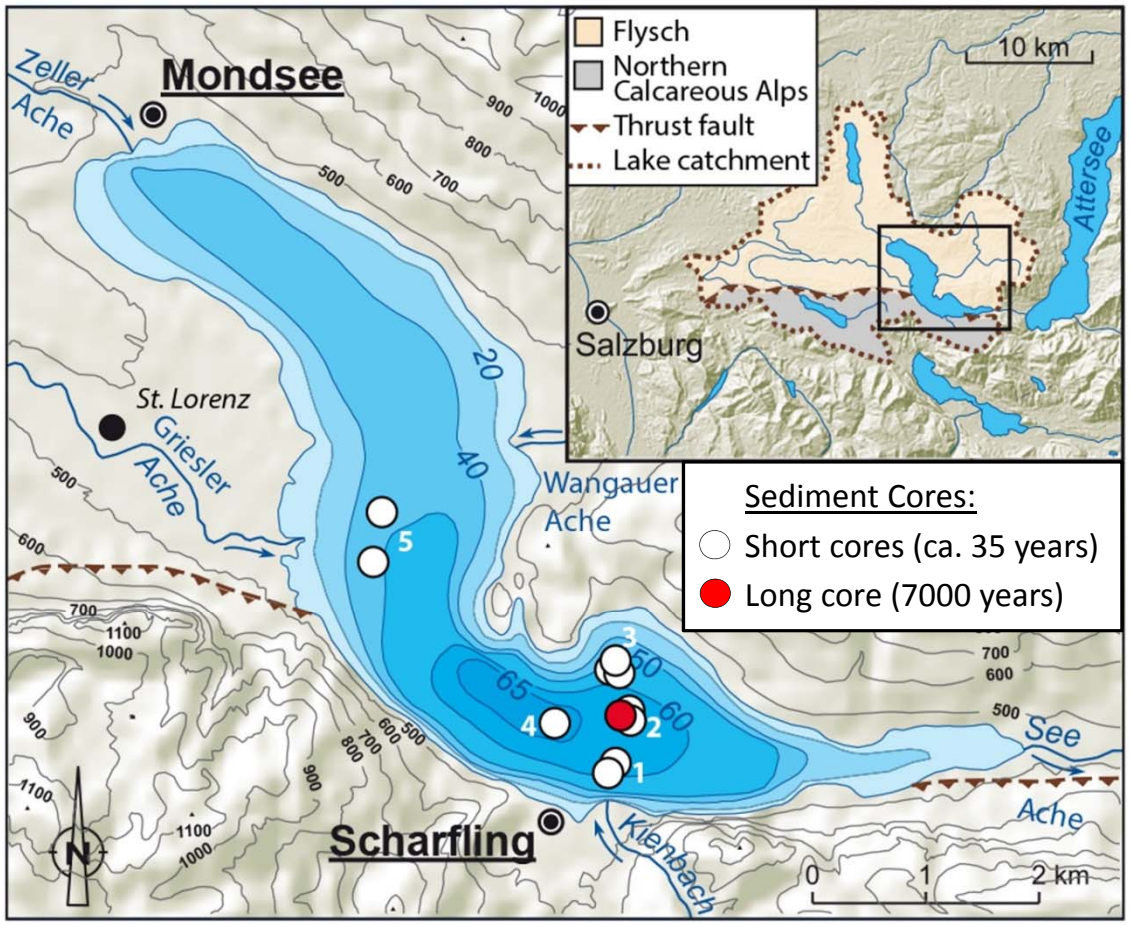
Refined estimates on **flood damage potentials**

Cyclone tracks & precipitation totals
1959-2015 & 2015-2100
Mondsee region



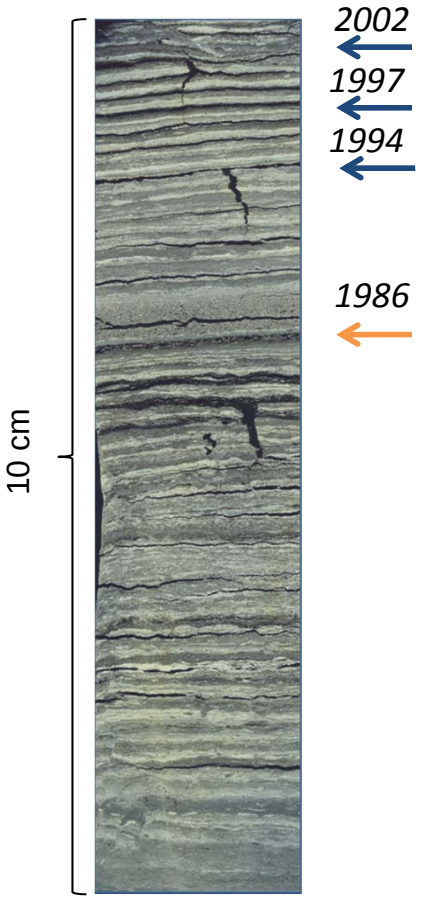
Loss data
on buildings for up to 25 years at municipal resolution

Project study: Mondsee (Upper Austria)



Altitude: 481 m asl, **Lake surface** 13.8 km², **Depth (max):** 68 m, **Catchment:** 247 km²

7000-year flood series from Mondsee sediments



Laminated Mondsee sediments (varves):

- Spring/Summer calcite layer, diatoms (algaes)
- Autumn/Winter clastic debris
- Abundant event layers
  - → Flood layers
  - → debris flows layers

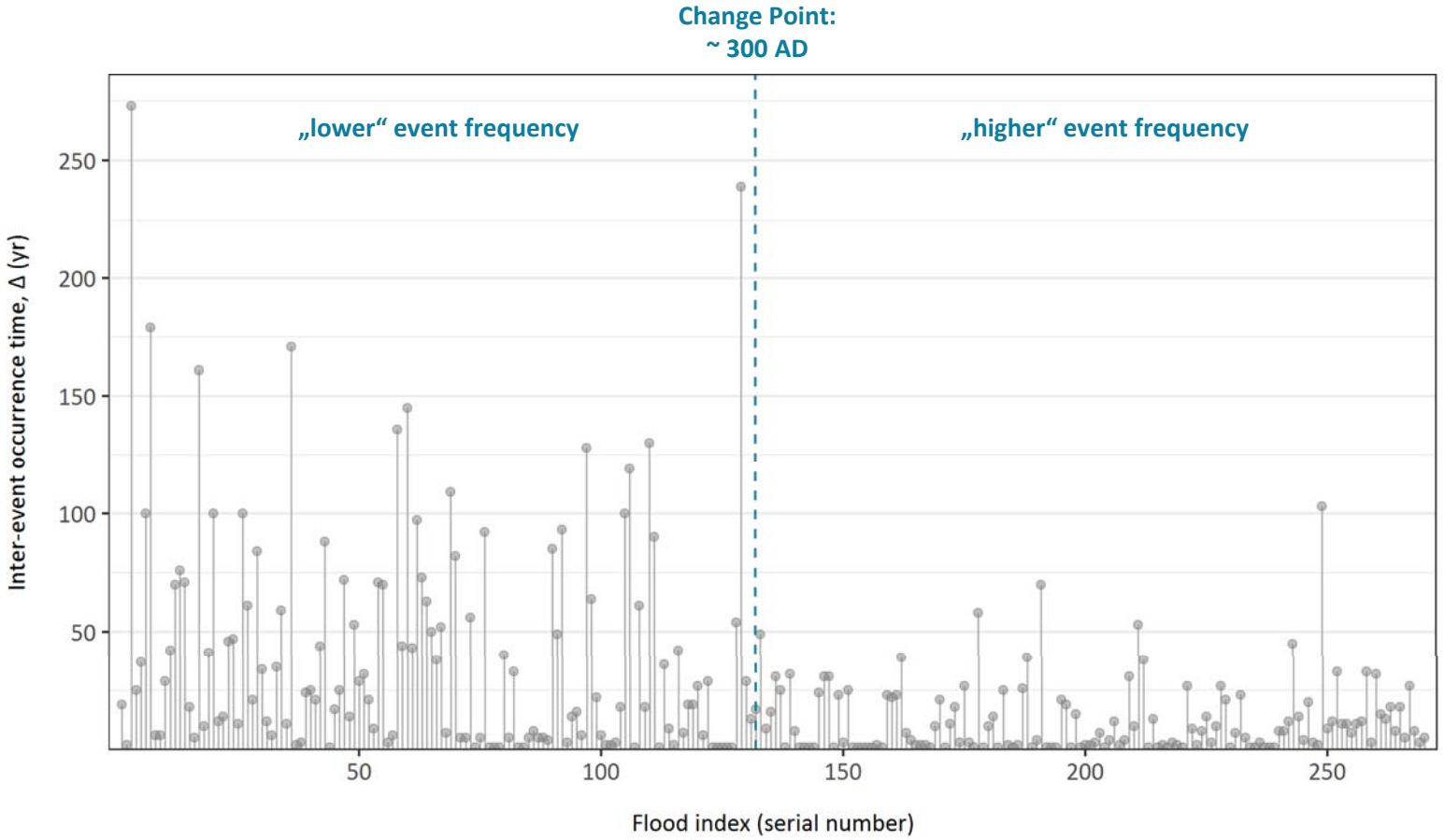
Event layer reconstruction:

Extreme precipitation in summer causes floods and debris flows that lead to detectable sediment input into the lake

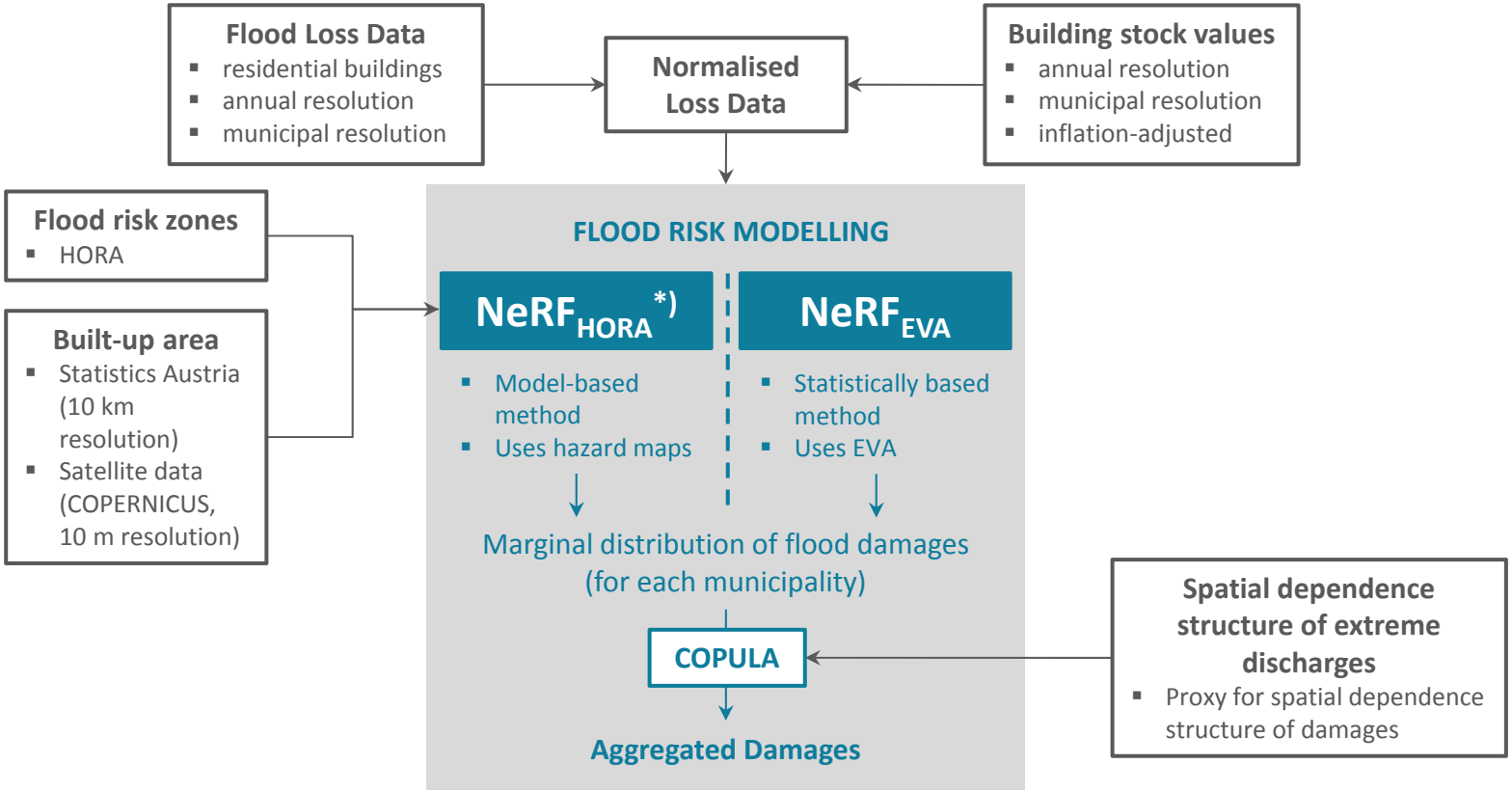
Sediment records

- Change Point(s)

  indicated by a Change Point Analysis on inter-event occurrence times



Method 1: Flood risk modelling using loss data



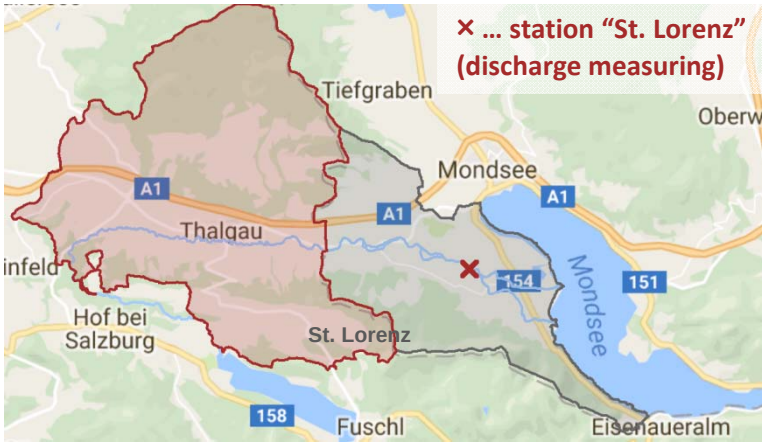
NeRF: **Ne**ighborhood
Relationship **F**lood risk model

*) based on Prettenthaler, F., Kortschak, D., et al. (2015): *Catastrophe Management: Riverine Flooding*, in Steininger, K. et al. (ed.) Economic Evaluation of Climate Change Impacts: Development of a Cross-Sectoral Framework and Results for Austria, Springer.

Method 2: Flood risk modelling using sediment & loss data

Probabilistic procedure

to relate sediment records to loss data



Map data ©2017 GeoBasis-DE/BKG (©2009), Google

1 Probability of "high" discharge

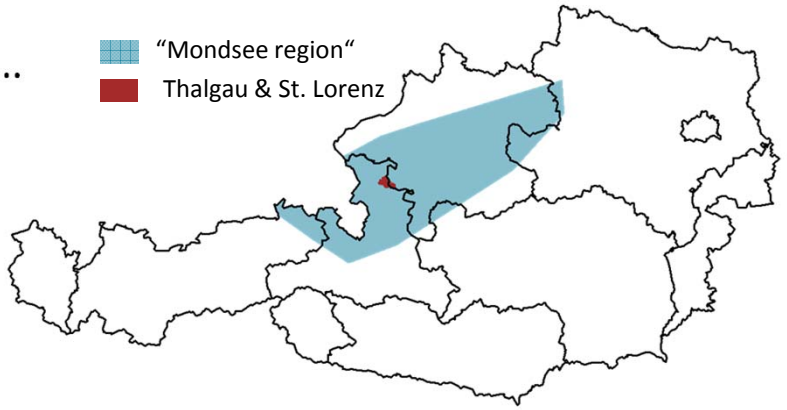
Griesler Ache (station St. Lorenz):
yearly max. peak discharge > 80 m³/s

2 Damage threshold for municipality Thalgau

Use $NeRF_{EVA}$ & $NeRF_{HORA}$ to calculate Value at Risk, based on probability of "high" discharge (1)

3 Conditional probability distribution of damages …

… for municipalities in the "Mondsee region", given that the damage in Thalgau is above or below the damage threshold of (2)



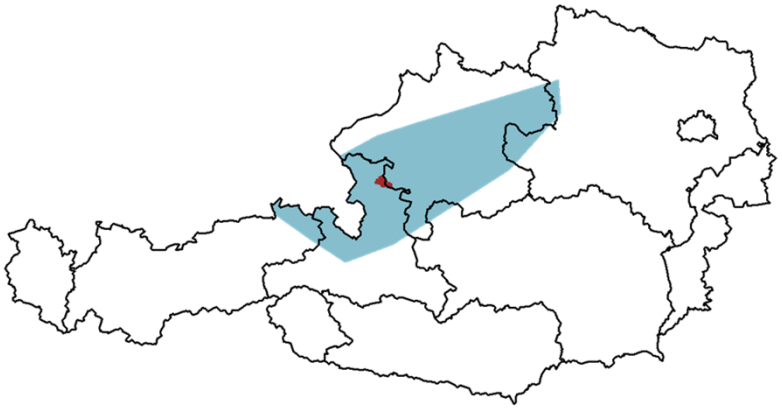
4 Probability that "high" discharge coincides with flood record in sediment data

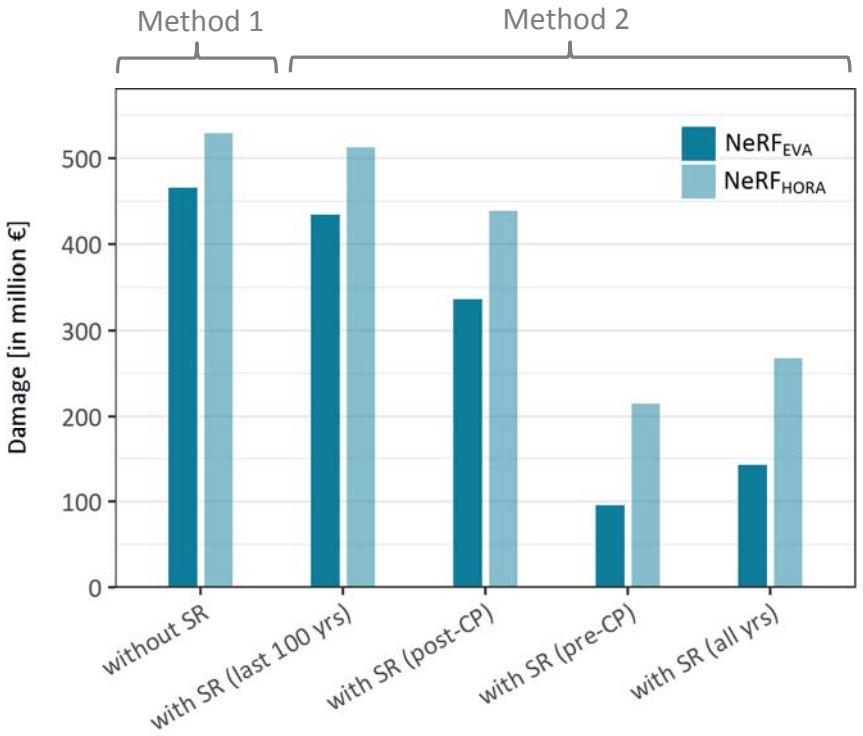
Preliminary results

- Estimated damage of a 200-year event
  for the "*Mondsee region*"

"***Mondsee region***":
Region with similar discharge extremes
as station "St. Lorenz"

Thalgau & St. Lorenz





SR … Sediment Records, CP … Change Point

Discussion of the proposed procedure

- Advantages
  of using sediment records
  - Long time periods with information on variability of event frequency
  - Relationship between current experience and former centuries

- Limitations
  of using sediment records
  - No information on event size in sediment records
  - Uncertainties in relationship between sediment records and loss data
  - Reasons for regime changes in flood occurrence (sediment records) uncertain (climate change or other reasons?)

Thanks for your attention!

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This study is part of the FloodRisk-7000 project (https://floodrisk.joanneum.at) funded by ACRP 2015, 8th Call