Extreme Weather Exposure Identification for the Primary Road Network in the Alpine Region

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Motivation

Trigger

Storm rainfall / hail event (return period: 25 years)

Effects

The mudslide buried the Tauern Autobahn (A10) between km 77.8 and km 78.0 at a length of about 200 meters with about 2000 m^3 of mudslide debris.

Motivation

Background

Against the background of global climate change, AIT aims at developing a **holistic risk assessment procedure** for ensuring high functional performance of the transportation infrastructure in the Alpine region.

Aim

Providing a **quantitative basis** for assessing the exposure of the primary road network in Austria to extreme weather events.

Research Question

How can the **exposure** of roads to extreme weather events be assessed?

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Extreme Value Analysis

Selection of Meteorological Indicators

Precipitation

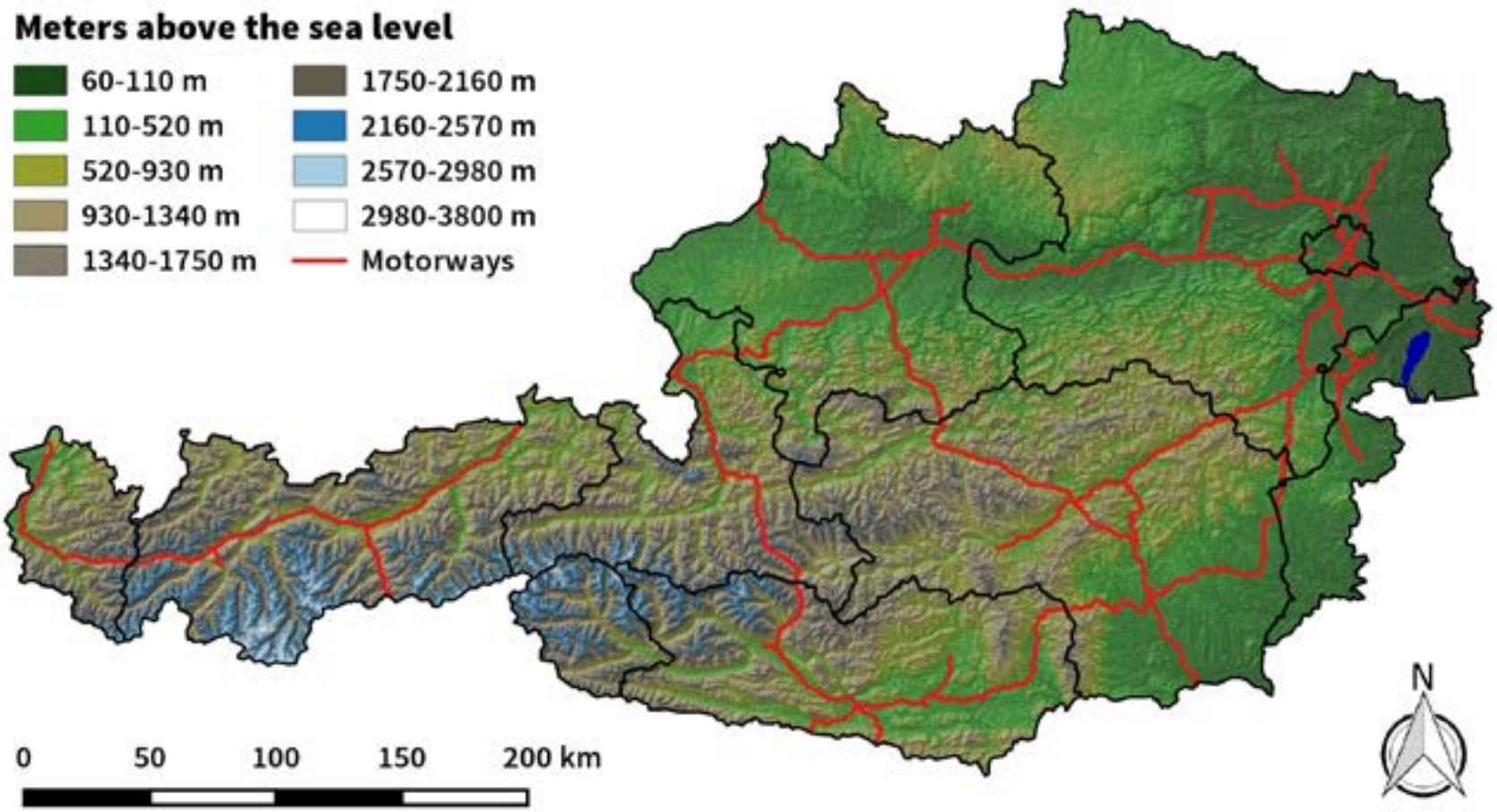
- Daily Rainfall Extremes [mm/d]
- Incessant Rainfall Extremes [mm/5d]

Temperature

- Freeze-Thaw Days [d/a]
- Heat Spells [d/a]

Extreme Value Analysis

Highways in Austria



Projection: MGI / Austria Lambert

Data Source: Project oe3d (based on BEV DGM, STRM Version 2.1, ASTER DEM) and OpenStreetMap.
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Extreme Value Analysis

Highways in Austria

Extreme Value Analysis

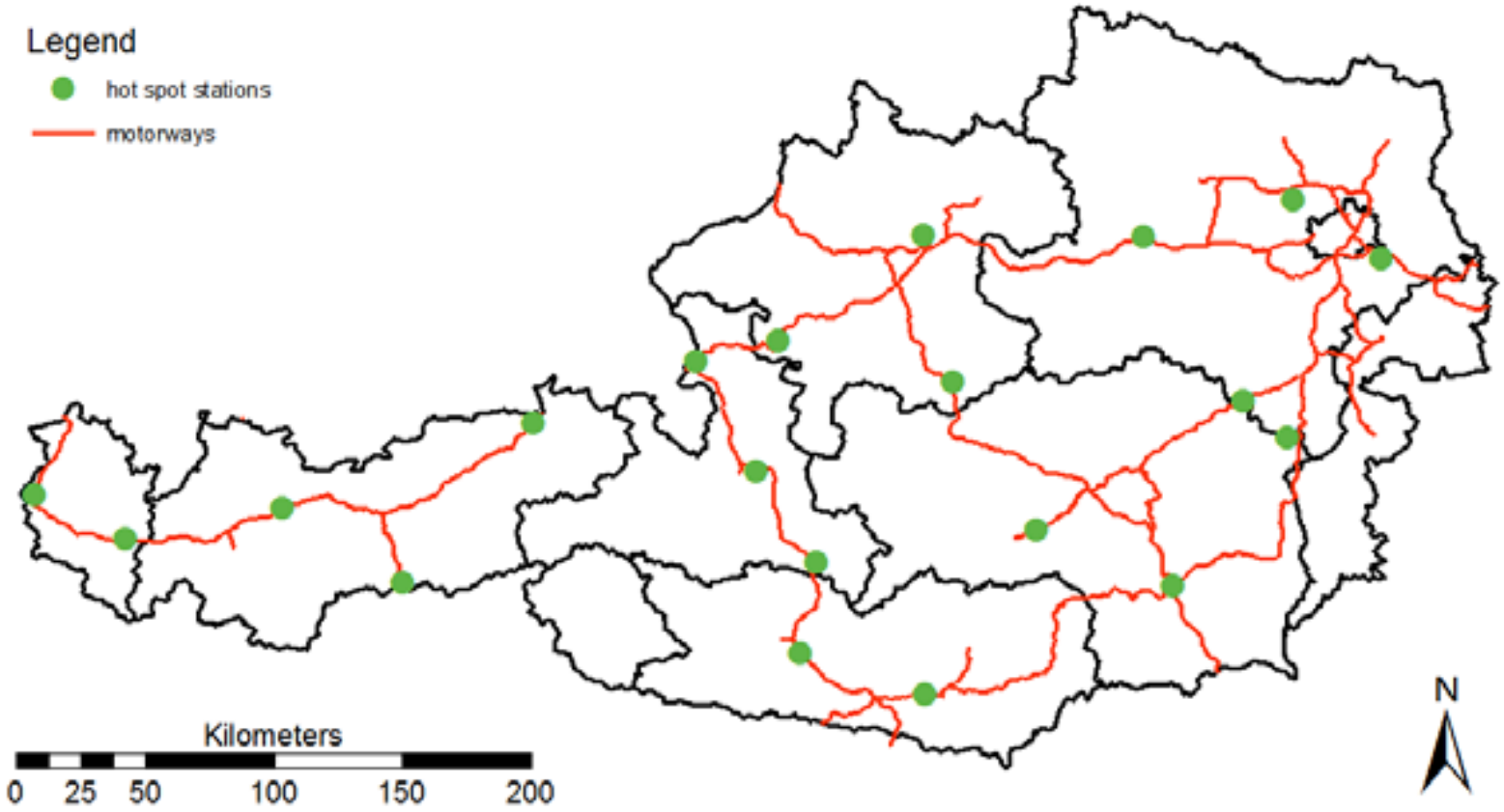
Selection of Hot Spot Regions

20 Hot Spot Regions in Austria are selected on the basis of the following considerations:

- Proximity of available measuring stations to the highway network
- Data quality and data availability
- Stations are chosen under the premise that the selected regions are evenly spread throughout Austria

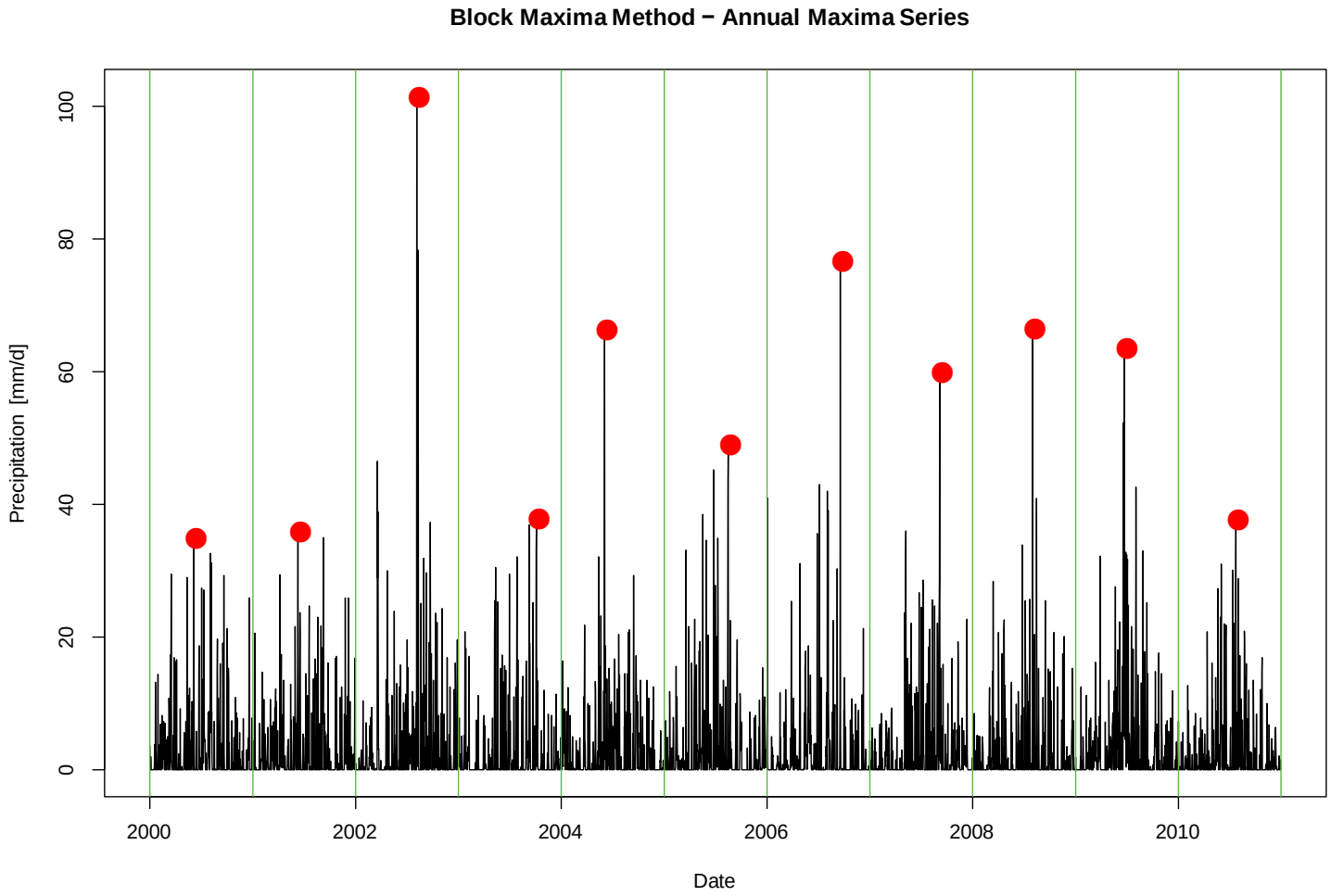
Extreme Value Analysis

Selection of 20 Hot Spot Regions



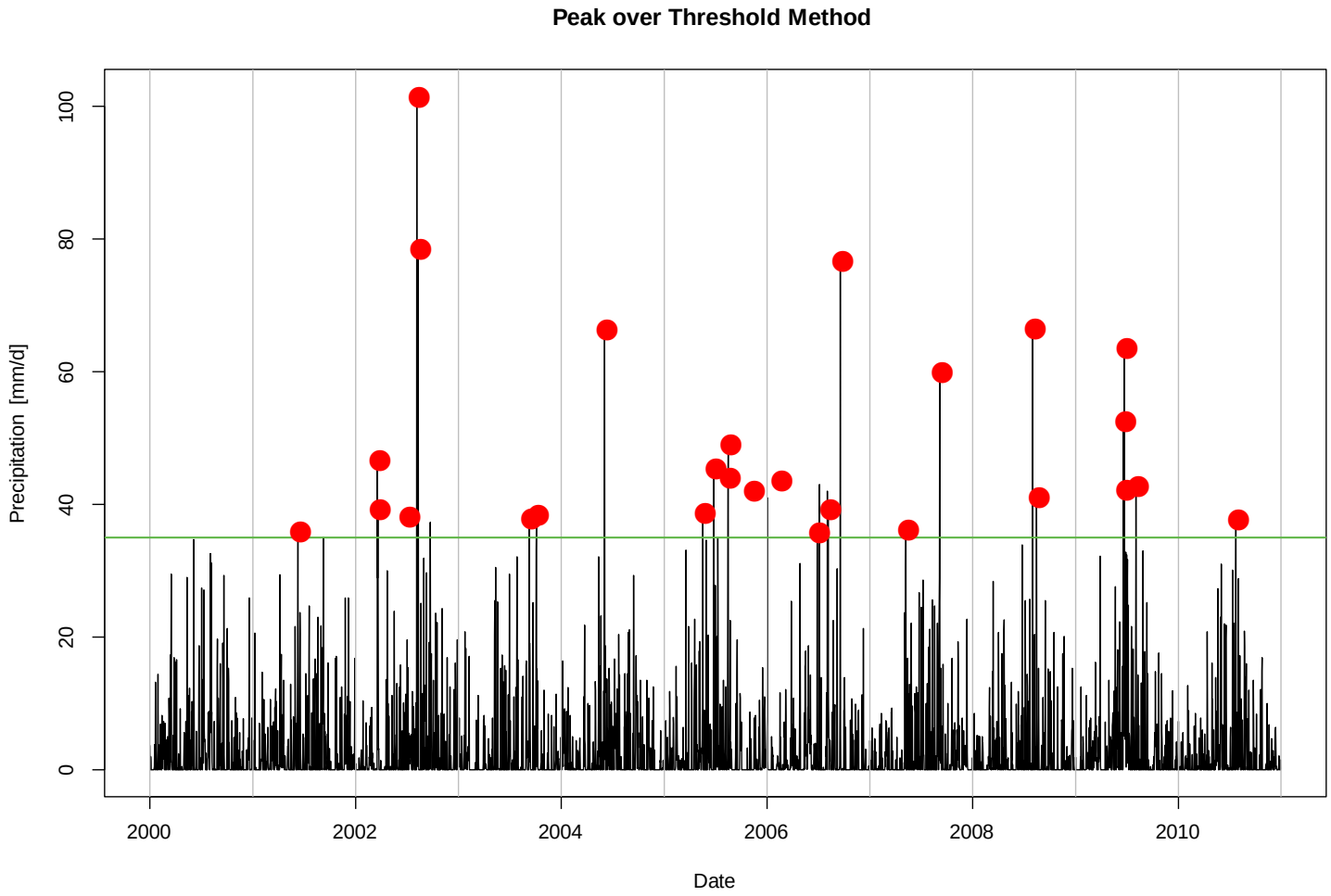
Extreme Value Analysis

Extreme Value Selection - Block Maxima



Extreme Value Analysis

Extreme Value Selection - Peaks over Threshold



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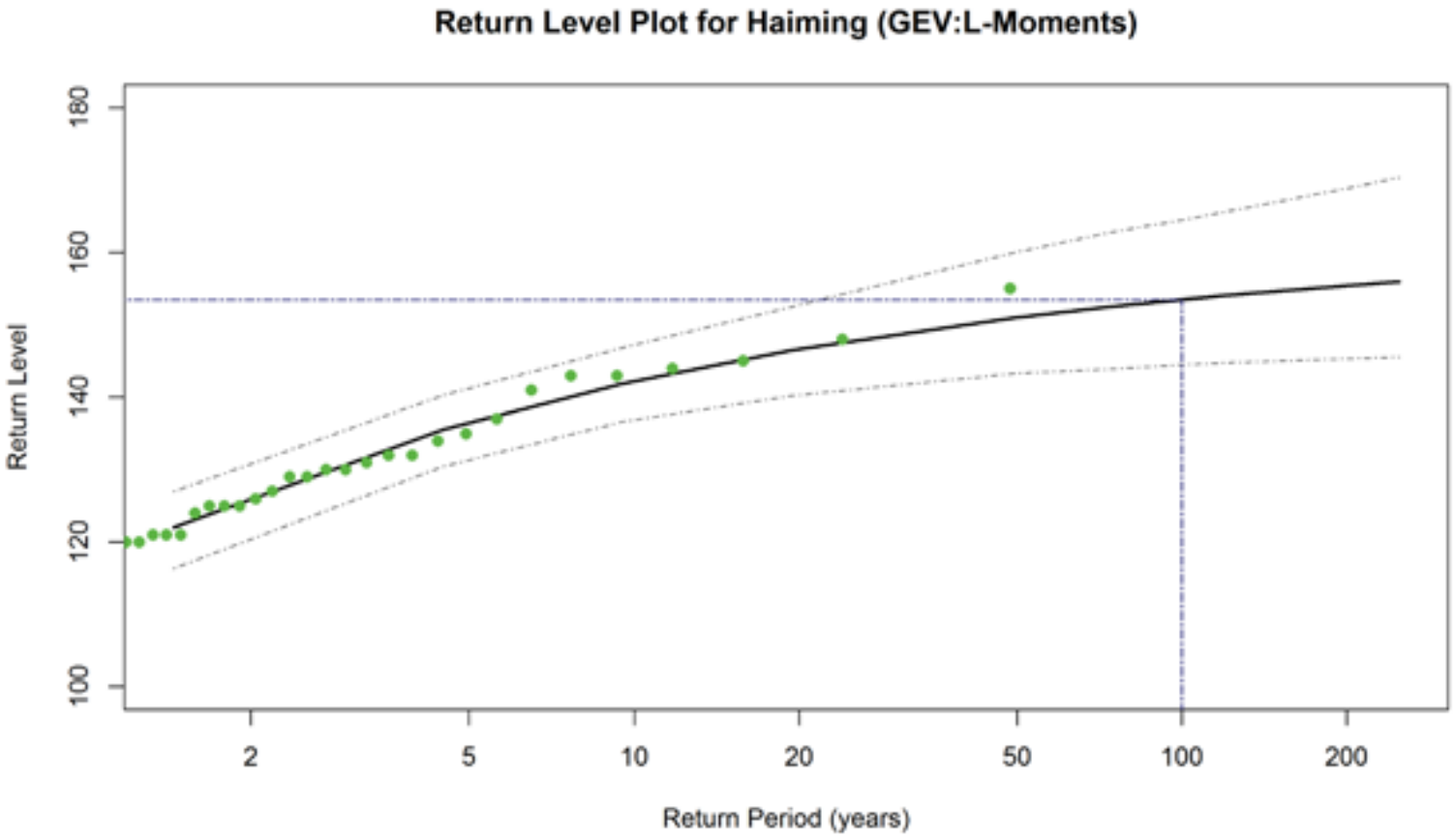
Extreme Value Analysis

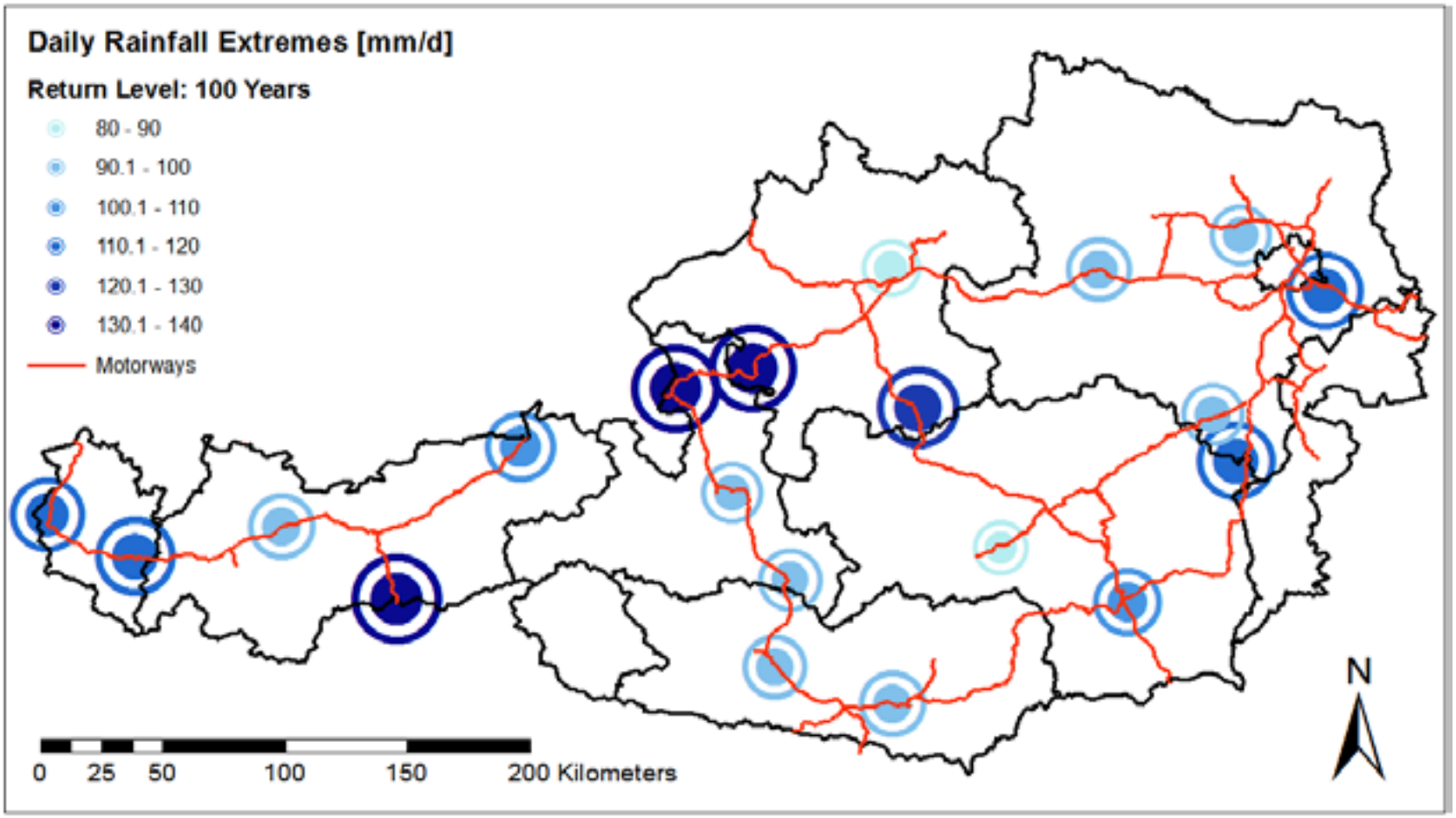
Fitting Results – Return Level Plots

Freeze-Thaw Days
(Haiming)



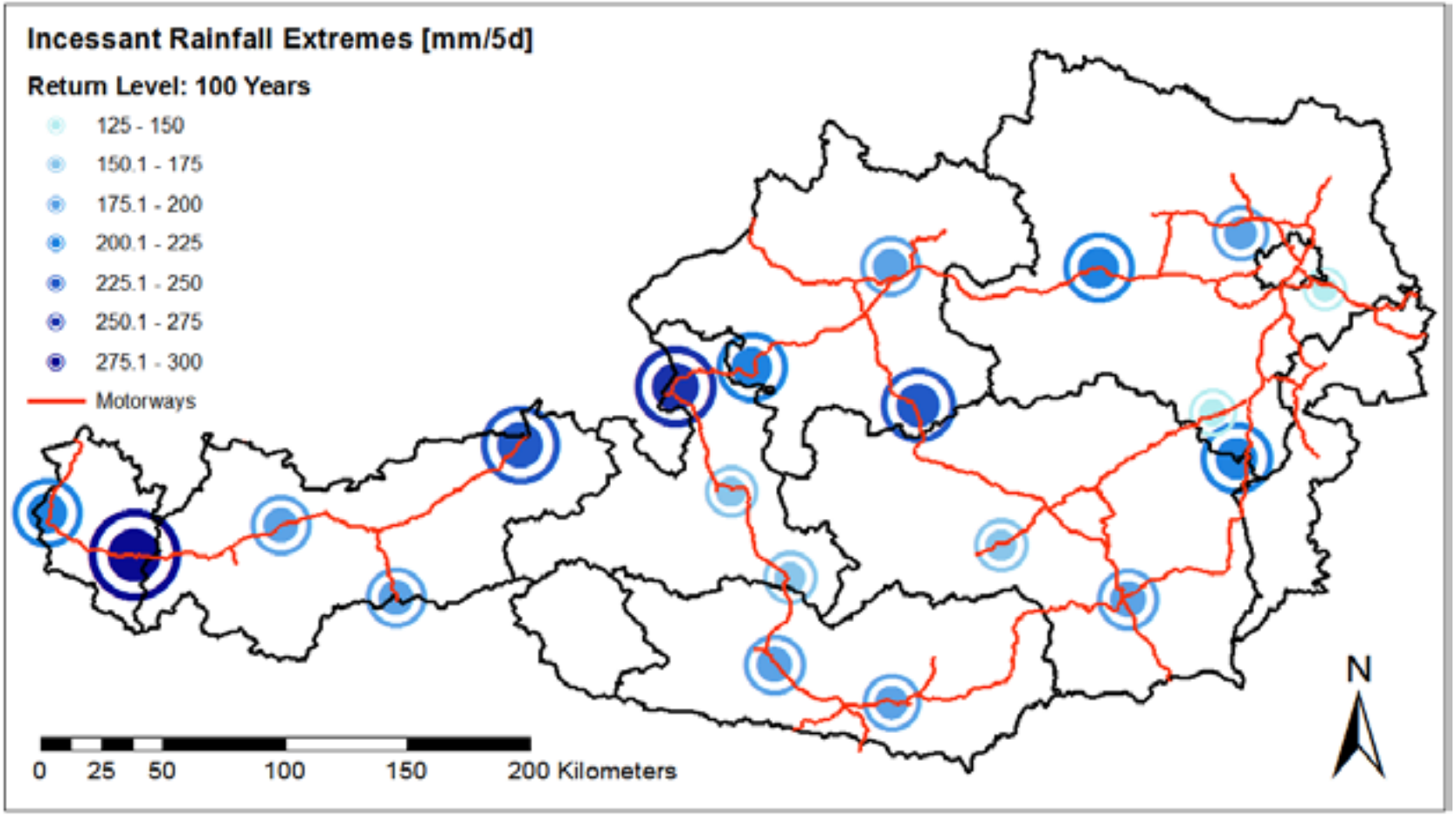
Extreme Value Analysis

Daily Rainfall Extremes



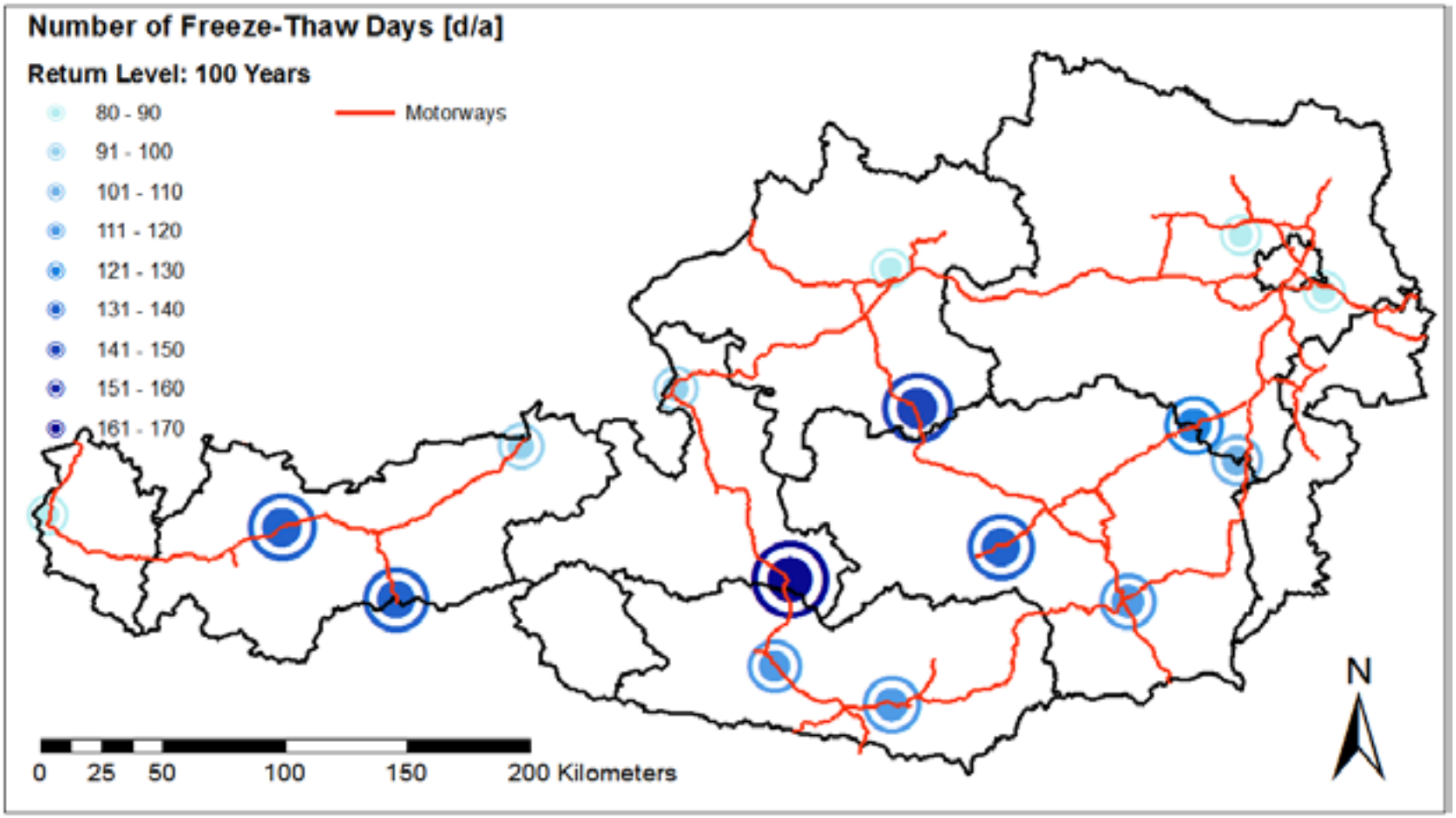
Extreme Value Analysis

Incessant Rainfall Events



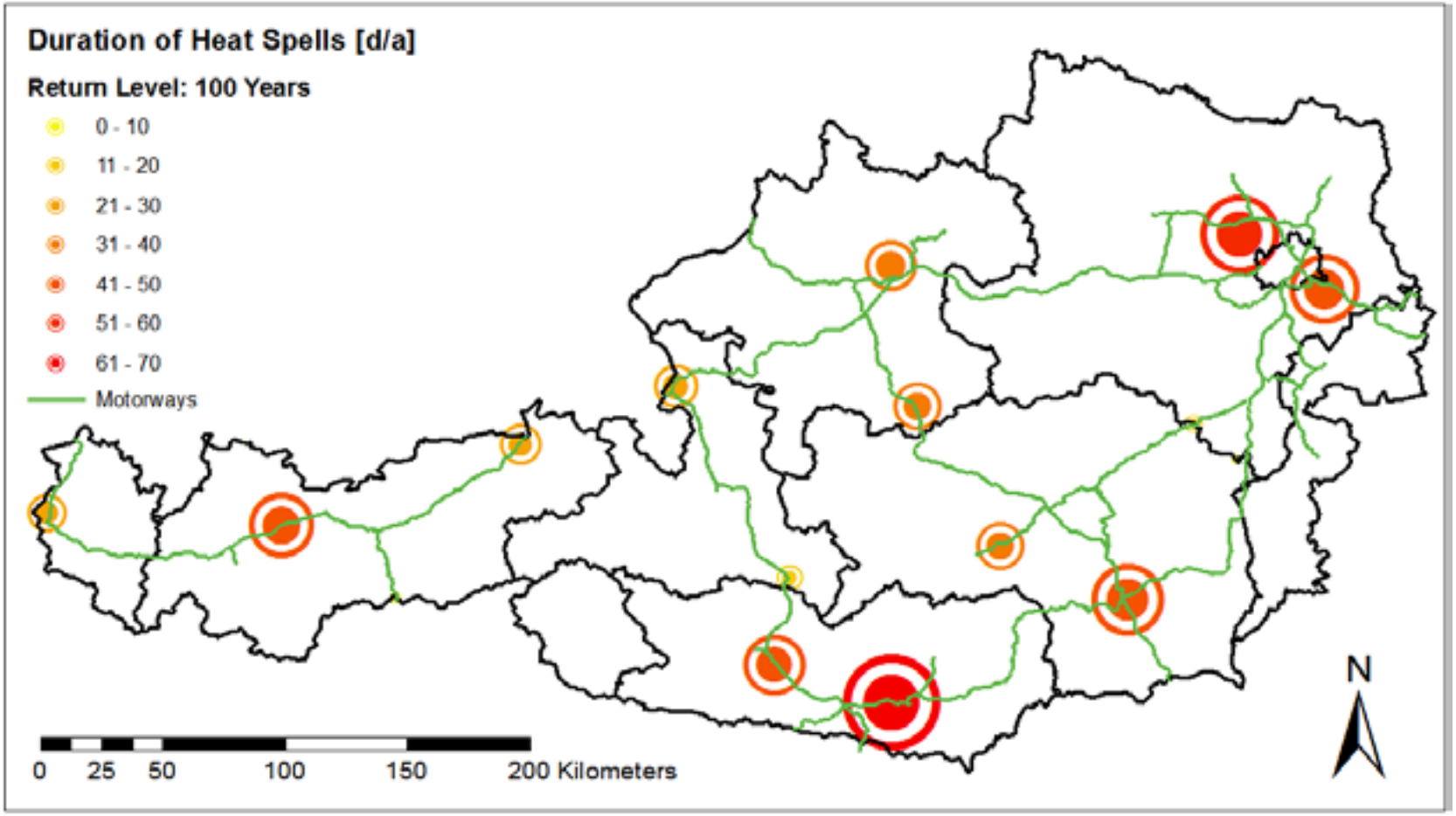
Extreme Value Analysis

Freeze-Thaw Cycles



Extreme Value Analysis

Heat Spells



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Conclusions

Extreme Value Analysis

- Readily usable and easily applicable methodology for estimating return levels of precipitation and temperature indicators at any hot spot.
- Robust estimation methods are recommended for weather data.
- If applicable, the peak over threshold approach provides better results.
- GEV is a suitable distribution for modelling the number of freeze-thaw cycles.

Strengths and Limitations

- The concept of hot spots works well for a **basic analysis** of inhomogenious regions.
- Data for **sufficiently long time series** might be difficult to get.
- Consideration of exposure to extreme weather is only the **first step** towards a holistic risk management system.

Outlook

From exposure to risk

- Analysis and modelling of the impacts of adverse weather events on road accidents in Austria.
- Analysis and modelling of the impacts of adverse weather events on road infrastructure in Austria.
- Identification of potentially threatened areas in Austria
  $\longrightarrow$ risk mapping.

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