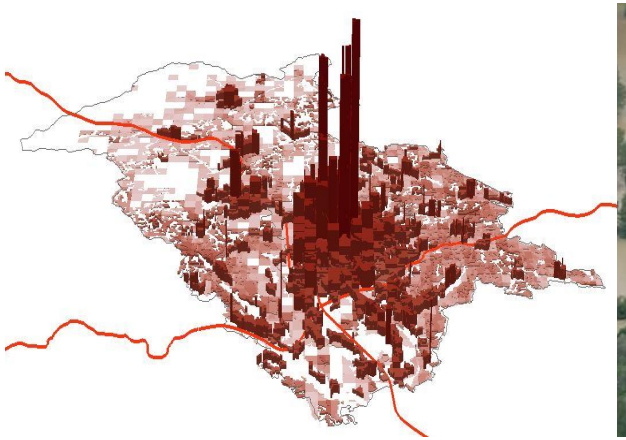
JOANNEUM RESEARCH POLICIES

CHR – Spring Seminar



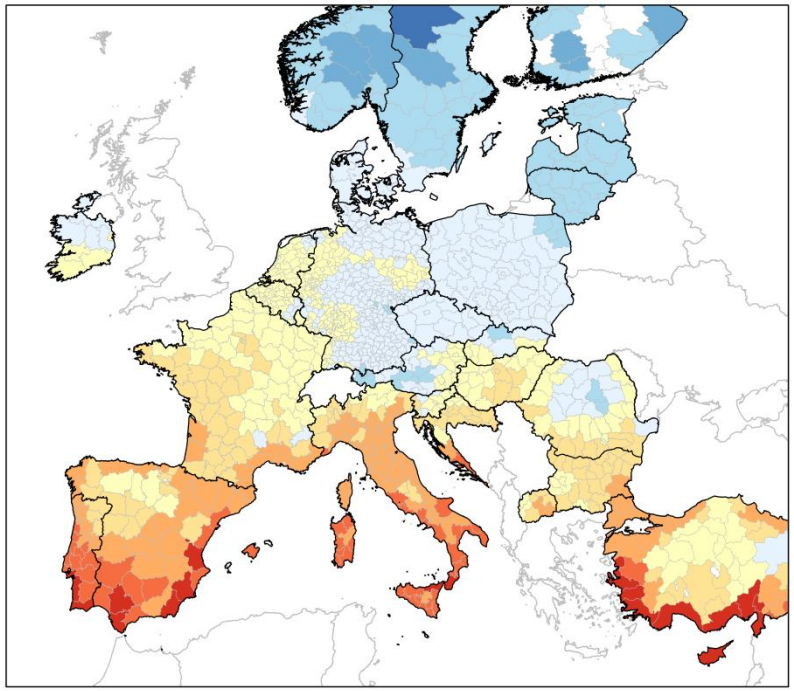
Building value data for normalizing damage data and develop socio economic scenarios

Dr. Franz Prettenthaler

Bregenz, 26 March 2014

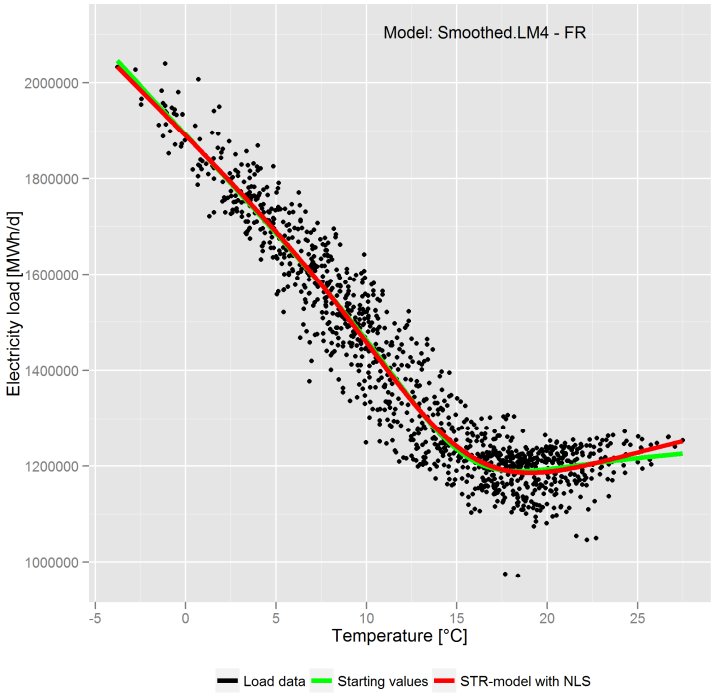
Socio-economic scenarios really matter in CC impact research

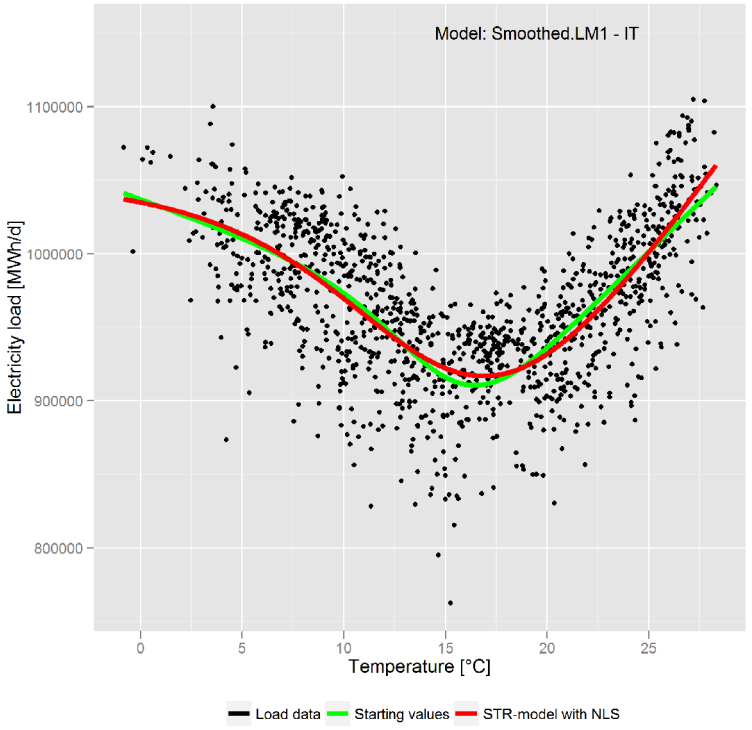
Hybrid indicators: Also (Average) Temperature is a socio-economic fabric



Weather & climate sensitivity of electricity demand

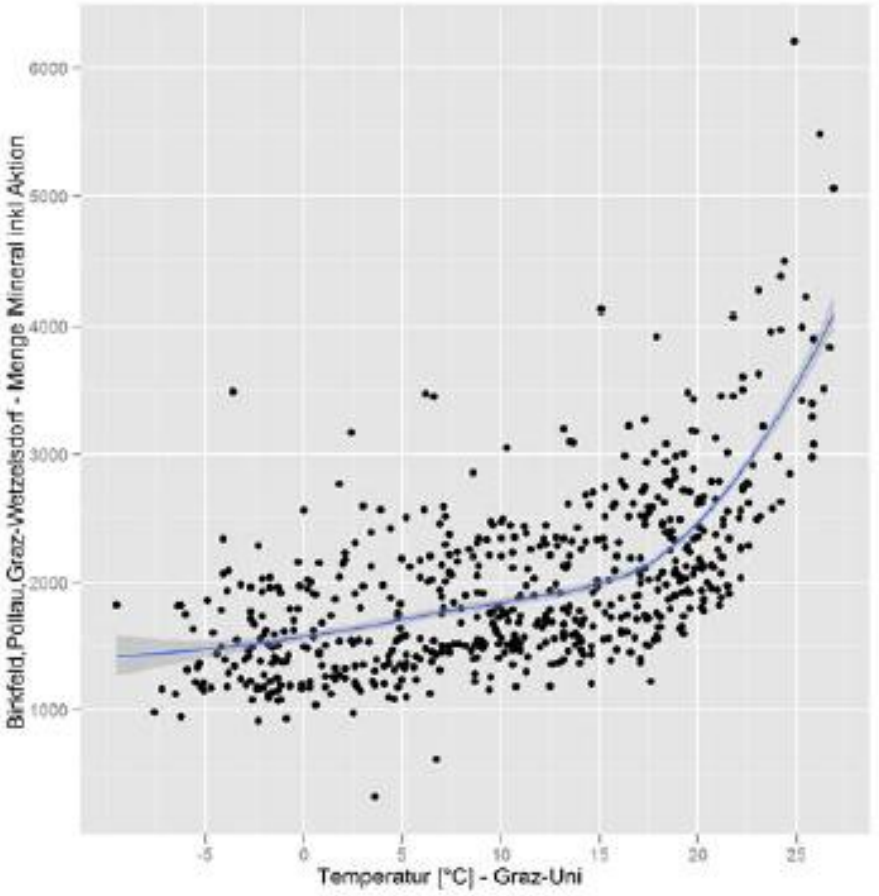
- e.g. France vs Italy



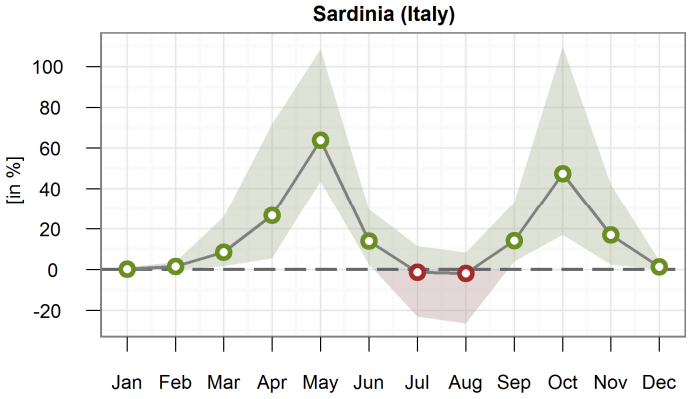


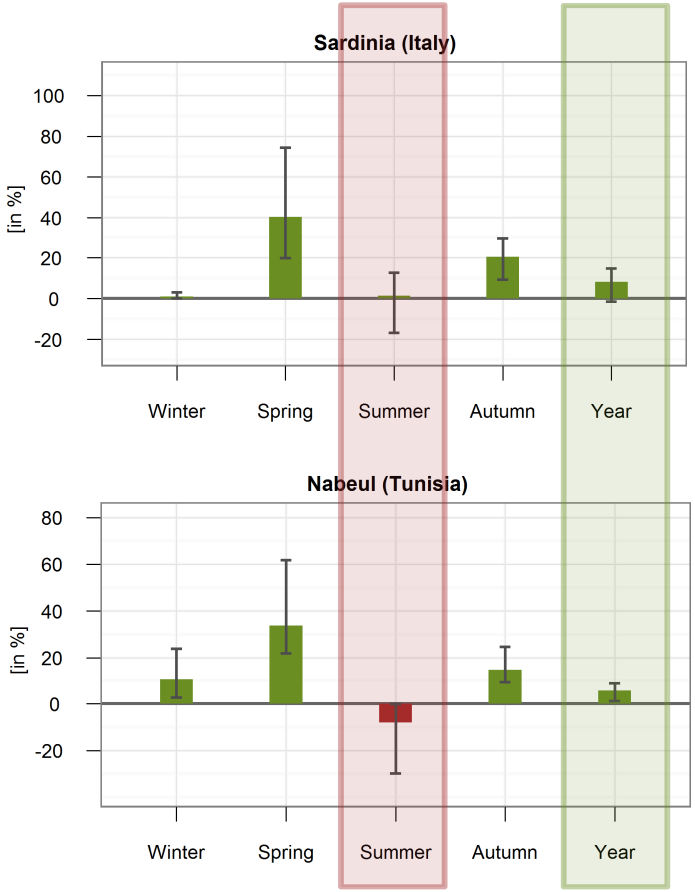
Drinking water temperature sensitivity

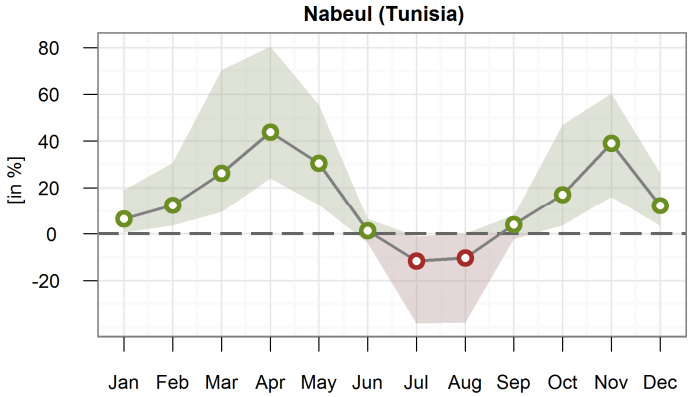
- 15 °C → 20 °C
  - **+ 18 %**
- 20 °C → 25 °C
  - **+ 54 %**



Expected change in overnight stays (in %) due to change from reference (1971-2000) to future (2041-2070) climatic conditions





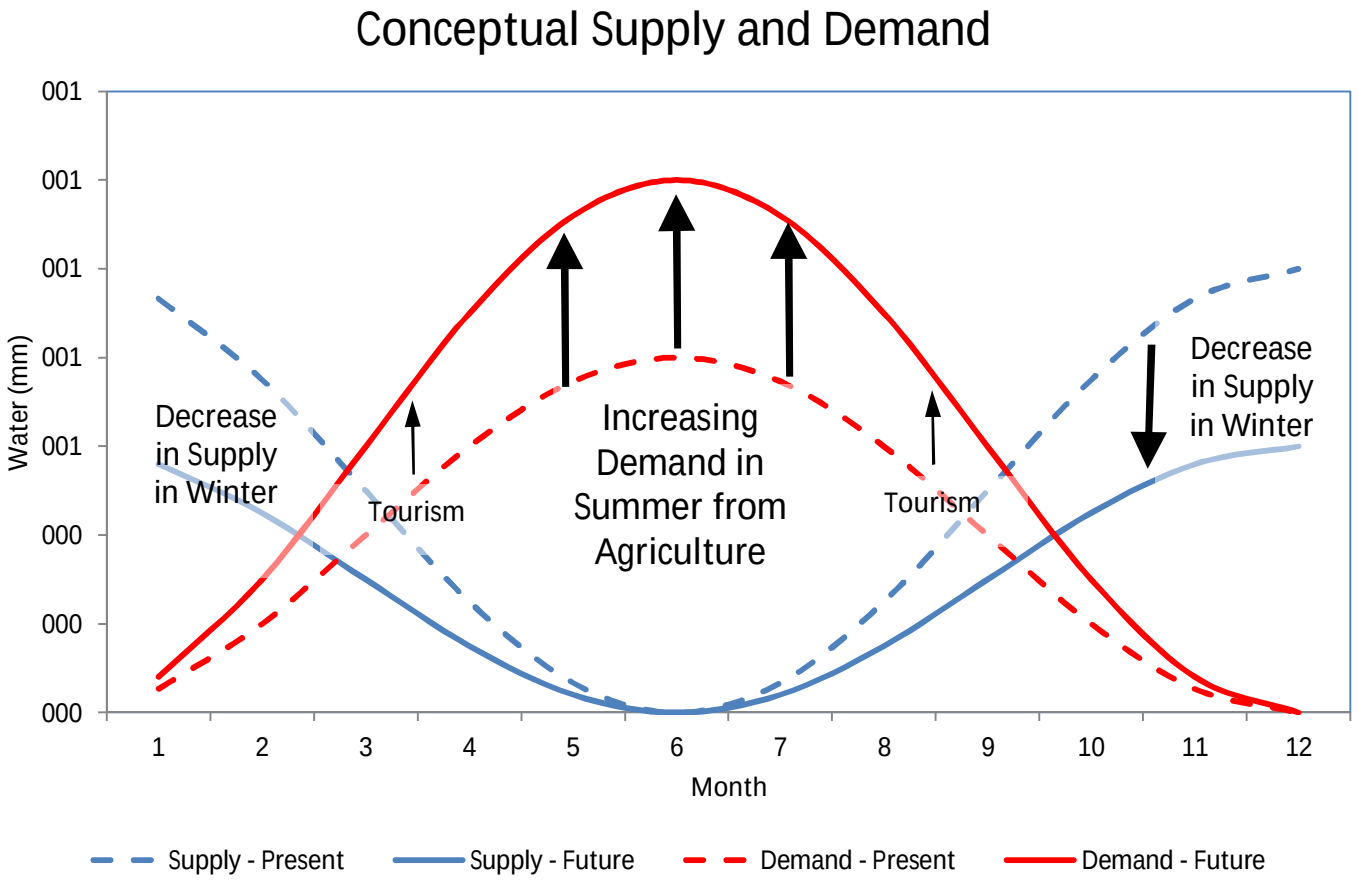


Potential losses in summer ...

... BUT ...

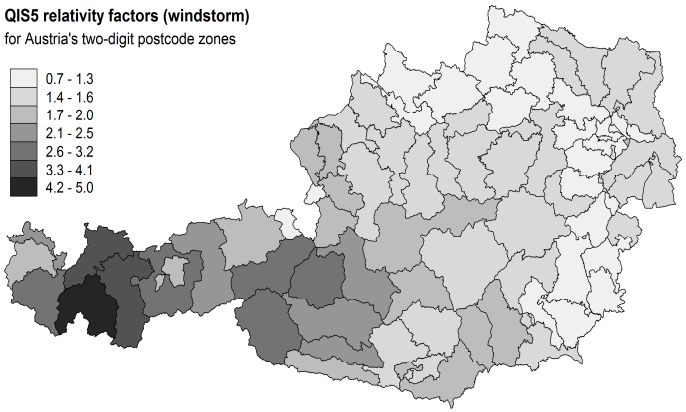
... tendentially positive annual net impacts.

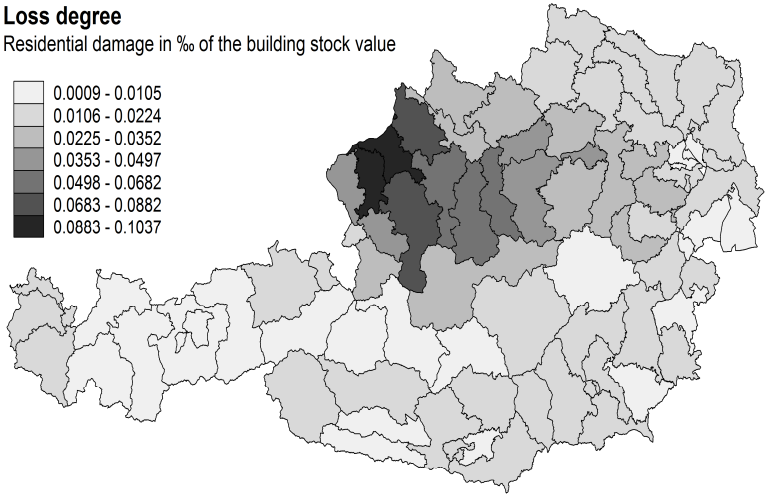
The main Challenge



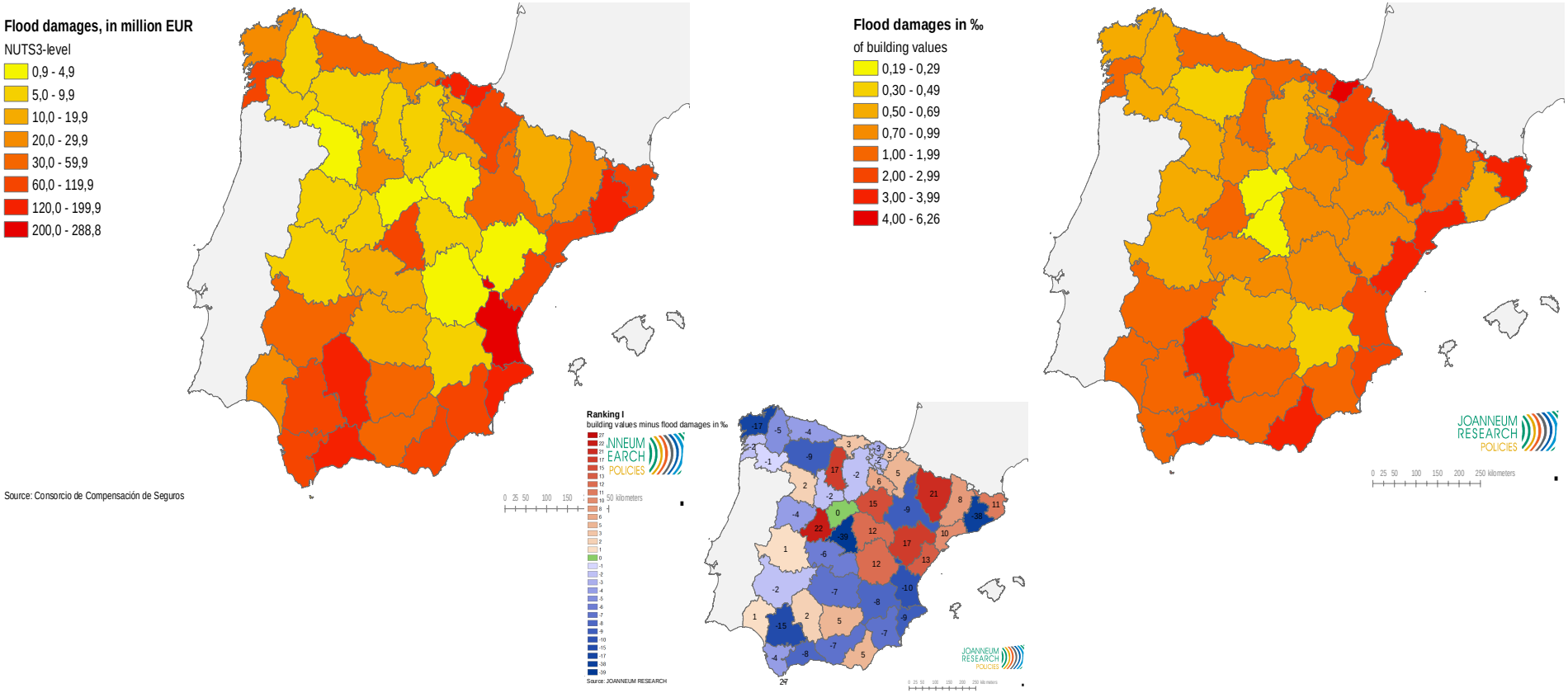
Results of neglecting socio-economics

- Normalized damage based risk modelling is under-developed in Europe
  - Global vs regional scale based modeling
  - Damage and exposure data make the difference

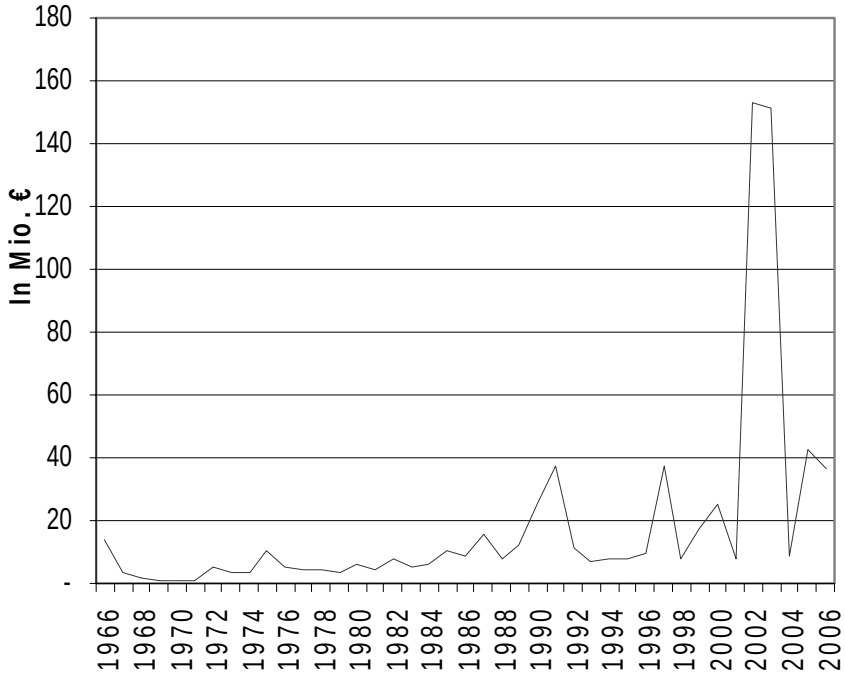


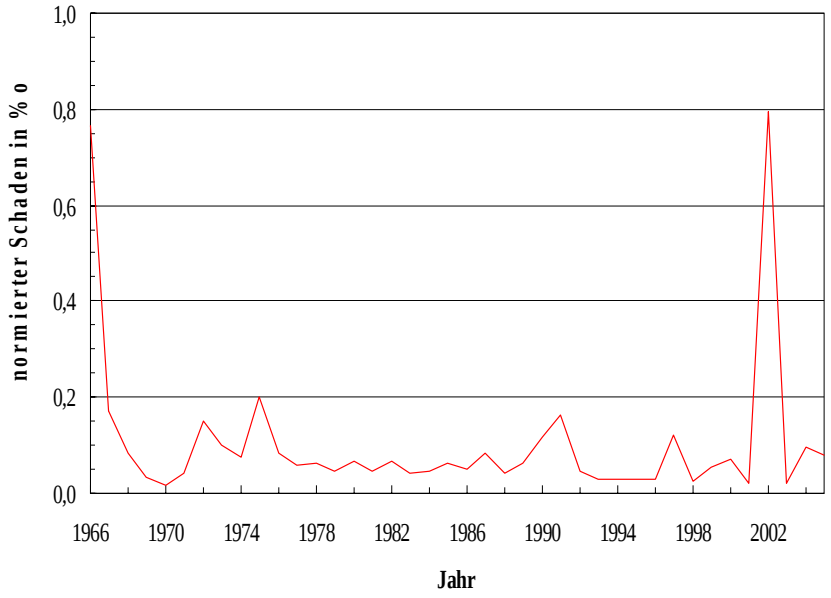


Regional normalization matters

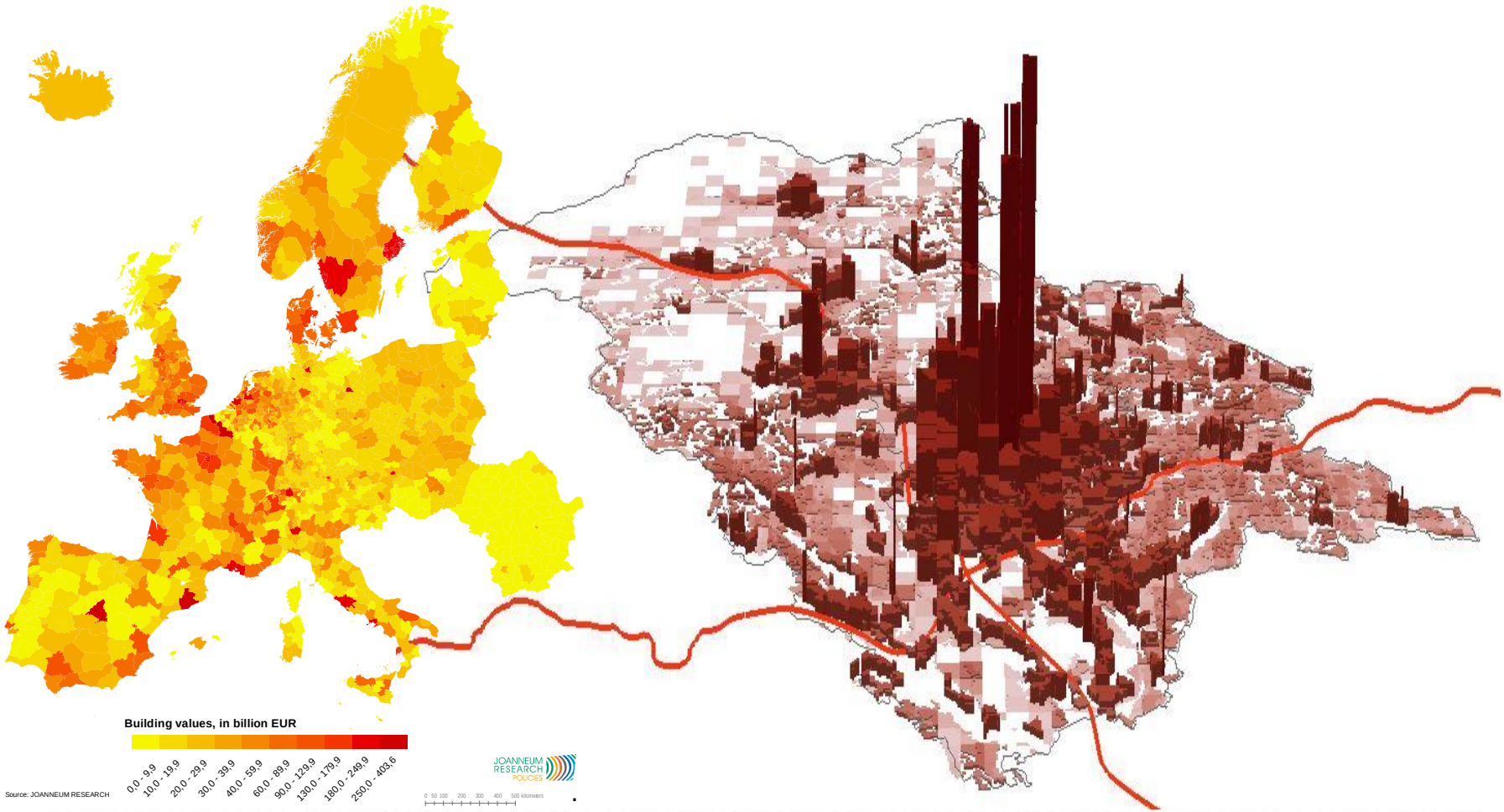


Temporal normalization matters



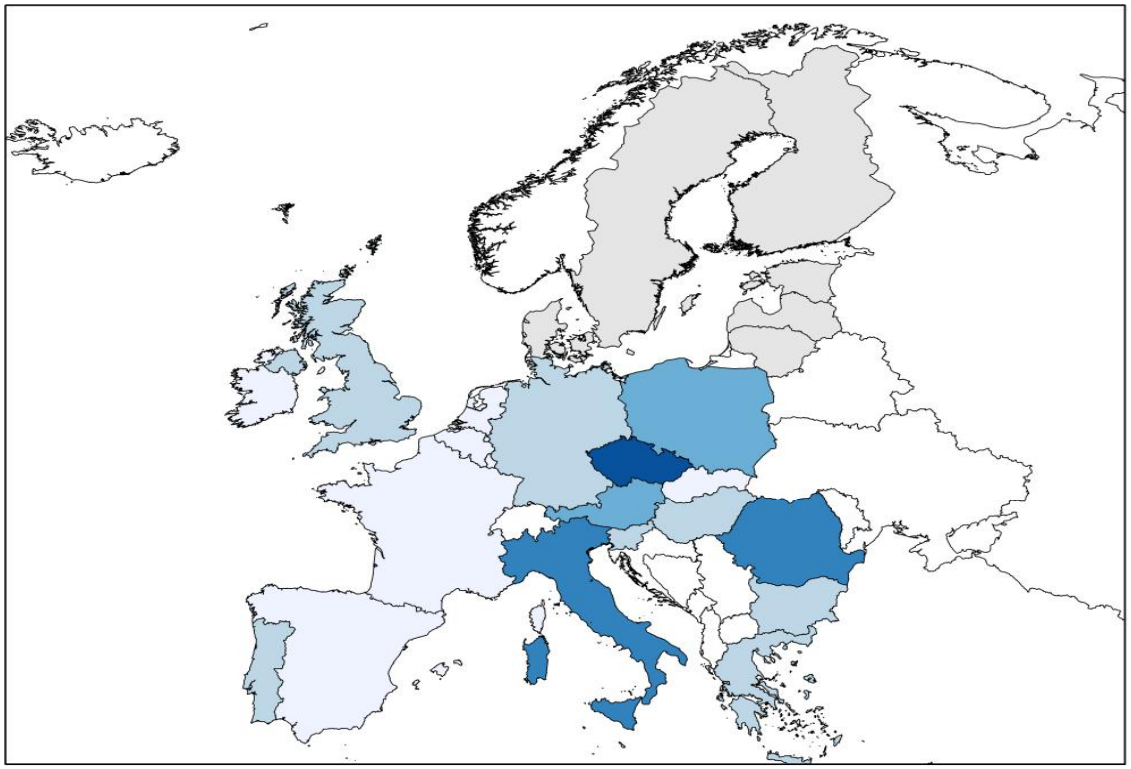


Start taking vulnerability serious



City of Graz, in mio. €, by 100m x 100m raster cells

Annual average total losses (1990-2010) as % of 2010 GDP - Flood

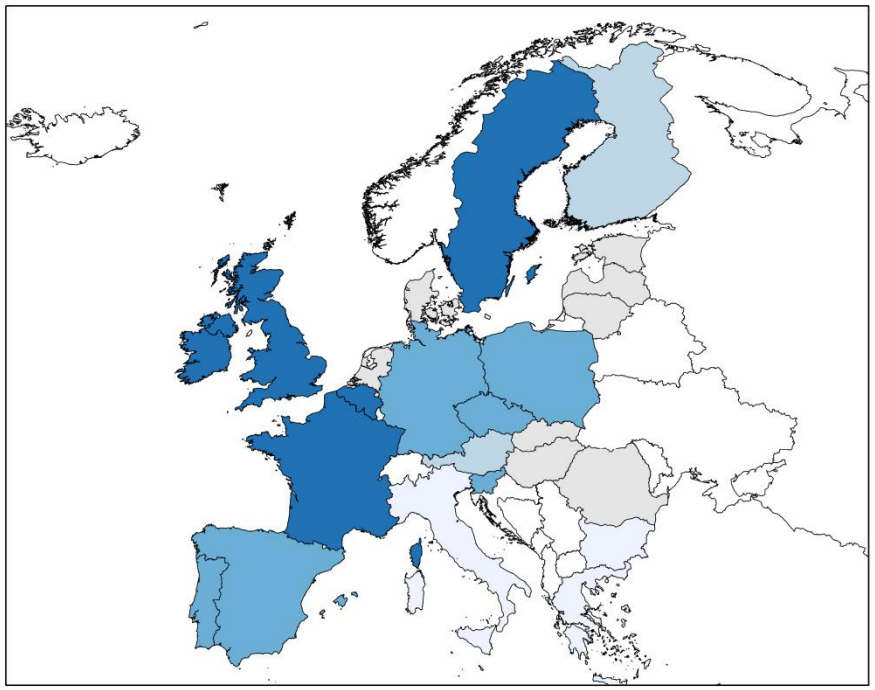


Annual average total losses (1990-2010)
reported to 2010 prices; as % of 2010 GDP (Flood)

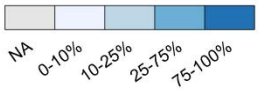
Centre for Economic and Innovation Research POLICIES
Data source: European Commission

Quelle: Daten: JRC 2012, Grafik: JR 2012

Natural catastrophes‘ rate of penetration of cover (estimates) - Flood



Natural catastrophes' rate of penetration of cover
for EU MS (Flood)



Centre for Economic and Innovation Research POLICIES
Data source: European Commission

Quelle: Daten: JRC 2012, Grafik: JR 2012

JOANNEUM RESEARCH POLICIES

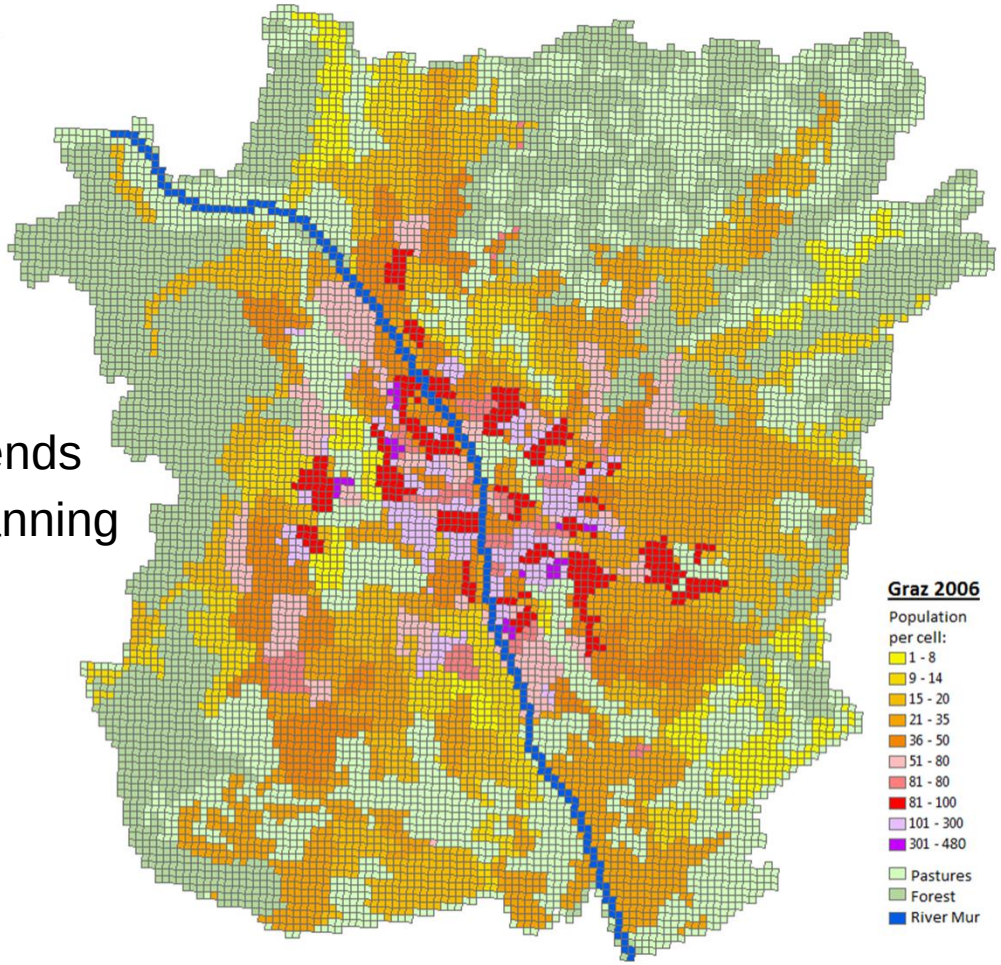
bmvit

Austrian Ministry for Transport, Innovation and Technology

SAT-Box (Site Appraisal Tool-Box): The Cellular Automata (CA) Approach for Szenario development

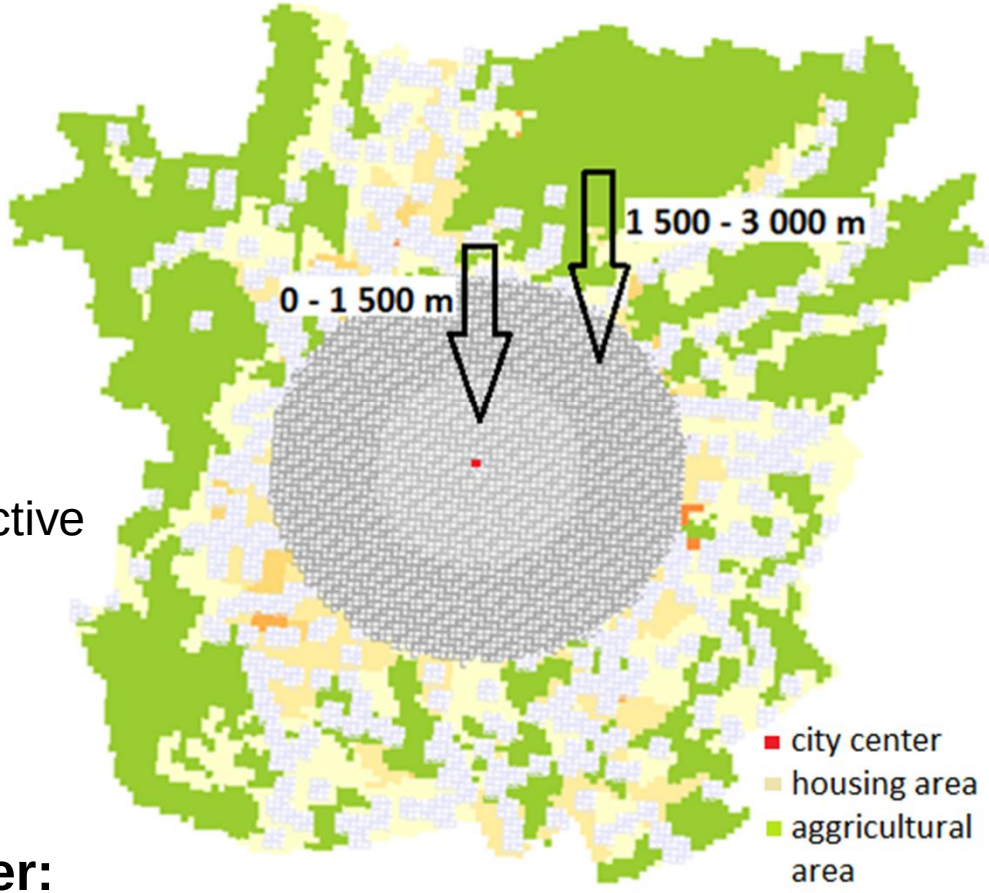
What do we do?

- **We use land use data and population data**
  - per cell (100m x 100m)
- **Calibrate Site (City) specific CA model**
- **Develop & Analyse different scenarios**
  - to represent socio-economic trends
  - to integrate decisions of city planning commission
- **Applications**
  - Risk potential
  - Sewage capacities
  - Develop new zoning rules
  - Optimal school location, public transport



The SAT-Box CA model

- **Structure of the model:**
  - Cells
  - States, property of each cell
  - Neighbourhoods
  - Transition rules
- **Model assumptions:**
  - Closeness to city center is attractive
  - Public transport connections are important
  - Monocentric city model



- **3 regions round the city center:**
  - 1 500 m: maximal walking of 20 minutes to city center
  - 3 000 m: easy cycling distance and good transport connection
  - > 3 000 m: peripheral regions – except if good public transport connection to city center

Why cellular automata?

- Natural model for gridded GIS data
- Data easy to aggregate
- Very flexible
- Intuitive, fast and economical representation
- Can compare different scenarios
- Can incorporate city planner or political “visions”
- Freedom to override past trends
- Evaluate existing planning restrictions and zoning rules
- Many applications possible

Characterisation of Scenarios

Scenario 1	fast population growth
Scenario 2	slow population growth
Scenario 3	socioeconomic preference for one part of the city
Scenario 4	population growth centred on the city's special development areas
Scenario 5	urban sprawl

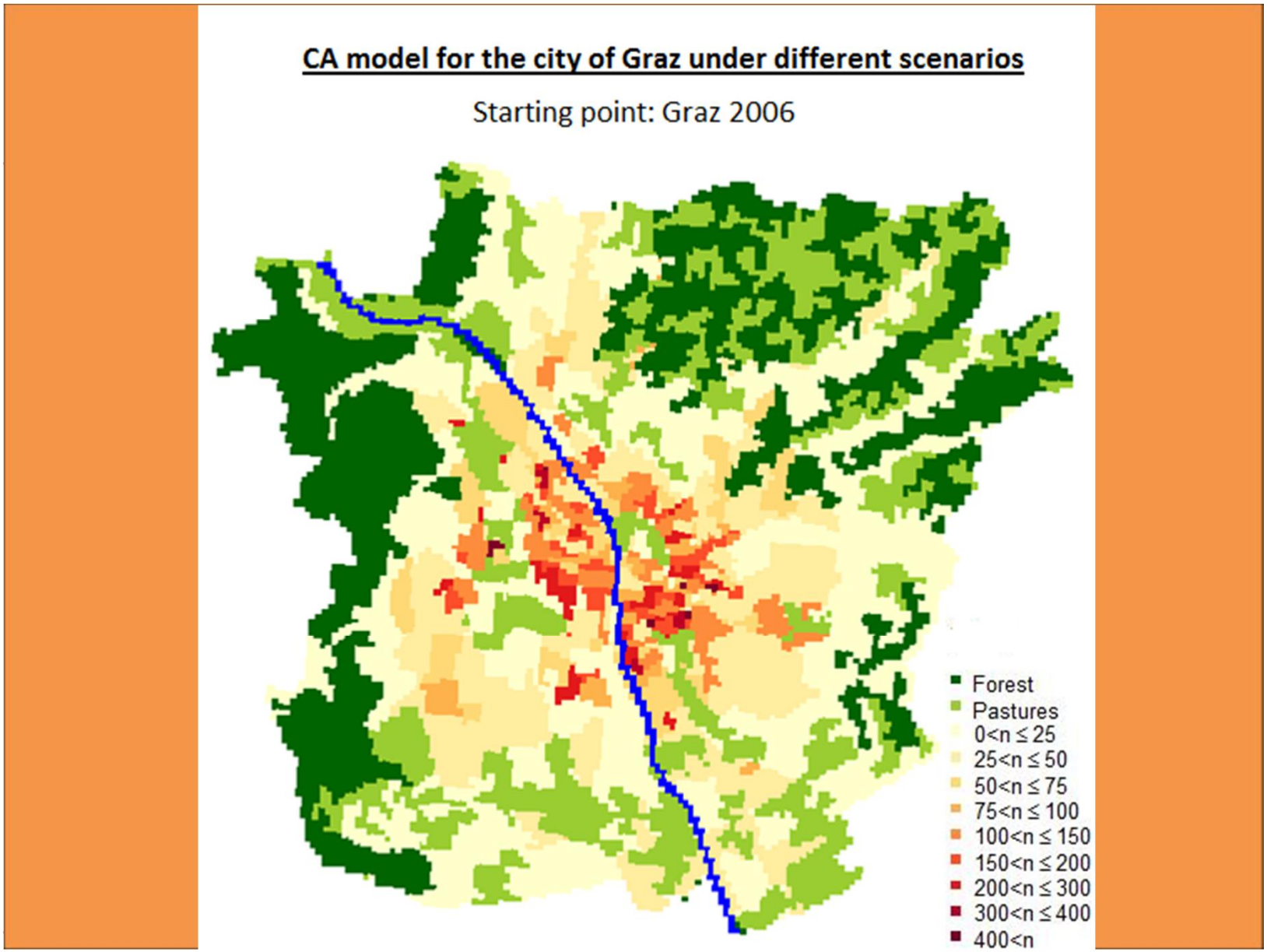
Data input

- Population per cell
- Corine Land Cover Data (2006) - GIS
  - 53% covered by CLC classes 1 or 2
- Public transport stops – GIS
- All major roads out of the city center – GIS
- Distance to the city center
- Distance to public transport stops
- River Mur – GIS

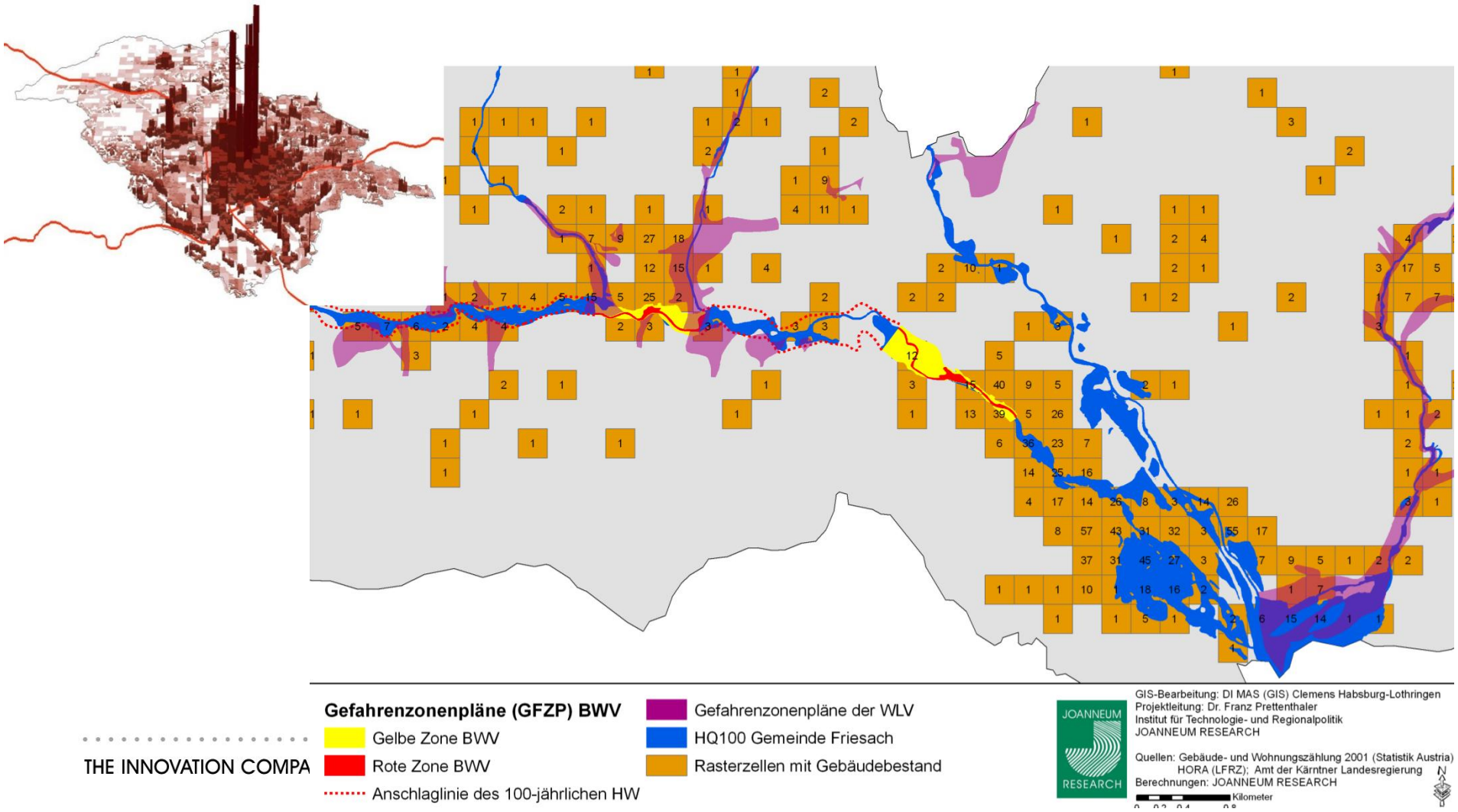
SAT-Box 2.0

- Urban Atlas GMES
- Polycentric development: distance (road, time) matrix every cell to every other

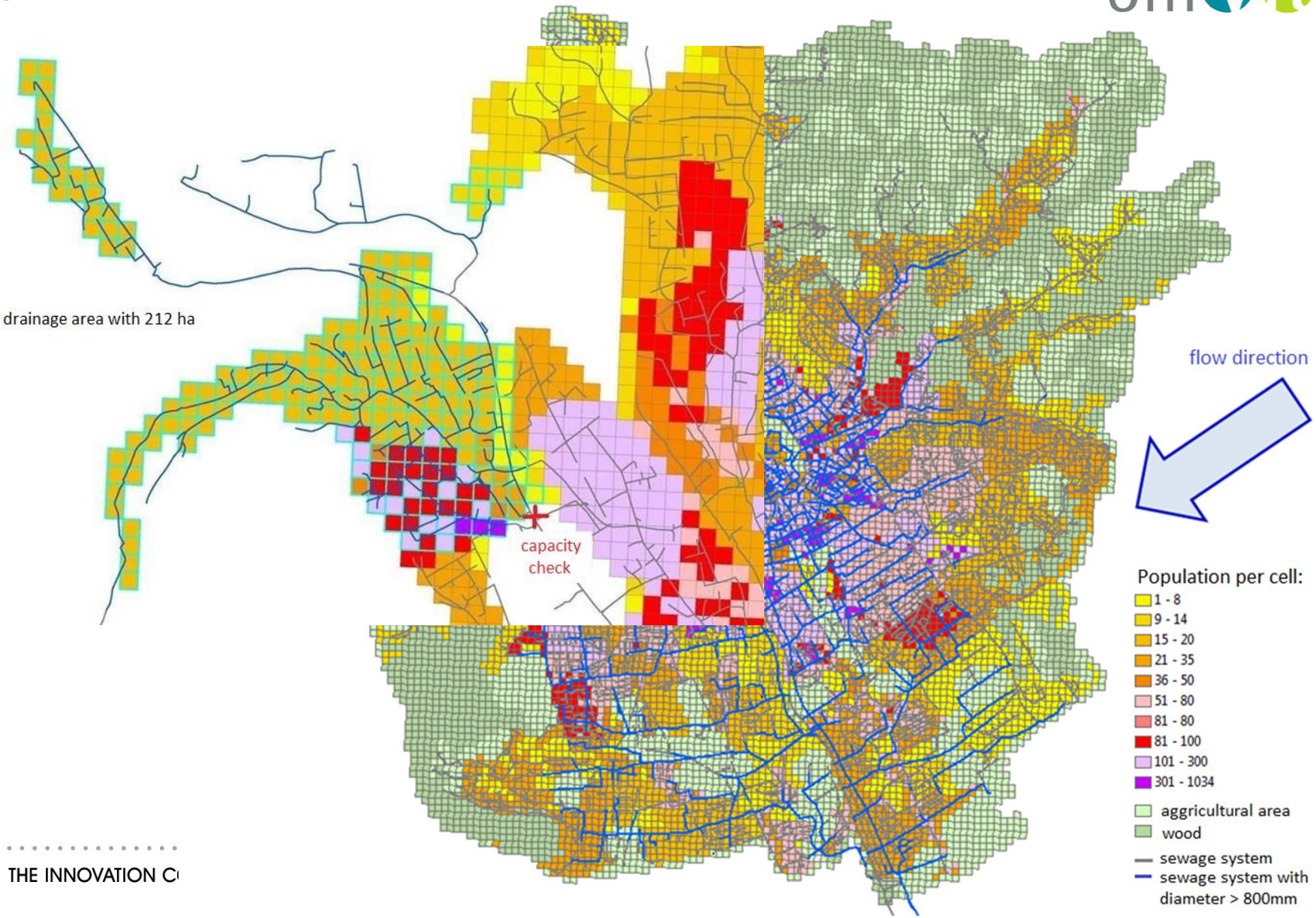
Simulation


CA model for the city of Graz under different scenarios
Starting point: Graz 2006
Forest
Pastures
0<n ≤ 25
25<n ≤ 50
50<n ≤ 75
75<n ≤ 100
100<n ≤ 150
150<n ≤ 200
200<n ≤ 300
300<n ≤ 400
400<n

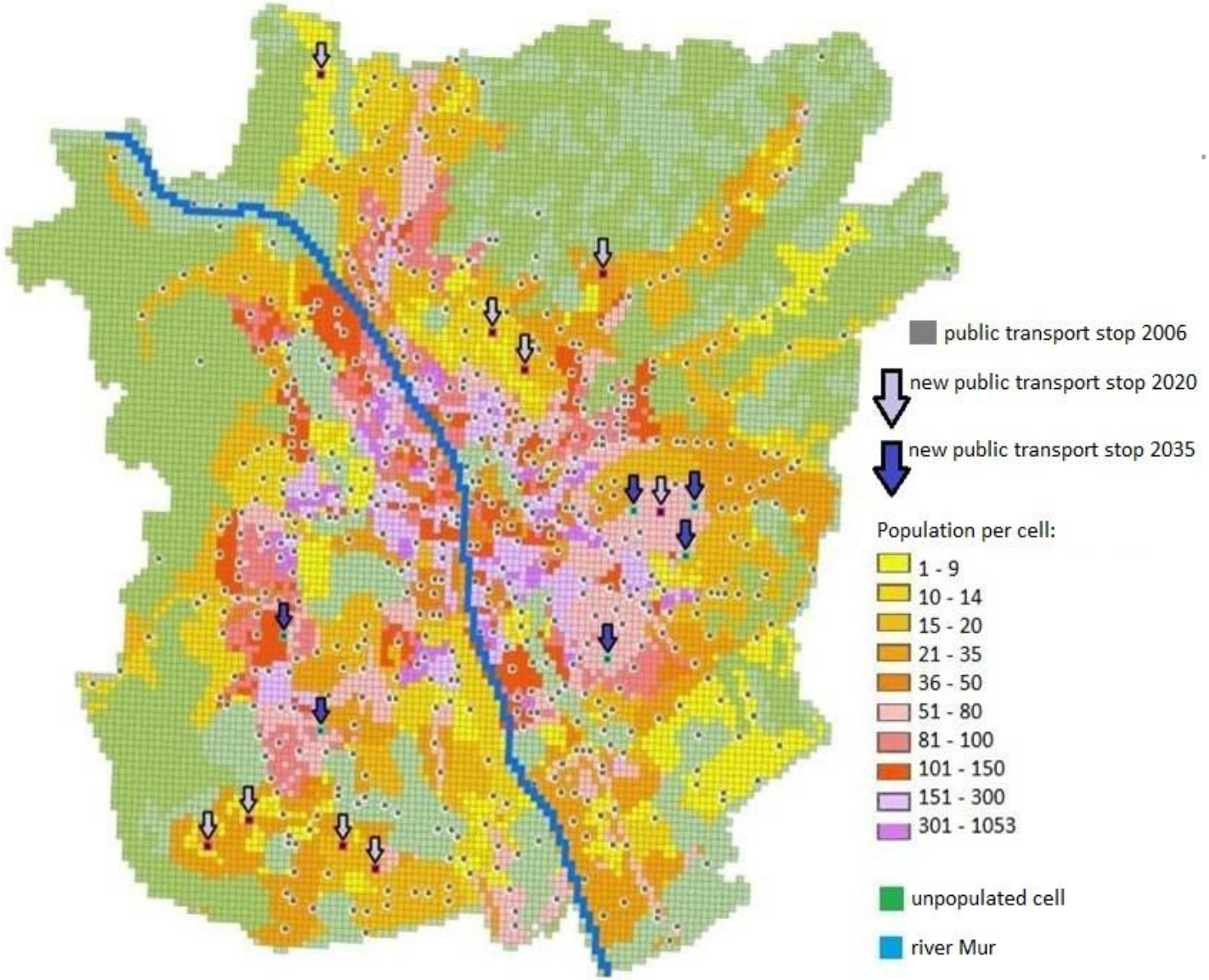
Application 1: Development of Risk potential



Application 2: Sewage capacity evaluation e.g. for heavy precipitation scenarios (Scenario 1)



Application 3: Dynamic transport stops (Scenario 1)



Thank you for your attention!

JOANNEUM RESEARCH - POLICIES

Regional Science, Risk and Ressource Economics unit (RRR)

Leonhardstraße 59, 8010 Graz
Sensengasse 1, 1090 Wien

franz.prettenthaler@joanneum.at

www.joanneum.at