ONKOLOŠKI INŠTITUT LJUBLJANA
INSTITUTE OF ONCOLOGY LJUBLJANA

EPIDEMIOLOGIJA IN REGISTER RAKA
EPIDEMIOLOGY AND CANCER REGISTRY

Slovenian maps of local standardized incidence ratio

Tina Žagar
Maja Primic Žakelj
Vesna Zadnik

(*Cancer Registry of the Republic of Slovenia*)

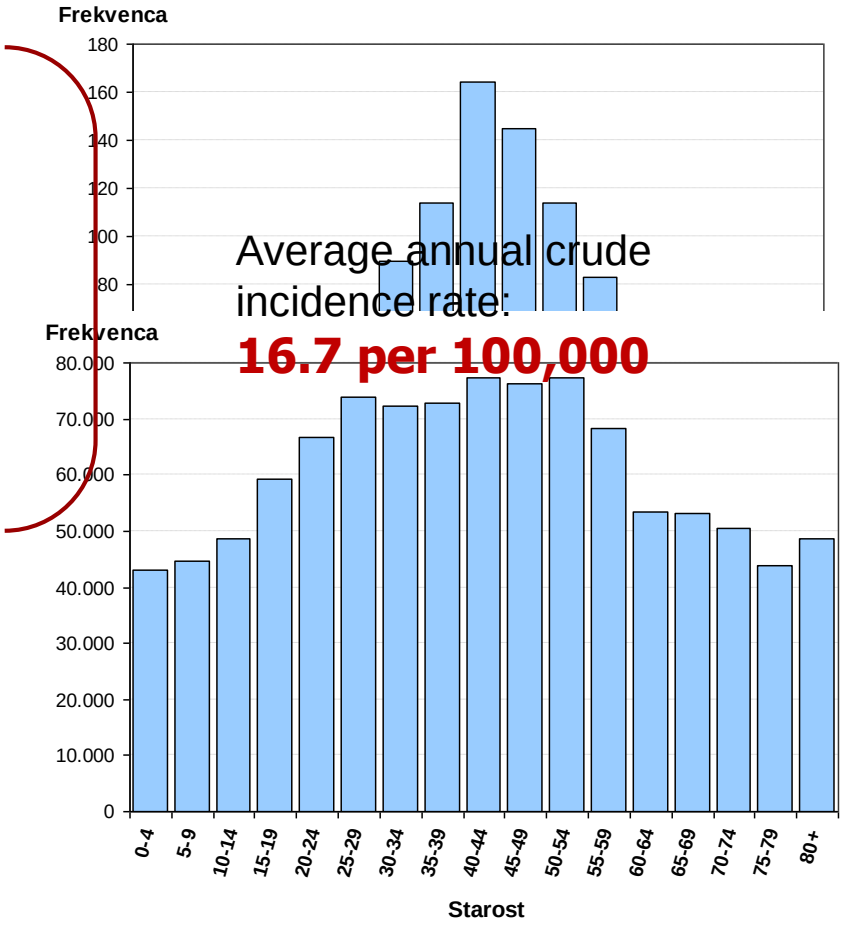
Background

- Cancer maps are important tools in public health research.
- Routinely collected data of cancer registries are of sufficient quality for use in geographical epidemiology.

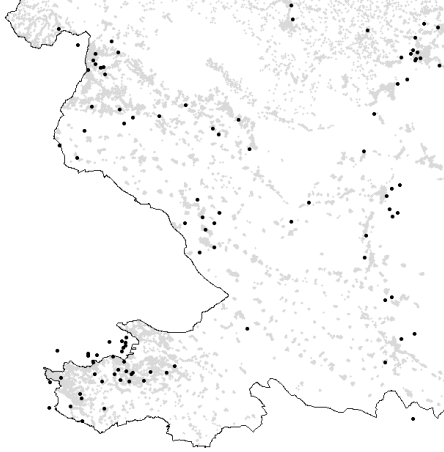
- In Slovenia the geographic coordinates for cancer cases as well as for population (~ 2 mio) are available.
- We developed a procedure to estimate the standardized incidence ratio (SIR), based on the georeferenced data.
- Local estimation of SIR

Data

- Cancer registry of RS:
  1,033 female patients with cervical cancer 2003–2008
- Central Population Register:
  1,030,654 females (in 2006)



Data

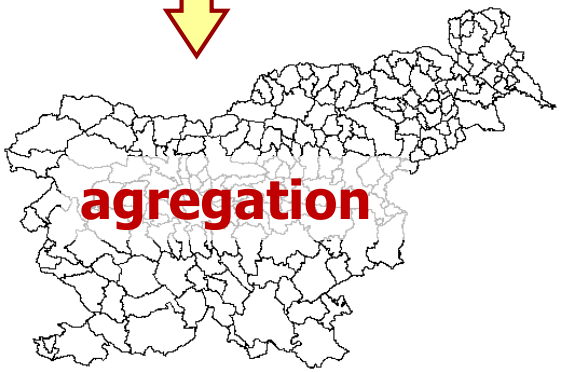


- Cancer registry of RS:
  1,033 female patients with cervical cancer 2003–2008 (6 years)
- Central Population Register:
  1,030,654 females (in 2006)

PIN
(x,y) coordinates

gender
age

- Surveying and Mapping Authority of the RS:
  193 municipalities
  (valid from 1990 to 2005)



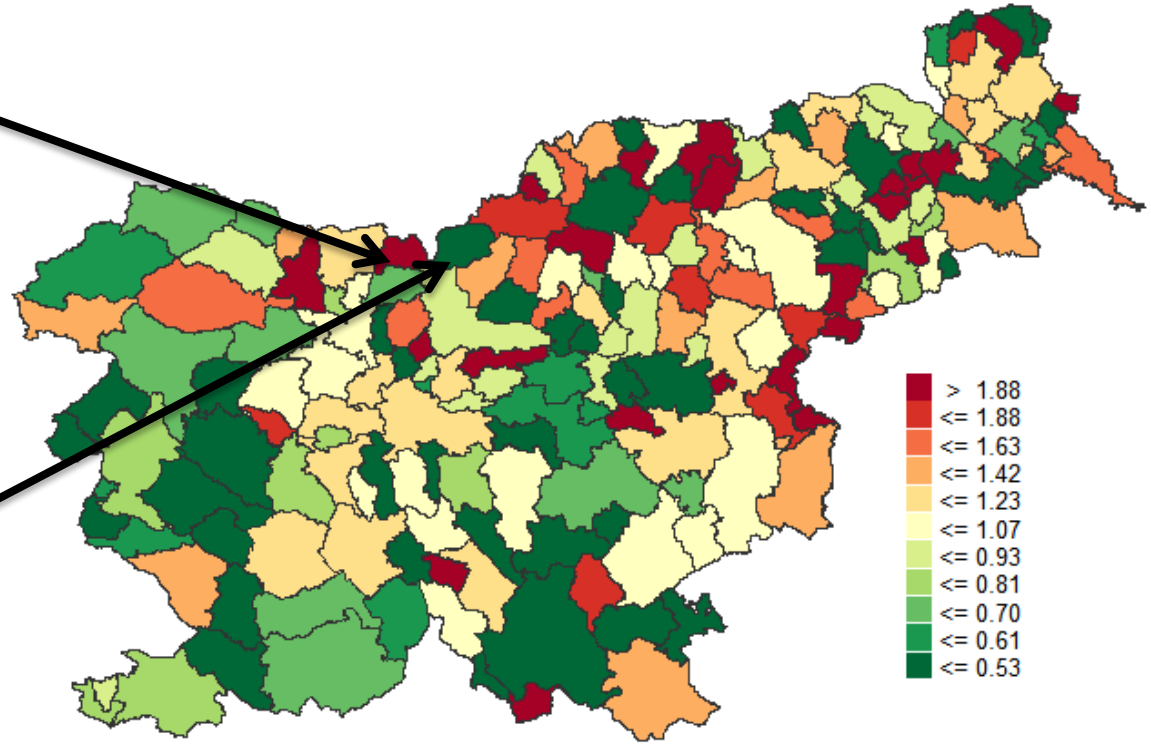
We wanted to compare several types of maps based on the same underlying data set.

SIR by municipalities

- In small spatial units the number of cancer cases is usually low - this can lead to unstable and misleading estimates of the true rate/ratio.

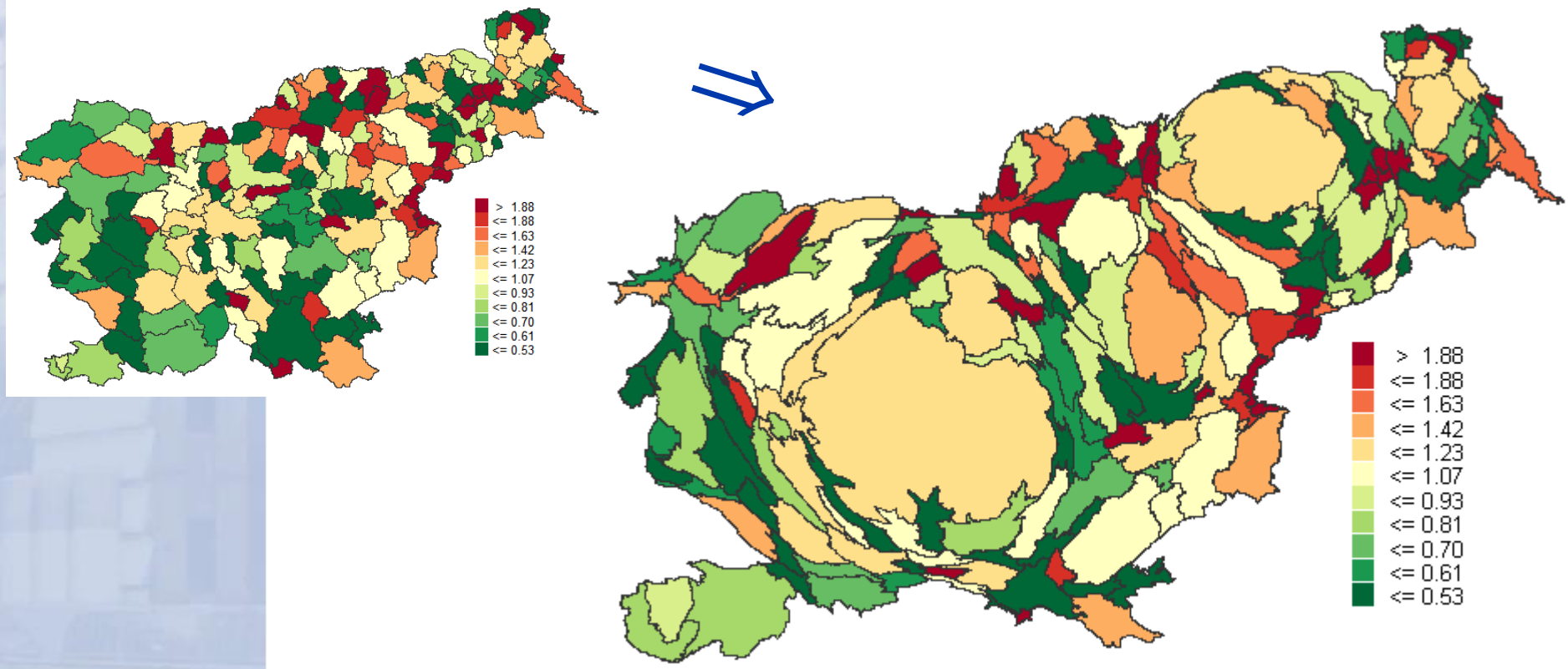
Jezerko
cases: 1
females: 364
SIR: 2.9
95% CI: 0.1-16.0

Solčava
cases: 0
females: 281
SIR: 0.0
95% CI: 0.0-13.1



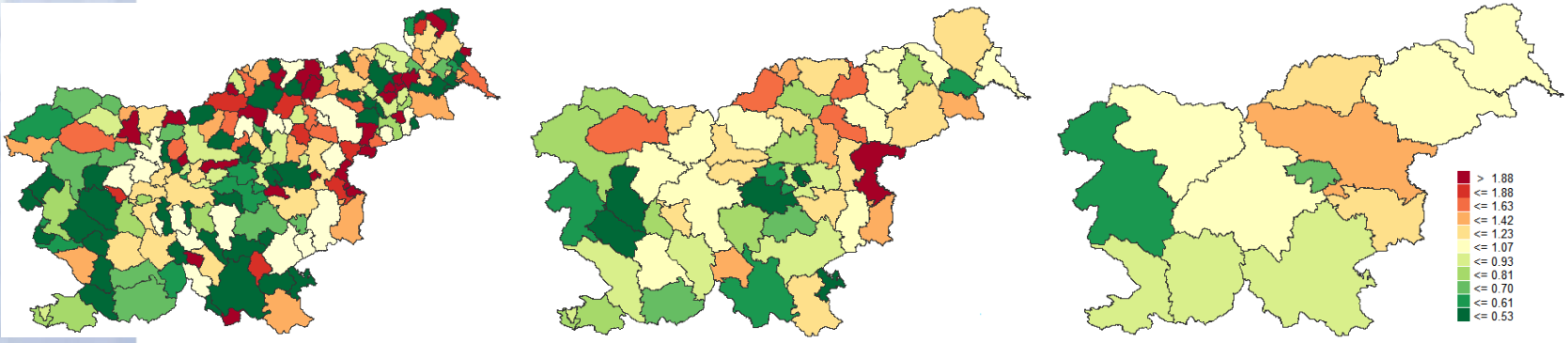
Small numbers problem

- Masking the spatial areas with small population.
- Population cartogram (anamorphic map).
  BUT : local people can't find their home



Small numbers problem

- Masking the spatial areas with small population.
- Population cartogram (anamorphic map).
  BUT : local people can't find their home
- Aggregation to larger spatial units.
  BUT : heterogeneity and modifiable areal unit problem (MAUP)



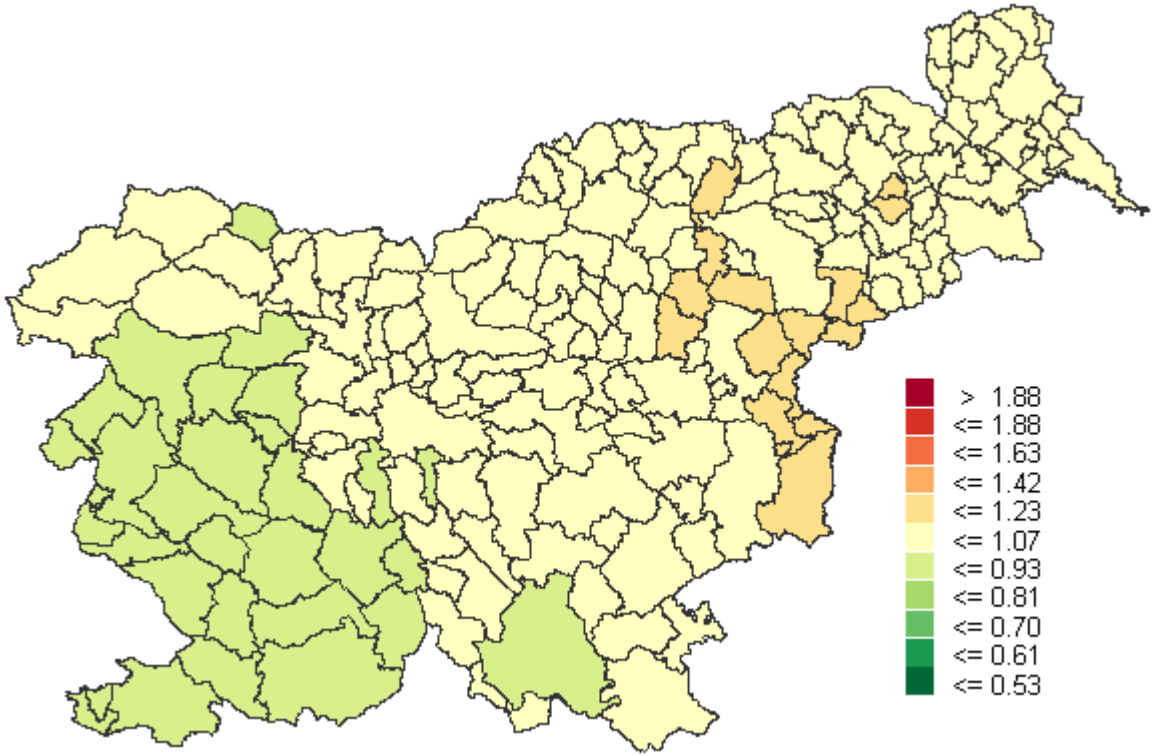
193 municipalities **58 administrative regions** **12 statistical regions**

Small numbers problem

- Masking the spatial areas with small population.
- Population cartogram (anamorphic map).
  BUT : local people can't find their home
- Aggregation to larger spatial units.
  BUT : heterogeneity and modifiable areal unit problem (MAUP)
- Extend the time period.
  BUT : cervical screening program started in 2003
- Smoothing.

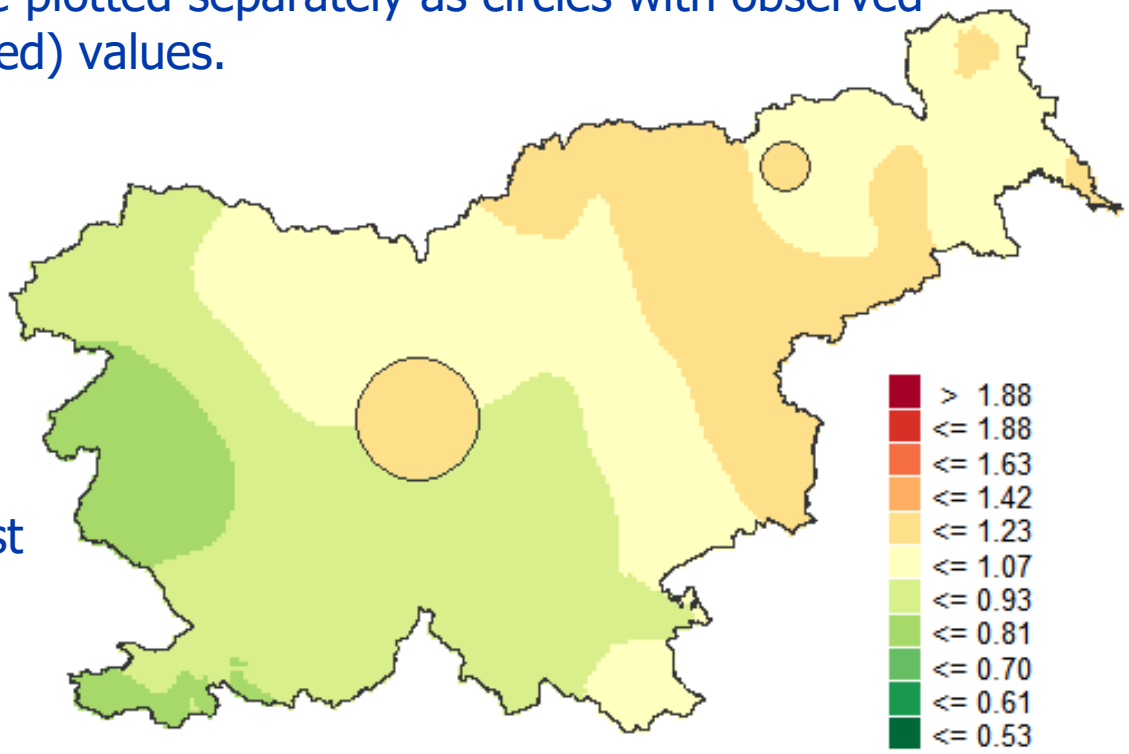
Bayesian hierarchical modelling

- Extreme values are heavily smoothed towards the average of the neighboring municipalities.



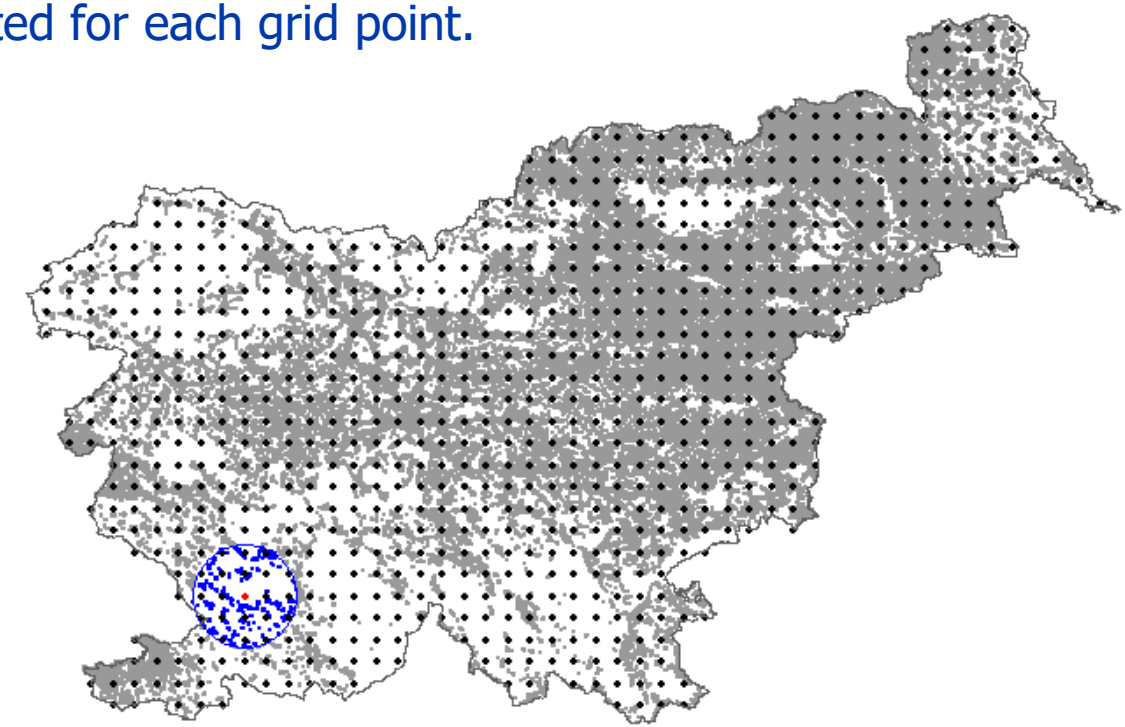
Floating weighted averages

- Weighted by population.
- Based on municipality data.
- Values of SIR for two largest cities (Ljubljana and Maribor) are plotted separately as circles with observed (un-smoothed) values.
- Similar West-to-East trend



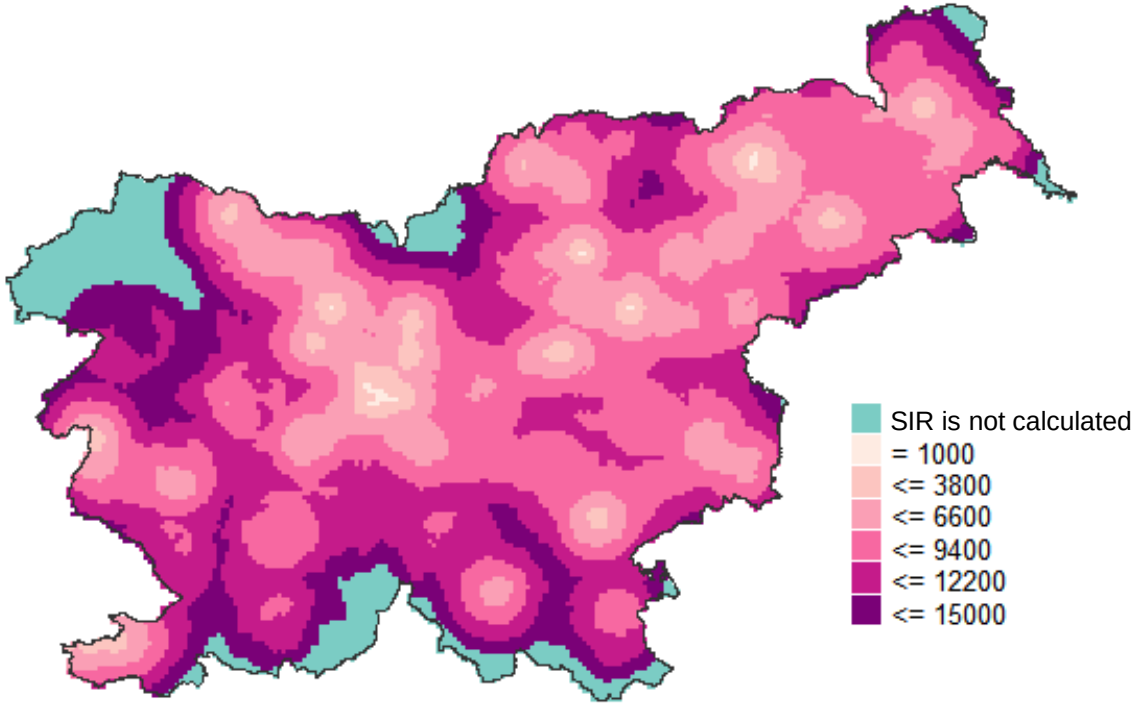
Local estimation of SIR – Data requirements

- X and Y coordinates are required for each person included in the analysis – cancer patients and general population.
- 20,614 grid points are 1 km apart.
- Grid points are the centers of circular "moving" window.
- SIR is calculated for each grid point.



Local estimation of SIR – Radius

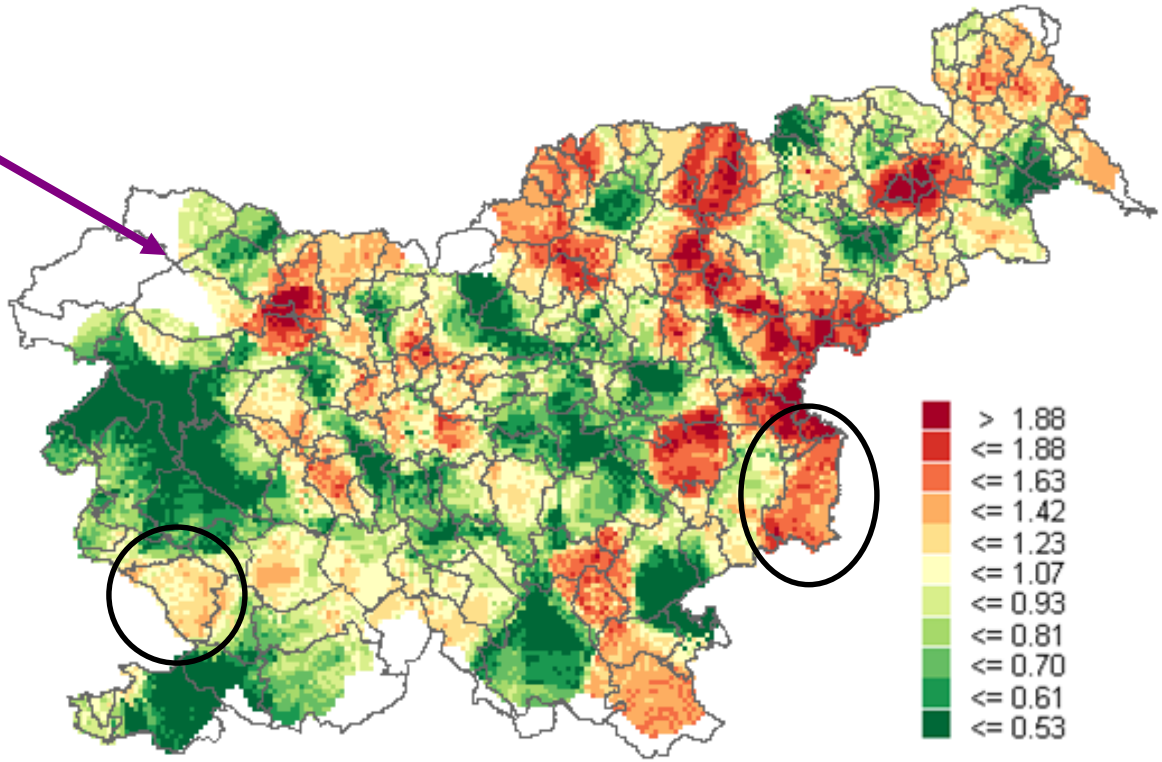
- The circle radius is not fixed in advance but is changing from 1 km (D_{min}) to 15 km (D_{max}) with step 1 km until predetermined minimum population of 7,000 is reached.
- The local SIR estimates are based on (approximately) the same population size, which makes them more stable and more comparable.



Local estimation of SIR – The map

- minPop = 7,000 population
- Radius is increasing from 1 km to 15 km

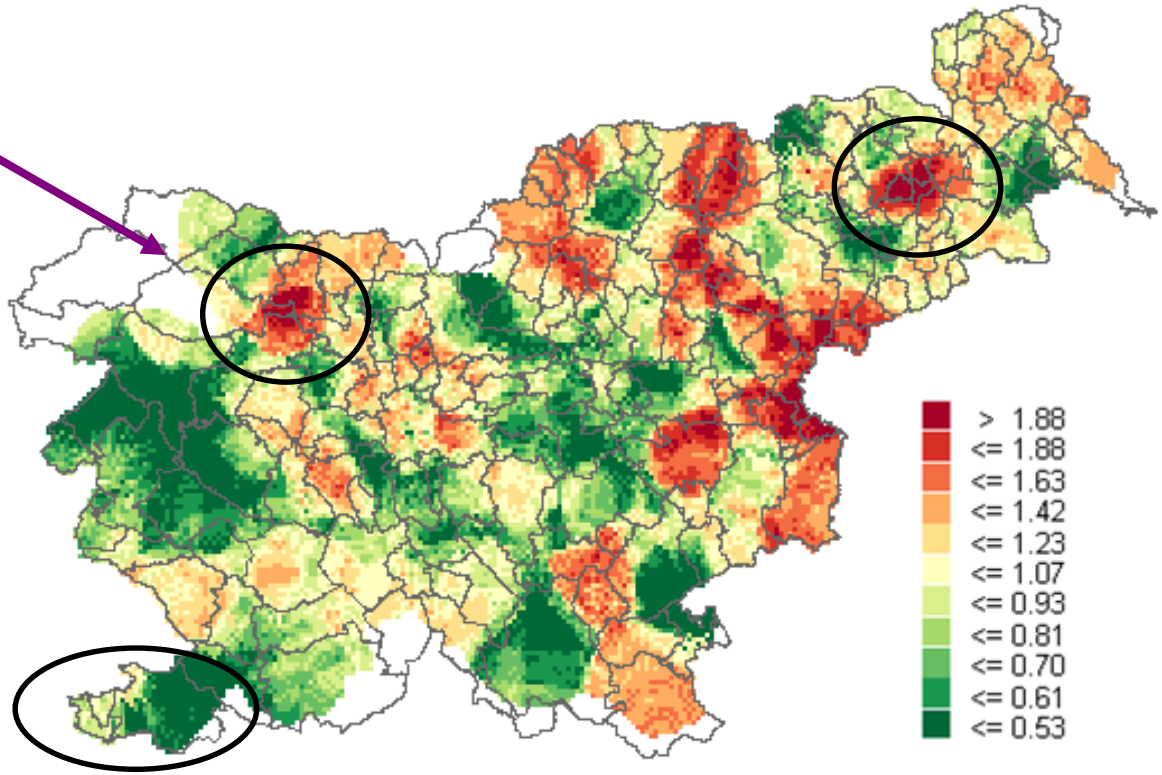
sparsely populated areas



Local estimation of SIR – The map

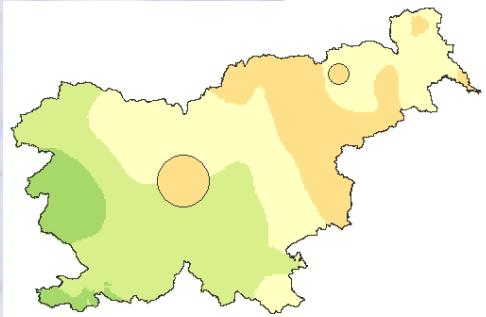
- minPop = 7,000 population
- Radius is increasing from 1 km to 15 km

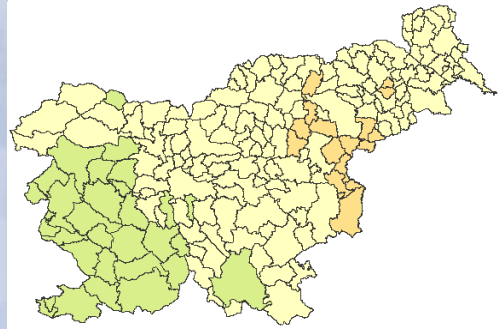
sparsely populated areas

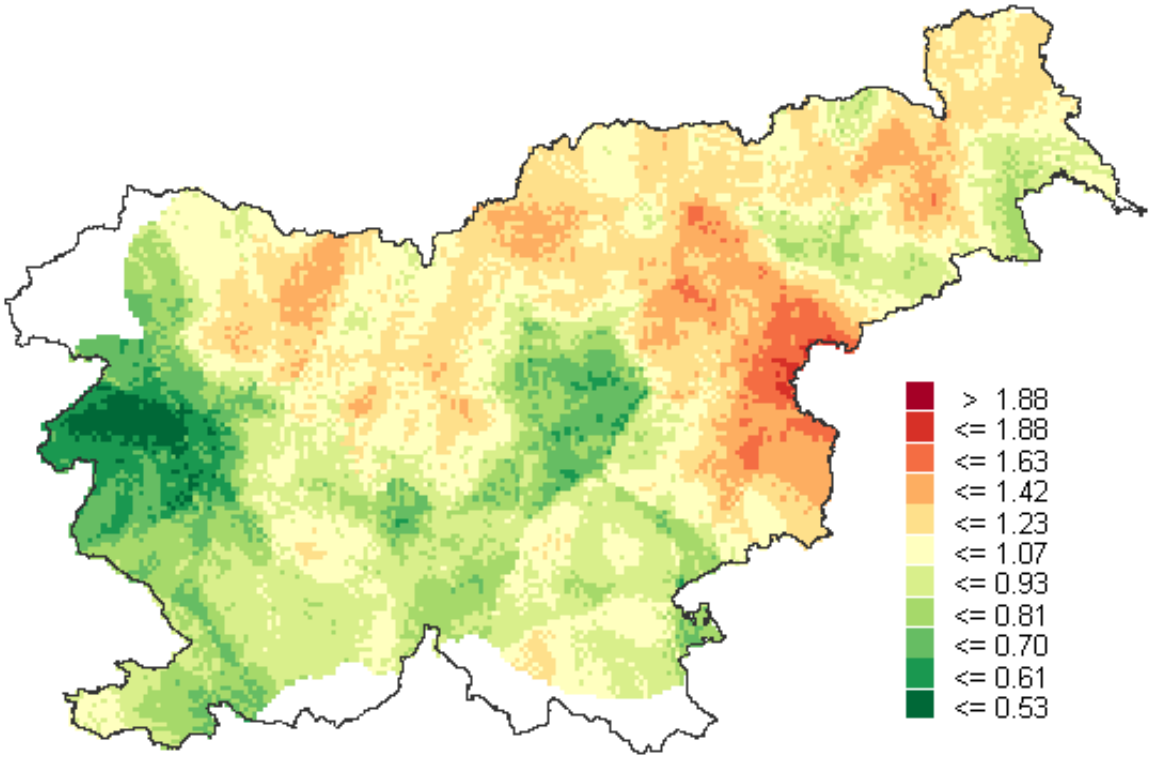


Local estimation of SIR – Different parameters

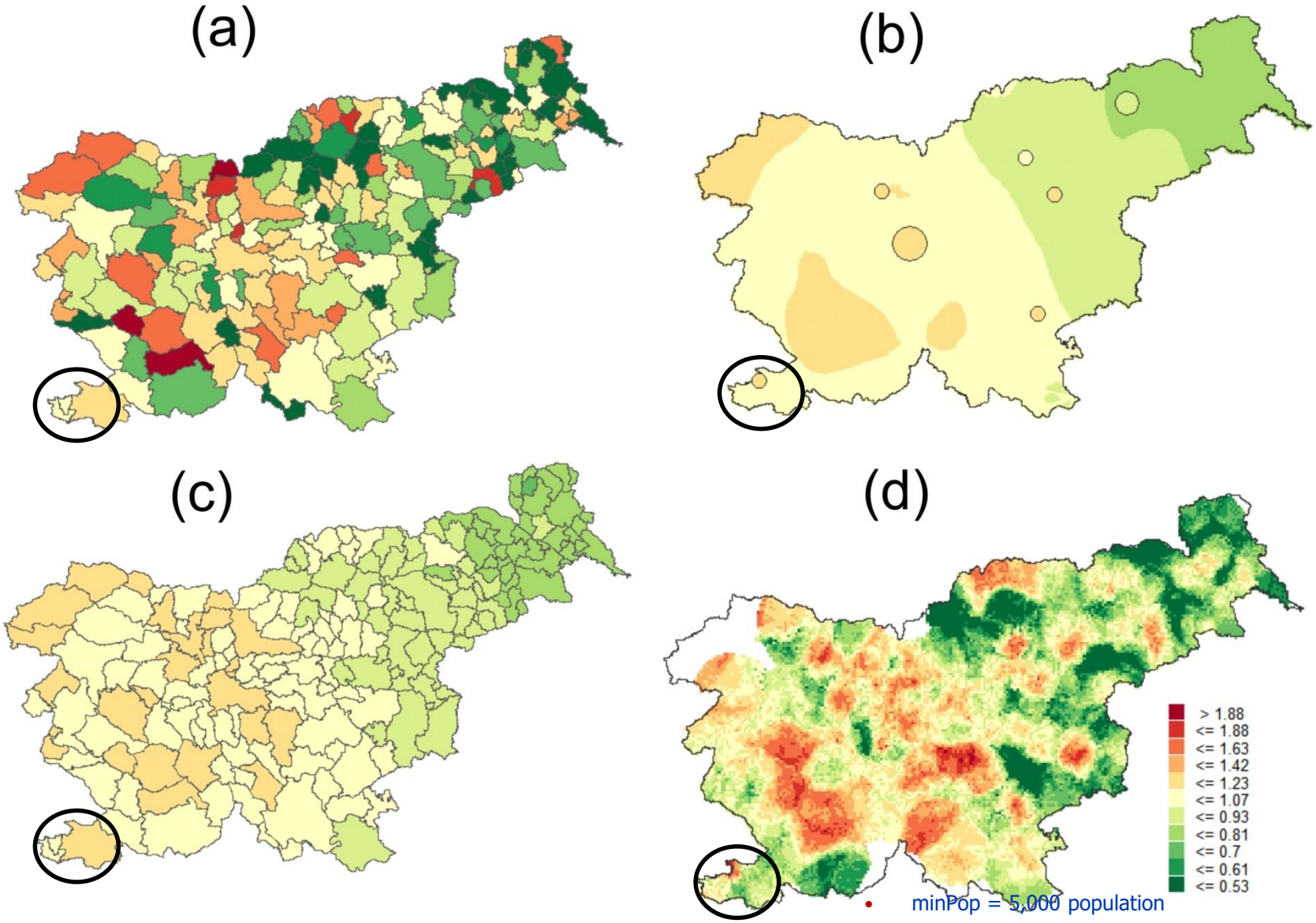
- minPop = 30,000 population
- Radius is increasing from 7 km to 30 km







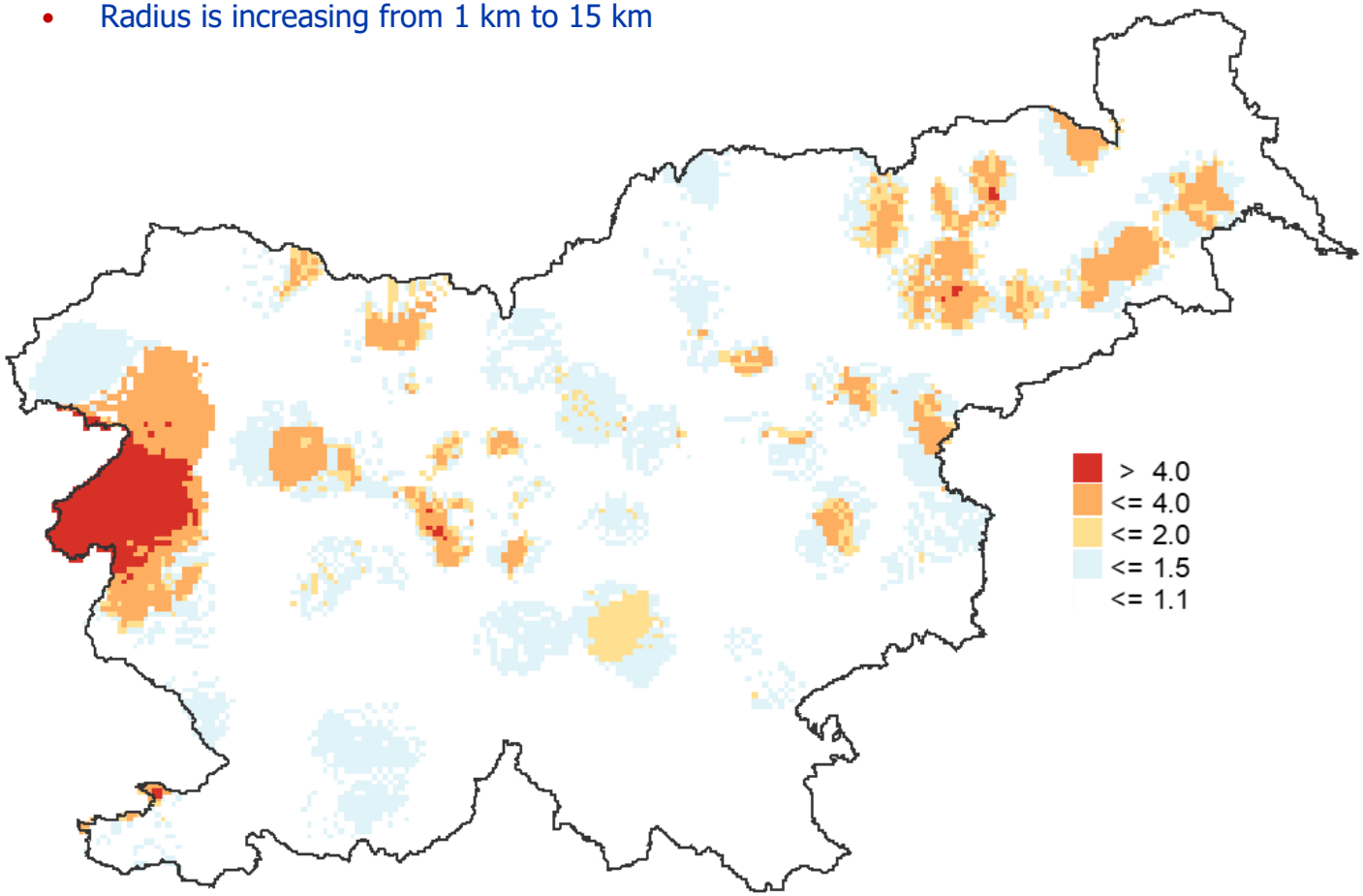
Breast cancer incidence for females, Slovenia 2002–2004



- minPop = 5,000 population
- Radius is increasing from 1 km to 15 km

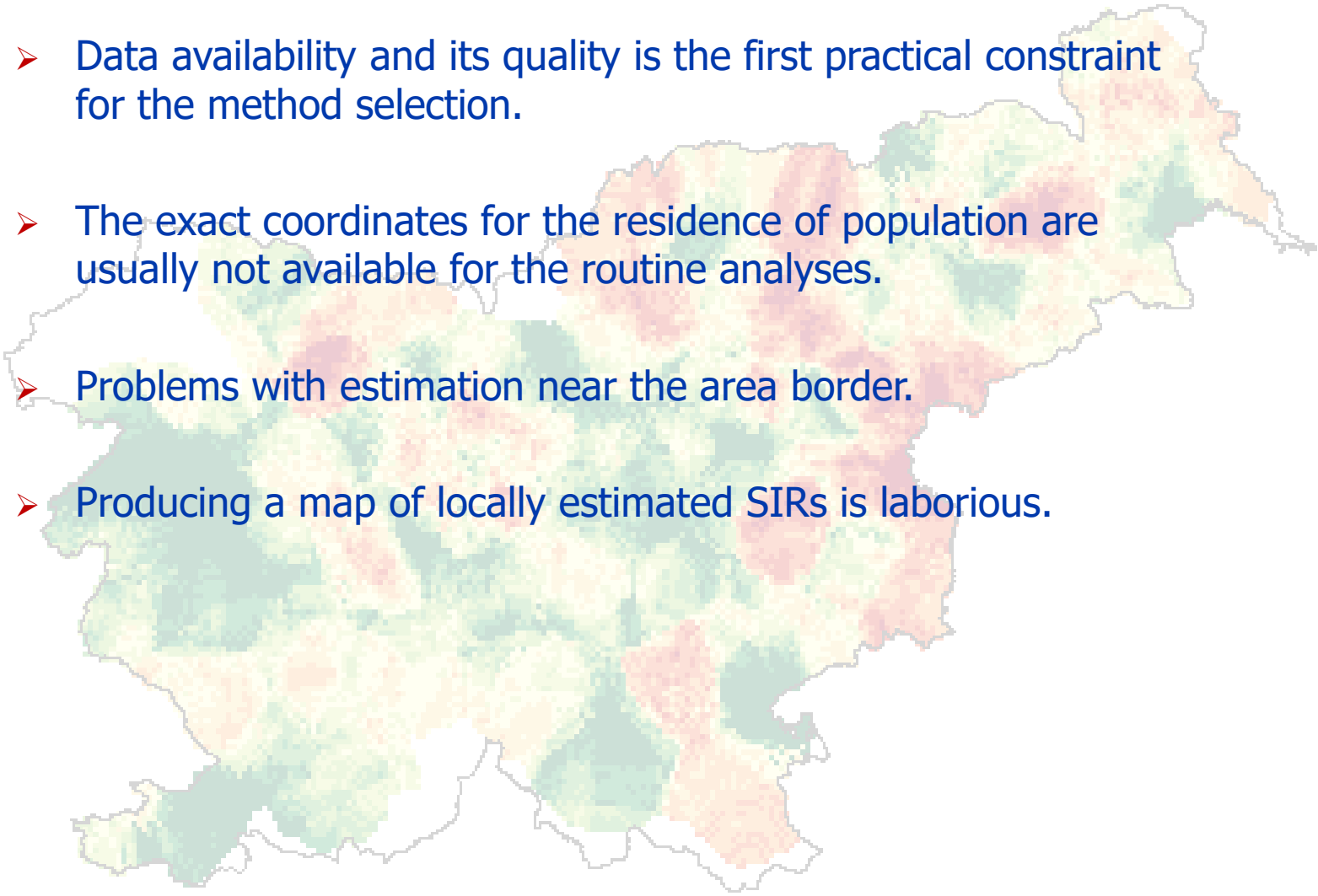
Mezotelioma, Slovenia (1997–2004)

- minPop = 7,000 population
- Radius is increasing from 1 km to 15 km



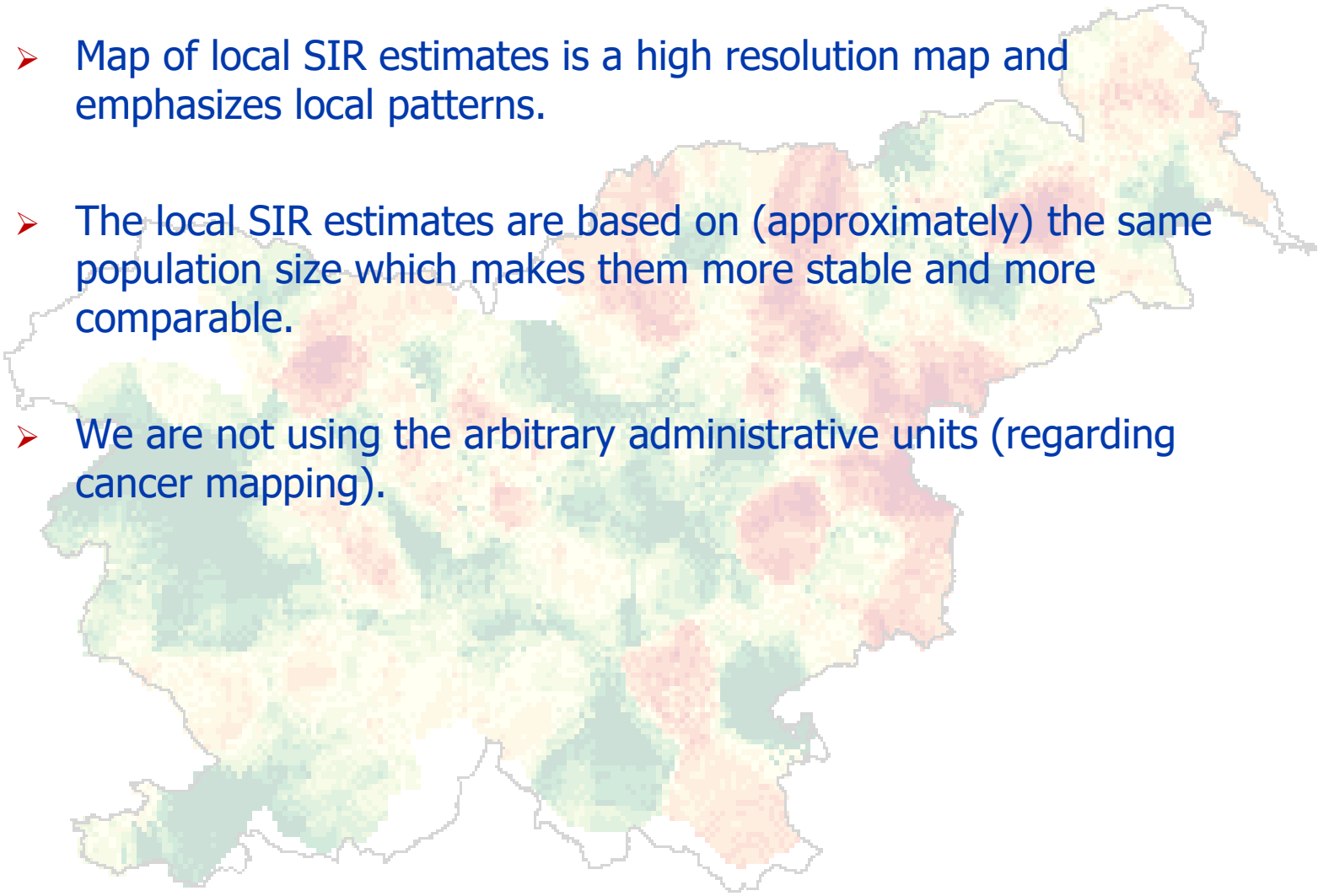
Local estimation of SIR – DISADVANTAGES

- Data availability and its quality is the first practical constraint for the method selection.
- The exact coordinates for the residence of population are usually not available for the routine analyses.
- Problems with estimation near the area border.
- Producing a map of locally estimated SIRs is laborious.



Local estimation of SIR – ADVANTAGES

- Map of local SIR estimates is a high resolution map and emphasizes local patterns.
- The local SIR estimates are based on (approximately) the same population size which makes them more stable and more comparable.
- We are not using the arbitrary administrative units (regarding cancer mapping).



SLORA

- Interactive web portal SloRa.
- http://www.slora.si/en/
- Cancer incidence, prevalence and survival data are presented from 1961 onwards.