

Preferred citation style for this presentation

Axhausen, K.W., M. Botte and S. Schönfelder (2004) Measuring the spatial reach of persons, cities or organisations, STELLA Group 3 meeting, Arlington, January 2004.

Measuring the spatial reach of persons, cities or organisations

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January 2004

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How to measure spatial reach ?

Question:

What area, footprint etc. is used by an organisation, person or city ?

- Person: Activity space
- City: Catchment area
- Organisation: Market

Problem

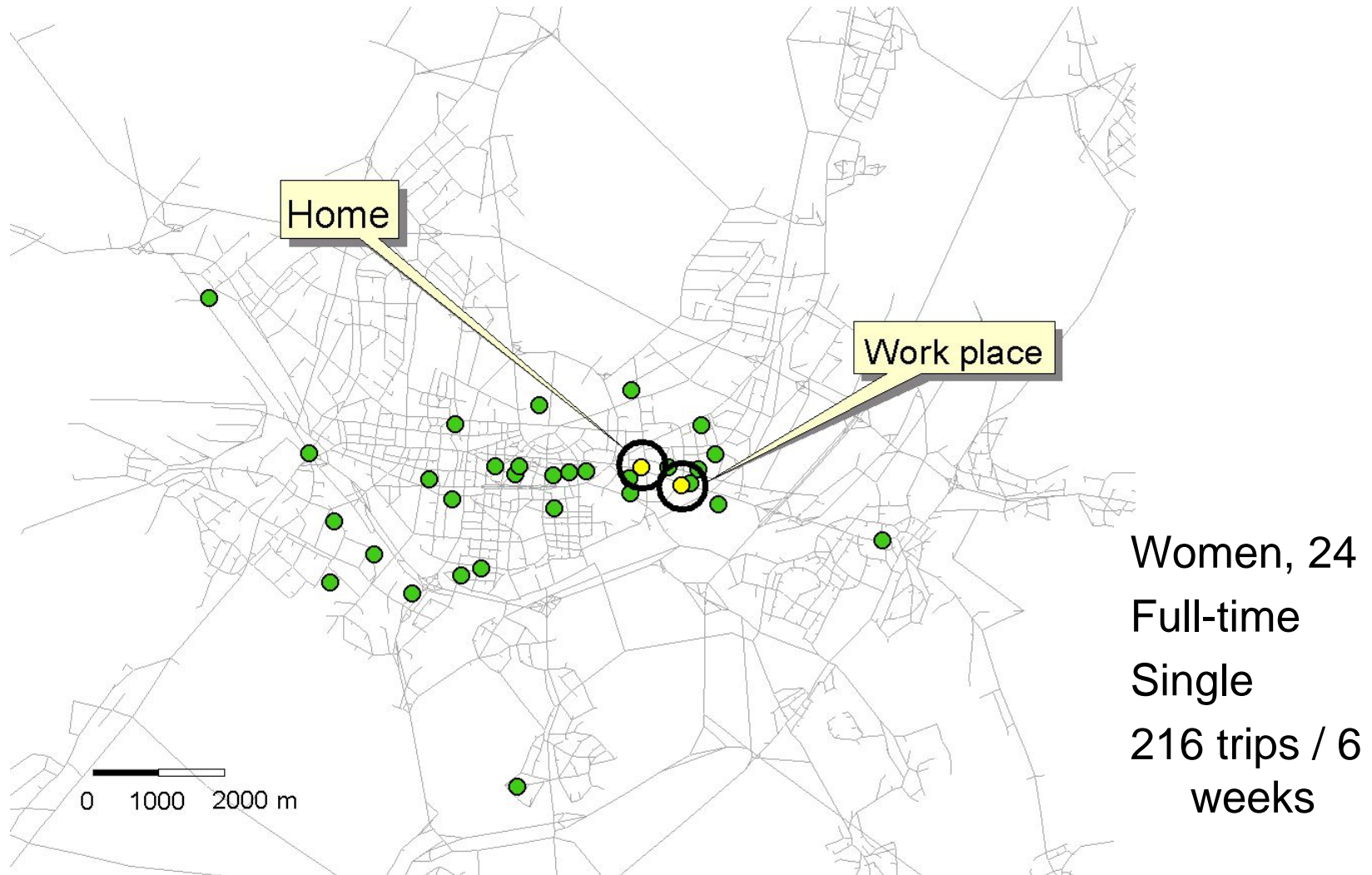
Transforming information about points of

- Contact
- Origin/destination
- Sale or use

into uni- or lowdimensional measures to allow

- Comparison over time
- Comparison across units

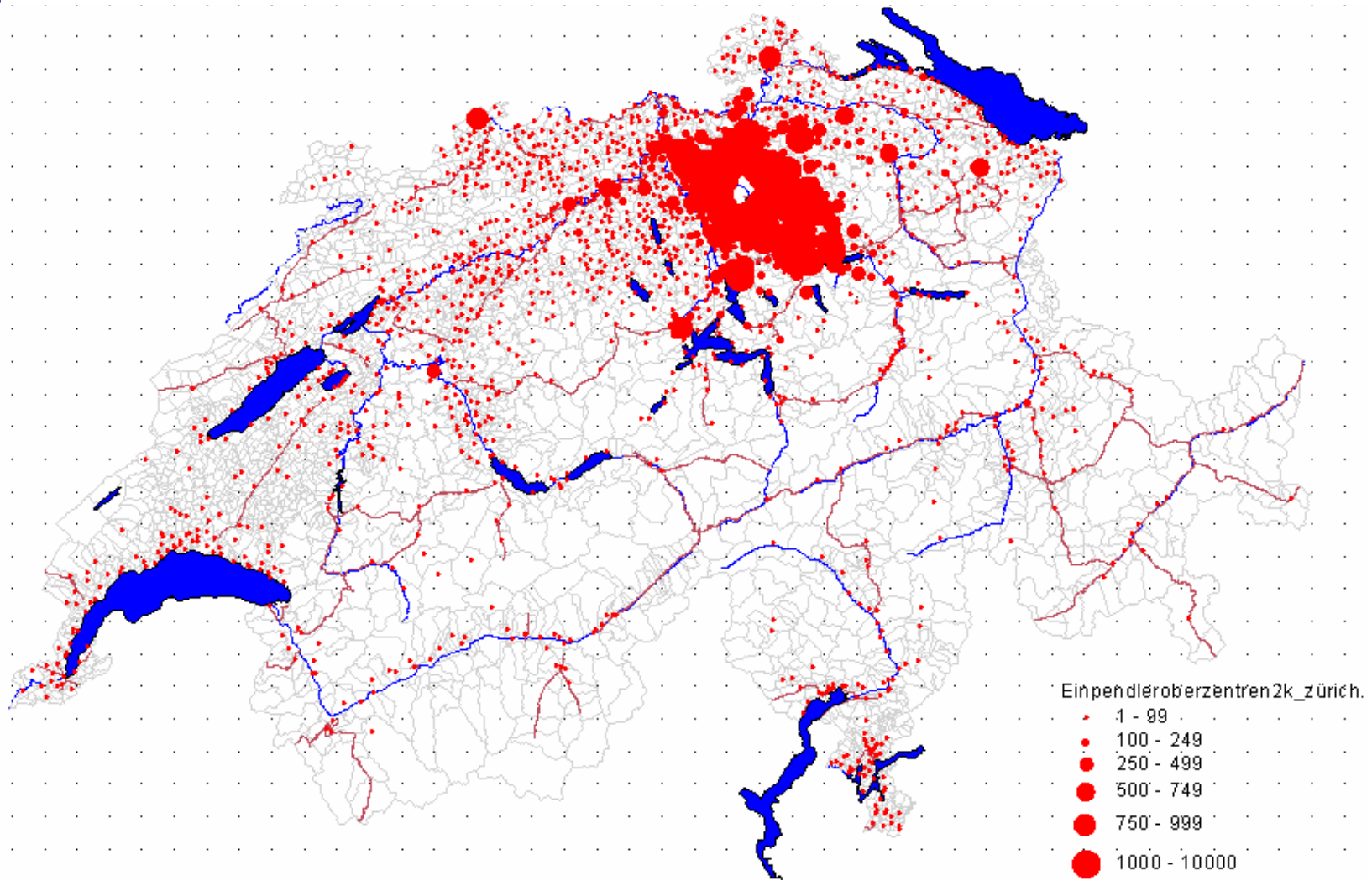
Example: Destinations visited over 6 week period



Example: Destinations visited over 6 week period



Example: Origins of commuters to Zürich (2000)



Approaches

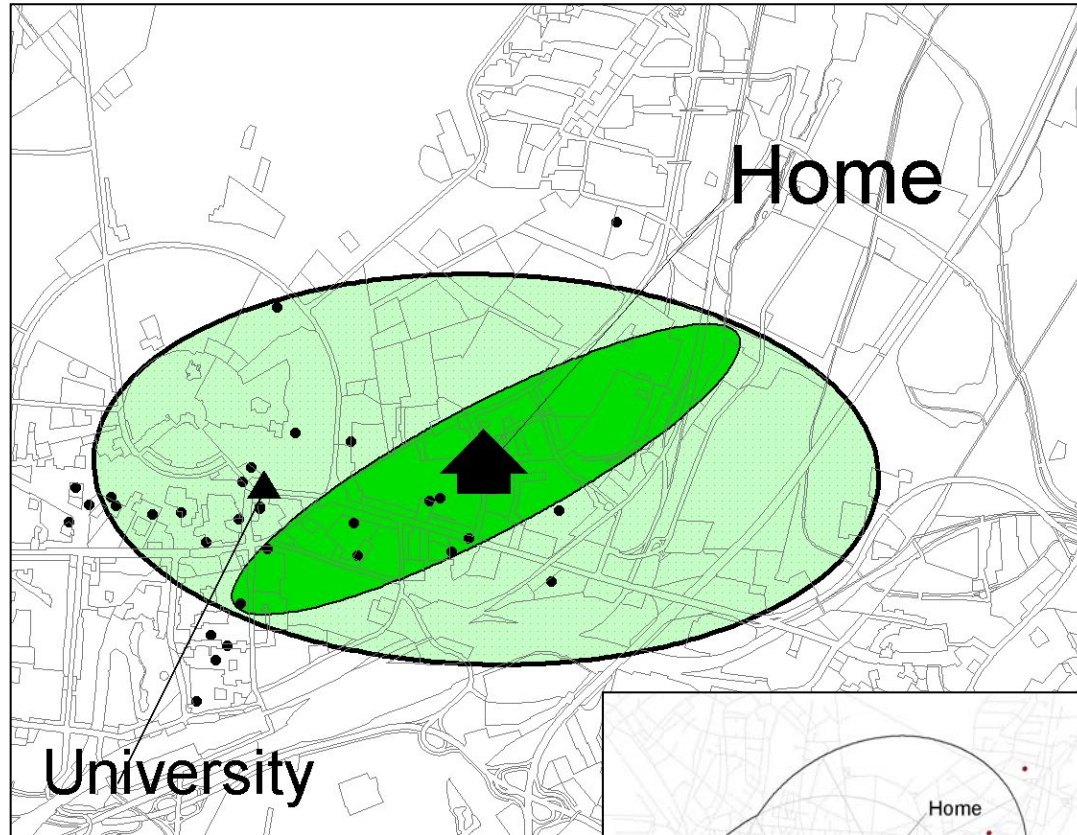
Parametric:

- 95% Confidence ellipse

Non-parametric:

- Kernel-density estimates (using a specific Kernel-density function)
- Shortest-path networks
- [Chosen-path networks]

Approach 1: 95% Confidence ellipse



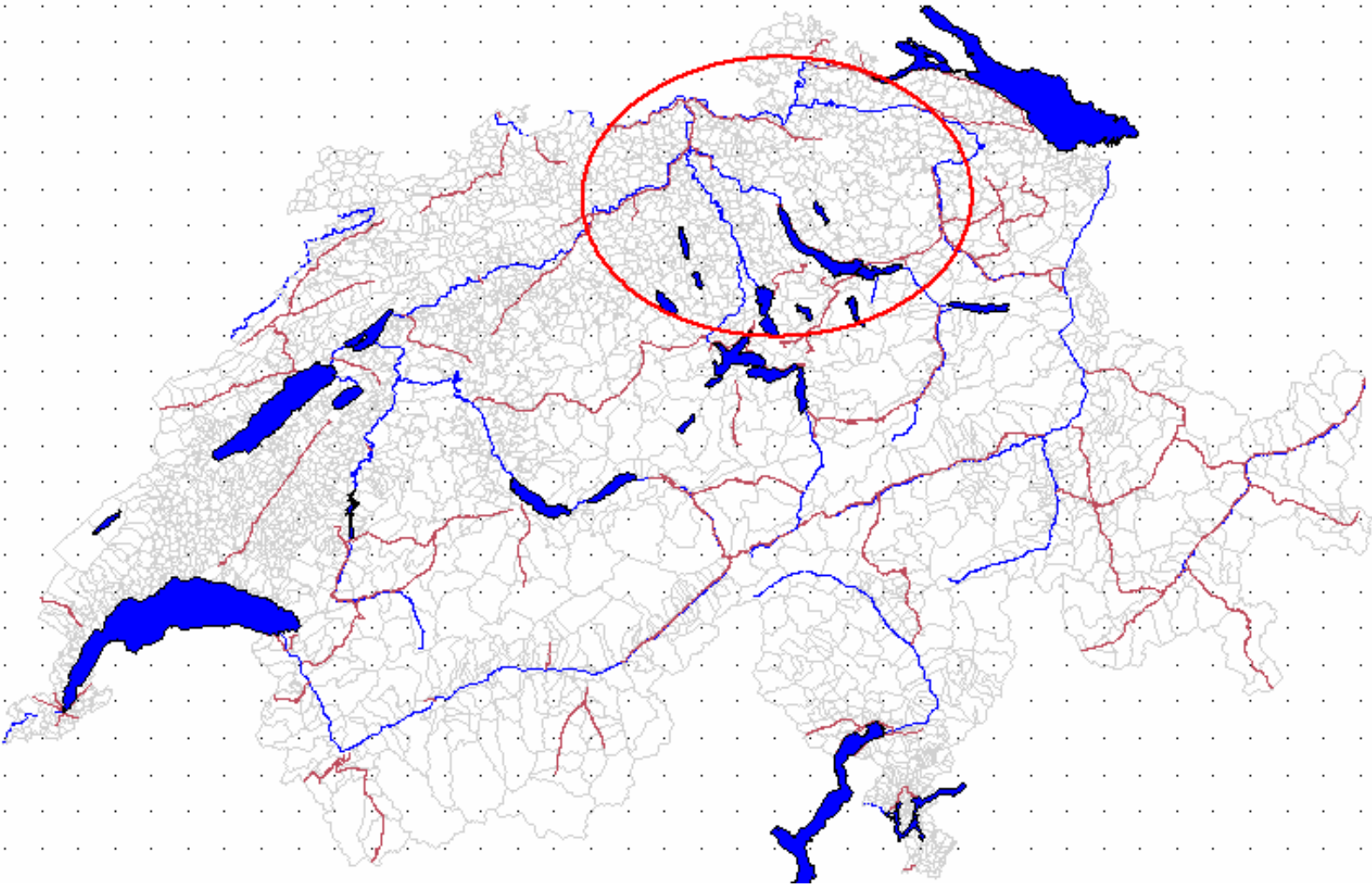
Smallest possible area of a true value of the population (i.e. activity locations)

Measure: Area

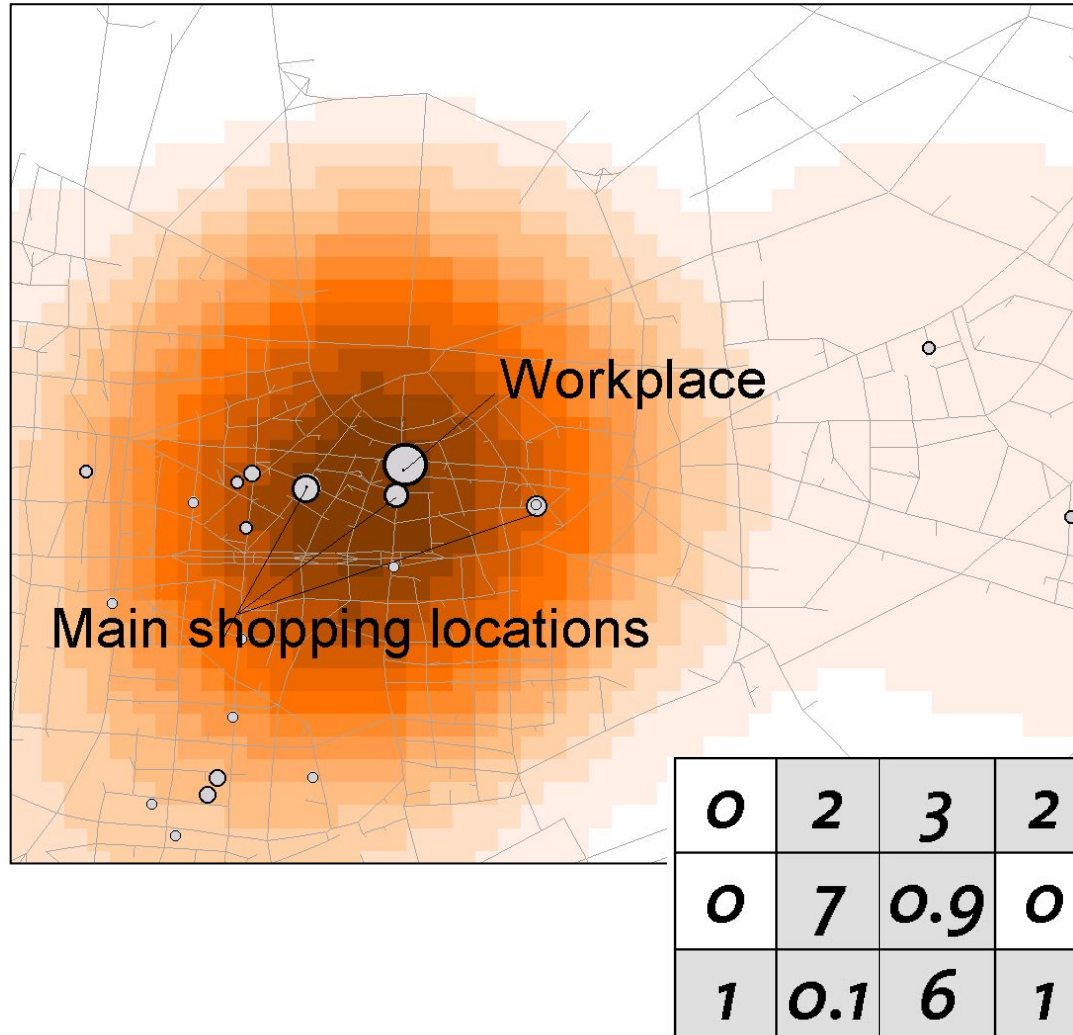
Focus: Spread of locations



Example: Zürich's commuter shed 2000



Approach 2: Kernel densities

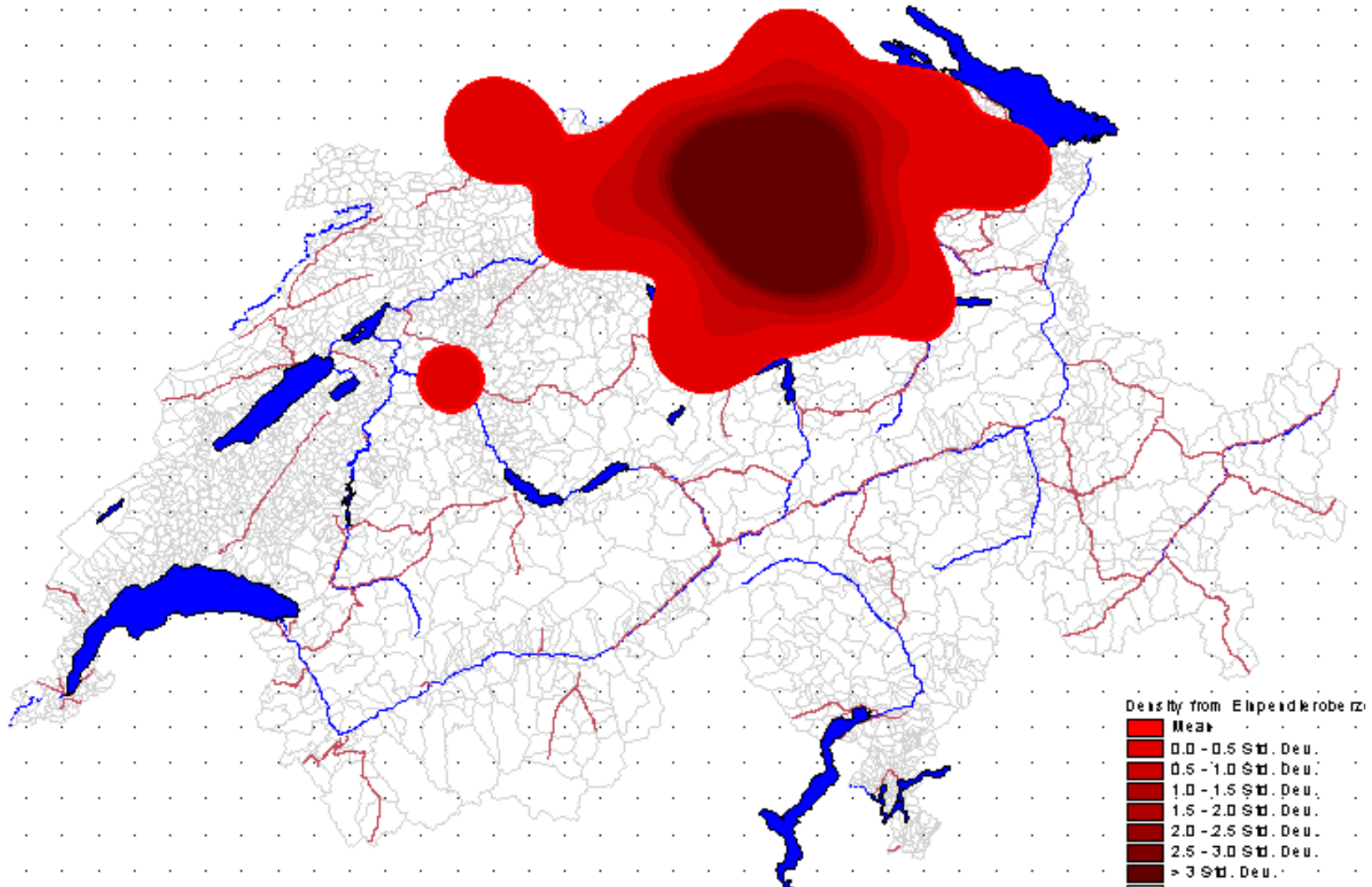


Density surface
created by
distribution of
locations weighted
by frequency of
visit

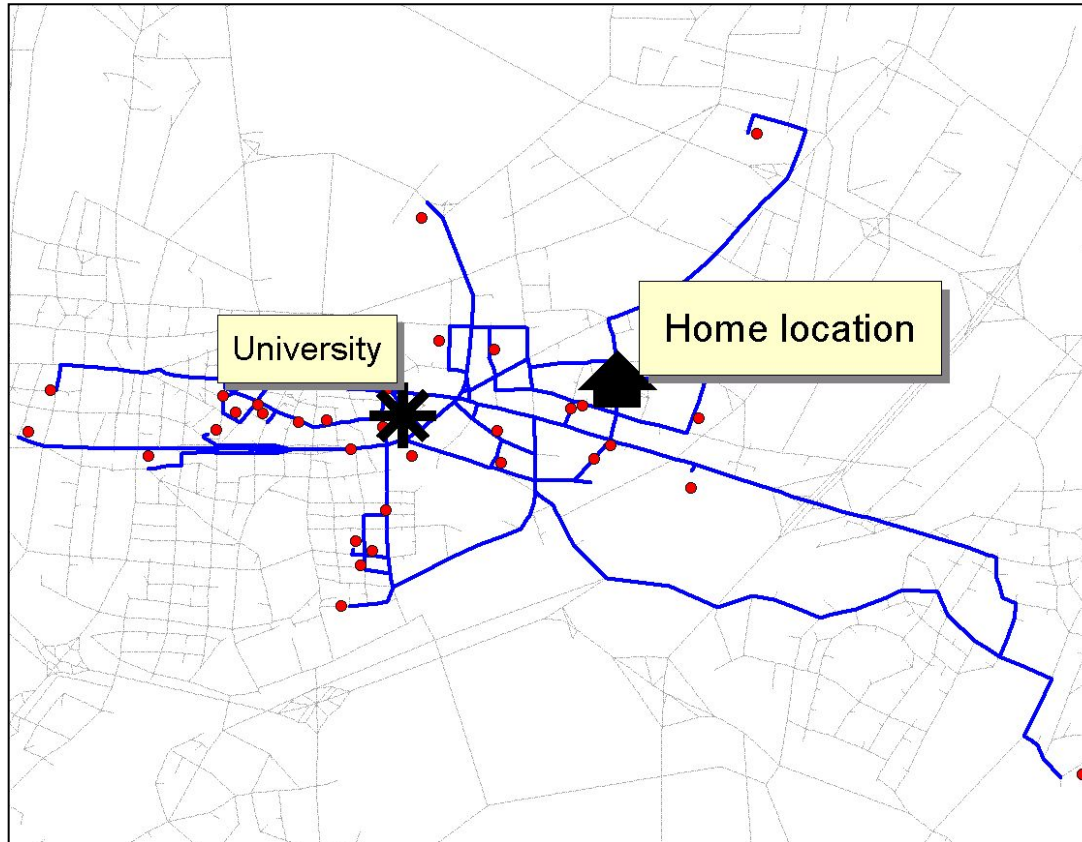
Measure: Area with
positive density
value

Focus: Clustering

Example: Zürich's commuter shed 2000



Approach 3: Shortest path network



Smallest geometry
based on all O-D-
relations observed
(e.g. shortest paths)

Measure: Length of
geometry / area
spanned / buffered
area

Focus: Spread of
locations

Obvious refinements

All:

- Segmentation by type of interaction; time period
- Appropriate weighting schemes (ln ?)

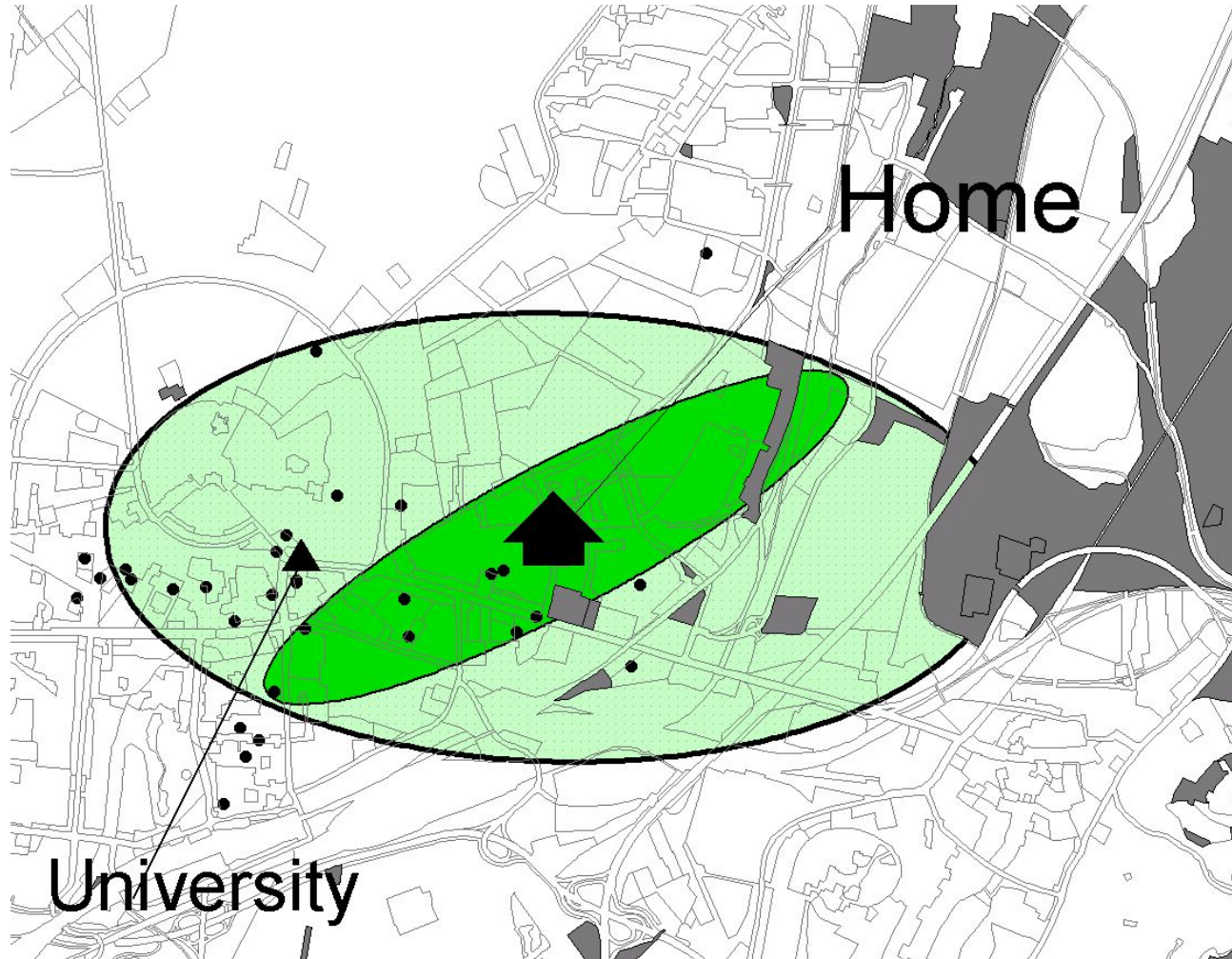
Confidence ellipse, Kernel densities:

- Removal of a-priori excluded spaces

Shortest path networks:

- Use mode-specific networks
- Use stochastic assignment

Refinement: Exclusion of excluded areas



Additional information

Confidence ellipse:

- Angle of the main axis relative to reference point
- Mean vector between point of interaction and base

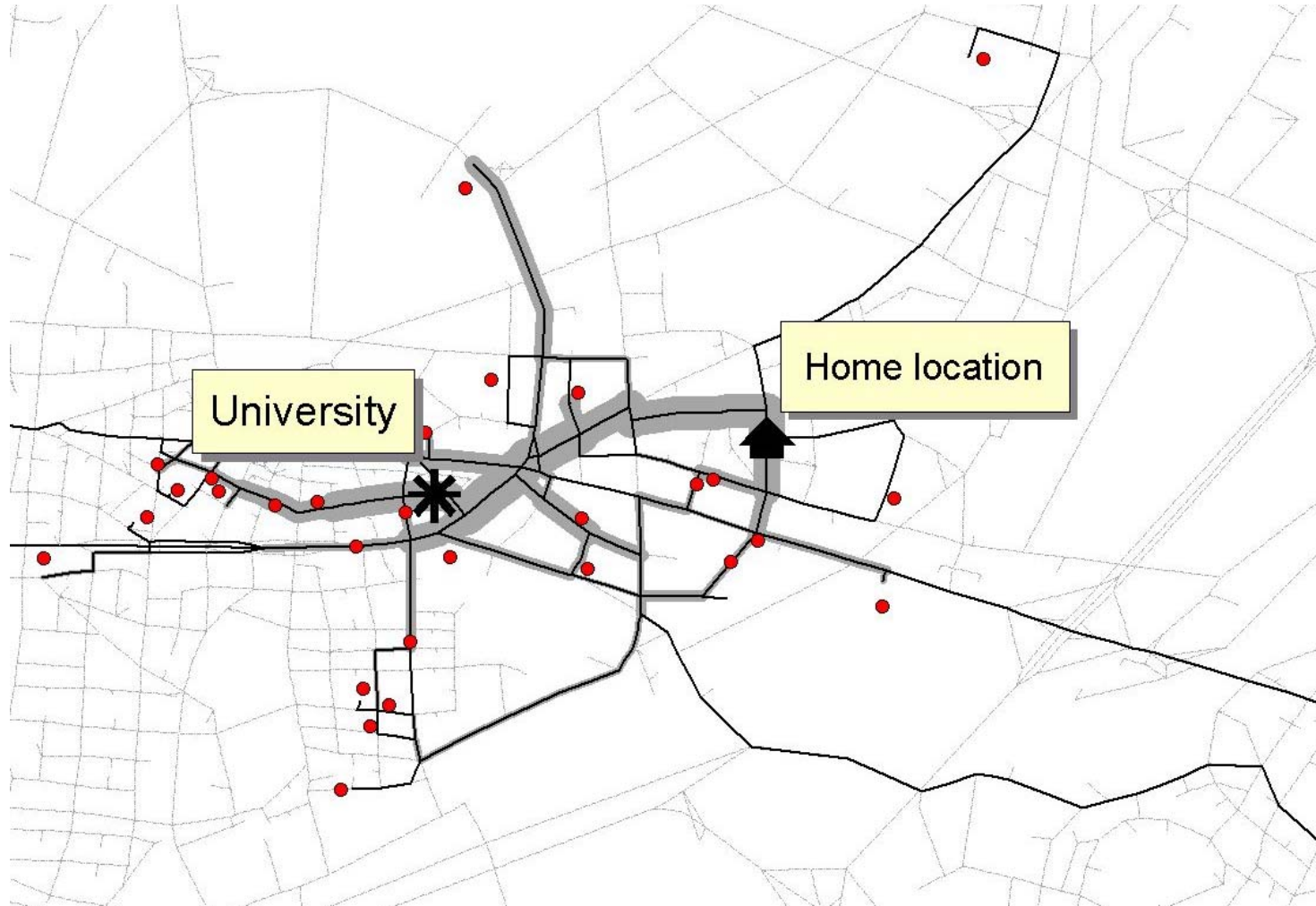
Kernel densities:

- Number of contiguous areas (clusters)

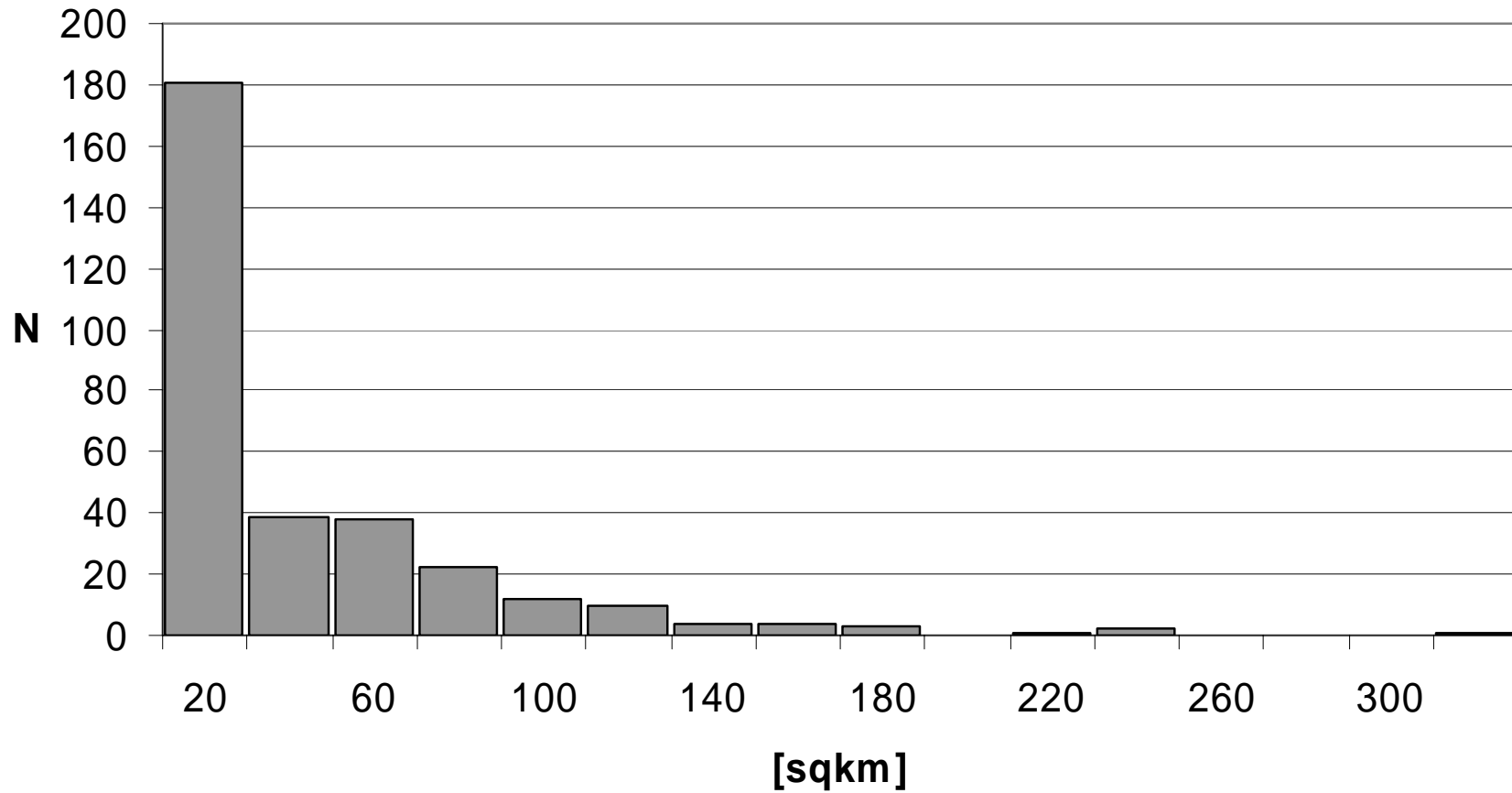
Shortest path networks:

- All descriptive statistics for network graphs
- Flow estimates

Additional information: Flow estimates

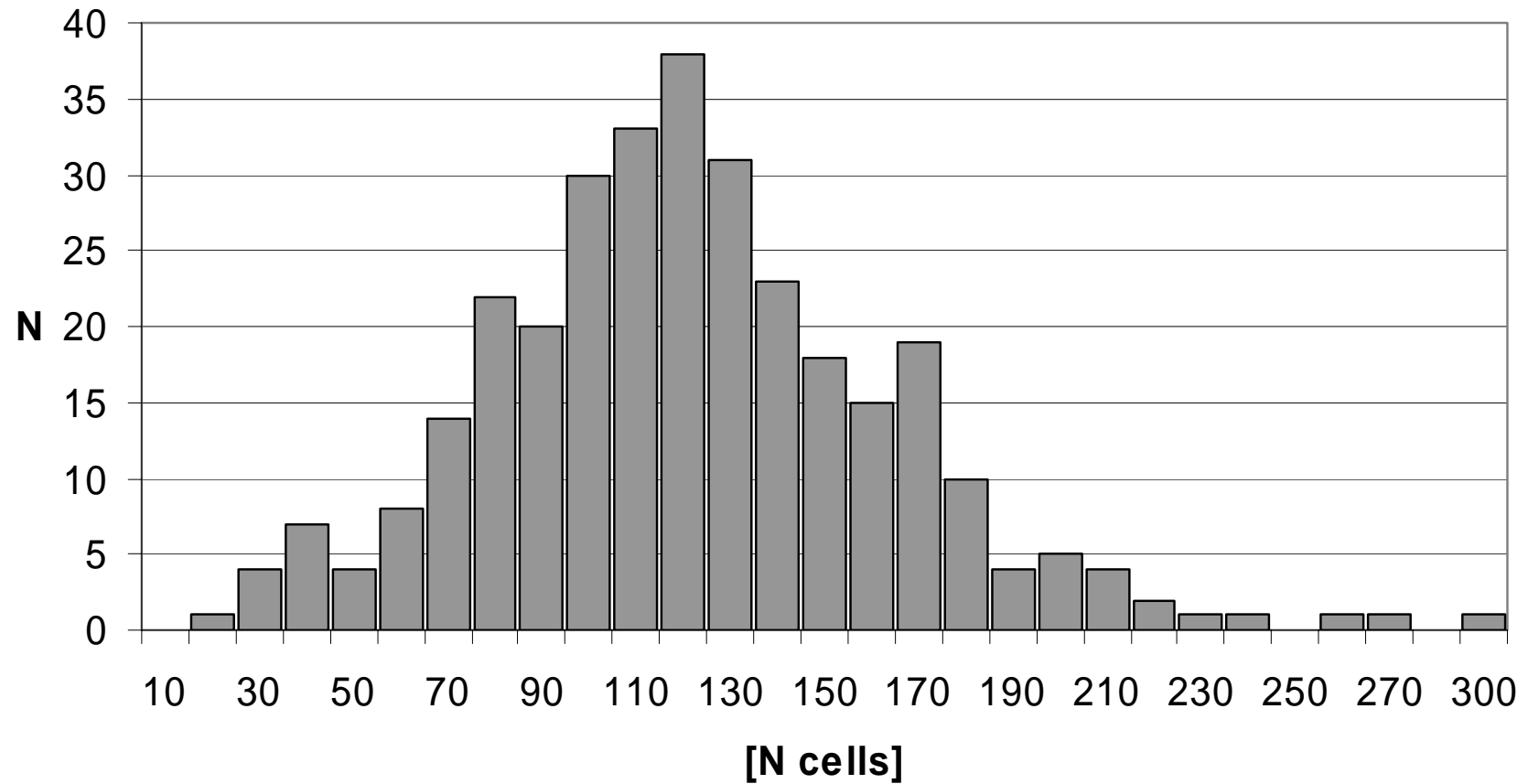


Activity space size variation: 95% CE*



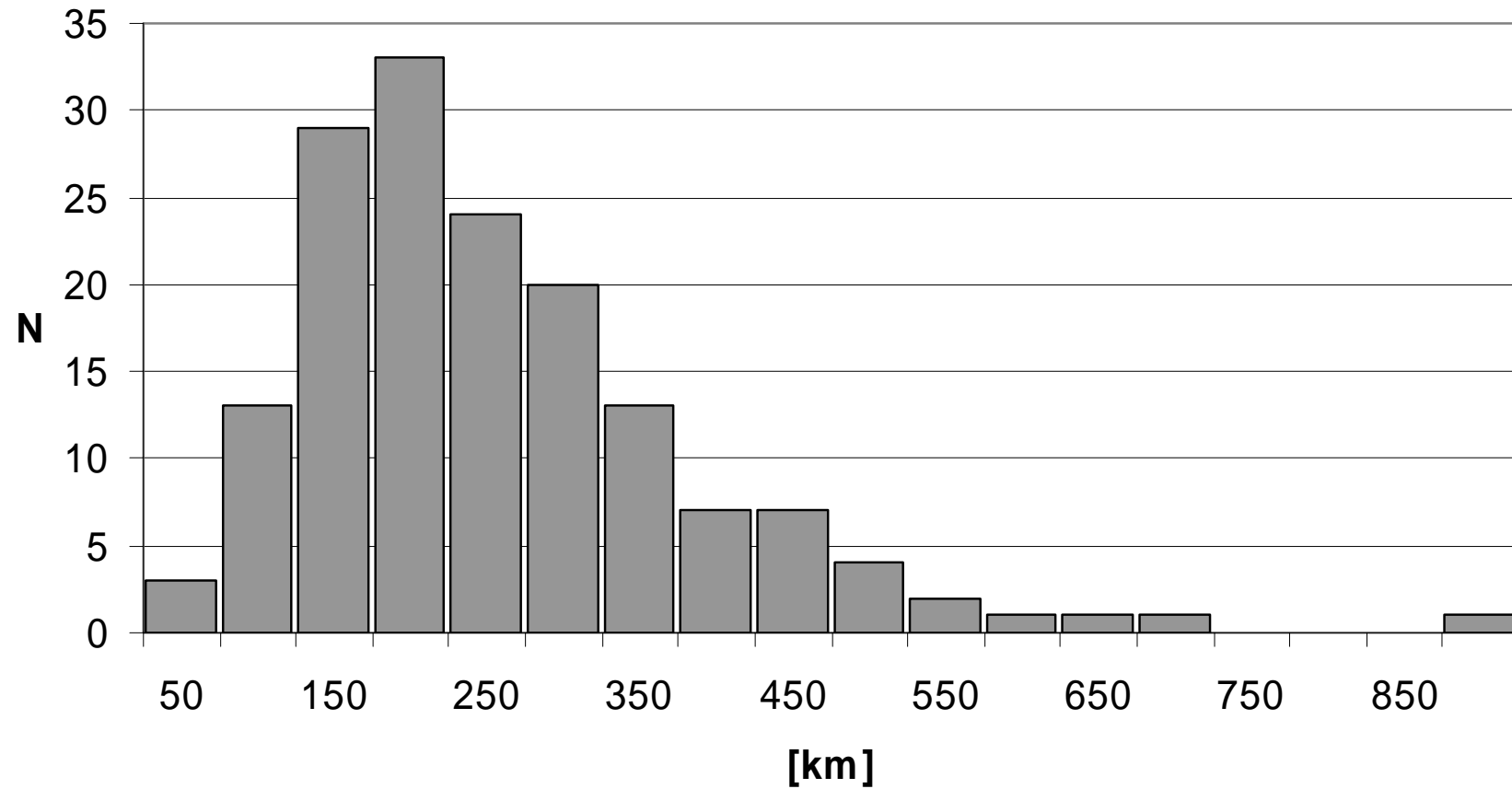
* Local trips only

Activity space size variation: Kernel densities*



* "Visited area", grid cells with positive Kernel densities value
[500*500m]; local trips only

Activity space size variation: Shortest path networks*



* Minimum network based on observed local O-D-relations

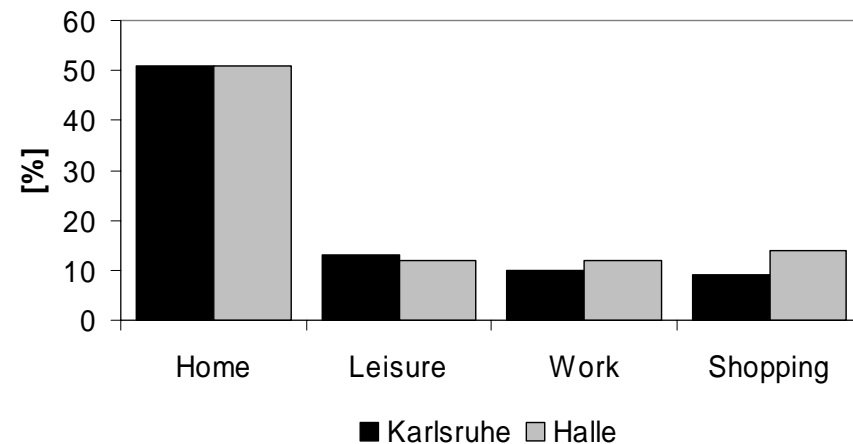
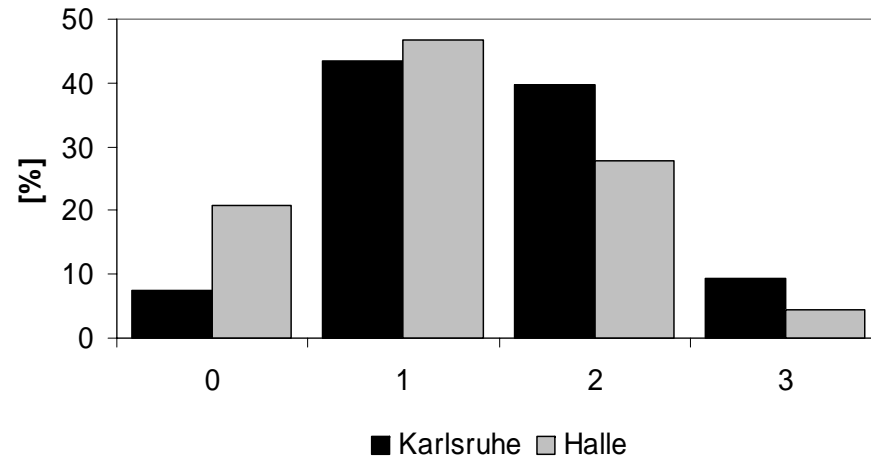
Number of clusters: Mobidrive

Cluster:

- radius: 1000m
- minimum 10% of all trips
- minimum 3 unique locations total

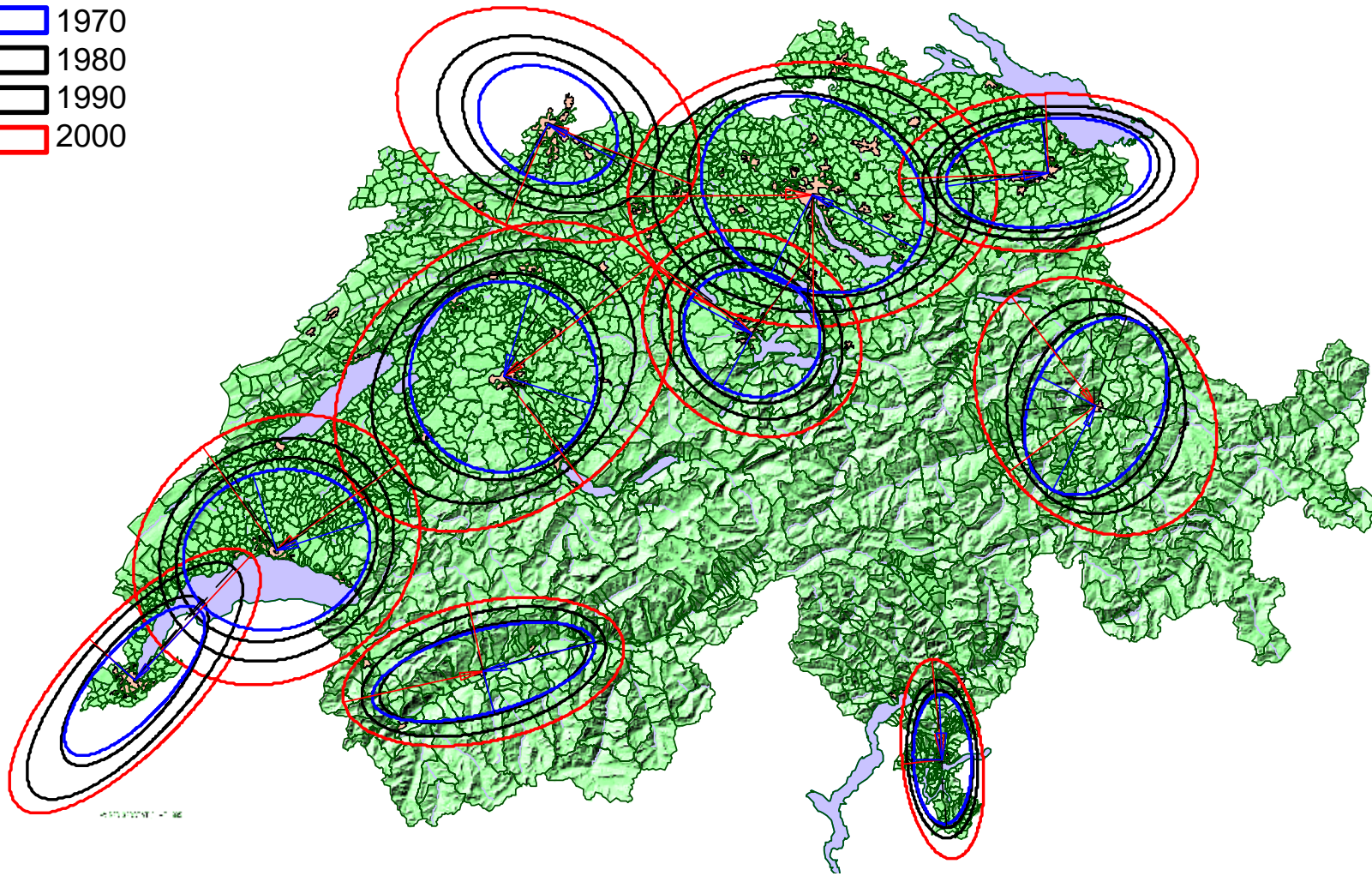
Which purposes as cores?

Workplace as centre
nonsignificant?

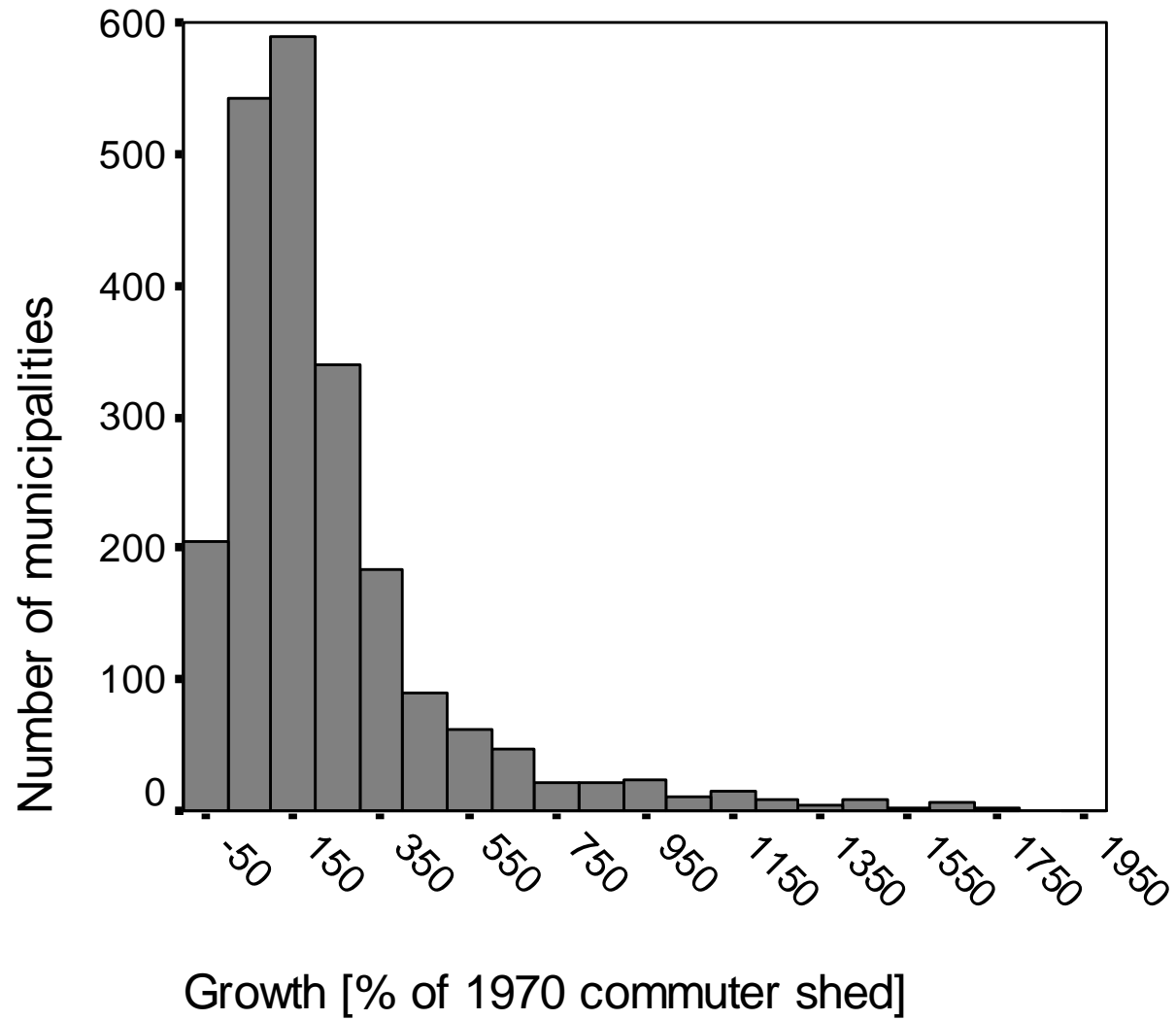


Trends: Swiss commuter sheds since 1970

- 1970
- 1980
- 1990
- 2000



Swiss commuter shed growth 1970 – 2000 (95% CE)



Swiss commuter shed growth 1970 – 2000 (95% CE)

Type of municipality:

	Core	Secondary centre	First ring	Second ring
Mayor centre	160	207	371	243
Mid-sized centre	145		239	321
Small centre	141			
„Commuter“	300			
Industrial	298			
Semi-rural	391			
Rural	450			

Advantages and disadvantages

Approach	Plus	Minus
Confidence Ellipse	Simple Useful secondary measures	Too rigid Overestimate
Kernel density	Identification of clusters, Follows pattern	Complex calculation
Shortest path network	Travel impacts obvious	Large data needs