

Preferred citation style for this presentation

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Accessibility and spatial development: The case of Switzerland between 1950 and 2000

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What is accessibility ?

Any number of definitions, but the basic types are:

- Existence of link of a given quality
- Number of opportunities reachable within a certain cost isoline
- Cost-weighted number of opportunities

Accessibility as *Potential*

Form:

$$A_i = \ln \sum_{\substack{c_{ij} < c_{\max} \\ k_{ij}=0}} X_j f(c_{ij})$$

with:

$A(i)$	Accessibility of location i
$c(ij)$	Generalised cost of movement from i to j
$X(j)$	Opportunities of interest at location j
$f[c(ij)]$	Weighting function of the generalised costs

Accessibility as *Potential*

Theoretical justification

- $A(i)$ is the log sum term of a simple destination choice model with $\ln X$ and sum measure of generalised costs
- $c(ij)$ could be inclusive term of a mode choice model

Normal application

- $c(ij) \sim$ travel time
- $f[c(ij)]$ is a negative exponential with a chosen b , so that $f[c(ij)] = \exp[-b * c(ij)]$
- $c(\max)$ is equal to infinity

Why are we interested in accessibility ?

Mechanisms:

- Accessibility \sim 1/Generalised costs \sim Speed
- Accessibility \sim Market size

What should follow from this:

- Benefits from trade (specialisation, economies of scale)
- Better fit between supply and demand (goods and labour markets)
- More reliability and range in services and supplies
- but, the winning region is unclear !

Accessibility change and economic growth

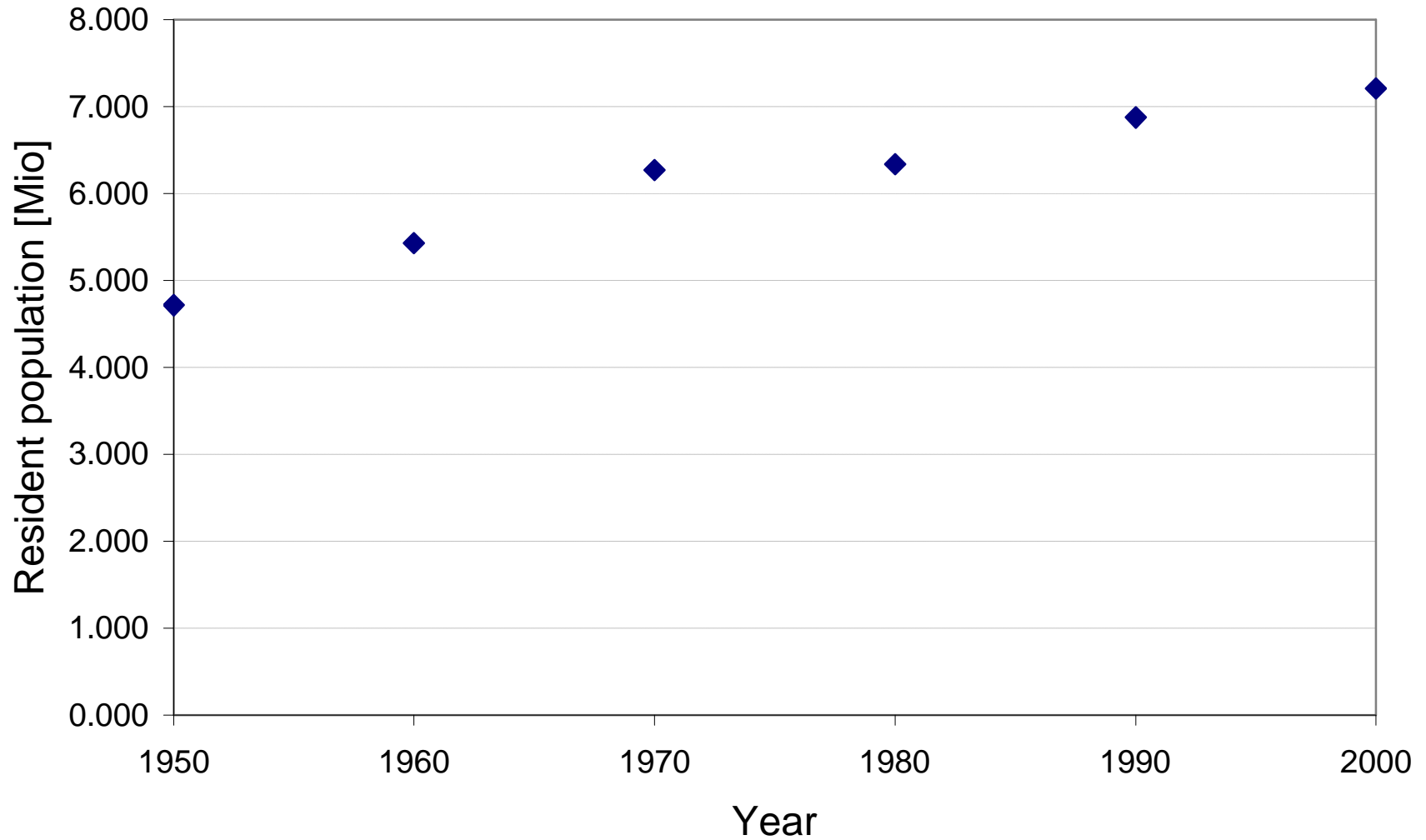
Previous work:

- Aschauer (1989) and others: large spatial units, short durations (10-15 years), public capital instead of accessibility
- Most authors argue: Massive early impacts, little further impacts expected

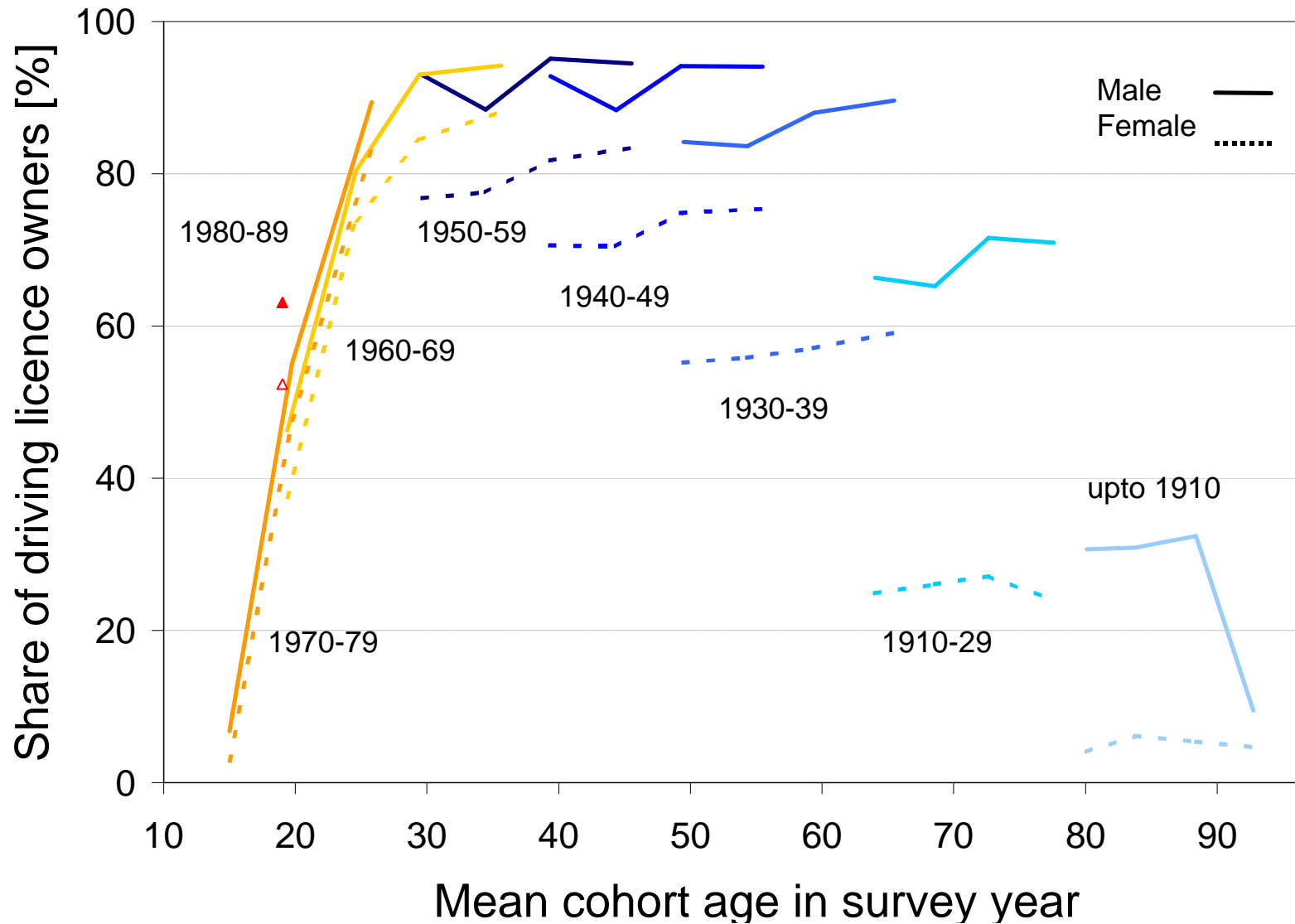
Aims of our work:

- Small spatial units (2900 municipalities)
- Long duration (50 years)
- Accessibility (detailed road and rail networks)
- Calibrated cost parameters (mode choice model)
- Population, employment, value added as Y's

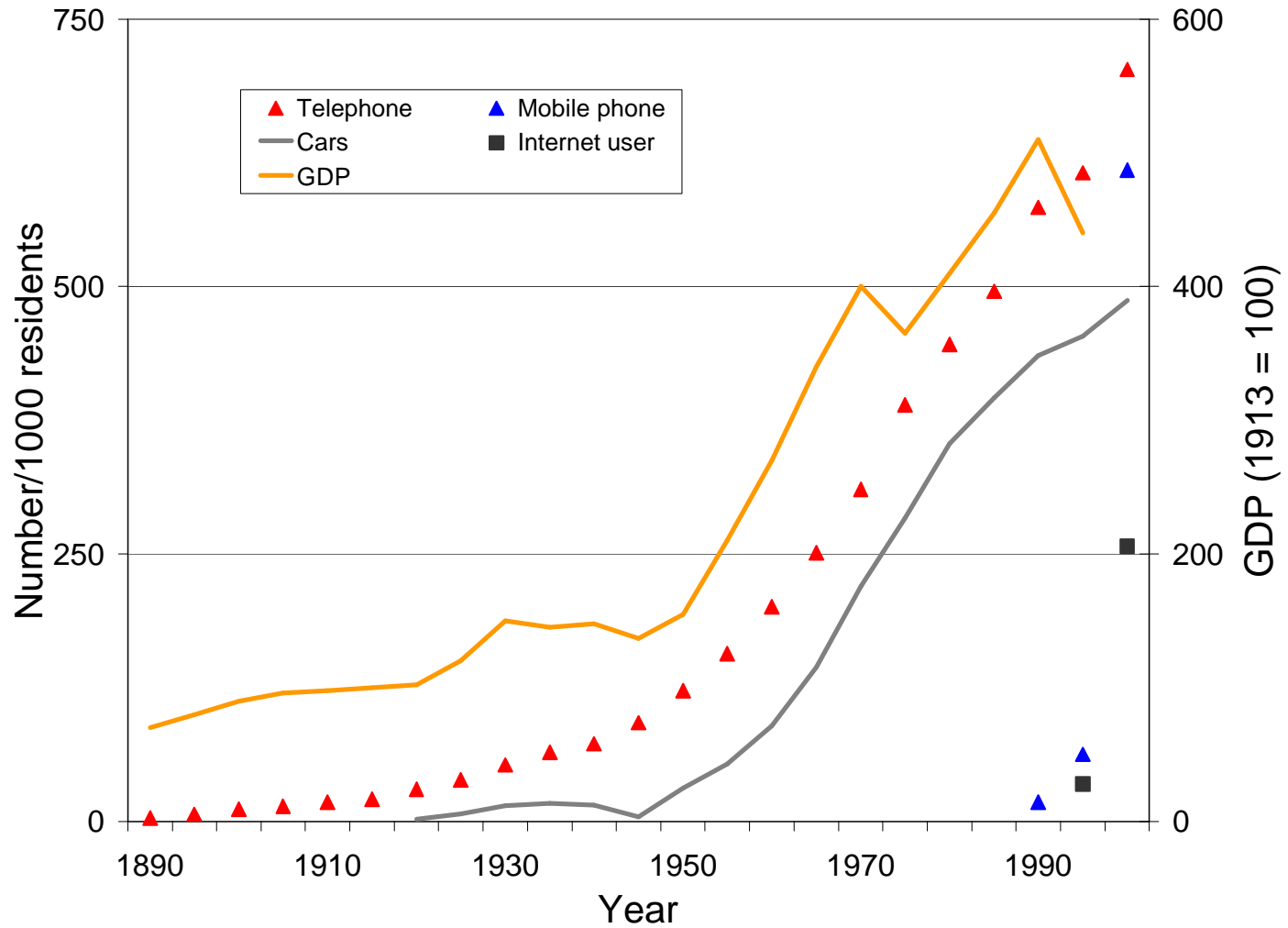
Confunding factors: Population growth



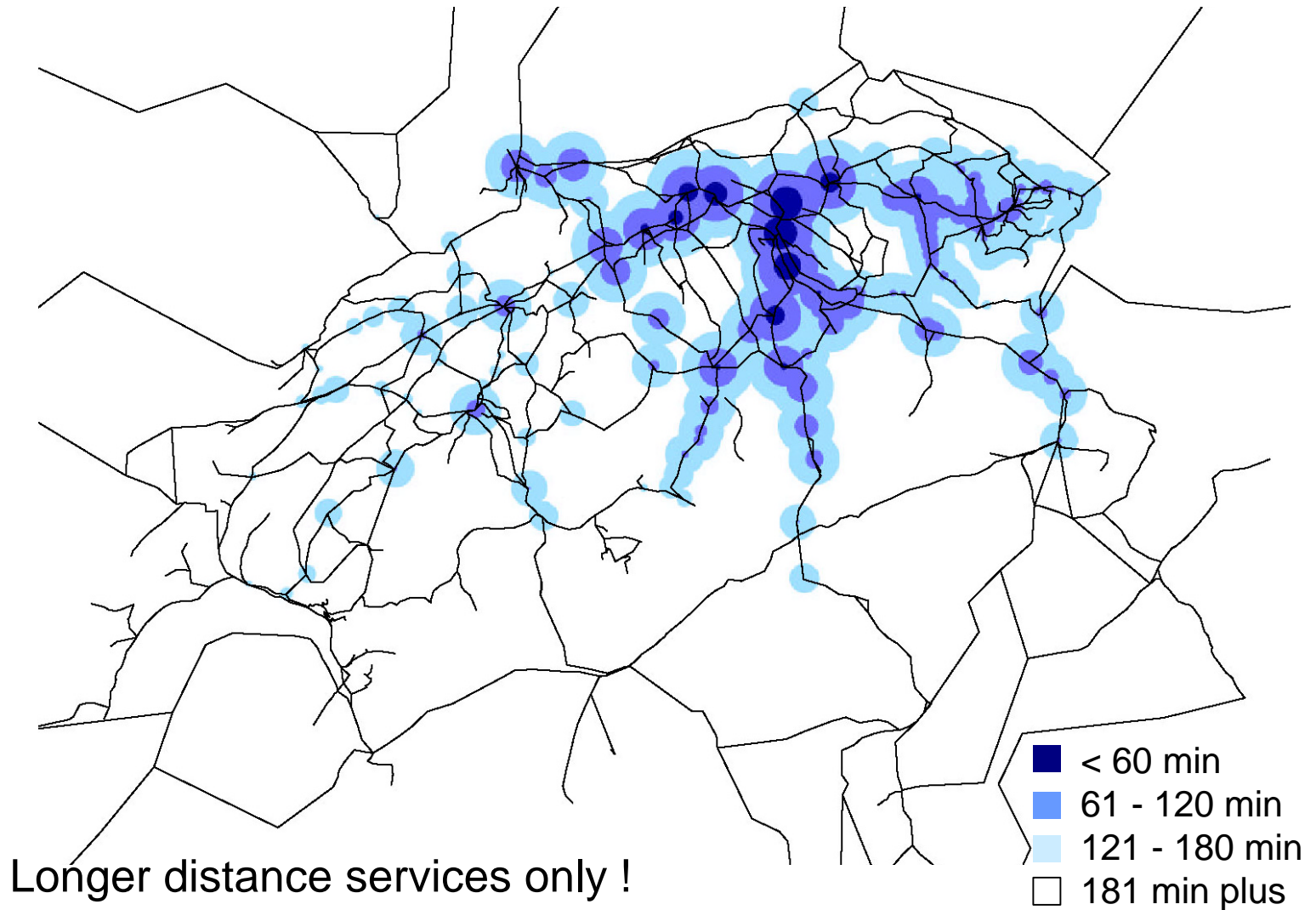
Confounding factors: Life style adjustment



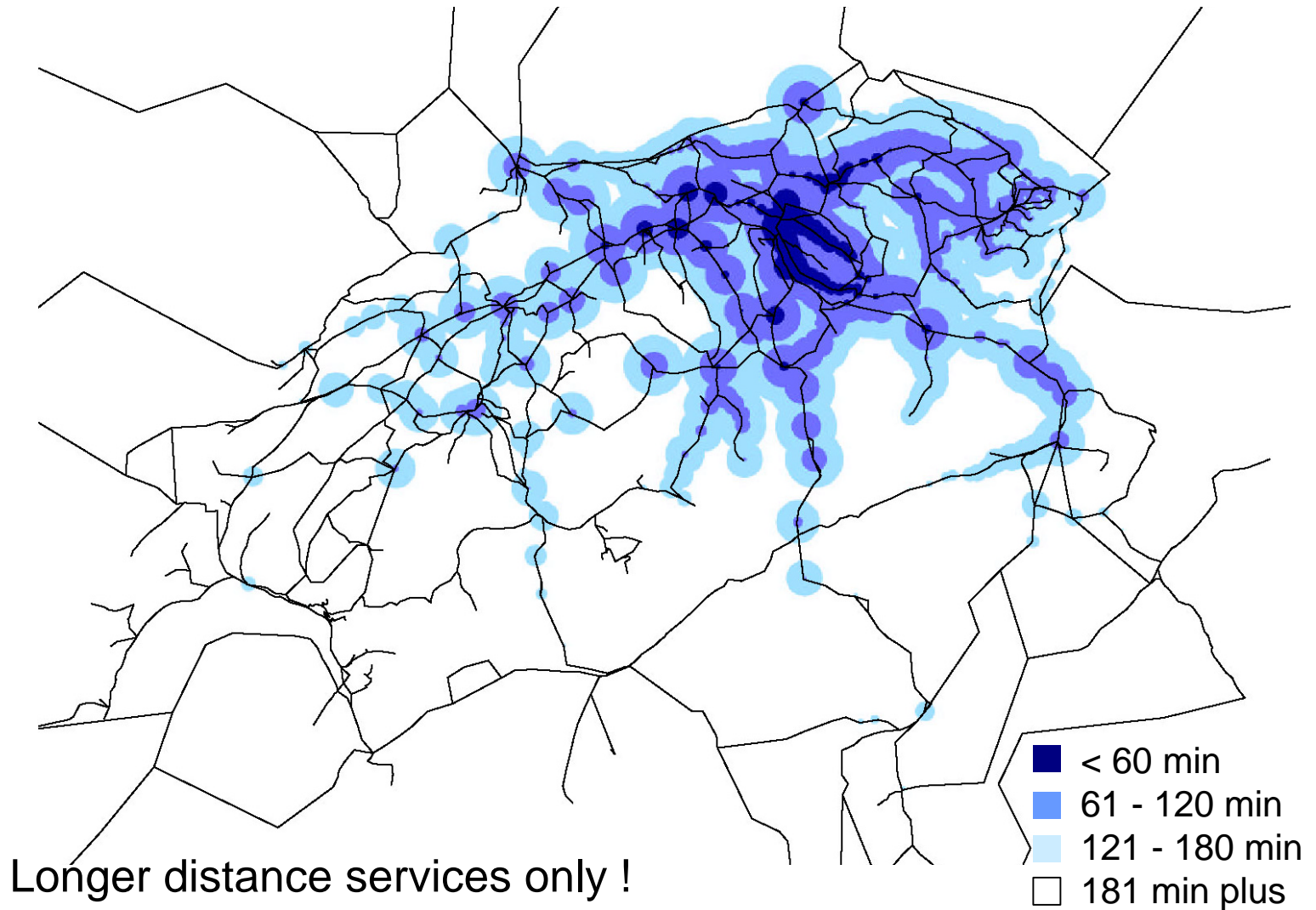
Confounding factors: GDP growth



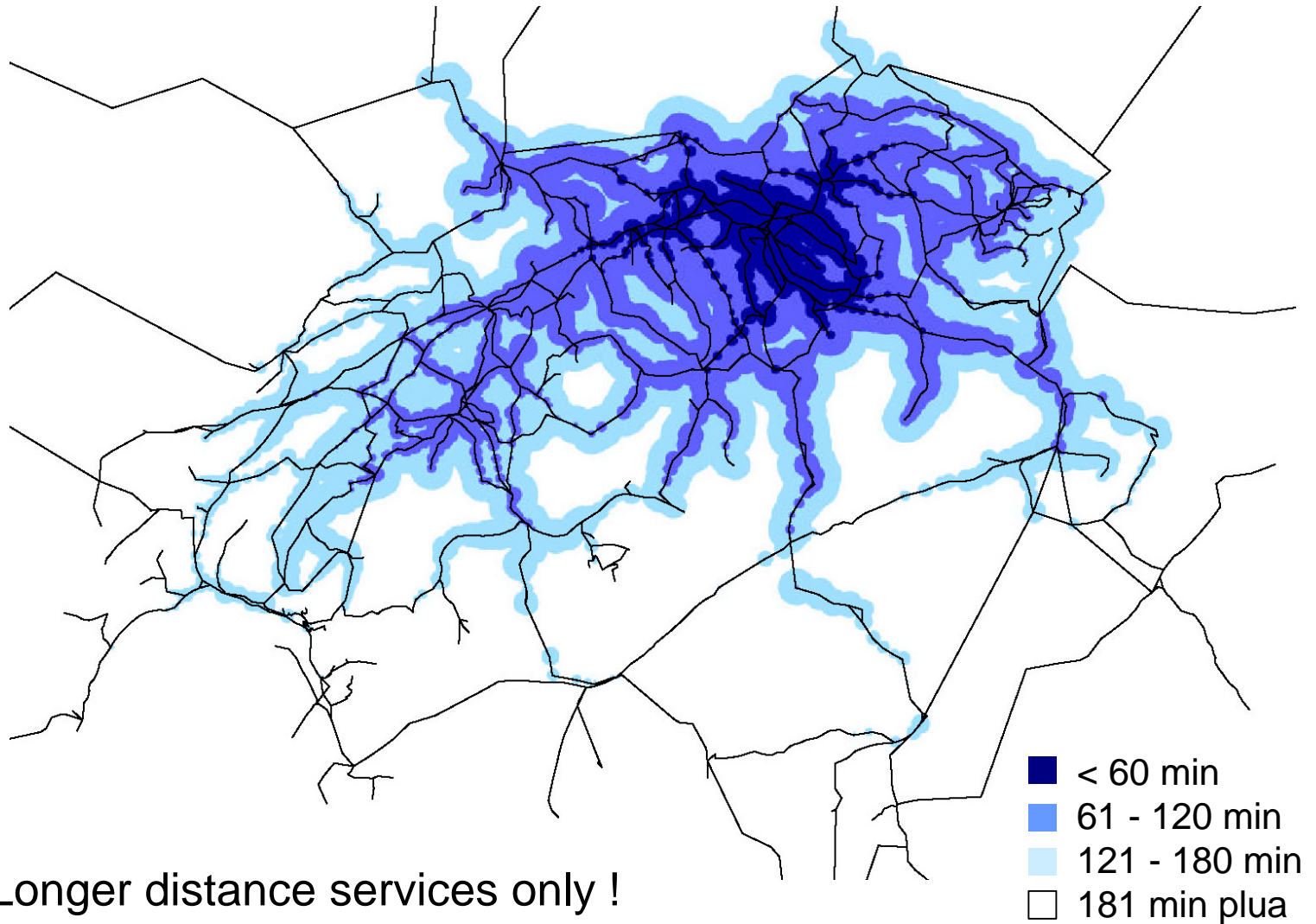
Railway isochrones (Zürich, 1960, 8 to 9 am)



Railway isochrones (Zürich, 1980, 8 to 9 am)

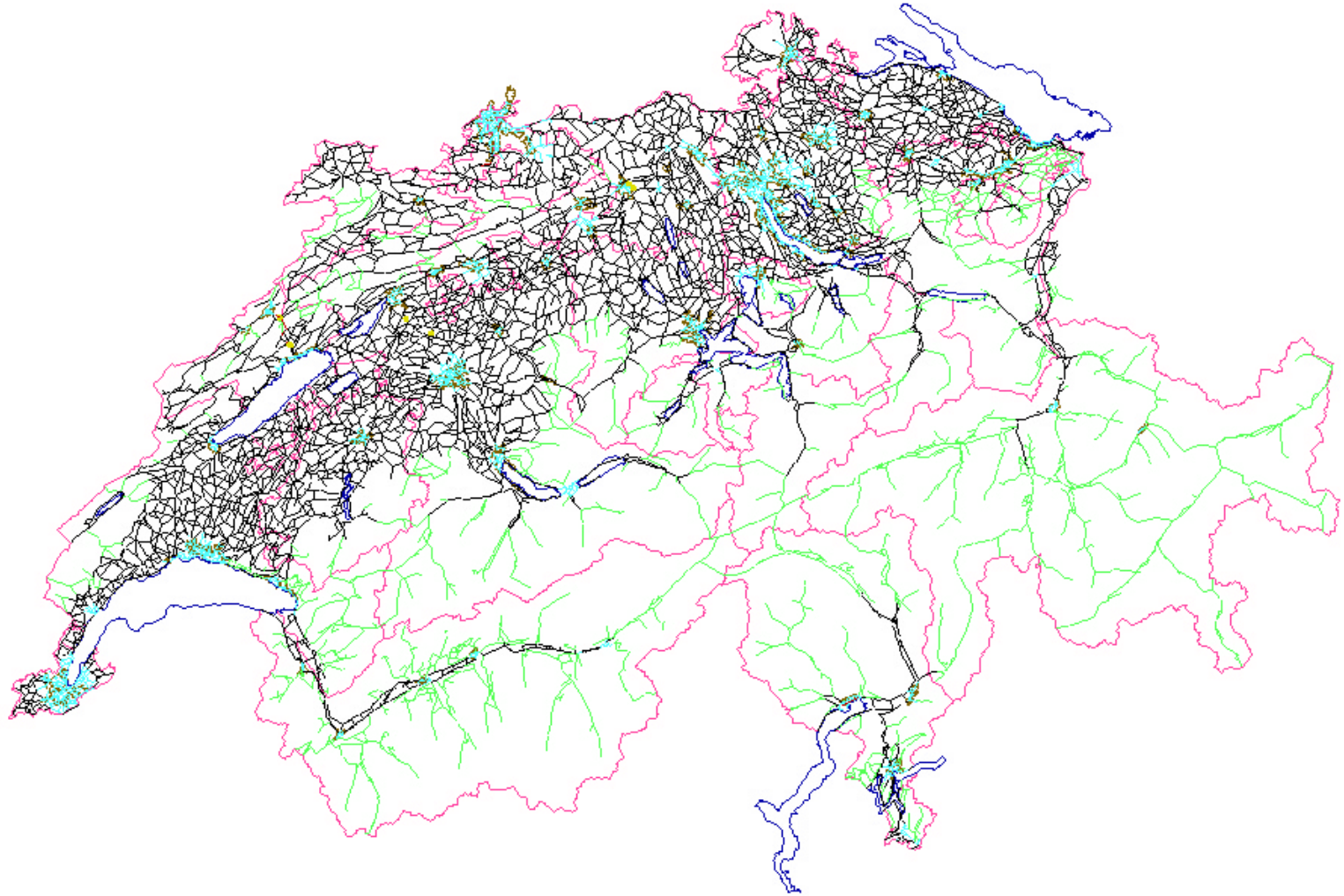


Railway isochrones (Zürich, 2000, 8 to 9 am)

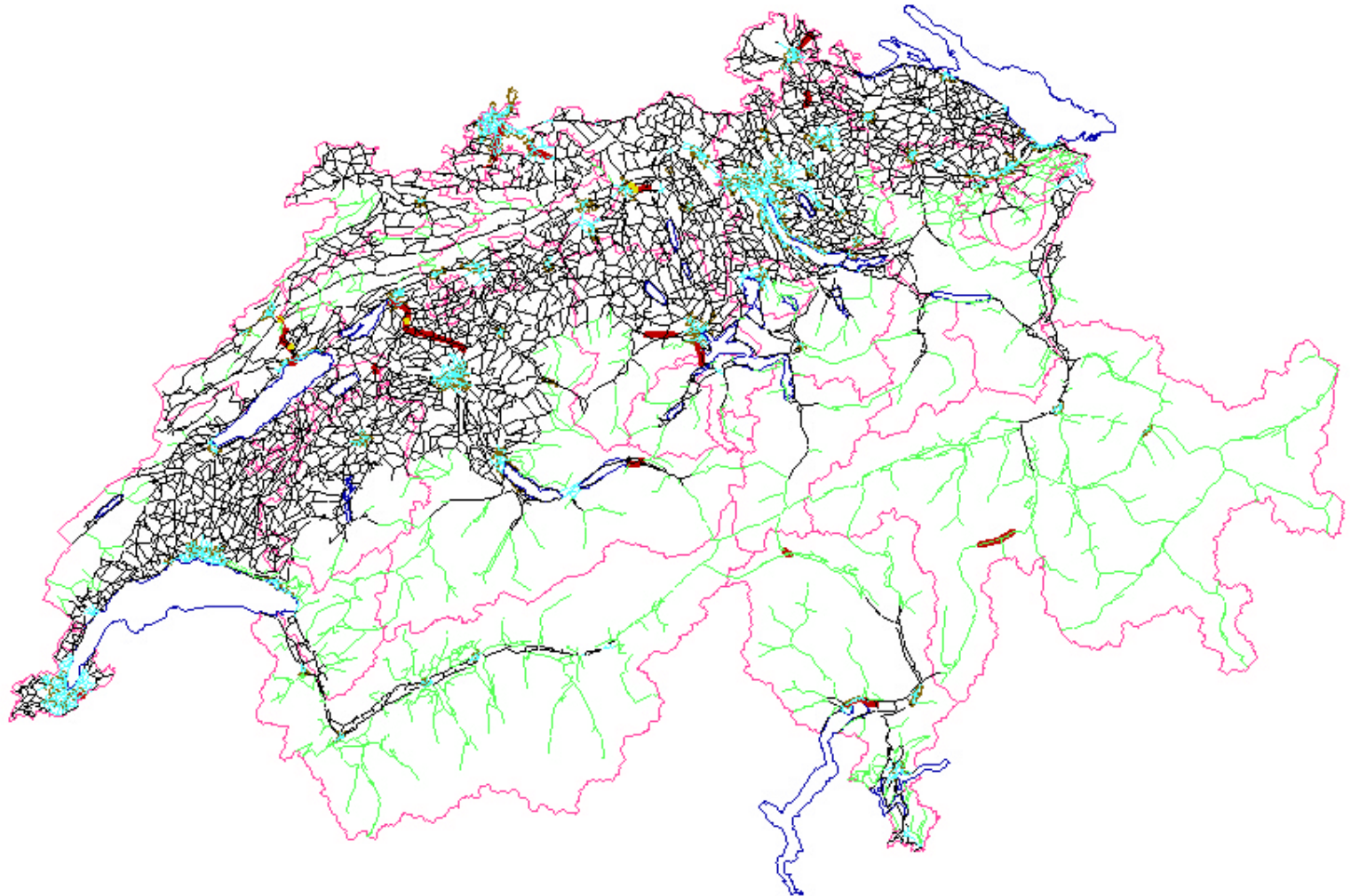


Longer distance services only !

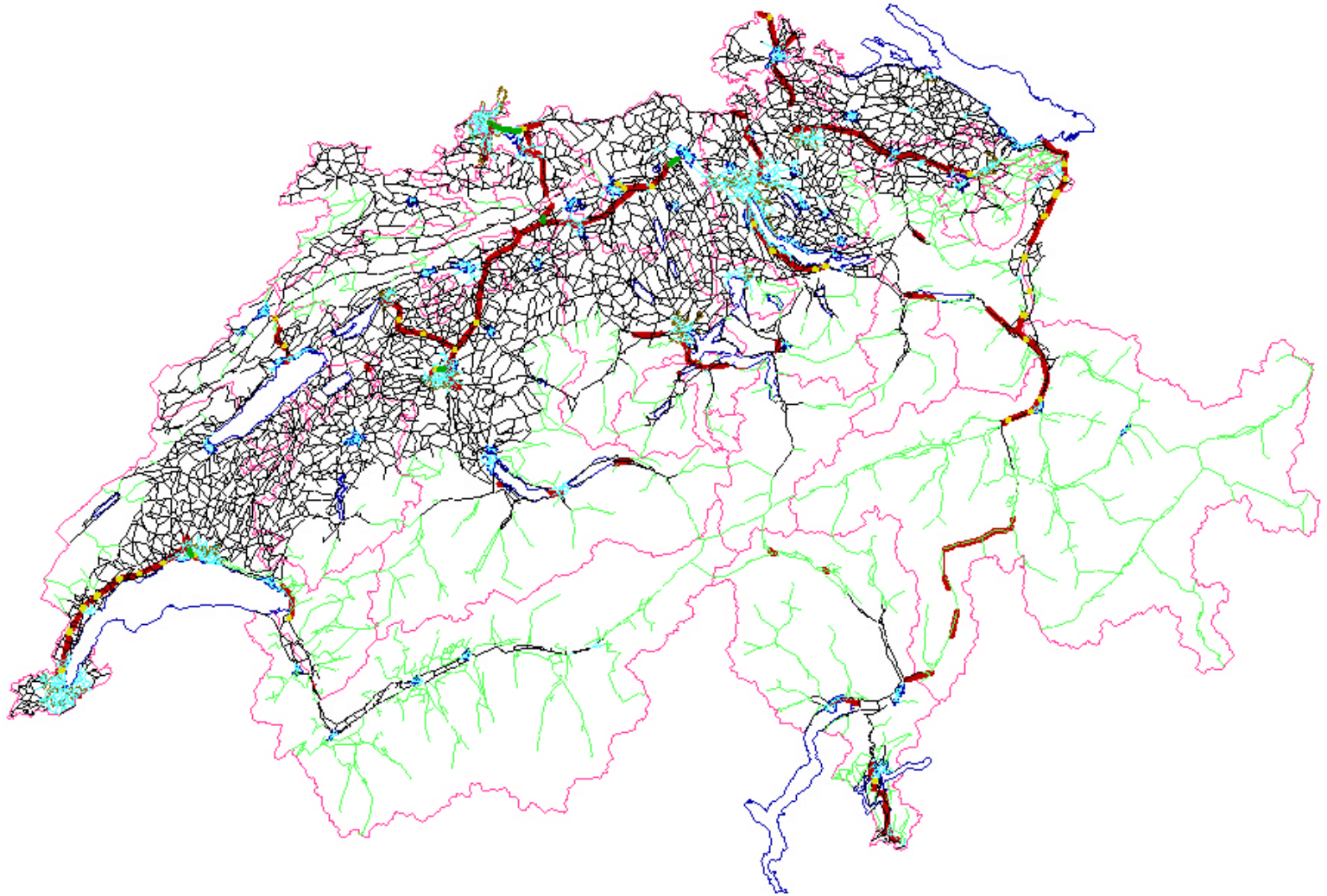
Motorway network 1950



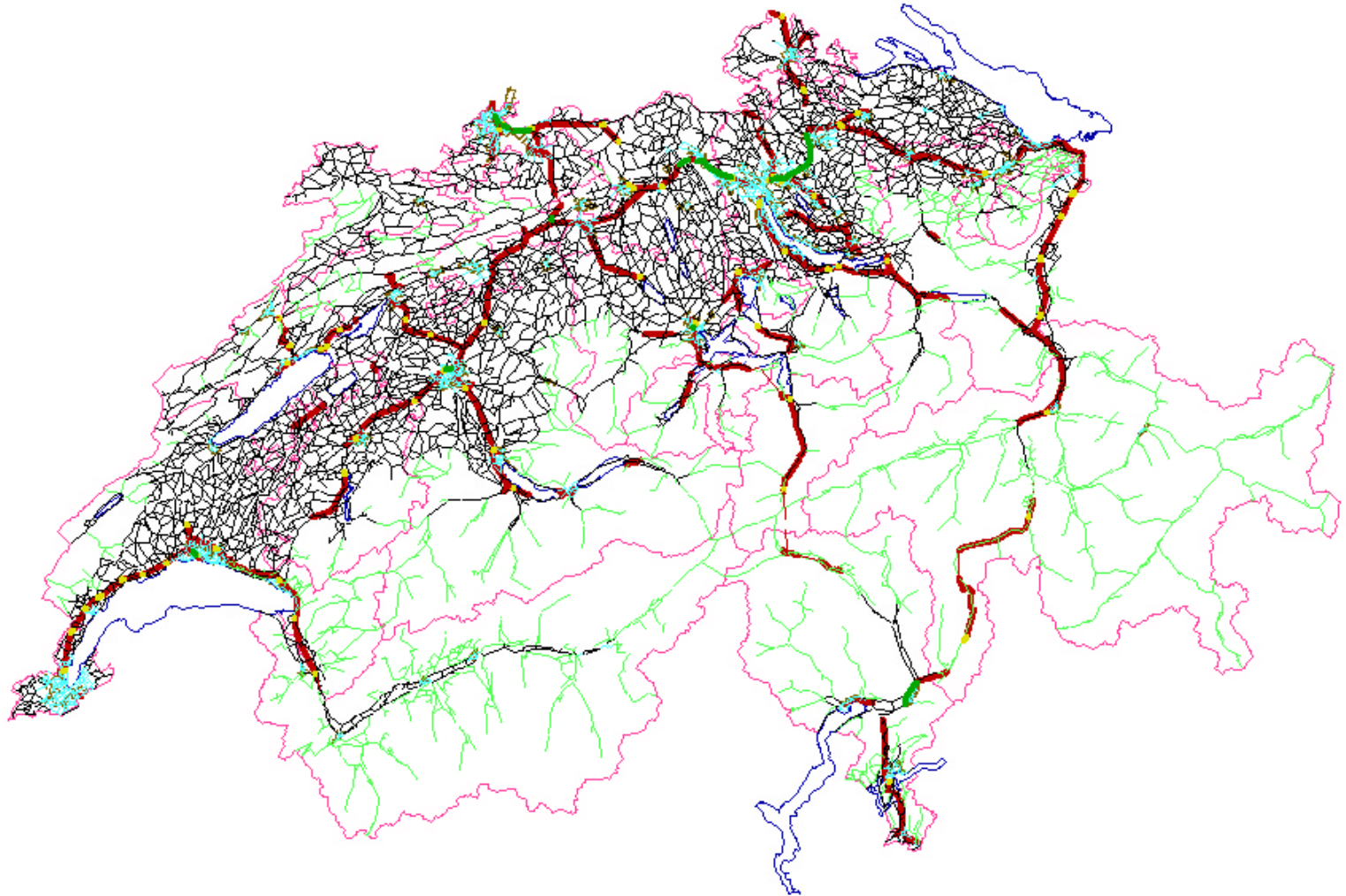
Motorway network 1960



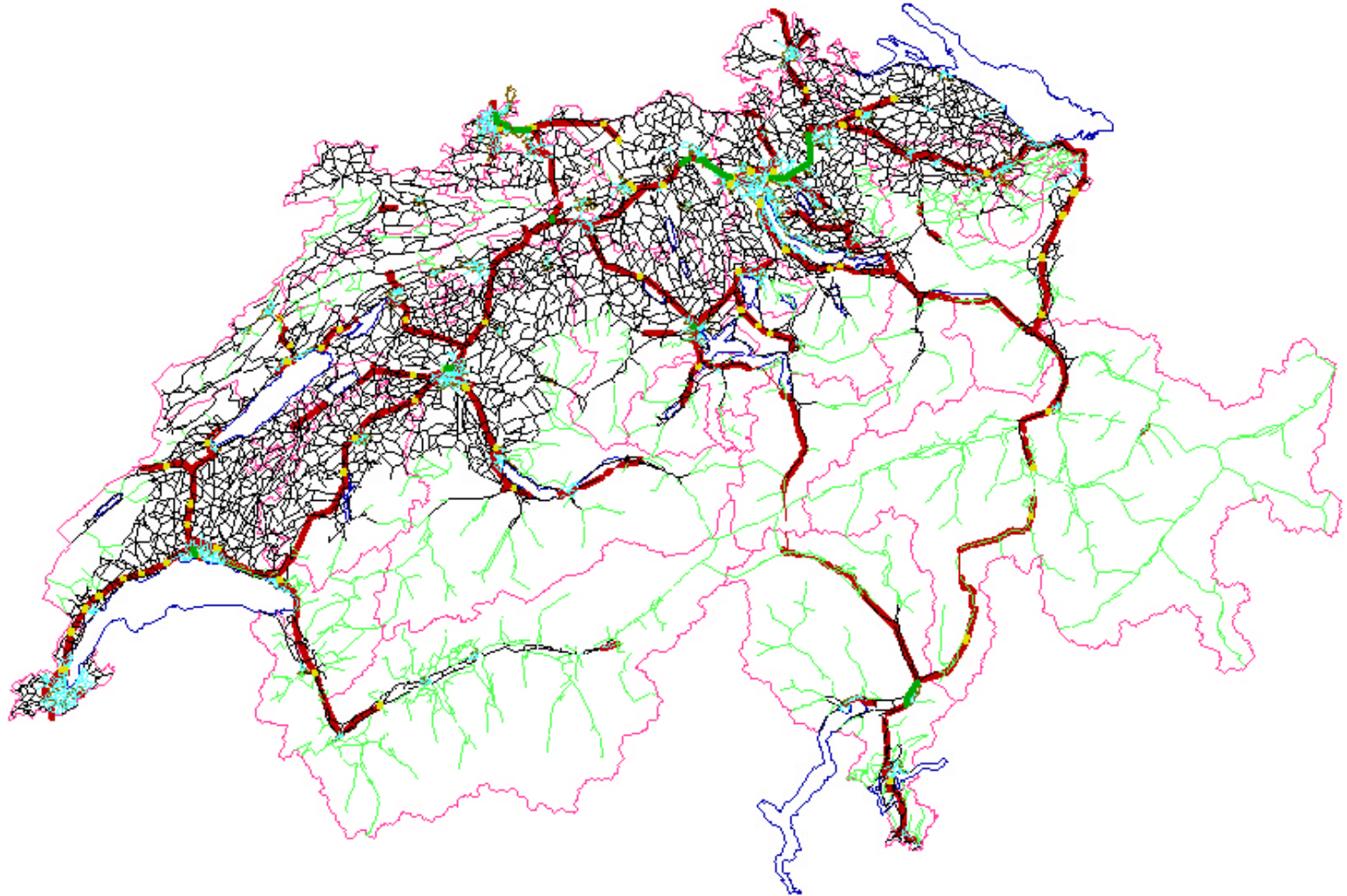
Motorway network 1970



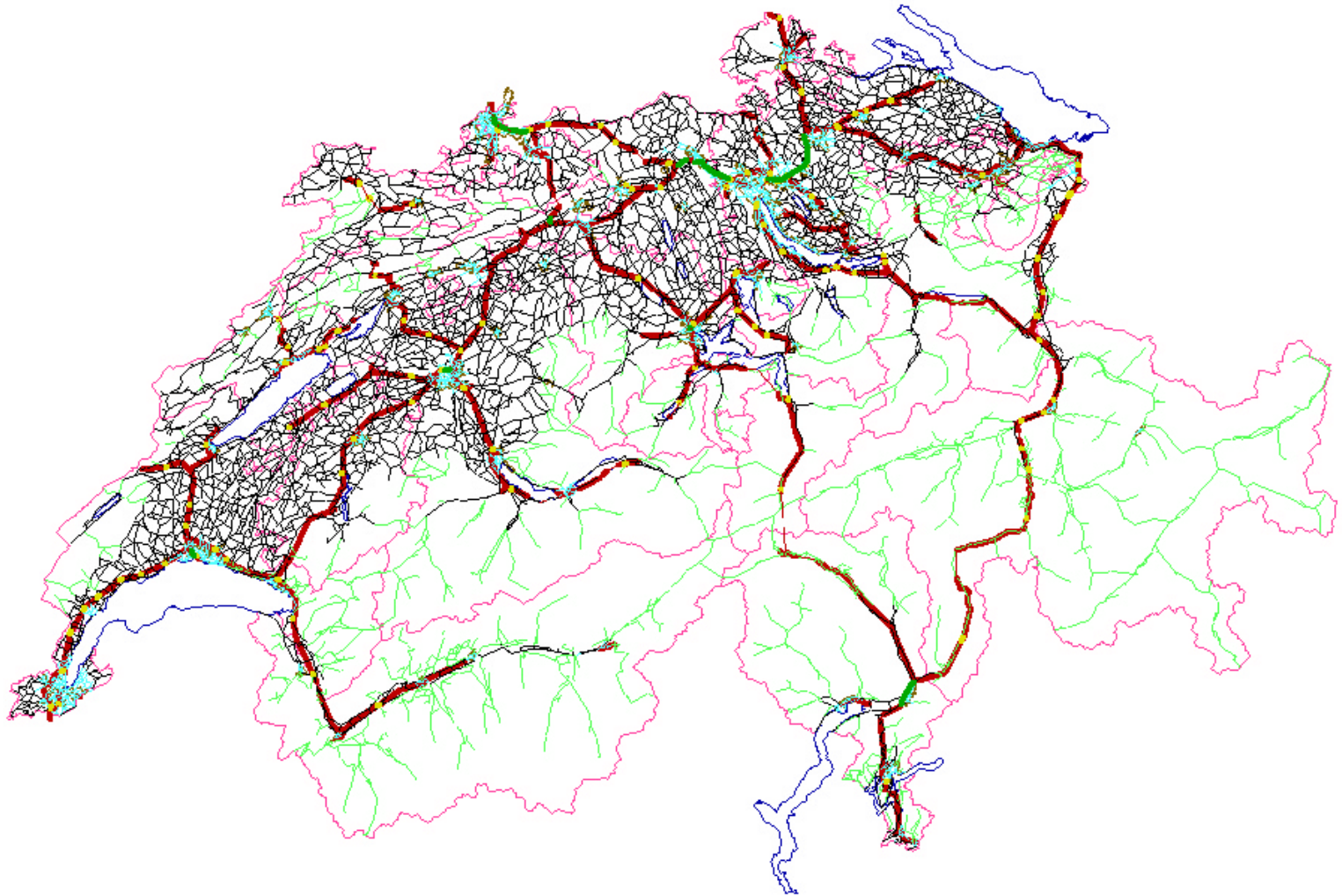
Motorway network 1980



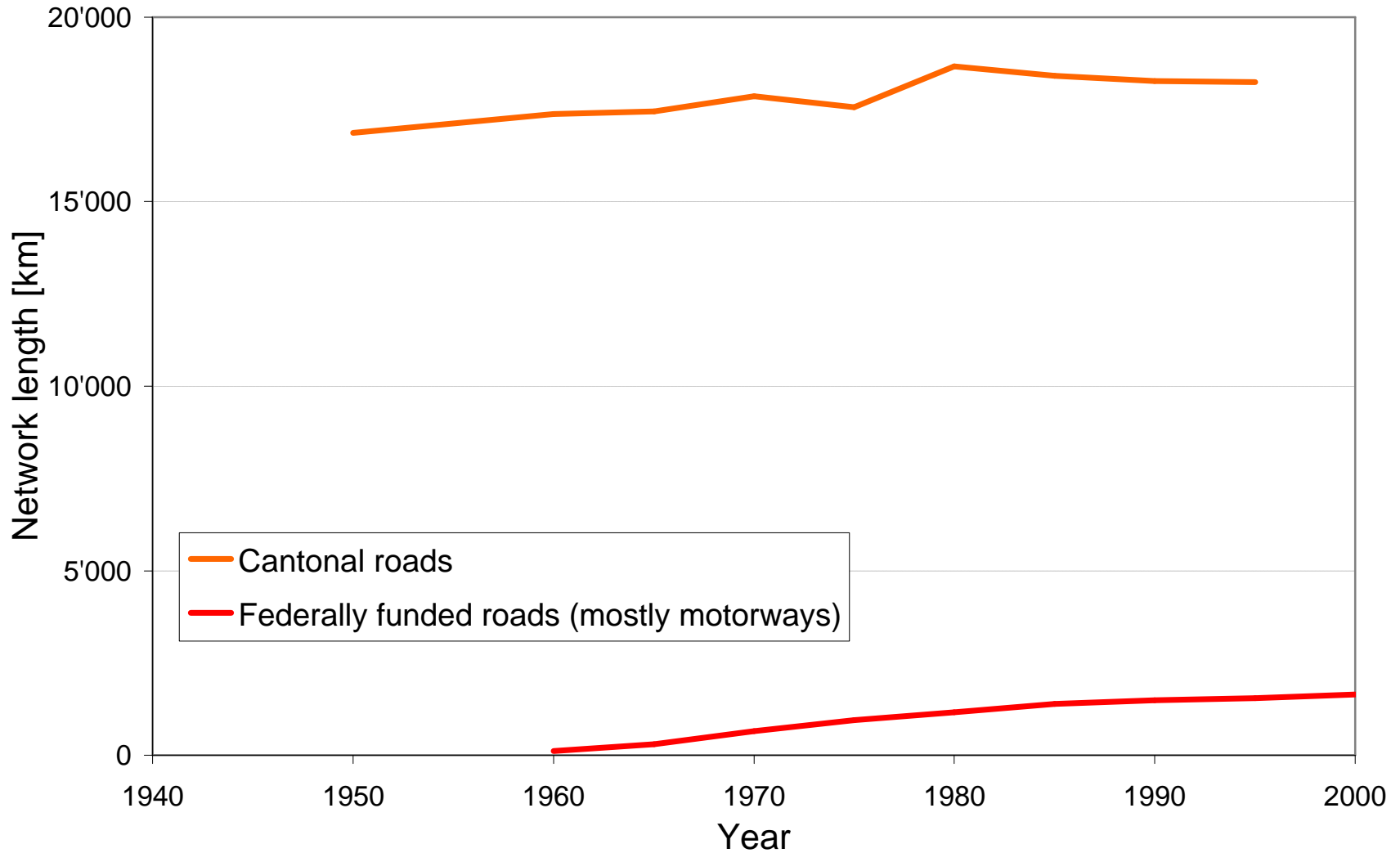
Motorway network 1990



Motorway network 2000



Development of the trunk road networks (1950-2000)



Initial accessibility estimates

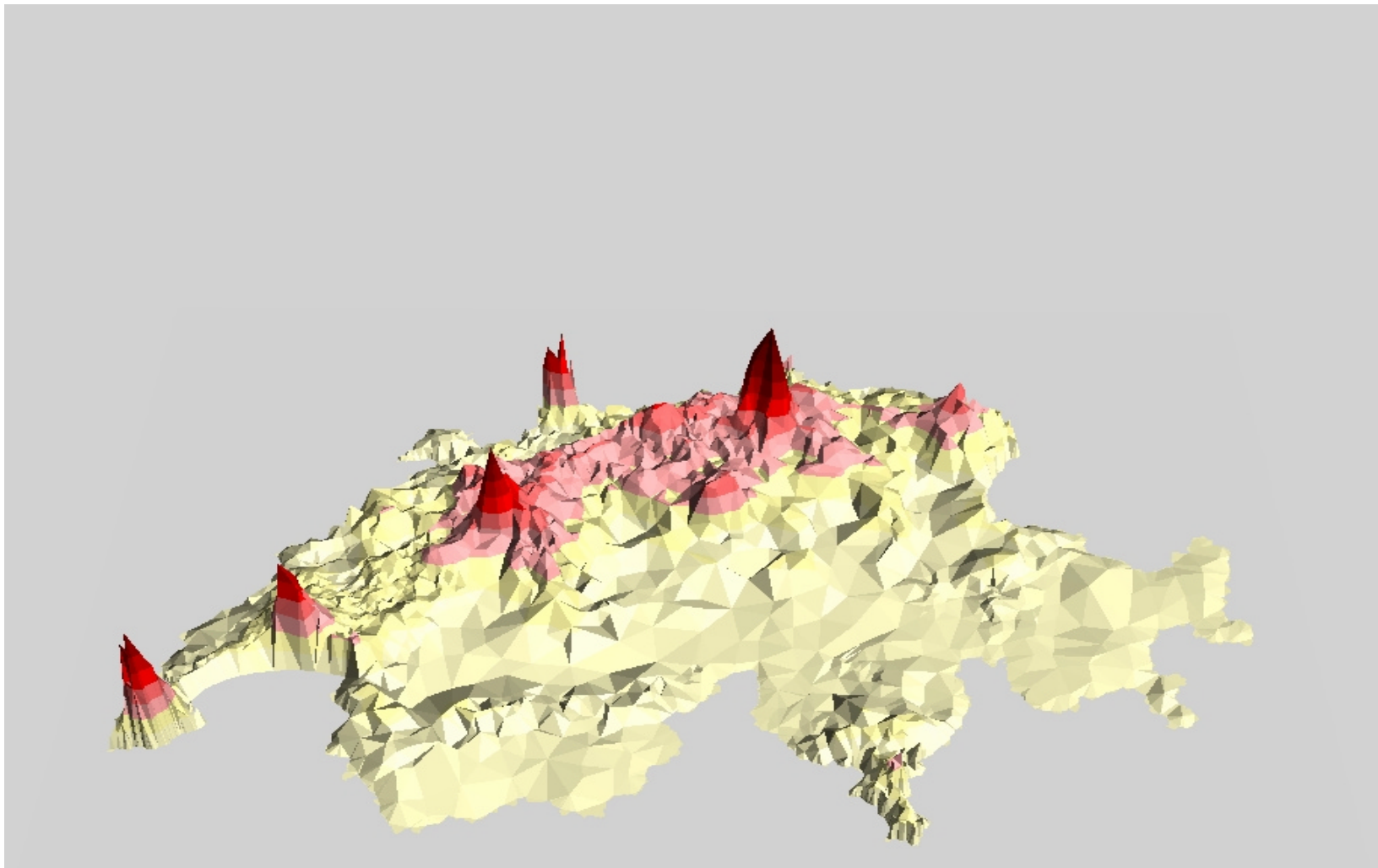
Networks

- Do not include all trunk roads built
- Initial mean speed estimates (no assignment)

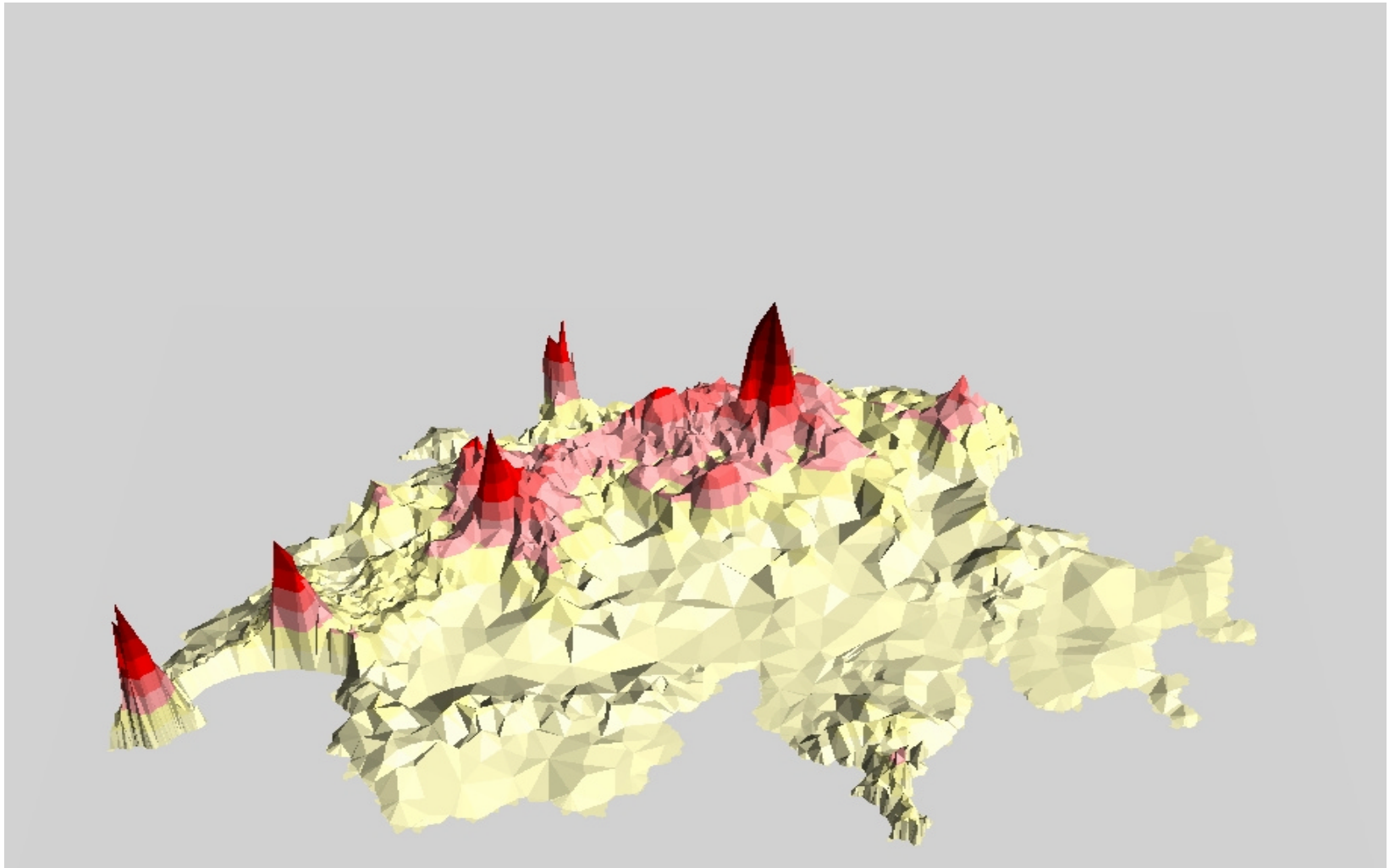
Opportunities

- Population only
- Arbitrary, but reasonable consideration of own-potentials
- b is a reasonable guess

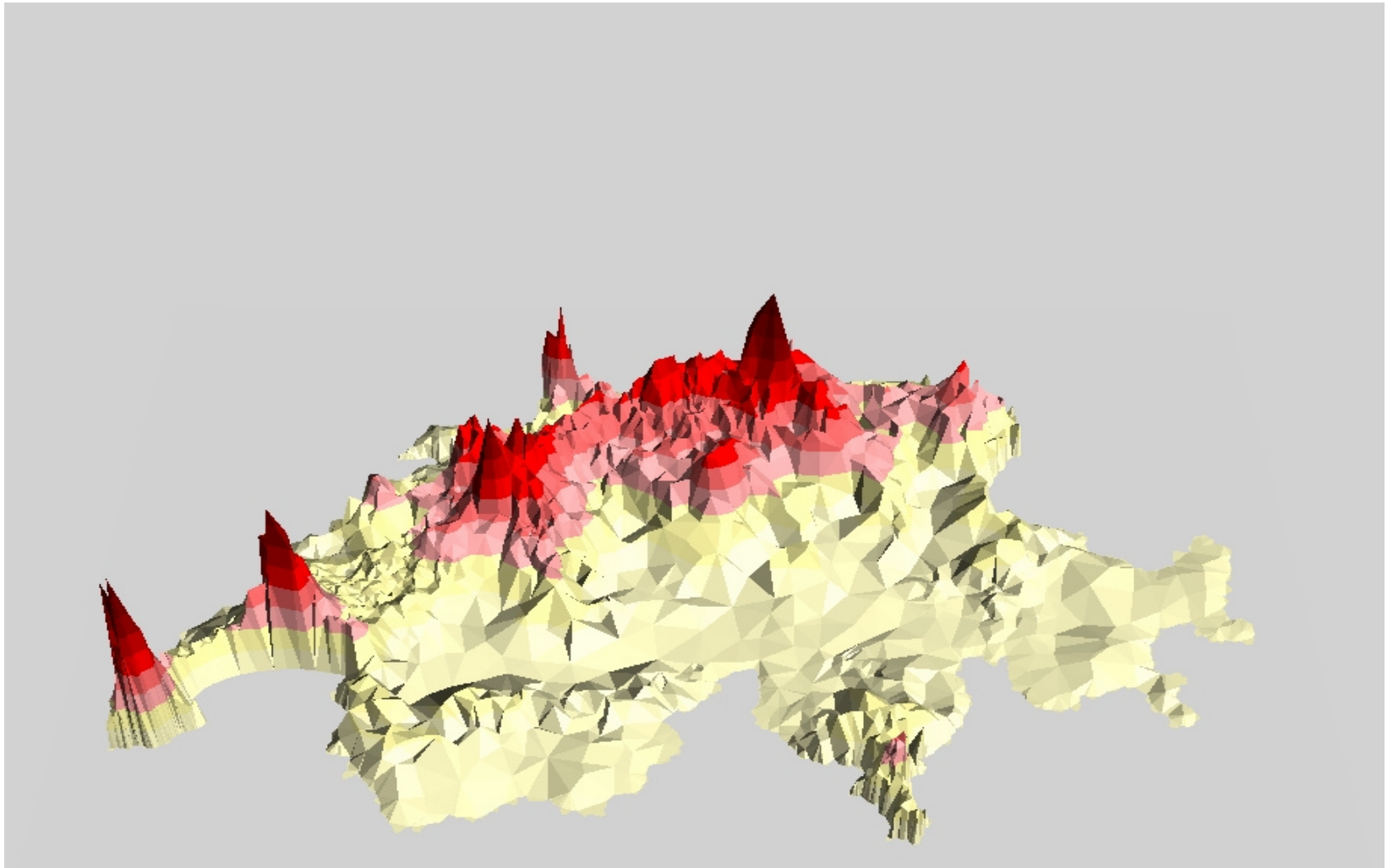
Road based accessibility (1950) (Switzerland only)



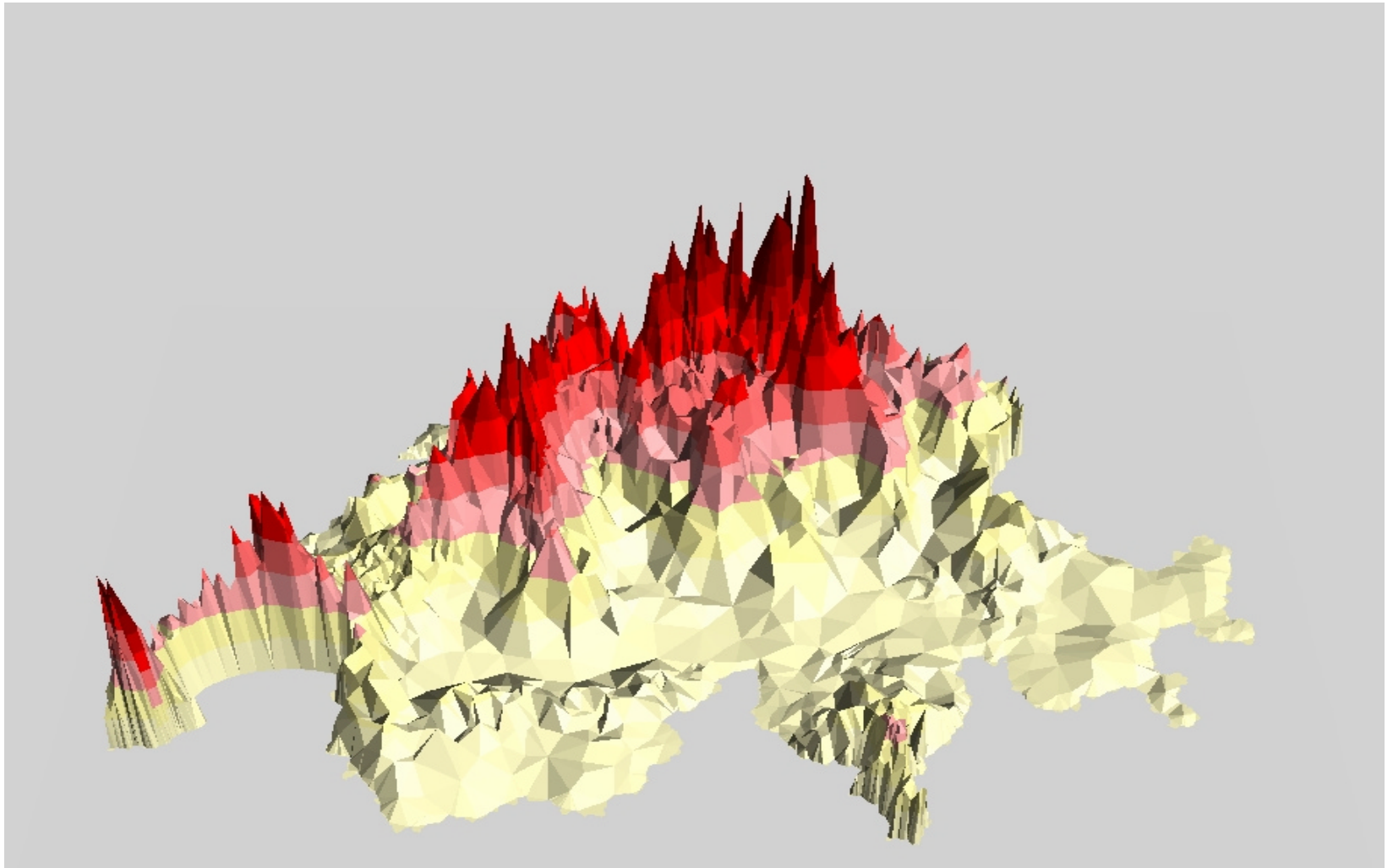
Road based accessibility(1960) (Switzerland only)



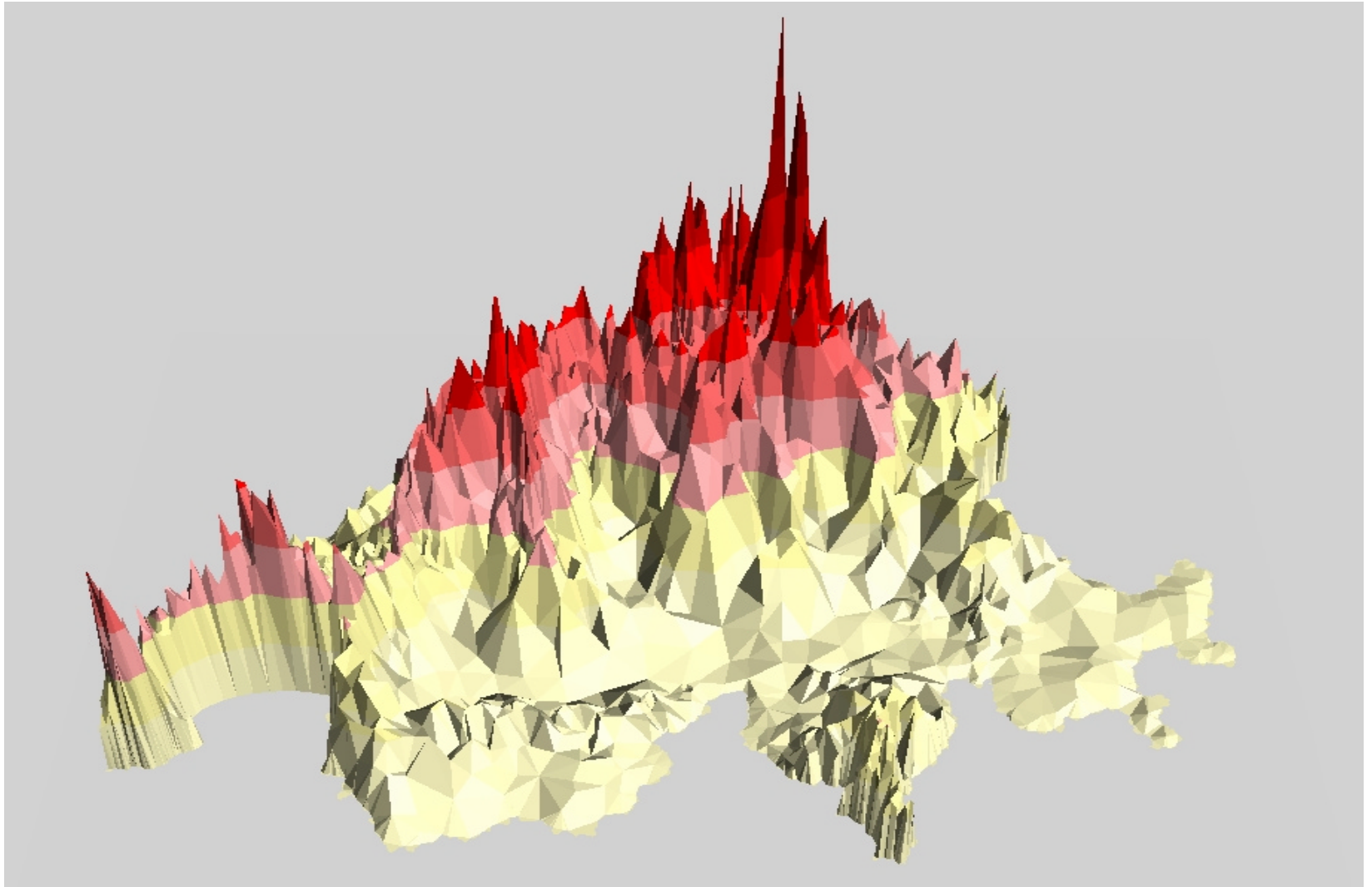
Road based accessibility (1970) (Switzerland only)



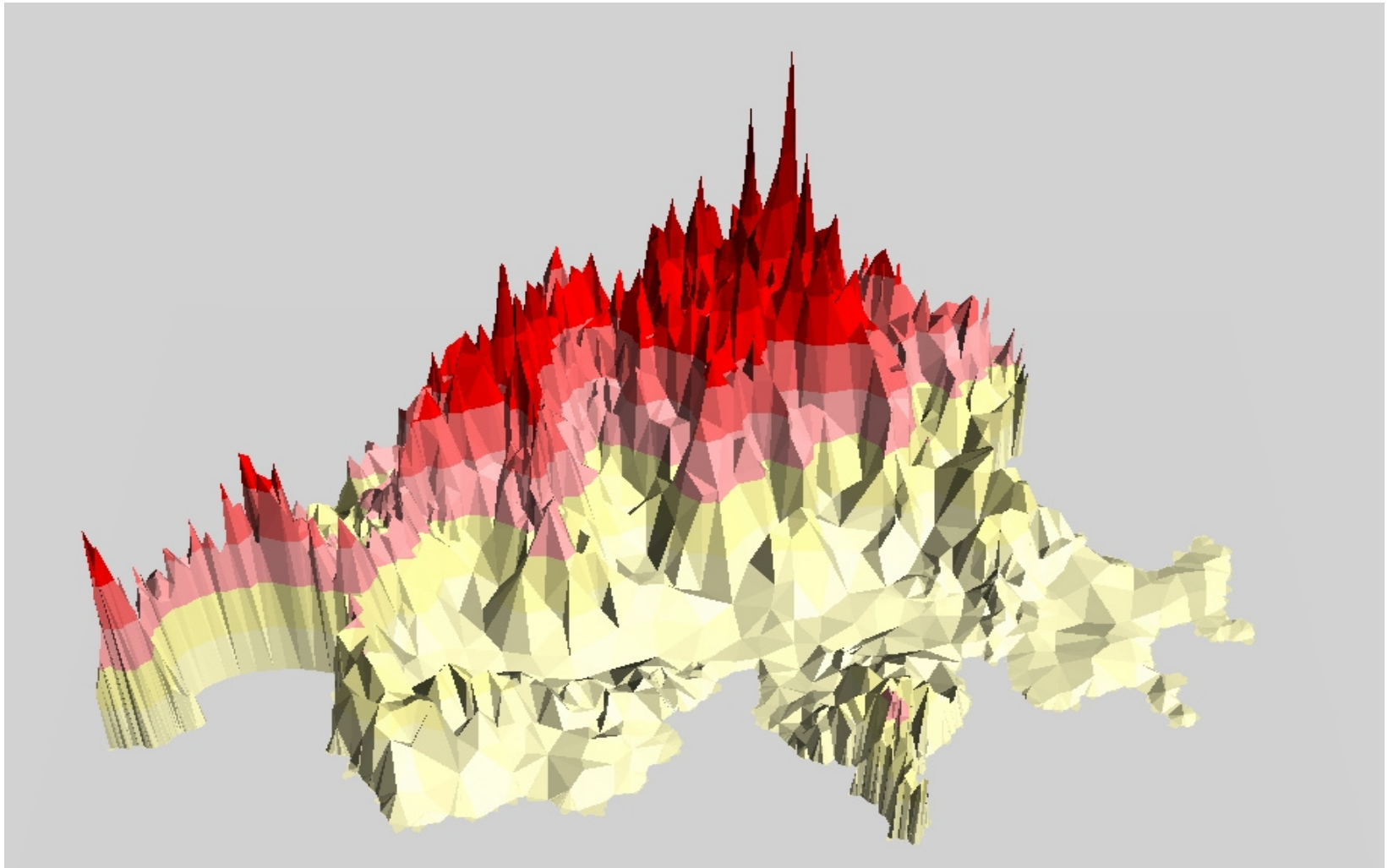
Road based accessibility (1980) (Switzerland only)



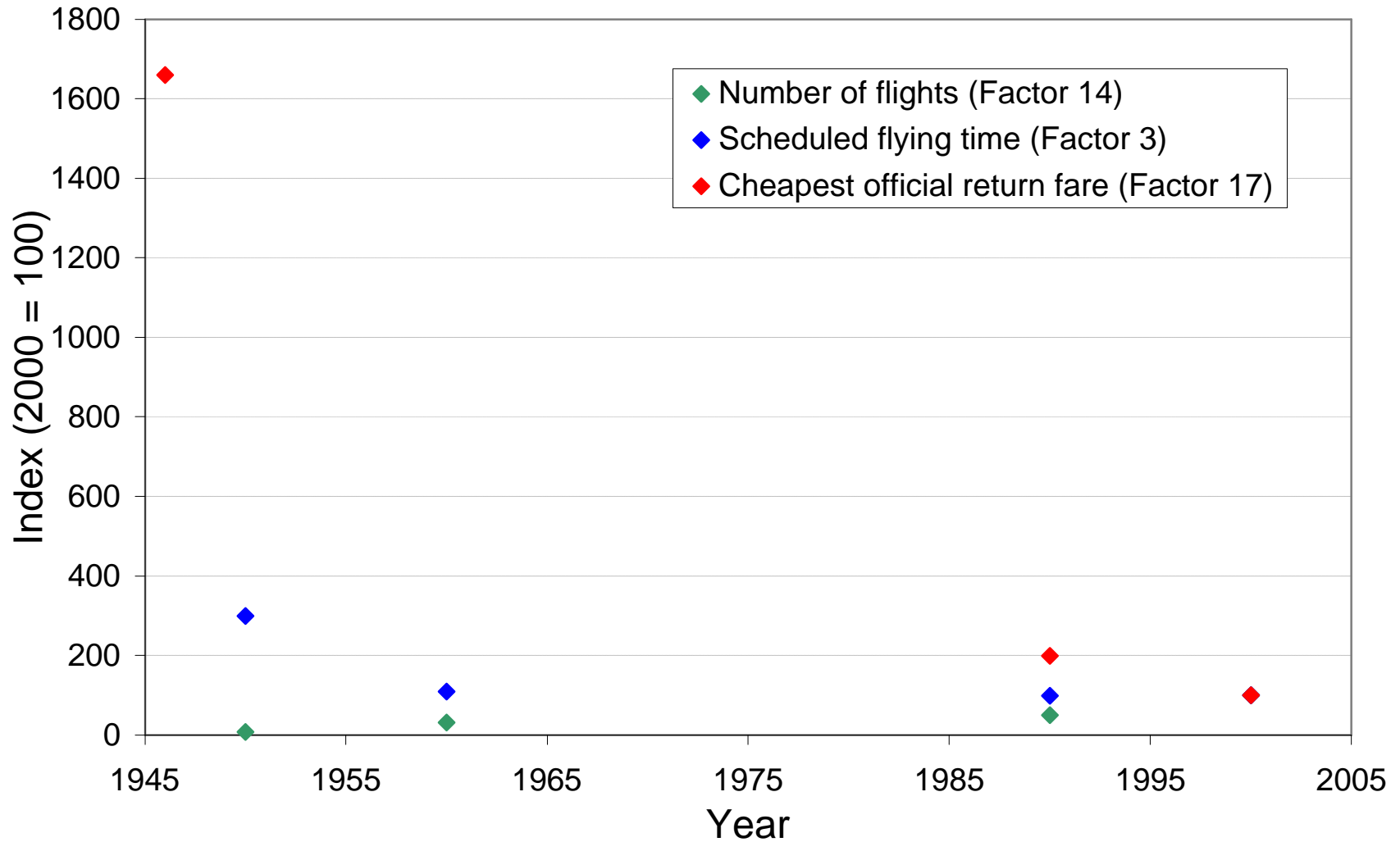
Road based accessibility (1990) (Switzerland only)



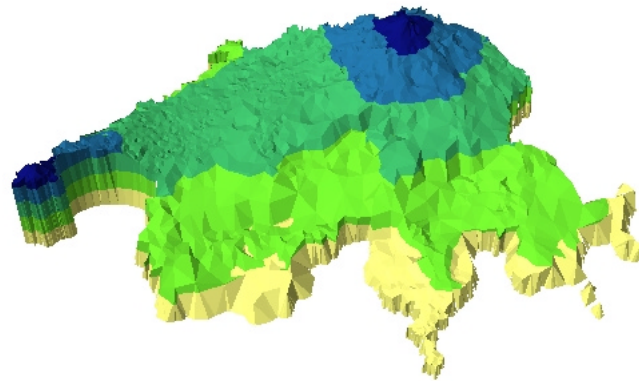
Road based accessibility (2000) (Switzerland only)



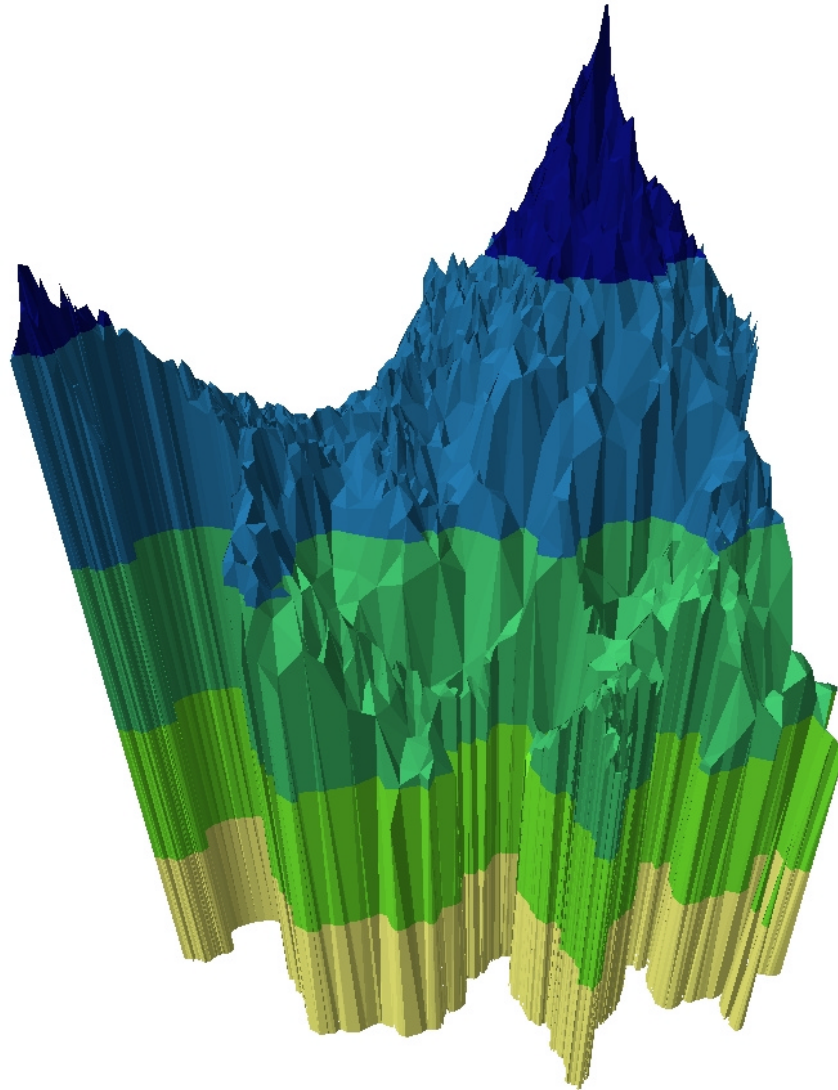
Confounding factors: Air traffic (technology, services)



Accessibility by air services (1950) (only abroad)



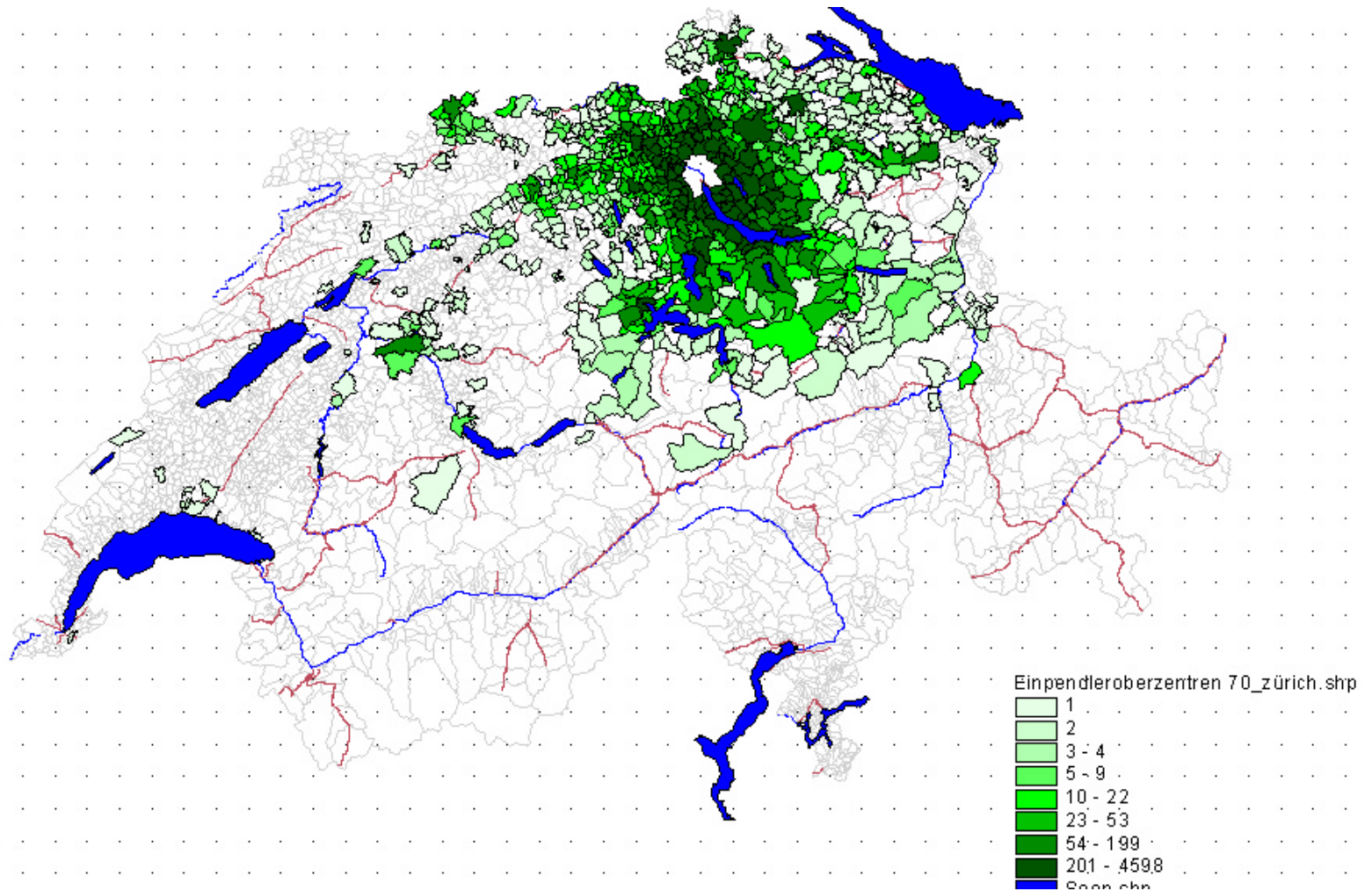
Accessibility by air services (1950) (only abroad)



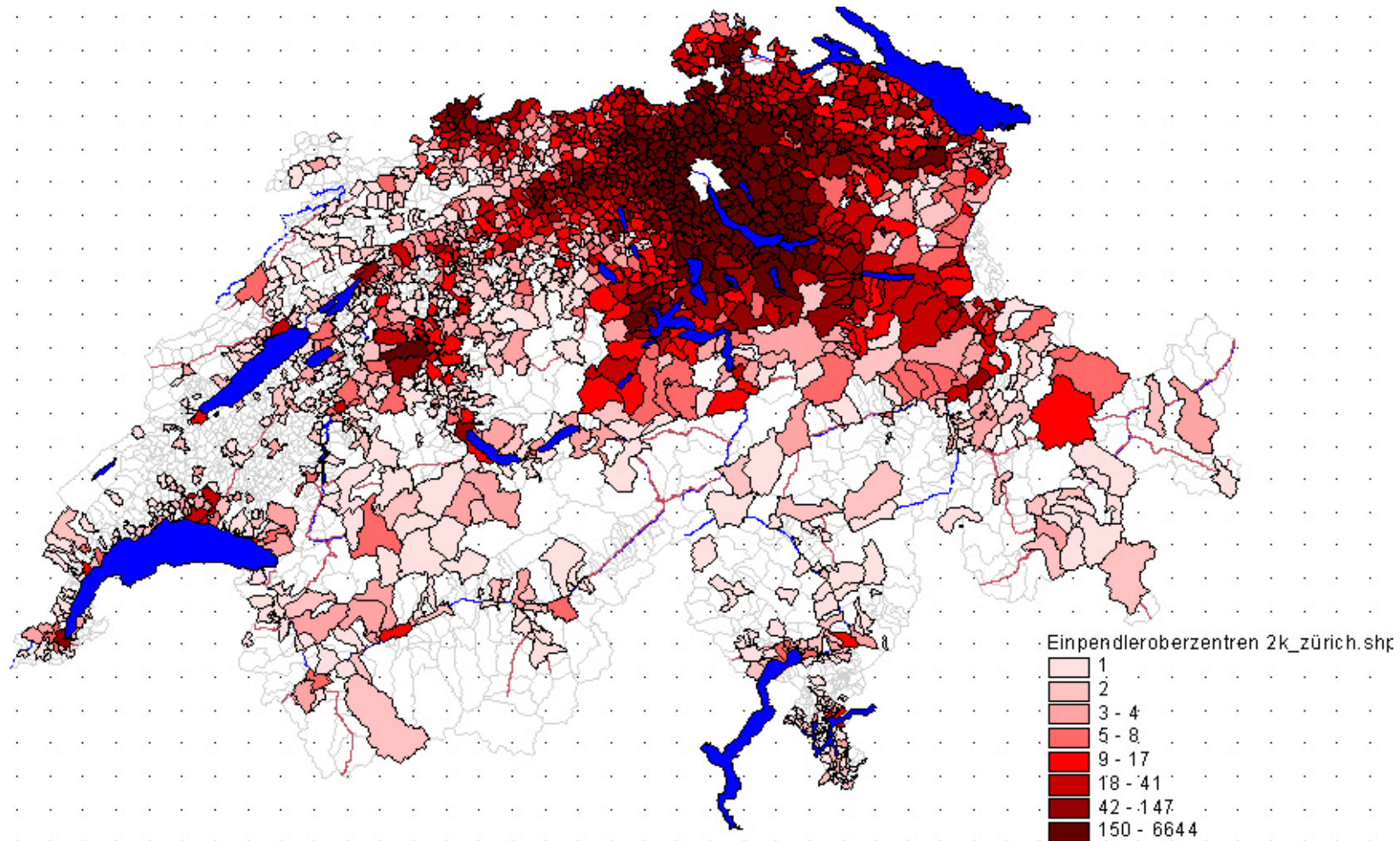
Modelling issues

- Causality between network growth and population/economic growth
- Spatial and temporal correlations
- Panel with few cross sections, but many units
- Simultaneous changes:
 - Networks and services
 - Restructuring of employment
 - Deindustrialisation/service growth (international competition)
 - Population growth
 - Real income growth (suburbanisation, motorisation)
 - Subsidies as confounding factors

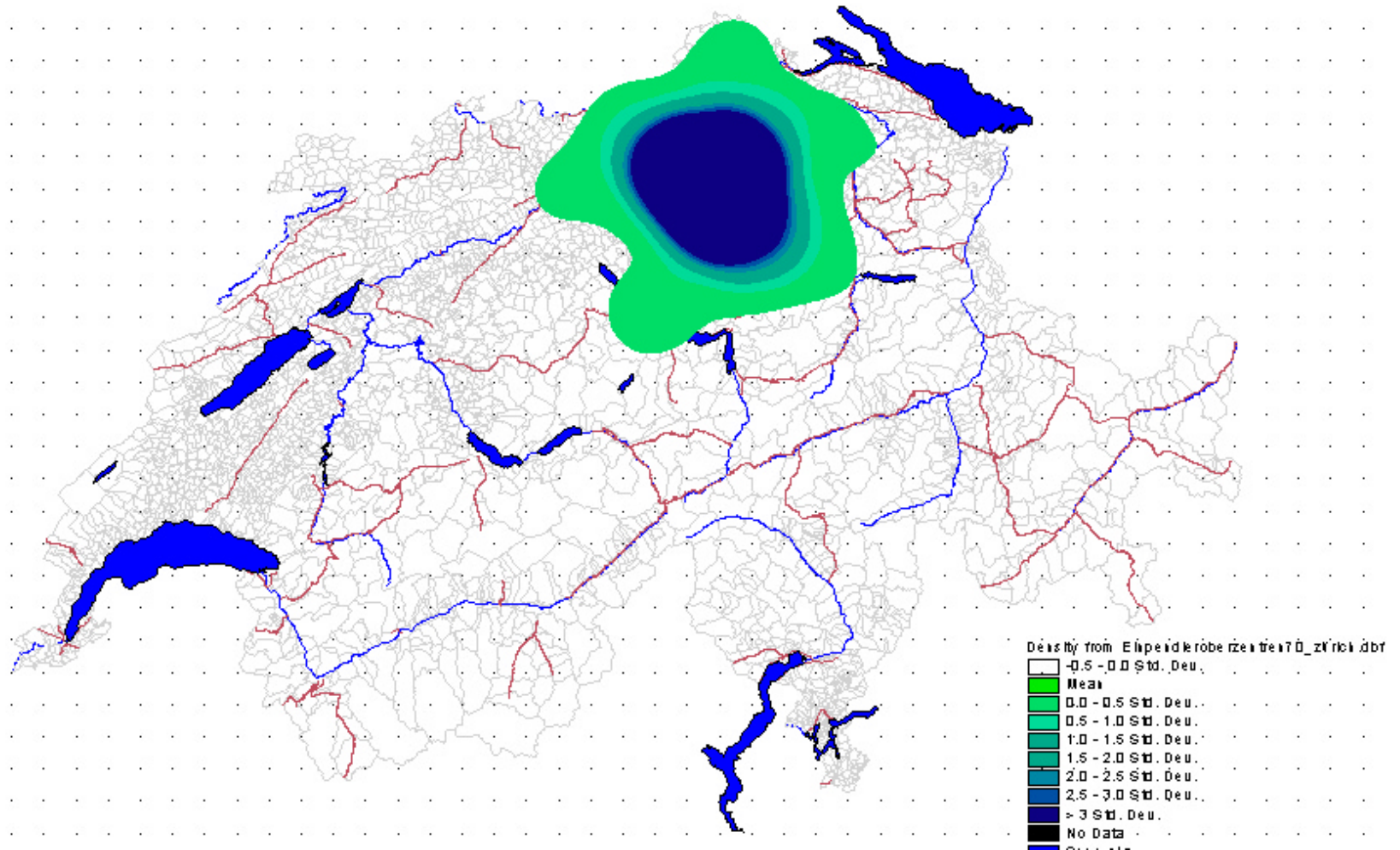
Responses: Commute shed (Zürich, 1970)



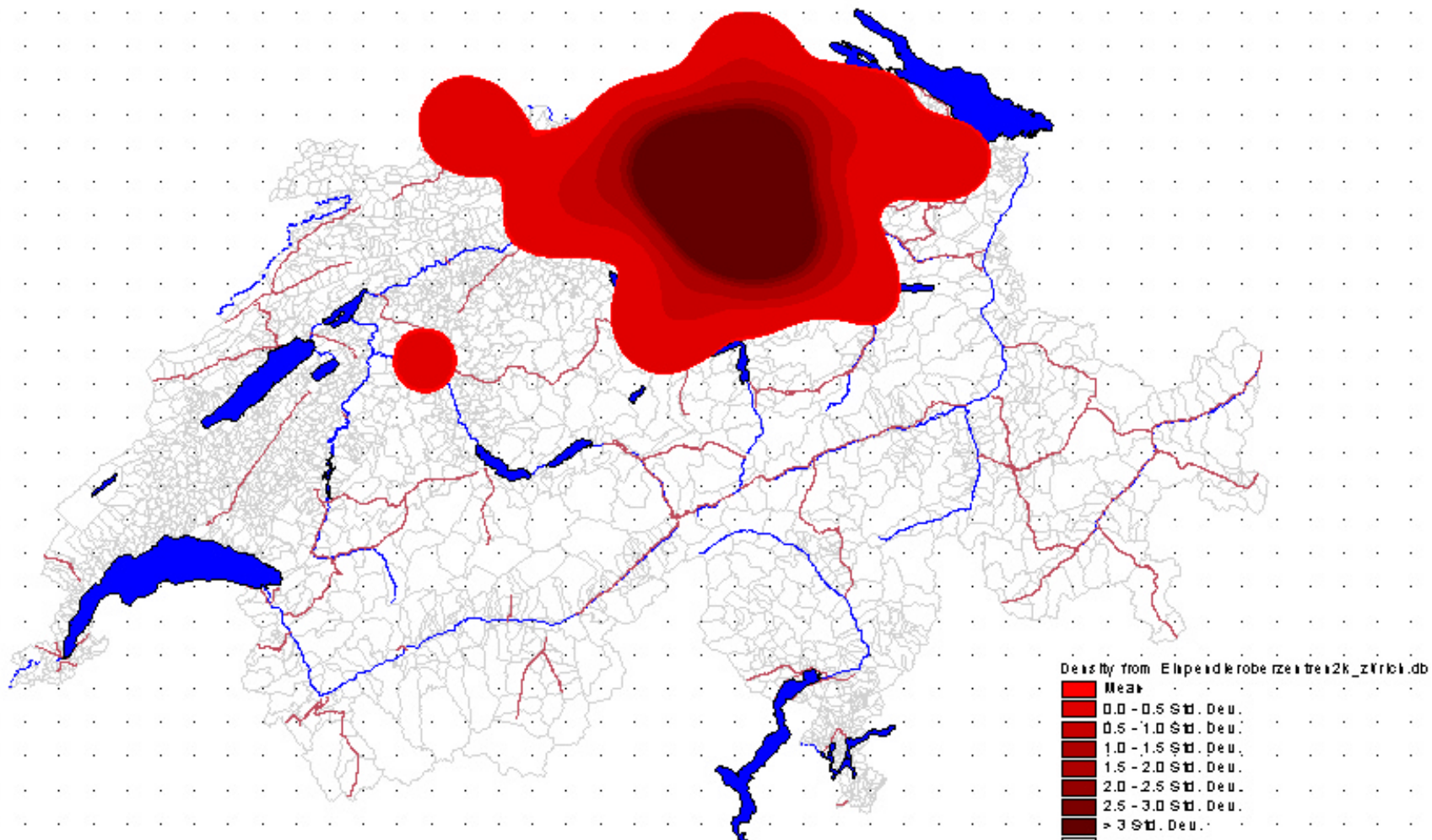
Responses: Commute shed (Zürich, 2000)



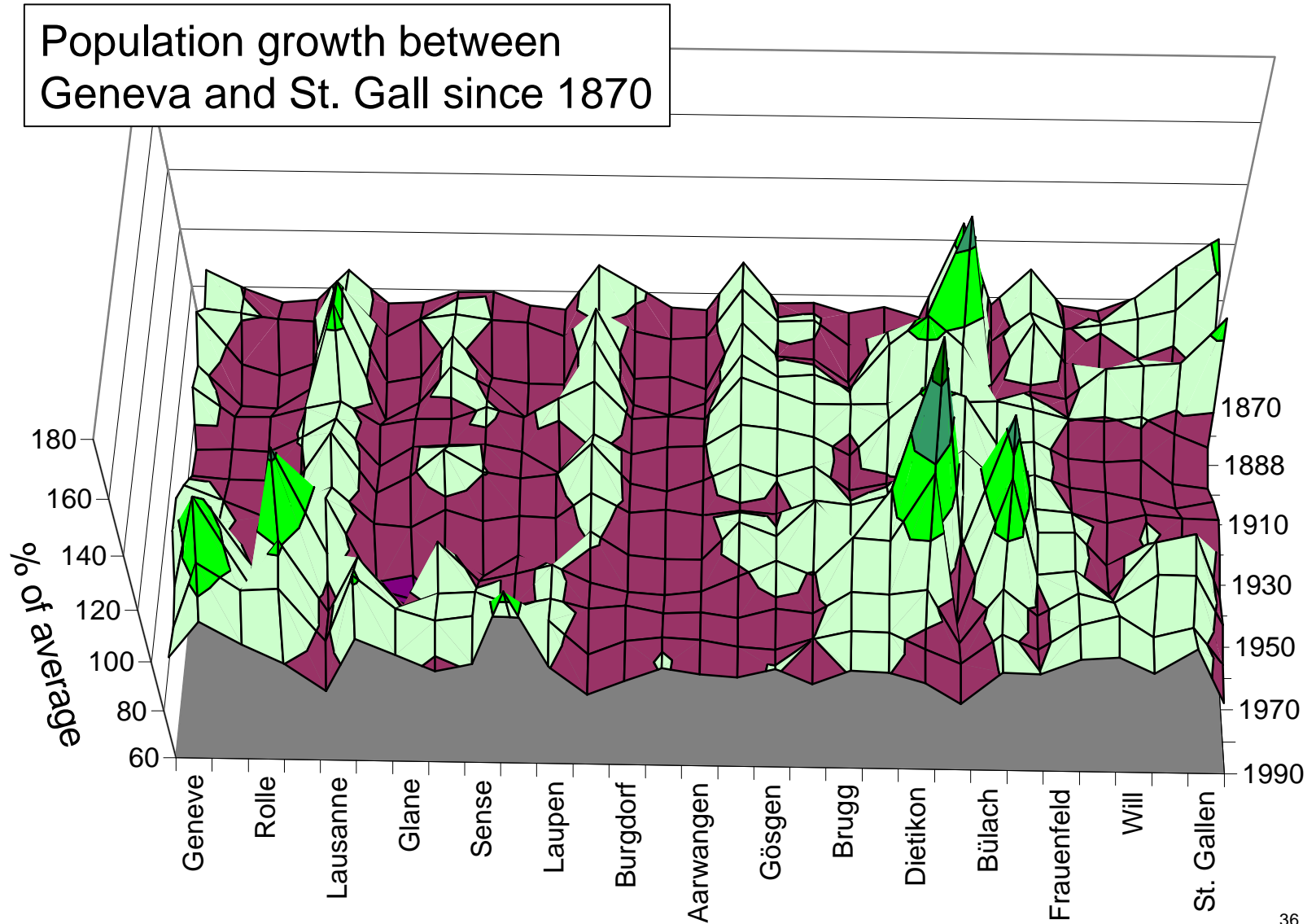
Responses: Density kernel estimates (Zürich, 1970)



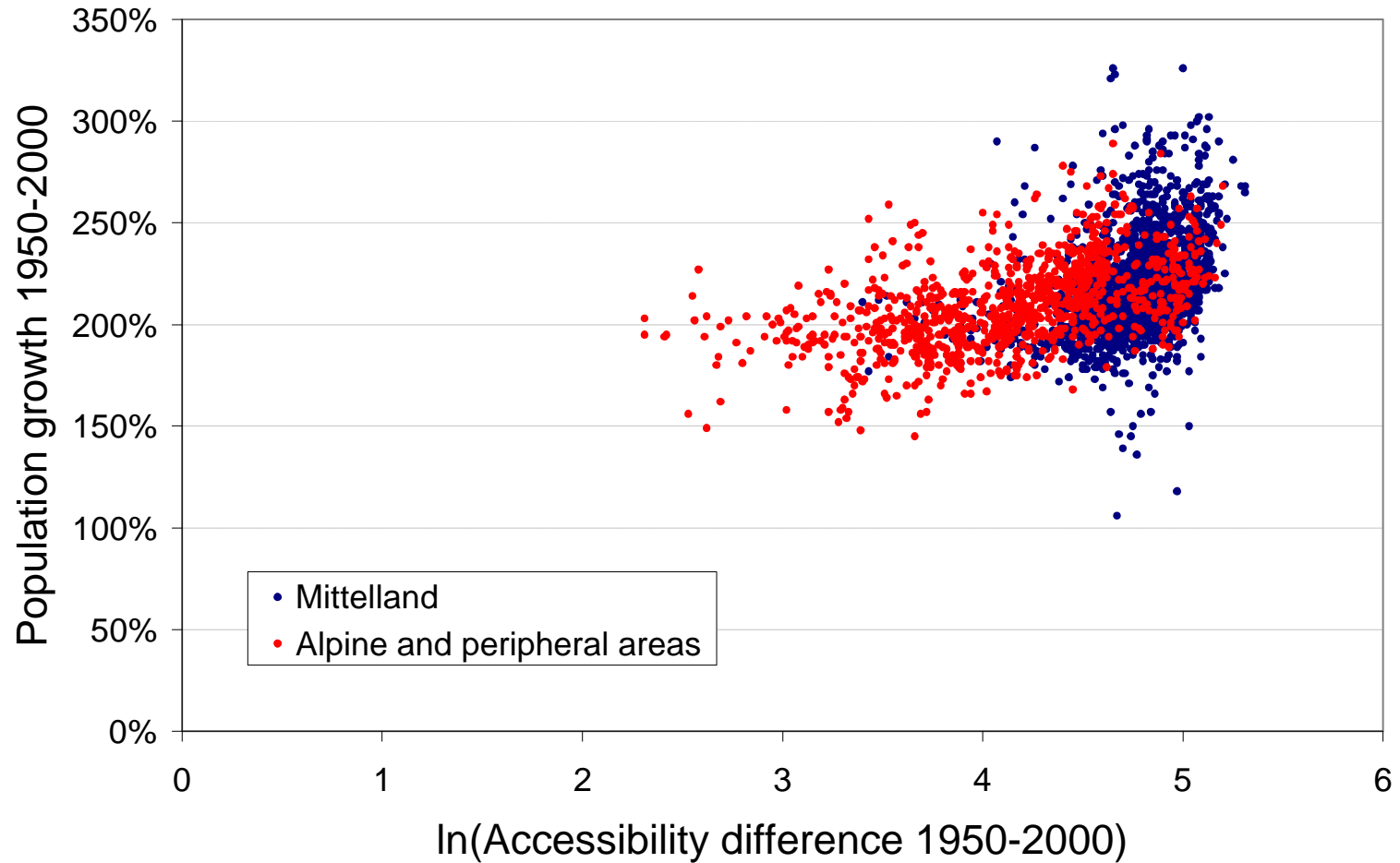
Responses: Density kernel estimates (Zürich, 2000)



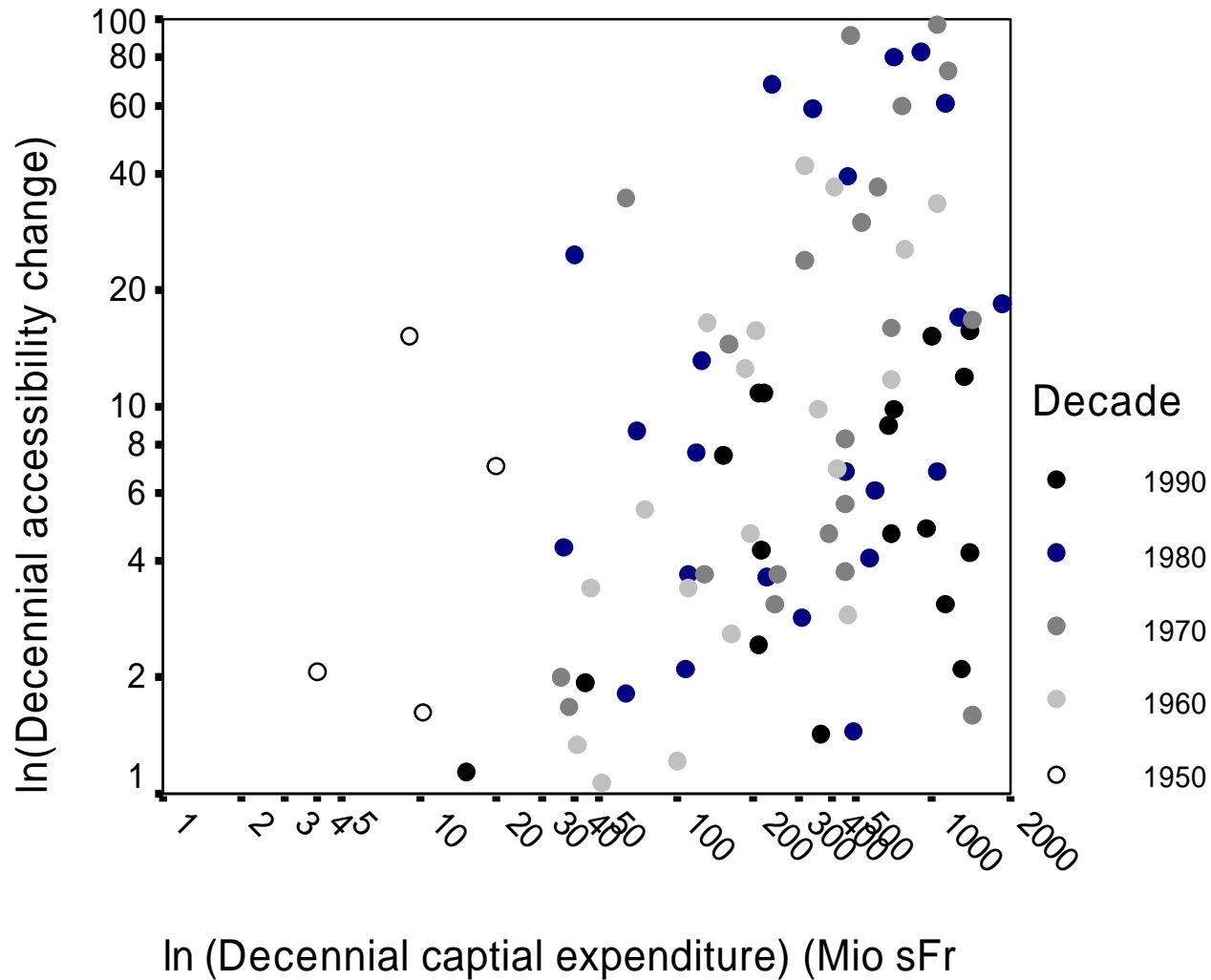
Response: „Zwischenstadt“, European suburbia



Response: Accessibility and population change



Link between investment and accessibility change



By canton !

Some too simple regressions (by canton and decade)

	Accessibility		ln(Accessibility)	
1950's	-	-	-	-
1960's	-	-	-	-
1970's	**	-	**	**
1980's	**	-	**	**
d(population)	**	**	**	**
d(investment)	**	-	**	**
1950's*d(investment)		-		-
1960's*d(investment)		-		-
1970's*d(investment)		**		-
1980's*d(investment)		-		-
R2	.33	.35	.54	.54

What next ?

Networks:

- Improved mean speed estimates
- Fully contemporaneous networks
- All railway services
- Assigned speed (~ demand estimates by municipality)

Parameters

- Specific beta's
- Generalised cost parameters (road, rail)

What next ?

Modelling:

- Appropriate panel models for
 - population growth
 - economic growth
- Accounting for spatial correlations
- Accounting for international competition

Literature

Aschauer, D. (1989) Is public expenditure productive?, *Journal of Monetary Economics*, **23** (2) 177 – 200.

Fröhlich, P. and K. W. Axhausen (2002) Development of car-based accessibility in Switzerland from 1950 through 2000: First results, *Arbeitsberichte Verkehr- und Raumplanung*, **111**, IVT, ETH, Zürich.

Gifford, J. L. (2003) *Flexible Urban Transportation*, Elsevier Science, Oxford.

Rietveld, P. and F. Bruinsma (1998) Is Transport Infrastructure Effective?: Transport Infrastructure and Accessibility: Impacts on the Space Economy, Springer, Berlin.

Tschopp, M., P. Fröhlich, P. Keller and K. W. Axhausen (2003) Accessibility, spatial organisation and demography in Switzerland from 1920 to 2000: First Results, *Arbeitsbericht Verkehrs- und Raumplanung*, **151**, IVT, ETH Zürich, Zürich.