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**IBC Forum 2003**

11/12 June 2003, Basel

## **Accessibility of regions**

**First results of the IBC development module «Accessibility»**

Prof. Dr. Kay W. Axhausen, IVT ETH Zürich / Andreas Bleisch, BAK Basel Economics

# Contents

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1. The project
2. The model
3. Network data
4. Activity data
5. Calculations & results
6. Outlook

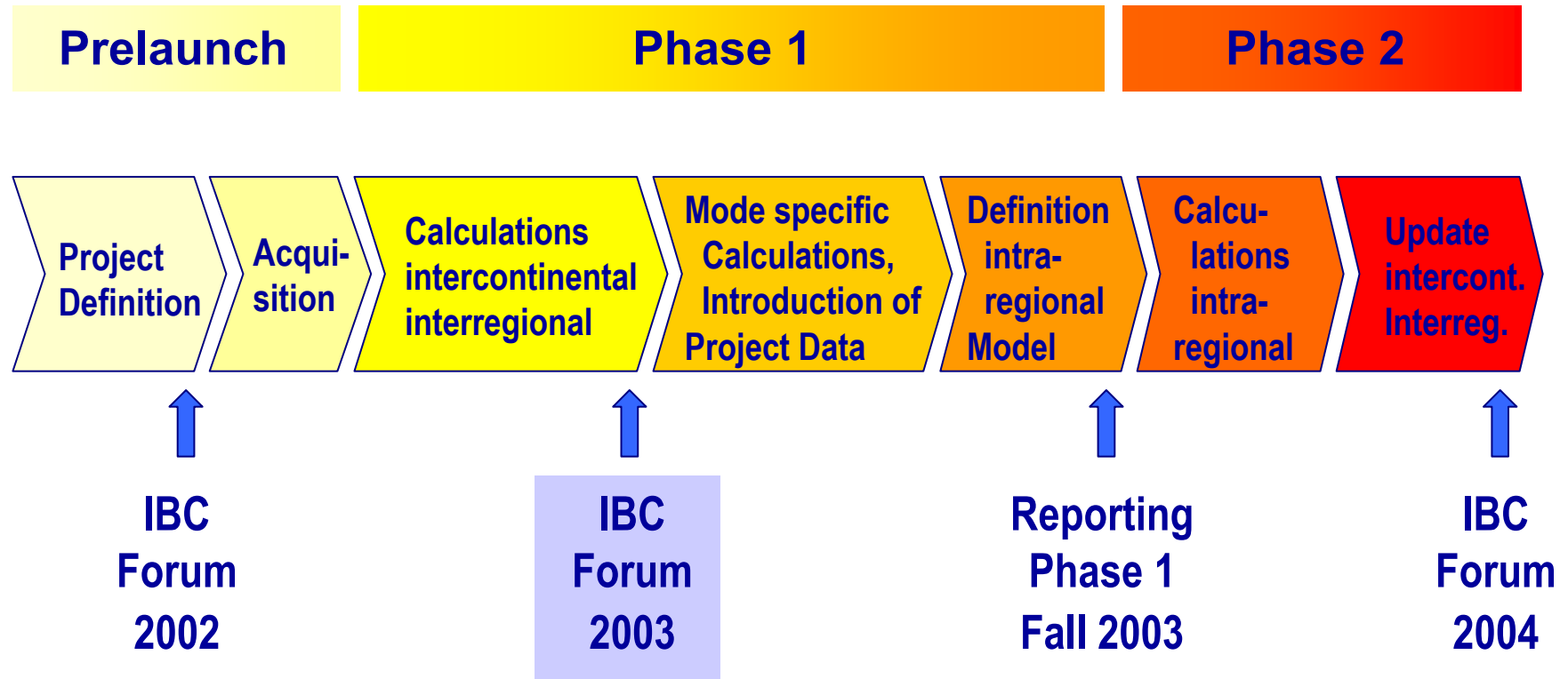
# The project

## Organisation



# The project

## Schedule



# The model

What accessibility to measure?

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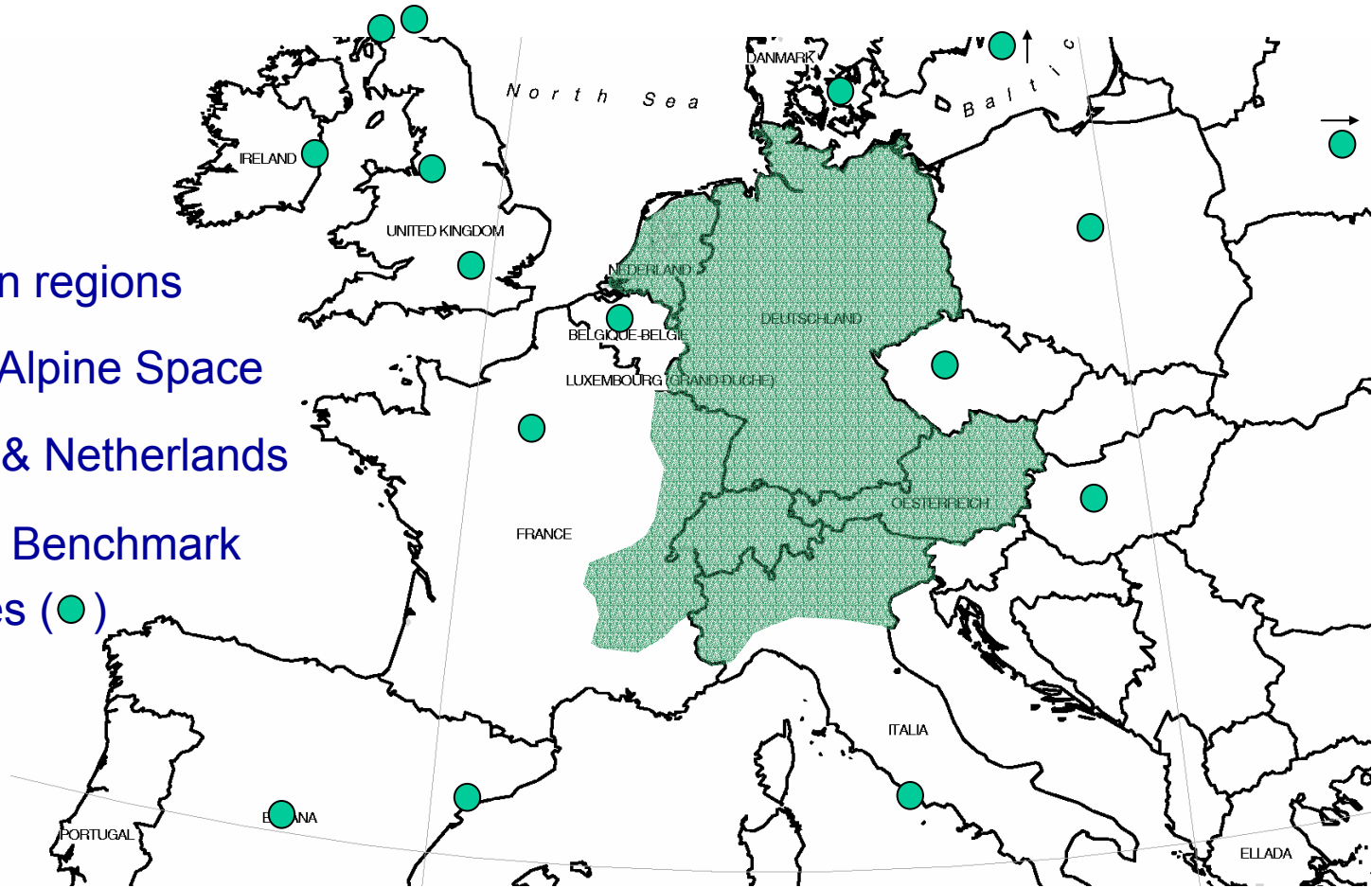
Focus:	Representatives of international companies and institutions
Type of accessibility:	Outbound (Origins → Destinations)
Origins:	IBC regions (Focus: Enlarged Alpine Space)
Destinations:	Markets for inputs & goods
Spatial impedance:	Travel time (fastest connection)
Traffic modes:	Rail, road and air
Spatial scale:	Intercontinental (global) & interregional (within Europe)

# The model

## Area of calculation (Origins)

220 European regions

- Enlarged Alpine Space
- Germany & Netherlands
- European Benchmark Metropoles (●)



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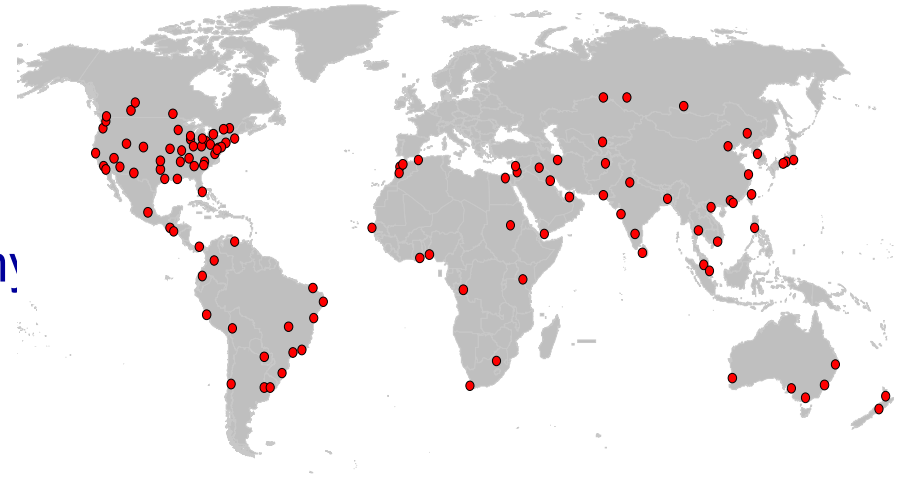
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# The model

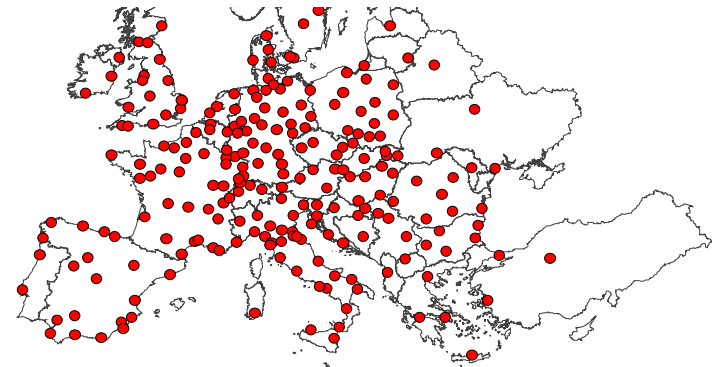
## List of destinations

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- **Intercontinental destinations:**  
120 international airports  
representing the world economy  
outside Europe



- **Interregional destinations:**  
400 regional centers  
representing European  
economy



# The model

## Accessibility measure

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- Multiple definitions of differing complexity
- Choice of a measure derived from welfare economics: the log sum term of destination choice model:

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

- Elements:
  - Opportunities for interaction/activity  $X_j$
  - Exponentially weighted generalised cost of travel  $k_{ij}$



# Network data

## Road network for Europe

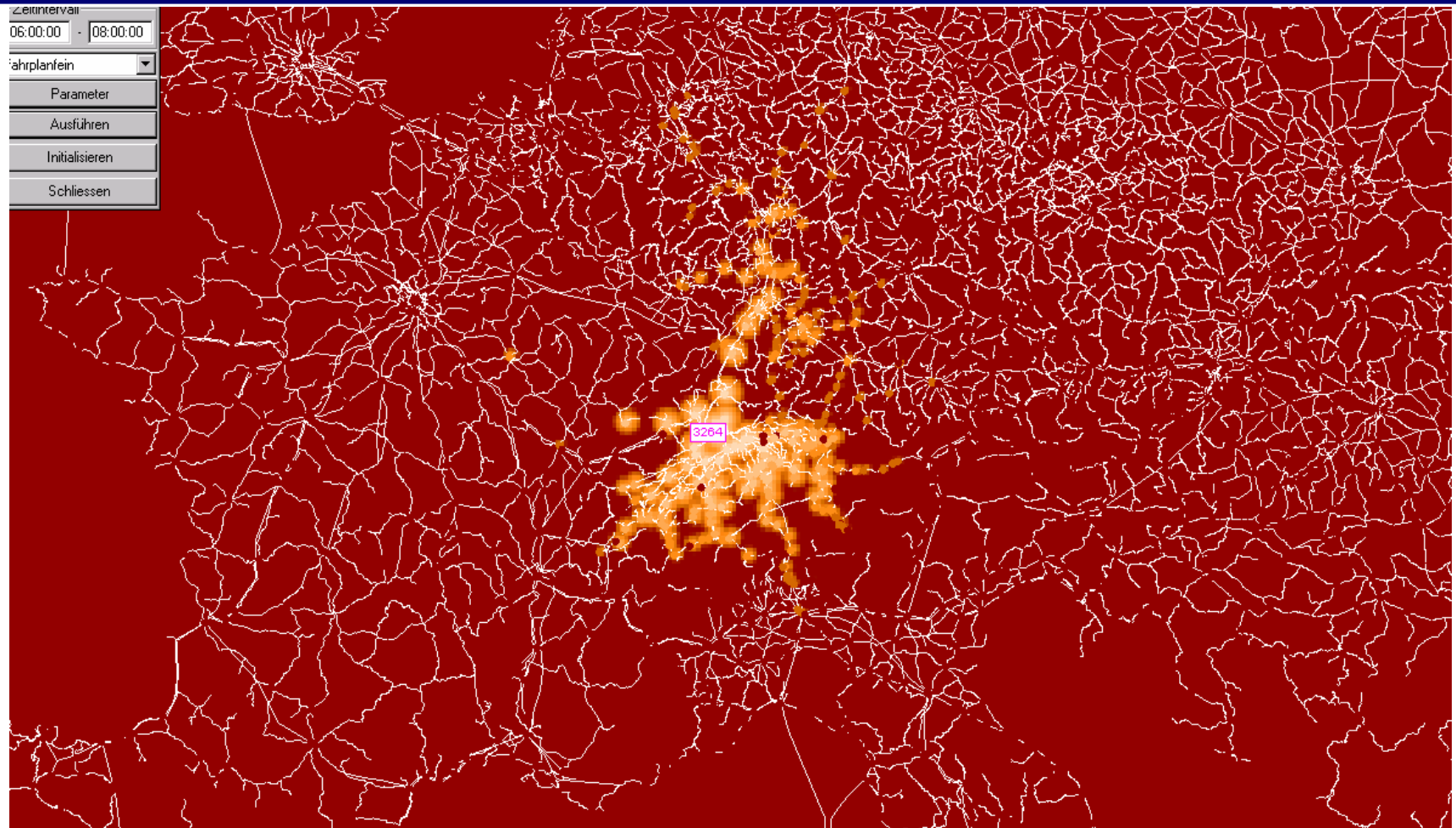
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- Sources:
  - Switzerland: IVT network
  - Rest of Europe: PTV, Karlsruhe
  - (Capacity restraint functions for 50 types of roads)
  
- Size:

■ Zones	657
■ Nodes	75'966
■ Links	223'238

# Network data

## Isochrones from Basel - Road



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# Network data

## Air traffic

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- Sources:

- All OAG flights for 23 - 29 September 2002
- European airport co-ordinates by IRPUD
- 3 levels of minimum transfer times allowed for
- Check-in-times according to information from Swiss and Lufthansa

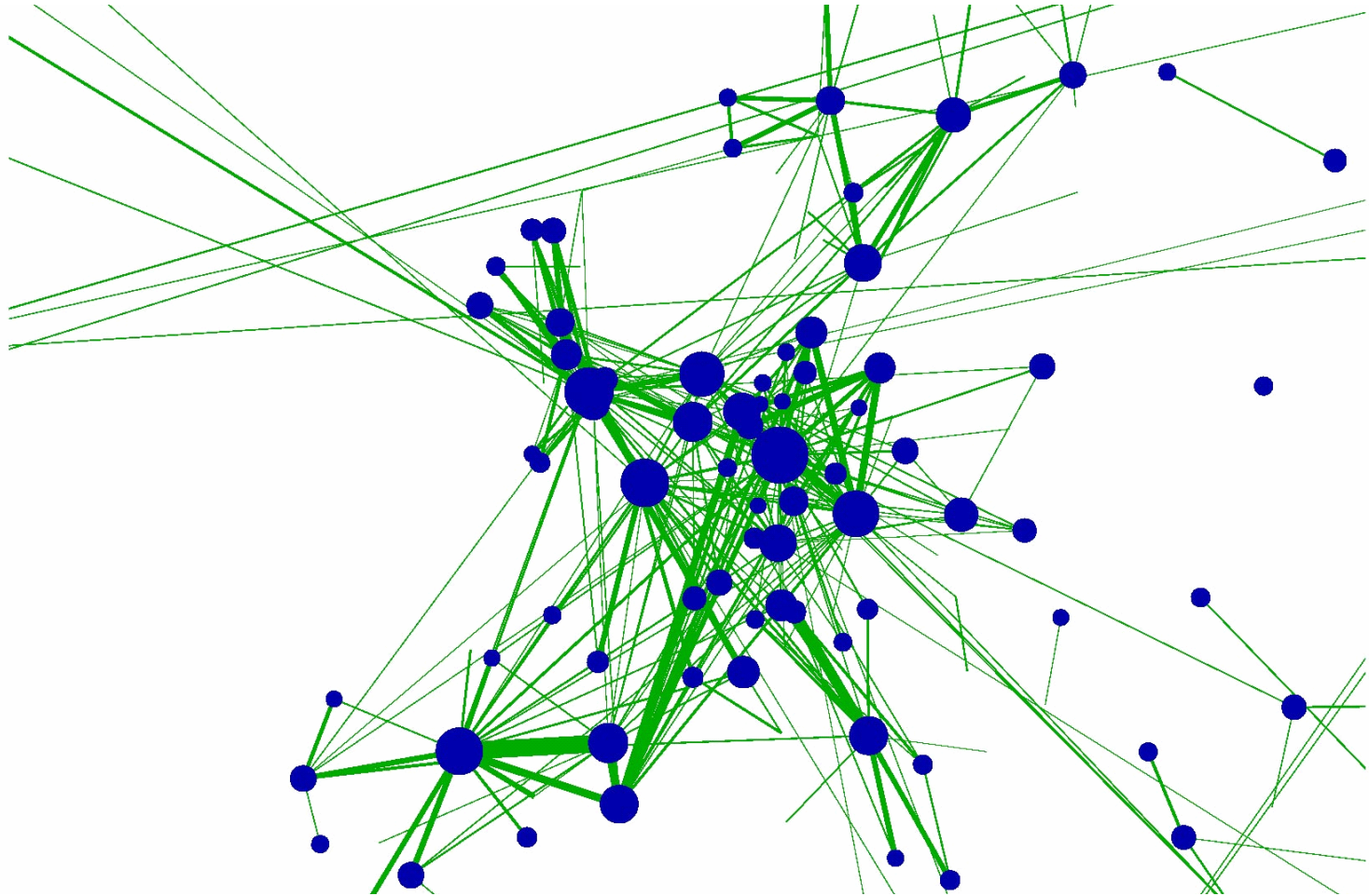
- Size:

- Airports                      349            (all European airports and all hubs outside Europe)
- Links                            8'904
- Flights                         49'967

# Network data

Departures and links with more than 10 flights/day (Europe)

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# Network data

## Railways

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- Sources:

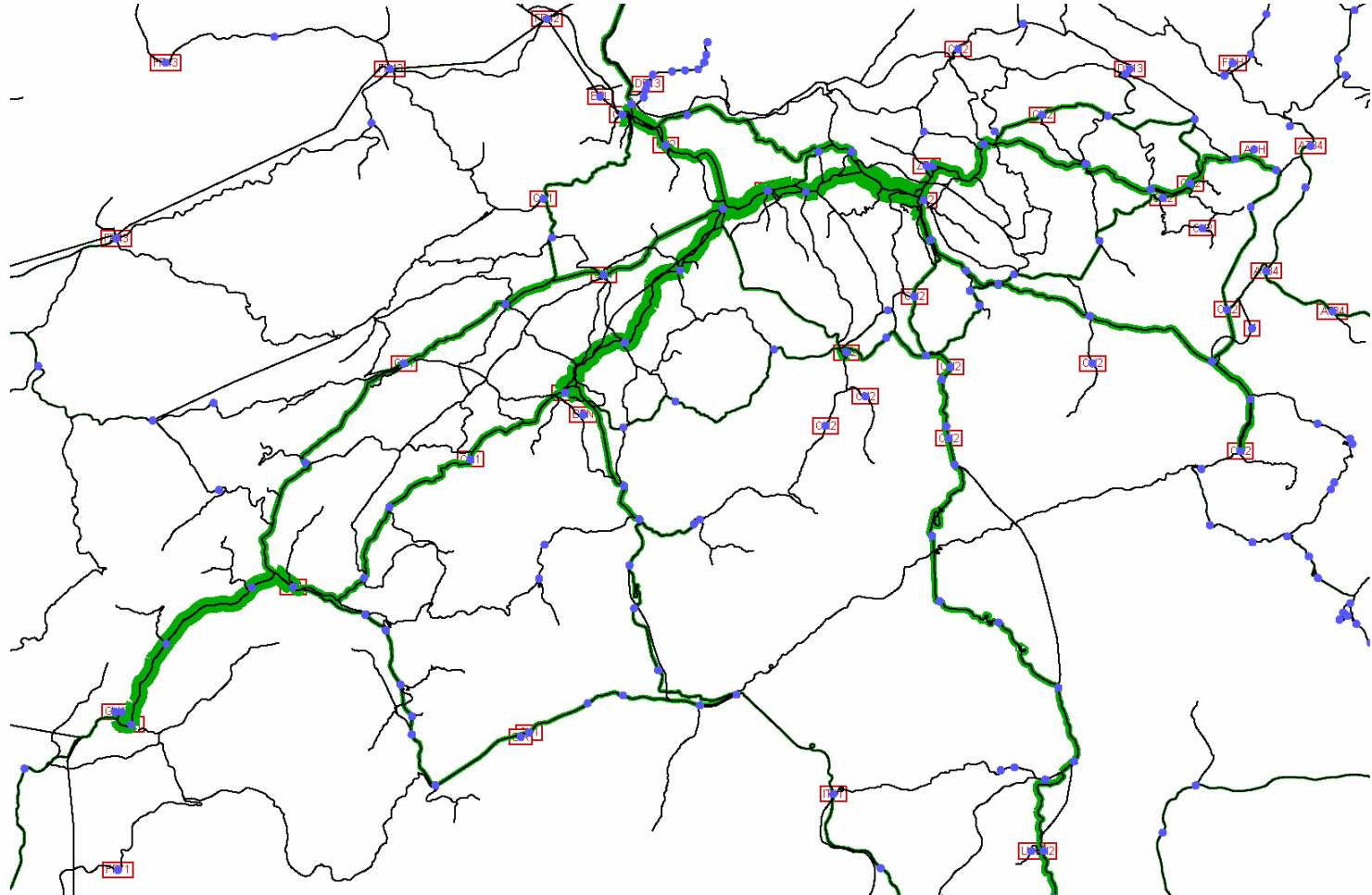
- Network geometrics by IRPUD, Dortmund
- Timetable according to Thomas Cook September 2002
  - Enlarged Alpine Space: trains from Regional Express-level upward
  - Rest of Europe: all high-quality services (EC, TGV, etc.)
- Airport access according to information on airport authority web sites (ca. 85); others are approximated by road distances

- Size

- Zones 657
- Nodes 35'836
- Stations with services 2'004
- Links 77'662
- Trains 5'335

# Network Data

## Swiss railways service frequencies



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## Network data

Calculation of shortest intermodal travel time for every connection

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- **Intercontinental connections: 220 (Origins) x 120 (Destinations)**

Central station origin → Destination airport outside Europe

Fastest connection including:

- Access time to departure airport (average of public transport and car access)
- Transfer time (change of traffic mode)
- Check-in time (destination- and airportspecific)
- Flight time including connecting time

- **Interregional connections: 220 (Origins) x 400 (Destinations)**

Central station origin → Central station destination

Fastest connection from modes:

- Road
- Railway
- Flight (travel time including access and transfer time departure airport, check-in time, flight time, transfer time at arrival airport and access time from arrival airport to central station destination)

# Activity data

Regional GDP's 2000

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## ■ Intercontinental activity data

National GDP's at current US-Dollars, regionalized for polycentric states with a GDP > US\$ 100 Mrd.

Allocation to the 120 international airports, serving as entry gates for the corresponding regions

**Datasource:** World Bank Indicators, National Statistical Agencies, Calculations BAK

## ■ Interregional activity data

Regional GDP's at current Euros (Level NUTS-2/NUTS-3),

Allocation to the 400 regional centers, serving as entry gates for the corresponding regions

**Datasource:** Eurostat, World Bank Indicators, IBC Database, Calculations BAK



## Calculations & results

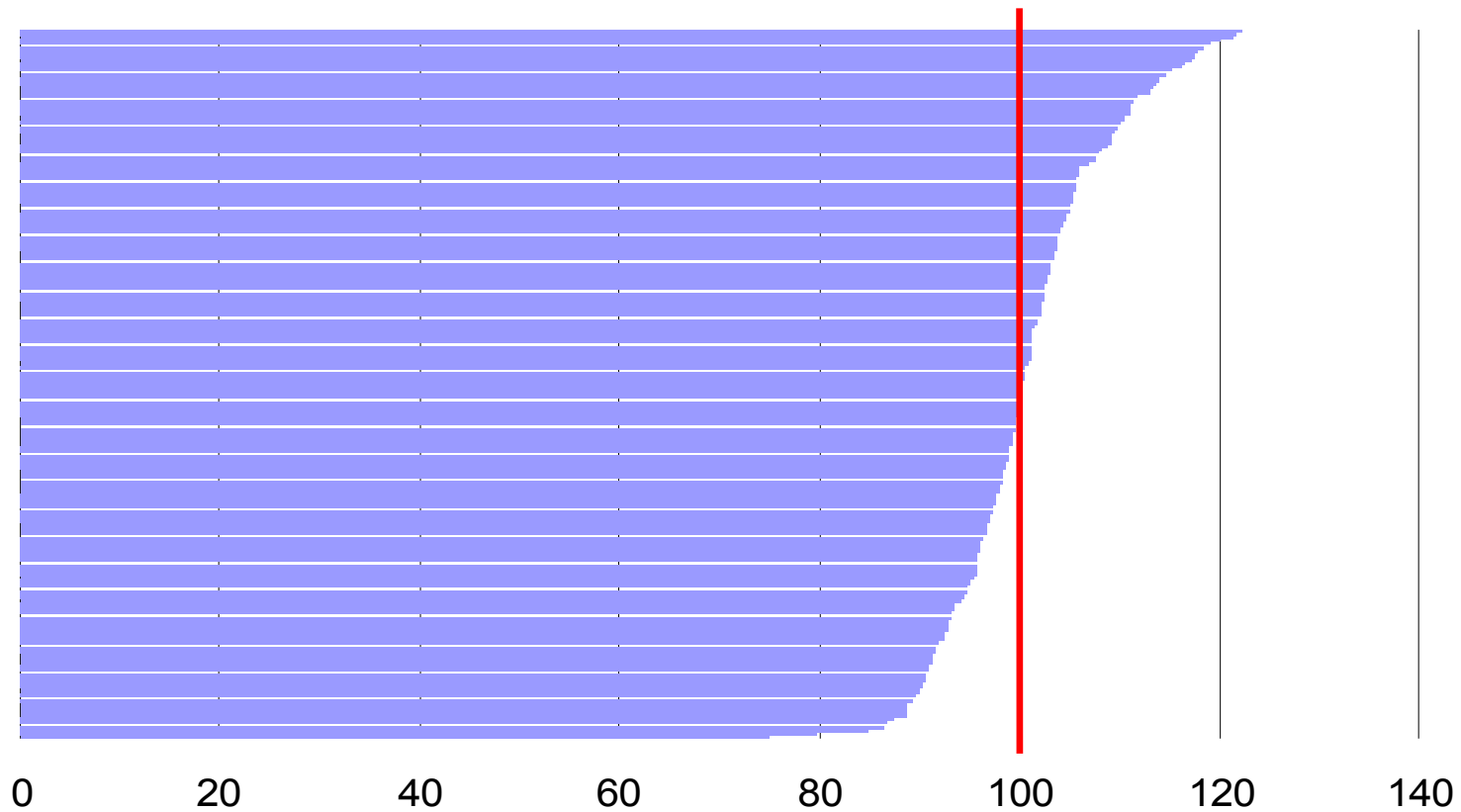
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- Calculation of intermodal potential accessibility  
(negative exponential function)
- Integration of service frequencies (time slots)
- Indexation of accessibility values:  
Average Enlarged Alpine Space = 100
- Results for interregional and intercontinental accessibility

# Calculations & Results

## Overview Ranking intercontinental

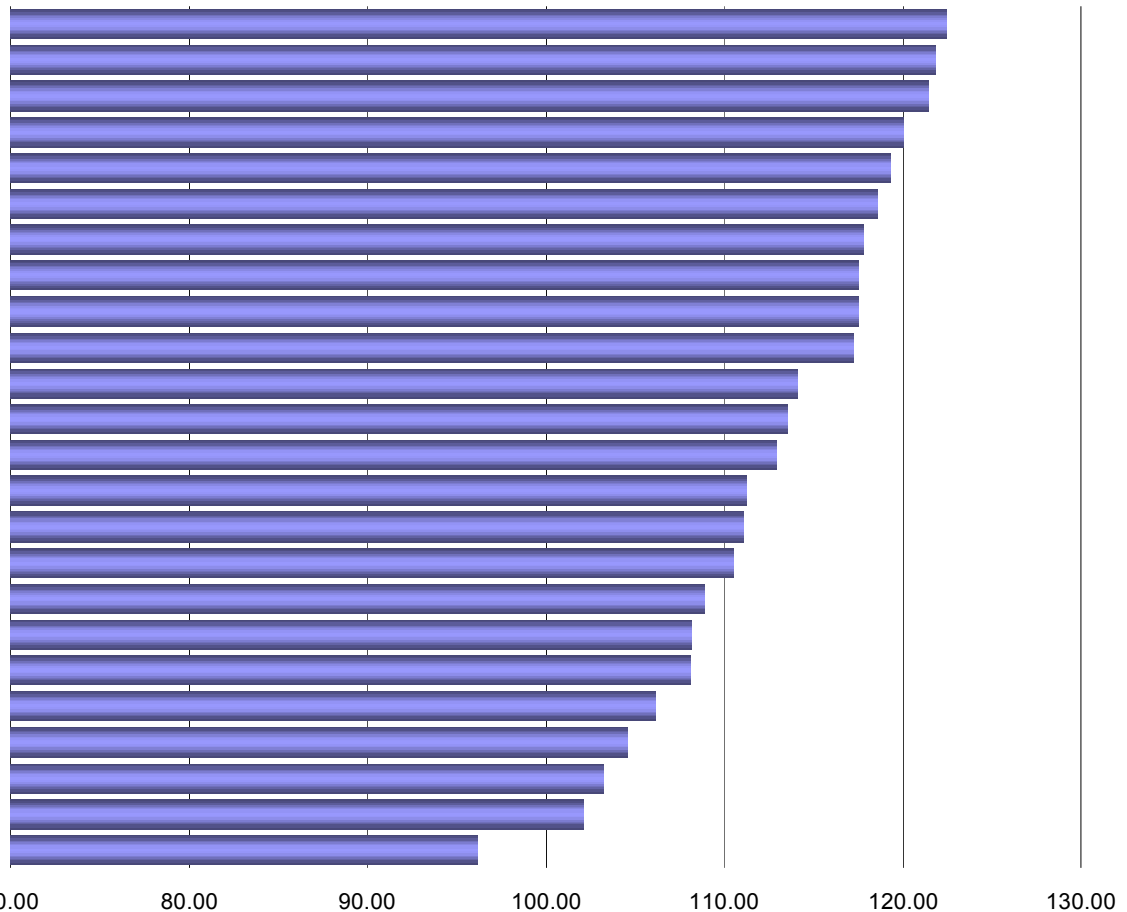
- Distribution of Index values for 220 origin regions



# Calculations & results

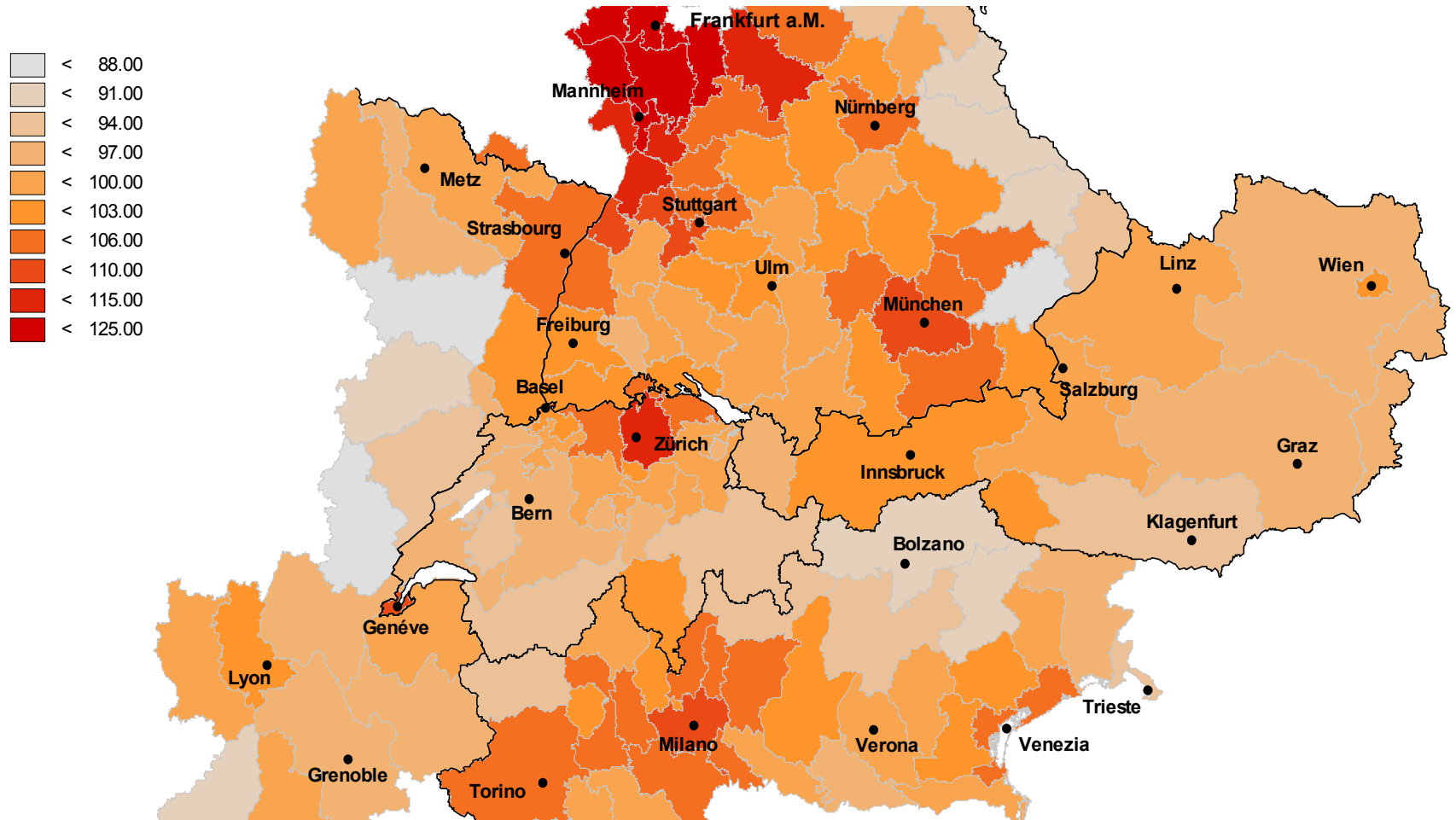
## Ranking intercontinental accessibility (fall 2002)

Rank	City	Country	Index
1	London	UK	122.45
2	Frankfurt	DE	121.84
3	Amsterdam	NL	121.46
4	Offenbach	DE	120.02
5	Darmstadt	DE	119.31
6	Mainz	DE	118.62
7	Utrecht	NL	117.76
8	Aschaffenburg	DE	117.55
9	Wiesbaden	DE	117.53
10	Paris	FR	117.29
16	Madrid	ES	114.10
17	Glasgow	UK	113.60
20	Manchester	UK	112.98
23	Düsseldorf	DE	111.28
25	Zürich	CH	111.10
27	Brussels	BE	110.56
36	Milano	IT	108.95
37	München	DE	108.19
38	Stuttgart	DE	108.08
42	Geneve	CH	106.17
58	Strasbourg	FR	104.65
73	Basel	CH	103.25
86	Wien	AT	102.13
157	Bern	CH	96.16



# Calculations & results

## Intercontinental accessibility map 2002



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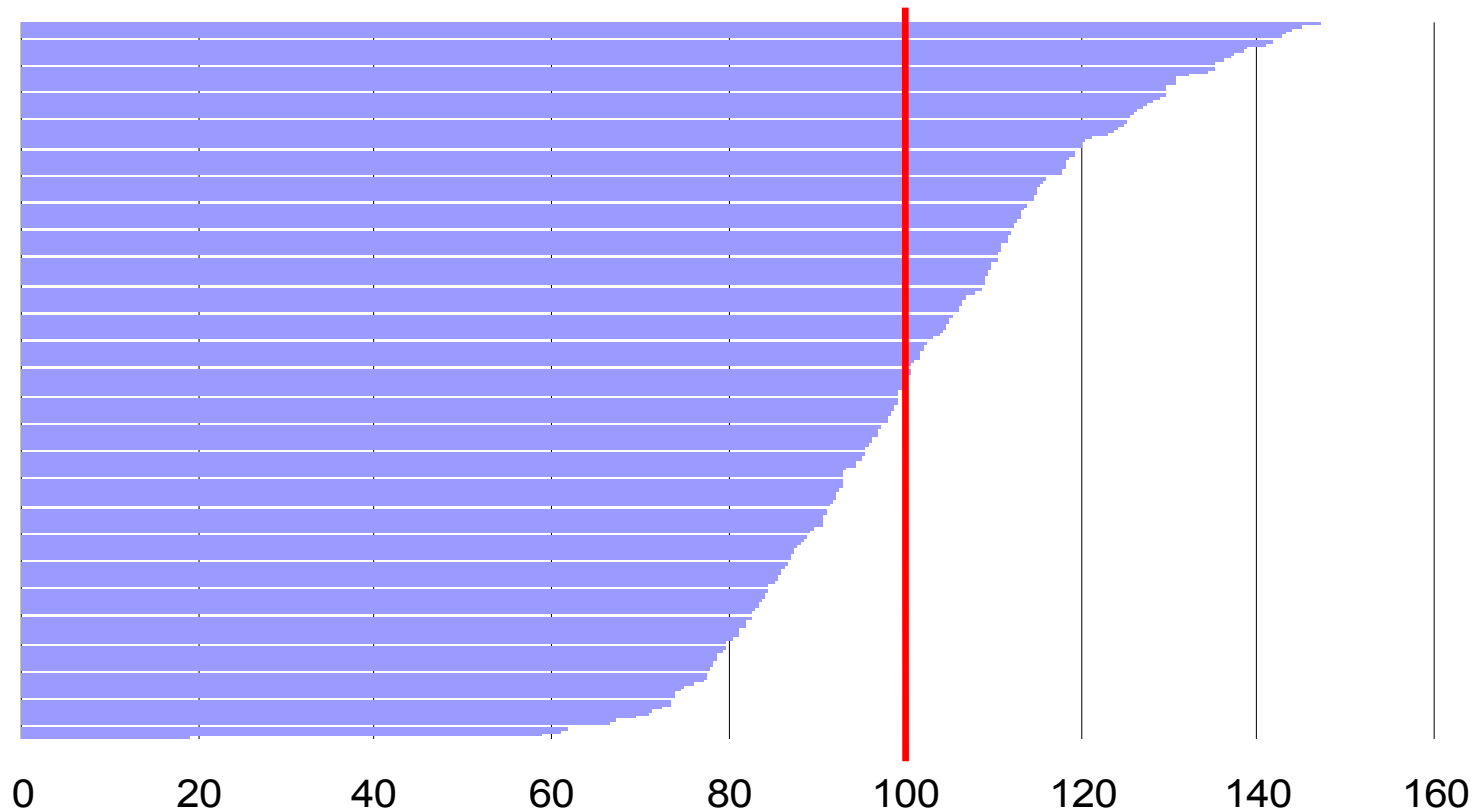
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# Calculations & Results

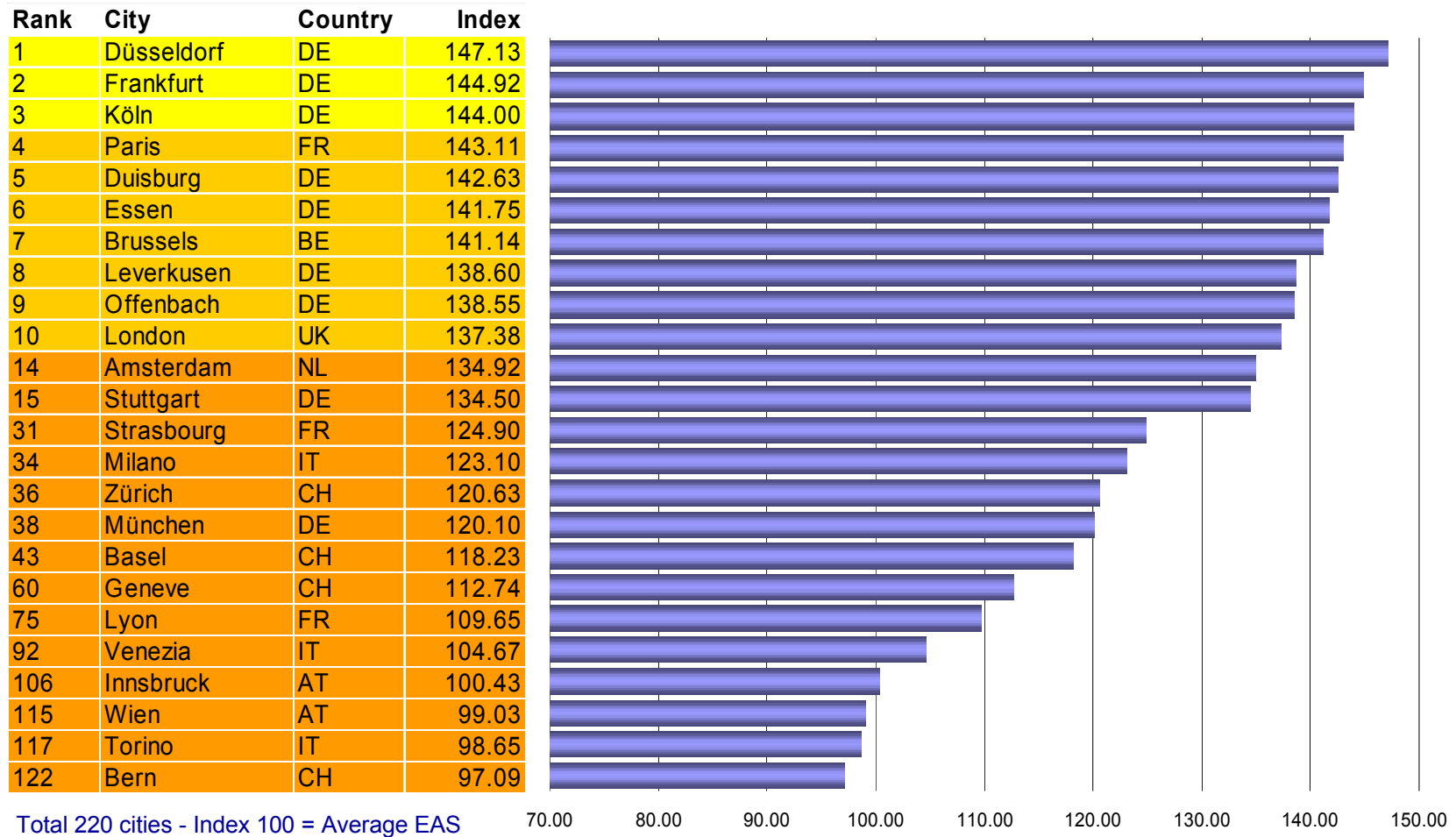
## Overview Ranking interregional

- Distribution of Index values for 220 origin regions



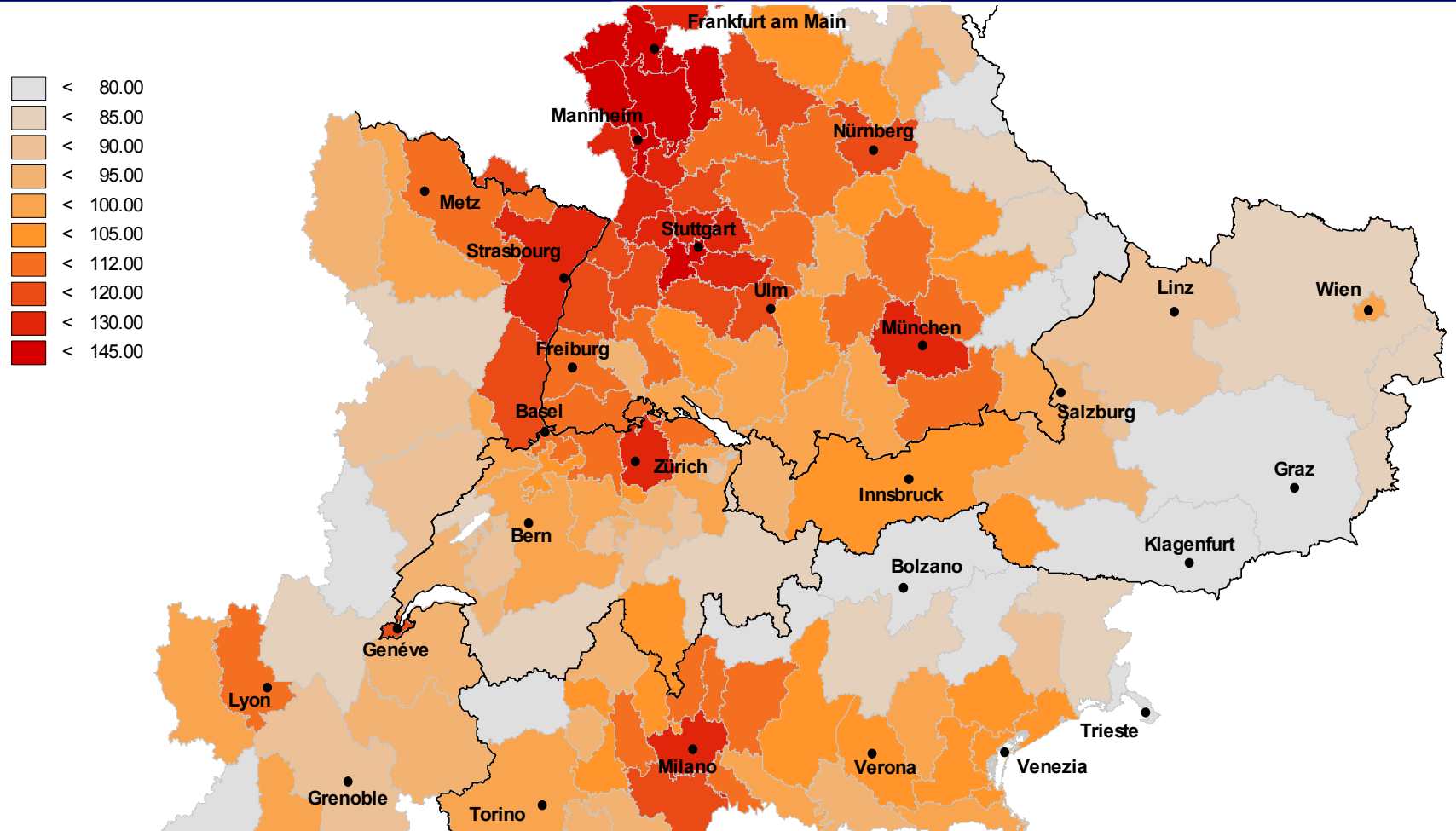
# Calculations & results

## Ranking interregional accessibility (fall 2002)



# Calculations & results

## Interregional accessibility map 2002



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# Outlook

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- Detailed analysis of the results
- Benchmarking for single modes road, rail and air
- Accessibility calculations for scenarios (infrastructure projects, changes in flight schedules etc.)
- Sector specific accessibility indicators
- Definition of intraregional accessibility indicators
- Freight accessibility model