

# Assessing the geographic resolution of exhaustive tabulation for geolocating Internet hosts

S. Siwipersad, S. Uhlig

Delft University of Technology  
The Netherlands

B. Gueye

Universite de Liege  
Belgium

# Agenda

- Introduction
- Database-driven IP geolocation
- Measurement-based IP geolocation
- Geographic resolution of databases
- Conclusions

# Introduction

- GPS-based geolocation
  - Satellite information
  - Exact location
- IP geolocation
  - Round trip time
  - Inferred location



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# Structure of databases

- IP blocks
  - Geographic location names
  - Geographic coordinates
  - Additional information
- 
- Example of database records:

```
2438856704, 2438859007, NL, NETHERLANDS, ZUID-HOLLAND, DELFT, 52    , 4.367, TUDELFT RC, TUDELFT.NL
1393650564, 1393650567, PL, POLAND      ,      ,      , 52.25, 21    , ELTRON    , TPNET.PL
3223215360, 3223216127,      ,      ,      ,      , 0    , 0    , HEWLETT-PACKARD COMPANY,
```

# Information sources for databases

- DNS:
- Whois:

```
cp38697-b.roose1.nb.home.nl (84.26.35.163)
```

```
% Information related to '84.26.0.0 - 84.26.255.255'
```

```
inetnum:      84.26.0.0 - 84.26.255.255
netname:      ATHOME-ROOSENDAAL-1
descr:        @Home Roosendaal Headend block
country:      NL
```

```
role:         AtHome Benelux IP Management
address:      Gyrocoopweg 90-92
address:      1042 AX Amsterdam
address:      The Netherlands
```

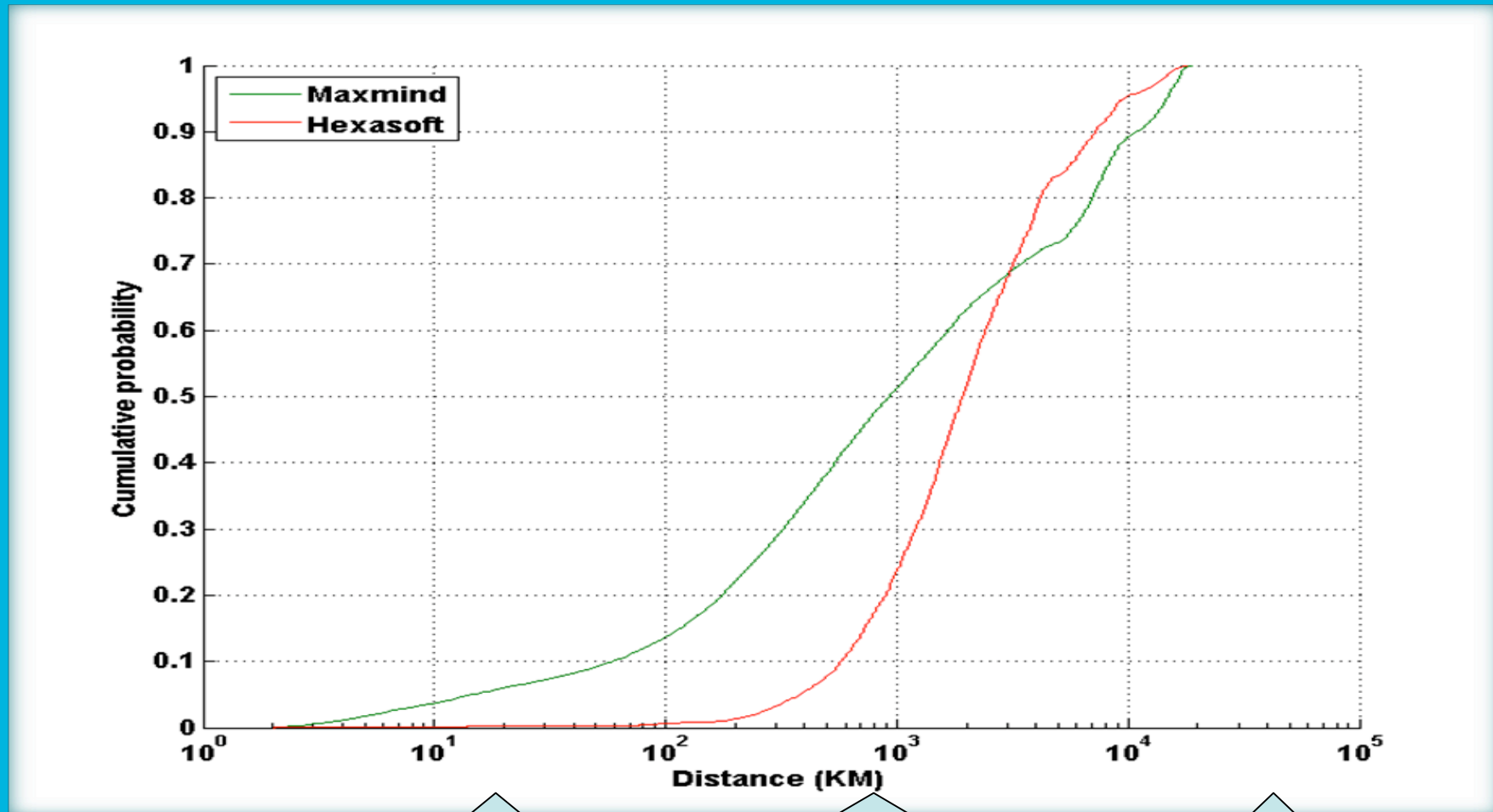
```
route:        84.24.0.0/13
descr:        @Home Benelux
origin:       AS9143
source:       RIPE # Filtered
```

- User subr

# Commercial geolocation databases

- Maxmind
  - 110 thousand cities
  - 3 million IP blocks (74% city-level, 4% country-level)
  - 2 billion IP addresses
- Hexasoft
  - 15 thousand cities
  - 5 million IP blocks (67% city-level, 33% country-level)
  - 4 billion IP addresses

# Span of a city- or country name



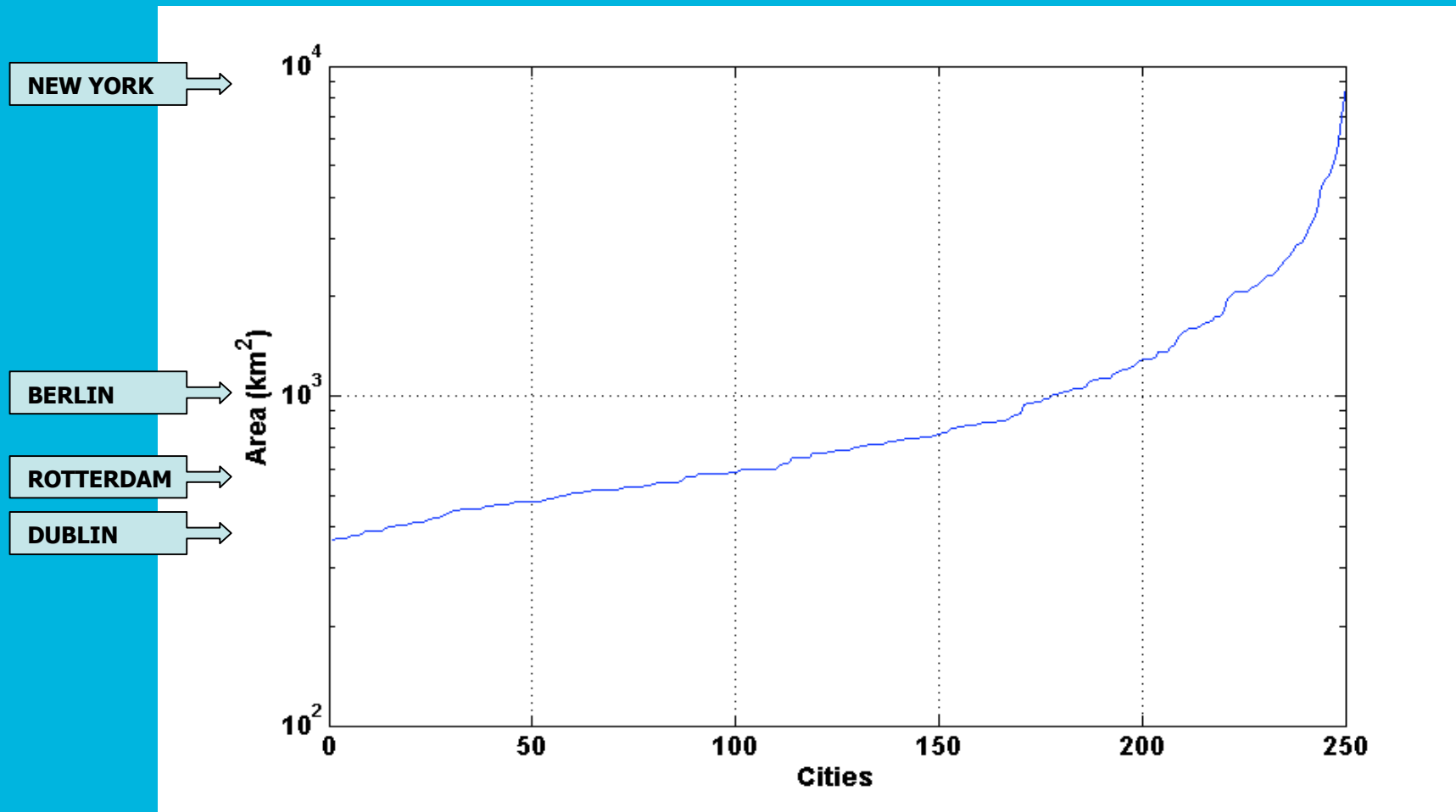
DELFT  
TO  
ROTTERDAM

AMSTERDAM  
TO  
MILAN

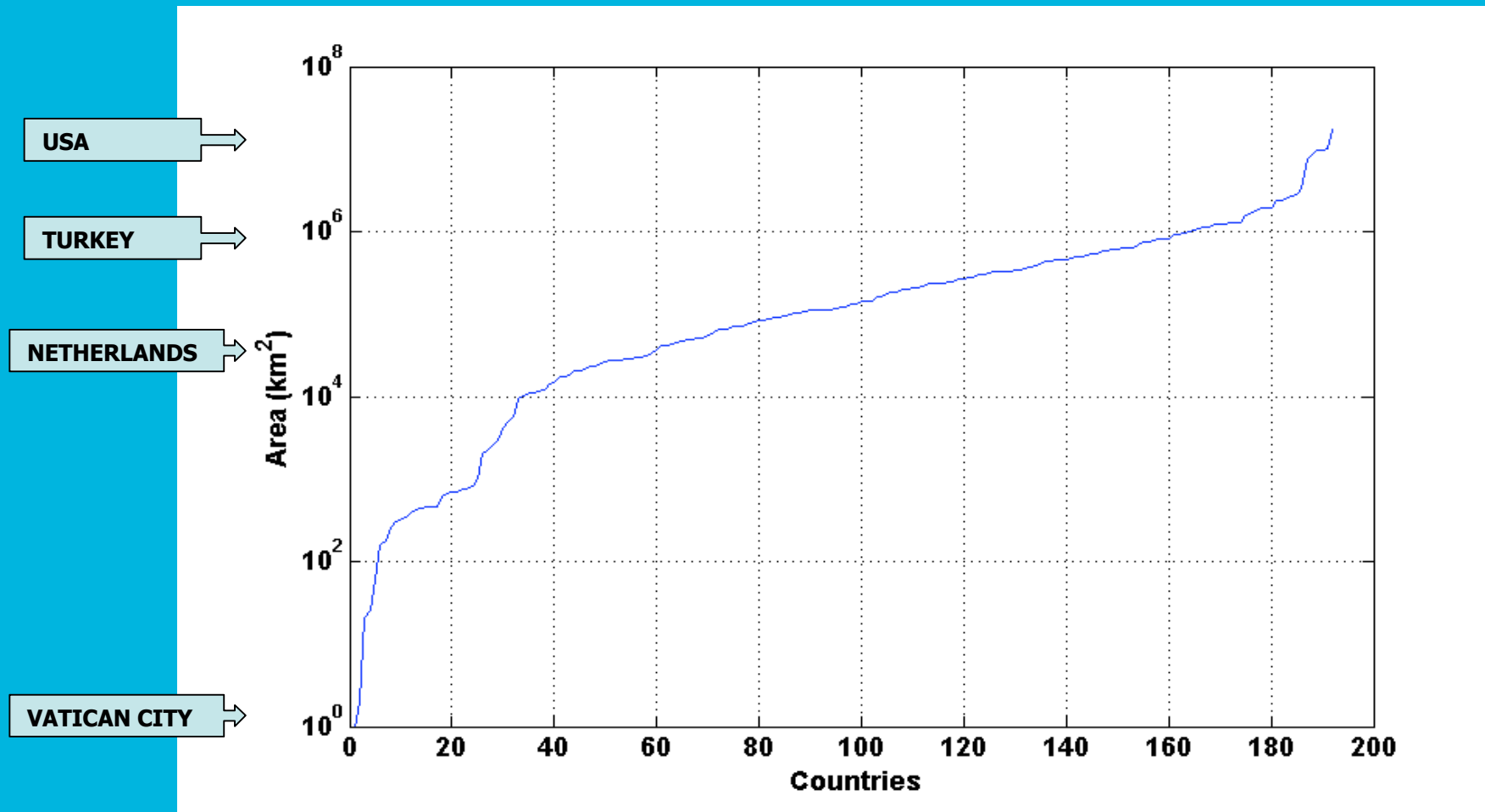
LOS  
ANGELES  
TO



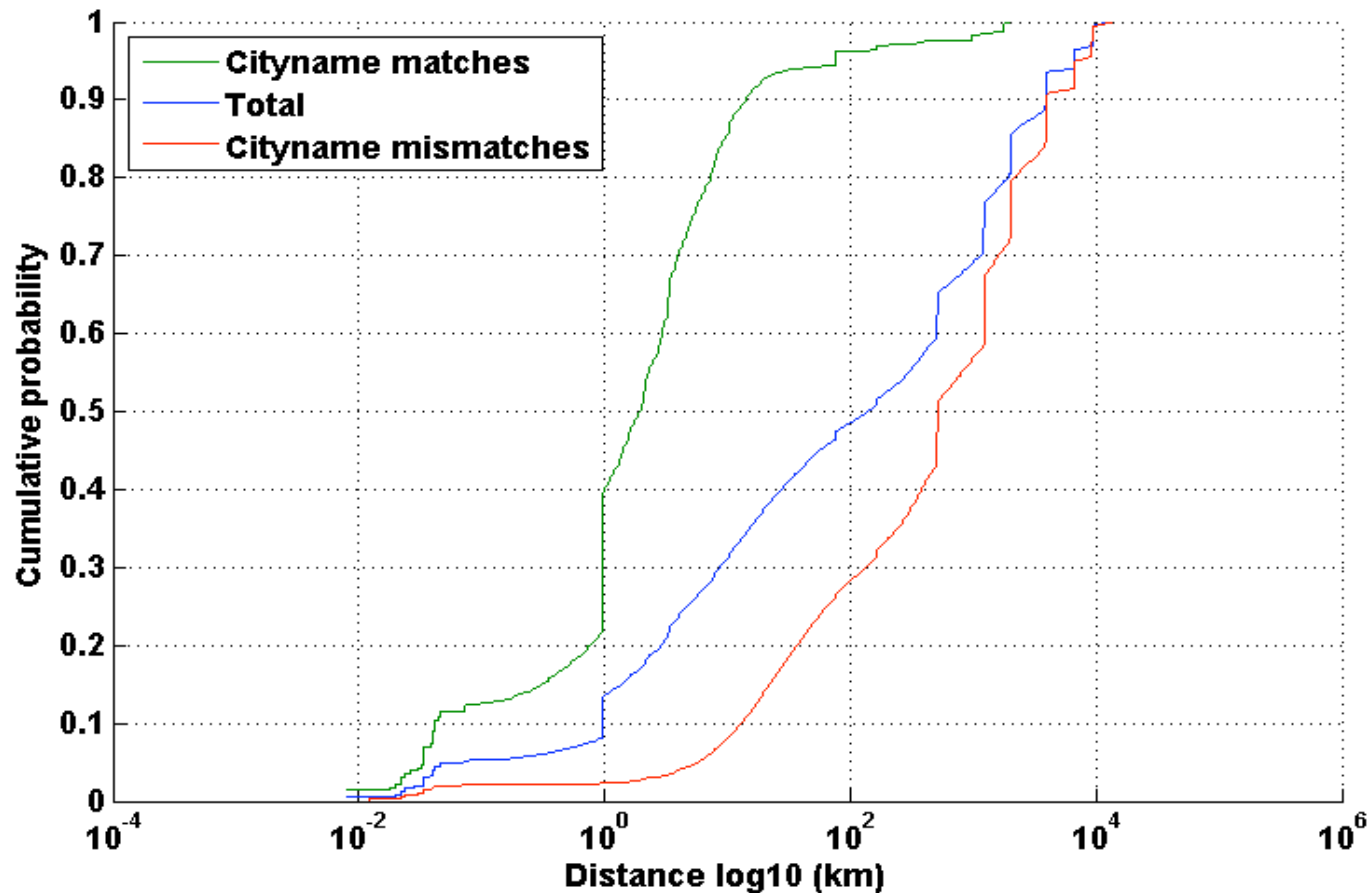
# Size of the largest cities



# Size of countries



# Differences between the databases



# Drawbacks of databases

- Staleness of the location information
- Incompleteness of the records within databases
- Uncertainty on the used sources and methodology
- Coarse granularity of the region
- Discrete solution space

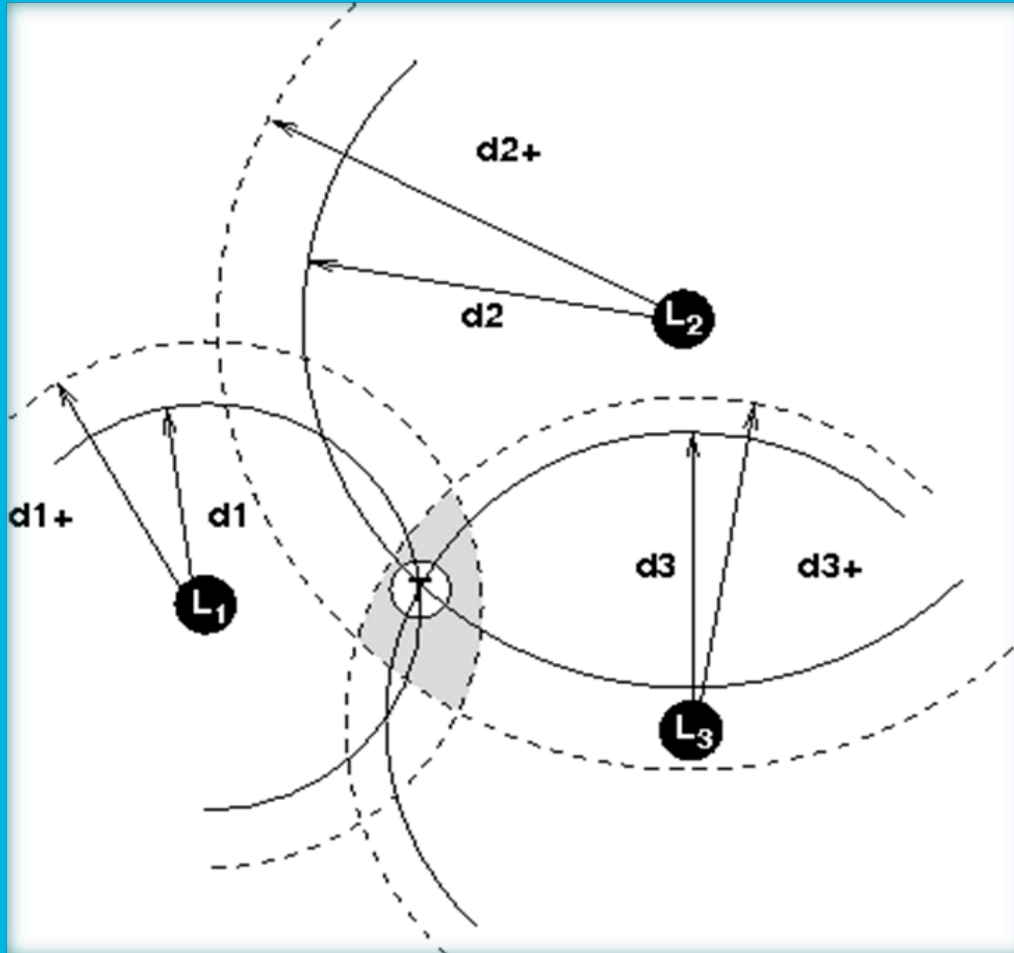
# Advantages of databases

- Easy deployment
- Fast lookups
- Resource inexpensive
- Suited for typical applications
- Reasonably priced

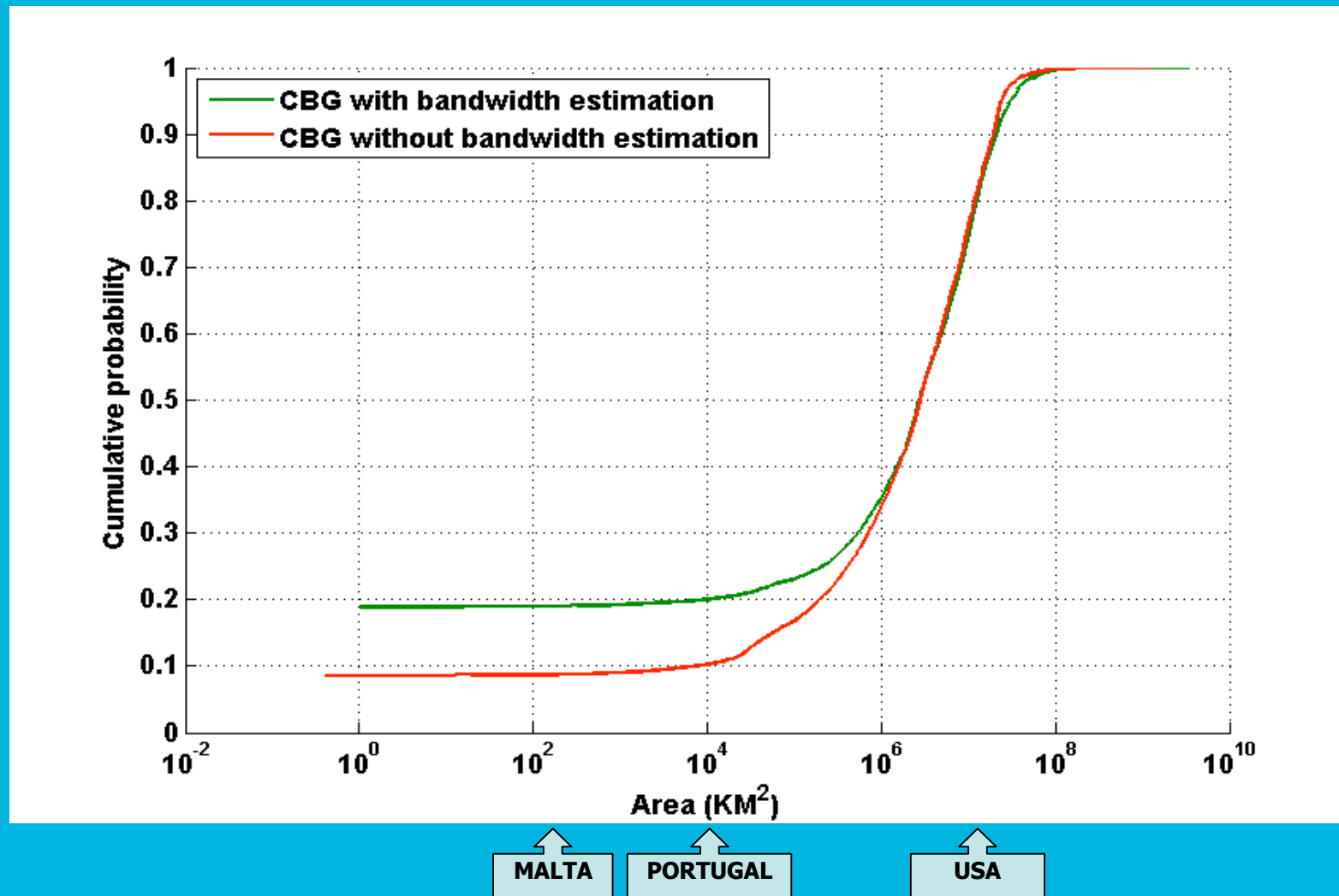
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# Constraint-based geolocation



# Area of the confidence region





# Limitations of measurements

- Relies on replies from probing
- Costly in terms of time and network resources
- Unwanted distortions inherent to measurements

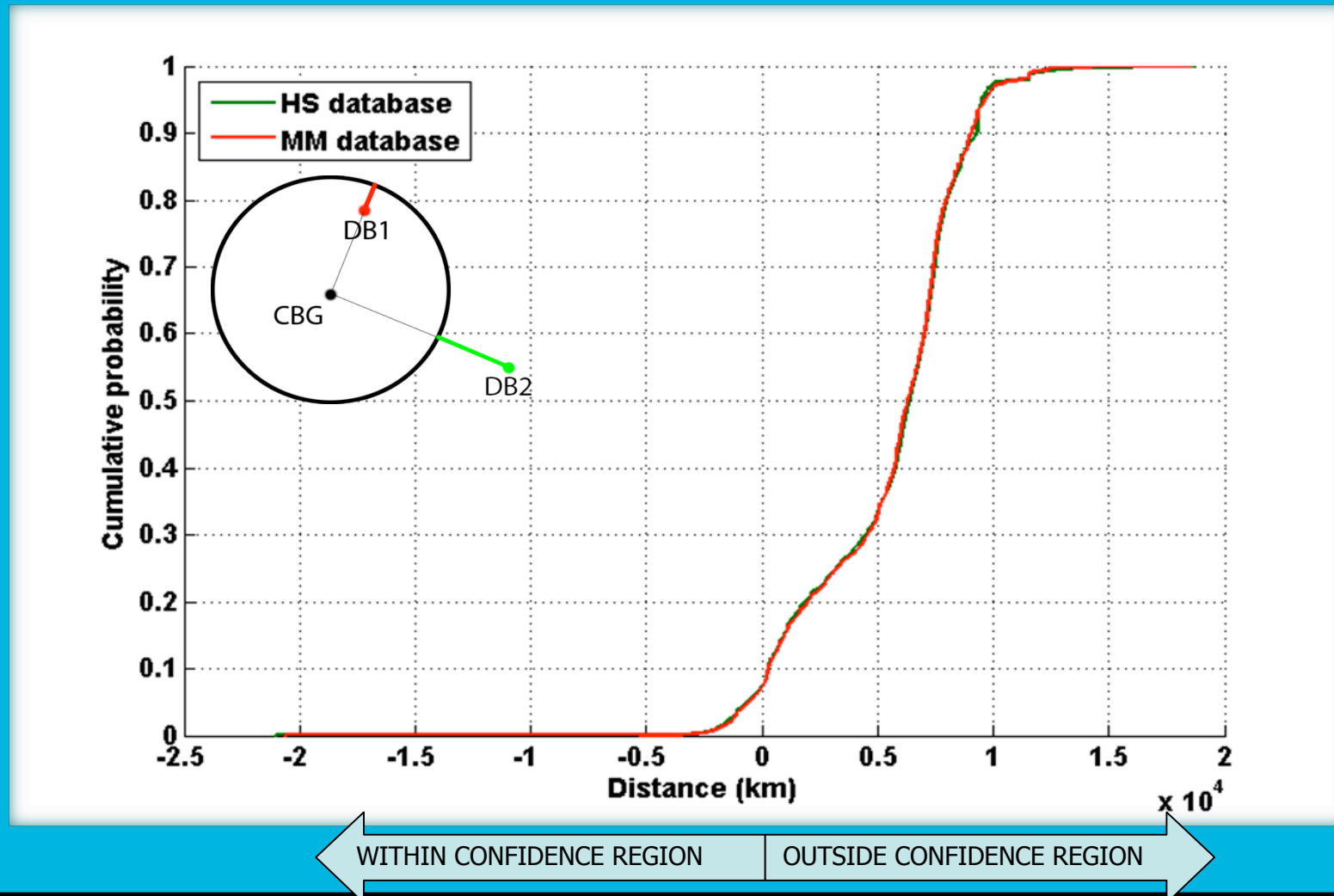
# Advantages of measurements

- Up-to-date location information
- Higher accuracy and finer granularity
- Confidence on area or location estimate
- Continuous solution space

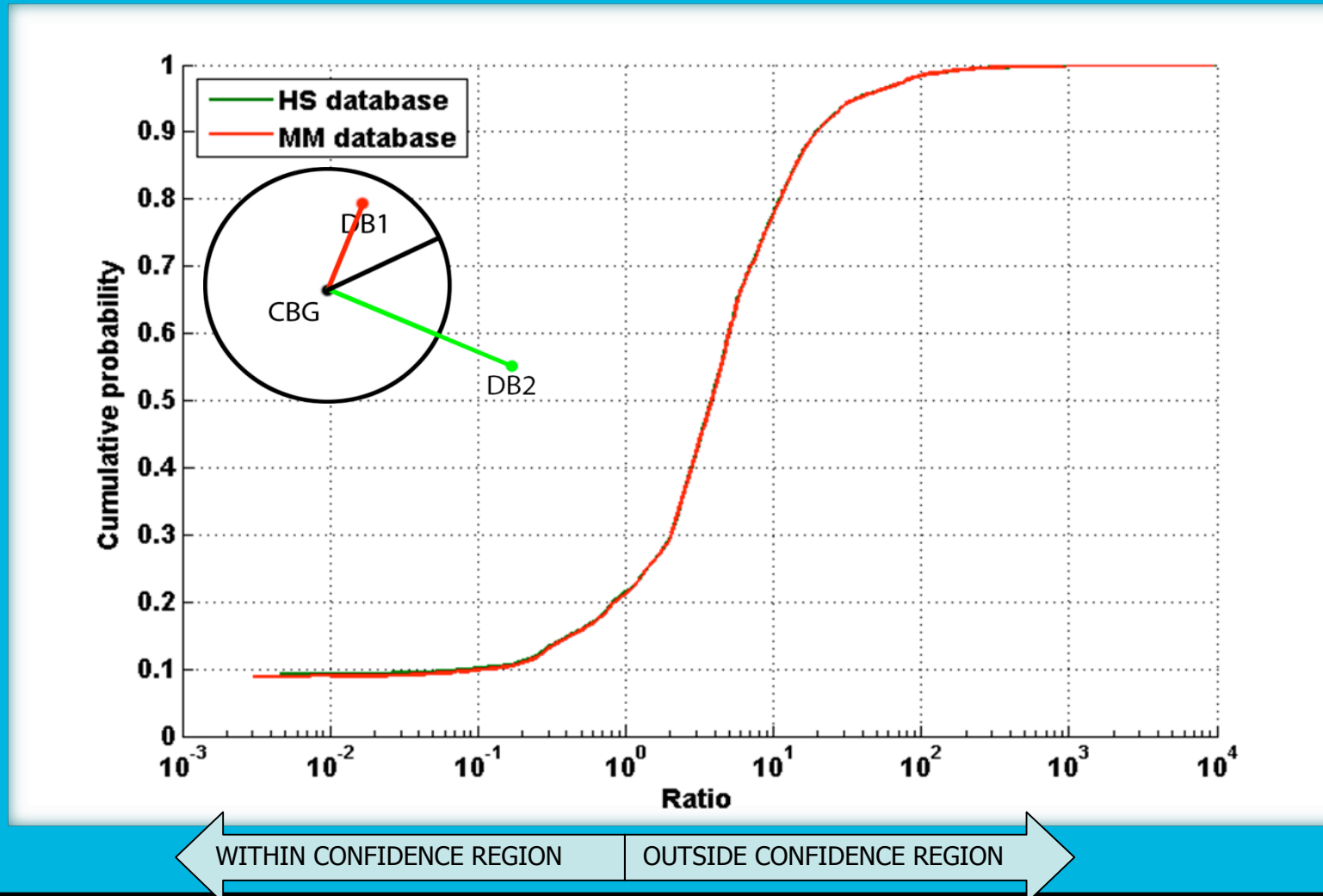
# Presentation outline

- Introduction
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- **Geographic resolution of databases**
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# Absolute resolution of databases



# Relative resolution of databases



# Presentation Outline

- Introduction
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- Investigation on the resolution of databases
- **Conclusions**

# Conclusions

- Databases need improvements:
  - more complete records
  - meta-data about methodology
- Measurements are not always possible, but desirable for better confidence, precision and validation
- Resolution of databases with respect to CBG is poor

# Future work

- Investigate the quality of the information used for databases
- Add information in databases records (e.g. confidence)
- Automated IP geolocation method selection (active vs. passive)