Cross-checking different sources of mobility information

Maxime Lenormand

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Cross-checking different sources of mobility information

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ECCS'14, Lucca, Italy

September 22, 2014

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Motivation

Different sources of mobility information

- Mobile phone data (September - November 2009)
- Twitter data (September 2012 - December 2013)
- Mobility survey (Census 2011)

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Comparison between the datasets on different aspects

- Spatial distribution
- Temporal distribution
- Origin-destination matrix

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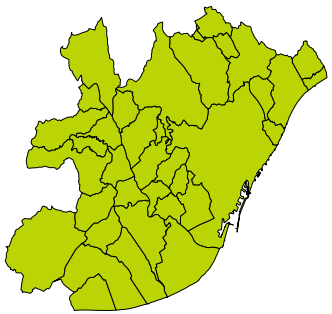
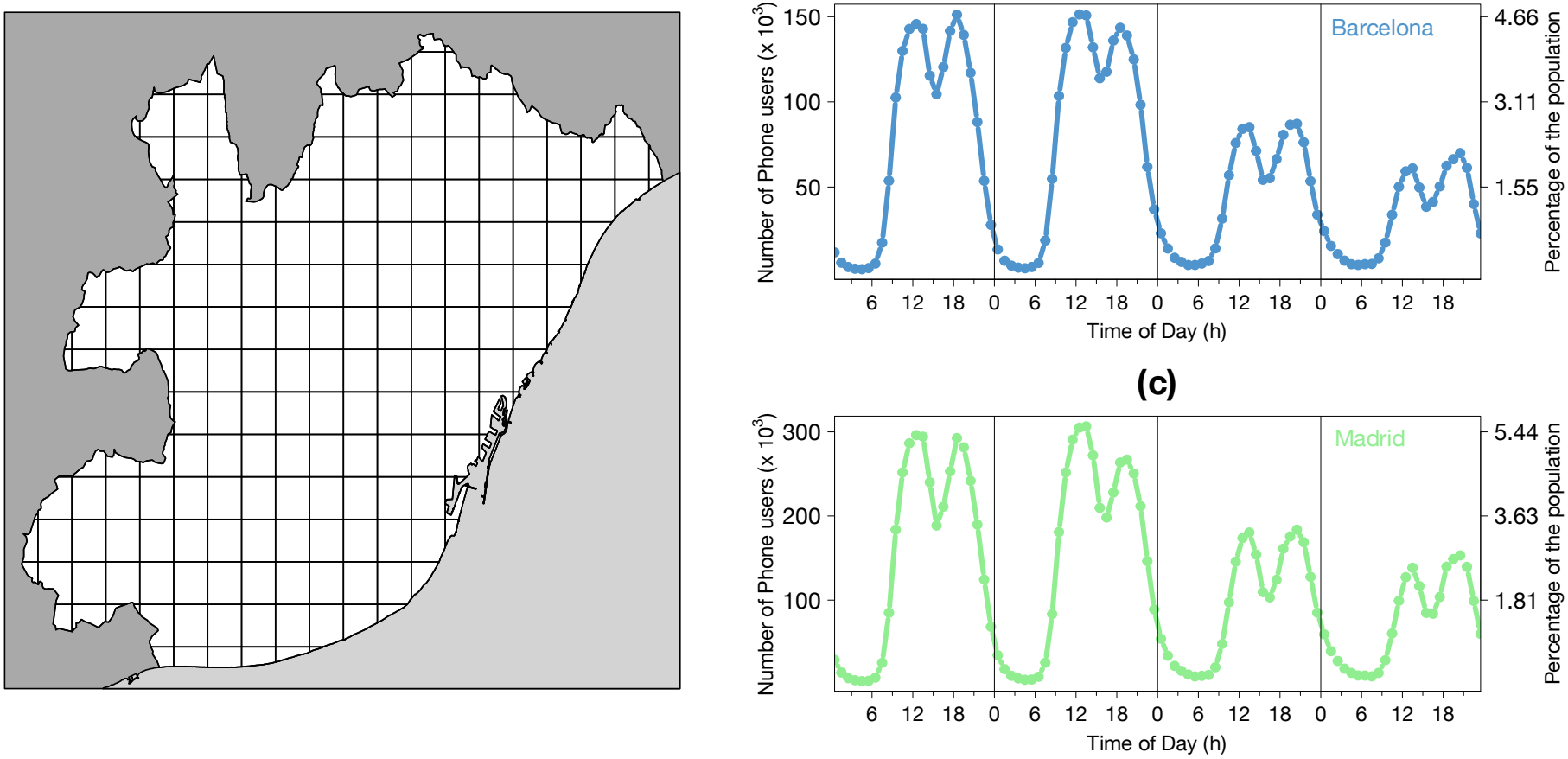
Madrid

Barcelona



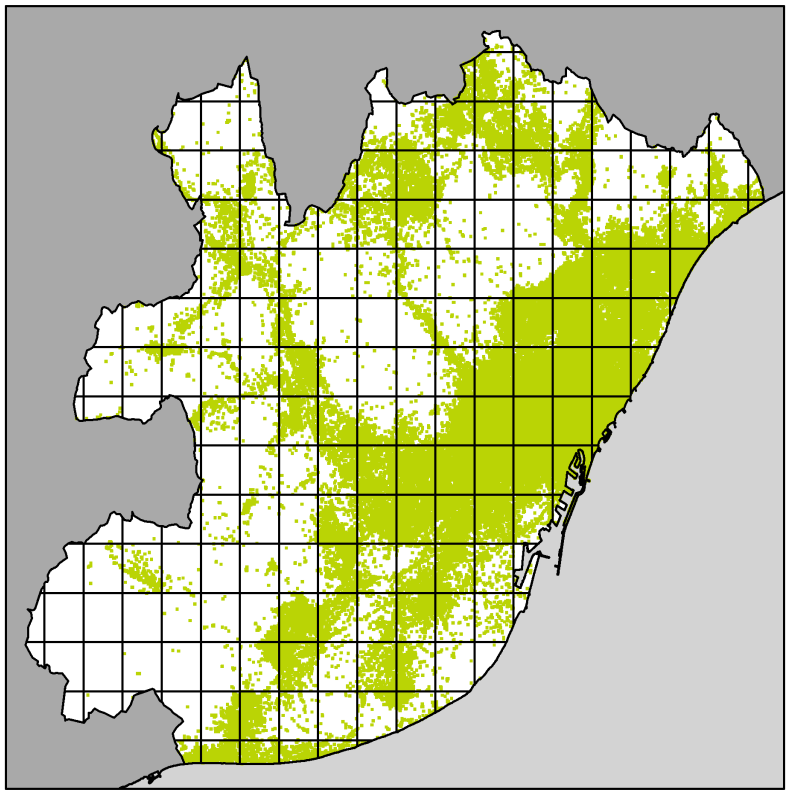
Mobile phone data

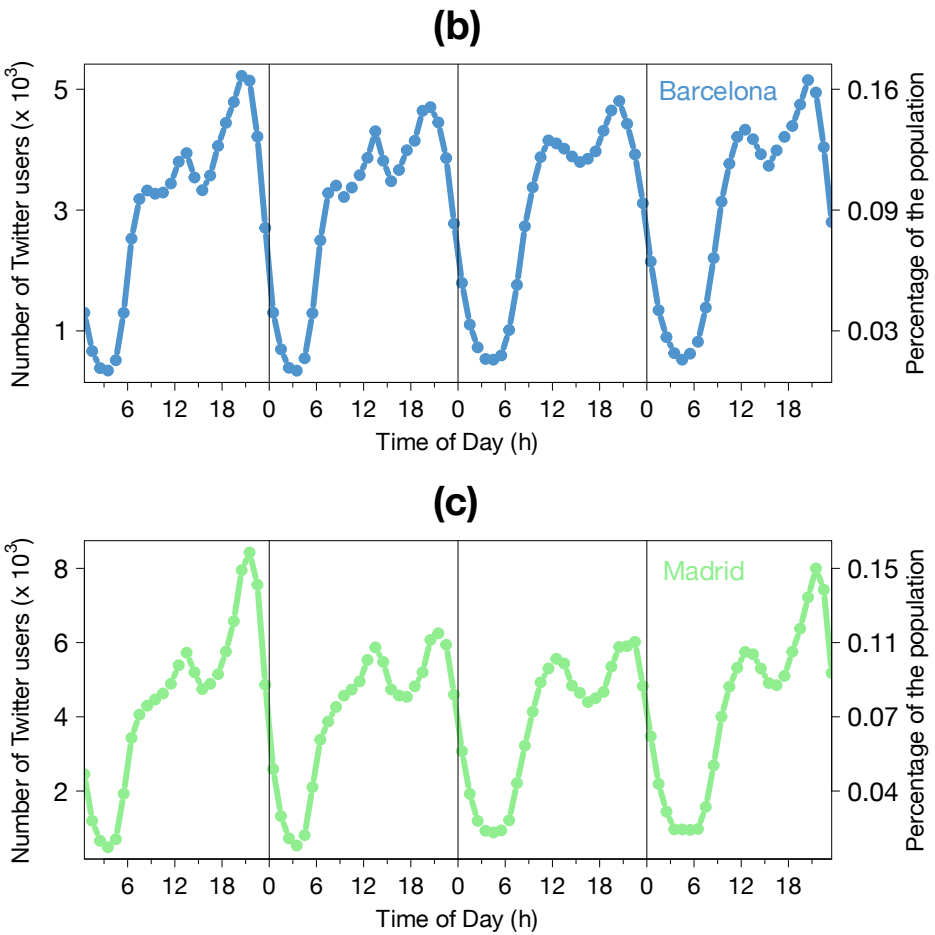
Average number of users per hour and per grid cell (1 and 4 km^2)



Twitter data

Average number of users per hour and per grid cell (1 and 4 km^2)





Origin-destination matrix

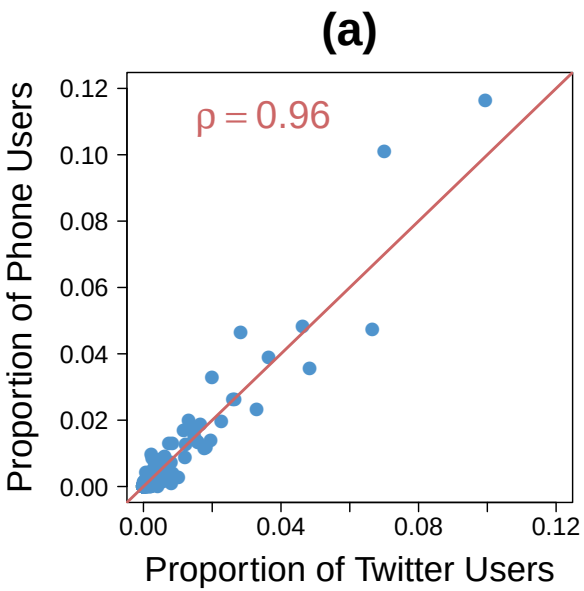
Estimating origin-destination flows using geolocalized data

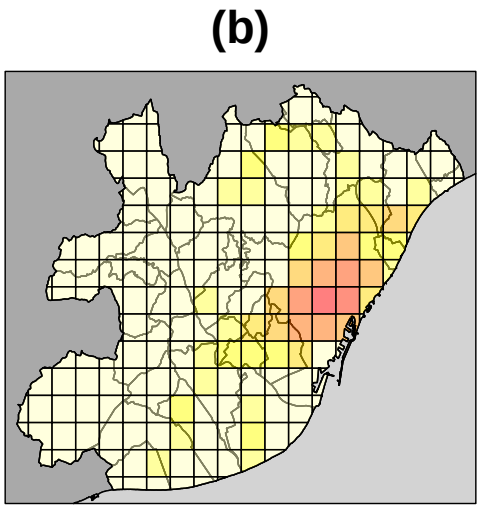
- Select the most active users
- Home: cell most frequently visited on weekdays between 8 pm and 7 am.
- Work: cell most frequently visited on weekdays between 9 am and 5 pm.

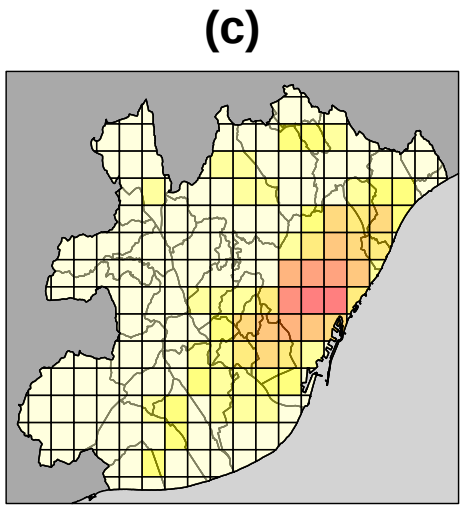
	U_1	...	U_n
U_1	T_{11}	...	T_{1n}
...	...	...	...
U_n	T_{n1}	...	T_{nn}

Spatial distribution

$$X_t = \left(x_t^g\right)_{1 \leq g \leq n} \quad , \quad 1 \leq t \leq 96$$



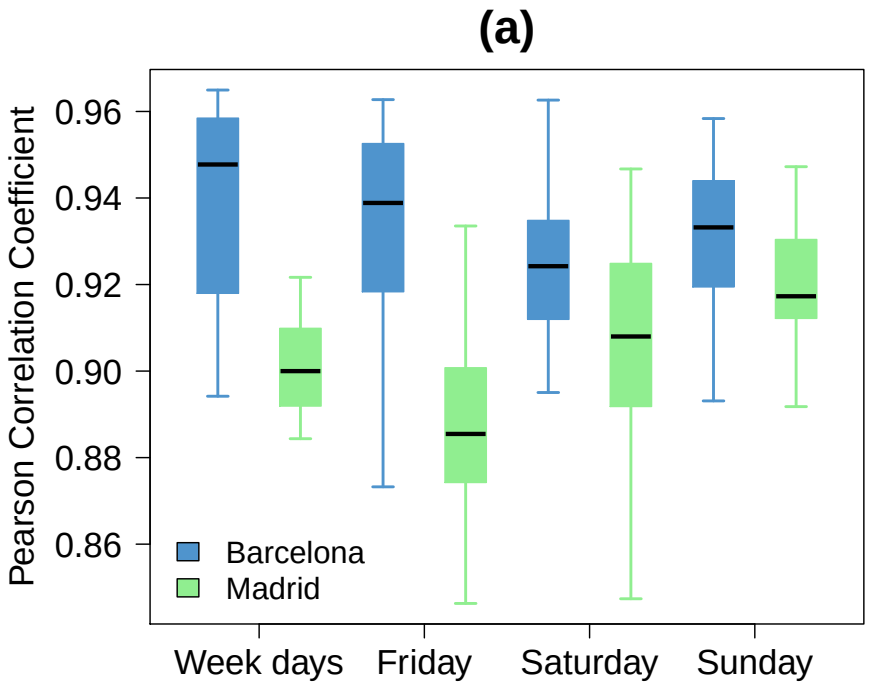


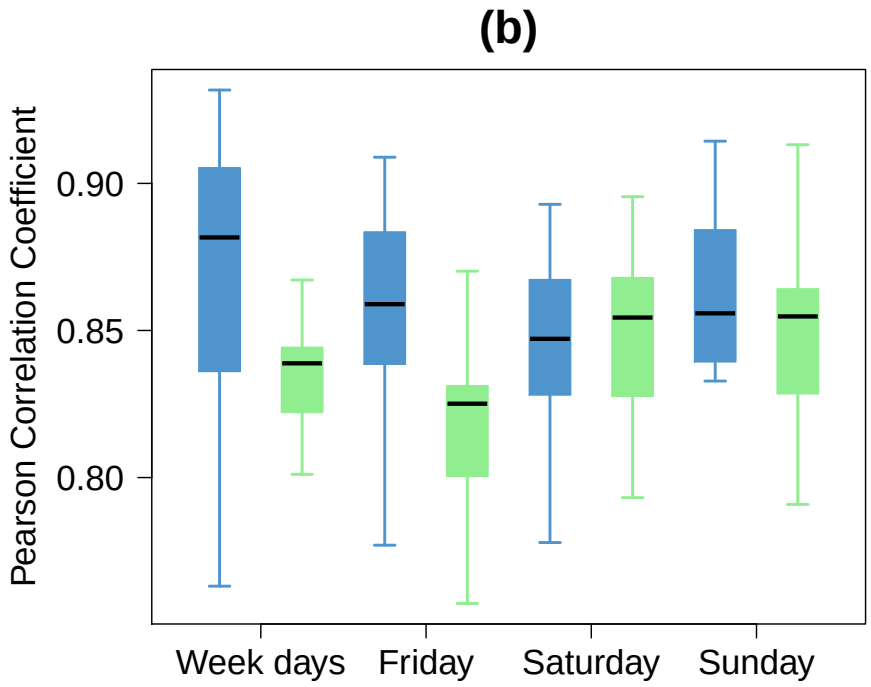


Cumulative proportion of users

- [0,0.1[
- [0.1,0.2[
- [0.2,0.3[
- [0.3,0.4[
- [0.4,0.5[
- [0.5,0.6[
- [0.6,0.7[
- [0.7,0.8[
- [0.8,0.9[
- [0.9,1]

Spatial distribution

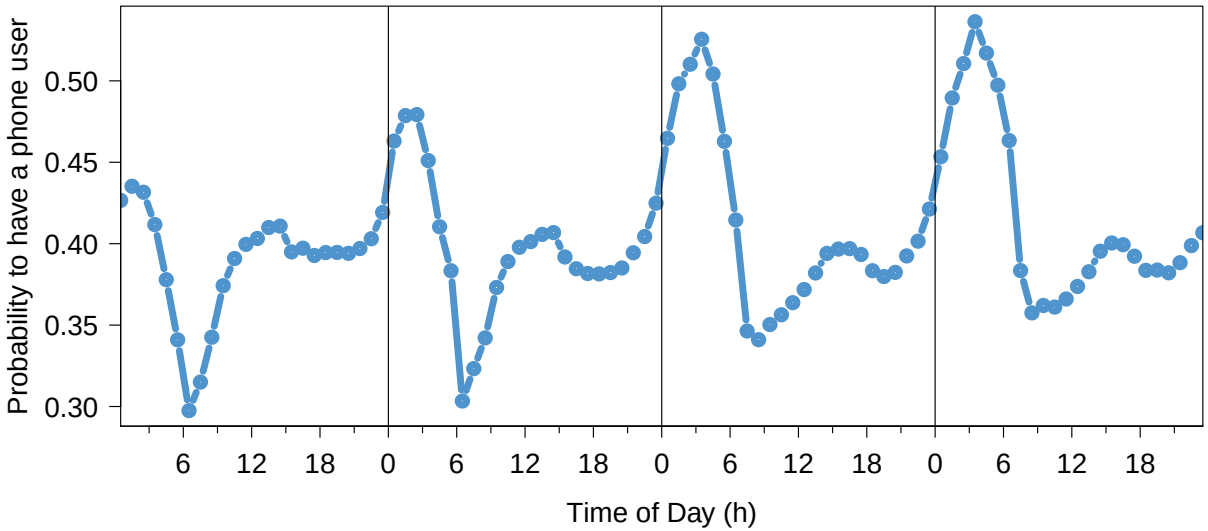




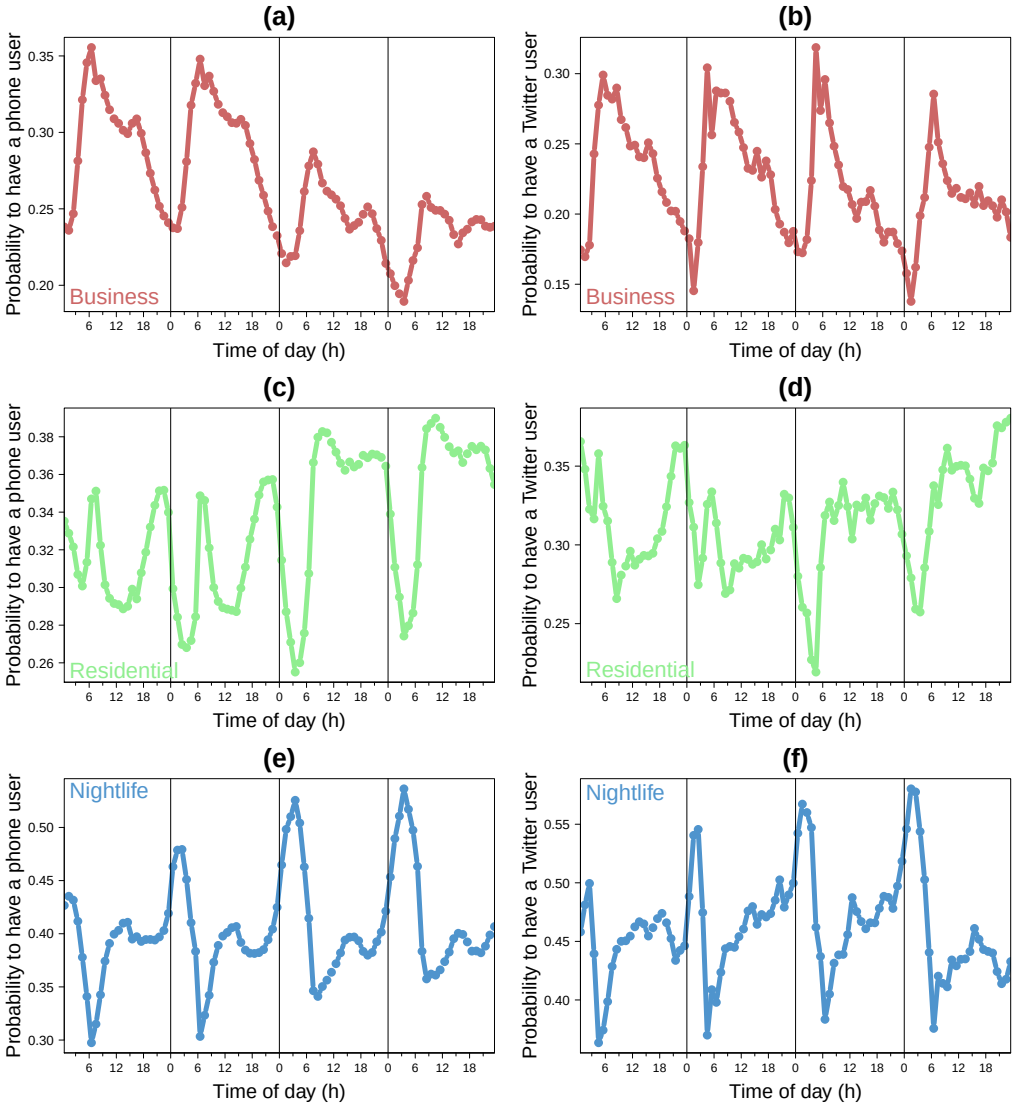
Temporal distribution

$$X^g = (x_t^g)_{1 \le t \le 96} \quad , \quad 1 \le g \le n$$

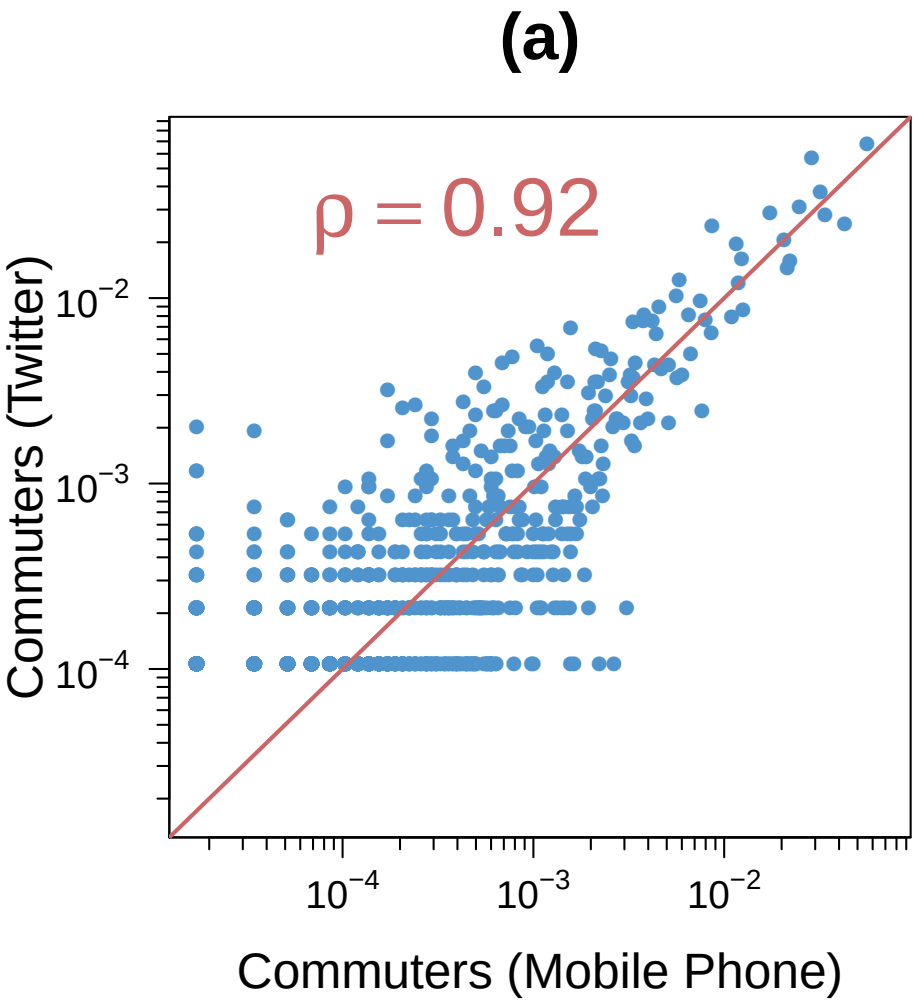
$$\hat{x}_t^g = \frac{x_t^g}{\sum_{k=1}^{n} x_t^k}$$

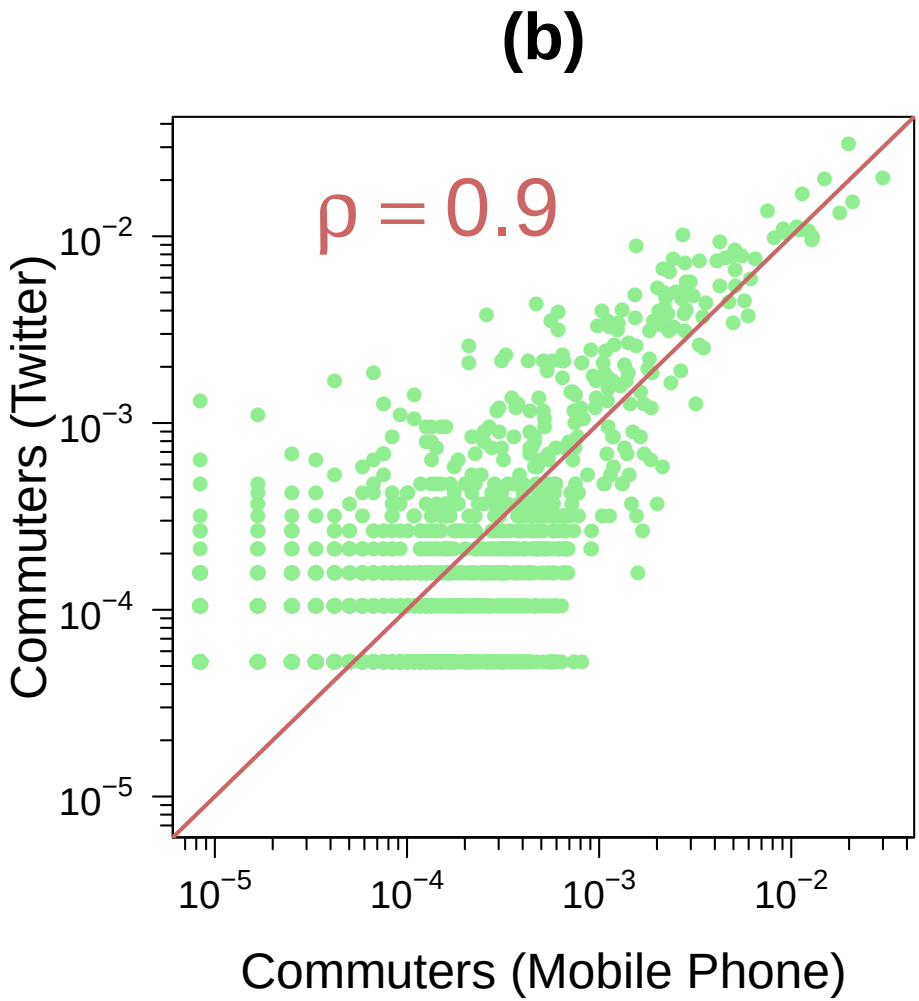


Temporal distribution



Origin-destination matrix





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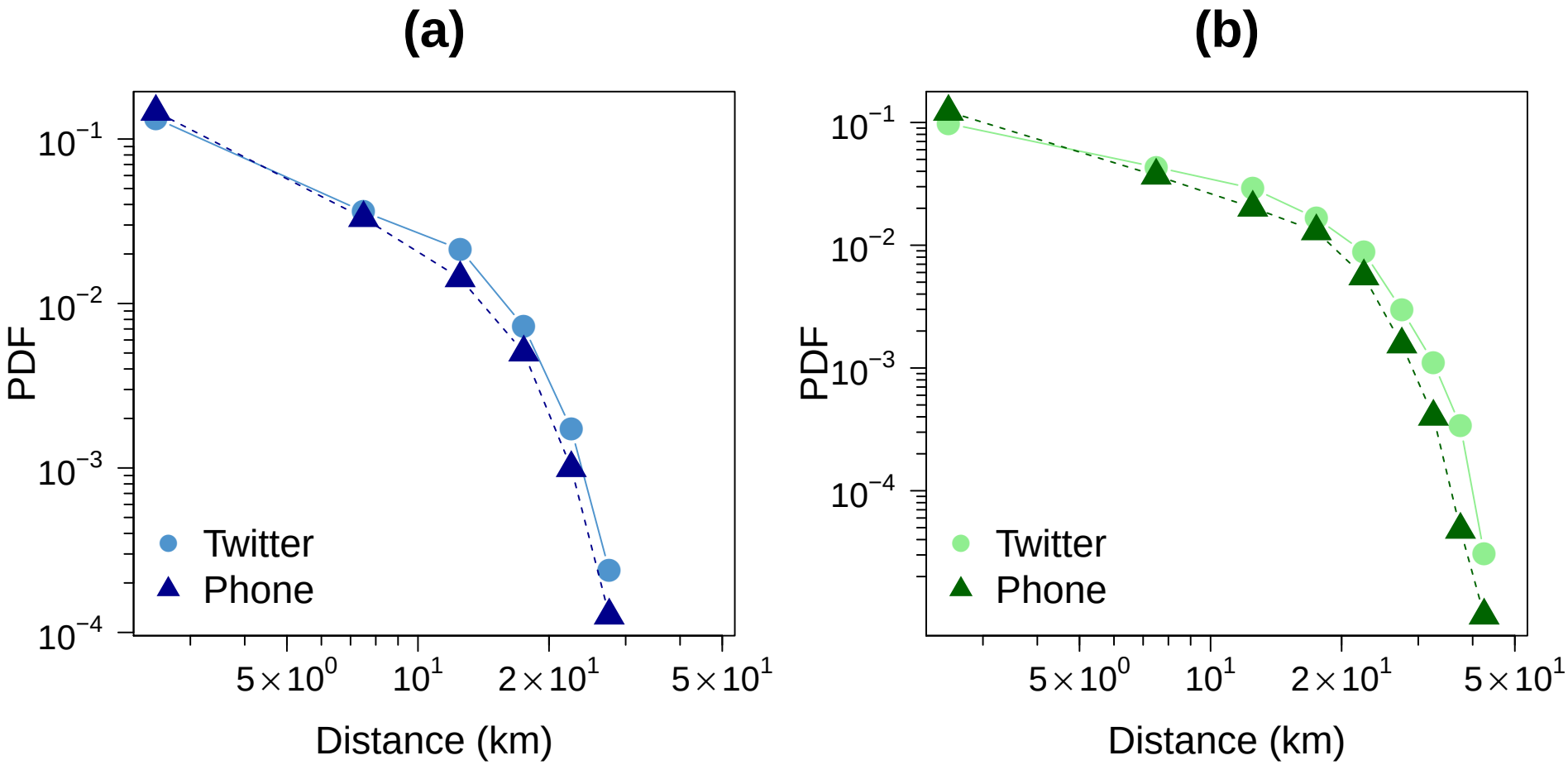

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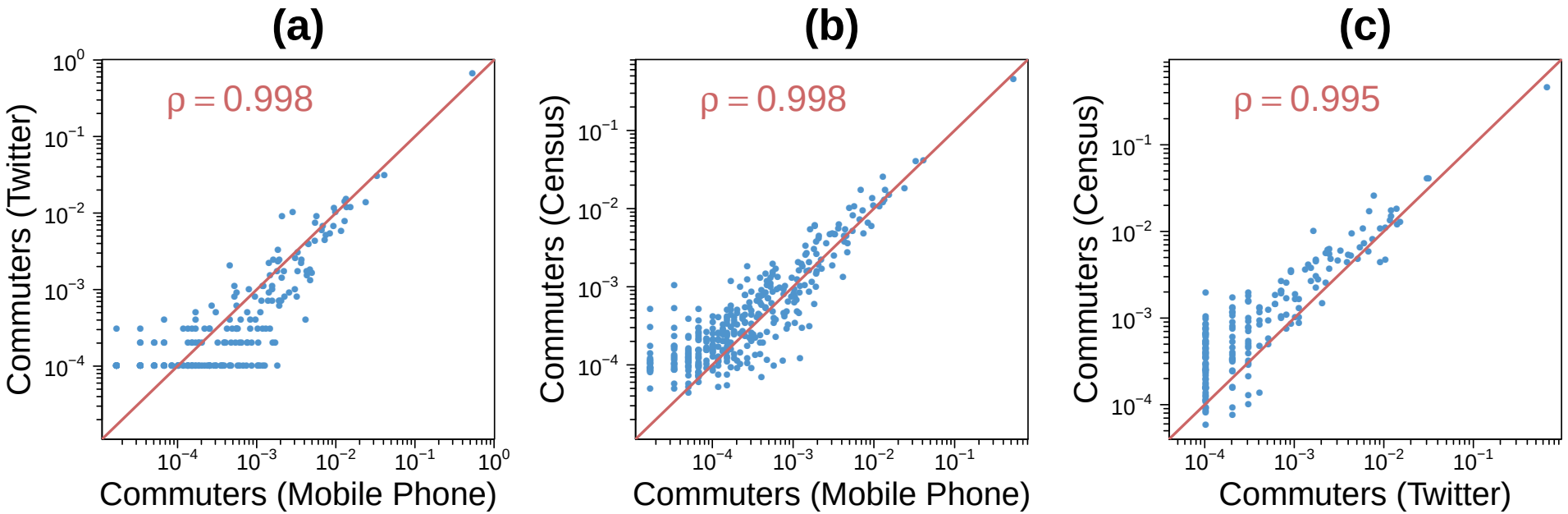

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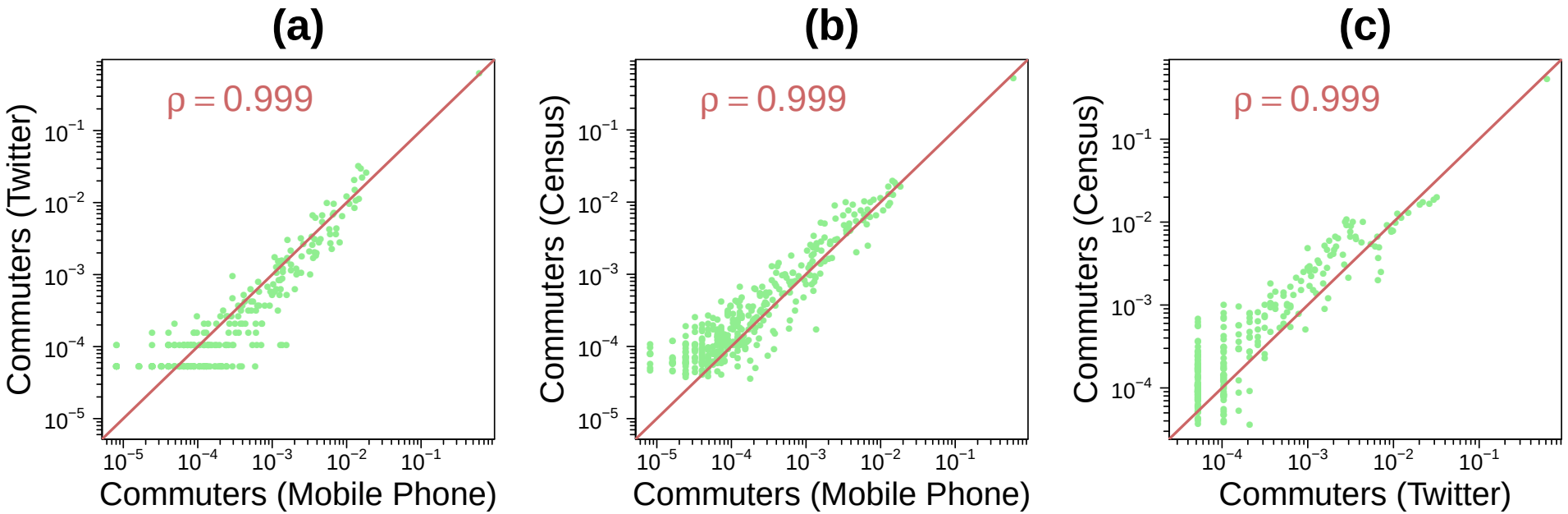

Conclusions

- Cell phone and Twitter data produce similar density patterns both in space and time.
  - **Hotspot analysis:** Louail *et al.* From mobile phone data to the spatial structure of cities. *Scientific Reports* 4, 5276.
  - **Land use detection:** Functional Network of the City. *CitiNet'14*, 25th September.
- Comparable OD matrices obtained with the three data sources.
- Two metropolitan areas: Madrid and Barcelona.
- Grid cells (1 or 2 km) and municipality.

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Antònia Tugores

Thomas Louail

Ricardo Herranz

Marc Barthelemy

Enrique Frías-Martínez

José Javier Ramasco

Lenormand *et al.* Cross-Checking Different Sources of Mobility Information. *PLoS ONE* 9, e105184 (2014).