

# *“Te veré volar en la ciudad de la furia”*

## *Movilidad Urbana y Data Science*

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EURECAT, Barcelona***

dataScience UDD



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GODA

S T E R E O

D O B L E V I D A



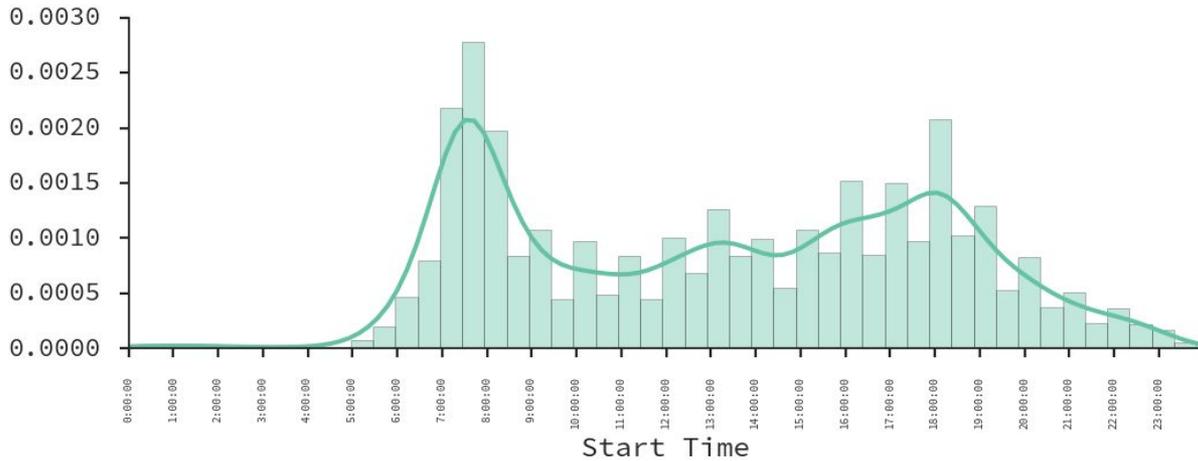
*Our own version of the Furious City...*

# ***Measuring and Understanding Mobility***

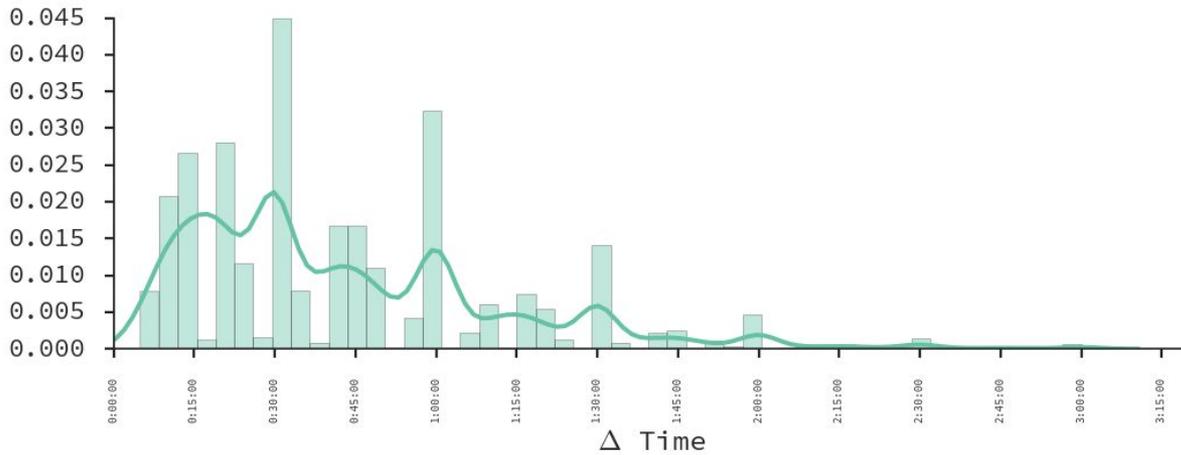


*A Travel Survey is built by aggregating Travel Diaries: What trips did you made yesterday?*





**Trip Start Times**  
Usage *peaks* are evident  
(good)



**Trip Duration**  
Self-reported limitations  
are evident at 15 minute  
intervals (not good)

# Problems

*Cities change faster than the frequency of surveys (**10 years!**)*

*Self-reported surveys have many drawbacks (expensive -time and money-, sampling, etc.).*

*Demand is predicted by ad-hoc surveys and closed/outdated models (e.g., Transantiago)*

# ***Mobile Data from Telecommunication Companies***

*Telefonica*

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**Investigación y Desarrollo Chile**



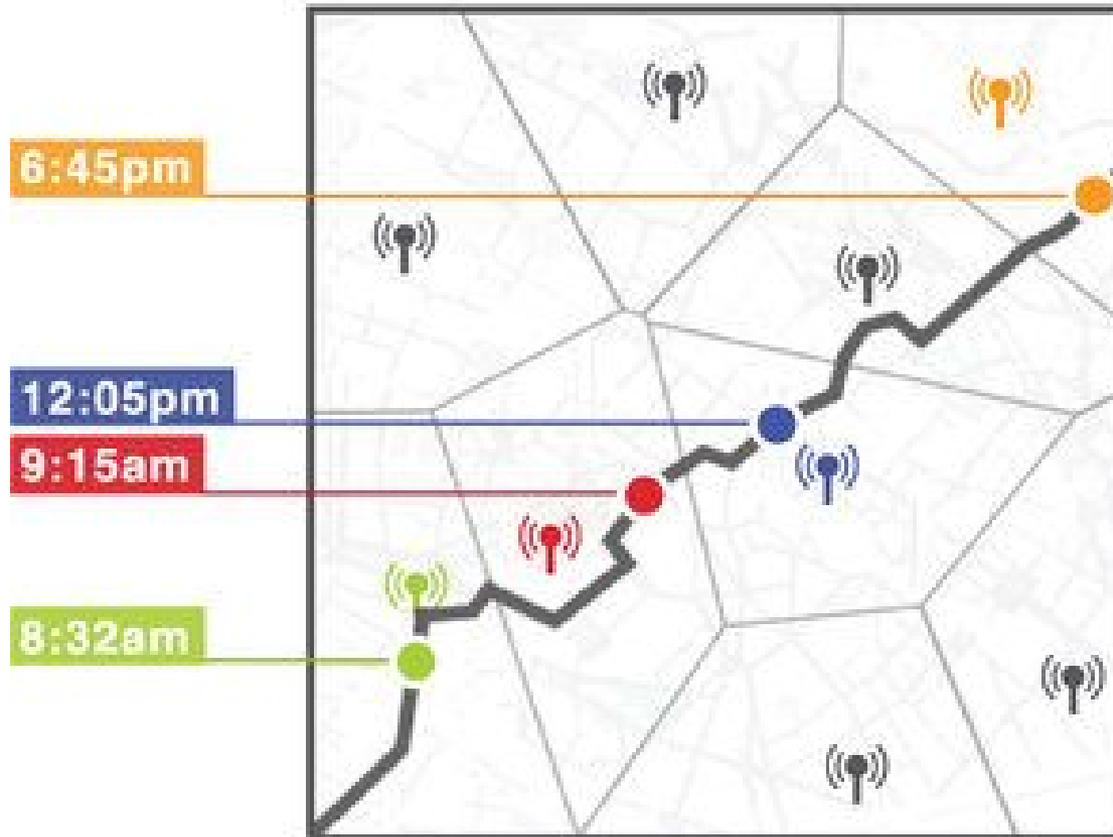
*I like to see mobile data as lights in the night.*



*It tells us many things by giving us signals.*



*In Chile, there are 132 mobile subscriptions per 100 inhabitants. That means that there are lots of signals!*



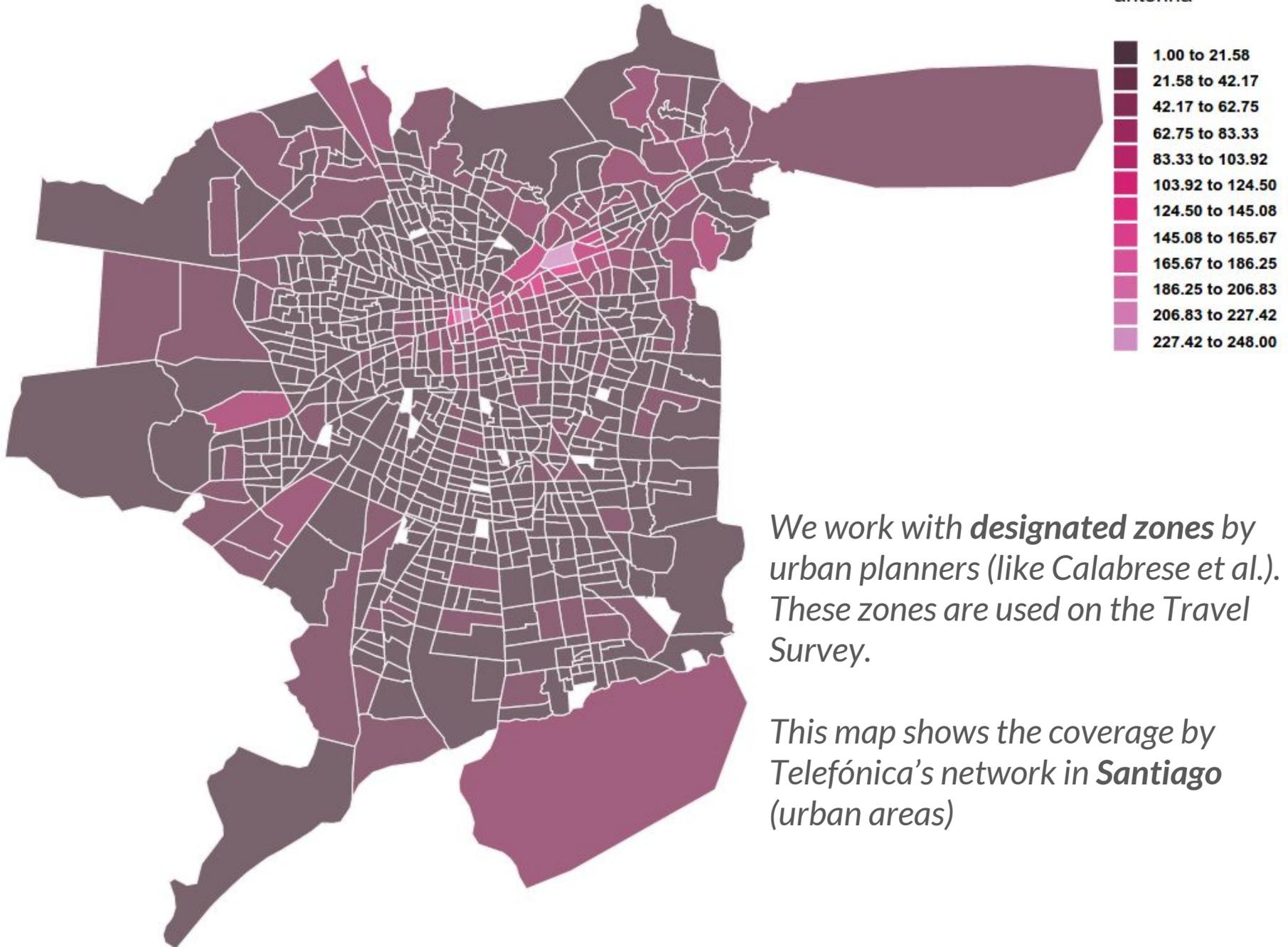
Source: Yves-Alexandre de Montjoye et. al, "Unique in the Crowd: The privacy bounds of human mobility." *Scientific Reports*

## ***Call Detail Records***

Used by telecommunications companies to bill customers. They are **cheap to obtain** (for companies!).

They have been used widely to study **human mobility** and **transport patterns**(see our paper for references).

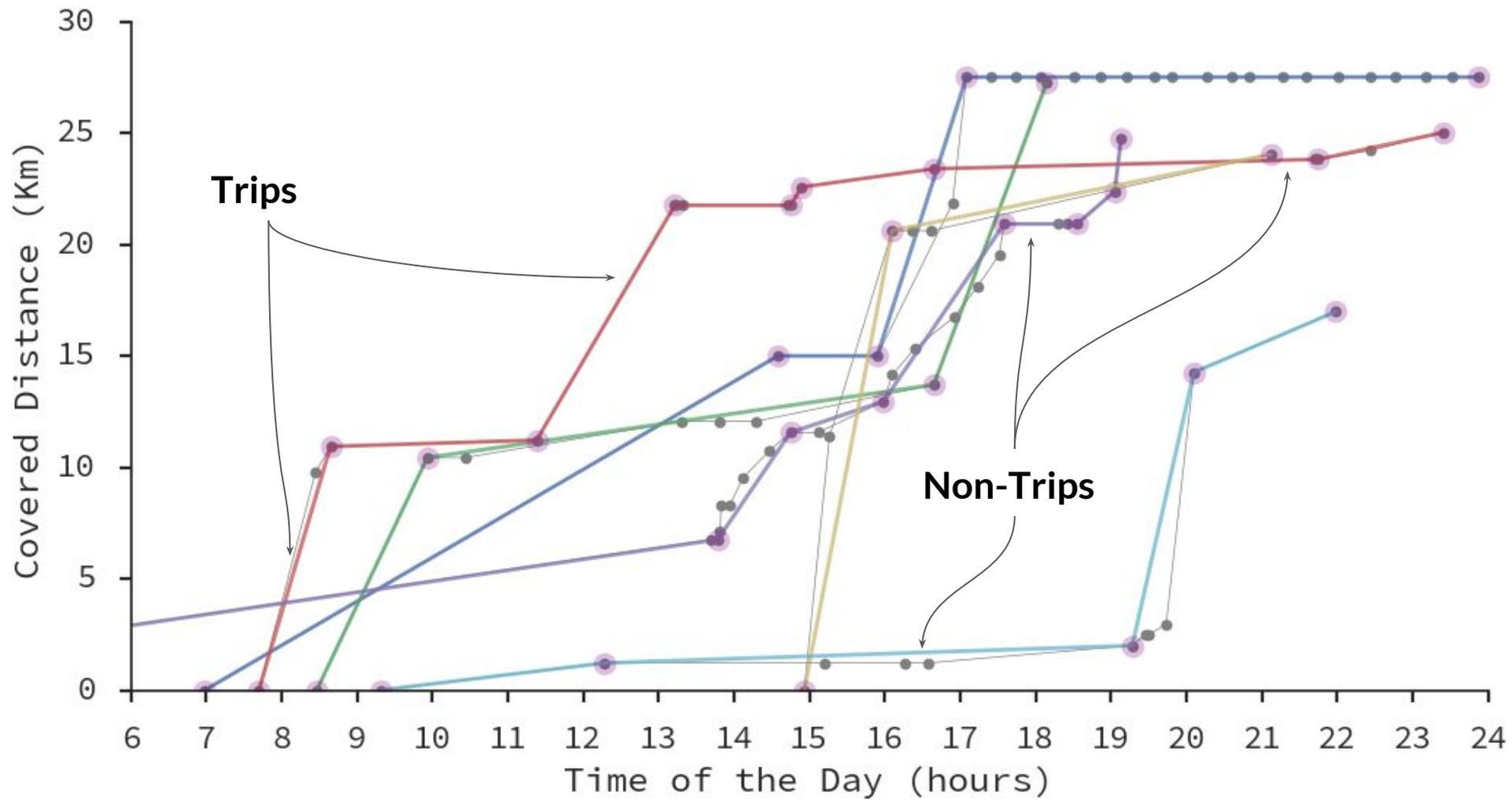
antenna

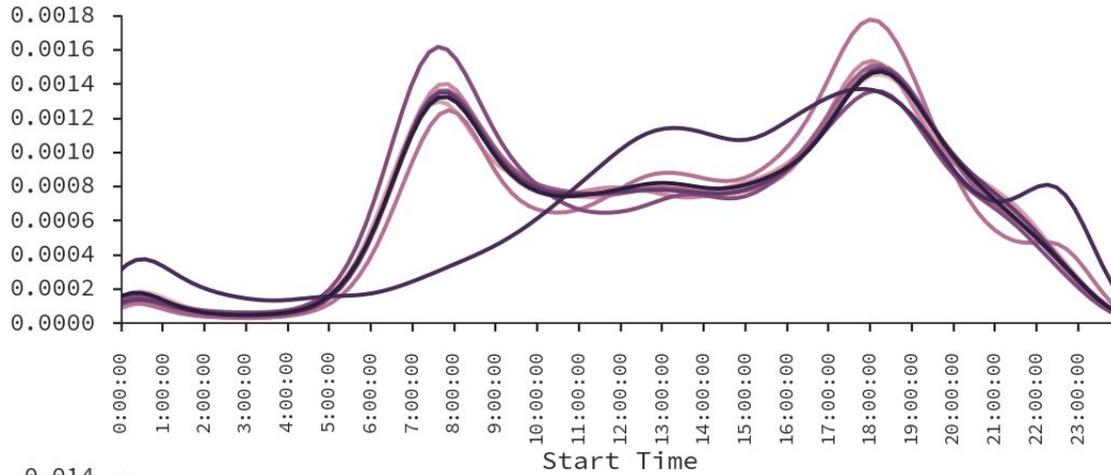


*We work with **designated zones** by urban planners (like Calabrese et al.). These zones are used on the Travel Survey.*

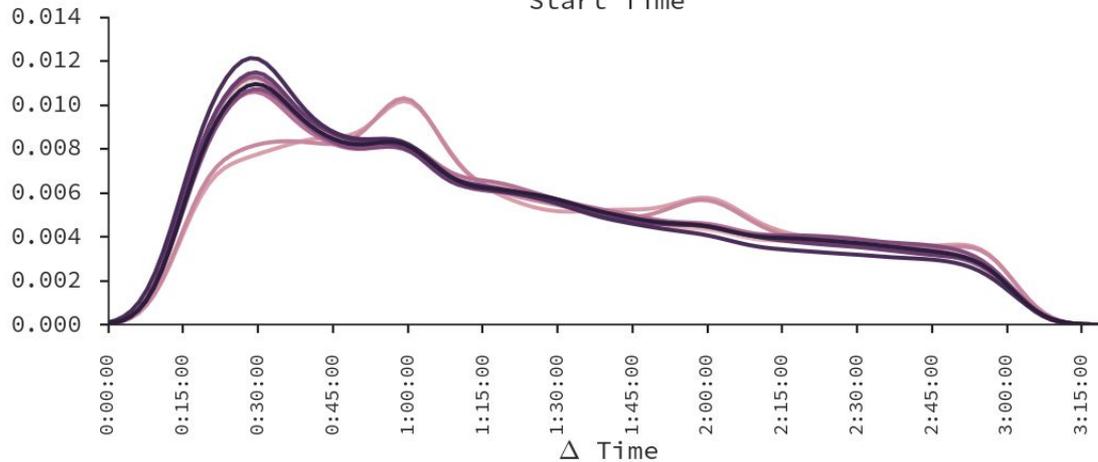
*This map shows the coverage by Telefónica's network in **Santiago** (urban areas)*

***OD Matrix and Trip  
Characteristics in  
Santiago, Chile***





Reconstructed peaks.  
**One day is anomalous!**  
*(it was an important soccer match)*

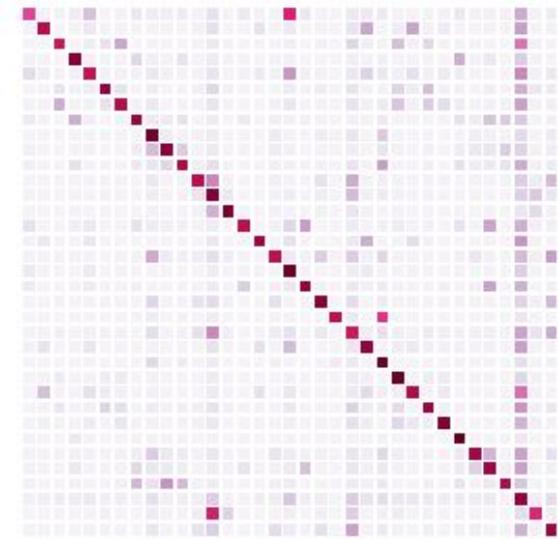


- 2015-06-01
- 2015-06-02
- 2015-06-08
- 2015-06-09
- 2015-06-15
- 2015-06-16
- 2015-06-22
- 2015-06-23
- 2015-06-29
- 2015-06-30

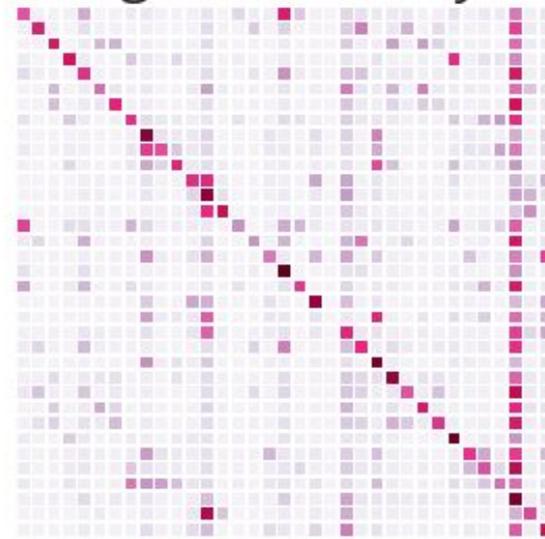
Many days are similar,  
but **two days are anomalous!**  
*(it was a public transportation strike - longer commuting times!)*

*Results of applying the algorithm to all days on the dataset, on a random sample of 35.000 devices per day. (note: OD Survey covers 40.000 people)*

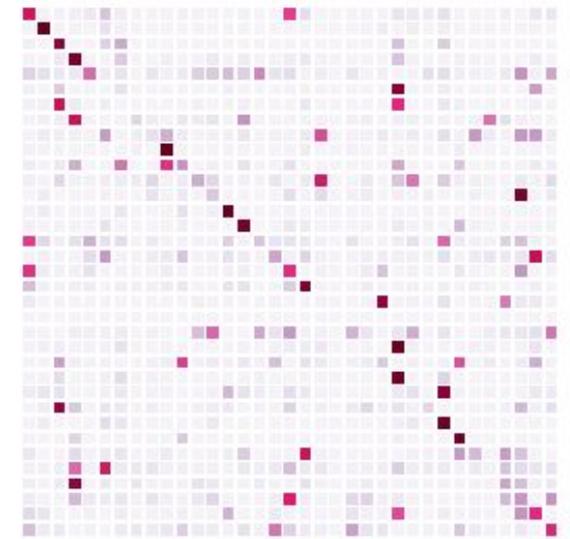
## Full Origin-Destiny Matrix



EOD Survey



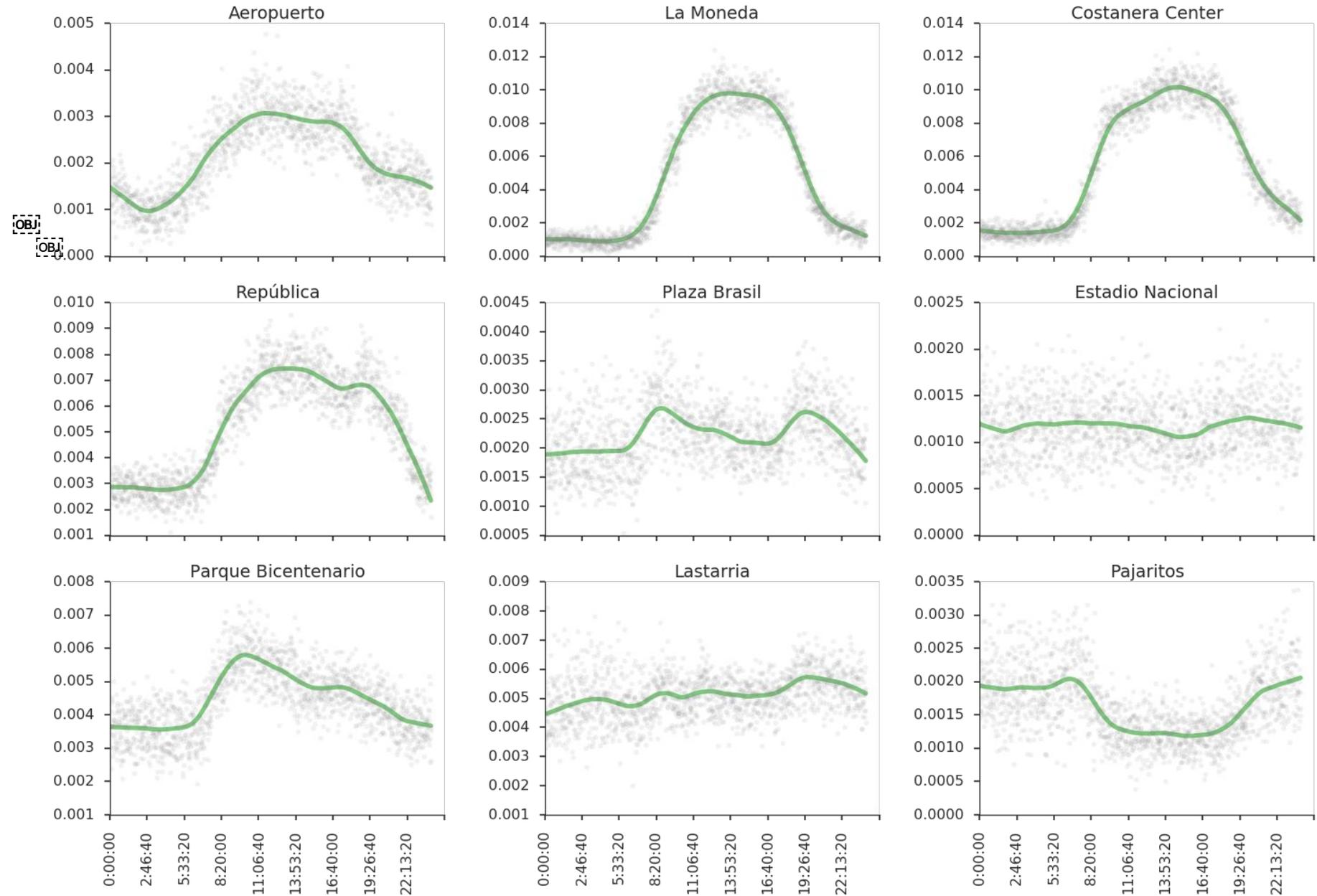
Algorithm ( $\rho = 0.89$ )



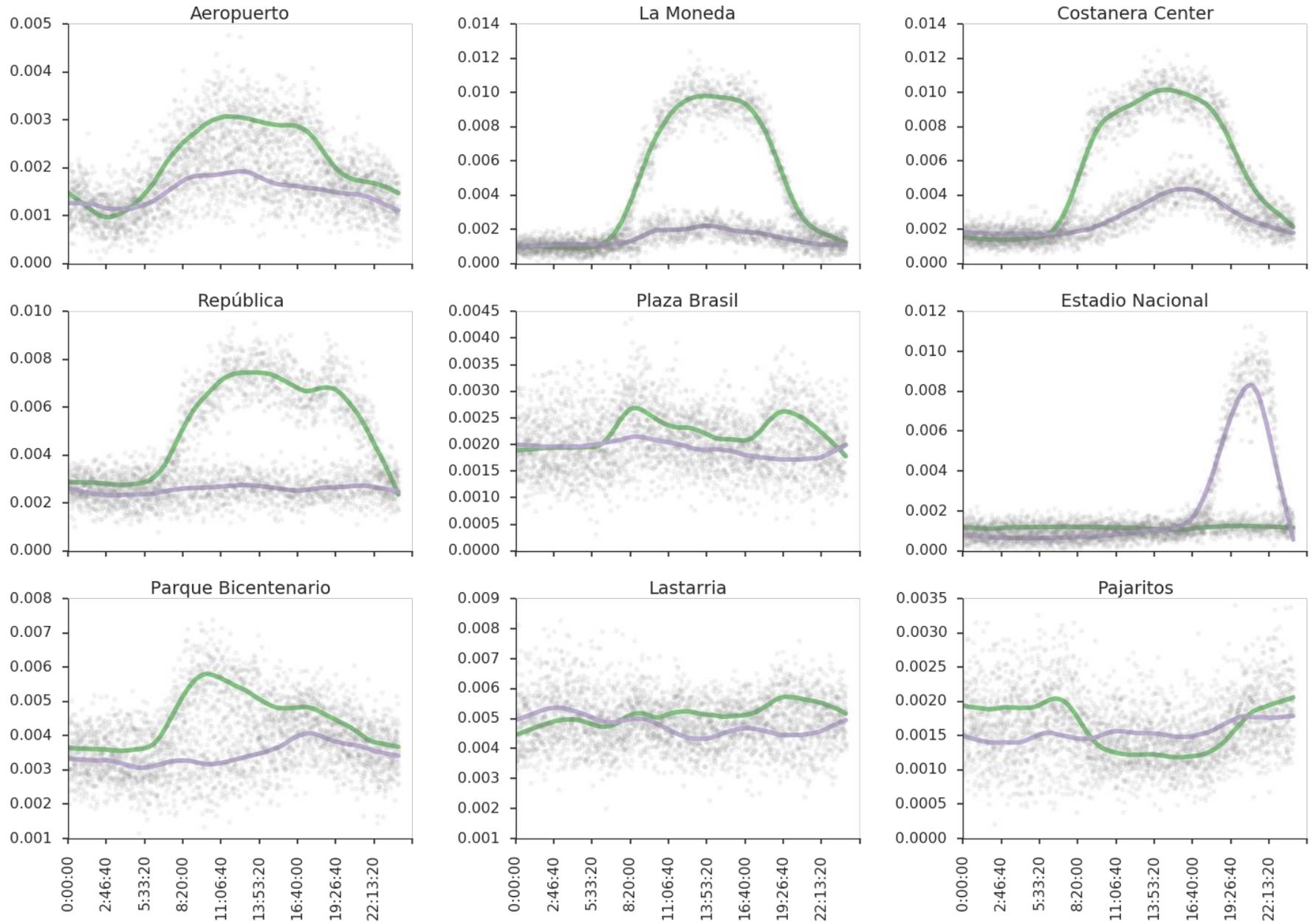
Transantiago ( $\rho = 0.30$ )

*In terms of **OD Pairs**, our rank-correlation is very high  
(see our paper for comparison with a smart-card based matrix)*

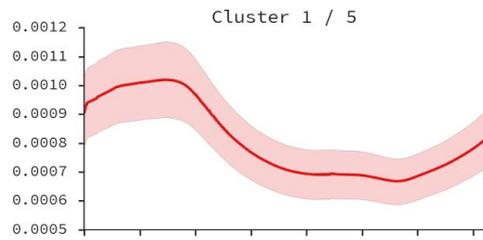
***Counting Connections  
to infer  
Land Use Patterns***



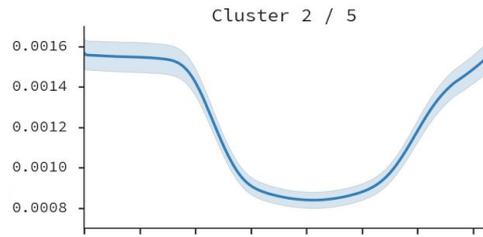
*A normal day on the fury city: June 1st, 2015.*



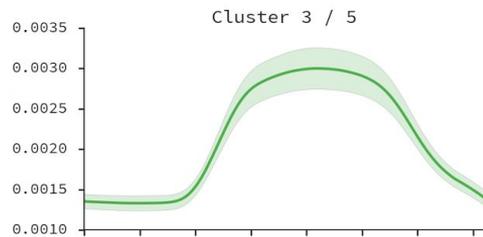
*A not so normal day on the fury city: June 29th, 2015 (purple). What happened that day?*



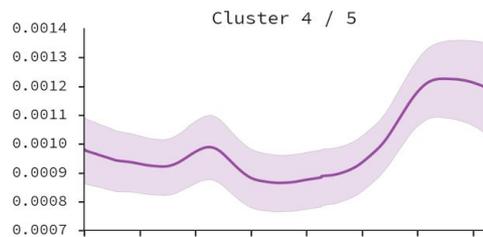
*Transition Places between dormitory and non-dormitory areas*



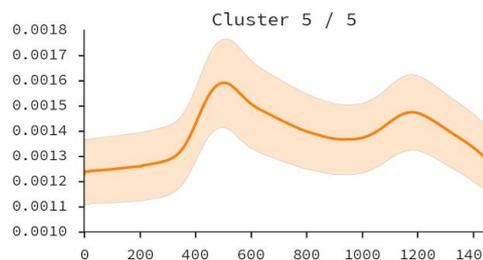
*Residential areas ("Dormitory")*



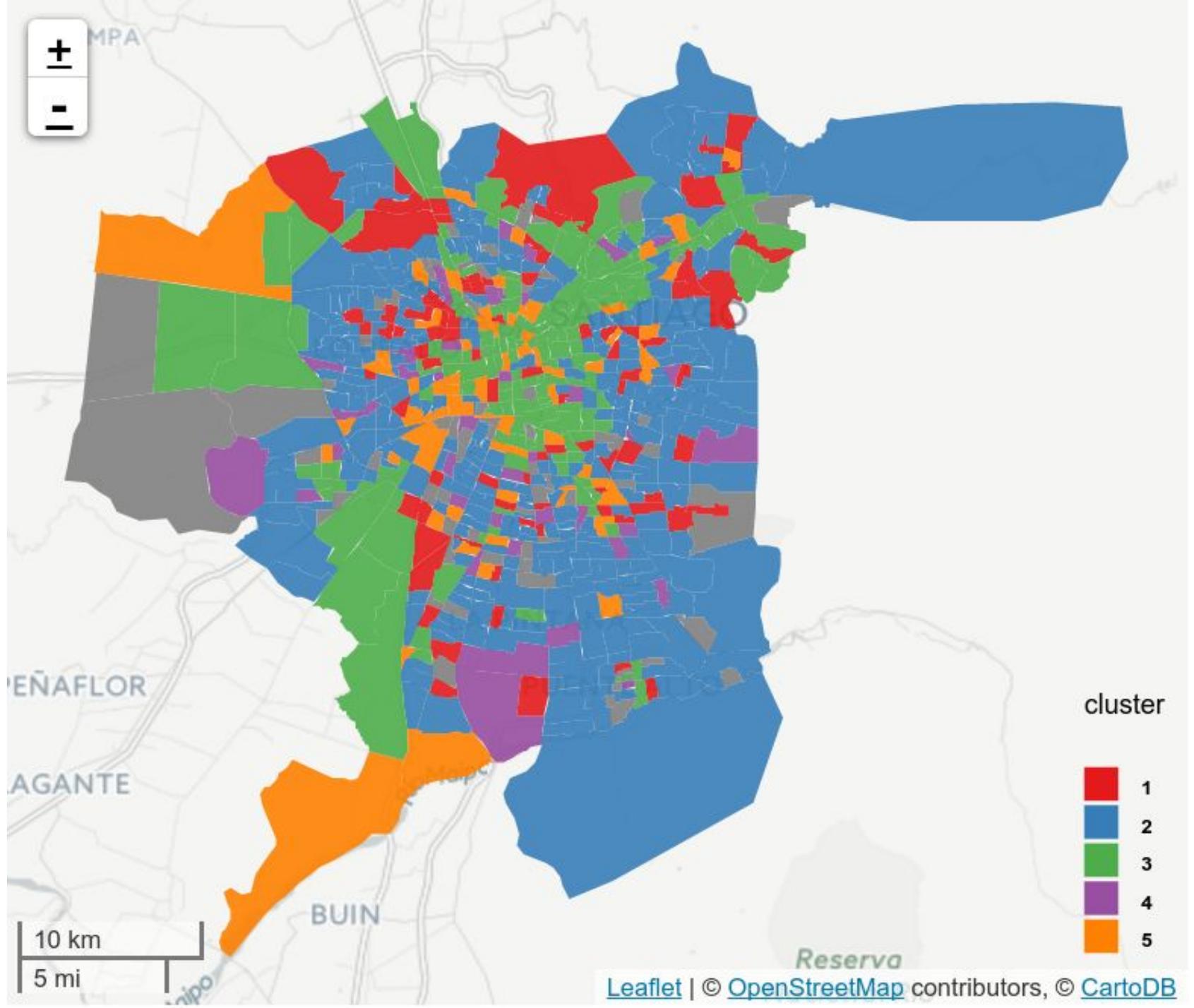
*Business Districts / University Districts*



*Places with activity AFTER working hours*



*Places with activity BEFORE working hours*



# Conclusions

Mobile data allows us to **model urban mobility** at a fraction of the costs of traditional methods...

...and with greater granularity:

- ***Time**: how to compare two+ days?*
- ***Space**: we can analyze mobility and land use at smaller spatial units than municipalities.*

***Next steps**: use this knowledge to move from the **furious city** to the **happy city**.*



*What are the effects on transportation of unexpected phenomena?  
How to improve transport flows on these events?*

# Thank you! Questions?

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<http://carnby.github.io> / <http://datagramas.cl>

@carnby

## *Papers:*

Graells-Garrido, E.; Peredo, O.; García, (2016, July). *Sensing Urban Patterns with Antenna Mappings: The Case of Santiago, Chile*. *Sensors* 2016, 16, 1098. (ISI)

Graells-Garrido, E., Saez-Trumper, D. (2016, May). *A Day of Your Days: Estimating Individual Daily Journeys Using Mobile Data to Understand Urban Flow*. In *Proceedings of the 2nd International Conference on IoT on the Urban Space*. ACM.

## *Acknowledgements: Anonymous Reviewers, Dani Pajarito, and the following photo sources:*

<https://www.flickr.com/photos/nhojleunamme/6922749700>

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