



Seeing the bigger picture: the BigData4ATM project

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Founding Members



The vision of a passenger-centric air transport system



Flightpath 2050: passenger-centric air transport system thoroughly integrated with other transport modes, with the goal of taking travellers from door to door predictably and efficiently

- Admittedly, air transport operations have so far lacked a passenger-oriented perspective, with performance objectives and decision criteria not necessarily taking into account the ultimate consequences for the passenger
- Understanding travel behaviour is an essential enabler for realising the vision of a passenger-centric air transport system. However, research has so far been constrained by the limited availability of mobility data:
 - Typically cross-sectional (static) demographic and economic datasets
 - Small samples
 - Assumptions about the permanence of behavioural traits over time

Opportunities



Mobile phone data



Twitter data



Public transport
smart card data



Google maps API
data



Credit card data



Flightradar24 data



Bluetooth/WiFi sensor
data



Boarding pass data

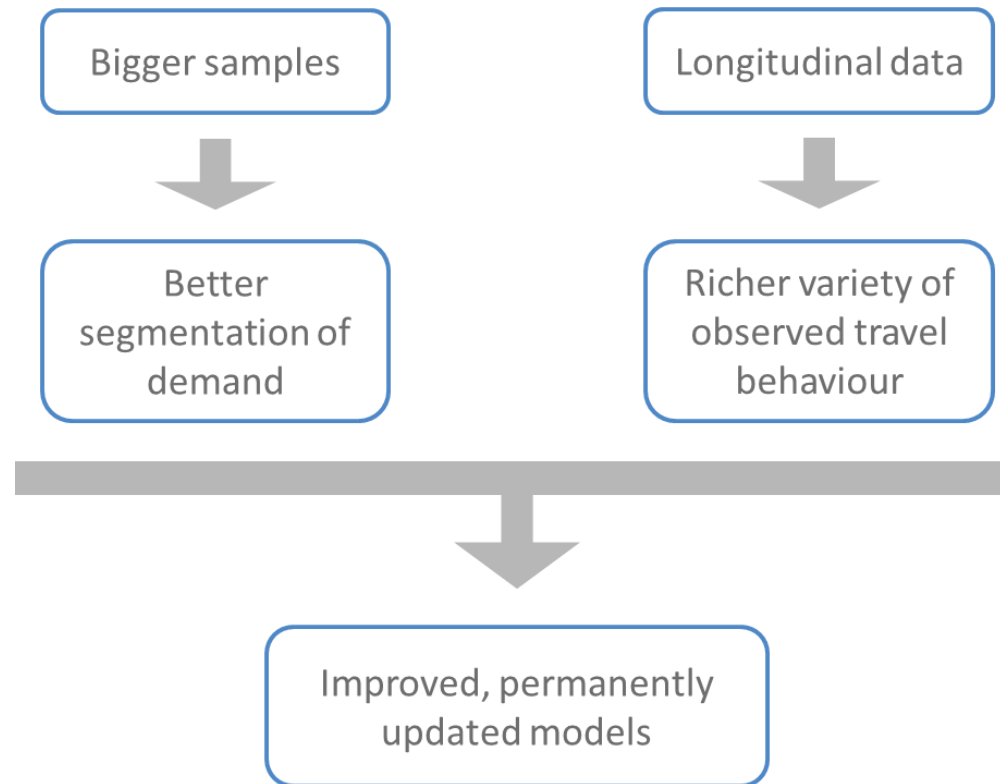
Geolocated data

Passive data collection

“Objective” data

Longitudinal data - permanently updated

New big data sources allow us to produce high-quality travel demand information with high spatial and temporal resolution



So what about aviation?

- New, citizen-centric data sources are beginning to be successfully exploited in other areas of transportation research: what are the opportunities for improving decision-making in air transport?
- How can different passenger-centric geolocated data coming from smart personal devices be analysed and combined with more traditional demographic, economic and air transport databases to extract relevant information about passengers' behaviour and inform decision making processes?

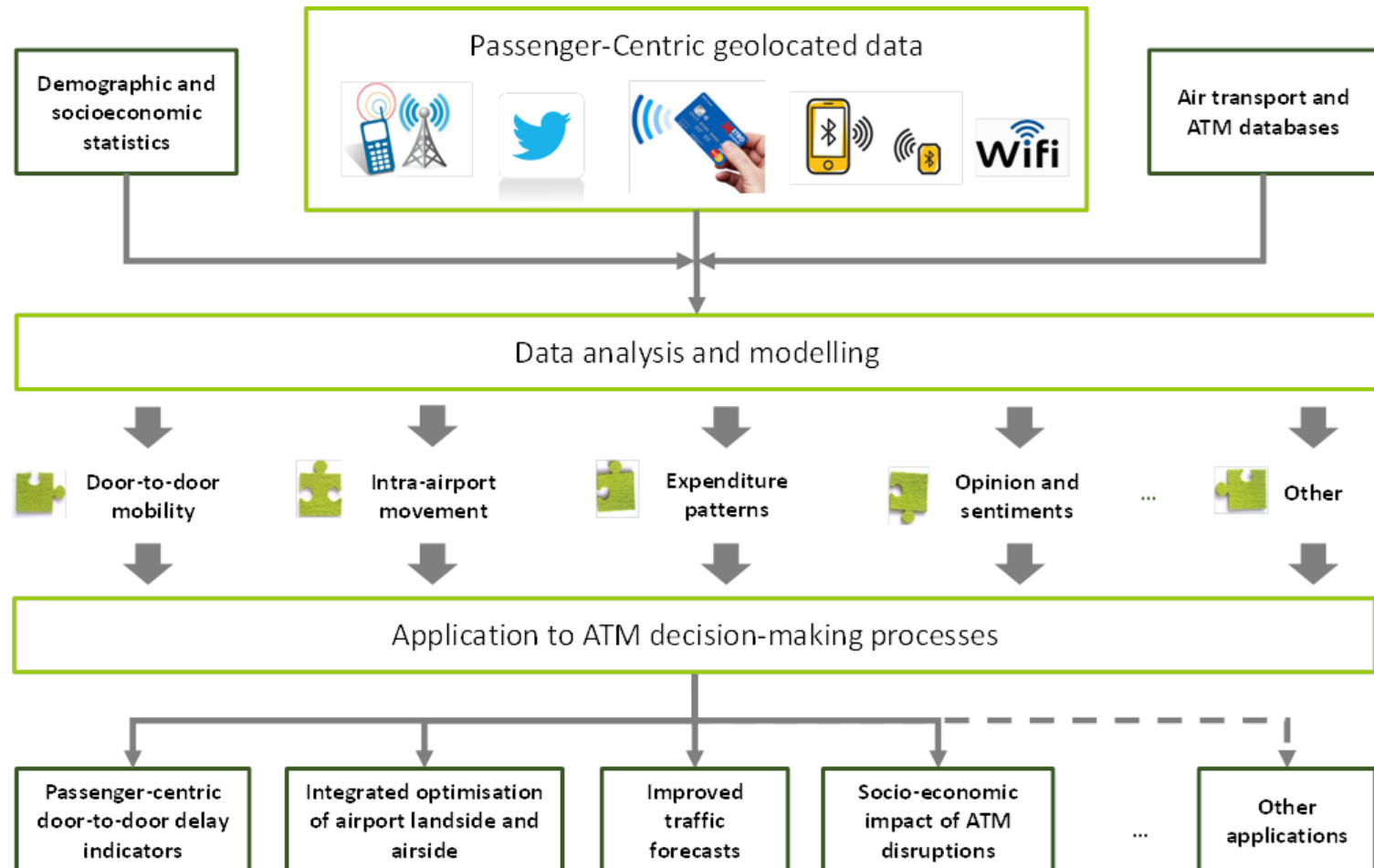
- H2020 - SESAR Exploratory Research - ATM Excellent Science & Outreach
- ER-02-2015: Data Science in ATM
- Start date: 9th May 2016. Duration: 24 months
- www.bigdata4atm.eu

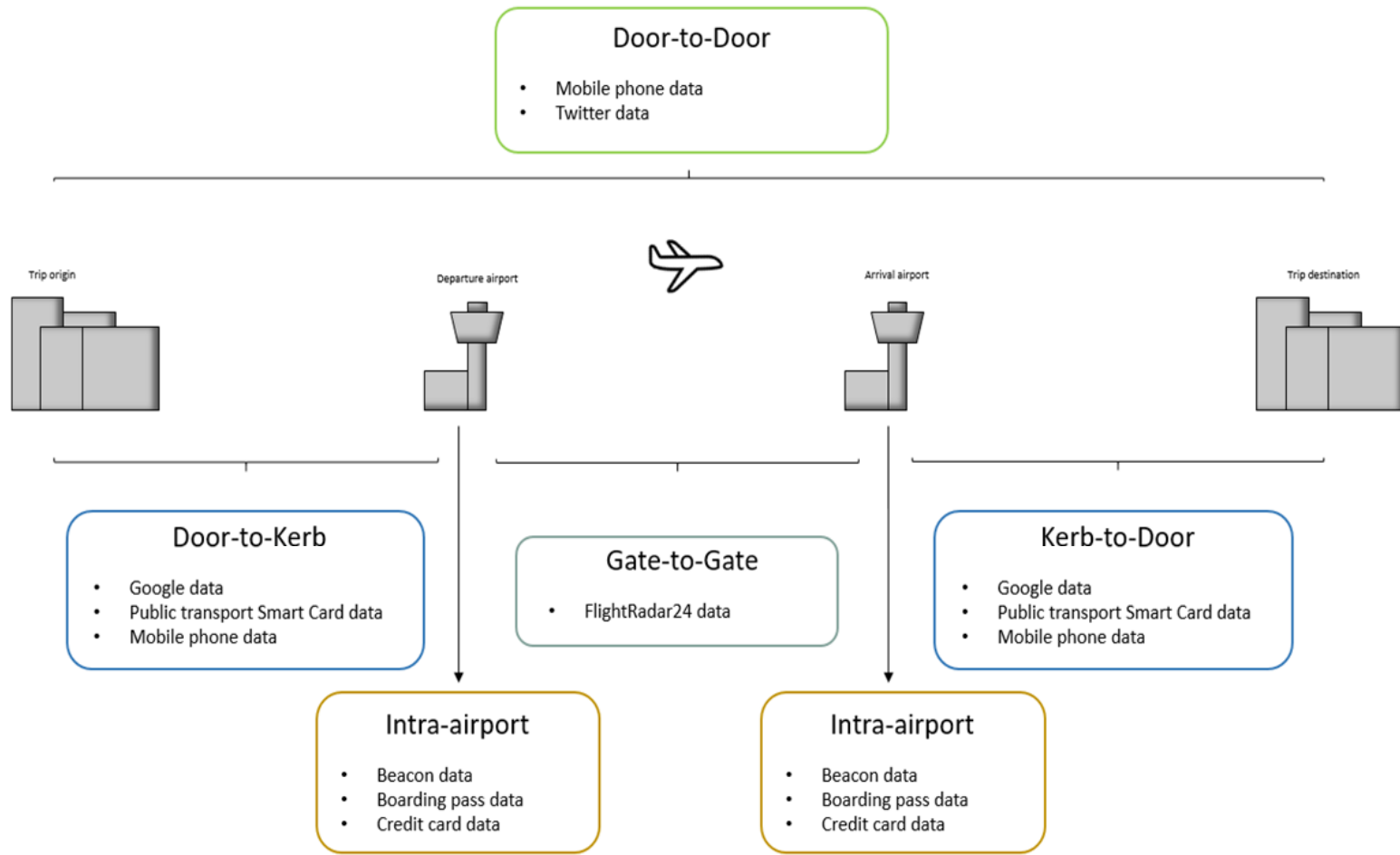
NOMMON



 **Fraunhofer**







Applications

Mobile phone data, Apps, smart card data, etc. used to analyse:

- Airport catchment area
 - Airport accessibility
 - Access/egress modes
- Door-to-door passenger journey
 - Passenger profile information
 - Residence/accommodation at destination
 - Length of the stay at the destination, visited places, etc.
 - Frequency of the trips

Example applications:

- Competition between airports and airport marketing
 - Increase demand within airport catchment area
 - Offer new routes to airlines
- Competition/complementarity with other transport modes
 - Integration with short-distance transport modes: improvement of airport accessibility
 - Competition/complementarity between high-speed train and airplane

Wi-Fi beacons, bank card transactions data and other airport data (boarding pass, airport layout, etc.) used to analyse:

- Kerb-to-gate activity
 - Mobility patterns
 - Expenditure patterns

Example applications:

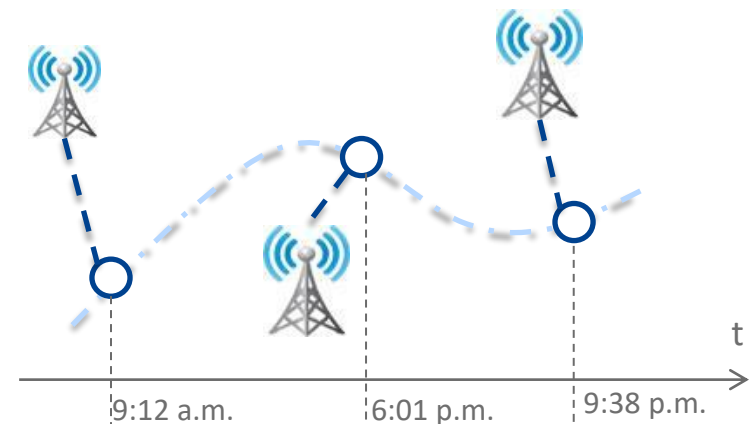
- Improved passenger experience and optimisation of airport resources
 - Identification and prediction of bottlenecks
 - Real-time information about airport services
- Non-aeronautical revenue optimisation
 - Identification of 'customer journeys' to optimise commercial layout
 - More effective advertising

A snapshot of results: the example of mobile phone records

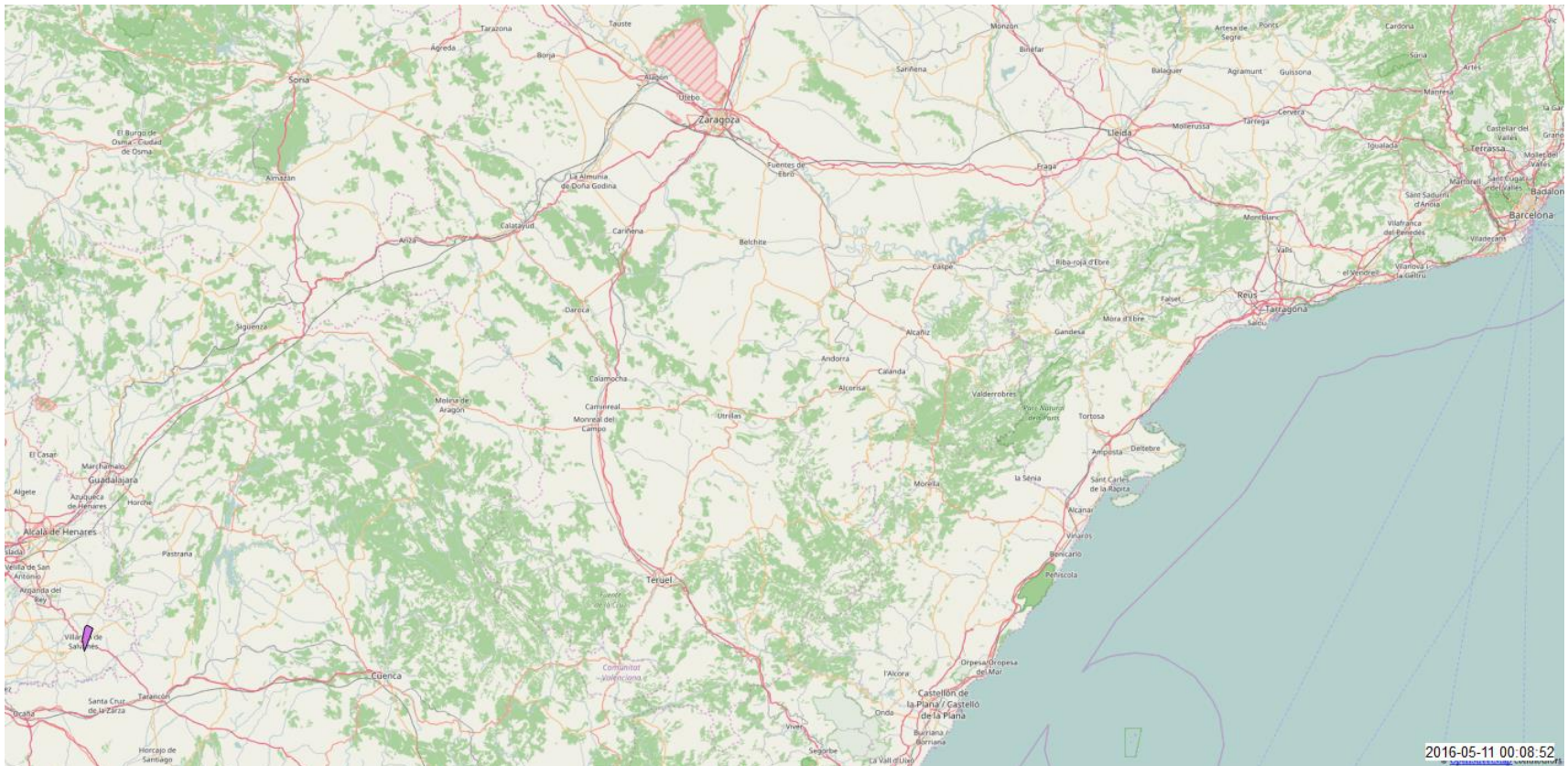
The data

Anonymised call detail records (CDRs) provided by Orange Spain

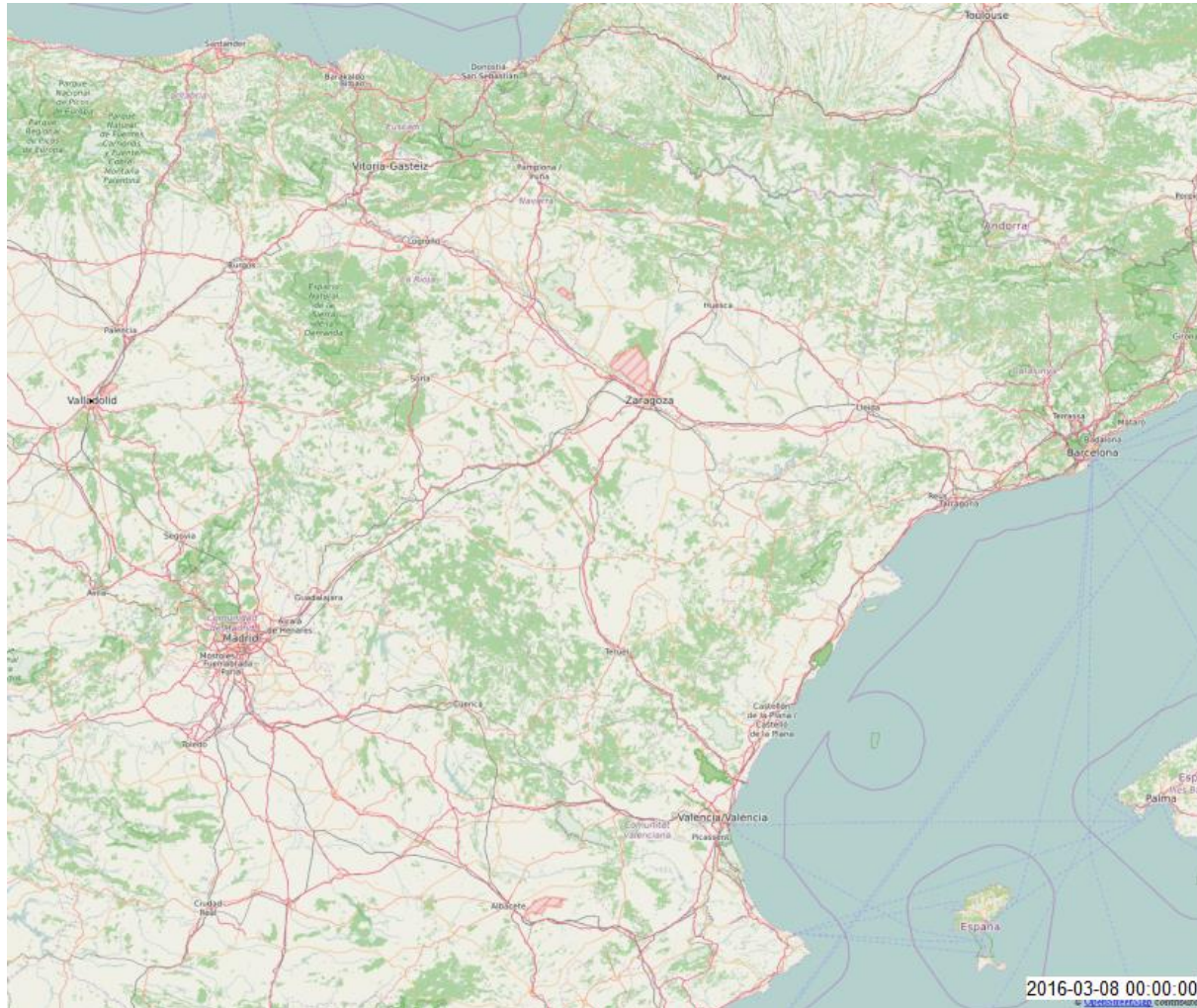
- Spatio-temporal data: time and cell tower to which the user is connected every time an event occurs
- Orange's clients + roamers that connect to Orange's network
- Sample of around 27% of the total population



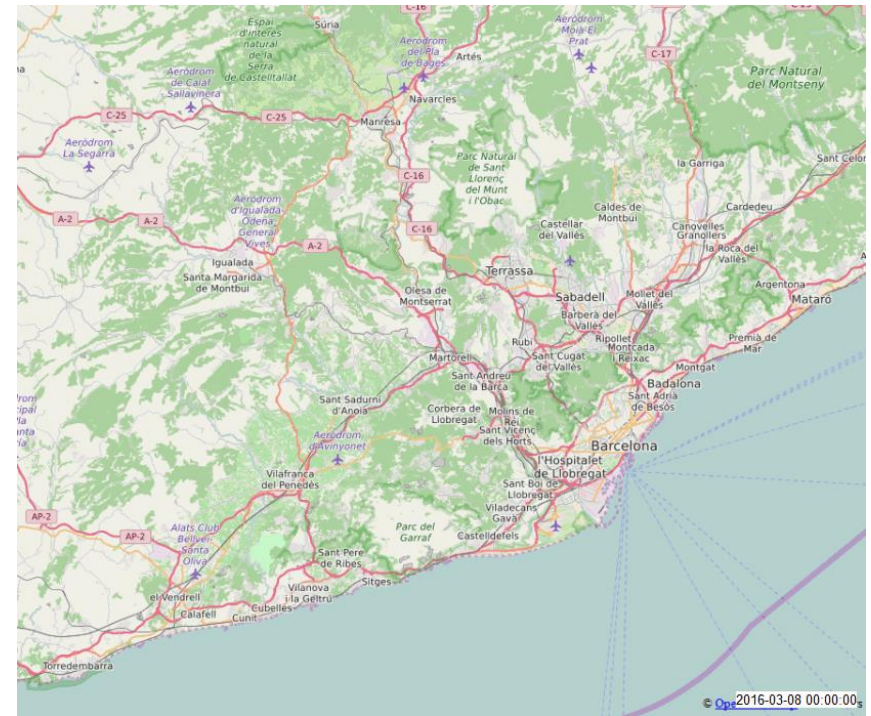
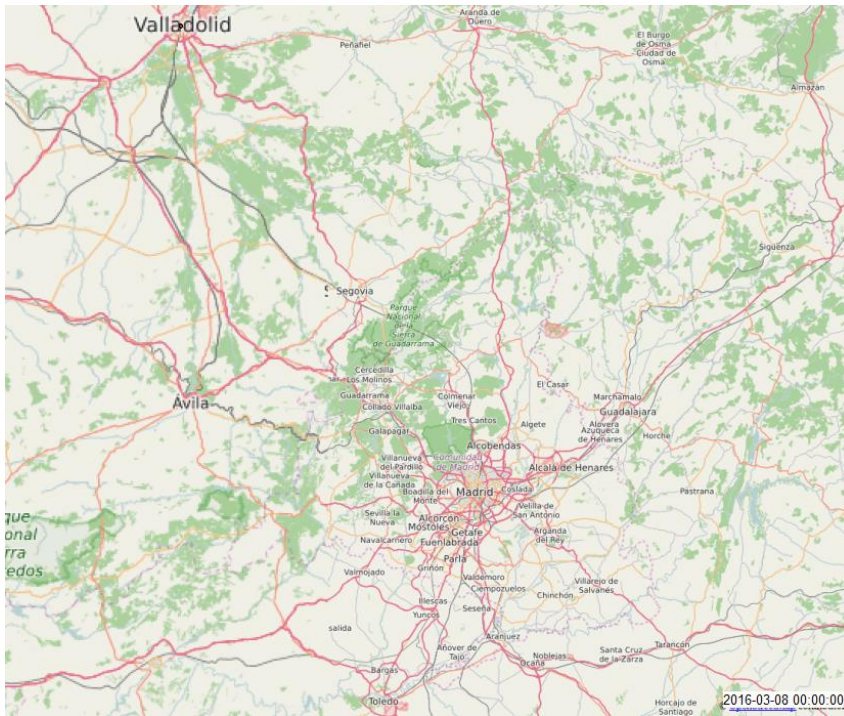
What we see



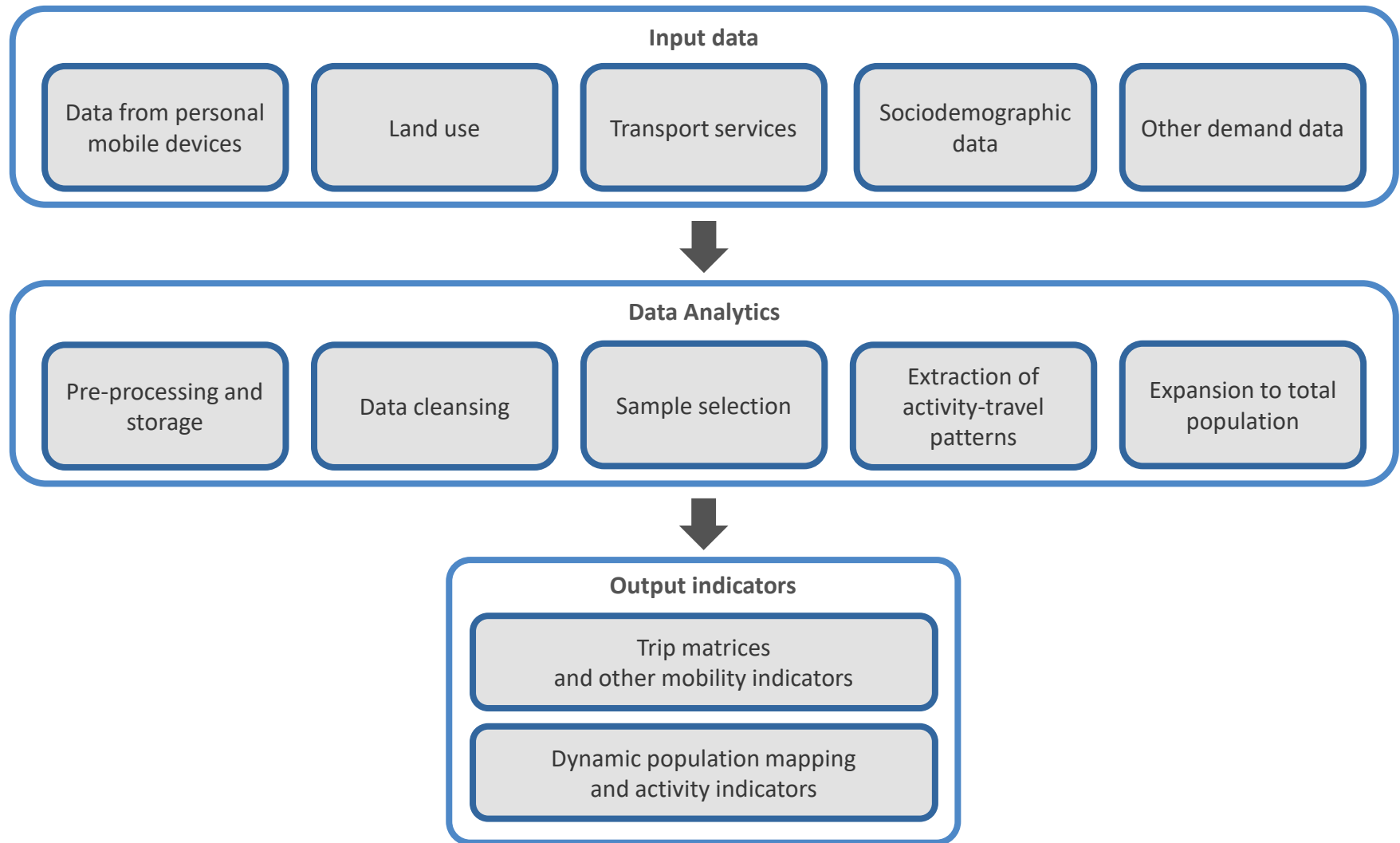
What we see



What we see



So how does it work?

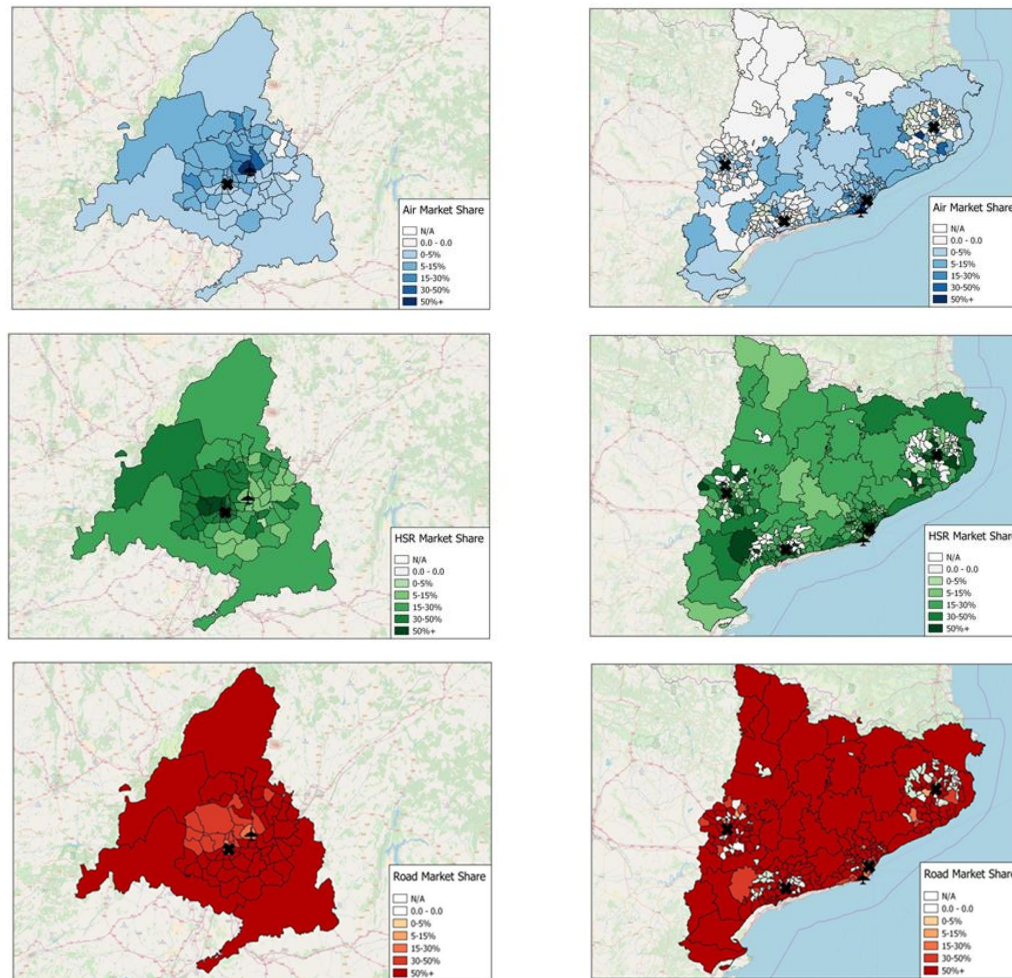


So how does it work?



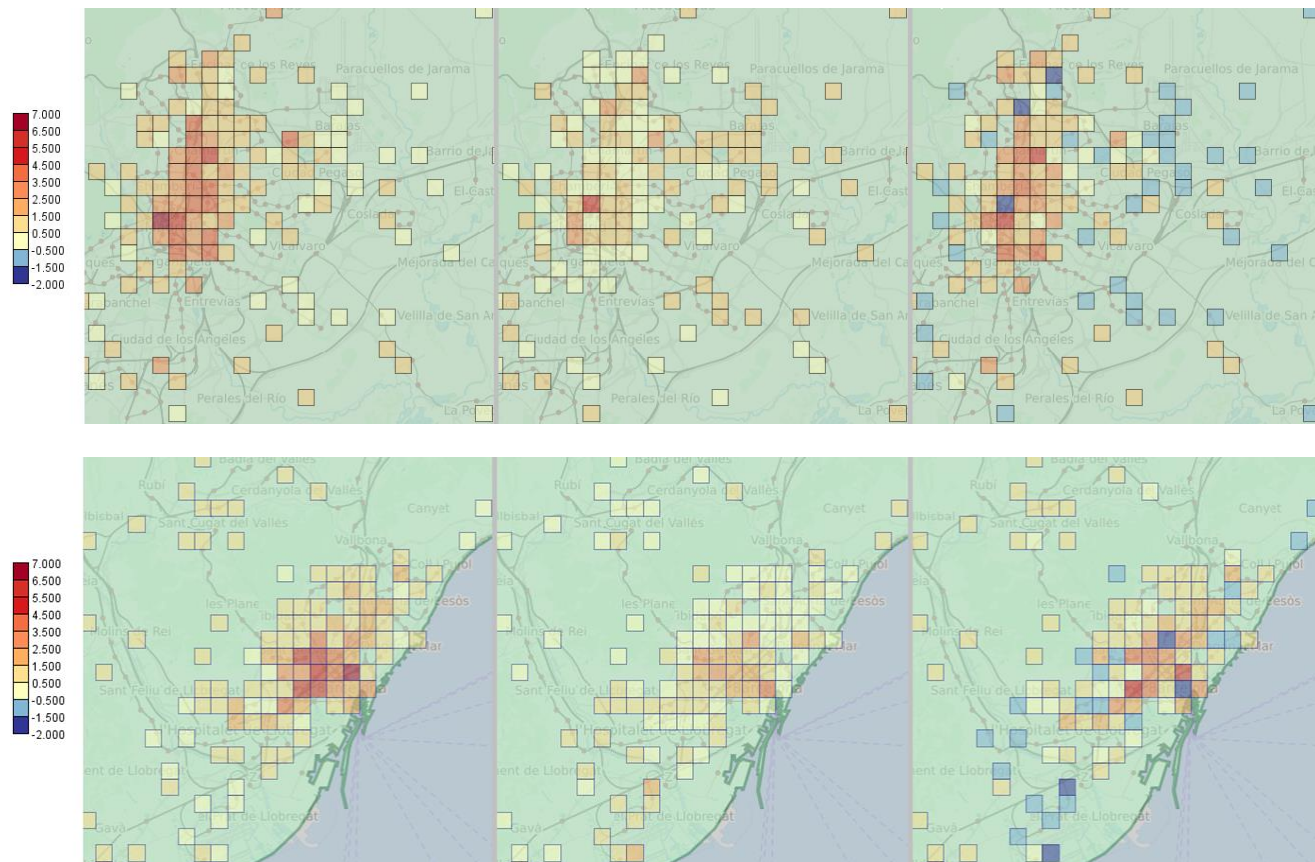
1. Sample construction
2. Identification of users' home
3. Generation of activity-travel diaries: activities, trips, trip legs
4. Adjustment of travel times
5. Expansion of the sample to the total population
6. Identification of target passengers
7. Extraction of indicators

Modal share



Modal share for trips between Madrid and Catalonia

Catchment areas

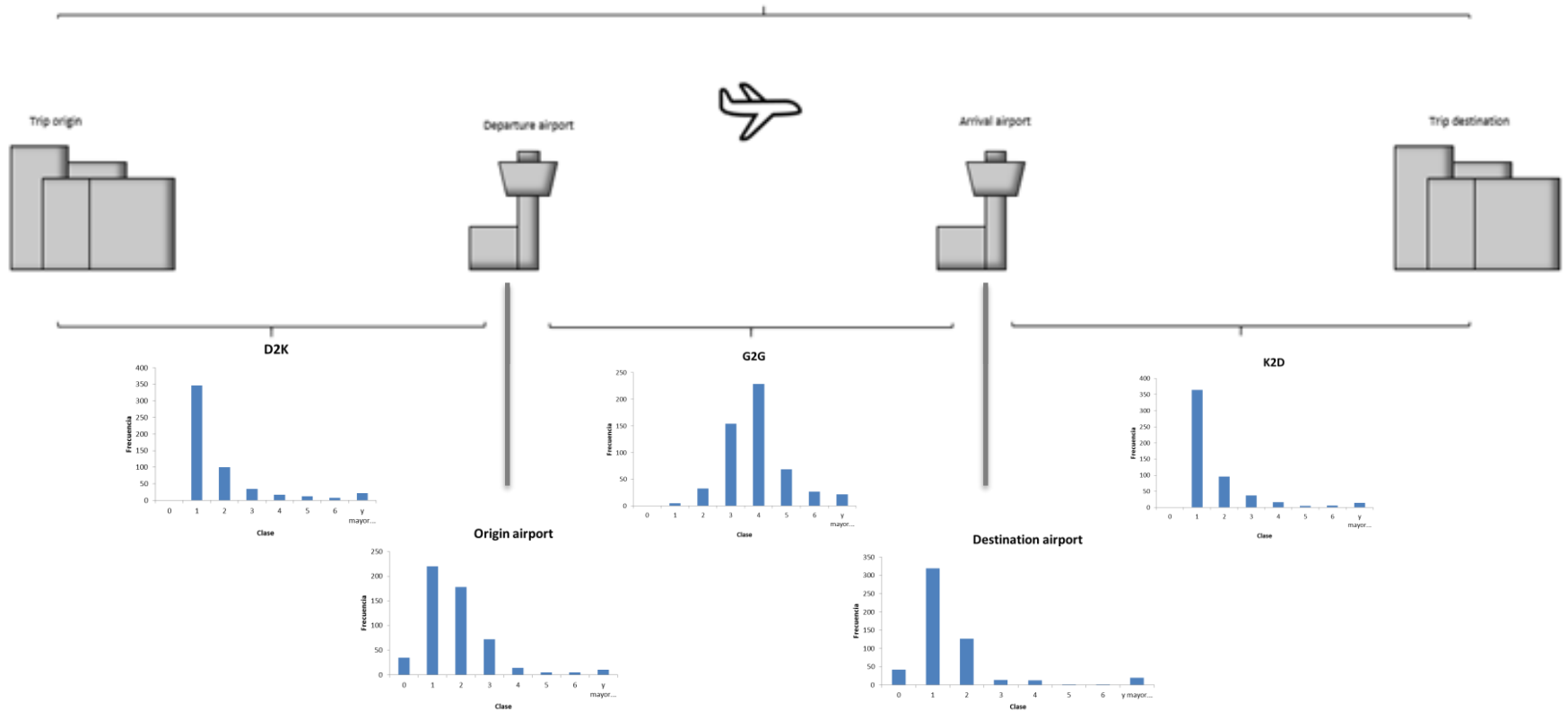


No Train trips

No Air trips

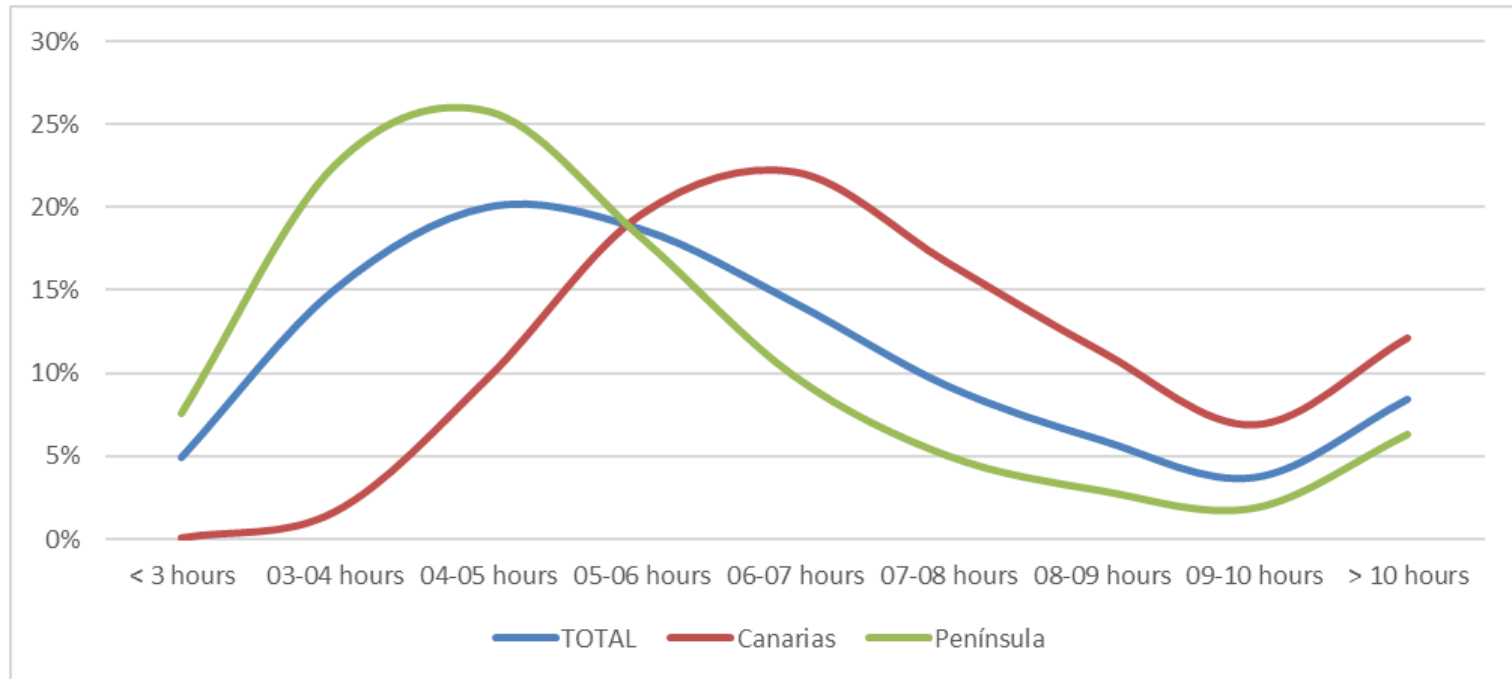
[No Train trips - No Air trips]

Door-to-door travel times



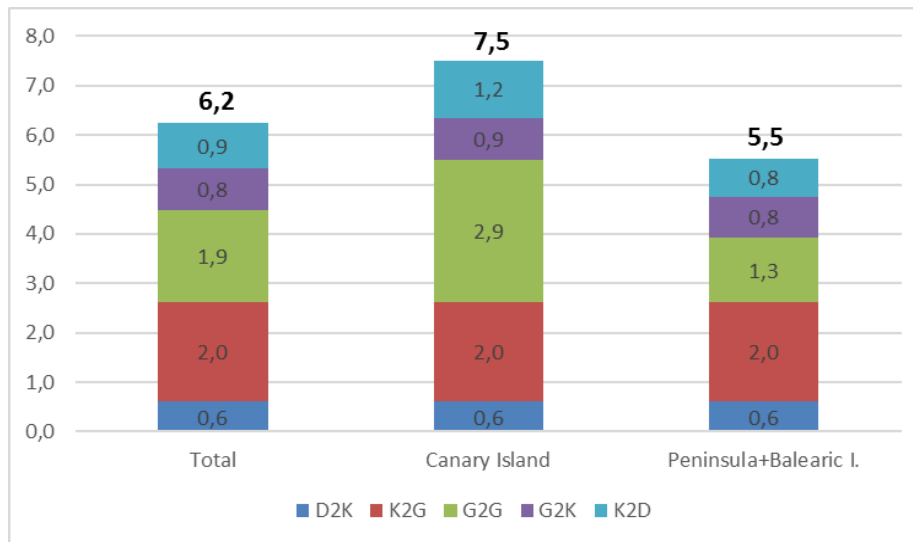
Trips from the Canary Islands to peninsular Spain

Door-to-door travel times



Trips arriving in Madrid from the rest of Spain: D2D travel time

Door-to-door travel times



- ☐ Half an hour to arrive to the airport
- ☐ 2 hours at departing airport
- ☐ Less than 1 hour at destination airport
- ☐ Almost 1 hour to reach final destination

Trips arriving in Madrid from the rest of Spain

Door-to-door travel times

AIRPORT	K2G TIME
JEREZ	1,5
FEDERICO GARCIA LORCA/GRANADA-JAEN	1,5
ASTURIAS	1,6
ALMERIA	1,7
VIGO	1,7
BARCELONA/EL PRAT	1,7
GRAN CANARIA	1,8
SANTIAGO	1,8
IBIZA	1,9
SAN SEBASTIAN	1,9
LA PALMA	2,0
LANZAROTE	2,1
TENERIFE NORTE	2,1
PALMA DE MALLORCA	2,1
VALENCIA/MANISES	2,2
TENERIFE SUR/REINA SOFIA	2,2
ALICANTE-ELCHE	2,3
A CORUNA	2,3
SEVILLA	2,4
FUERTEVENTURA	2,4
MALAGA/COSTA DEL SOL	2,4
MENORCA	2,4
BILBAO	2,5
SANTANDER SEVE BALLESTEROS	2,8

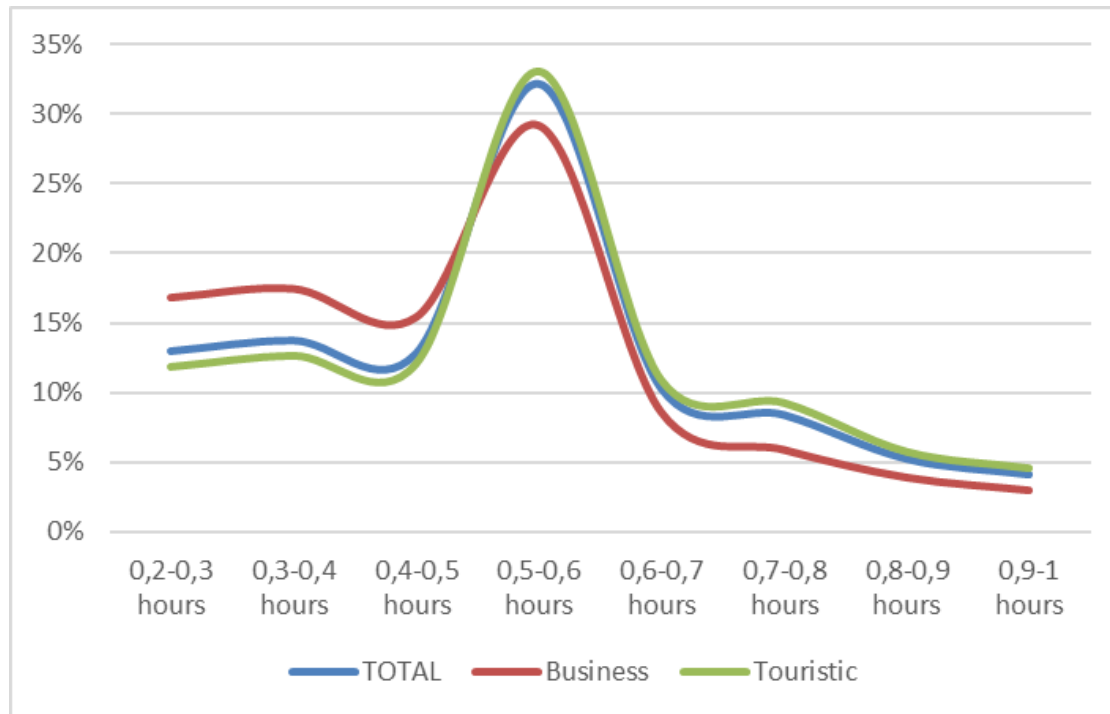
Trips arriving in Madrid from the rest of Spain:
time at origin airport

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Trips arriving in Madrid from the rest of Spain:
time at origin airport

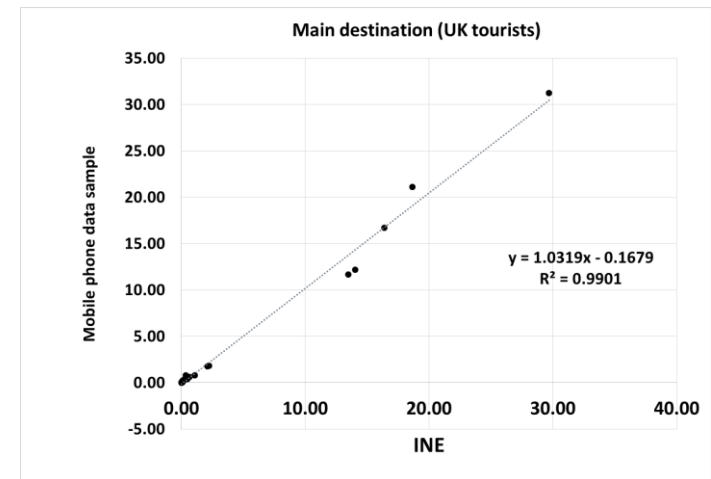
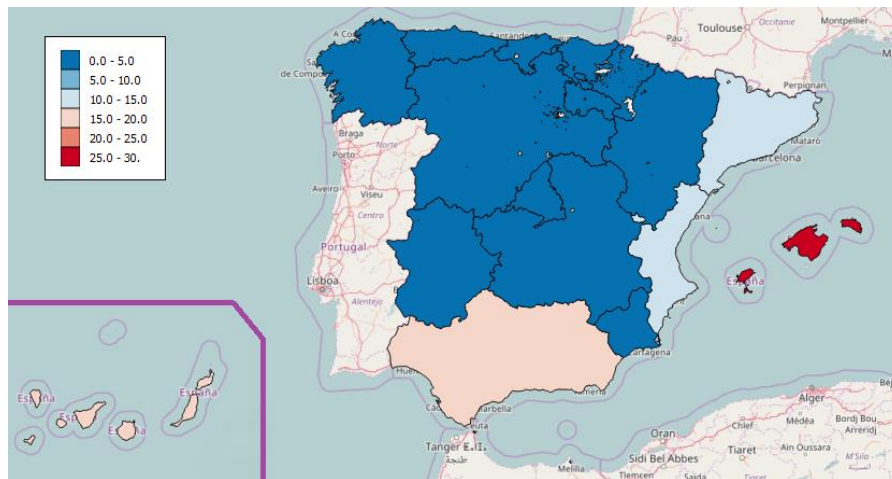
Door-to-door travel times



Trips arriving in Madrid from the rest of Spain:
time at destination airport

Passenger behaviour at destination

Main destination of British tourists in Spain



Passenger behaviour at destination



Locals



Spanish tourists



Foreign tourists

To conclude

The promise of Big Data



Data streams generated by smart personal devices offer a great potential for analysing passenger behaviour with an unprecedented level of detail

But...

These data also come with a number of challenges:

- Noise and errors
- Biases
- Less explanatory power: behavioural information not always directly observable, it has to be inferred from the data
- Limited sociodemographic information
- Computational challenges
- Additional regulatory, organisational and business challenges (privacy, algorithmic transparency, business models...)

Some final considerations



No single data source provides the full picture: need for data fusion

Blend airport-specific data with external data to realise full potential

Algorithms matter: devil's in the details

Rigorous validation is essential

Need for more applied research at the intersection of data science and transportation modelling, in close collaboration with airports



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Thank you very much
for your attention!



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Founding Members



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