

# Disparities in travel times between car and transit: Spatiotemporal patterns in cities

Yuan Liao<sup>1,\*</sup>, Jorge Gil<sup>2</sup>, Rafael H. M. Pereira<sup>3</sup>, Sonia Yeh<sup>1</sup>, and Vilhelm Verendel<sup>4</sup>

## Introduction

### Background

- A mode shift from car to transit
- Important travel time (TT) in the mode choice

### Research gap

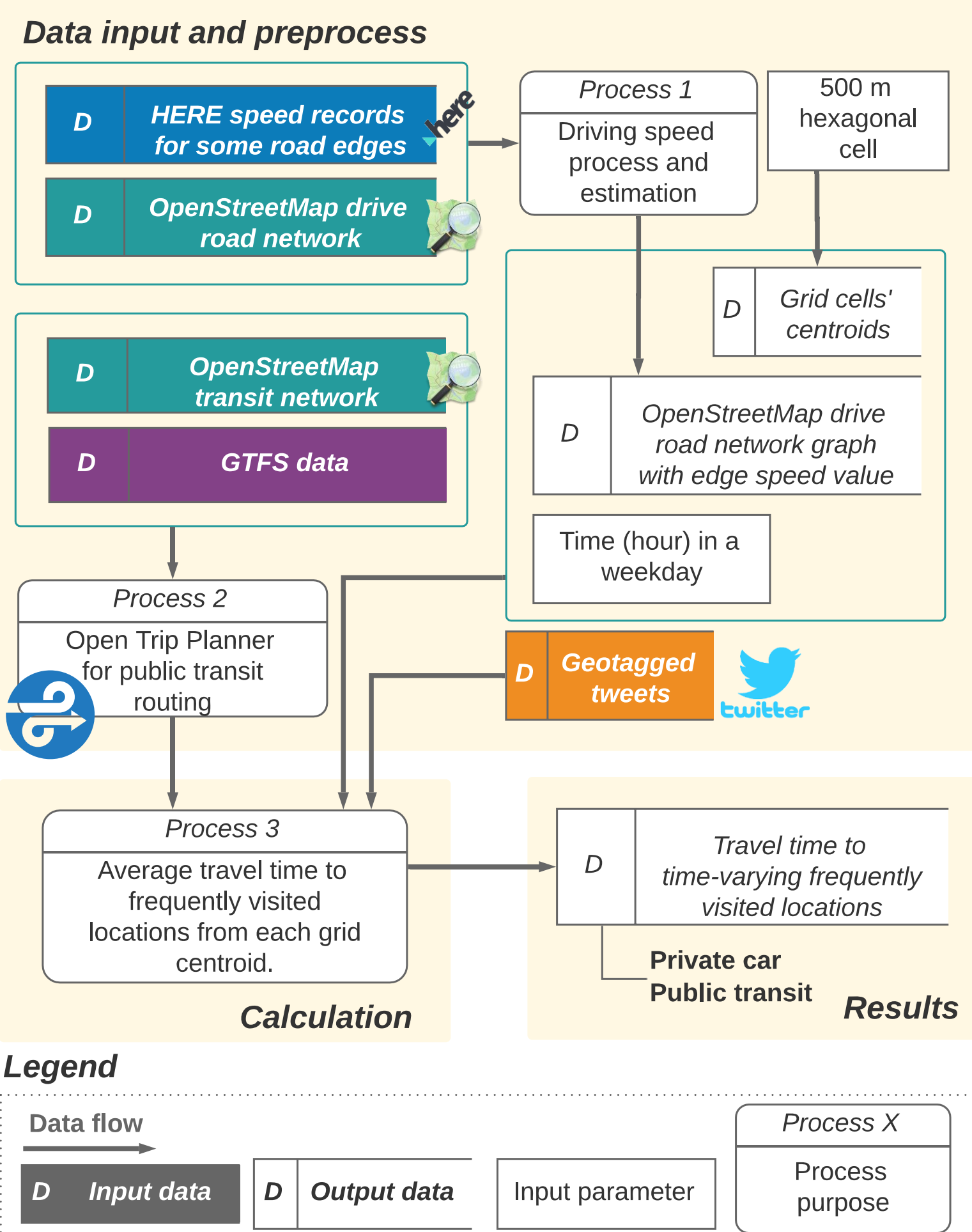
Robust methods and data for comparing travel times between cars and PT are much needed

### This study

Spatiotemporal patterns of how car and transit travel times vary in four different cities with —

- Finer characterization
- Use of real-world data
- Incorporation of real demand patterns
- Cross-regional insights

## Methods



## Results

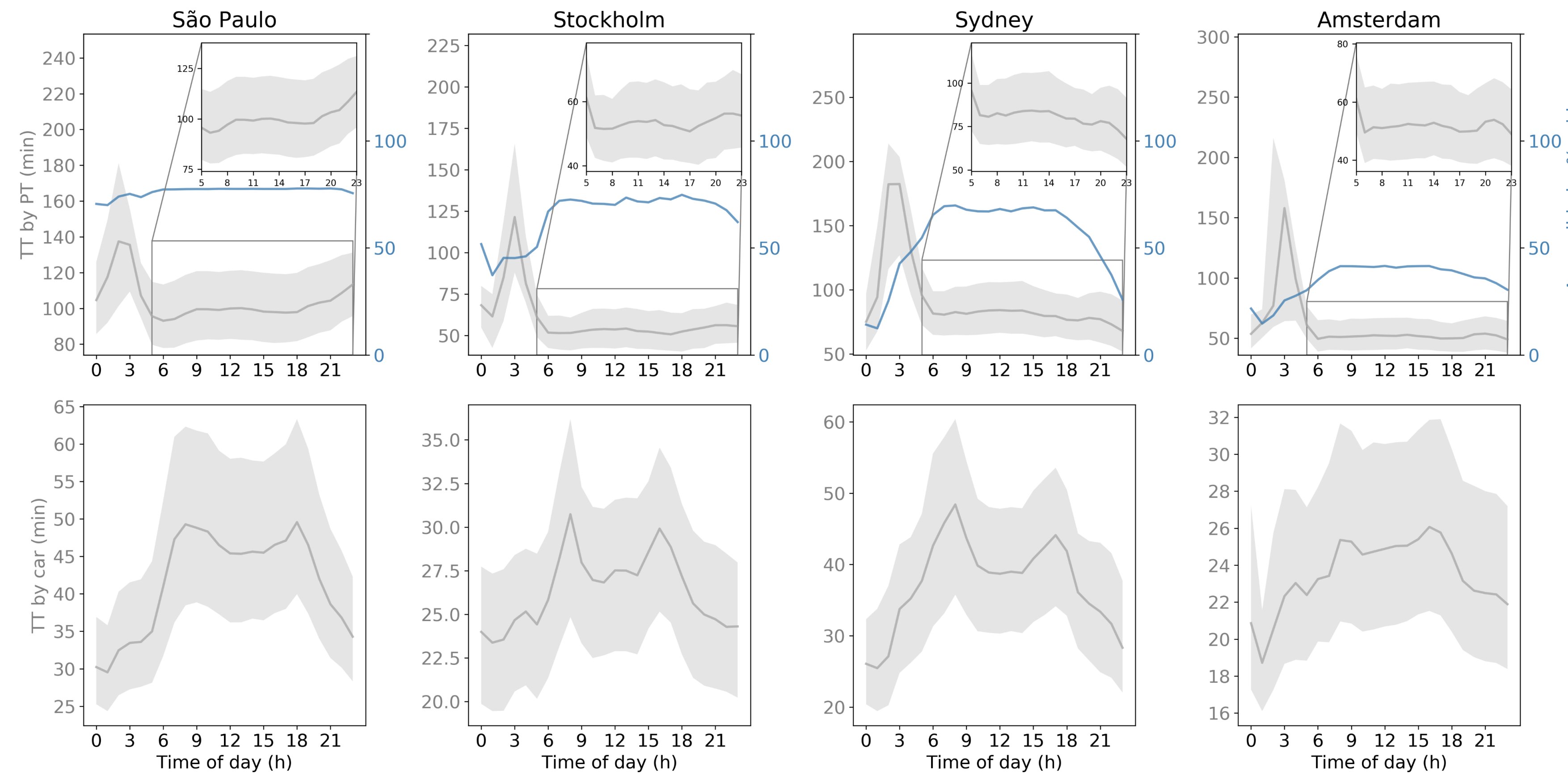


Figure 1 Temporal variations of TT by PT and by car over the course of an average weekday.

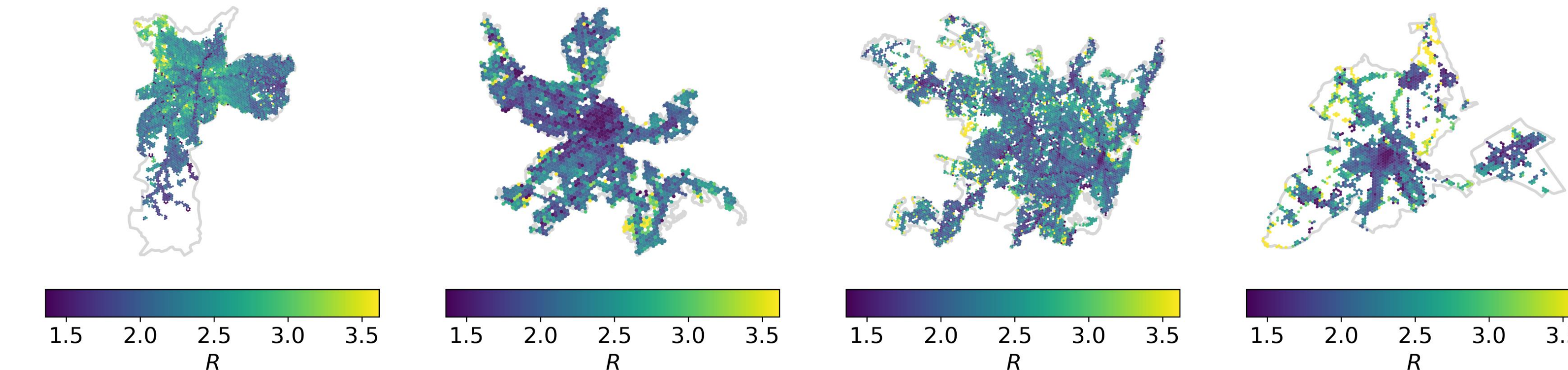


Figure 2 Spatial variation of travel time ratio  $R$  to frequently visited locations.

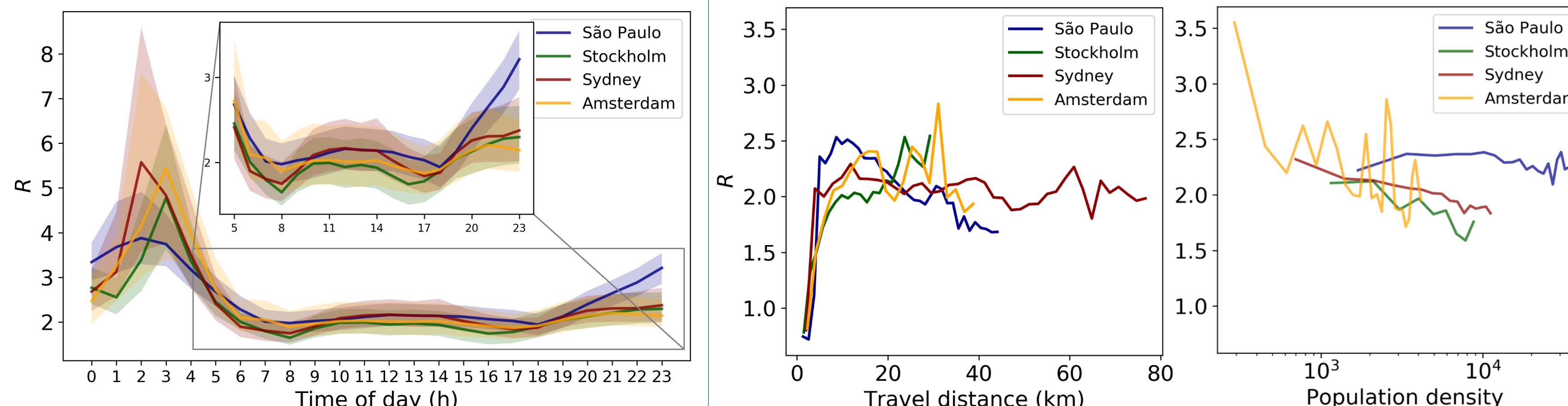


Figure 3 Temporal variation of citywide average  $R$ .

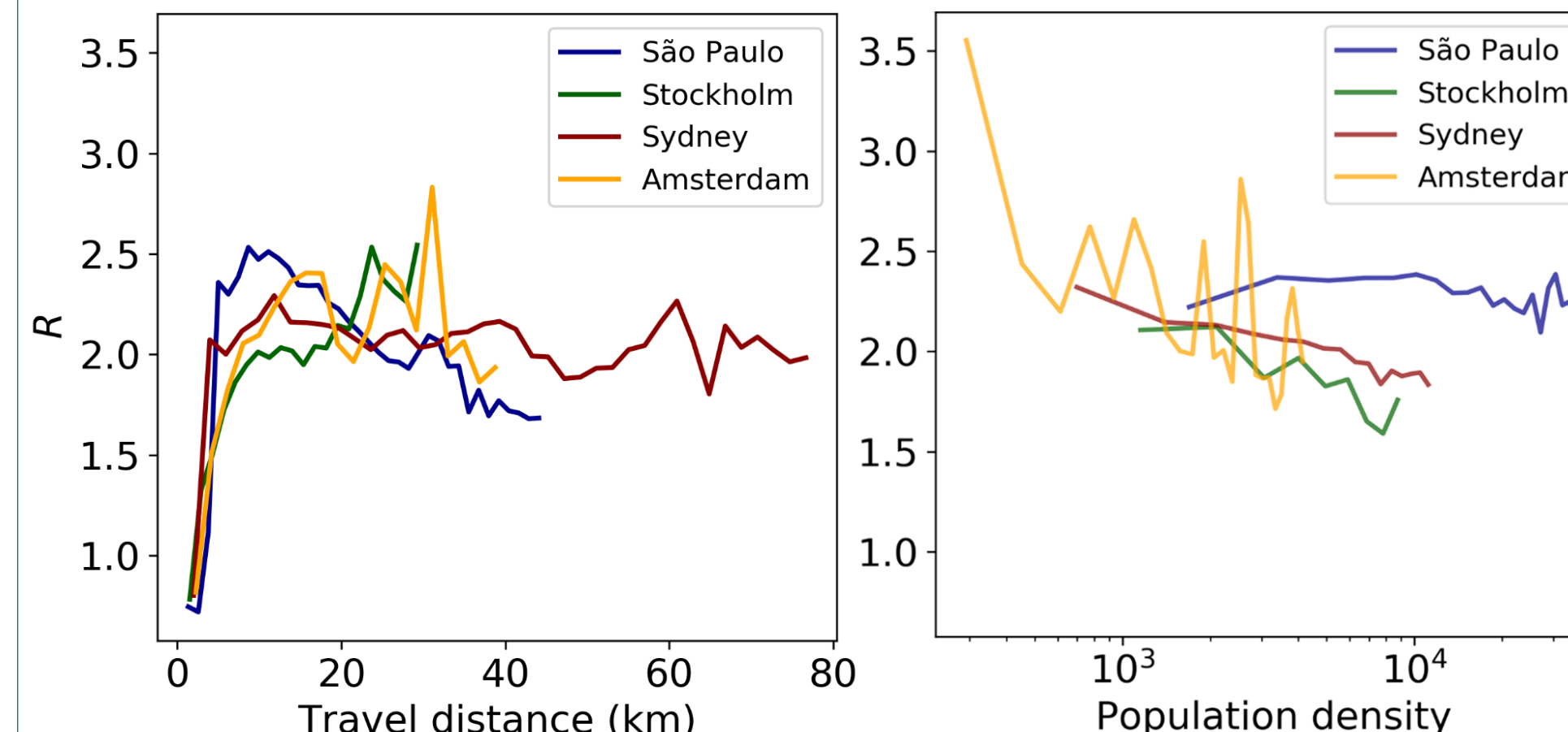


Figure 4  $R$  as a function of travel distance and population density.

City	Area (km <sup>2</sup> )	Population	GDP (\$/capita)	Mode share (%)				R	R <sup>a</sup>
				D	PT	W	B		
São Paulo	1,500	12,000,000	9,800	28	31	31	1	2.3	1.4
Stockholm	400	1,400,000	53,000	32	47	14	7	2.1	2.5
Sydney	2,000	4,300,000	50,000	59	25	4	3	2.2	2.3
Amsterdam	880	1,500,000	46,000	20	17	29	32	2.2	2.1

Table 1 City statistics, mode share, and travel time ratio  $R$  at the city level. D = Driving, PT = Public transit, W = Walking, B = Biking. <sup>a</sup> Average value weighted by population density in each grid cell.

## Main findings

- A computational framework incorporating new and large real-world data sets demonstrates its usefulness.
- The revealed travel time disparities between public transport and cars are presented at a high spatial and temporal granularity enabling detailed and local-level explorations.
- Using PT takes on average 1.4-2.5 times longer than driving a car.
- The disparity tends to be much smaller near city centres and in the surroundings of PT lines.
- PT can outperform car use on average for short-distance travel (< 3 km) and during peak rush hour in Stockholm and Amsterdam.
- $R < 1$  for travel distances less than 3 km, then increases rapidly but quickly stabilises at around 2.

Communities and authorities need to be better informed of the detailed spatial and temporal patterns of disparities in travel times between the two modes, as a better understanding of this spatiotemporal variation is crucial to more accurate predictions of residents' mode choices and identify potential areas for improvements in future studies.