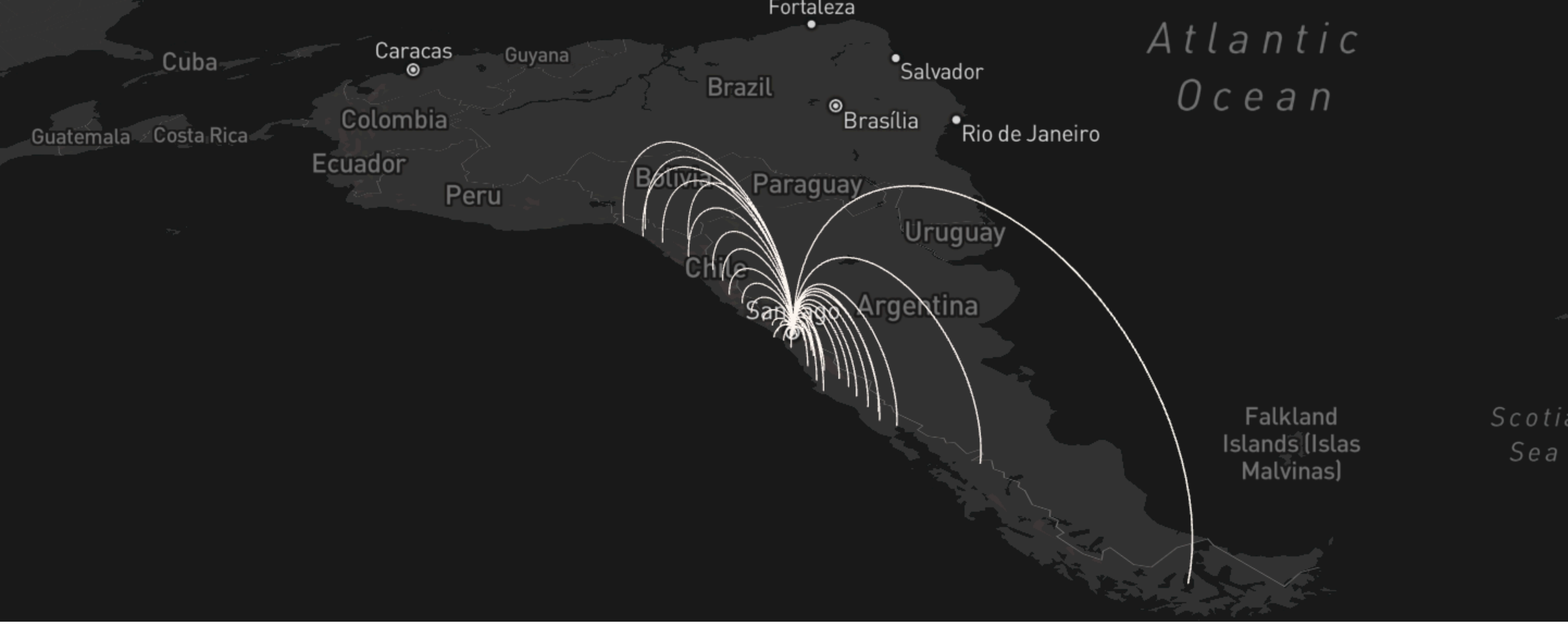


RECAST: Training Workshop

UNIVERSITY OF LIVERPOOL

Naciones Unidas CEPAL 75 años Trabajando por un futuro productivo, inclusivo y sostenible

UKRI Research England

Geographic Data Science Lab

Overview:
Digital Footprint Data

Structure

1. Introduction to human mobility & digital footprint data

2. Opportunities of digital footprint data

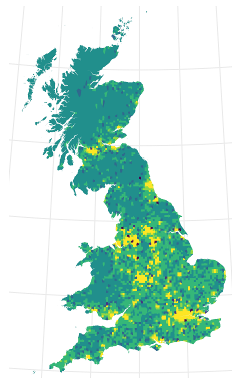
3. Challenges of digital footprint data

Human Mobility

Causes	Geographical scale	Impacts

Local urban mobility

Internal migration

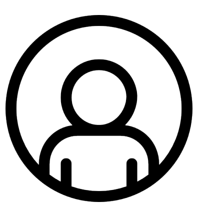


International migration

Causes

Place inequalities

Population inequalities



Individual inequalities

Impacts

Place inequalities

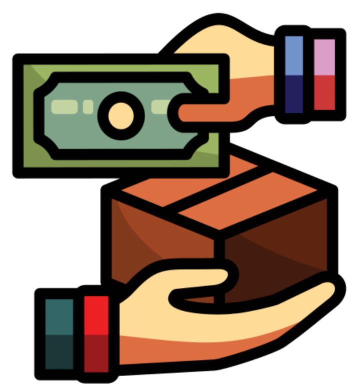
Population inequalities

Individual inequalities

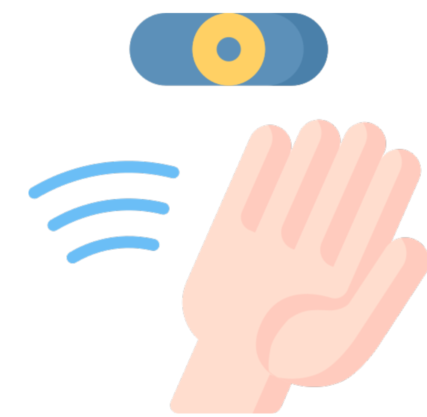
Digital Footprint Data?

Internet

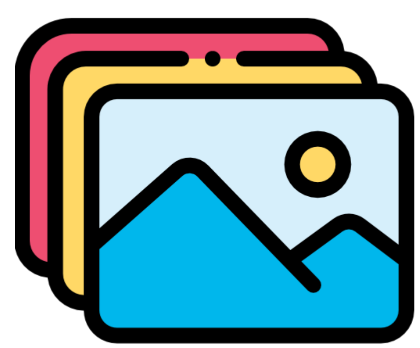
Social media



Commercial & transactional



Sensor



Imagery

Data for Mobility

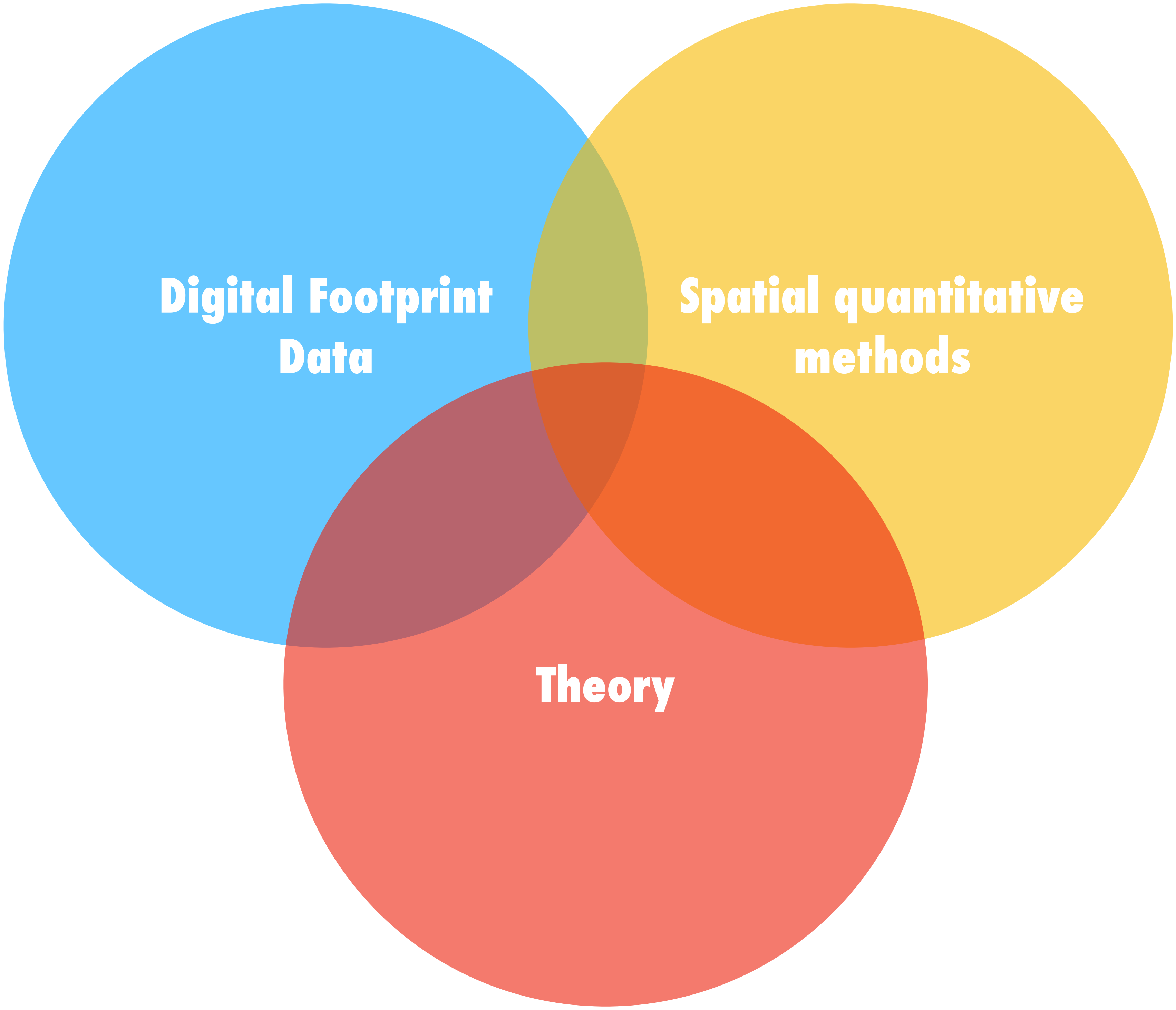
CDR/XDR
~100m-1km
~30min

GPS
~5-20m
~10-25min

Bluetooth
~1-10m

Smart card
location

Warning **Not** collected for research purposes



“Although ‘big data’ and, more recently, ‘big code’ may have captured the limelight, theory is invaluable and should not be disregarded” (Franklin 2023: 178)

Opportunities

High resolution

Geographical and temporal granularity

Contents lists available at ScienceDirect

Transportation Research Part C

journal homepage: www.elsevier.com/locate/trc

To travel or not to travel: 'Weather' is the question. Modelling the effect of local weather conditions on bus ridership

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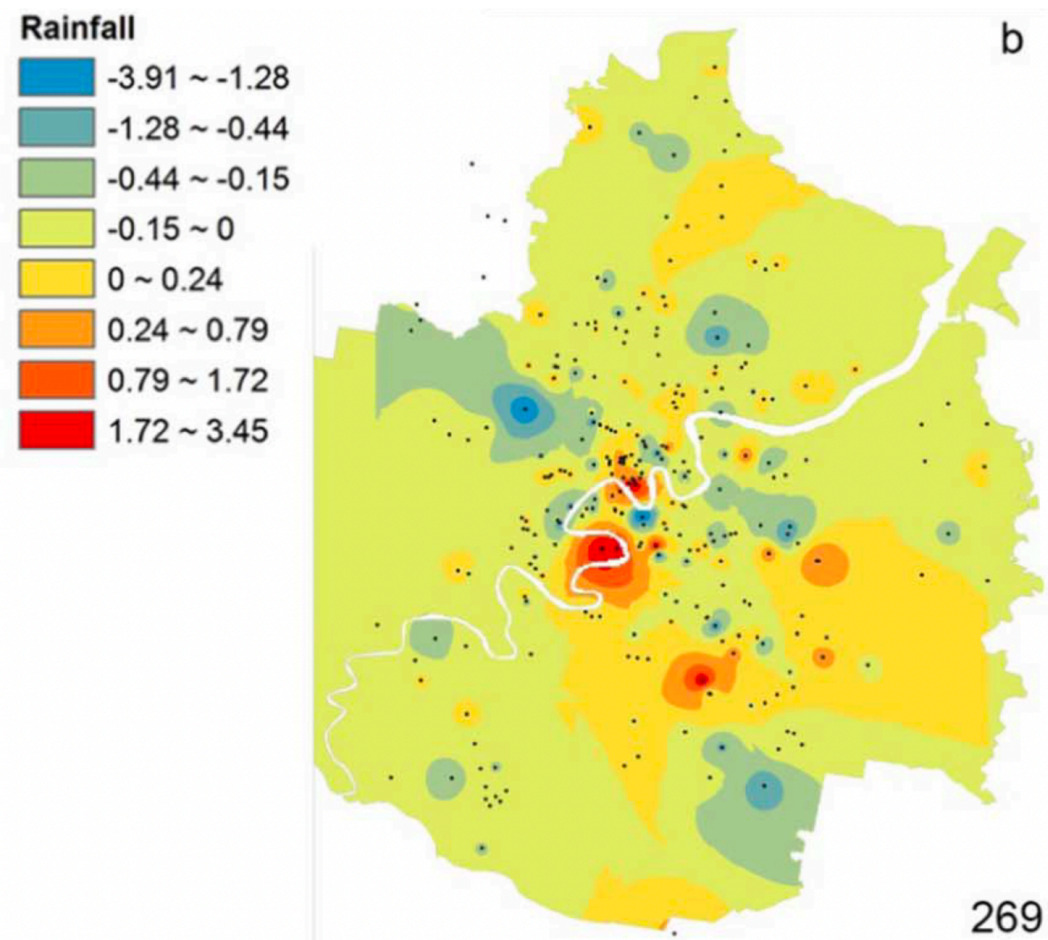
[b] School of Earth and Environmental Sciences, The University of Queensland, 4072, Australia
[c] Department of Geography and Planning, School of Environmental Sciences, University of Liverpool, Liverpool L69 7ZT, UK
[d] School of Civil Engineering, The University Queensland, 4072, Australia

ARTICLE INFO

Keywords:
Public transport
Weather
Time-series modelling
Travel behaviour

ABSTRACT

While the influence of weather on public transport performance and ridership has been the topic for some research, the real-time response of transit usage to variations in weather conditions is yet to be fully understood. This paper redresses this gap by modelling the effect that local weather conditions exert on hourly bus ridership in sub-tropical Brisbane, Australia. Drawing on a transit smart card data set and detailed weather measurements, a suite of time-series regression models are computed to capture the concurrent and lagged effects that weather conditions exert on bus ridership. Our findings highlight that changes in particularly temperature and rainfall were found to induce significant hour-to-hour changes in bus ridership, with such effects varying markedly across both a 24 h period and the transit network. These results are important for public transport service operations in their capacity to inform timely responses to real-time changes in passengers' travel demand induced by the onset of particular weather conditions.



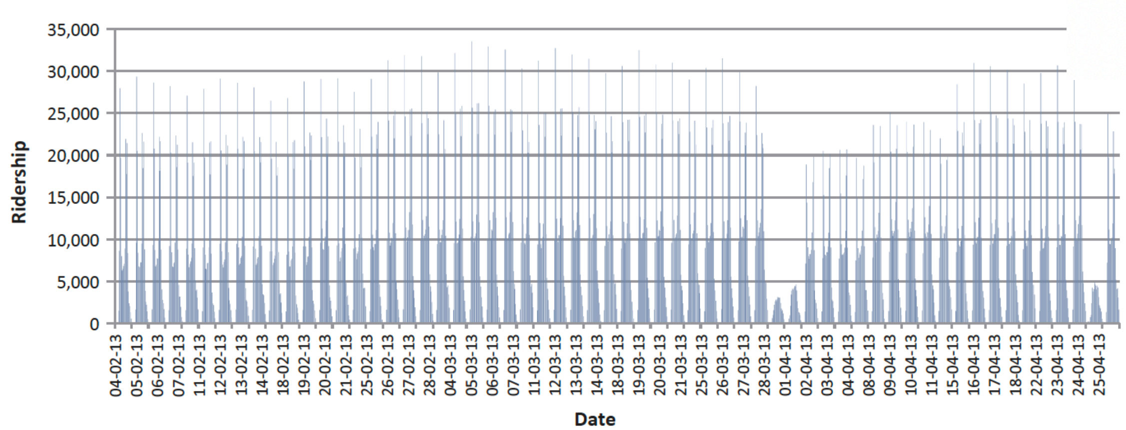


Fig. 6. Weekday hourly ridership.

Greater geographical coverage

Assessing stay-at-home at a global scale

Contents lists available at ScienceDirect

Cities

journal homepage: www.elsevier.com/locate/cities

Sensing global changes in local patterns of energy consumption in cities during the early stages of the COVID-19 pandemic

Francisco Rowe[a,*], Caitlin Robinson[b], Nikos Patias[a]

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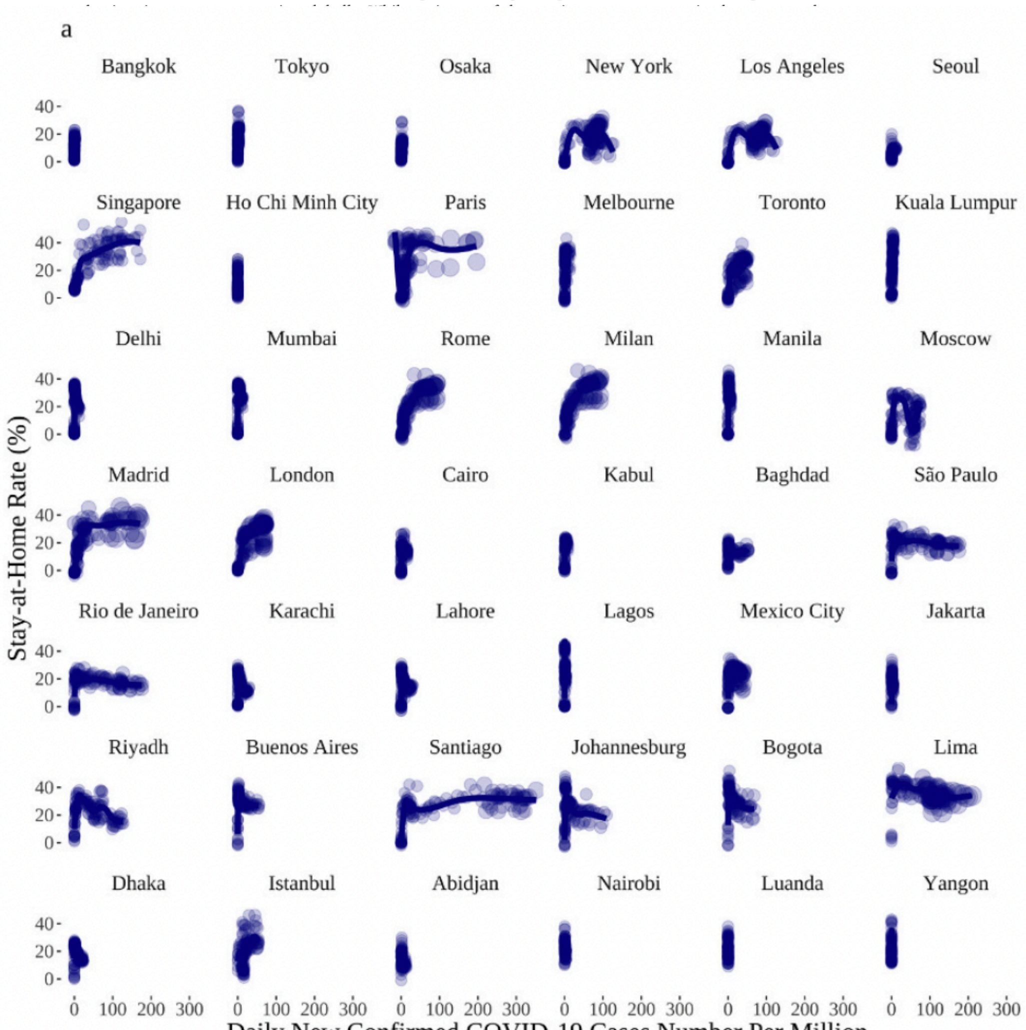
[b] School of Geographical Sciences, University of Bristol, Bristol, United Kingdom

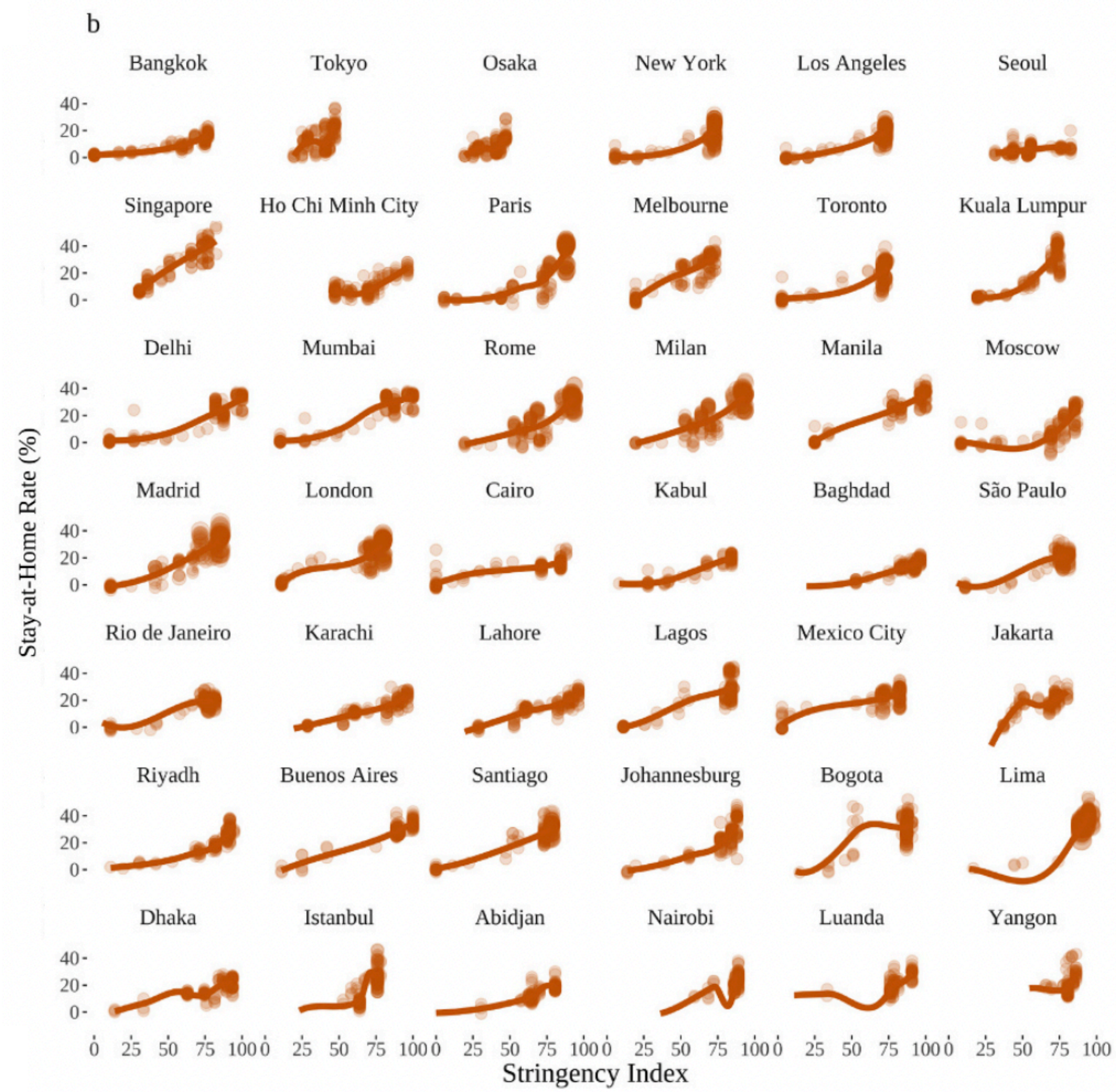
ARTICLE INFO

Keywords:
COVID-19
Urban energy use
Mobility
Night-time light satellite imagery
Cities

ABSTRACT

COVID-19, and the wider social and economic impacts that a global pandemic entails, led to unprecedented





Near real-time availability

Measuring population movement during COVID-19

Received: 24 February 2022 | Revised: 1 May 2022 | Accepted: 3 May 2022
DOI: 10.1002/psp.2578

RESEARCH ARTICLE

WILEY

Understanding patterns of internal migration during the COVID-19 pandemic in Spain

Received: 31 March 2022 | Accepted: 17 November 2022
DOI: 10.1002/psp.2637

RESEARCH ARTICLE

WILEY

Urban exodus? Understanding human mobility in Britain during the COVID-19 pandemic using Meta-Facebook data

Francisco Rowe[1] | Alessia Calafiore[2] | Daniel Arribas-Bel[1,3] | Krasen Samardzhiev[1] | Martin Fleischmann[1]

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[2]Edinburgh College of Art, University of Edinburgh, Edinburgh, Scotland, UK
[3]The Alan Turing Institute, British Library, London, England, UK

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Funding information
Engineering and Physical Sciences Research Council; Alan Turing Institute

Abstract

Existing empirical work has focused on assessing the effectiveness of nonpharmaceutical interventions on human mobility to contain the spread of COVID-19. Less is known about the ways in which the COVID-19 pandemic has reshaped the spatial patterns of population movement within countries. Anecdotal evidence of an urban exodus from large cities to rural areas emerged during early phases of the pandemic across western societies. Yet, these claims have not been empirically assessed. Traditional data sources, such as censuses offer coarse temporal frequency to analyse population movement over infrequent time intervals. Drawing on a data set of 21 million observations from Meta-Facebook users, we aim to analyse the extent and evolution of changes in the spatial patterns of population movement across the rural–urban continuum in Britain over an 18-month period from March 2020 to August 2021. Our findings show an overall and sustained decline in population movement during periods of high stringency measures, with the most densely populated areas reporting the largest reductions. During these periods, we also find evidence of higher-than-average mobility from high-density population areas to low-density areas, lending some support to claims of large-scale population movements from large cities. Yet, we show that these trends were temporary. Overall mobility levels trended back to precoronavirus levels after the easing of nonpharmaceutical interventions. Following these interventions, we found a reduction in movement to low-density areas and a rise in mobility to high-density agglomerations. Overall, these findings reveal that while COVID-19 generated shock waves leading to temporary changes in the patterns of population movement in Britain, the resulting vibrations have not significantly reshaped the prevalent structures in the national pattern of population ... ate level

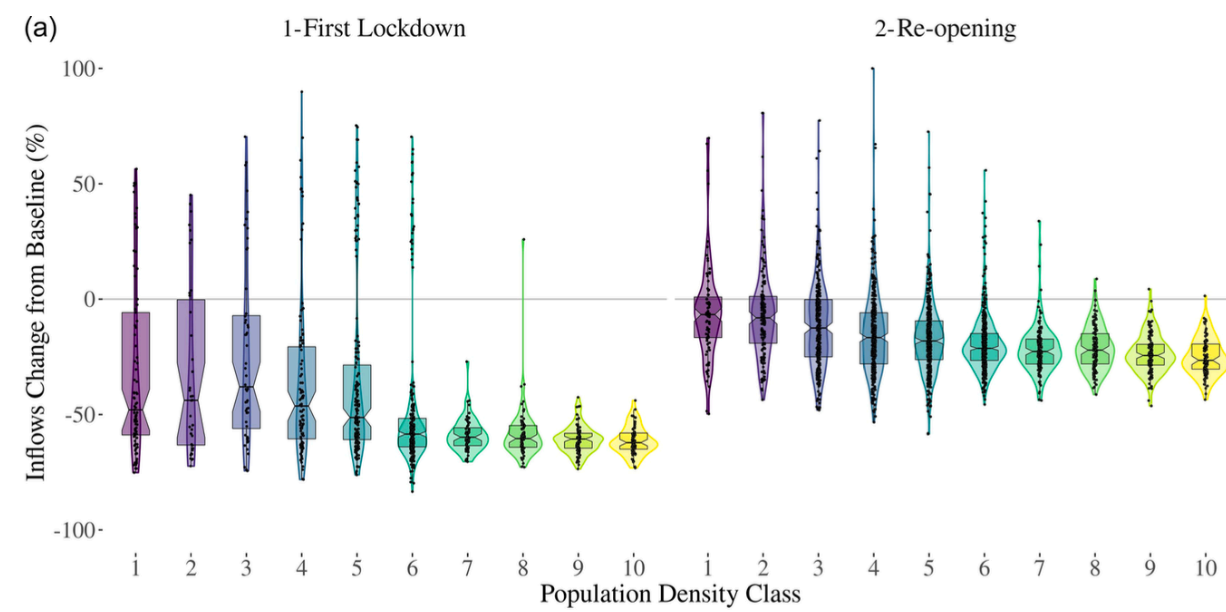
 Maps

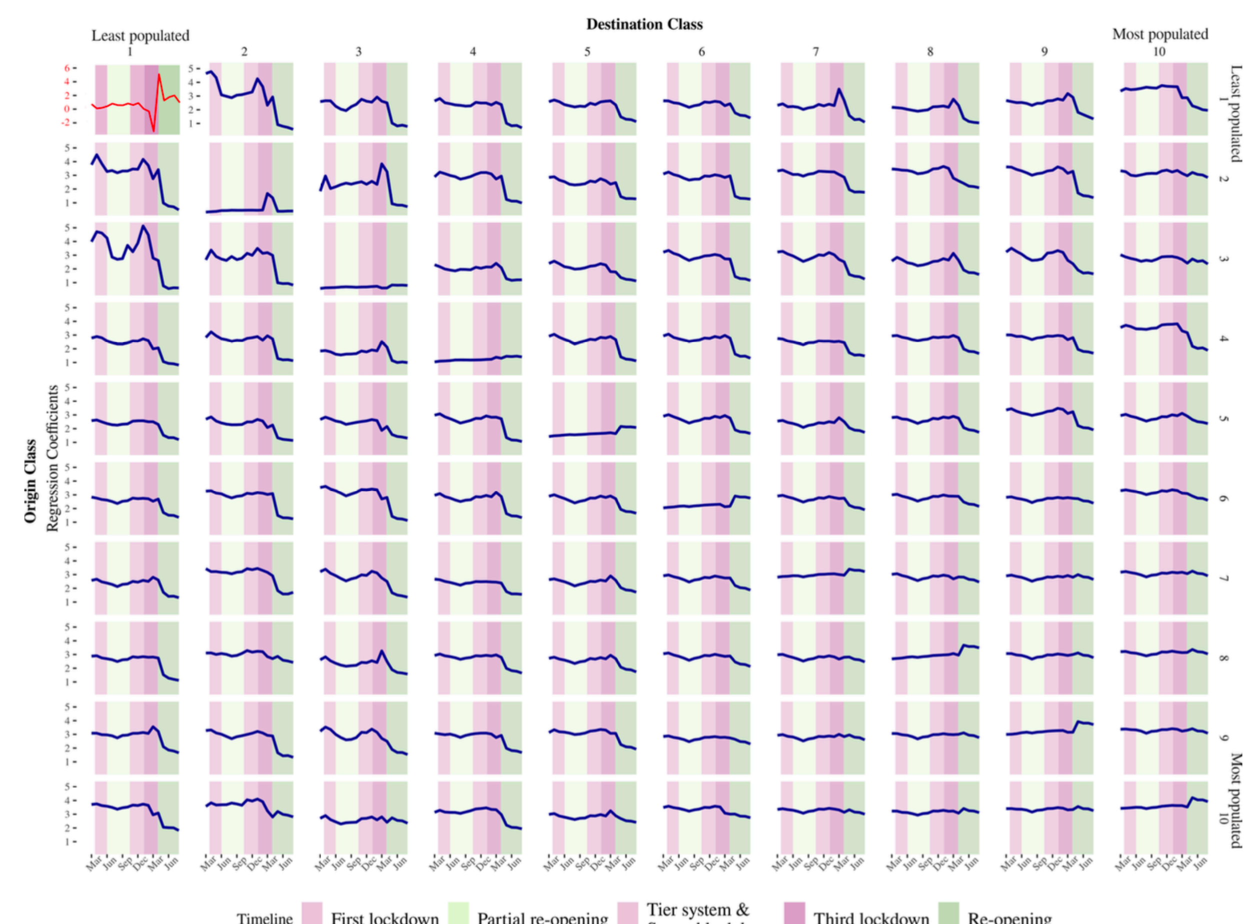
Mobility Trends Reports

Learn about COVID-19 mobility trends. Reports are published daily and reflect requests for directions in Apple Maps. Privacy is one of our core values, so Maps does not associate your data with your Apple ID and Apple does not keep a history of where you have been.

COVID-19 Community Mobility Reports

See how your community is moving around differently due to COVID-19





Near real-time availability

Measuring climate-induced population displacement

REGIONAL STUDIES, REGIONAL SCIENCE
2022, VOL. 9, NO. 1, 665–668
https://doi.org/10.1080/21681376.2022.2135458

Routledge Taylor & Francis Group
RSA Regional Studies Association

REGIONAL GRAPHIC

OPEN ACCESS Check for updates

Using digital footprint data to monitor human mobility and support rapid humanitarian responses

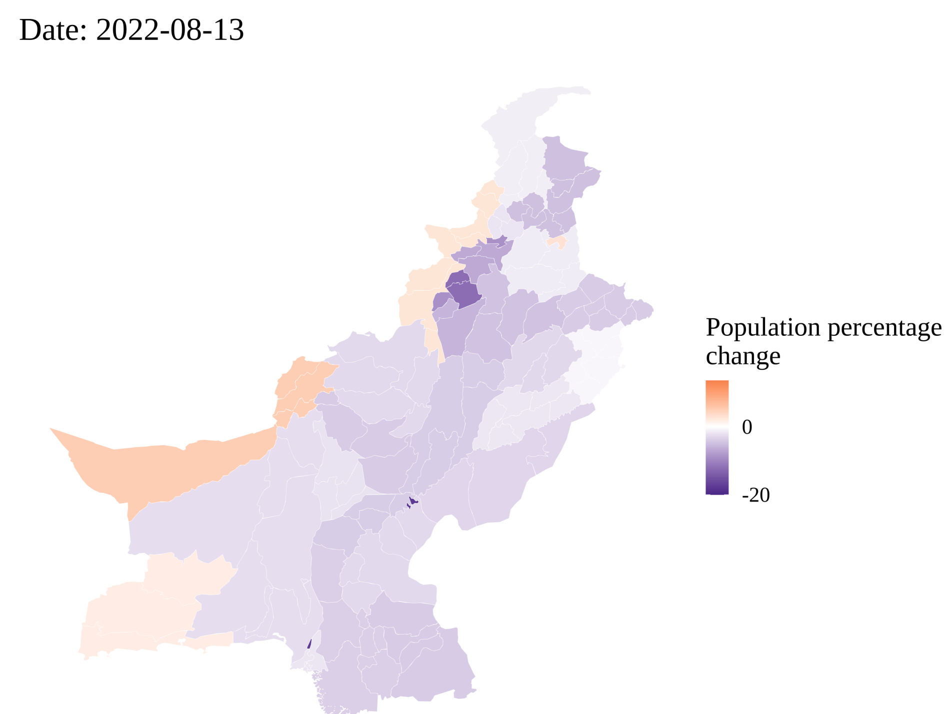
Francisco Rowe

ABSTRACT
Global warming is increasing the frequency of extreme weather events leading to an increased risk of large-scale population displacements. Since June 2022, Pakistan has recorded destructive flash flooding resulting from melting glaciers and torrential monsoon rainfall. Emergency responses have documented flood-related deaths, injuries and damaged infrastructure – less is known about population displacements resulting from recent floods. Information about these populations and mobility is critical to ensure the appropriate delivery of humanitarian assistance where it is most needed. Lack of granular spatial data in real time has been a key barrier. This article uses digital footprint data from Meta Facebook to identify the patterns of population displacement in Pakistan in near-real time.

ARTICLE HISTORY
Received 28 September 2022; Accepted 3 October 2022

KEYWORDS
digital footprint data; human mobility; population displacement; flooding; Pakistan; geographical data science

Global warming is increasing the frequency of extreme weather events, natural disasters and large-scale population displacements. Pakistan is a current example of such events. Since June 2022, Pakistan has suffered destructive flash flooding. As of 3 September 2022, a third of the country was estimated to be underwater (Scarr et al., 2022). Pakistan has the largest number of glaciers outside the polar regions and higher temperatures have led to excess water from melting ice in the Himalayas. Sudden outbursts of melting glacier water coupled with torrential monsoon rainfall and long-term deforestation have thus contributed to landslides, floods and the overflowing of the Indus River, which stretches 2880 km across Pakistan from north to south. Since June 2022, 33 million people are estimated to have been affected, over 1500 killed and over 6000 injured as a result of damaged or collapsing housing and public infrastructure (Scarr et al., 2022). The south-eastern province of Sindh is the worst affected area (Scarr et al., 2022).



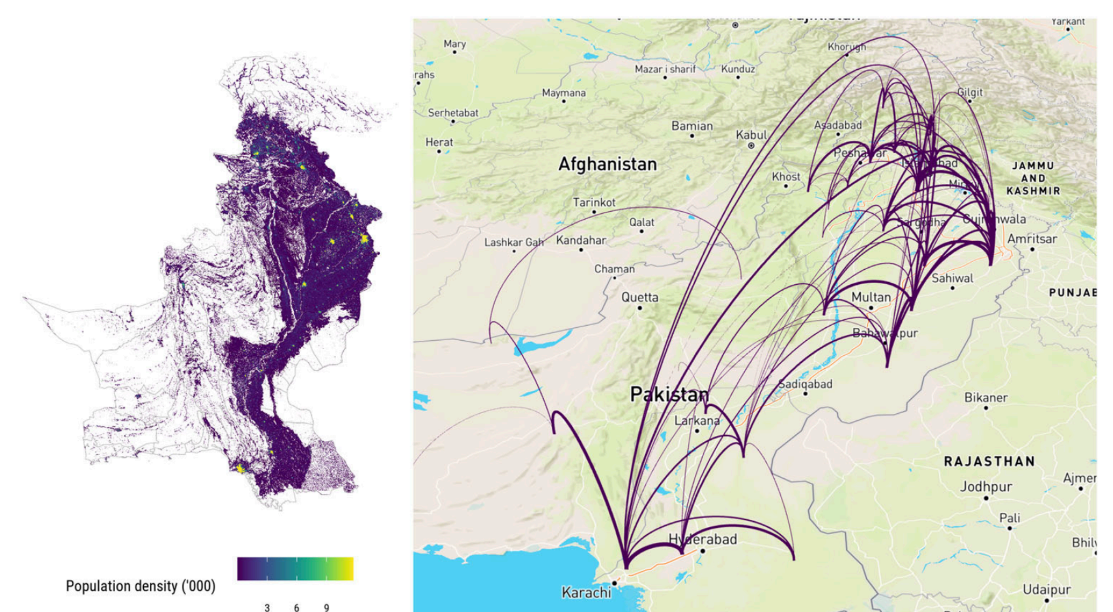


Figure 2. (a) Population density; and (b) human mobility flows on 15 August. Sources: (a) Global human settlement layer; and (b) Meta Facebook Data for Good.

Near real-time availability

Measuring conflict-induced population displacement

Sensing population displacement from Ukraine using Facebook data: Identifying potential settlement areas within host countries

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International Institute for Applied Systems Analysis, Wittgenstein Centre, Austria

Ruth Neville
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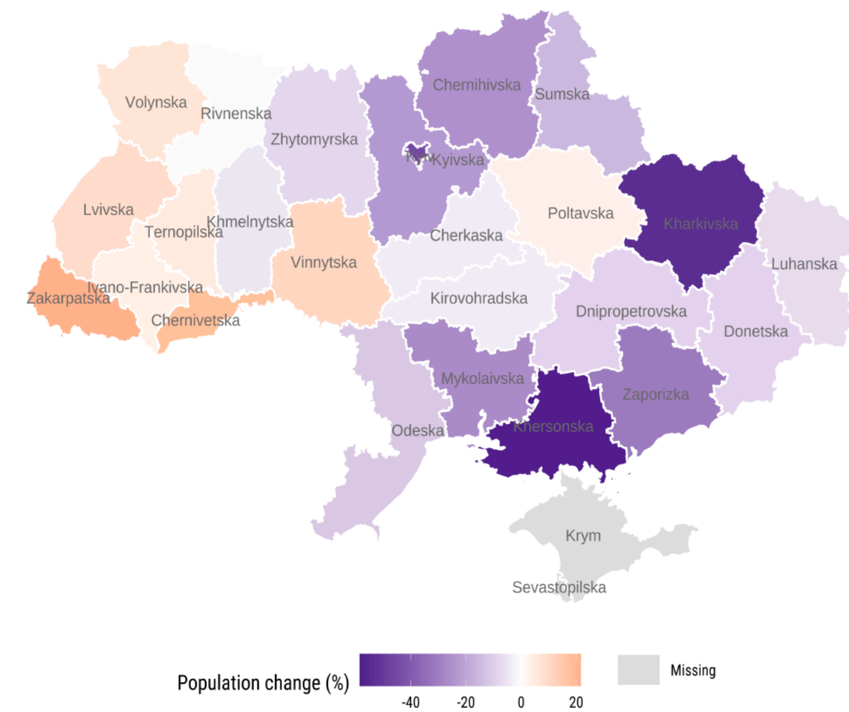
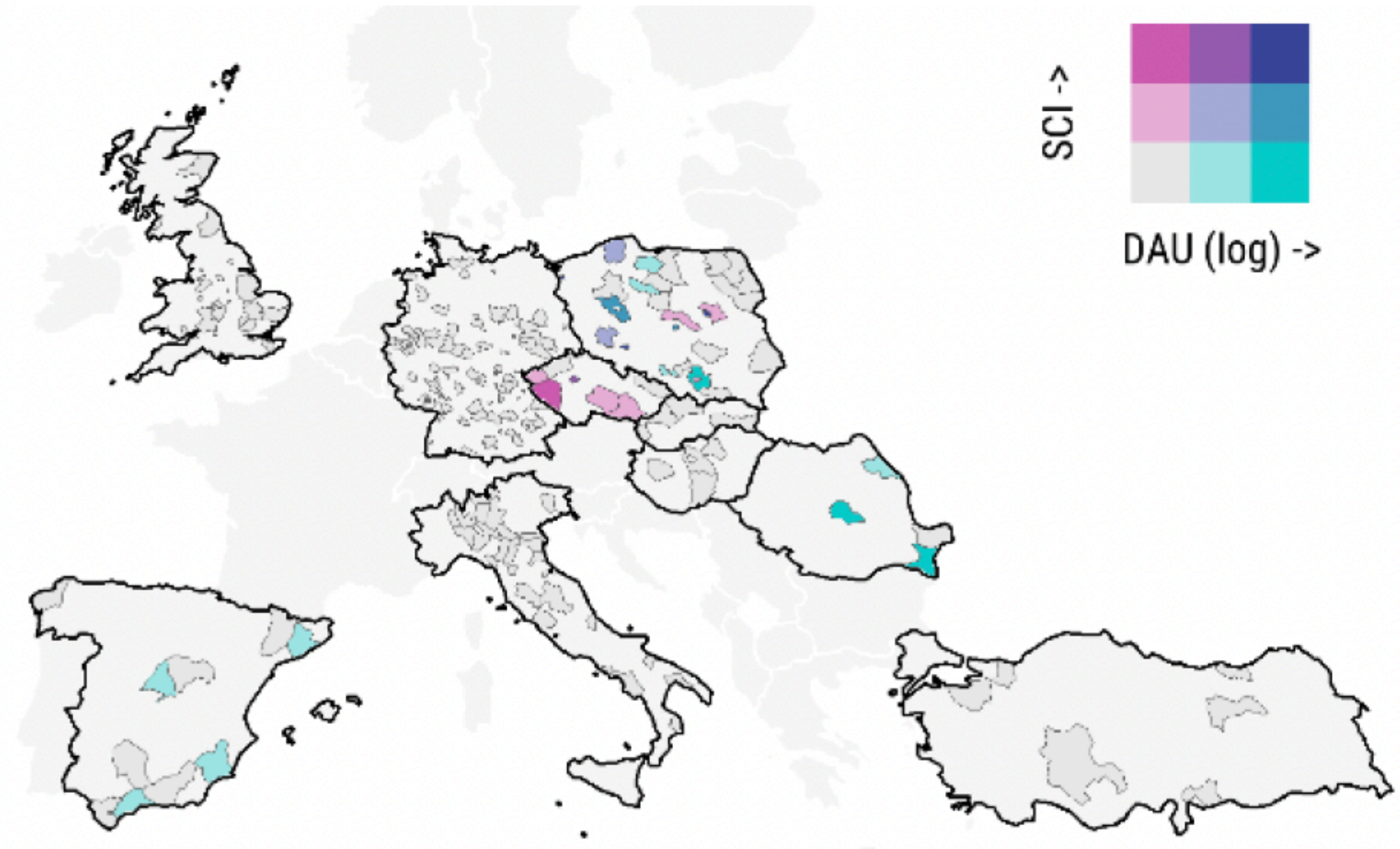
Sofía Gil-Clavel
Faculty of Technology, Policy, and Management, TU Delft, The Netherlands
Laboratory of Digital and Computational Demography, Max Planck Institute for Demographic Research, Germany

Francisco Rowe*
Geographic Data Science Lab, Department of Geography and Planning, University of Liverpool, UK

Abstract: The escalation of conflict in Ukraine has triggered the largest refugee crisis in Europe since WWII. As of mid-April 2023, over 8.2 million people have fled Ukraine. Large-scale efforts have been made to identify the major receiving countries. However, less is known about the sub-national areas within host countries where refugees have migrated. Identifying these areas is key for the appropriate allocation of humanitarian aid. By combining digital Facebook API data and traditional data from Eurostat, this paper aims to identify and characterise potential settlement areas of Ukrainians across the main destination countries in Europe. We identify high concentrations of Ukrainians in urban areas with a pre-existing diaspora and tight labour market conditions across southern, northern-west and central Poland and the city of Prague in Czech Republic. We also find potential settlements in key urban agglomerations with a moderate diaspora and high levels of unemployment in Spain. Only in Romania, refugees seem to have settled in rural areas which show a moderate diaspora but low levels of unemployment. Potential settlement areas in Germany, Italy and the United Kingdom are spread across the country. Surprisingly, we do not identify potential settlement areas in bordering regions with Ukraine within neighbouring countries, suggesting that refugees may have used them only as transit points. Our findings point out that different packages of humanitarian assistance may be needed according to the number of refugees and the characteristics of settlement areas.



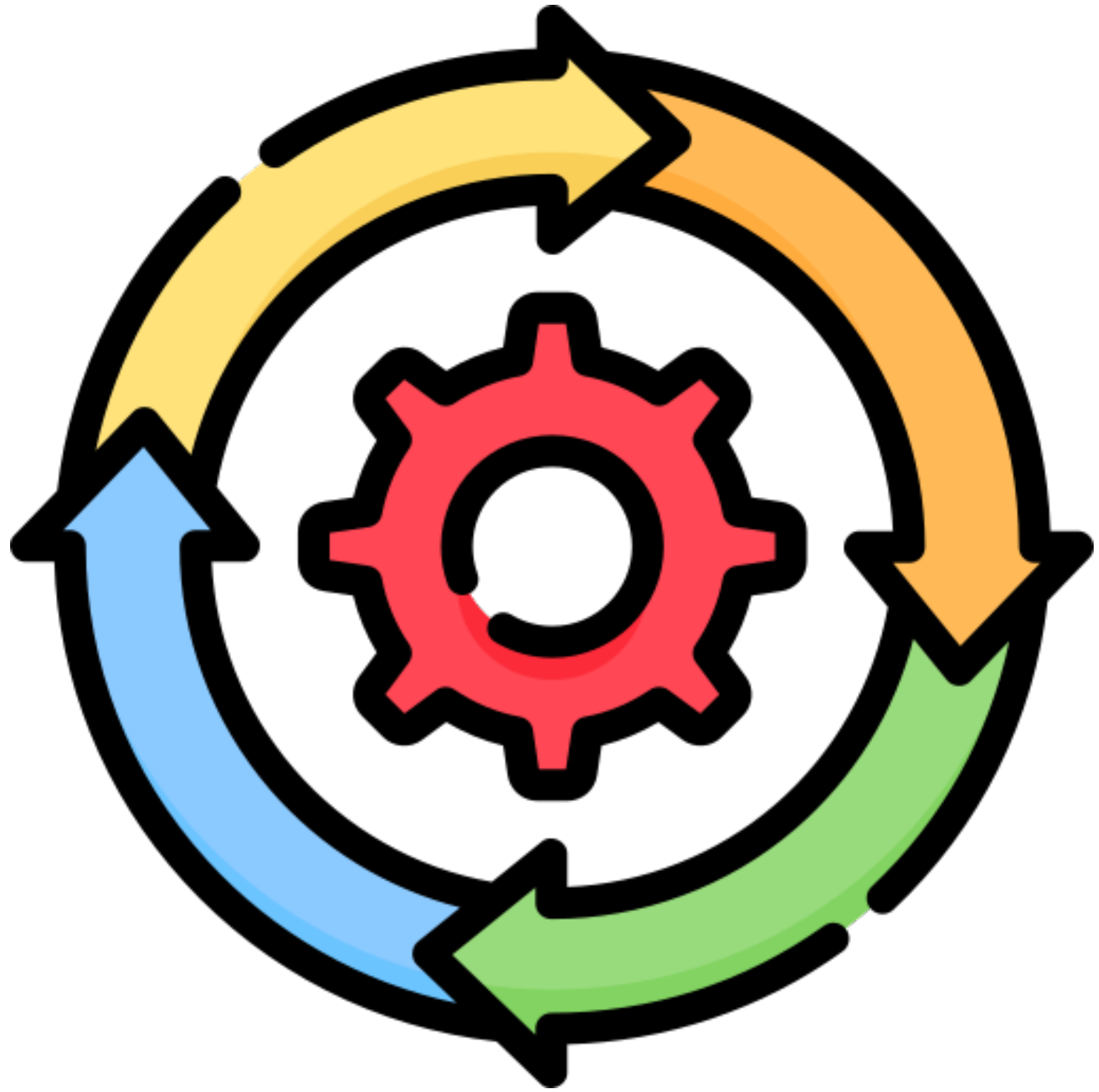


Challenges

Epistemology

Strengthening interdisciplinary collaborations

Enriching existing theories



Embracing data-driven thinking

1. Dynamic perspective
2. Focusing on distribution extremes

Data

Accessibility & discoverability

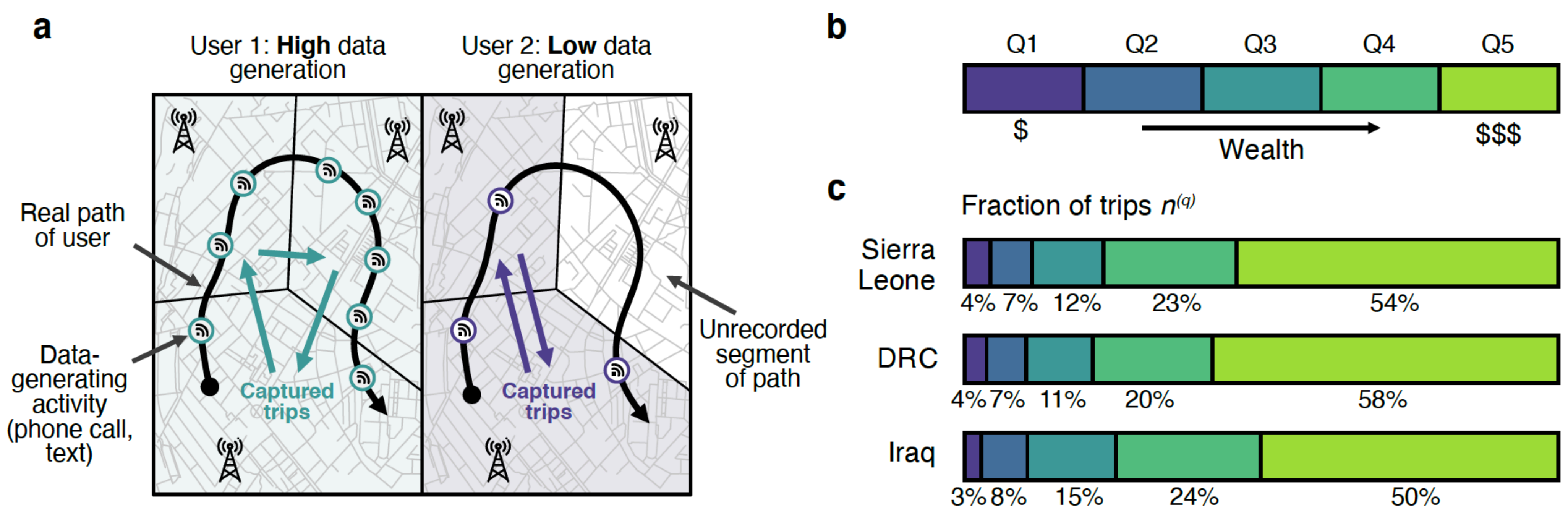
Variable standards in who & how

Integration & interoperability

Unrelated digital data environments

Spatial, social and demographic **biases**

Urban, educated, wealthy, young & middle-age individuals



Source: Schlosser, Sekara Brockmann and Garcia-Herranz (2021).

Methodology

Adoption of data science & ML/AI

Lack of standard practice

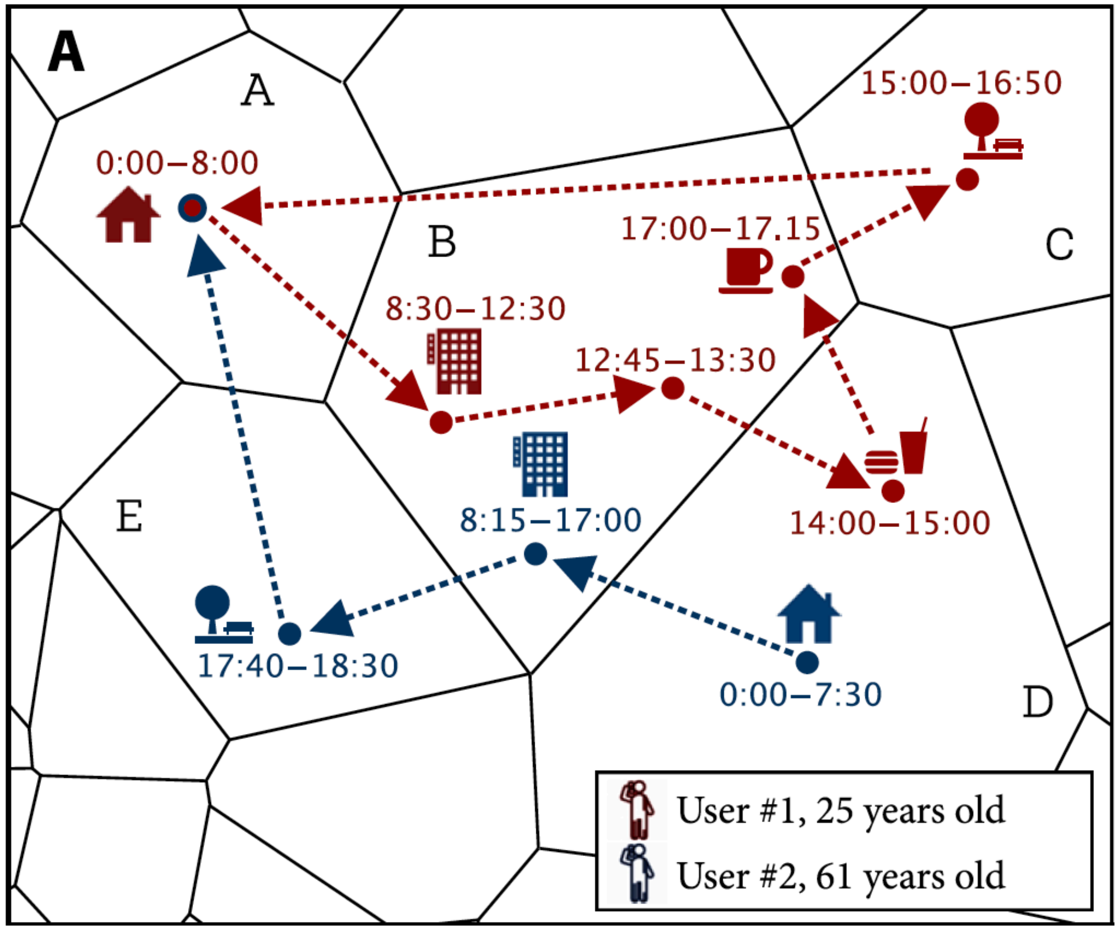
Data engineering & validation

Generalisation of observed patterns

Re-weighting /resampling sp. post-stratification

Infusing socio-economic & demographic attributes

device_id	latitude	longitude	timestamp
488bb45a-fbd4-458e	48.8	30.2	1643674140
76549c5b-56ab-4e1	51.5	31.1	1643674140
910db600-1f54-4bfd	47.1	37.6	1643674140
9f7a8f26-bbbc-4725	50.5	30.2	1643674140
2175e67e-a541-4acf	47.7	35.6	1643674140



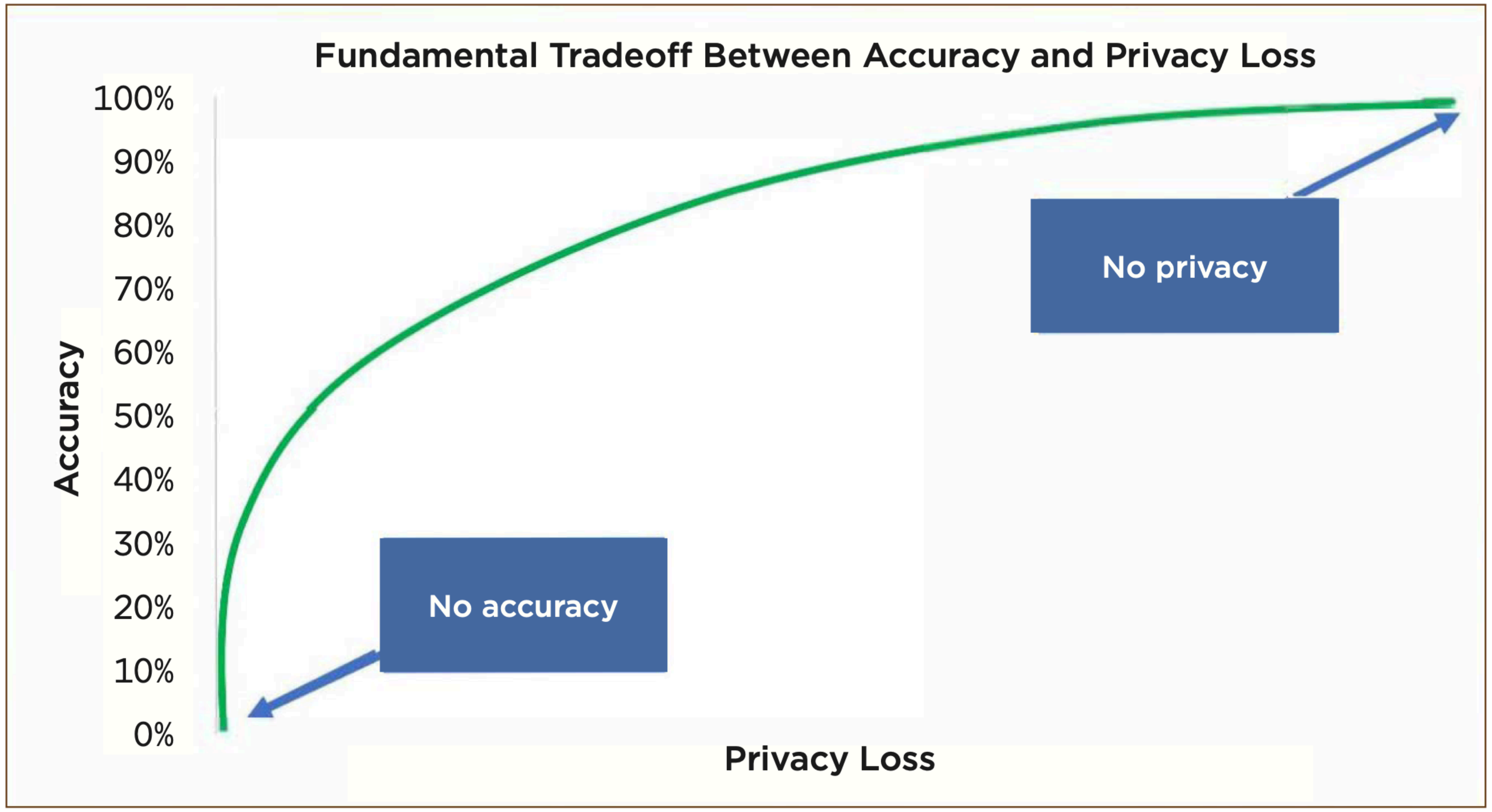
Source: Oliver, Lepri and Sterly et al. (2020)

Ethics & Privacy

Anonymisation

Privacy *vs* Accuracy

Barriers to replicability & reproducibility



Source: US Census Bureau 2022

Conclusions

Final Remarks (I)

- Digital footprint data offer opportunities to enhance our understanding of human mobility & migration and improve transport, navigation systems, pandemic responses & urban spaces.

Yet…

- Key epistemological, ethical, data and methodological challenges exist and need to be addressed in order to unleash the opportunities offered by digital footprint data

Final Remarks (II)

- Protocols for ensuring FAIR data & generating anonymised & synthetic data
- Trusted research digital environments
- Frameworks for assessing & correcting data generation & usage biases
- Repository of standard tools & practices for data engineering & validation
- Expanding & developing new dynamic theories

Overview:
Meta-Facebook Mobility Data

Data for Good

Access to privacy-preserving data for partners to tackle social problems

Data on human mobility during crisis

Two datasets:

- Facebook Population
- Movements

Missing something on home location detection

Population

Who?

Number of Facebook users (mobile app users w/ location services device setting on)

Spatial resolution:

Administration areas

Microsoft Bing Tiles - 2.5-6 Km2

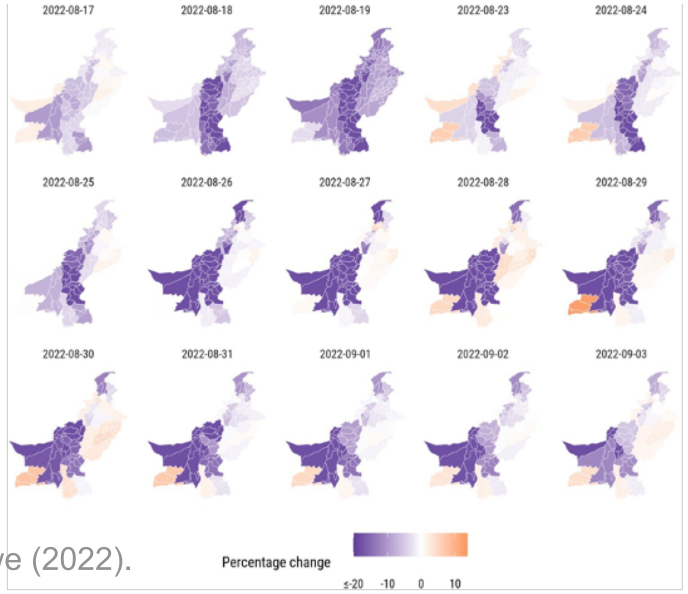
Near real-time - Time window: 00:00, 8:00 and 16:00 (Pacific Time)

The location where users **spent most time** within each 8-hour window

Period covering the entire event & **baseline period**

No information for units w/ less than 10 obs.

Datasets are discontinued after 90 days after the last data update



Source: Rowe (2022).

Boliva Dengue Fever Outbreak Feb 27 2023

Updated 28 may 2023 • 27 feb 2023 – 28 may 2023
Facebook Population During Crisis • Bolivia

Facebook Population During Crisis shows the number of Facebook users observed in a location following a crisis compared to a precrisis baseline period. It can help responders identify areas that are heavily impacted by a disaster, analyze how populations are reacting and where they go when they evacuate, and make strategic decisions about how to position services or supplies.

Mapa Acerca de Documentación Descargar Files

Turkiye Turkey Earthquake Full Country Version Feb 8 2023

Updated 9 may 2023 • 5 feb 2023 – 9 may 2023
Facebook Population During Crisis • Turkey

Facebook Population During Crisis shows the number of Facebook users observed in a location following a crisis compared to a precrisis baseline period. It can help responders identify areas that are heavily impacted by a disaster, analyze how populations are reacting and where they go when they evacuate, and make strategic decisions about how to position services or supplies.

Mapa Acerca de Documentación Descargar Files

The Avalanche in Nathu La, Sikkim, India

Expiring soon

Updated 18 abr 2023 • 4 abr 2023 – 18 abr 2023
Facebook Population During Crisis • India

Facebook Population During Crisis shows the number of Facebook users observed in a location following a crisis compared to a precrisis baseline period. It can help responders identify areas that are heavily impacted by a disaster, analyze how populations are reacting and where they go when they evacuate, and make strategic decisions about how to position services or supplies.

Mapa Acerca de Documentación Descargar Files

The Tornadoes in Central Indiana, US

Expiring soon

Updated 14 abr 2023 • 1 abr 2023 – 14 abr 2023
Facebook Population During Crisis • United States

Facebook Population During Crisis shows the number of Facebook users observed in a location following a crisis compared to a precrisis baseline period. It can help responders identify areas that are heavily impacted by a disaster, analyze how populations are reacting and where they go when they evacuate, and make strategic decisions about how to position services or supplies.

Mapa Acerca de Documentación Descargar Files

The Flooding Across Southern Bahia, Brazil

Updated 8 may 2023 • 25 abr 2023 – 8 may 2023
Facebook Population During Crisis • Brazil

Facebook Population During Crisis shows the number of Facebook users observed in a location following a crisis compared to a precrisis baseline period. It can help responders identify areas that are heavily impacted by a disaster, analyze how populations are reacting and where they go when they evacuate, and make strategic decisions about how to position services or supplies.

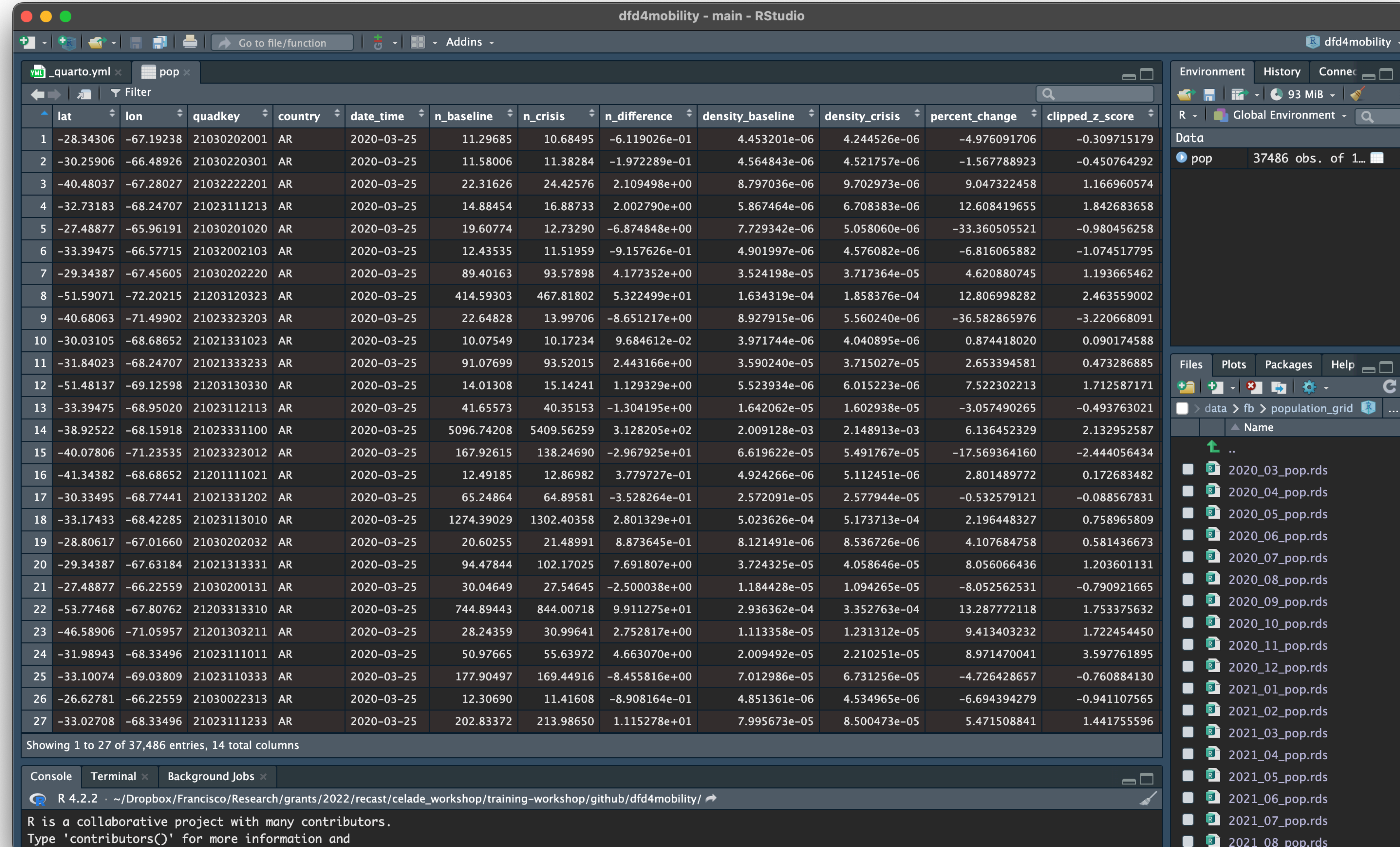
Mapa Acerca de Documentación Descargar Files

The Tornadoes in Central Oklahoma, US

Updated 3 may 2023 • 20 abr 2023 – 3 may 2023
Facebook Population During Crisis • United States

Facebook Population During Crisis shows the number of Facebook users observed in a location following a crisis compared to a precrisis baseline period. It can help responders identify areas that are heavily impacted by a disaster, analyze how populations are reacting and where they go when they evacuate, and make strategic decisions about how to position services or supplies.

Mapa Acerca de Documentación Descargar Files



	lat	lon	quadkey	country	date_time	n_baseline	n_crisis	n_difference	density_baseline	density_crisis	percent_change	clipped_z_score
1	-28.34306	-67.19238	21030202001	AR	2020-03-25	11.29685	10.68495	-6.119026e-01	4.453201e-06	4.244526e-06	-4.976091706	-0.309715179
2	-30.25906	-66.48926	21030220301	AR	2020-03-25	11.58006	11.38284	-1.972289e-01	4.564843e-06	4.521757e-06	-1.567788923	-0.450764292
3	-40.48037	-67.28027	21032222201	AR	2020-03-25	22.31626	24.42576	2.109498e+00	8.797036e-06	9.702973e-06	9.047322458	1.166960574
4	-32.73183	-68.24707	21023111213	AR	2020-03-25	14.88454	16.88733	2.002790e+00	5.867464e-06	6.708383e-06	12.608419655	1.842683658
5	-27.48877	-65.96191	21030201020	AR	2020-03-25	19.60774	12.73290	-6.874848e+00	7.729342e-06	5.058060e-06	-33.360505521	-0.980456258
6	-33.39475	-66.57715	21032002103	AR	2020-03-25	12.43535	11.51959	-9.157626e-01	4.901997e-06	4.576082e-06	-6.816065882	-1.074517795
7	-29.34387	-67.45605	21030202220	AR	2020-03-25	89.40163	93.57898	4.177352e+00	3.524198e-05	3.717364e-05	4.620880745	1.193665462
8	-51.59071	-72.20215	21203120323	AR	2020-03-25	414.59303	467.81802	5.322499e+01	1.634319e-04	1.858376e-04	12.806998282	2.463559002
9	-40.68063	-71.49902	21023323203	AR	2020-03-25	22.64828	13.99706	-8.651217e+00	8.927915e-06	5.560240e-06	-36.582865976	-3.220668091
10	-30.03105	-68.68652	21021331023	AR	2020-03-25	10.07549	10.17234	9.684612e-02	3.971744e-06	4.040895e-06	0.874418020	0.090174588
11	-31.84023	-68.24707	21021333233	AR	2020-03-25	91.07699	93.52015	2.443166e+00	3.590240e-05	3.715027e-05	2.653394581	0.473286885
12	-51.48137	-69.12598	21203130330	AR	2020-03-25	14.01308	15.14241	1.129329e+00	5.523934e-06	6.015223e-06	7.522302213	1.712587171
13	-33.39475	-68.95020	21023112113	AR	2020-03-25	41.65573	40.35153	-1.304195e+00	1.642062e-05	1.602938e-05	-3.057490265	-0.493763021
14	-38.92522	-68.15918	21023331100	AR	2020-03-25	5096.74208	5409.56259	3.128205e+02	2.009128e-03	2.148913e-03	6.136452329	2.132952587
15	-40.07806	-71.23535	21023323012	AR	2020-03-25	167.92615	138.24690	-2.967925e+01	6.619622e-05	5.491767e-05	-17.569364160	-2.444056434
16	-41.34382	-68.68652	21201111021	AR	2020-03-25	12.49185	12.86982	3.779727e-01	4.924266e-06	5.112451e-06	2.801489772	0.172683482
17	-30.33495	-68.77441	21021331202	AR	2020-03-25	65.24864	64.89581	-3.528264e-01	2.572091e-05	2.577944e-05	-0.532579121	-0.088567831
18	-33.17433	-68.42285	21023113010	AR	2020-03-25	1274.39029	1302.40358	2.801329e+01	5.023626e-04	5.173713e-04	2.196448327	0.758965809
19	-28.80617	-67.01660	21030202032	AR	2020-03-25	20.60255	21.48991	8.873645e-01	8.121491e-06	8.536726e-06	4.107684758	0.581436673
20	-29.34387	-67.63184	21021313331	AR	2020-03-25	94.47844	102.17025	7.691807e+00	3.724325e-05	4.058646e-05	8.056066436	1.203601131
21	-27.48877	-66.22559	21030200131	AR	2020-03-25	30.04649	27.54645	-2.500038e+00	1.184428e-05	1.094265e-05	-8.052562531	-0.790921665
22	-53.77468	-67.80762	21203313310	AR	2020-03-25	744.89443	844.00718	9.911275e+01	2.936362e-04	3.352763e-04	13.287772118	1.753375632
23	-46.58906	-71.05957	21201303211	AR	2020-03-25	28.24359	30.99641	2.752817e+00	1.113358e-05	1.231312e-05	9.413403232	1.722454450
24	-31.98943	-68.33496	21023111011	AR	2020-03-25	50.97665	55.63972	4.663070e+00	2.009492e-05	2.210251e-05	8.971470041	3.597761895
25	-33.10074	-69.03809	21023110333	AR	2020-03-25	177.90497	169.44916	-8.455816e+00	7.012986e-05	6.731256e-05	-4.726428657	-0.760884130
26	-26.62781	-66.22559	21030022313	AR	2020-03-25	12.30690	11.41608	-8.908164e-01	4.851361e-06	4.534965e-06	-6.694394279	-0.941107565
27	-33.02708	-68.33496	21023111233	AR	2020-03-25	202.83372	213.98650	1.115278e+01	7.995673e-05	8.500473e-05	5.471508841	1.441755596

Movement

Who?

Number of Facebook users in different spatial units at two points in time

Spatial resolution:

Administration areas

Microsoft Bing Tiles - 2.5-6 Km2

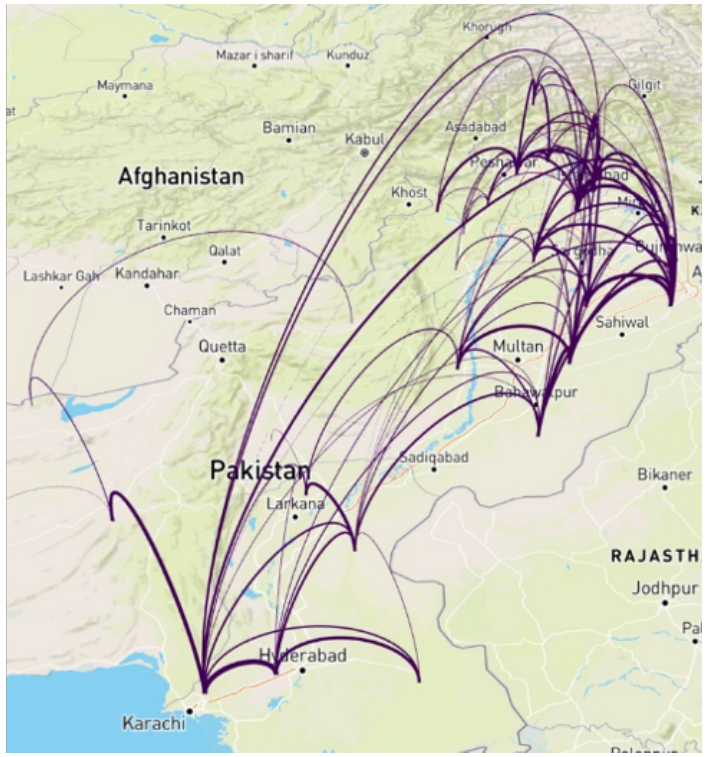
Near real-time - Time window: 00:00, 8:00 and 16:00 (Pacific Time)

Comparison of locations where users **spent most time** within each 8-hour window

Period covering the entire event & **baseline period**

No information for units w/ less than 10 obs.

Datasets are discontinued after 90 days after the last data update



Source: Rowe (2022).

39 datasets

Most recent

The Flooding in Lugbe, Abuja, Nigeria

New

Updated 7 jul 2023 • 24 jun 2023 – 7 jul 2023
Movement Between Places During Crisis • Nigeria

Movement Between Places During Crisis shows how many Facebook users moved from one area to another and if this movement is more or less than a normal day before a crisis or event.

Acerca de Documentación Descargar Files

The Flooding Across Santiago Metropolitan Region and O'Higgins, Chile

New

Updated 6 jul 2023 • 23 jun 2023 – 6 jul 2023
Movement Between Places During Crisis • Chile

Movement Between Places During Crisis shows how many Facebook users moved from one area to another and if this movement is more or less than a normal day before a crisis or event.

Acerca de Documentación Descargar Files

The Tornado in Moss Point, Mississippi, US

New

Updated 3 jul 2023 • 20 jun 2023 – 3 jul 2023
Movement Between Places During Crisis • United States

Movement Between Places During Crisis shows how many Facebook users moved from one area to another and if this movement is more or less than a normal day before a crisis or event.

Acerca de   Documentación   Descargar   Files

Mayon Volcano Eruption Philippines 20 June 2023

New

Updated 3 jul 2023 • 20 jun 2023 – 3 jul 2023
Movement Between Places During Crisis • Philippines

Movement Between Places During Crisis shows how many Facebook users moved from one area to another and if this movement is more or less than a normal day before a crisis or event.

Acerca de   Documentación   Descargar   Files

The Wildfires in Quebec Province, Canada

Updated 20 jun 2023 • 8 jun 2023 – 20 jun 2023
Movement Between Places During Crisis • Canada

Movement Between Places During Crisis shows how many Facebook users moved from one area to another and if this movement is more or less than a normal day before a crisis or event.

Acerca de   Documentación   Descargar   Files

Nairobi Flooding Study June 8 2023

Updated 5 jul 2023 • 8 jun 2023 – 5 jul 2023
Movement Between Places During Crisis • Kenya

Movement Between Places During Crisis shows how many Facebook users moved from one area to another and if this movement is more or less than a normal day before a crisis or event.

Acerca de   Documentación   Descargar   Files

Movement During COVID-19

discontinued

Four Latin American countries:

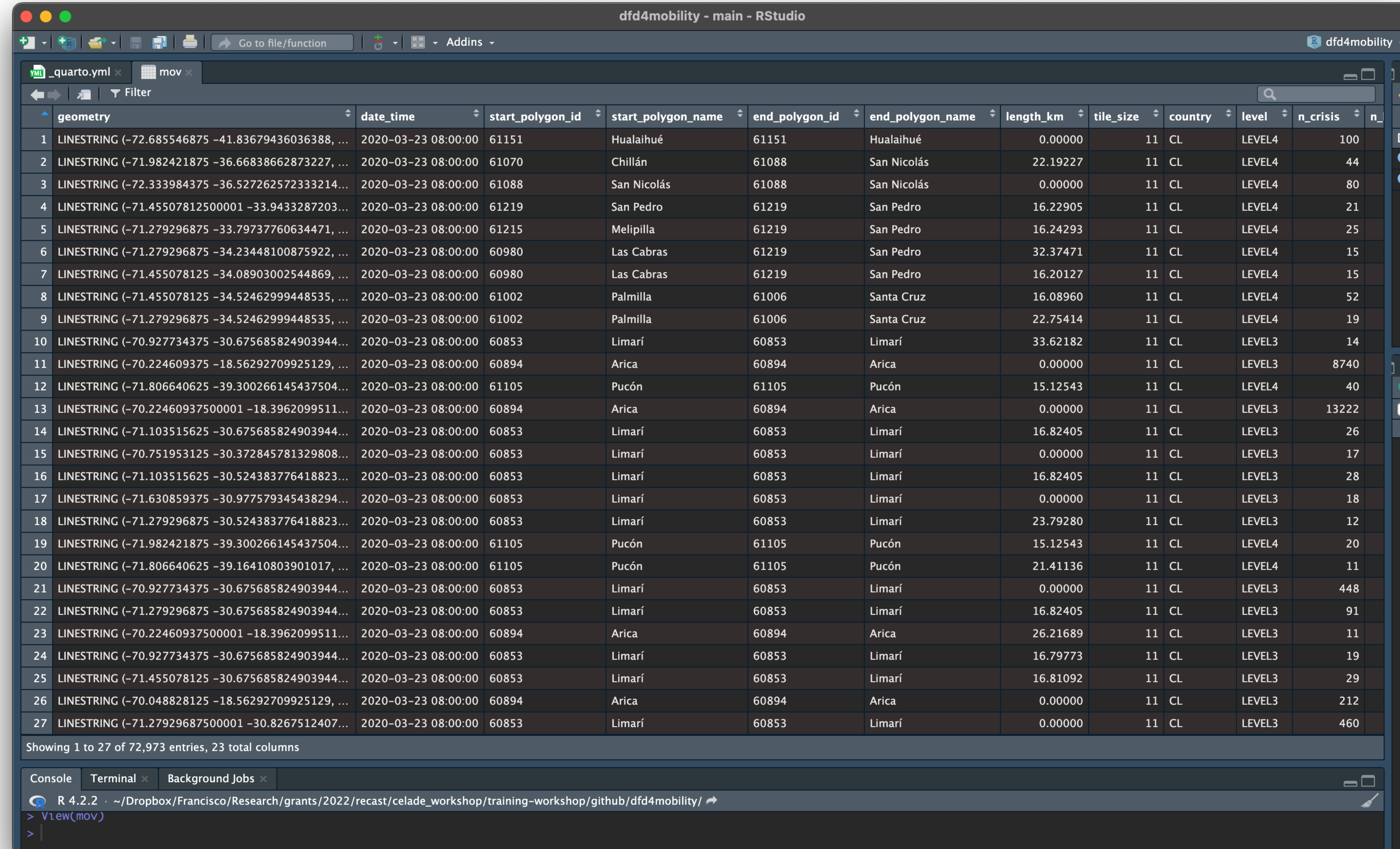
- Argentina, Chile, Colombia and Mexico

Period:

- March 2020 - May 2022
- Microsoft Bing Tiles - 2.5-6 Km2

Baseline:

- 45 days ending on March 10th 2020



	geometry	date_time	start_polygon_id	start_polygon_name	end_polygon_id	end_polygon_name	length_km	tile_size	country	level	n_crisis	n_
1	LINESTRING (-72.685546875 -41.83679436036388, ...	2020-03-23 08:00:00	61151	Hualaihué	61151	Hualaihué	0.00000	11	CL	LEVEL4	100	
2	LINESTRING (-71.982421875 -36.66838662873227, ...	2020-03-23 08:00:00	61070	Chillán	61088	San Nicolás	22.19227	11	CL	LEVEL4	44	
3	LINESTRING (-72.333984375 -36.527262572333214...	2020-03-23 08:00:00	61088	San Nicolás	61088	San Nicolás	0.00000	11	CL	LEVEL4	80	
4	LINESTRING (-71.45507812500001 -33.9433287203...	2020-03-23 08:00:00	61219	San Pedro	61219	San Pedro	16.22905	11	CL	LEVEL4	21	
5	LINESTRING (-71.279296875 -33.79737760634471, ...	2020-03-23 08:00:00	61215	Melipilla	61219	San Pedro	16.24293	11	CL	LEVEL4	25	
6	LINESTRING (-71.279296875 -34.23448100875922, ...	2020-03-23 08:00:00	60980	Las Cabras	61219	San Pedro	32.37471	11	CL	LEVEL4	15	
7	LINESTRING (-71.455078125 -34.08903002544869, ...	2020-03-23 08:00:00	60980	Las Cabras	61219	San Pedro	16.20127	11	CL	LEVEL4	15	
8	LINESTRING (-71.455078125 -34.52462999448535, ...	2020-03-23 08:00:00	61002	Palmilla	61006	Santa Cruz	16.08960	11	CL	LEVEL4	52	
9	LINESTRING (-71.279296875 -34.52462999448535, ...	2020-03-23 08:00:00	61002	Palmilla	61006	Santa Cruz	22.75414	11	CL	LEVEL4	19	
10	LINESTRING (-70.927734375 -30.675685824903944...	2020-03-23 08:00:00	60853	Limarí	60853	Limarí	33.62182	11	CL	LEVEL3	14	
11	LINESTRING (-70.224609375 -18.56292709925129, ...	2020-03-23 08:00:00	60894	Arica	60894	Arica	0.00000	11	CL	LEVEL3	8740	
12	LINESTRING (-71.806640625 -39.300266145437504...	2020-03-23 08:00:00	61105	Pucón	61105	Pucón	15.12543	11	CL	LEVEL4	40	
13	LINESTRING (-70.22460937500001 -18.3962099511...	2020-03-23 08:00:00	60894	Arica	60894	Arica	0.00000	11	CL	LEVEL3	13222	
14	LINESTRING (-71.103515625 -30.675685824903944...	2020-03-23 08:00:00	60853	Limarí	60853	Limarí	16.82405	11	CL	LEVEL3	26	
15	LINESTRING (-70.751953125 -30.372845781329808...	2020-03-23 08:00:00	60853	Limarí	60853	Limarí	0.00000	11	CL	LEVEL3	17	
16	LINESTRING (-71.103515625 -30.524383776418823...	2020-03-23 08:00:00	60853	Limarí	60853	Limarí	16.82405	11	CL	LEVEL3	28	
17	LINESTRING (-71.630859375 -30.977579345438294...	2020-03-23 08:00:00	60853	Limarí	60853	Limarí	0.00000	11	CL	LEVEL3	18	
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19	LINESTRING (-71.982421875 -39.300266145437504...	2020-03-23 08:00:00	61105	Pucón	61105	Pucón	15.12543	11	CL	LEVEL4	20	
20	LINESTRING (-71.806640625 -39.16410803901017, ...	2020-03-23 08:00:00	61105	Pucón	61105	Pucón	21.41136	11	CL	LEVEL4	11	
21	LINESTRING (-70.927734375 -30.675685824903944...	2020-03-23 08:00:00	60853	Limarí	60853	Limarí	0.00000	11	CL	LEVEL3	448	
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25	LINESTRING (-71.455078125 -30.675685824903944...	2020-03-23 08:00:00	60853	Limarí	60853	Limarí	16.81092	11	CL	LEVEL3	29	
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Showing 1 to 27 of 72,973 entries, 23 total columns


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> View(mov)
>
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Checking Installation Status

Software

✅ R

✅ Studio

✅ Quarto

✅ Libraries

Source: Rowe (2022).

Data Access

Download

Source: Rowe (2022).