Chaire LOGISTICS CITY

INTERNATIONAL SEMINAR. RECENT RESEARCH RESULTS ON URBAN LOGISTICS AND E-COMMERCE MOBILITIES
(WEDNESDAY 9TH 2022 – EIVP/UNIV EIFFEL)

Geography of warehouses in the United States and spatial patterns of Amazon warehouses. New insights on warehousing spatial patterns.

Université Gustave Eiffel

Dr. Matthieu Schorung

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sogaris

POSTE IMMO

Région îledeFrance

- Social sciences, urban studies, geography and urban planning
- Macro spatial analyses to micro level studies
- Warehouses, innovations, new trends in consumption and impacts on city logistics

https://www.lvmt.fr/en/chaires/logistics-city/

Results available online, eg:

- E-book on warehouse geography in the United States
- Observatory of ecommerce mobilities
- Report of Amazon warehouses
- Logistics real estate and relationships with urban form, macro analyses

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State of the art

Several recent studies have analyzed the **location of warehouses** in metropolitan areas and how this has changed over time. These studies have demonstrated a **shift in the location of warehouses and logistics facilities to peri-urban areas** (Bowen, 2008; Allen and Browne, 2010; Cidell, 2010; Heitz and Dablanc, 2015; Giuliano et al., 2016; Heitz, Dablanc, and Tavasszy, 2017).

The location dynamics of logistics warehouses are based on **several criteria and a complex supply chain cost structure** (transportation, accessibility, distribution activities, structure of the regional economy, warehouse equipment, land and real estate, organization of logistics flows and the last mile, etc.) (Dablanc and Rakotonarivo, 2010).

This progression has been described as "**logistics sprawl**", a phenomenon that can be defined as "the tendency for warehouses to move from urban to suburban and exurban areas" (Dablanc and Ross, 2012, p. 434), which has been identified by research in all the case studies considered (Cidell, 2010; Dablanc and Ross, 2012; Dablanc et al., 2014; Heitz and Dablanc, 2015).

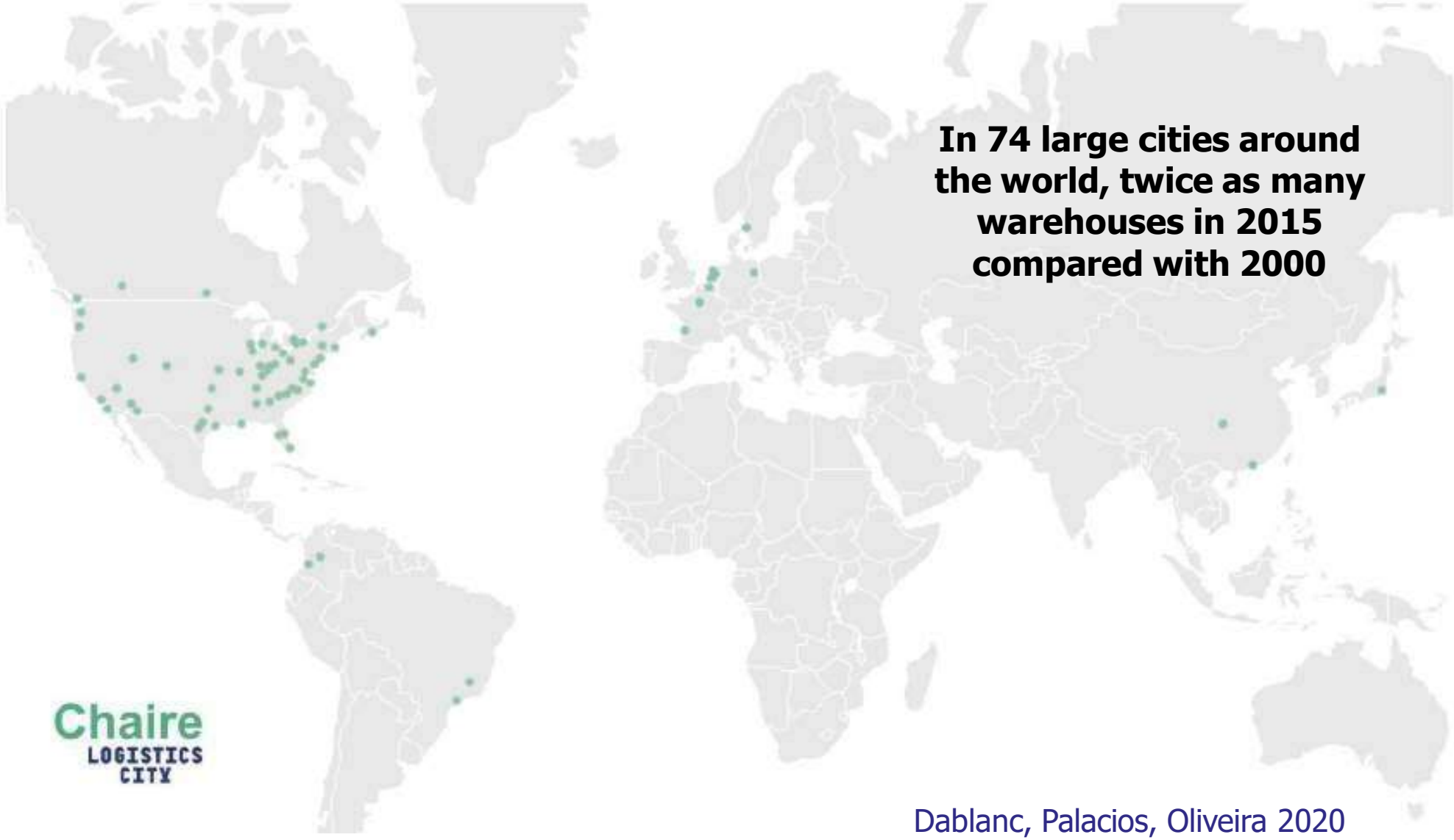
In the **case of North America, there have been several analyses of case studies** in Atlanta, Los Angeles and Seattle, Toronto (Dablanc and Ross, 2012; Dablanc et al., 2014; Woudsma et al., 2016), and recently a comparative study on Chicago and Phoenix (Dubic, Kuo, Giron-Valderrama, Goodchild, 2020).

2019-2021 : Database on logistics sprawl

Database on warehouse location patterns in 74 cities around the world, following a comparative meta-analysis: Presentation: "Locational patterns of warehouses in 74 cities around the world, a comparative meta-analysis", by Laetitia Dablanc, Laura Palacios-Argüello and Leise de Oliveira
→ https://www.lvmt.fr/wp-content/uploads/2022/01/Dablanc-Palacios-Arguello-De-Oliveira-2020.pdf

- To provide a cleaned and more comprehensive database related to freight facilities in large metropolitan areas
- To make comparative analyses regarding location factors related to logistics facilities and issues raised based on secondary sources
- To provide novel elements in the study of locational patterns of freight facilities in metropolitan areas

LOGISTIC SPRAWL ANALYSIS



In 74 large cities around the world, twice as many warehouses in 2015 compared with 2000

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Dablanc, Palacios, Oliveira 2020

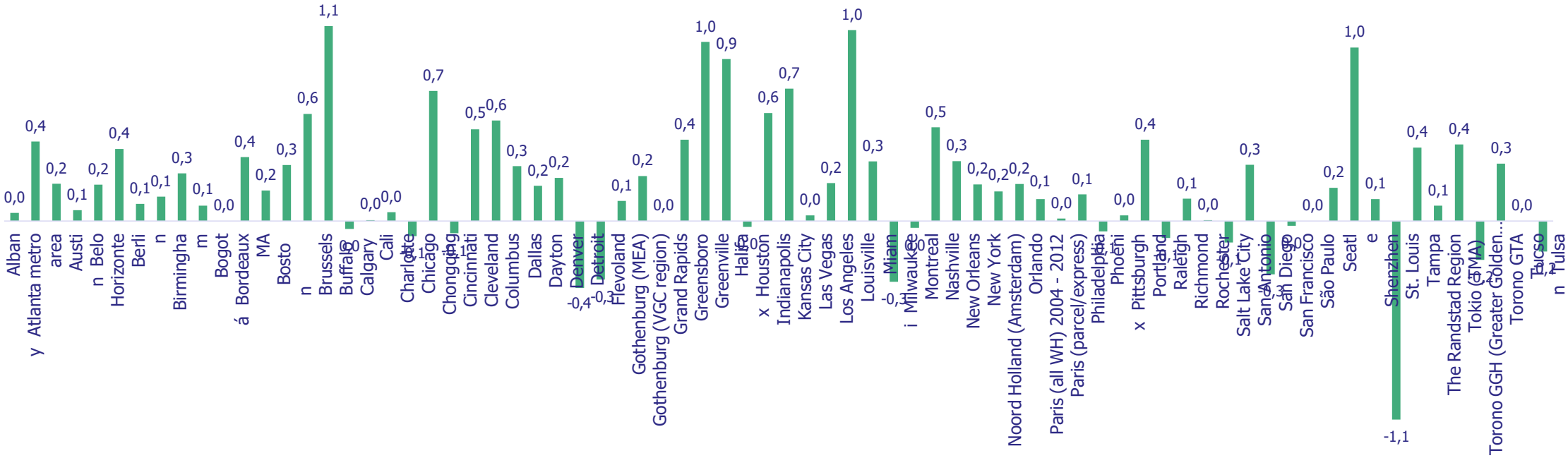
17 indicators

- Name and size of studied metro area
- Type of metropolitan area
- Population (million - most recent year)
- Population density (inhabitants/km^2)
- Name of warehouse data source
- Number of warehouses (most recent year)
- **Number of warehouses per million people** (most recent year)
- % change per year in number of WH per million people
- **Number of warehouses per 1000 km^2** (most recent year)
- Average size of warehouses (m^2)
- Time period studied for logistics sprawl analysis
- Number of years of analysis
- Average distance of warehouses to centre of gravity (most recent year) (km)
- Change in average distance of WHs to centre of gravity (over the years) (km)
- **Change in average distance of WHs to centre of gravity per year** (km/year) (logistics sprawl)
- Cluster indicator
- **Type of land use control**

Main results (Dablanc, *Logistics geographies, research from the Logistics City Chair, Webinar Presentation,* DIST - Interuniversity Department of Regional & Urban Studies and Planning, Politecnico di Torino, Italy, May 2022)

- The number of warehouses per capita has increased in all cities
- The larger the city the higher the number of warehouses per capita
- Logistics sprawl has happened in 80% of cases
- Logistics sprawl is positively linked to land cost differentials between central and suburban areas
- Logistics sprawl is positively linked to availability of large land parcels in suburban areas
- Logistics sprawl is negatively linked to regional land use control

Logistics sprawl: change in average distance to center of gravity of all warehouses (km/y) (Dablanc, Palacios-Arguellos, de Oliveira, 2020)



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2021-2022 : Atlas of warehouses in the United States

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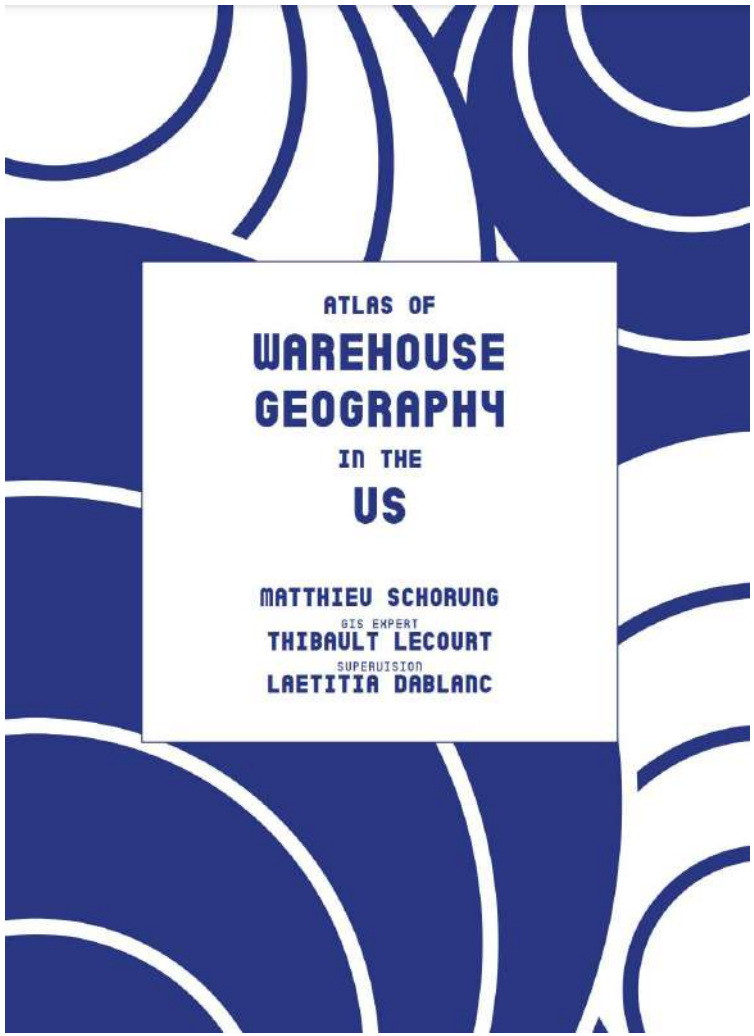
E-book on Warehouse Geography in the United States



- Major mapping work including the latest CBP database available (2019)
- Analysis at the national scale
- **45 US metropolitan areas (MSA / CSA)**
- **8 US megaregions**
- Diachronic interpretation (from 2012 to 2019)
- Calculation of indicators (barycenters, ellipses, warehouse density)
- Different method of map representation (grid, heatmaps)

Available (free download)
https://drive.google.com/file/d/18pLAegEpFKSf5SkXpIzdpPXelwAa0JQU/view

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Methodology

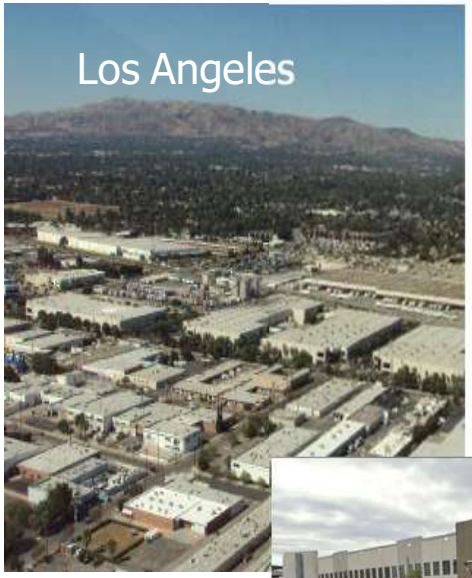
The aim of this research is to analyze warehousing development patterns in **four U.S. metropolitan areas**, based on the **County Business Pattern database** (U.S. Census Bureau) for 2012 and 2019 data at Zip Codes granularity.

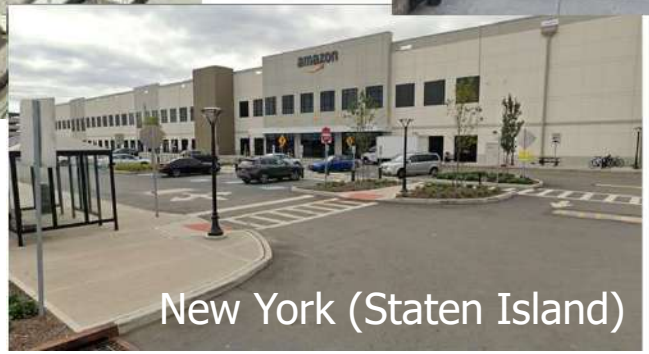
The **same data period (2012-2019**) was defined for the four metropolitan areas to ensure consistency in the analysis. Warehousing is defined in this study as establishments classified in subsector **493** ("Warehousing and Storage") of the North American Industry Classification System (**NAICS**). This classification covers establishments engaged in operating merchandise warehousing and storage facilities.

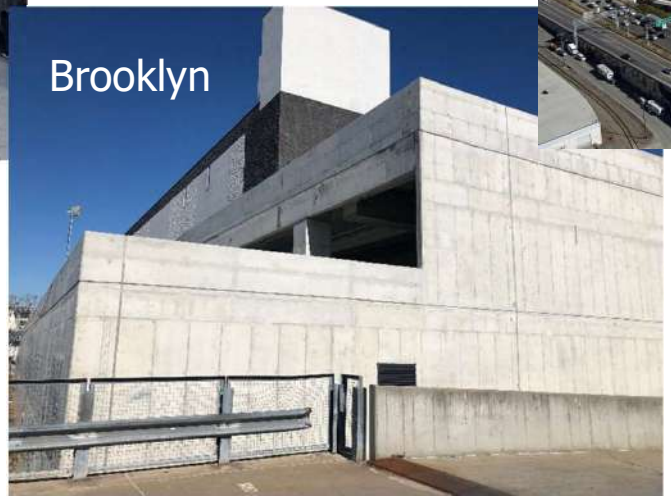
This research used **R**, a language for statistical computing, to compile, aggregate the data and the **QGIS** software wase used to map the warehouse establishments and to provide the spatial analysis, especially the barycenters.

Context. Diverse logistics landscapes in large US cities (Schorung, Dablanc, 2022)

- The changes in the location of logistics facilities reflect the broader transformation of warehousing and logistics as an economic sector.
    * On the one hand, the creation of so-called "XXL" distribution centers or mega-fulfillment centers (over 50,000 square meters), which follow the historical trend of logistics zones moving away from urban centers
    * On the other hand, the search for space in dense areas to meet demand arising from e-commerce.







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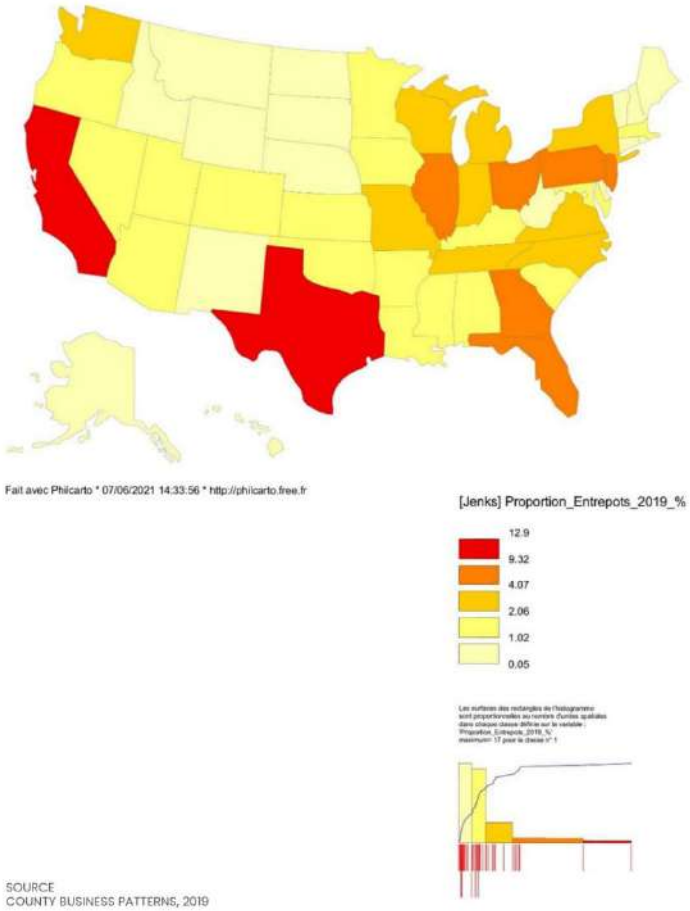
An evolving geography

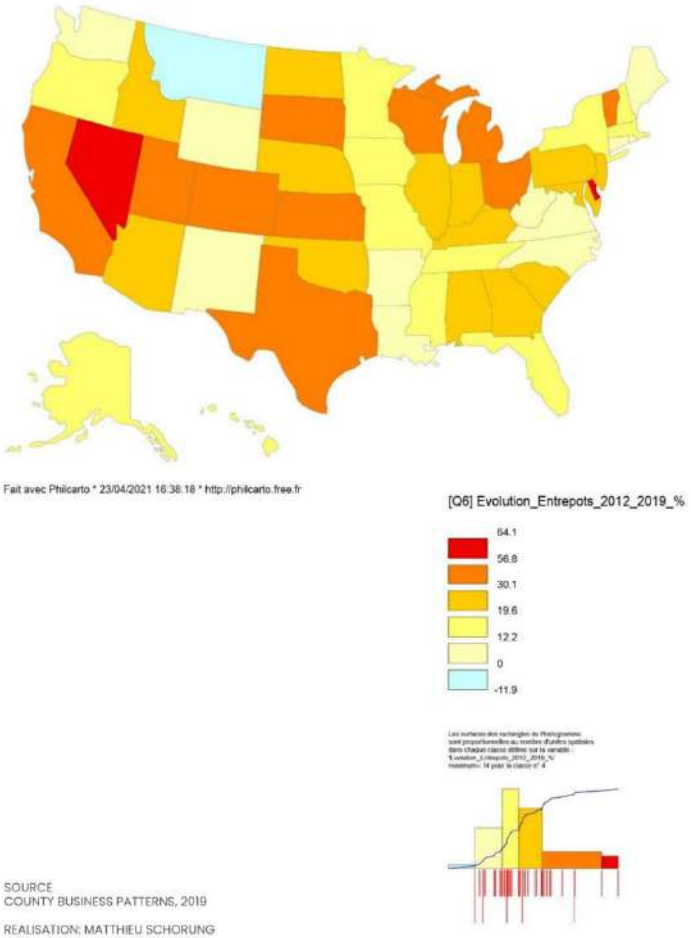
Map 1.
Share of logistics establishments by state in 2019.



SOURCE
COUNTY BUSINESS PATTERNS, 2019

REALISATION: MATTHIEU SCHORUNG

Map 2.
Changes in the number of logistics facilities by state between 2012 and 2019.



SOURCE
COUNTY BUSINESS PATTERNS, 2019

REALISATION: MATTHIEU SCHORUNG

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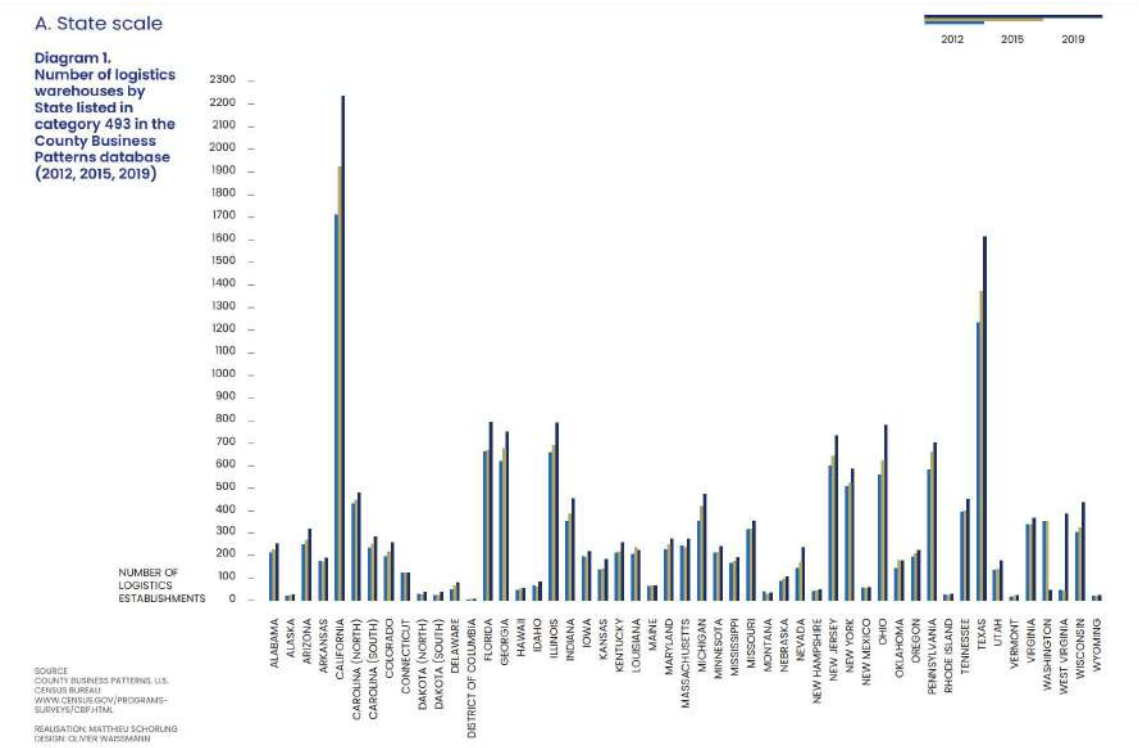
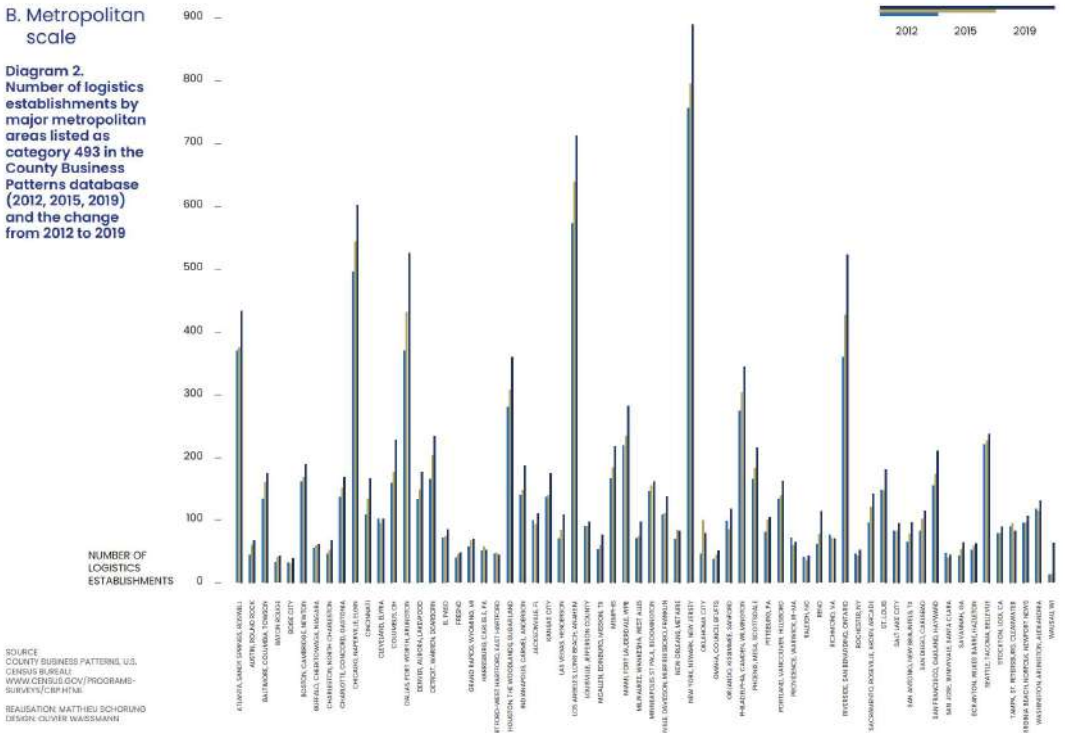
An uneven spatial distribution of logistics warehouses in the US





→ States with the most warehouses (2019) : California, Texas, New York+New Jersey

→ Metropolitan areas with the most warehouses (2019) : New York, Los Angeles+Riverside, Chicago, Dallas, Atlanta

- In 2019, only nine states had more than 500 logistics facilities listed under the County Business Pattern survey code 493: New York (589), Pennsylvania (706), New Jersey (736), Georgia (752), Ohio (781), Illinois (791), Florida (795), Texas (1616) and California (2238).

- Only 8 metropolitan areas had more than 300 logistics establishments in 2019. In addition, the trend is for the main logistics hubs to grow in size, in a process that could be likened to a metropolization of logistics

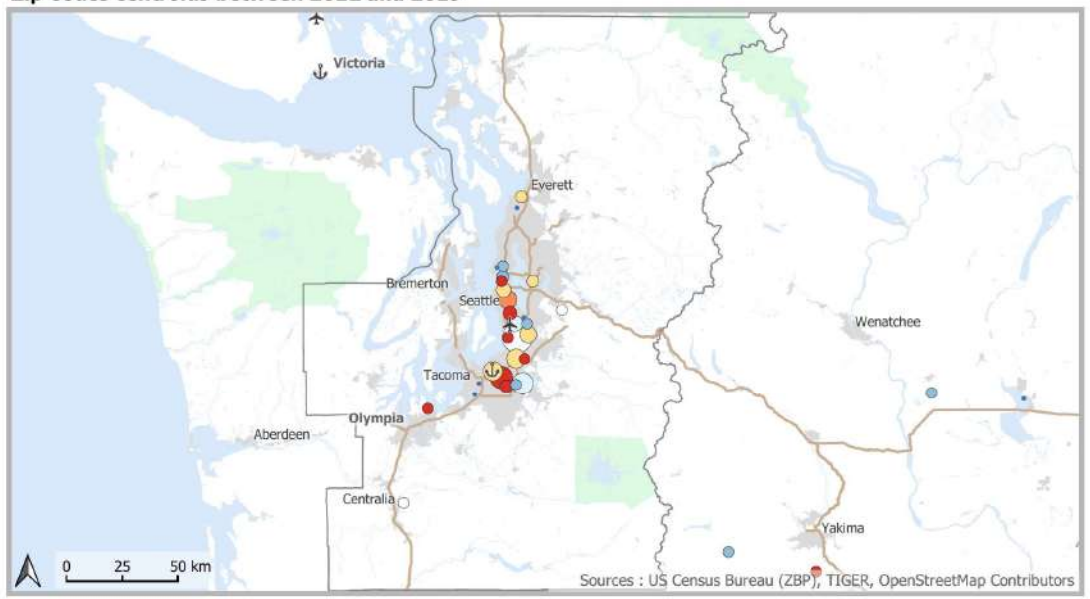
- In 4 of the top 10 logistics hubs (more than 250 warehouses in 2019 in the metropolitan area - CSA or MSA), logistics sprawl is declining: Chicago, Miami, New York, Seattle.

Tab. 1. Number of logistics establishments per major metropolitan areas listed as category 493 in the County Business Pattern database (2012, 2015, 2018, 2019) and the change between 2012 and 2019.

MSA	2012	2015	2018	2019	Evolution 2012-2018 (%)
Atlanta, Sandy Springs, Roswell	371	376	419	434	16.9
Chicago, Naperville, Elgin	496	544	580	602	21.3
Dallas, Fort Worth, Arlington	371	432	505	526	41.7
Houston, The Woodlands, Sugar Land	281	308	362	360	28.1
Los Angeles, Long Beach, Anaheim	573	639	707	713	24.4
New York, Newark, New Jersey	757	795	861	890	17.5
Philadelphia, Camden, Wilmington	275	304	339	345	25.4
Riverside, San Bernardino, Ontario	360	428	496	523	45.2

(Source : U.S. Census Bureau, 2012, 2015, 2018, 2019)

Zip Codes centroids between 2012 and 2019

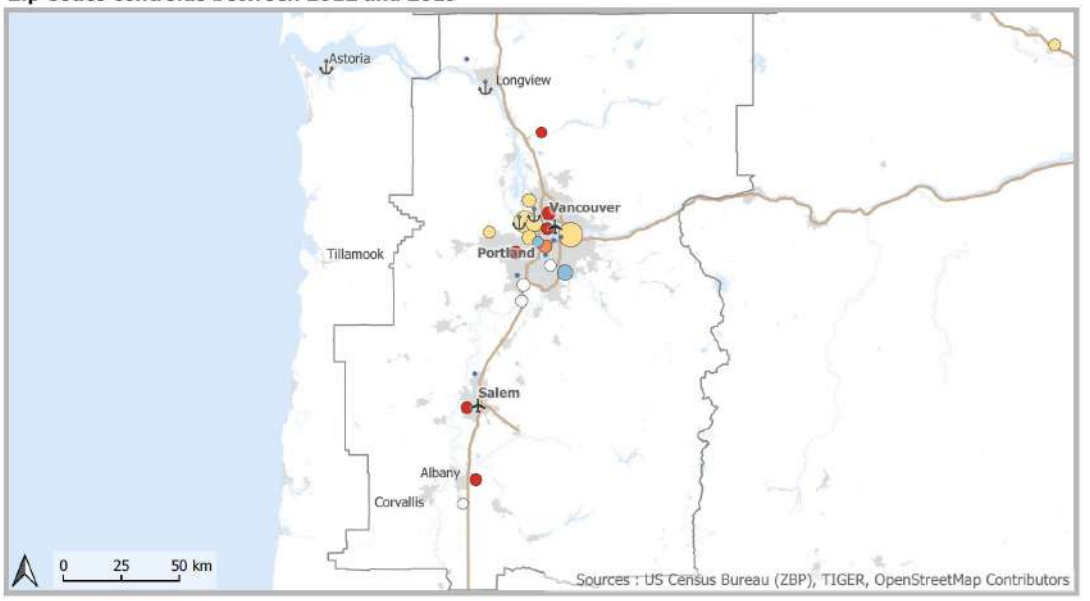


Evolution 2012 - 2019
- -100%
- From -67% to -25%
- From -25% to -5%
- From -5% to +5%
- From +5% to +49%
- From +49% to +99%
- From +99% to +600%

Number of logistics establishments in 2019
100
50
25
10
3

- Studied CSA/MSA
- Urban areas (2020)
- Protected lands areas
- Oceans, rivers and lakes
- Airports Ports
- Primary roads (2020)

Zip Codes centroids between 2012 and 2019



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Next step :
To identify the causes of this decline of logistics sprawl:
examples of Seattle and Portland

-sign of the decline of old warehouse areas ? (closure of old warehouses?)
-consequence of public policies ? (zoning, incentives, UGB [urban growth boundary] in Portland)
-other ?

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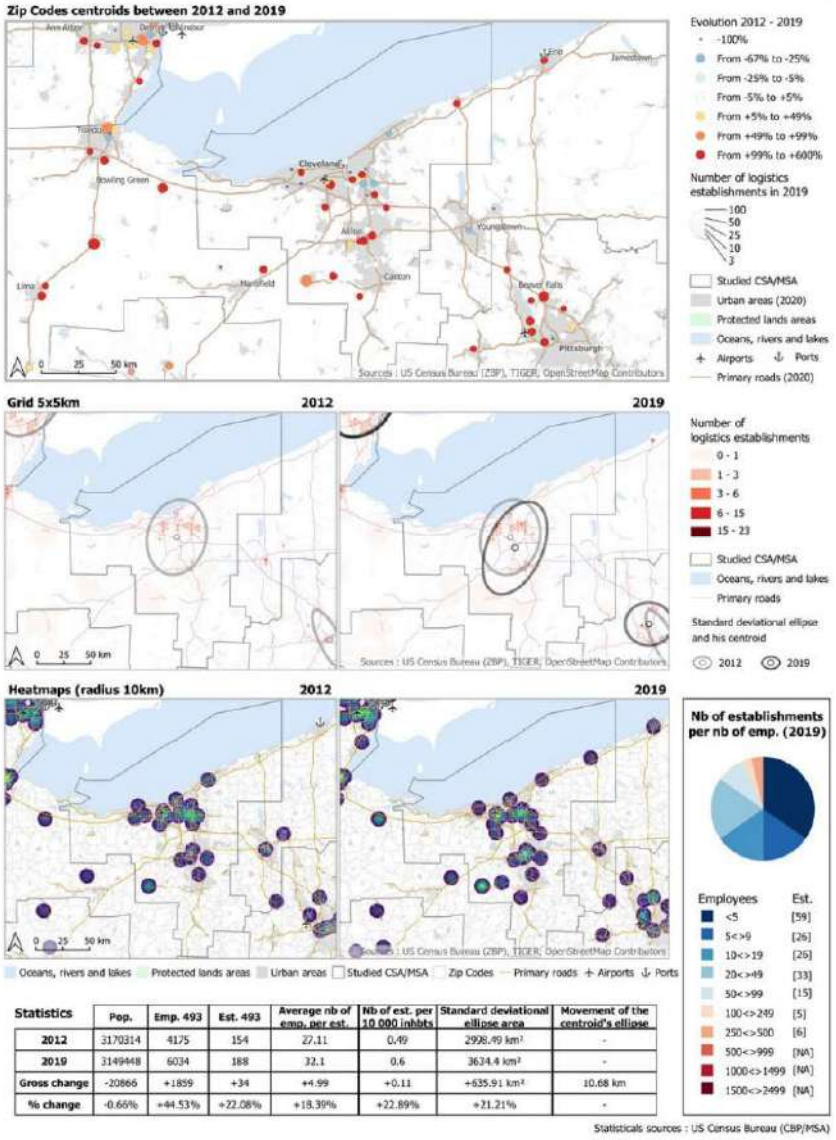
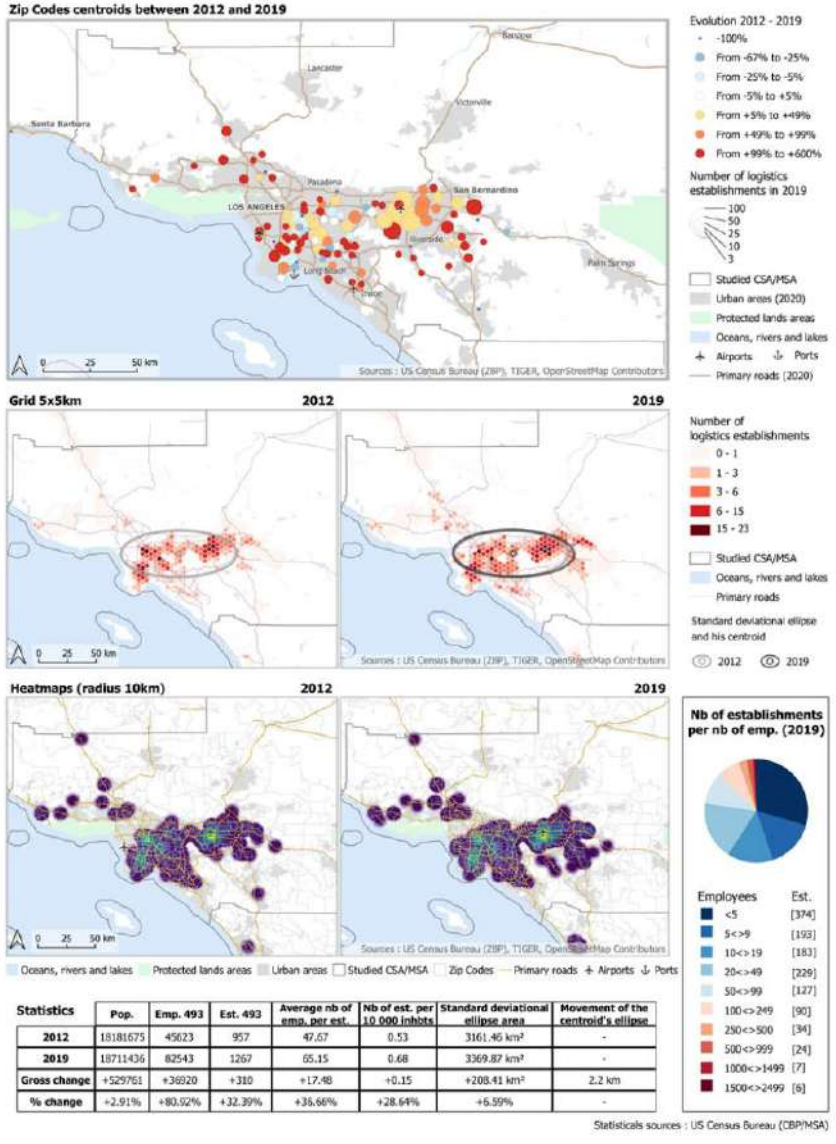
[CSA] Cleveland-Akron-Canton, OH



Statistics	Pop.	Emp. 493	Est. 493	Average nb of emp. per est.	Nb of est. per 10 000 inhbts	Standard deviational ellipse area	Movement of the centroid's ellipse
2012	3170314	4175	154	27.11	0.49	2998.49 km²	-
2019	3149448	6034	188	32.1	0.6	3624.4 km²	-
Gross change	-20866	+1859	+34	+4.99	+0.11	+635.91 km²	10.68 km
% change	-0.66%	+44.53%	+22.08%	+18.39%	+22.89%	+21.21%	-

Statisticals sources : US Census Bureau (CBP/MSA)

[CSA] Los Angeles-Long Beach, CA



Statistics	Pop.	Emp. 493	Est. 493	Average nb of emp. per est.	Nb of est. per 10 000 inhbts	Standard deviational ellipse area	Movement of the centroid's ellipse
2012	18181675	45623	957	47.67	0.53	3161.46 km²	-
2019	18711436	82543	1267	65.15	0.68	3369.87 km²	-
Gross change	+529761	+36920	+310	+17.48	+0.15	+208.41 km²	2.2 km
% change	+2.91%	+80.92%	+32.39%	+36.66%	+28.64%	+6.59%	-

Statisticals sources : US Census Bureau (CBP/MSA)

Two examples of map boards in the e-book

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- It is crucial to understand the factors that drive the location of logistics facilities in metropolitan areas
- Phenomenon of logistics sprawl or the gradual return of small logistics facilities to the central zones of MSAs.

- The term "logistics sprawl" refers to growth in the number of warehouses on the outskirts of large cities, particularly in peri-urban areas where densities are low, land is available and cheap, and plots are large (Giuliano et al., 2013; Dablanc et al., 2014).

- The lack of regulation in metropolitan margins has encouraged the construction of warehouses in peri-urban areas, fueling a process of logistics sprawl (Dablanc et al., 2014) in which warehouses become concentrated in sparsely populated peri-urban areas (Bowen, 2008; Cidell, 2010).

- The intensity of logistics sprawl varies with the type of warehouse (greater for distribution centers, lower for courier terminals) and according to the type of strategy pursued by logistics actors.

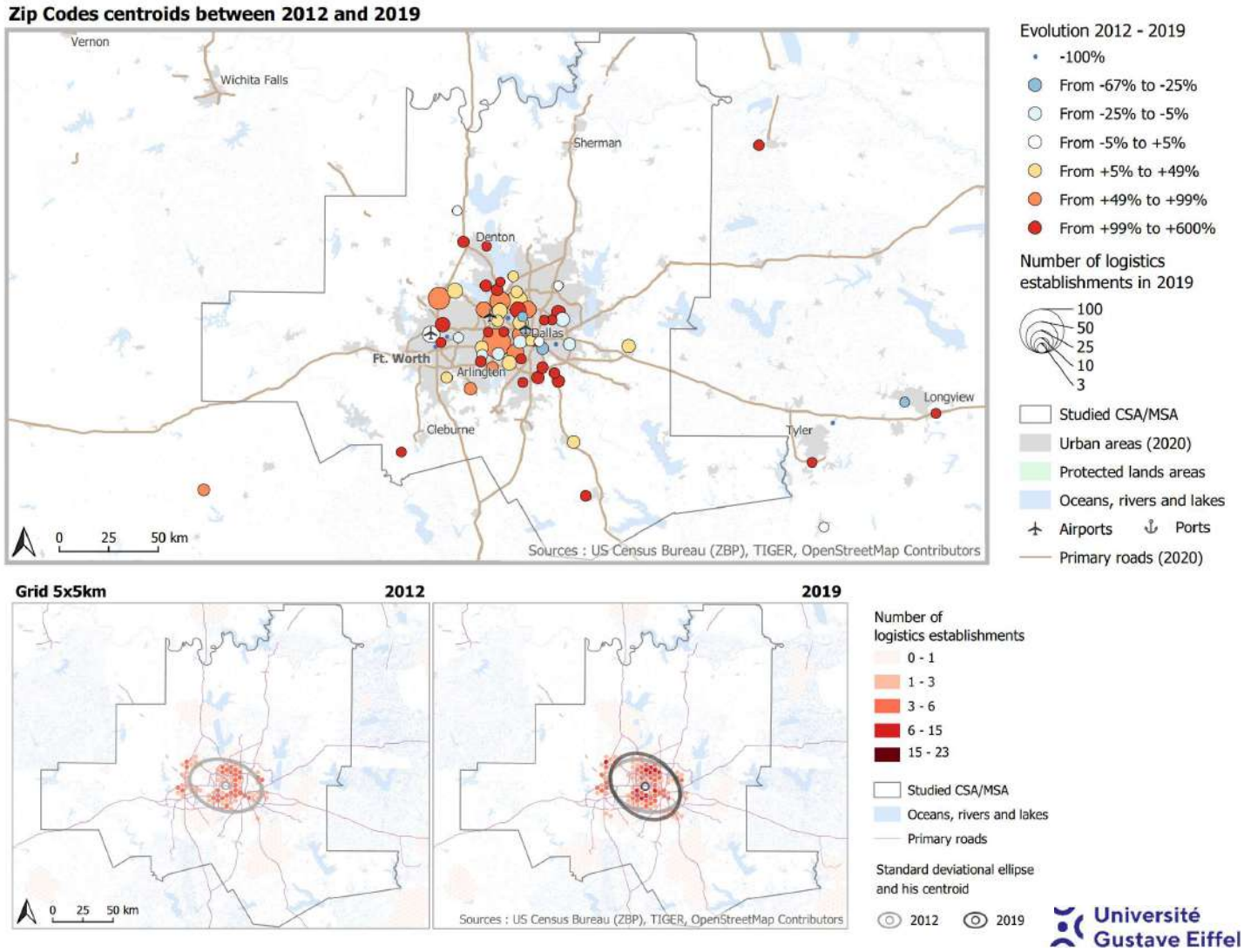
An analysis of warehousing development patterns in four metropolitan areas

(Schorung, Lecourt, 2022 ; Schorung, Dablanc, 2022) :

1) Dallas-Fort Worth-Arlington MSA
2) Houston-The Woodlands-Sugar Lands MSA
(Texas Triangle megaregion)
3) New York-Newark-New Jersey MSA
4) Philadelphia-Camden-Wilmington MSA
(south of the Northeast megaregion)

DALLAS-FORT WORTH-ARLINGTON MSA

- 376 warehouses (2012), 533 (2019) → + 42%
- A significant increase : the northeast part of the metropolitan area, the southeast, and the southwest near Arlington.
- A dual pattern of warehousing development: the reinforcement of logistics establishments in the first peri-urban ring around Dallas and at the same time the rapid development of a second ring on the edges of the Dallas metropolitan area.
- The standard deviational ellipse area from the barycenter increase by almost 20% (2012-2019)



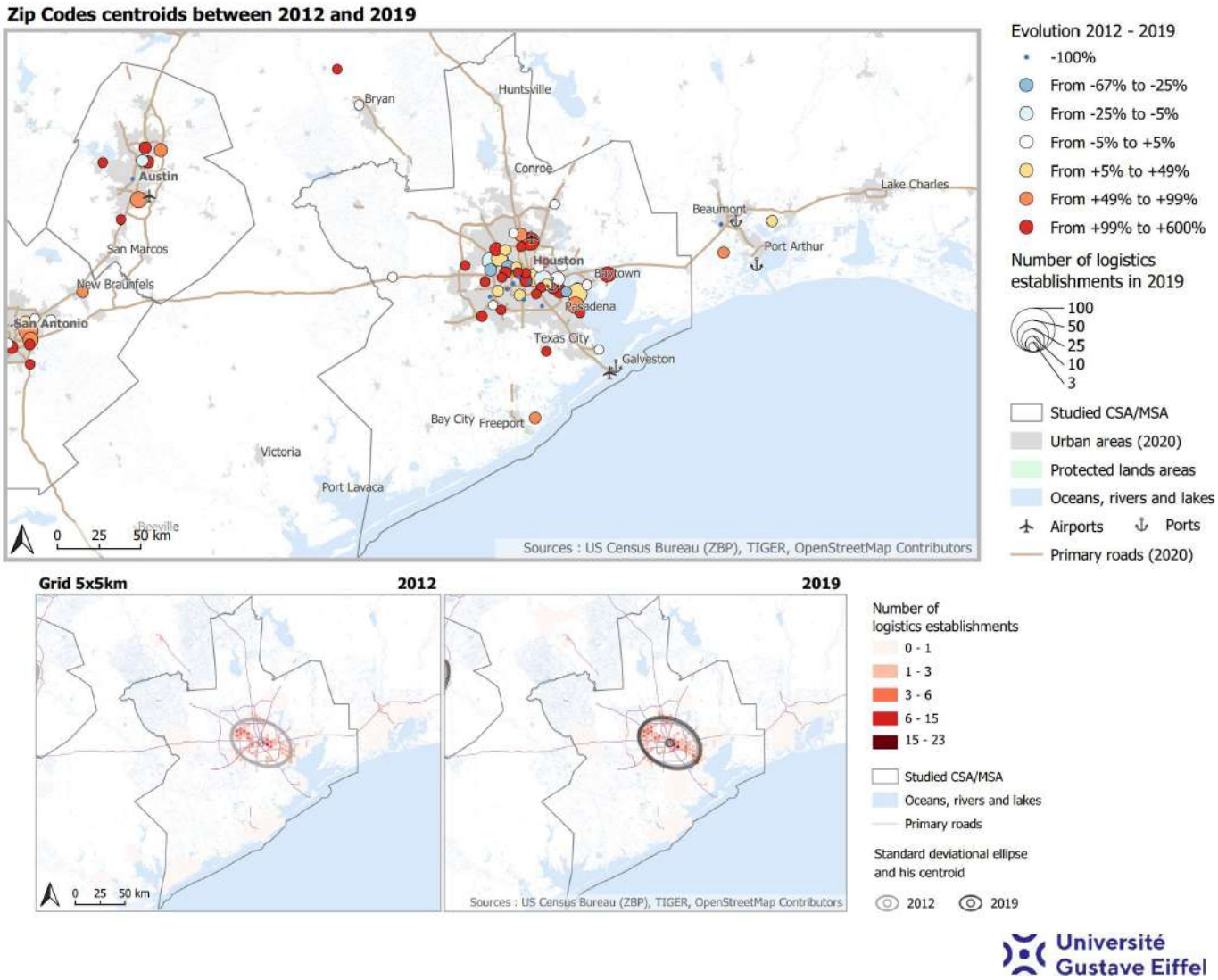
HOUSTON-THE WOODLANDS-SUGAR LANDS MSA

- A fast-growing logistics hub : increase of 29,1% (2012-2019) : 281 warehouses (2012) ; 363 (2019)

- Typical of large Sunbelt cities: strong demographic and economic growth & very significant levels of urban sprawl.

- Three main logistics clusters: a cluster around the Port of Houston to the southeast; a cluster around the international airport to the north; and a west/northwest axis from downtown (Interstate 10, Washington Avenue, Interstate 610, Hempstead Road)

- The standard deviational ellipse area from the barycenter increase by almost 14% (2012-2019)



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NEW YORK-NEWARK-NEW JERSEY CSA

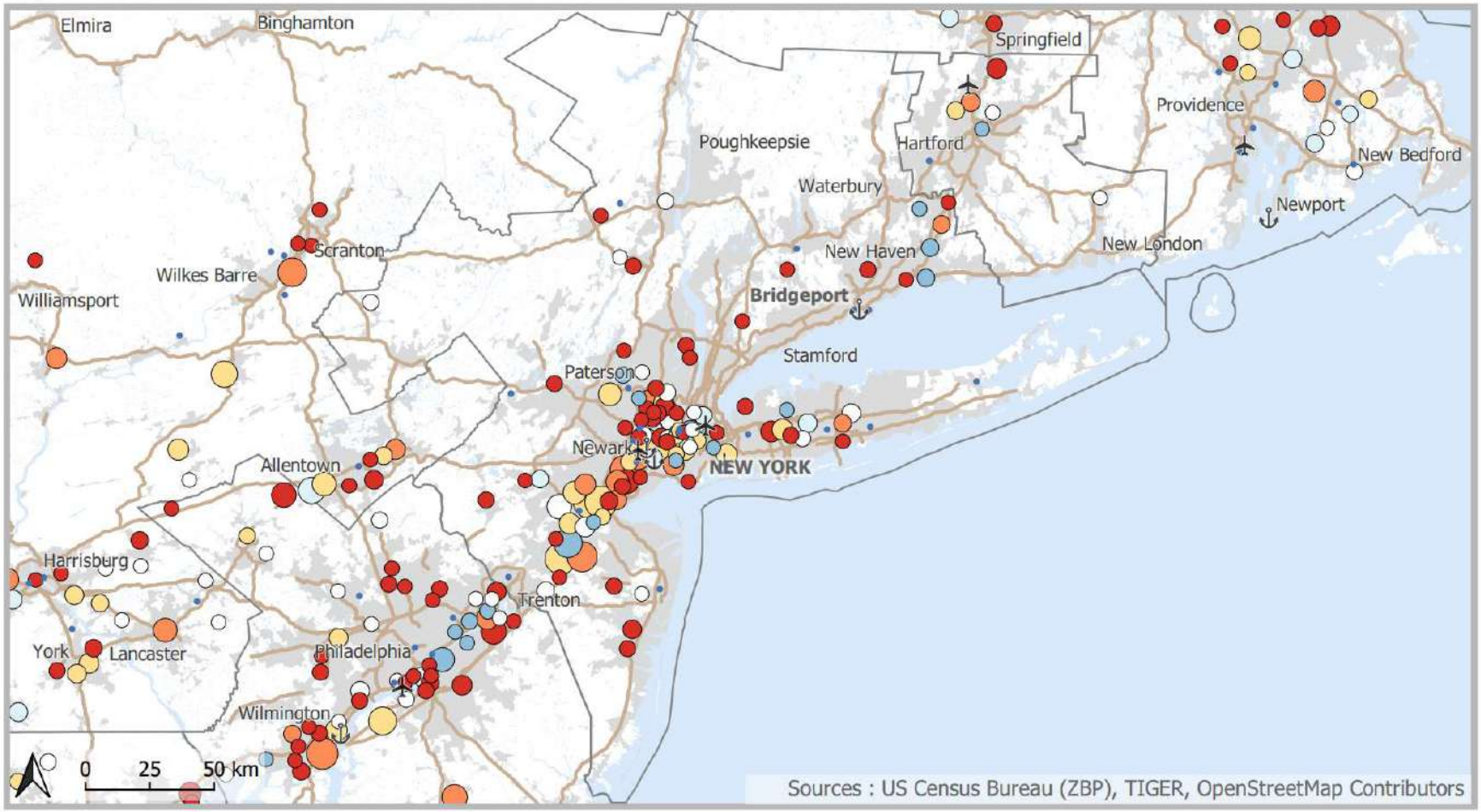
- Major warehousing hub in the US : 844 warehouses (2012), 993 (2019) → 17.6% increase over the seven years. New York's major logistics hub continues to grow, confirming the metropolitan area's role as an international and domestic gateway.

- High concentration of logistics establishments that makes the map harder to read than in the other case studies.

- A distinctive form, essentially confined to the megacity's urban corridor.
- Why ? Major transportation infrastructures (Port of New York-New Jersey, Interstates, Newark and La Guardia airports) & the limited number of available parcels of land in a highly urbanized region

- The standard deviational ellipse area (from the barycenter) was 4906.91 km² in 2019 → a **decrease** of 7.25% between 2012 and 2019

Zip Codes centroids between 2012 and 2019



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PHILADELPHIA-CAMDEN-WILMINGTON CSA

- The number of warehouses in the Philadelphia-Camden-Wilmington CSA grew significantly between 2012 and 2019, from 324 logistics facilities in 2012 to 395 in 2019, an increase of 22 percent.

- As a result, the number of warehouses per 10,000 residents increased by 20.4% from 2012 (0.45/10,000 residents) to 2019 (0.55/10,000 residents). The location patterns of the logistics warehouses differ significantly from those in the Dallas-Fort Worth CSA.

- Most warehouses follow the Megalopolis urban corridor along a longitudinal northeast/southeast axis. It is within this urban corridor that major highway and rail transportation infrastructure, as well as major ports and airports, are concentrated.

- Confirm the major trends in the logistics real estate market, in particular a division in this market between warehouses located on the periphery and warehouses located near the center.

- Standard deviational ellipse area (from the barycenter) was calculated for both years:

- in 2012 the standard deviational ellipse area from the barycenter was 4763.58 km²;
- in 2019, this area was 5567.76 km².

The standard deviational ellipse area increased by 16.8% between 2012 and 2019.

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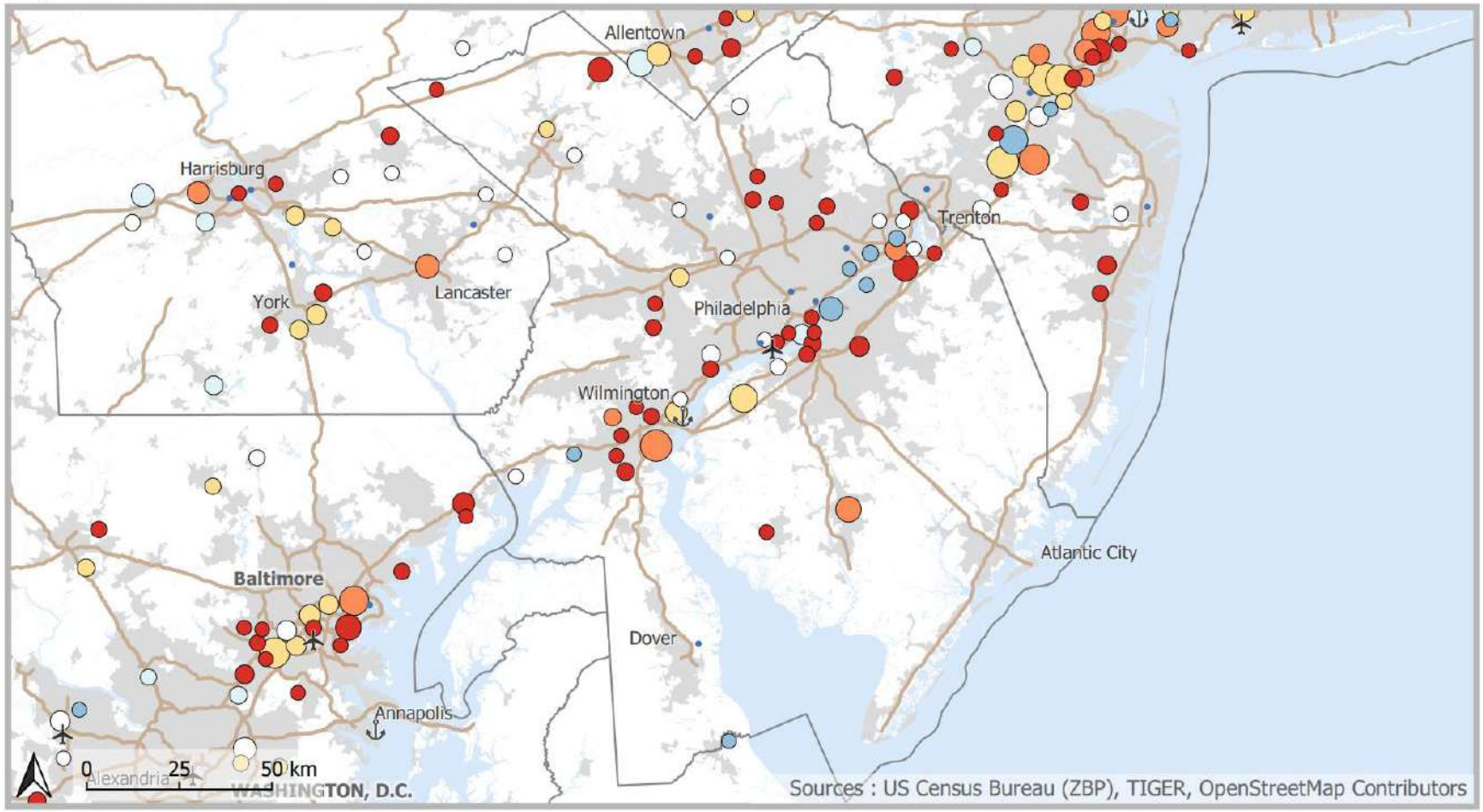
Zip Codes centroids between 2012 and 2019



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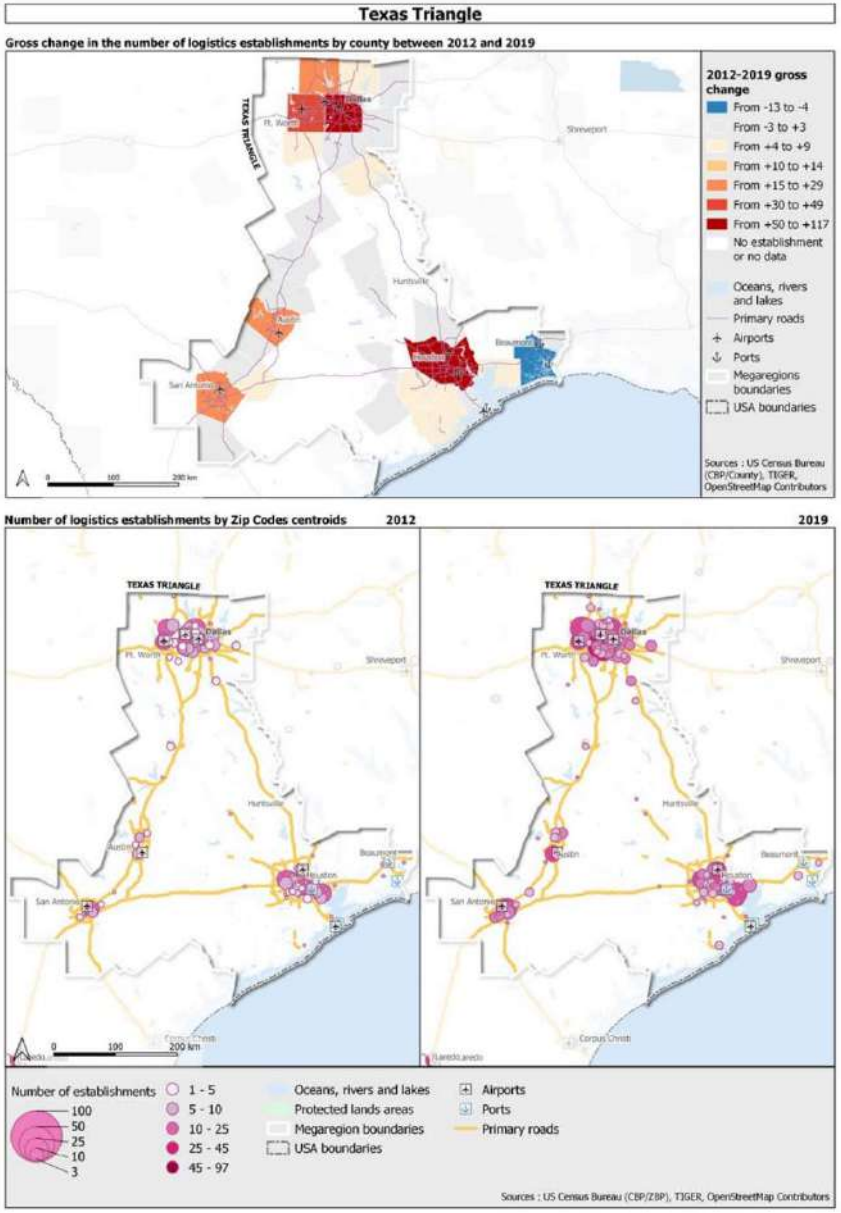

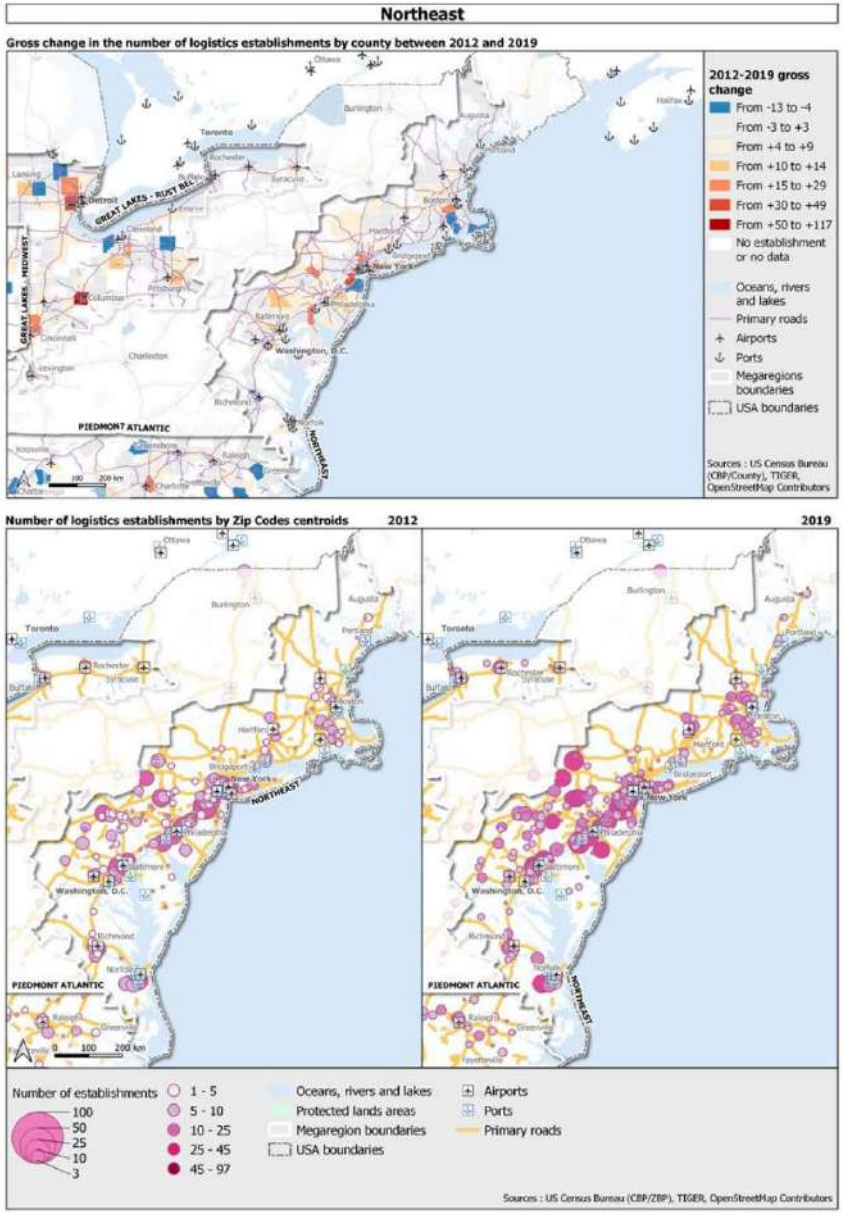

A look at the megaregion scale: logistics clusters

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Conclusions and discussions

1) The number of warehouse establishments in the four metropolitan areas analyzed in this study grew rapidly between 2012 and 2019.

2) There was an increase in warehousing in the Houston and the Dallas areas, which have experienced steady logistics sprawl. The Dallas area is a typical case of a booming warehousing hub (+41.7% between 2012 and 2019) and of a sprawling metropolitan area.

3) The Houston-The Woodlands-Sugar Lands CSA appears to be following the same path. This area has also experienced strong growth in numbers of logistics establishments (+29.1% between 2012 and 2019) but has undergone less sprawl than the Dallas area.

4) Significant clustering of warehouses in theses areas → proximity of major infrastructures (Port of Houston, Houston International Airport) and interstates/highways.

Conclusions and discussions

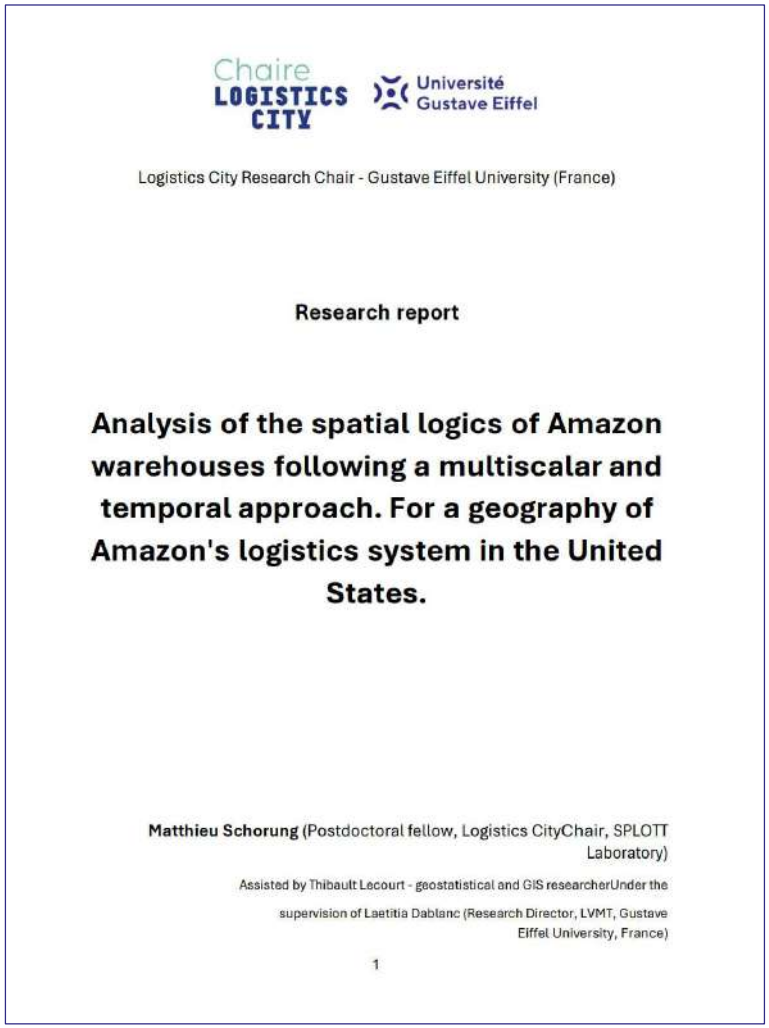
5) The two other case studies (Philadelphia-Camden-Wilmington CSA and New York-Newark-New Jersey CSA) reveal quite different trajectories.

Especially, the New York-Newark-New Jersey metropolitan area has experienced moderate growth in the number of logistics establishments (+17.6% between 2012 and 2019) but this growth occurred in an already mature and well-developed logistics market (993 warehouses in 2019).

This is the only one of the four case studies to show shrinkage in its standard deviational ellipse area and reduced sprawl in its warehousing sector.

This present research adds new metropolitan areas to those where the phenomenon of logistics sprawl has been analyzed. Logistics sprawl has been confirmed for six metropolitan areas in North America and Europe (Atlanta, Los Angeles, Phoenix, Chicago, Toronto, and Paris) (Dablanc et al., 2014; Heitz and Dablanc, 2015; Woudsma et al., 2016; Dubie et al., 2020) and has not been confirmed for one metropolitan area (Seattle) (Dablanc et al., 2014).

2021-2022 : Analysis of spatial patterns of Amazon warehouses



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Logistics City Research Chair - Gustave Eiffel University (France)

Research report

Analysis of the spatial logics of Amazon warehouses following a multiscalar and temporal approach. For a geography of Amazon's logistics system in the United States.

Matthieu Schorung (Postdoctoral fellow, Logistics CityChair, SPLOTT Laboratory)

Assisted by Thibault Lecourt - geostatistical and GIS researcherUnder the supervision of Laetitia Dablanc (Research Director, LVMT, Gustave Eiffel University, France)

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https://halshs.archives-ouvertes.fr/halshs-03489397

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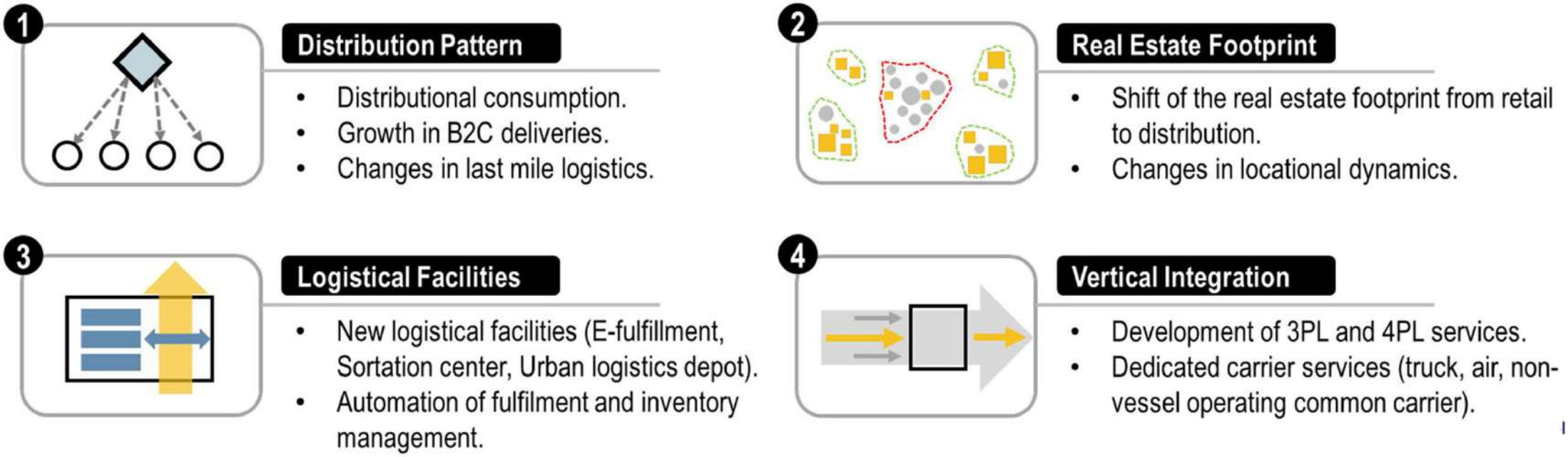
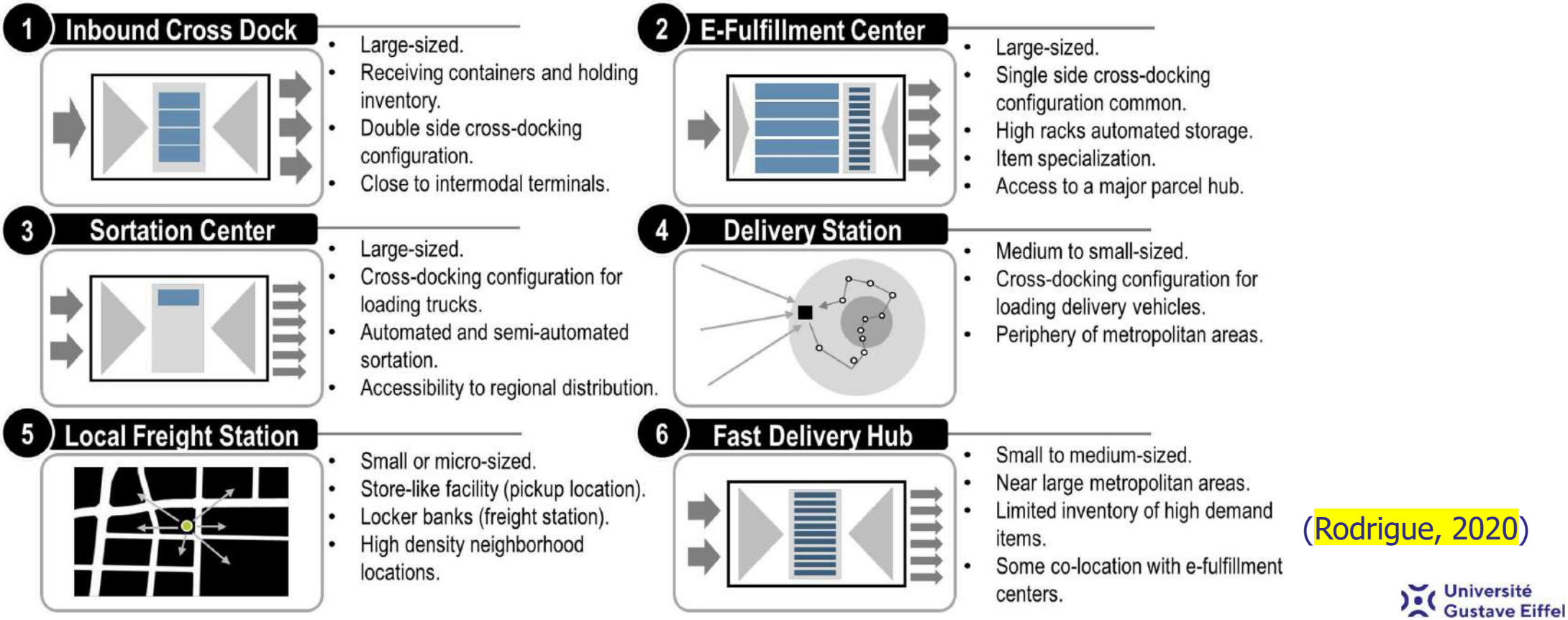
Jean-Paul Rodrigue (2020) has identified four major effects of e-commerce on the distribution of goods:
-effect on distribution structures (growth of B2C deliveries)
-effect on the real estate market (decrease in retail real estate and land footprint and increase in warehouse footprint)
-effect on logistics facilities (development of new types of warehouses - e-fulfillment centers, sortation centers, urban logistics centers)
-effect on business strategies (vertical integration, development of 3PL and 4PL services or own transport services by e-commerce pure players).

Rodrigue, J. P. (2020). The distribution network of Amazon and the footprint of freight digitalization. Journal of Transport Geography, 88.



E-commerce players are seeking to maximize access to urban markets and minimize delivery times by relying on significant economies of scale and density, particularly for their distribution centers (Houde *et al.*, 2017), developing their own urban logistics strategies for last-mile deliveries (Browne *et al.*, 2019) and promoting this vertical integration, of which Amazon is a pioneer company (Lieb and Leib, 2016).



(Rodrigue, 2020)

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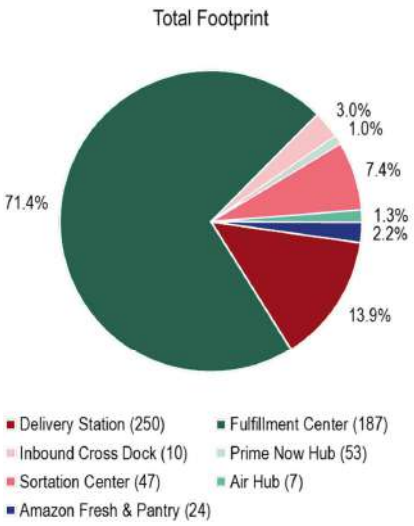
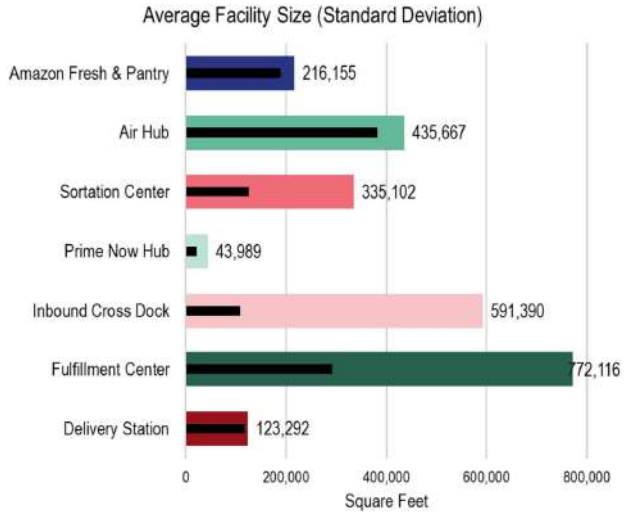
For the United States, the database lists a total of 302.6 million *square feet* of logistics equipment and warehouses, or 28.1 million square meters, and more than 144.6 million *square feet* of projects, or 13.4 million square meters planned (2021-2024).

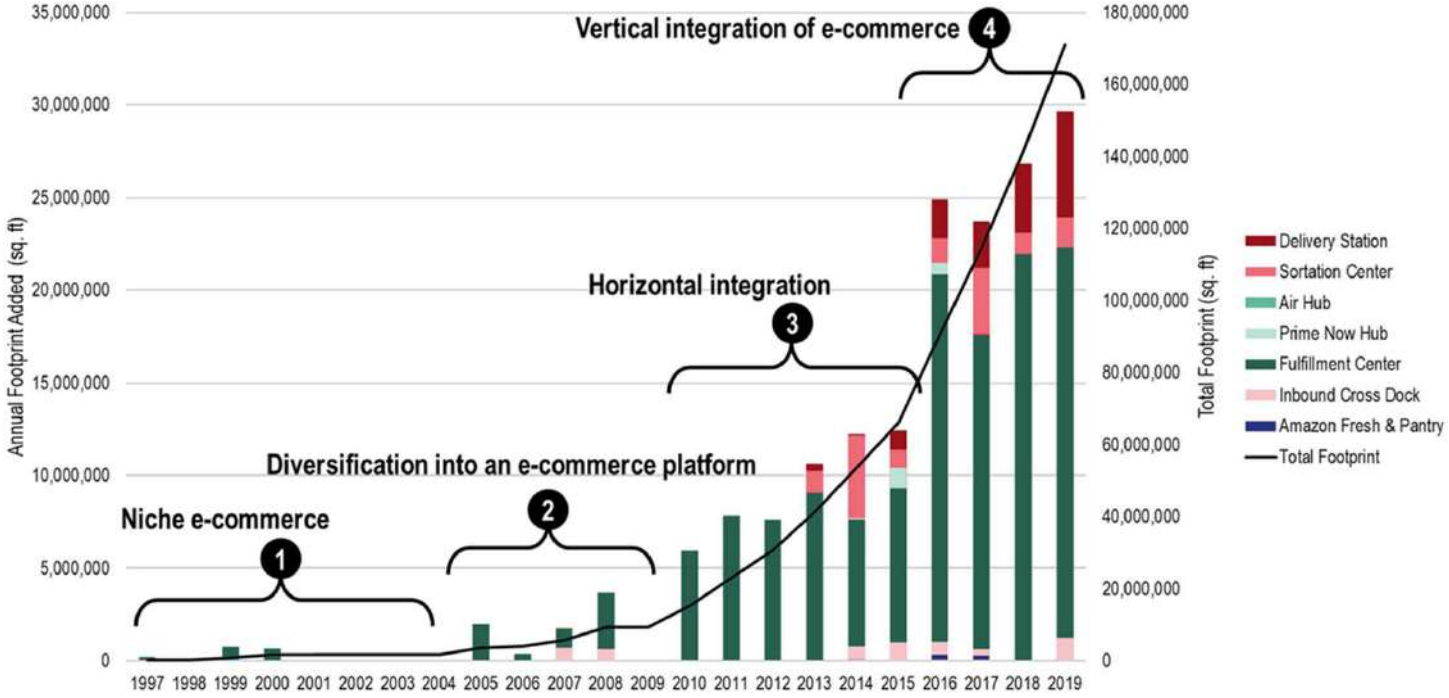
Amazon warehouses are listed from 9 warehouse categories:

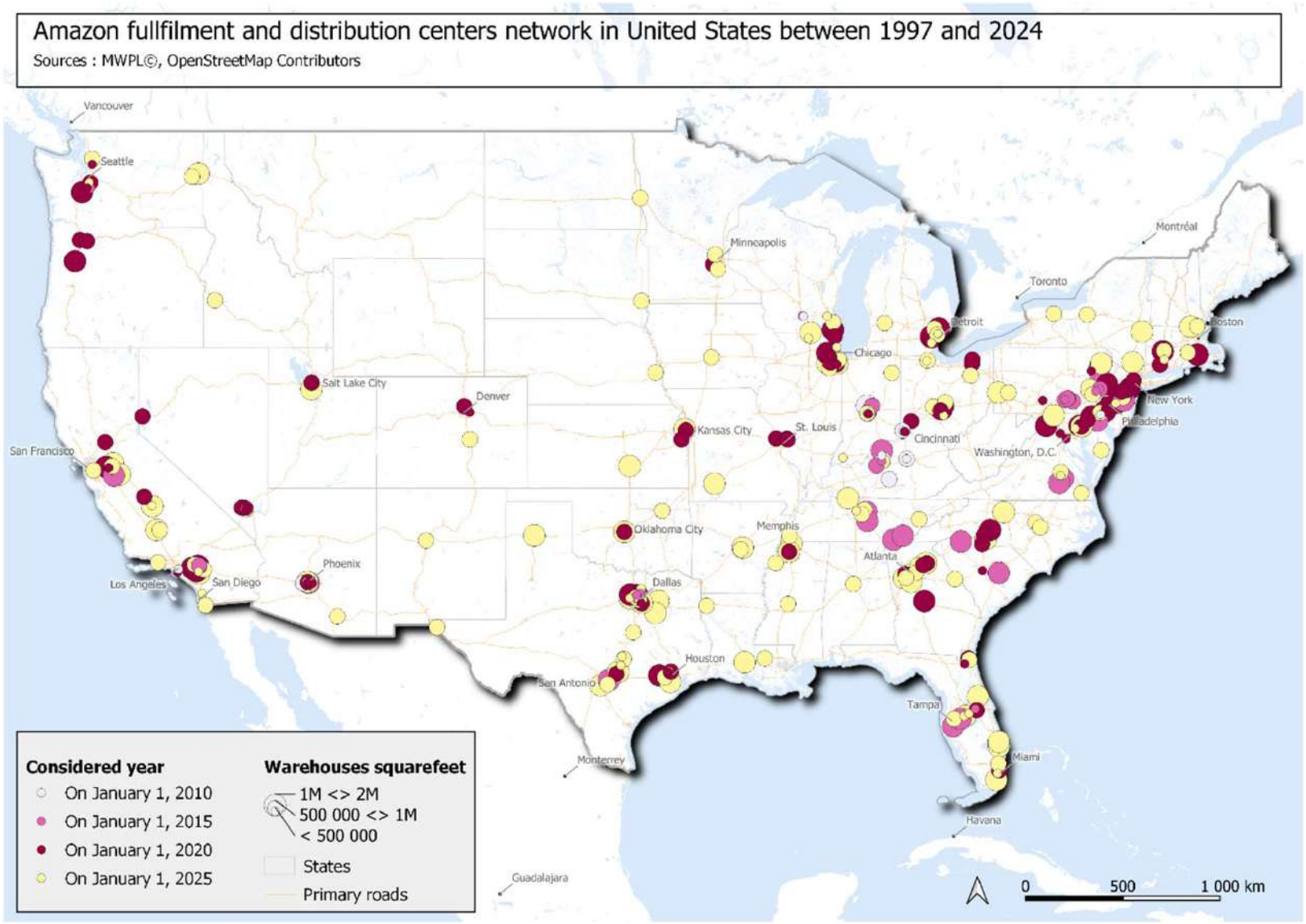
- *Fulfillment and Distribution Centers*, which are large distribution centers that concentrate consumers' online orders, generally ranging from 500,000 to 2 million *square feet* for the largest centers.
- *Pantry/Fresh Food Fulfillment Centers* correspond to the same type of warehouse as the previous category, i.e. a large distribution center, but specialized in the management of orders for perishable and/or fresh food products as well as cleaning products.
- *Whole Foods Retail Grocery Delivery Centers* fit a very specific category with a limited number of facilities, the stores of the Whole Foods chain acquired by Amazon in June 2017 for $13.7 billion.
- *Prime Now Hubs* are local delivery *hubs* dedicated to express deliveries and Amazon's *Prime Now* premium service. These urban *hubs* respond to requests for very fast deliveries, less than 48 hours, and for instant deliveries.
- *Inbound Cross Dock Centers* correspond to processing centers for maritime containers loaded with goods imported into the United States, generally located near major multimodal *hubs* (ports, logistics platforms, rail *hubs*):
- *Regional Sortation Centers* are the intermediate regional links between several large distribution centers. They are used to sort packages for a given region from multiple Amazon distribution centers.
- *Delivery Stations (Packages)* and *Delivery Stations (Heavy/Bulky)* are two categories that represent small last-mile delivery centers that serve either as distribution locations for delivery drivers picking up packages or as final delivery locations for orders that are not intended for home delivery.
- *Air Gateways* correspond to facilities near or within an airport space that handle the cargo pallets of air cargo services from or to major distribution centers and large pooling centers.





Logistics footprint and average size of Amazon logistics facilities, mid 2020 (Rodrigue, 2020).





Evolution over time (at four selected time steps) of fulfillment and distribution centers all categories combined across the United States.

(Schorung, Lecourt, 2022)

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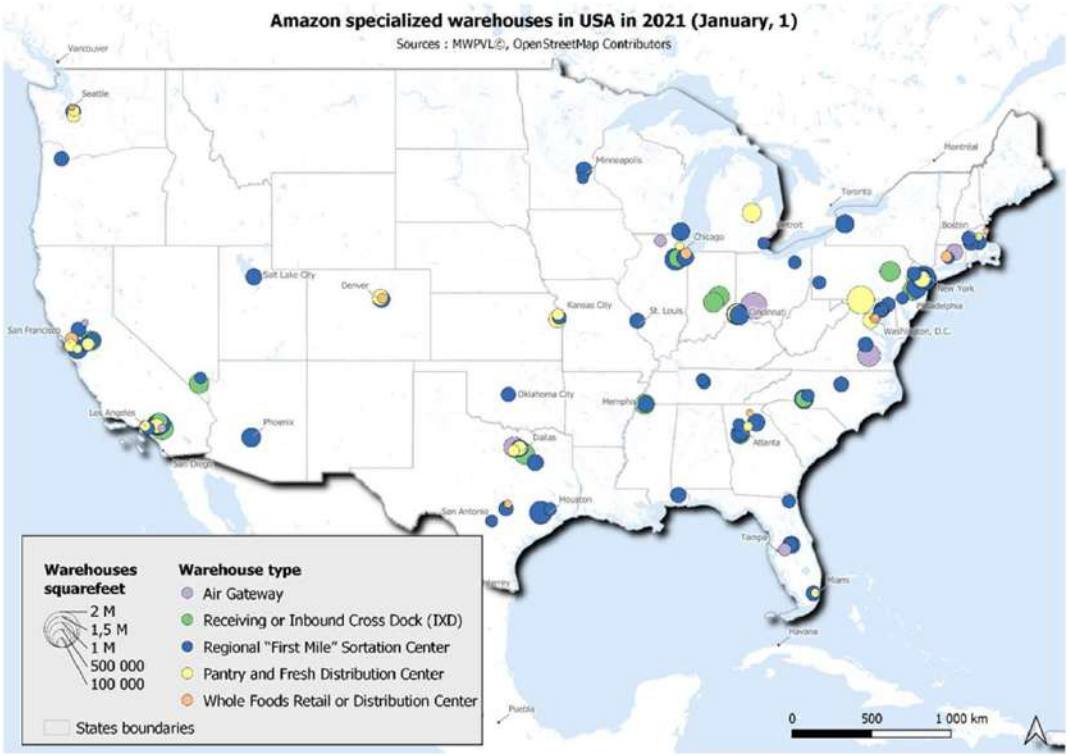
Three remarks can be made on the geography of Amazon fulfillment centers:

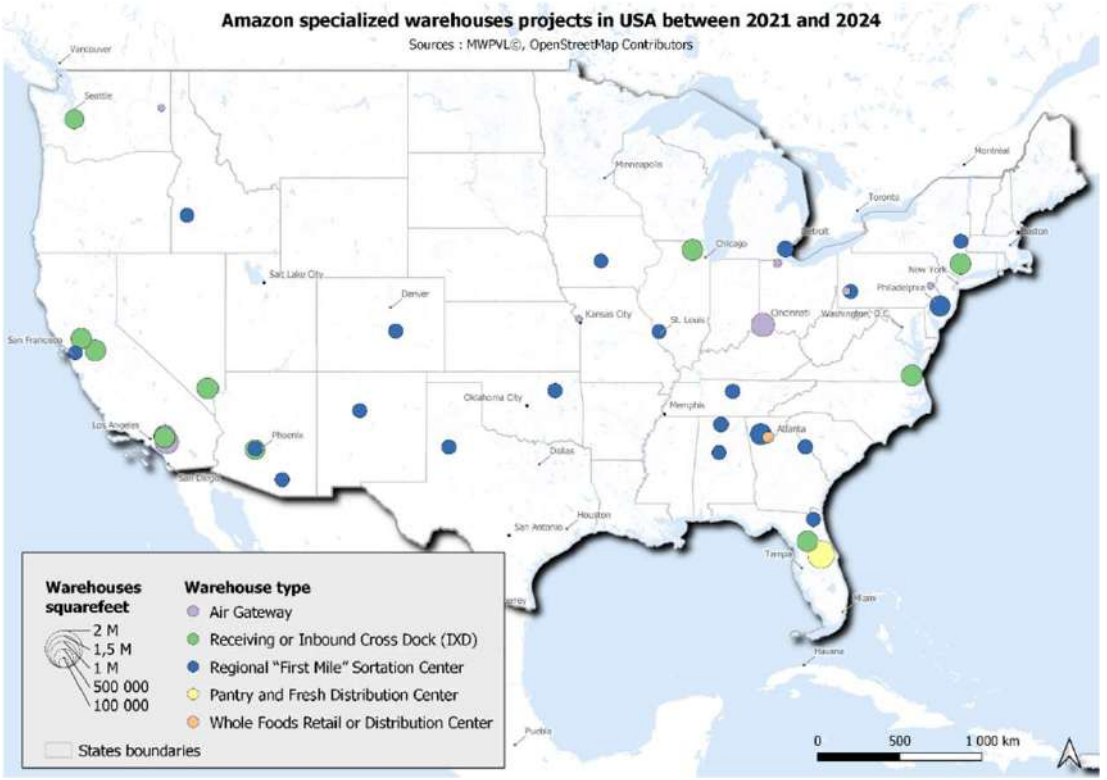
- Until 2015, the establishment of large distribution centers is very selective geographically, being concentrated in certain major economic regions of the country (California, Atlanta region, Northeast region). It is interesting to note that other major regions and metropolises of national importance are not concerned by the establishment of distribution centers before 2015 or else by a distribution center of modest size (Texas metropolises, Chicago, St. Louis, Miami, Detroit, Boston). This may reflect Amazon's strategy of locating in a few key areas with a mature or strong e-commerce market and favoring a location near major "gateways", as illustrated by the situation in the East-south around Atlanta.

- From 2015 to 2020, Amazon's spatial presence is expanding very significantly, reflecting the massification of its activities and its dominant position in the e- commerce sector. All major metropolitan areas now have one or more large distribution centers, forming clusters of warehouses in the most urbanized regions (North East, Great Lakes region, Atlantic Piedmont, Texas Triangle, California). In addition, previously ignored inland regions and mid-sized cities are seeing the arrival of fulfillment centers (Salt Lake City, Denver, Las Vegas, Phoenix, Kansas City, Oklahoma City, Portland, Minneapolis etc.). This global evolution signals the company's horizontal integration strategy during the 2010s aimed at economies of scale and cost reduction through the multiplication of warehouses and the development of a tight network of large distribution centers and specialized warehouses.

- The projects listed from 2021 to the end of 2024 reflect a threefold strategy of the company:

    - **continued horizontal integration** with a sharp increase in the number of distribution centers in the United States;
    - **tightening of the network in the best-endowed megaregions** (Great Lakes, Northeast, Texas Triangle, California, Florida, Atlantic Piedmont,Northwest region);
    - **the deployment of an interstitial strategy** aimed at filling "the gaps" in less densely populated territories with projects planned in medium- sized cities and in states or regions that do not have a major metropolis (Idaho, North Dakota, South Dakota, New Mexico) as well as in smaller cities in states that already have them.





(Schorung, Lecourt, 2022)

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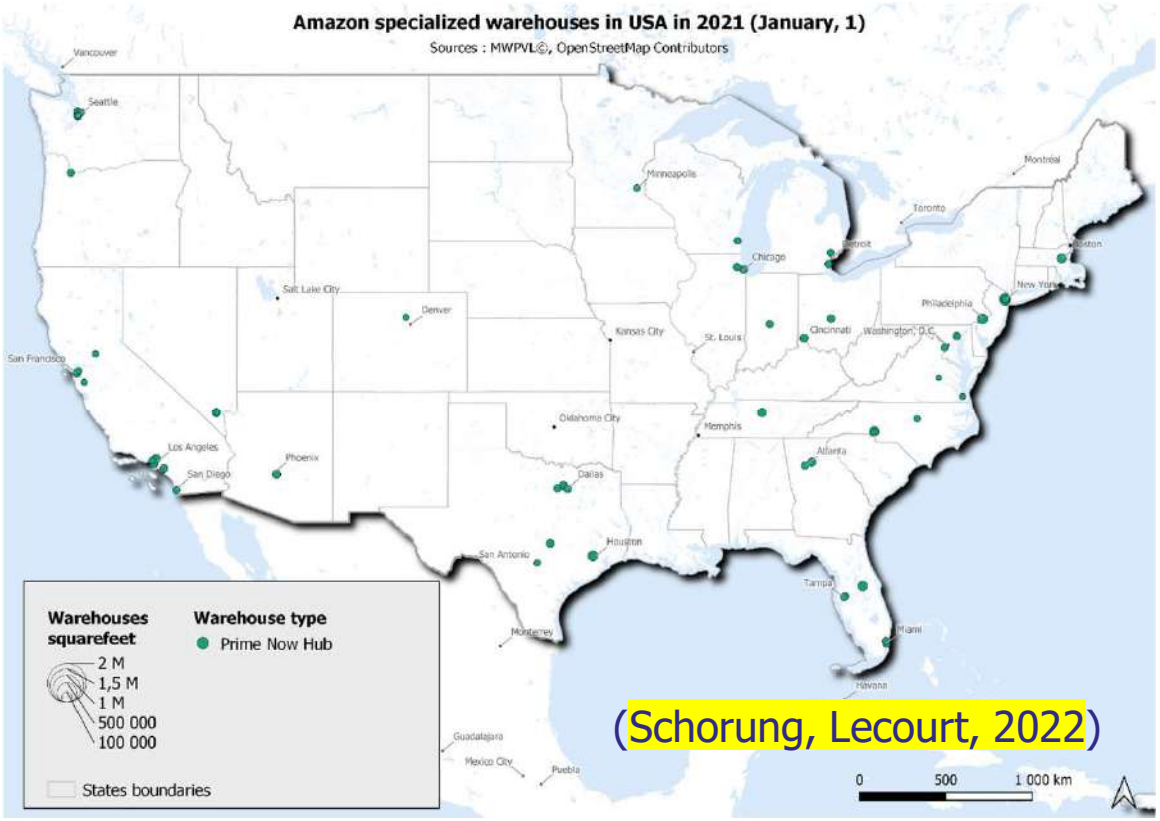
Amazon and its last mile strategy and fast or instant deliveries

Location of small urban Amazon warehouses dedicated to *Prime Now* service as of January 1, 2021.



(Schorung, Lecourt, 2022)

For several years, Amazon has been offering fast (less than 48 hours), very fast (less than 24 hours) and even instantant (within one day) delivery services for certain types of products.

These new services offered to consumers require, in addition to the logistics structures already mentioned, adapted and dedicated logistics equipment, in particular for the Prime Now paid service. In line with its global strategy of horizontal and vertical integration, the company is developing small urban warehouses that enable it to control the various links in the logistics chain, particularly the last mile.

These urban warehouses for Prime Now are small compared to other warehouse categories and still have a spatial coverage that is fairly limited to the main metropolitan markets where demand for this type of delivery is highest - there are several warehouses in the metropolitan areas of Los Angeles, San Francisco, Dallas or New York City.

In 2016, 44.8 million U.S. households signed up for Amazon Prime. That number is expected to grow to 81.4 million by 2021 and 90.2 million by 2025, according to projections by consulting firm Insider Intelligence.

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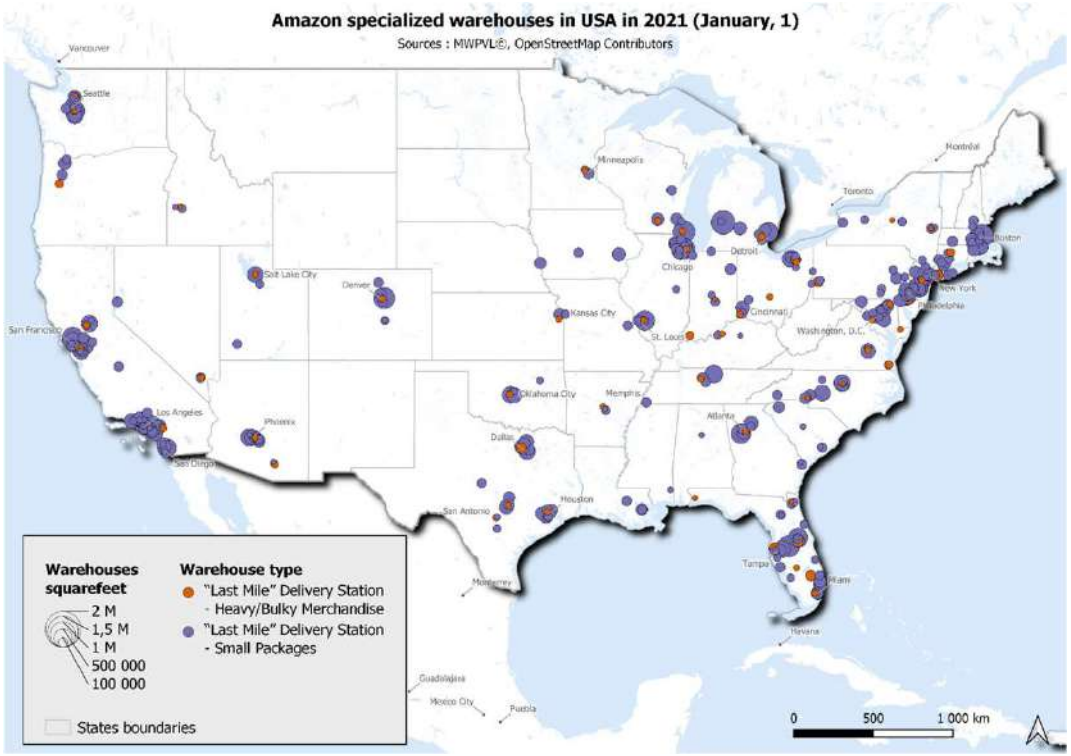
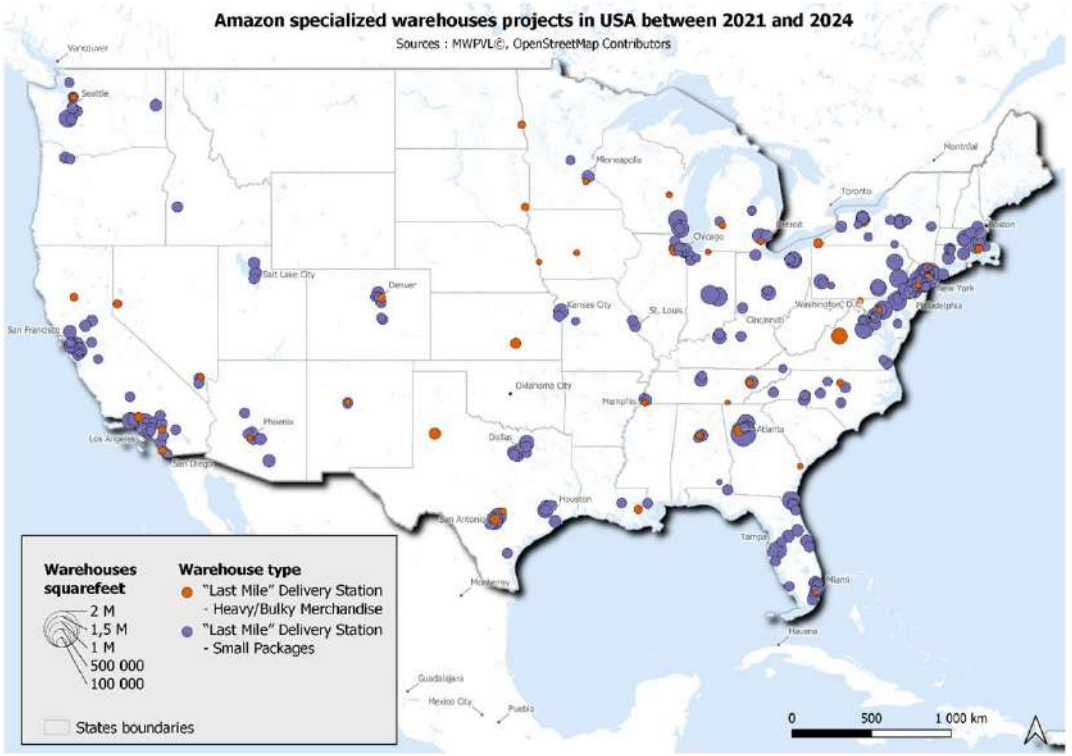
Location of last mile delivery sites in the United States as of January 1, 2021.



Location of planned "last mile station" projects in the United States between 2021 and 2024.



(Schorung, Lecourt, 2022)

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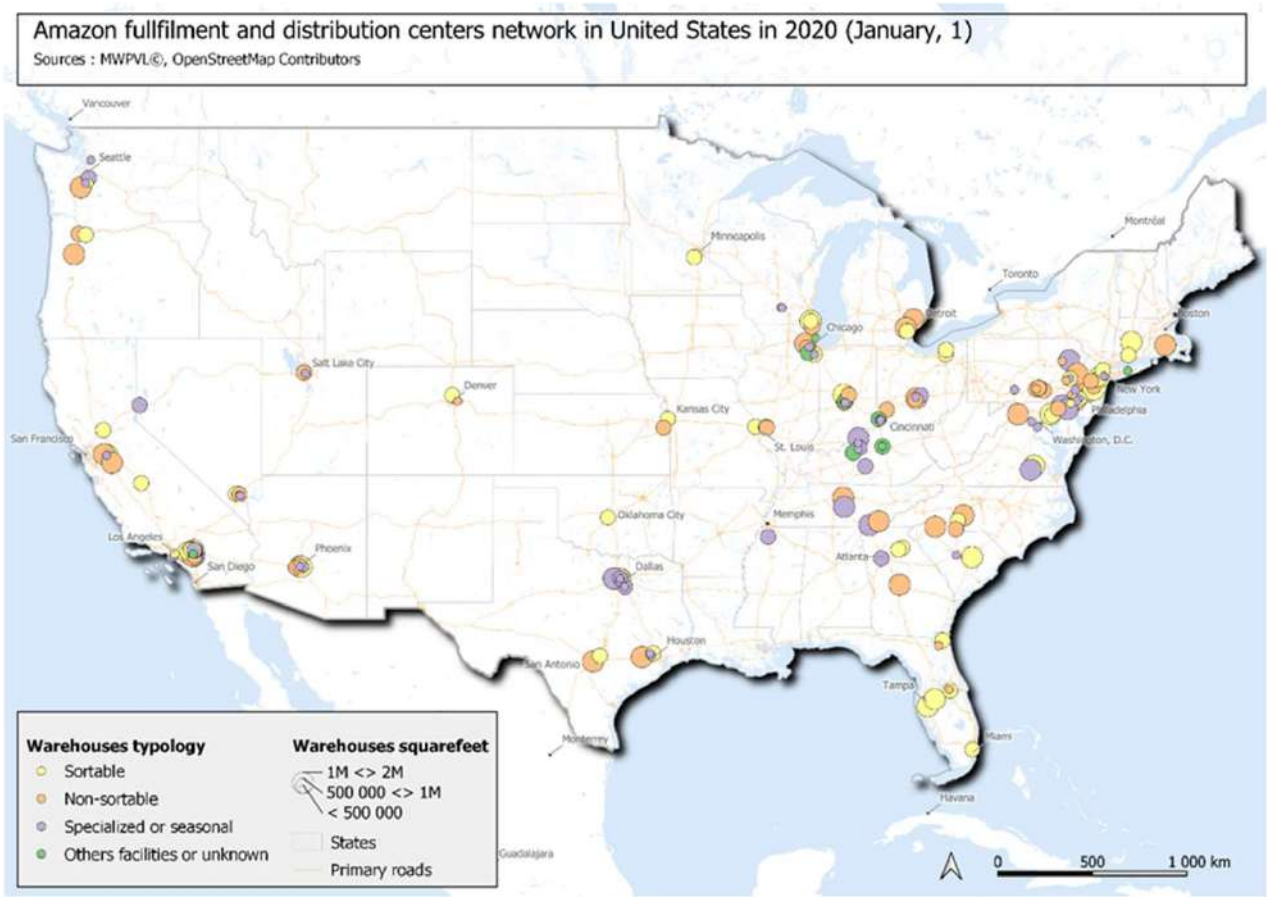
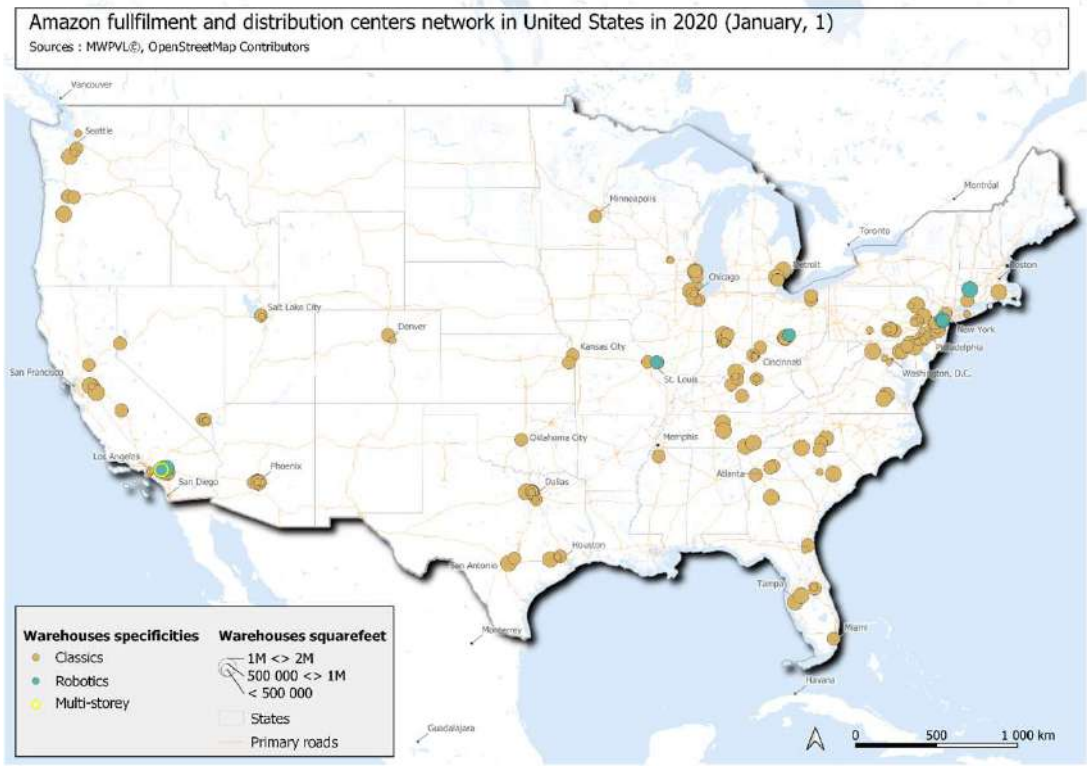
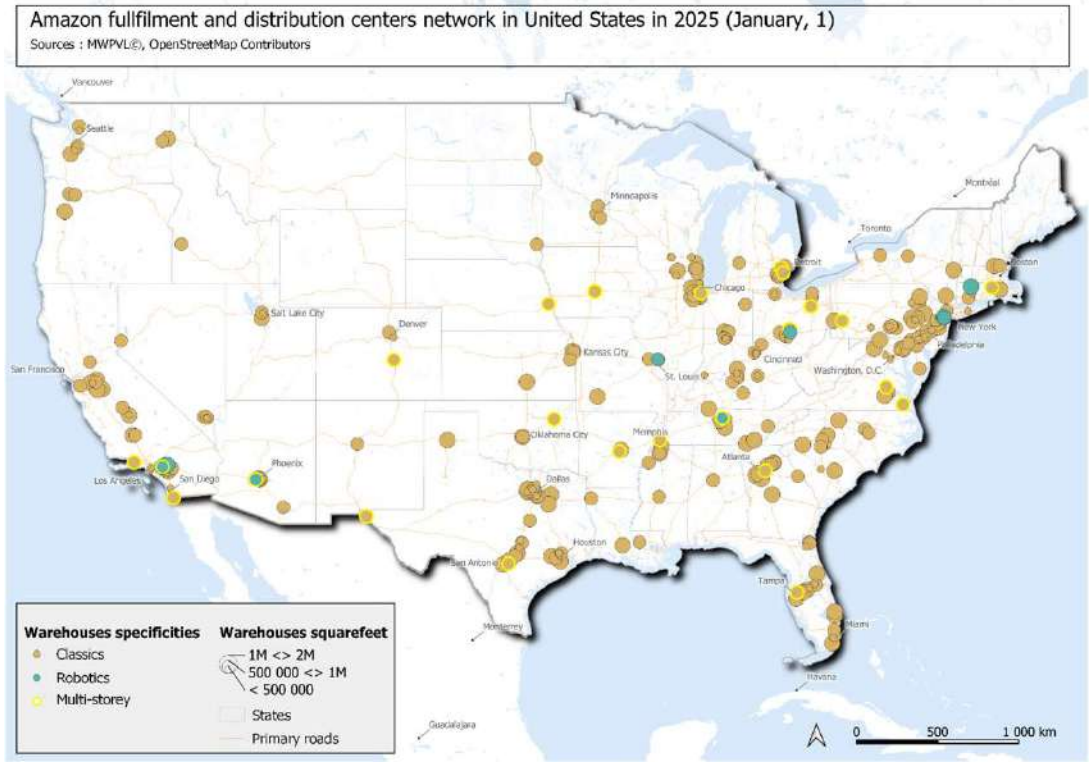
The company Amazon has engaged from 2014-2015 in a vertical integration strategy to control several components of the global supply chain, from importing goods, to chartering air assets for distribution over continental distances to the last mile.

This diversification strategy is represented in this map in which the distribution centers are listed according to their main characteristic specified in the database: "sortable" (for sortable goods that can be shipped in parcels), "non-sortable" (for non-sortable goods that cannot be shipped in parcels), "specialized or seasonal" (for warehouses supporting a specific type of goods or warehouses that are only used for particular periods such as Christmas or Thanksgiving), "other or unknown" (for warehouses that do not have a specific characteristic mentioned).



In addition, the company has embarked on a strategy of diversifying its logistics equipment to incorporate the latest innovations in the field of warehousing (multi-storey warehouses, robotized warehouses)





(Schorung, Lecourt, 2022)

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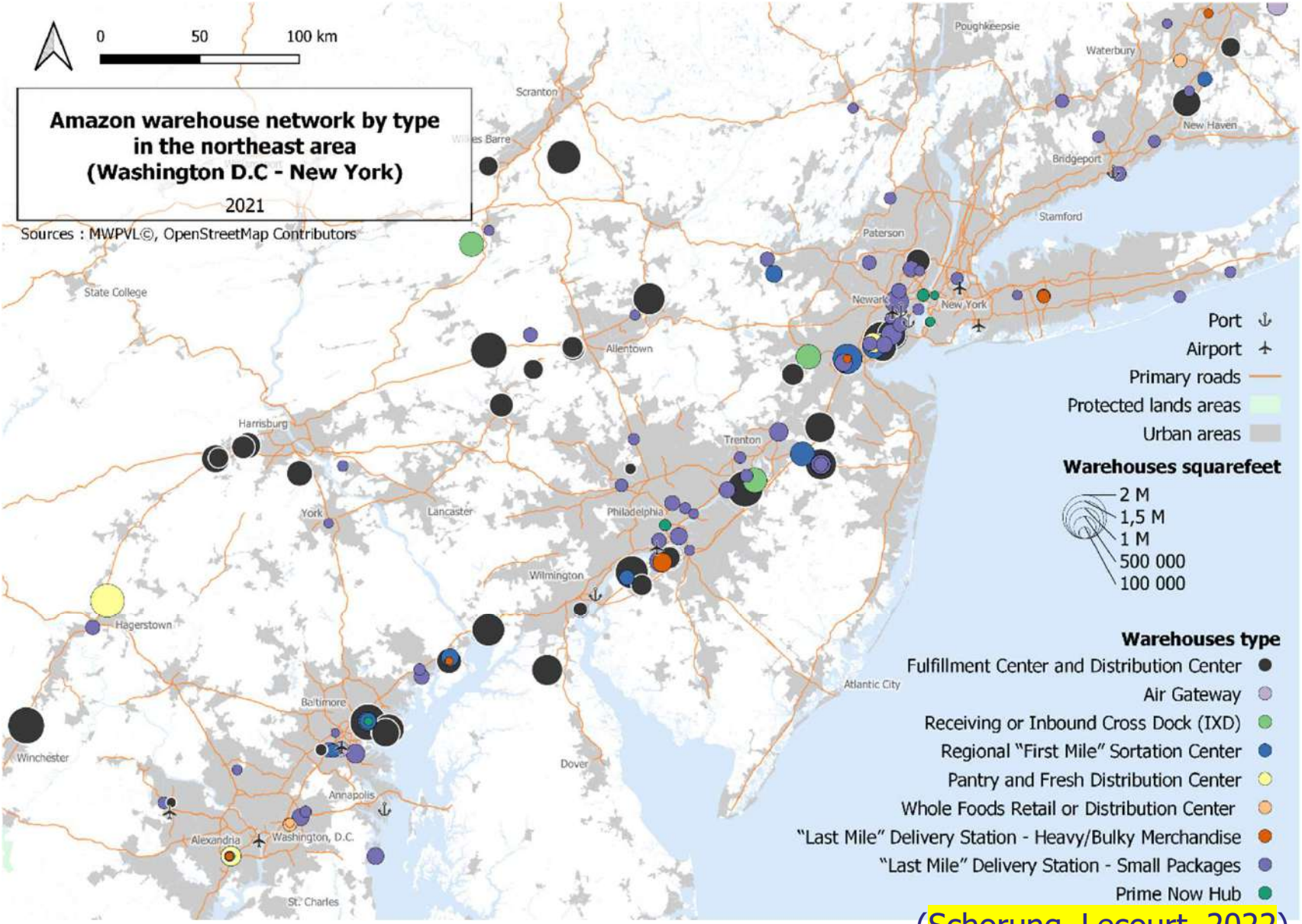
A regional and metropolitan approach

Amazon's Northeast (Washington D.C.-New York City) logistics network in 2021



(Schorung, Lecourt, 2022)

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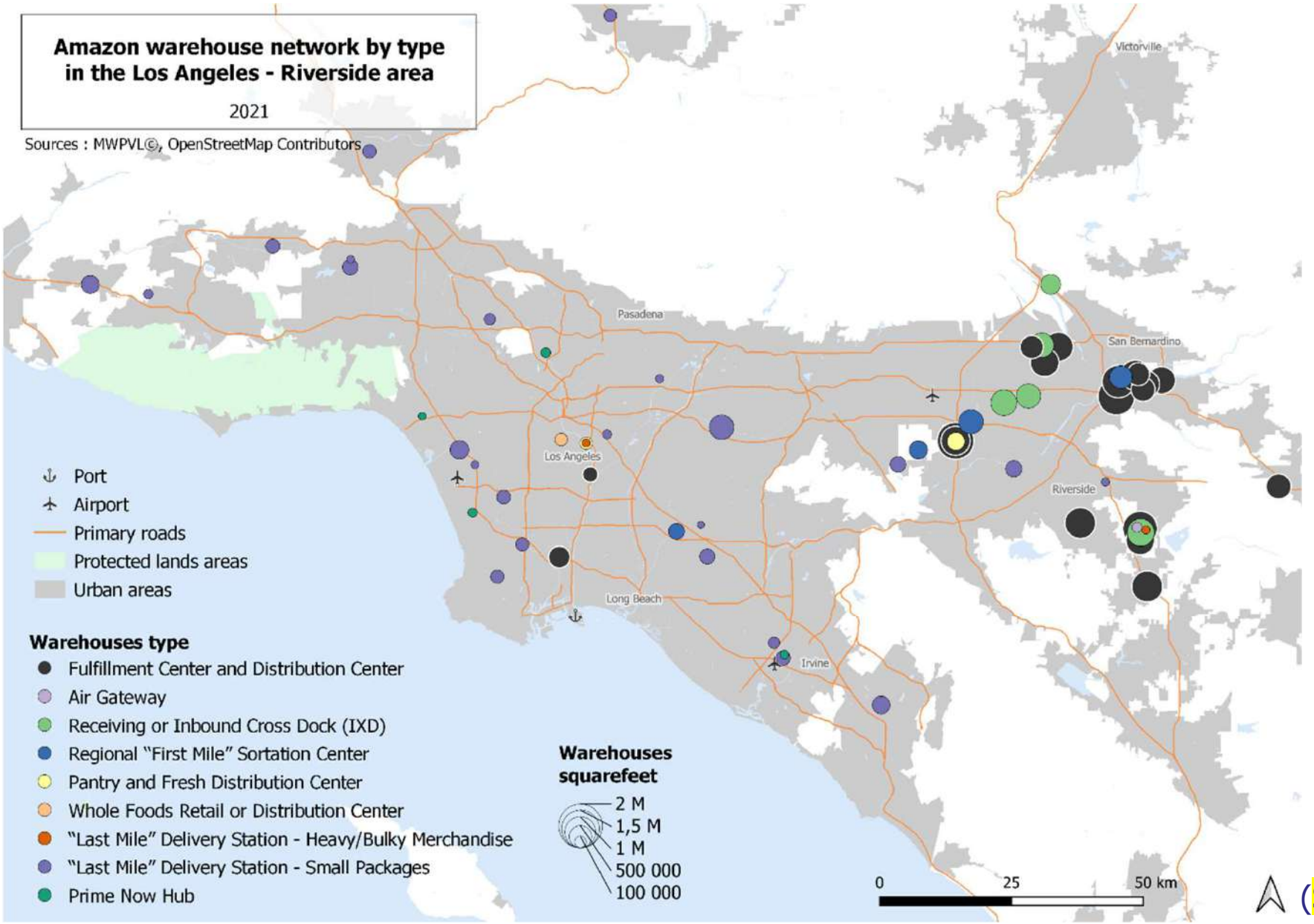
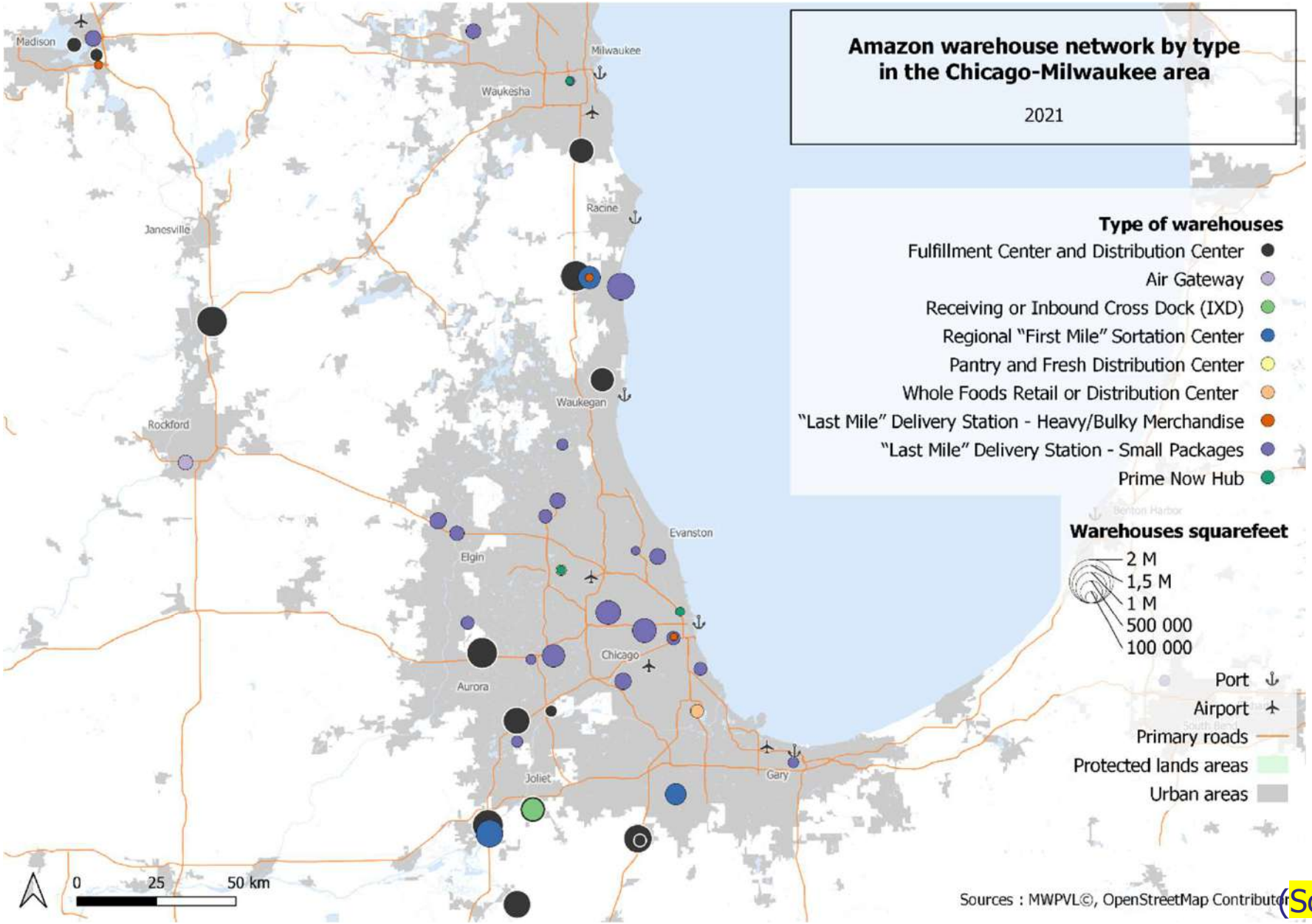


Amazon's logistics network in the Los Angeles metropolitan area (Los Angeles-San Bernardino-Riverside) in 2021

(Schorung, Lecourt, 2022)



Amazon's logistics system network in the Chicago metropolitan area in 2021

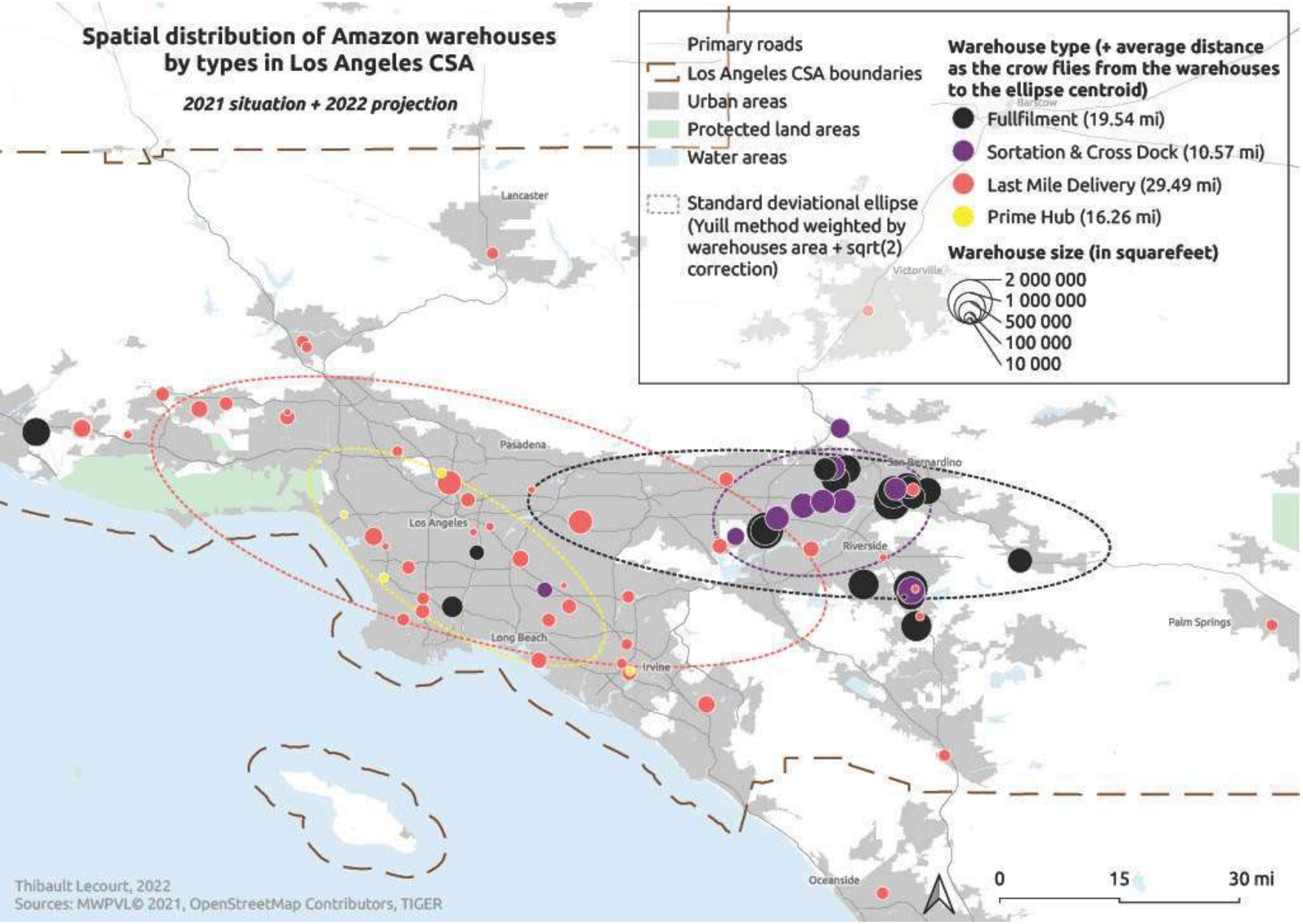
(Schorung, Lecourt, 2022)

Main processes to remember :

- process specialization of logistics facilities to support the company's vertical integration strategy (distribution centers and local delivery points for products that can be packaged and for products that cannot, robotized warehouses, multi-story warehouses, airport hubs specific to Amazon, small logistics spaces for the Prime Now service or to ensure the last mile);
- process of diversification of facilities, both in terms of warehouse size and location (location in dense urban areas or in dense peri-urban areas, location in outlying areas or even on the bangs of metropolitan areas);
- process of dualisation of logistics markets and the warehousing sector, with the largest peripheral warehouses (fulfillment centers, inbound cross docks, regional sortation centers) on the one hand, and intermediate or small urban logistics areas (last mile delivery stations, Prime Now hubs) on the other;
- process of taking direct control of the various links in the global logistics chain, allowing control of flows and distribution routes and less dependence on third-party carriers or shippers, particularly for long and medium distance operations.

- a dual spatial logic of networking and concentration of logistics warehouses, with the development of clusters of warehouses around major transport infrastructures (motorway interchanges, regional or international airports, ports, rail freight network) and the creation of a more or less narrow newtork of warehouses, particularly in urban logistics areas;

- a dual spatial logic that focuses on the outskirts of metropolitan areas and on dense urban centers. This analysis confirms the emergence of a dual logistics real estate market with, on the one hand, large peri-urban or even exurbanized warehouses that structure logistics chains on an international, national and regional scale (Heitz et al., 2017) and, on the other hand, small urban warehouses or ULAs (urban logistics spaces) designed to serve metropolitan areas and the last mile chain and final deliveries
- This dual entry into the logistics real estate market is well illustrated by developments in Amazon's US locations.



Analysis of the spatial patterns of warehousing development.

(©Lecourt; Schorung/Chaire Logistics City, 2022)

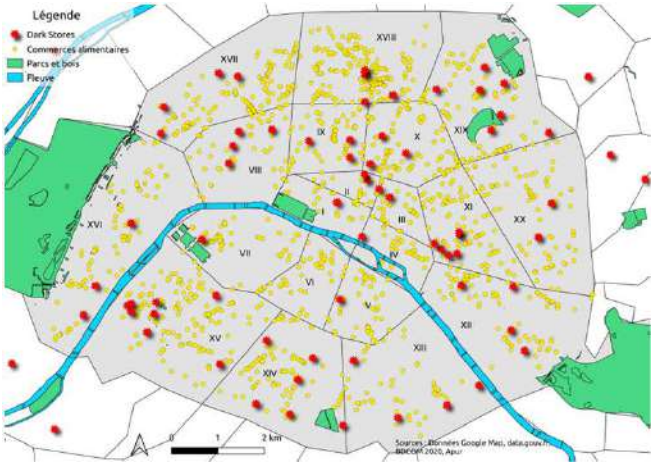
2022-2023 : Next steps on warehouses and urban logistics

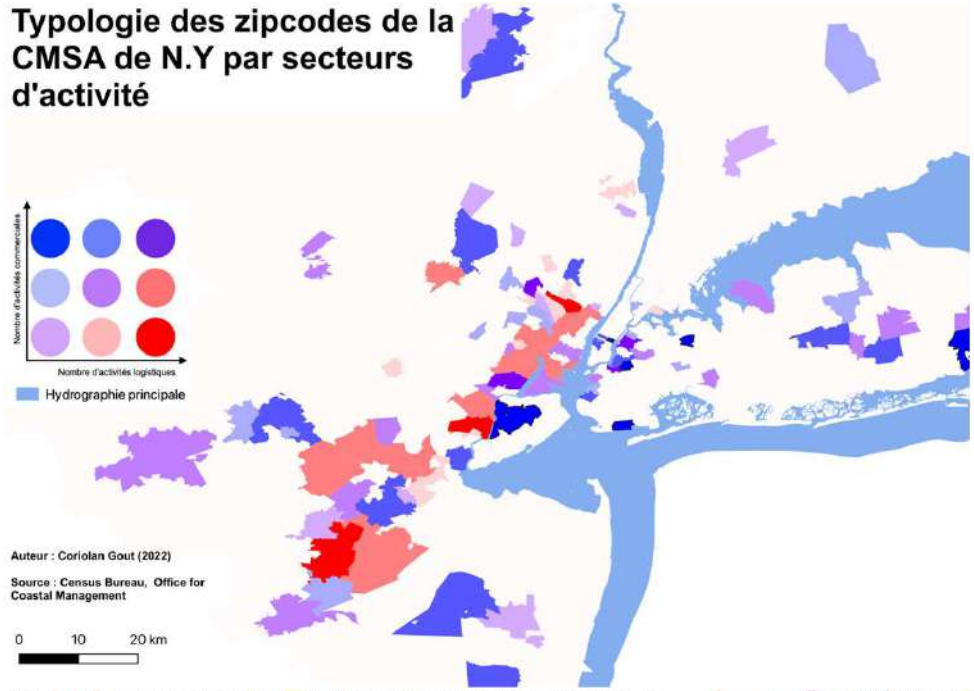
1) update of the Chair's database and addition of new metropolises (notably Tokyo) – collaboration with Dr. Renata de Oliveira (Minas Gerais, Brazil)

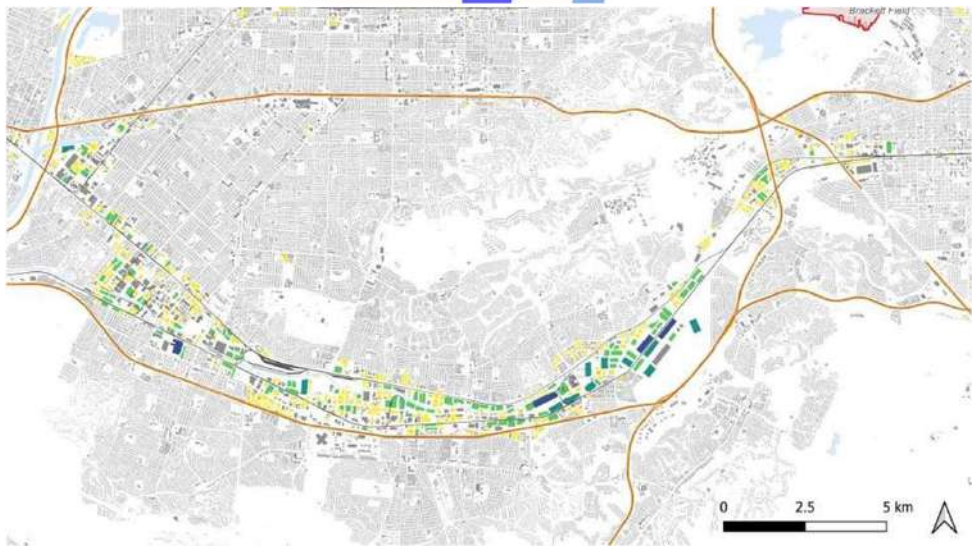
2) deepening of the "freight landscape" concept (Coriolan Gout, 2022)

3) exploration of new methods of data collection on warehouses: OpenStreetMap

4) further work on small warehouses and micro-hubs related to e-groceries and quick commerce.







Bibliography

- Allen, J., Browne, M., 2010. Considering the Relationship Between Freight Transport and Urban Form. Green Logistics.
- Andreoli, D., Goodchild, A., Vitasek, K., 2010. The Rise of Mega Distribution Centers and The Impact on Logistical Uncertainty. Transportation Letters 2 (2), 75-88.
- Bowen, J., 2008. Moving Places : The Geography of Warehousing in the US. Journal of Transport Geography 16, 379-387.
- Bowen, J., 2012. A Spatial Analysis of FedEx and UPS: Hubs, Spokes and Network Structure. Journal of Transport Geography 24, 419-431.
- Browne, M., Behrens, S., Woxenius, J., Giuliano, G., Holguin-Veras, J., 2019. Urban Logistics : Management, Policy and Innovation in a Rapidly Changing Environment Kogan-Page, London.
- Cidell, J., 2010. Concentration and Decentralization : The New Geography of Freight Distribution in US Metropolitan Areas. Journal of Transport Geography 18, 363-371.
- Christopherson, S., Belzer, M., 2009. The Next Move: Metropolitan Regions and the Transformation of the Freight Transport and Distribution System in Urban and Regional Policy and its Effects 2, 194-222.
- Dablanc, L., Rakotonarivo, D., 2010. The Impacts of Logistics Sprawl: How Does the Location of Parcel Transport Terminals Affect the Energy Efficiency of Goods' Movements in Paris and What Can We Do About It? Procedia Soc. Behav. Sci. 2 (3), 6087-6096.
- Dablanc, L., Ross, C., 2012. Atlanta: a Mega Logistics Center in the Piedmont Atlantic Megaregion (PAM). Journal of Transport Geography 24, 432-442.
- Dablanc, L., Ogilvie, S., Goodchild, A., 2014. Logistics Sprawl: Differential Warehousing Development Patterns in Los Angeles, California, and Seattle, Washington. Transport Research Records 2410, 105-112.
- Dablanc, L., Savy, M., Veltz, P., Culoz, A., Vincent, M., 2017. Des marchandises dans la ville, un enjeu social, environnemental et économique majeur Terra Nova, Report, 113p.
- Dablanc, L., Morganti, E., Arvidsson, N., Woxenius, J., Browne, M., Saidi, N., Dablanc, L., Morganti, E., Arvidsson, N., & Woxenius, J., 2017. The Rise of On-demand 'Instant Deliveries' in European cities Supply Chain Forum: An International Journal.
- Dablanc, L., Rouhier, J., Lazarevic, N., Klauenberg, J., Liu, Z., Koning, M., Kelli de Oliveira, L., Combes, F., Coulombel, N., Gardrat, N., Blanquart, C., Heitz, A., Seidel, S., 2018. CITYLAB Deliverable 2.1, Observatory of Strategic Developments Impacting Urban Logistics (2018 version) European Commission, 242p.
- Dablanc, L., 2018. E-commerce Trends and Implications for Urban Logistics in Browne, M., Behrends, S., Woxenius, J., Giuliano, G., & Holguin-Veras, J., (Eds.) Urban Logistics: Management, Policy and Innovation in a Rapidly Changing Environment Kogan Page Publishers, 187-195.
- Dubie, M., Kuo K., Giron-Valderrama, G., Goodchild, A., 2020. An Evaluation of Logistics Sprawl in Chicago and Phoenix. Journal of Transport Geography 88, 102298.
- Giuliano, G., O'Brien, T., Dablanc, L., Holliday, K., 2013. NCFRP Project 36(05) Synthesis of Freight Research in Urban Transportation Planning National Cooperative Freight Research Program, Washington D.C.
- Giuliano, G., Kang, S., Yuan, Q., 2016. Spatial Dynamics of the Logistics Industry and Implications for Freight Flows in NCST Project USC-CT-TO-004 METRANS Transportation Center, Sol Price School of Public Policy, University of Southern California, Los Angeles (CA).
- Hagberg, J., Sundström, M., Nicklas, E-Z., 2016. The Digitalization of Retailing : An Exploratory Framework. International Journal of Retail Distribution Management 44(7), 694-712.
- Heitz, A., Dablanc, L., 2015. Logistics Spatial Patterns in Paris: Rise of Paris Basin as Logistics Megaregion. Transportation Research Records 2477, 76-84.
- Heitz, A., Launay, P., & Beziat, A., 2017. Rethinking Data Collection on Logistics Facilities: New Approach for Measuring the Location of Warehouses and Terminals in Metropolitan Areas. Transportation Research Record: Journal of the Transportation Research Board 2609.
- Heitz, A., Dablanc, L., Tavasszy, L.A., 2017. Logistics Sprawl in Monocentric and Polycentric Metropolitan Areas: The Cases of Paris, France, and the Randstad, the Netherlands. Region 4, 93–107.
- Heitz, A., 2017. La Métropole Logistique : structure urbaine et enjeux d'aménagement. La dualisation des espaces logistiques métropolitains PhD Dissertation, University of Paris-Est (France).
- Hesse, M., 2004. Land for Logistics: Location Dynamics, Real Estate Markets and Political Regulation of Regional Distribution Complexes. Tijdschrift voor Economische en Sociale Géographie vol. 95, n° 2, 162-173.
- Hesse, M., 2008. The City as terminal. Logistics and Freight Distribution in an Urban Context Ashgate Publishing.
- Hesse, M., Rodrigue, J-P., 2004. The Transport Geography of Logistics and Freight Distribution. Journal of Transport Geography vol. 12, n° 3, 171-184.
- Houde, J-F., Newberry, P., Seim, K., 2017. Economies of Density in E-commerce: A Study of Amazon's Fulfillment Center Network in National Bureau of Economic Research, Working Paper 23361.
- Lieb, R.C., Leib, K.J., 2016. 3PL CEO Perspectives on the Current Status and Future Prospects of the Third-Party Logistics Industry in North America: the 2014 Survey. Transportation Journal 55(1), 78-92.
- Movahedi, B., Lavassani, K., Kumar, V., 2009. Transition to B2B E-marketplace Enabled Supply Chain: Readiness Assessment and Success Factors. The International Journal of Technology, Knowledge and Society vol. 5, n° 3, 75-88.
- Oliveira, R., Schorung, M., Dablanc, L., 2021. Relationships among urban characteristics, real estate market, and spatial patterns of warehouses in different geographic contexts. Research Report, Research Chair Logistics City, University Gustave Eiffel.
- Raimbault, N., 2014. Gouverner le développement logistique de la métropole : périurbanisation, planification et compétition métropolitaines PhD Dissertation, University of Paris-Est.
- Ramcharran, H., 2013. E-commerce Growth and the Changing Structure of the Retail Sales Industry. International Journal on E-Business Research 9(2), 46-60.
- Rodrigue, J-P., 2004. Freight, Gateways and Mega-Urban Regions: The Logistics Integration of the BostWash Corridor. Tijdschrift voor economische en sociale geographie vol. 95, n° 2, 147-161.
- Rodrigue, J-P., 2017. The Freight Landscape: Convergence and Divergence in Urban Freight Distribution. Journal of Transport and Land Use 10(1), 557-572.
- Rodrigue, J-P., 2020. The Distribution Network of Amazon and the Footprint of Freight Digitalization. Journal of Transport Geography 88, 102825.
- Sakai, T., Kawamura, K., Hyodo, T., 2016. Logistics Facility Distribution in Tokyo Metropolitan Area: Experiences and Policy Lessons. Transportation Research Procedia 12, 263-277.
- Sakai, T., Beziat, A., Heitz, A., 2020. Location Factors for Logistics Facilities: Location Choice Modeling Considering Activity Categories. Journal of Transport Geography 85, 102710.

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Thank you for your attention !

matthieu.schorung@gmail.com

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