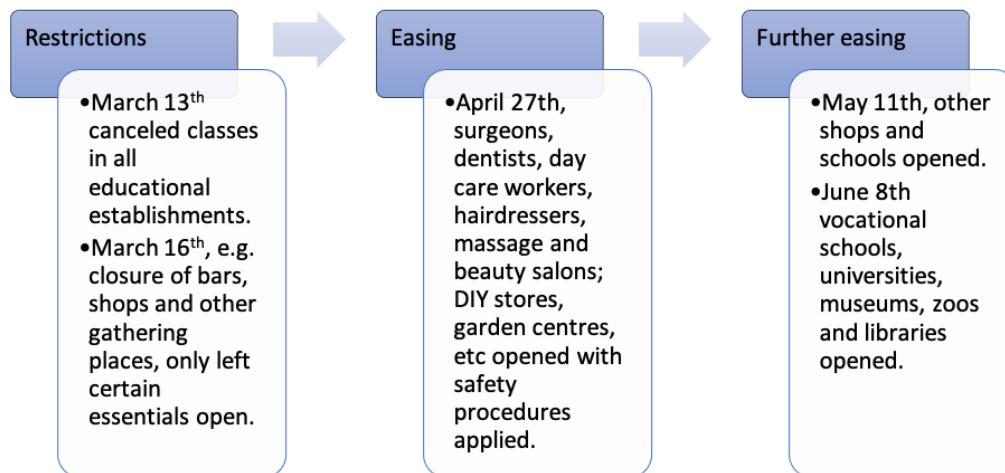


Project Report - Covid Mobility

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Introduction

From March to June in 2020, the Swiss federal government has adopted a series of measures to combat the Coronavirus (COVID-19) and eased these restrictions in a three-step process, as shown below.



Graph 1: Measures to Combat the COVID-19 (FOPH 2020)

This report aims to evaluate the impact of these measures on the mobility of Zurich city based on its open data (Stadt Zürich Open Data 2020). Motorized individual traffic is selected to measure mobility because it is less sensitive to the change of weather or temperature compared to bicycle and pedestrian traffics.

Methods

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The dataset contains the numbers of individual motor vehicles in Zurich per hour, measured by 64 stations, each of them counts vehicles passing the station from both directions. In this report, 9 time-units are selected, which are Wednesdays of every 2 weeks from March to June. To simplify the analysis, the hourly numbers of vehicles from both directions of each station are aggregated as the sum per day for each station. Stations Z019, Z037, Z043, Z051 and Z047 are removed because they contain null values. In total, 531 observations are included in the analysis. Since the original file `mobility.csv` is large, the aggregation process was done with the query function on PostgreSQL. After the data sorting, `IMV.csv` is used for the plotting. The projected coordinate system from the metadata is CH1903+ / LV95 and it is applied on all layers in the analysis.

All data points are classified into 7 classes by natural break based on the variable "Ratio" (column `Difference (Ratio)`), which is the difference of counts between the measured day and March 4th (column `Difference`) divided by the counts on March 4th (column `Initial Sum`). The color theme is selected to be colorblind-friendly. The size of data points is determined by the counts on the measured day (column `Day Sum`). The analysis is carried out by the function Animation in ArcGIS Pro, operations are showned by the time line of feature layer `IMV_all points`. To visualize the trend associated with locations, 10 stations are selected randomly (Esri 2020) from all stations and save as the layer `March4_10points`. The tool to generate line graphs is Excel.

Results

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The animation (see Map.mp4) offers the change of counts for 59 stations through 9 days, accordingly, there are 9 maps, here only shows 3 out of them.

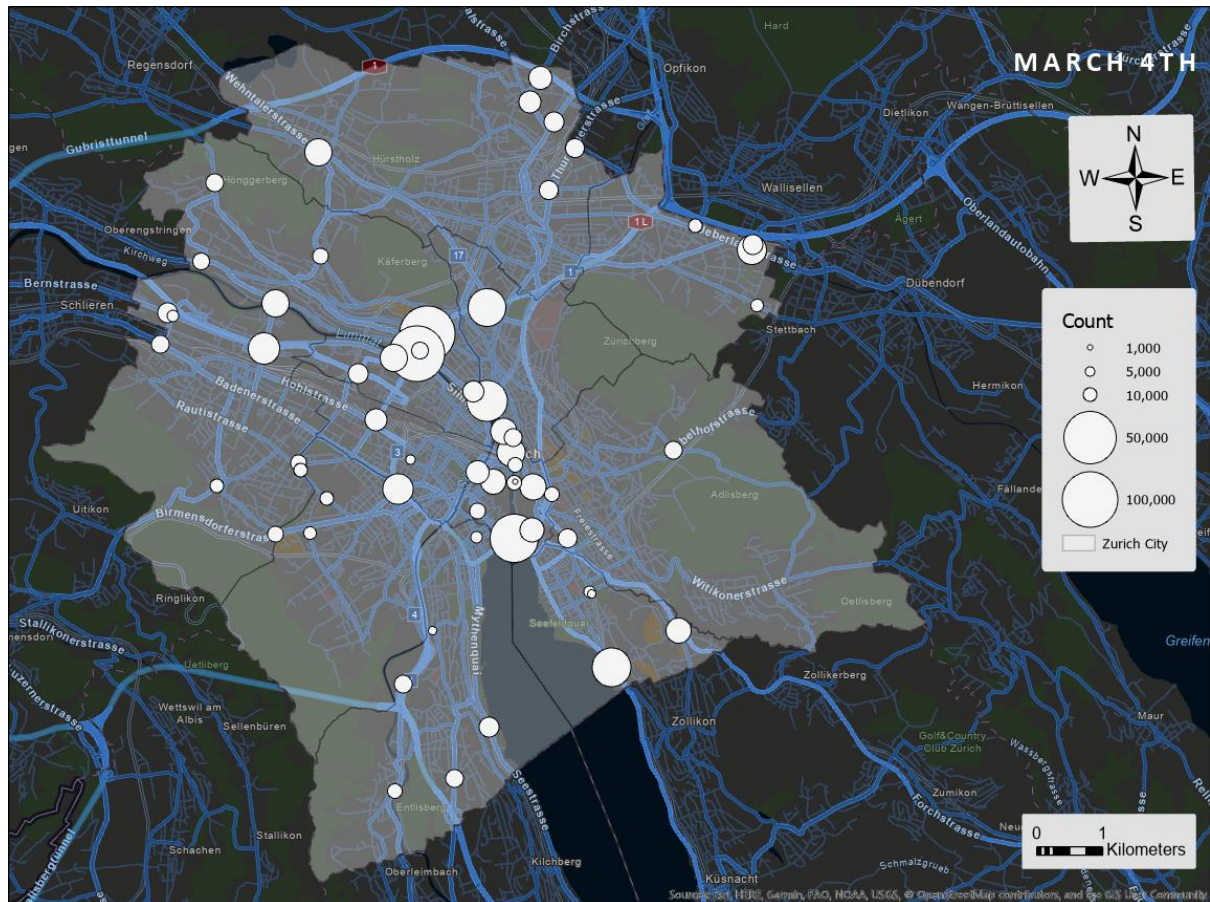


Figure 1: Map of motorized individual traffic in city Zurich before the lockdown

As shown by these 3 maps, the lockdown and easing have a clear impact on mobility, although the tendency is heterogeneous at different locations. In Figure 2, the traffic reduced significantly after the lockdown, especially in the city center such as station “Bahnhofstrasse”. Stations far away from the center but are on main roads also decreased notably, such as at stations “Thurgauerstrasse”, “Leimbachstrasse”, “Albisriederstrasse”, etc. In Figure 3, after the lockdown was eased completely, the traffic at most stations was back to the intensity before the lockdown, except for stations “Milchbuckttunnel”, “Limmattalstrasse”, “Gessnerallee” etc. In the meanwhile, some have clearly surpassed the amounts before the lockdown, such as the station “Strandbad Wollishofen”.

A detailed change regarding the change of measures is better visualized by the animation, during the timespan, the color of points changed from brownish to whitish and became bluish; the size of points first reduced and increased afterward. Both trends are as expected, the mobility responded timely to the change of measures. Although the lockdown was completely eased on June 8th and the numbers increased from June 1st to June 10th, it decreased again from June 10th to June 24th.

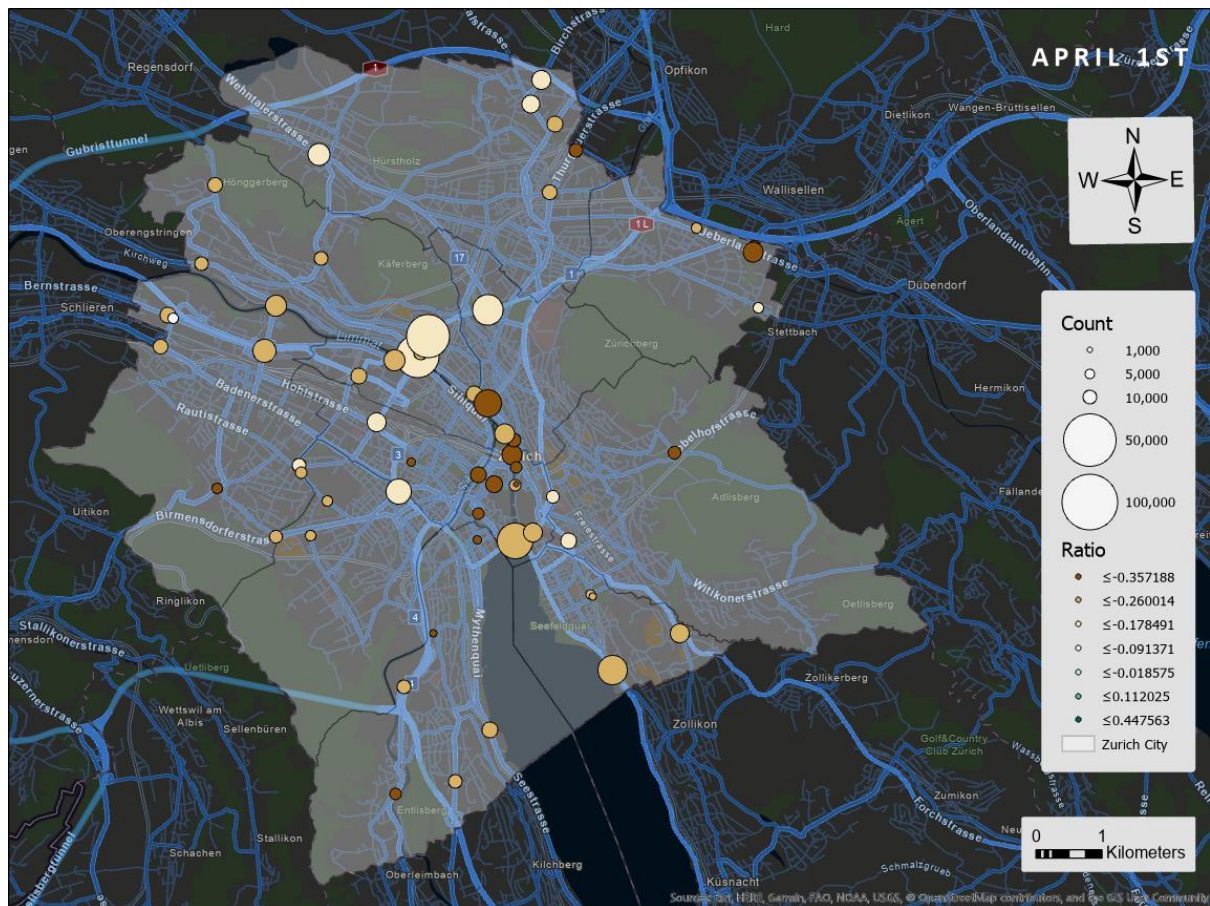


Figure 2: Map of motorized individual traffic in city Zurich during the lockdown

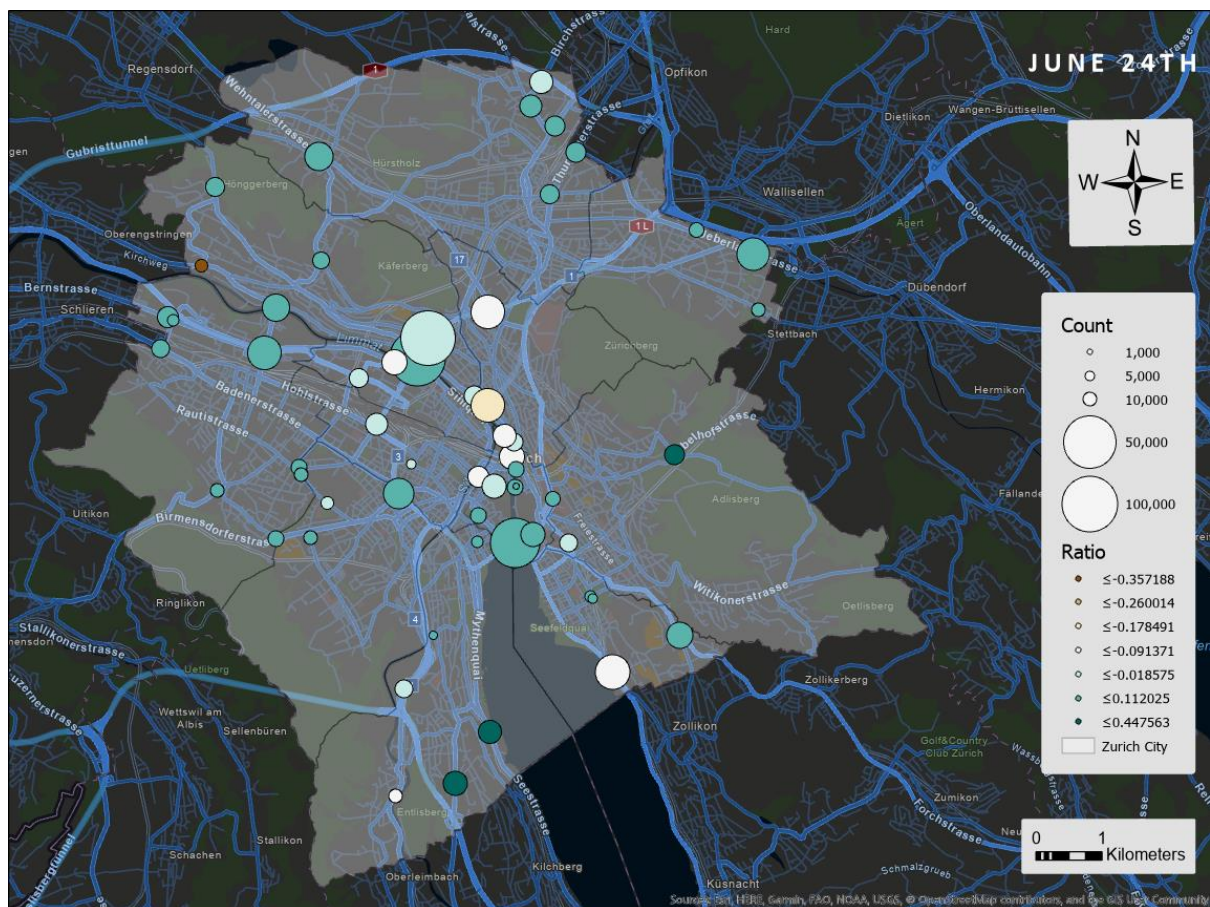


Figure 3: Map of motorized individual traffic in city Zurich after the lockdown

The overall change in number and ratio of the randomly selected stations shows similar patterns as the maps above. In Graph 2, the trend of station “Rosengartestrasse” seems to have changed most than others. However, in Graph 3, when comparing the change in ratio, it remained most stable, and it is the station “Neue Winterthurstrasse” which changes most significantly.

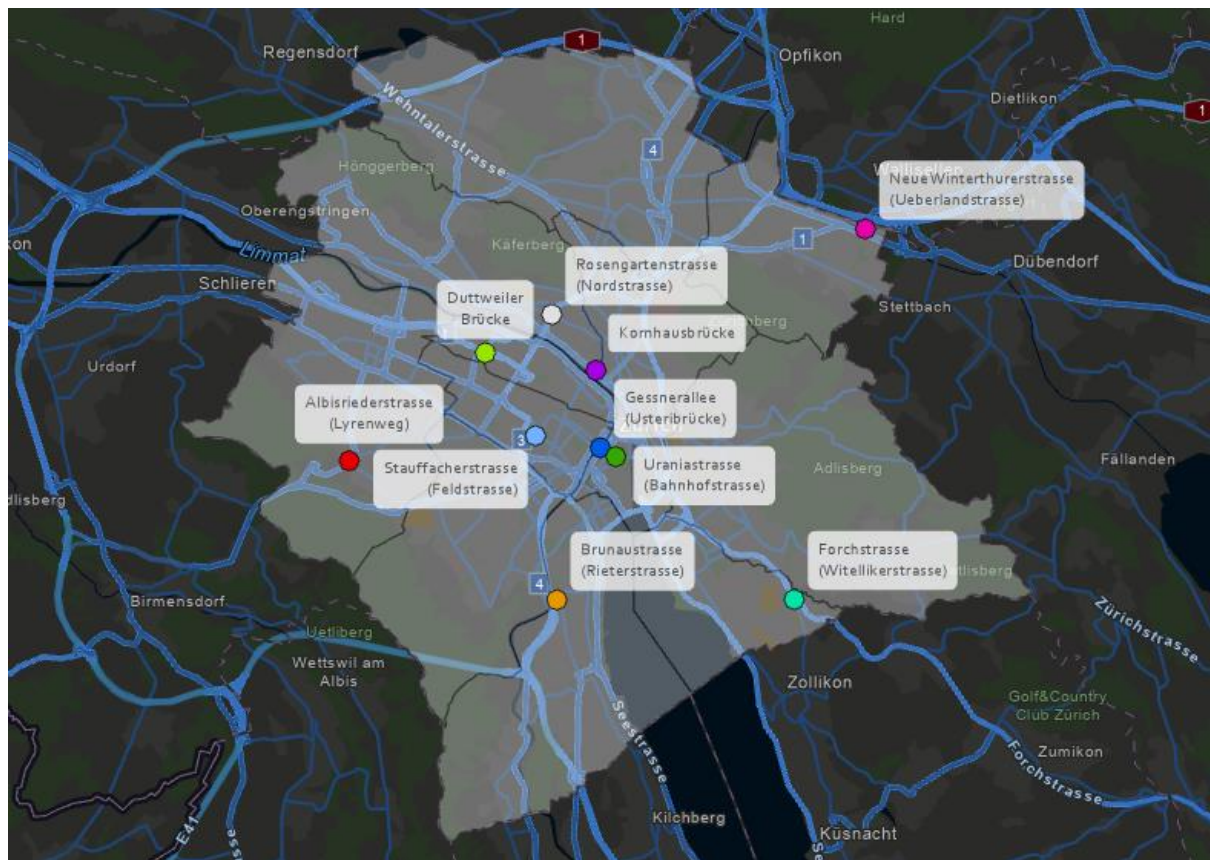
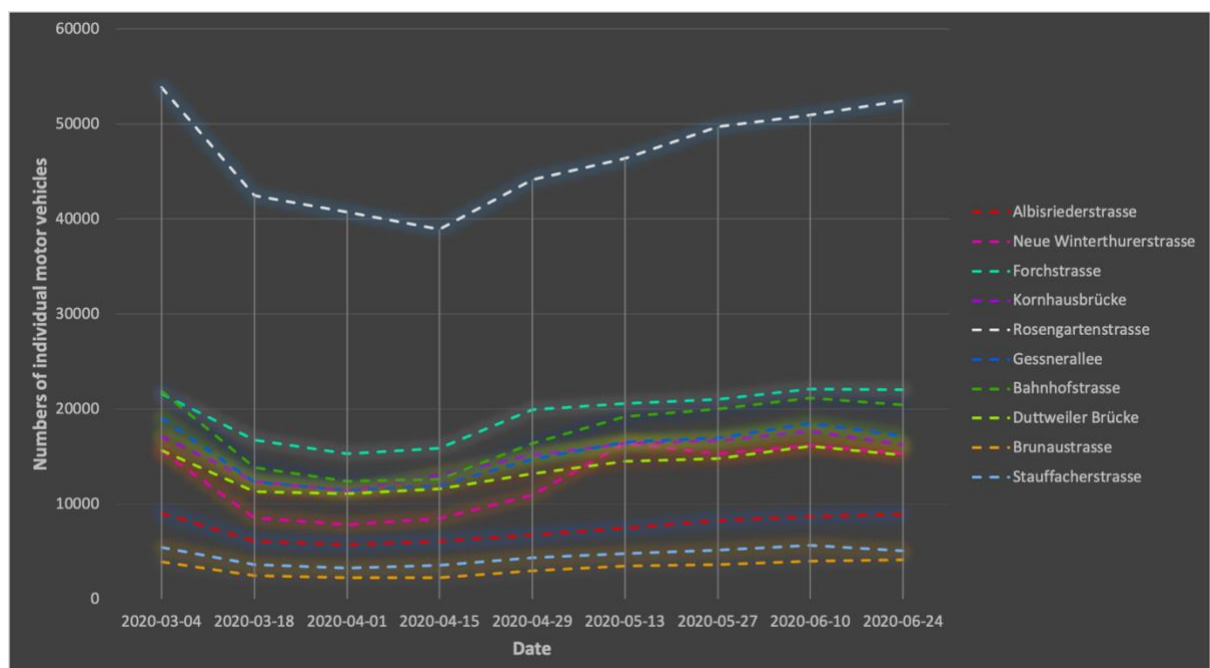
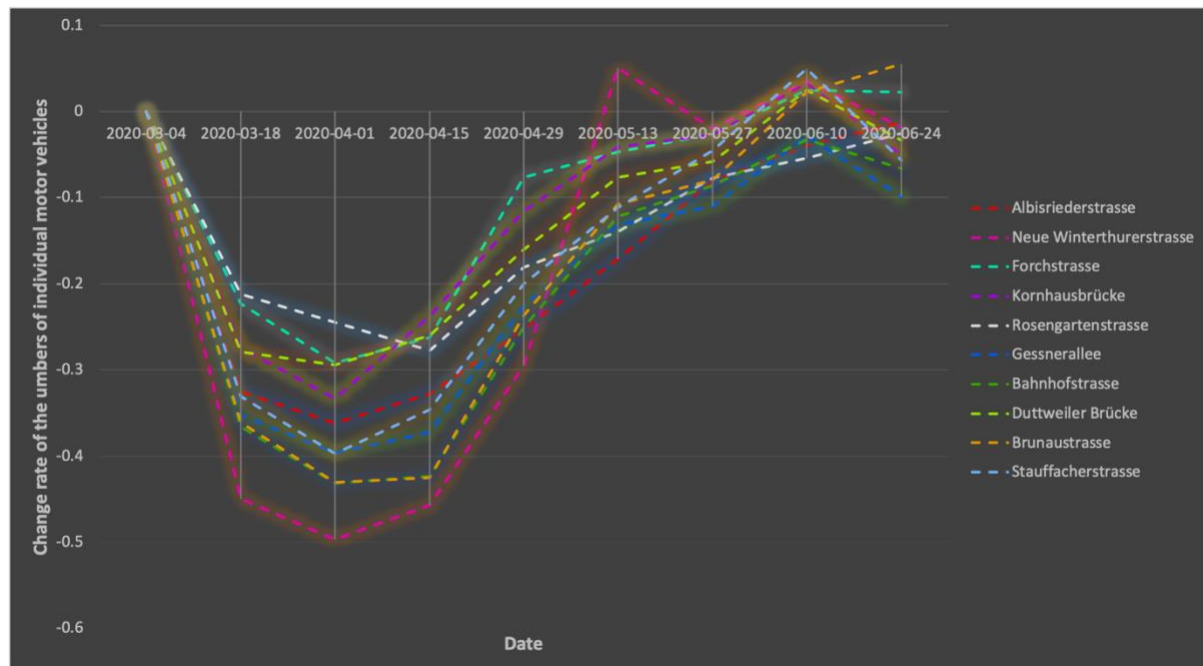


Figure 4: random selection of 10 stations by ArcGIS Pro



Graph 2: the change of numbers of individual motor vehicles



Graph 3: the change ratio of numbers of individual motor vehicles

Discussion

In general, City Zurich Open Data offers a high-quality dataset, however, it contains null values which resulted in the loss of data in the analysis (45 observations), if reasons behind the null values are explained, solutions such as replacing them with historic data can be taken. The selection of time-units considered the suitable intervals, lagged-impact of the measures, fluctuation of traffics within a week, etc. However, to fully utilize the dataset, the optimal selection of time-unit should be daily, but it will increase the workload considerably. The visualization is informative because it includes 2 attributes at the same time and colored by a colorblind-friendly color ramp. The colors indicate 7 different levels of the ratio change classified by the natural break, however, the classification is slightly skewed to the negative side and it would confuse the readers. Since the range of numbers of vehicles in the dataset is large, ranging from 588 to 54183, therefore it is necessary to set the limitation of the size of points. The difference between the size of the points on the maps is much smaller than in reality.

Source

Esri (2020): Technical Support. (<https://support.esri.com/en/technical-article/000013141> [17.12.2020])

Federal Office of Public Health (2020): Coronavirus - Measures and ordinances. (<https://www.bag.admin.ch/bag/en/home/krankheiten/ausbrueche-epidemien-pandemien/aktuelle-ausbrueche-epidemien/novel-cov/massnahmen-des-bundes.html#-1863604723> [19.12.2020])

Stadt Zürich Geodaten (2020): Stadtkreise. (<https://www.stadt-zuerich.ch/geodaten/download/Stadtkreise?format=10007> [15.12.2020])

Stadt Zürich Open Data (2020): Daten der Verkehrszählung zum motorisierten Individualverkehr (Stundenwerte). (https://data.stadt-zuerich.ch/dataset/sid_dav_verkehrszaehlung_miv_od2031 [14.12.2020])