China Data Institute

Center for Geographic Analysis
Harvard University

社会地理计算联合研究中心
Geocomputation Center for Social Science

# “Resources for COVID-19”

# Introduction to the Virus Data

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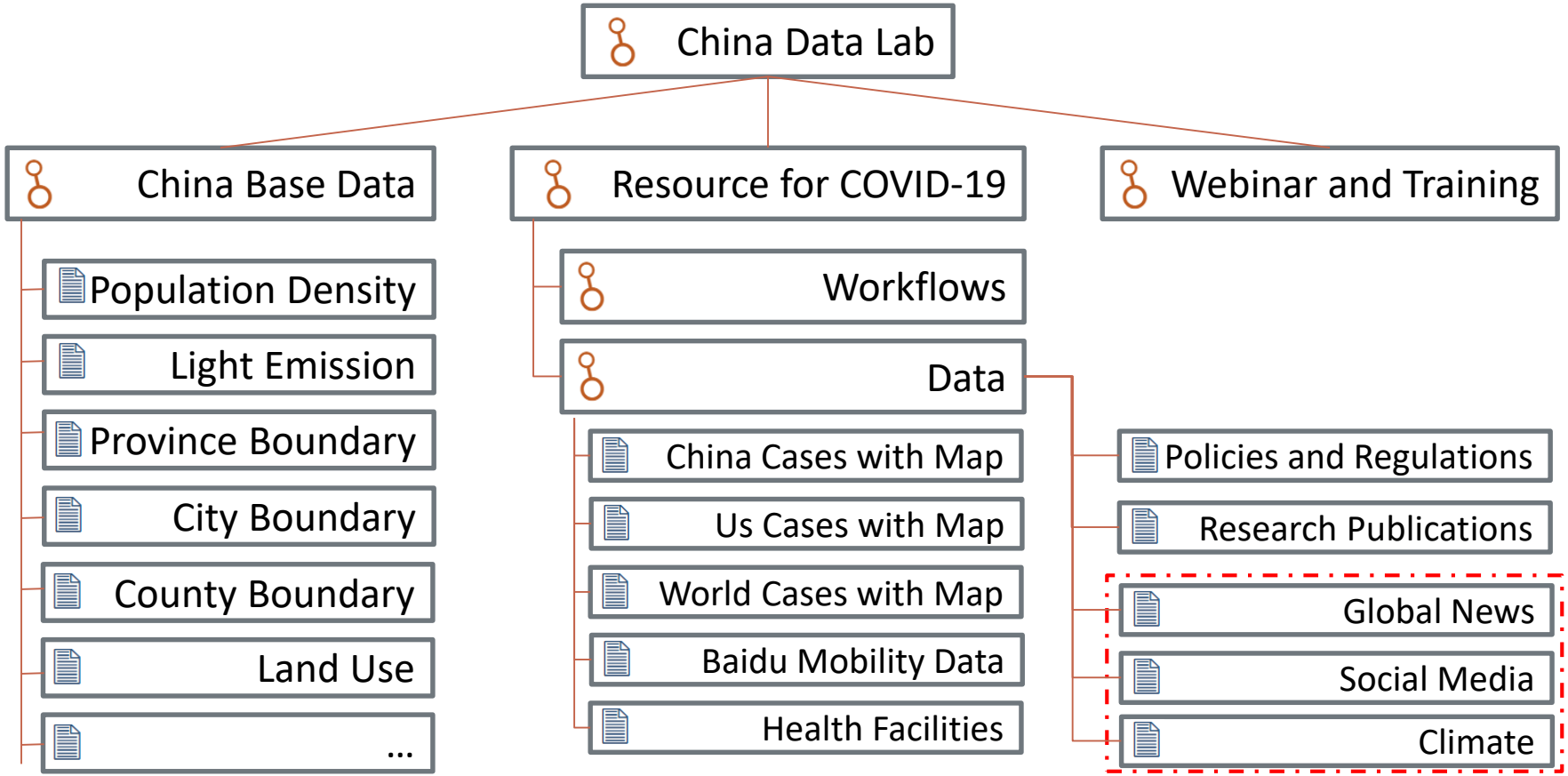
# Outline

- ❑ Data Sources
- ❑ Data Processing
- ❑ Data Integration
- ❑ Data Depository
- ❑ Data Cloud
- ❑ Data Workflows
- ❑ Sample Works for Data Analysis
- ❑ Discussion

# “Resources for COVID-19” at Harvard Dataverse



# Data Sources

- Base data:
  - China Data Institute, China Province and City Census Data with Comparable GIS Maps for Census 2000 and 2010.
  - China Data Institute, US State and County Census Data with Comparable GIS Maps for Census 1970, 1980, 1990, 2000 and 2010.
- Virus data:

| Region | Source | Link | Start Date | Update |
|---|---|---|---|---|
| China | DXY | https://github.com/BlankerL/DXY-COVID-19-Data | 1/14/2020 | 3/18/2020 |
| US | USA FACTS<br>The New York Times | https://github.com/nytimes/covid-19-data; https://usafacts.org/ | 1/22/2020 | 3/29/2020 |
| Italy | Department of Civil Protection | https://github.com/pcm-dpc/COVID-19 | 1/22/2020 | 3/28/2020 |
| Global | John Hopkins University | https://github.com/CSSEGISandData/COVID-19 | 1/22/2020 | 3/28/2020 |

# Data Classification

**China**

- China virus data by administrative units:
  - Province
  - City
- China virus data by categories:
  - Confirmed cases
  - Death cases
  - Recovered cases

**USA**

- US virus data by administrative units:
  - State
  - County
- US virus data by categories:
  - Confirmed cases
  - Death cases
  - Recovered cases

**Global**

Country virus data by categories:

- Confirmed cases
- Death cases
- Recovered cases

# Data Processing and Integration: China

**Base maps:**

1. Merge the urban districts of Shanghai, Beijing, Chongqing and Tianjin of the prefecture city map
2. Recode those merged districts of Shanghai, Beijing, Chongqing and Tianjin of the city map

| OBJECTI | GbCity | City_CH | City_EN |
|---|---|---|---|
| 1 | 1101 | 北京市辖区 | Beijing (Districts) |
| 2 | 1102 | 北京市辖县 | Beijing (Counties) |
| 3 | 1201 | 天津市辖区 | Tianjin (Districts) |
| 4 | 1202 | 天津市辖县 | Tianjin (Counties) |
| 5 | 1301 | 石家庄市 | Shijiazhuang |
| 6 | 1302 | 唐山市 | Tangshan |
| 7 | 1303 | 秦皇岛市 | Qinhuangdao |
| 8 | 1304 | 邯郸市 | Handan |
| 9 | 1305 | 邢台市 | Xingtai |
| 10 | 1306 | 保定市 | Baoding |
| 11 | 1307 | 张家口市 | Zhangjiakou |
| 12 | 1308 | 承德市 | Chengde |
| 13 | 1309 | 沧州市 | Cangzhou |
| 14 | 1310 | 廊坊市 | Langfang |
| 15 | 1311 | 衡水市 | Hengshui |
| 16 | 1401 | 太原市 | Taiyuan |
| 17 | 1402 | 大同市 | Datong |
| 18 | 1403 | 阳泉市 | Yangquan |
| 19 | 1404 | 长治市 | Changzhi |

**Virus data tables:**

1. Assign GB code as in the base map for each city in the virus data table
2. Match those cities in the virus data table to those cities on the base map
3. Merge those county level cities or special regions in the virus table to match the city base map

**Map merging:**

1. Merge the virus data table with the province map by GB code
2. Merge the virus data table with the prefecture city by GB code

**河南省**：济源市

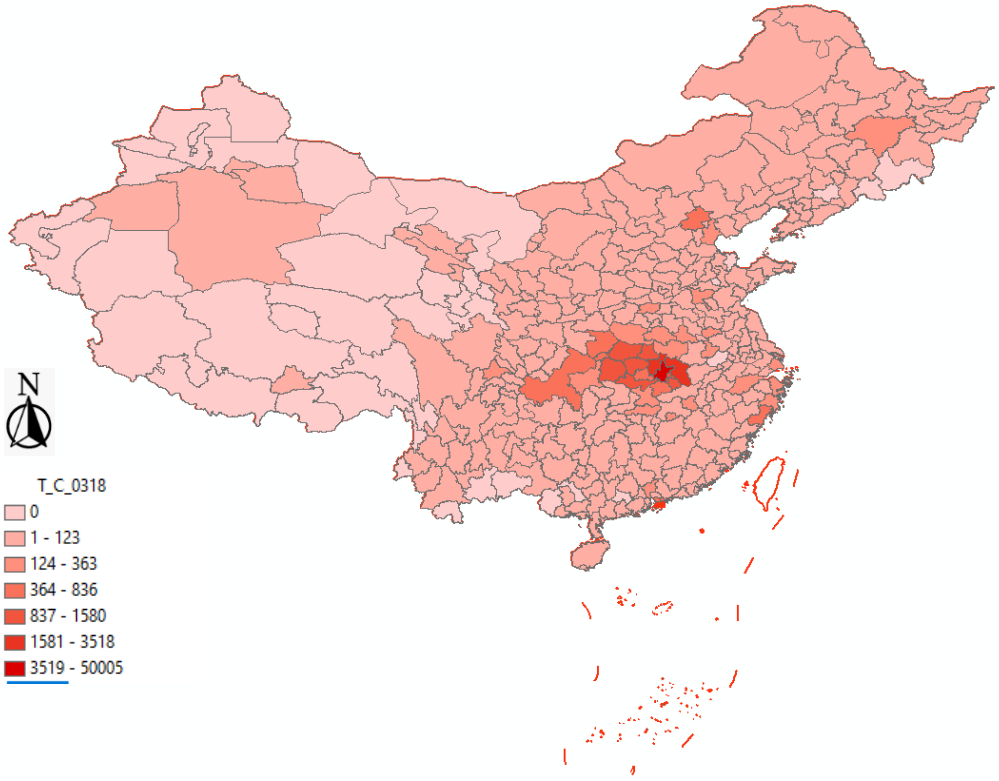
**湖北省**：仙桃市、潜江市、天门市、神农架林区

**海南省**：五指山市、琼海市、文昌市、万宁市、东方市、屯昌县、定安县、澄迈县、临高县、保亭黎族苗族自治县、琼中黎族苗族自治县、白沙黎族自治县、陵水黎族自治县、昌江黎族自治县、乐东黎族自治县

**新疆维吾尔自治区**：石河子市、阿拉尔市、图木舒克市、五家渠市、北屯市、铁门关市、双河市、可克达拉市、昆玉市、胡杨河市

# Sample Map for the Virus Data of China

The Choropleth Map of Confirmed Cases as of March 27, 2020



# Data Processing and Integration: US

- Retrieve the virus data by states from https://usafacts.org/

```
date,state,fips,cases,deaths
2020-01-21,Washington,53,1,0
2020-01-22,Washington,53,1,0
2020-01-23,Washington,53,1,0
2020-01-24,Illinois,17,1,0
2020-01-24,Washington,53,1,0
2020-01-25,California,06,1,0
2020-01-25,Illinois,17,1,0
2020-01-25,Washington,53,1,0
2020-01-26,Arizona,04,1,0
2020-01-26,California,06,2,0
2020-01-26,Illinois,17,1,0
```

→ Data Transformation →

| A | B | C | D | E | F |
|---|---|---|---|---|---|
| FIPS | state | 1/21/2020 | 1/22/2020 | 1/23/2020 | 1/24/2020 |
| 53 | Washington | 1 | 1 | 1 | 1 |
| 17 | Illinois | 0 | 0 | 0 | 1 |
| 6 | California | 0 | 0 | 0 | 0 |
| 4 | Arizona | 0 | 0 | 0 | 0 |
| 25 | Massachusetts | 0 | 0 | 0 | 0 |
| 55 | Wisconsin | 0 | 0 | 0 | 0 |
| 48 | Texas | 0 | 0 | 0 | 0 |
| 31 | Nebraska | 0 | 0 | 0 | 0 |

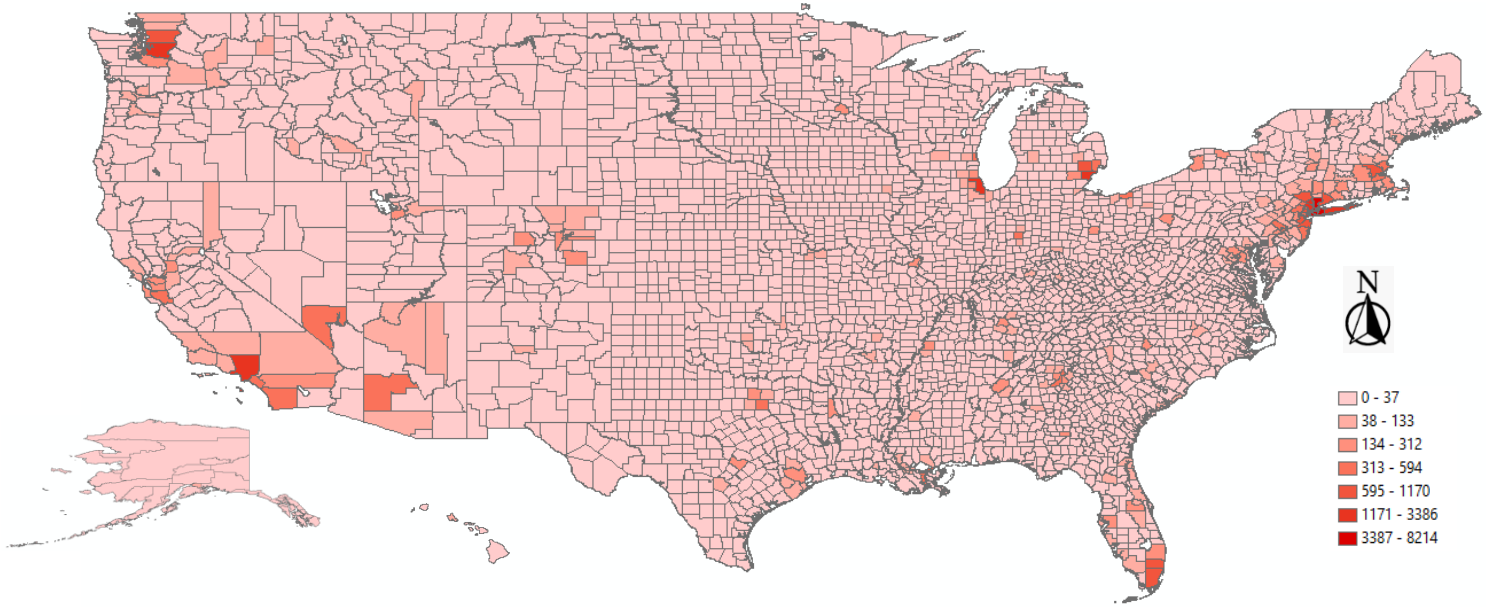
- Retrieve the virus data by county

Website → Monitor Request → Parse JSON → Write CSV

- Merge the virus data with the US Base map by state and county based on the FIPS code

# Sample Map for the Virus Data of US

The Choropleth Map of Confirmed Cases as of March 27, 2020



# Data Processing: Italy

## Italy Virus Data

- Region
- Province

| A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|
| code_region | name_reg | code_province | name_province | province_abbr | 2/24/2020 | 2/25/2020 |
| 13 | Abruzzo | 69 | Chieti | CH | 0 | 0 |
| 13 | Abruzzo | 66 | L'Aquila | AQ | 0 | 0 |
| 13 | Abruzzo | 68 | Pescara | PE | 0 | 0 |
| 13 | Abruzzo | 67 | Teramo | TE | 0 | 0 |
| 13 | Abruzzo | 979 | In fase di definizione/aggiornamen | | 0 | 0 |
| 17 | Basilicata | 77 | Matera | MT | 0 | 0 |
| 17 | Basilicata | 76 | Potenza | PZ | 0 | 0 |
| 17 | Basilicata | 980 | In fase di definizione/aggiornamen | | 0 | 0 |
| 4 | P.A. Bolza | 21 | Bolzano | BZ | 0 | 1 |
| 4 | P.A. Bolza | 981 | In fase di definizione/ag | | | |
| 18 | Calabria | 79 | Catanzaro | CZ | | |
| 18 | Calabria | 78 | Cosenza | CS | | |

Cases by Province

| | |
|---|---|
| Florence | Firenze |
| Forli' - Cesena | ForlÃ¬-Cesena |
| Mantua | Mantova |
| Monza and Brianza | Monza e della Brianza |
| Padua | Padova |
| Pesaro E Urbino | Pesaro e Urbino |
| Reggio Di Calabria | Reggio di Calabria |
| Reggio Nell'Emilia | Reggio nell'Emilia |
| Syracuse | Siracusa |

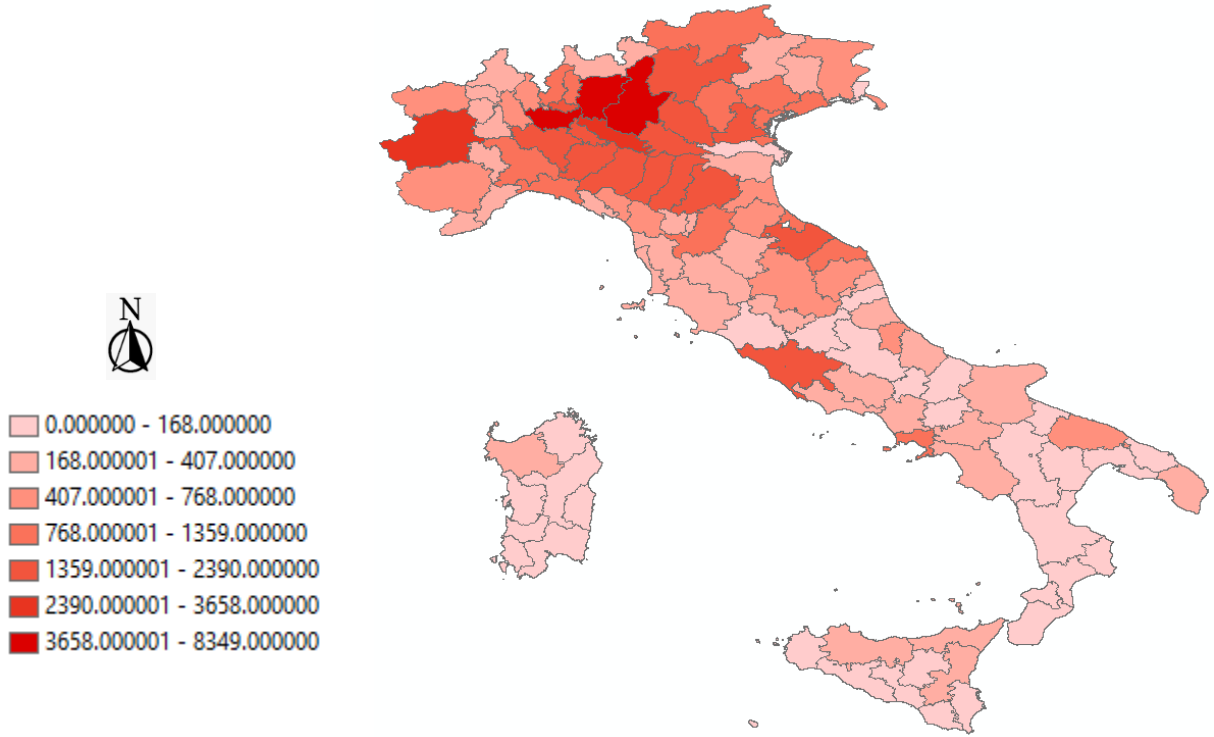
Province Mapping List

| ID_1 | NAME_1 | ID_2 | NAME_2 |
|---|---|---|---|
| 16 | Toscana | 92 | Livorno |
| 16 | Toscana | 93 | Lucca |
| 16 | Toscana | 94 | Massa Carrara |
| 16 | Toscana | 95 | Pisa |
| 16 | Toscana | 96 | Pistoia |
| 16 | Toscana | 97 | Prato |
| 16 | Toscana | 98 | Siena |
| 17 | Trentino-Alto A | 99 | Bolzano |
| 17 | Trentino-Alto A | 100 | Trento |
| 18 | Umbria | 101 | Perugia |
| 18 | Umbria | 102 | Terni |
| 19 | Valle d'Aosta | 103 | Aosta |
| 20 | Veneto | 104 | Belluno |

Province Basemap

# Sample Map for the Virus Data of Italy

The Choropleth Map of Confirmed Cases as of March 28, 2020



# Data Processing and Integration: World

## Global Virus Data

| Province/State | Country/Region | Lat | Long | 1/22/20 | 1/23/20 | 1/24/20 |
|---|---|---|---|---|---|---|
| | Afghanistan | 33.0 | 65.0 | 0 | 0 | 0 |
| | Albania | 41.1533 | 20.1683 | 0 | 0 | 0 |
| | Algeria | 28.0339 | 1.6596 | 0 | 0 | 0 |
| | Andorra | 42.5063 | 1.5218 | 0 | 0 | 0 |
| | Angola | -11.2027 | 17.8739 | 0 | 0 | 0 |
| | Antigua and Barbuda | 17.0608 | -61.7964 | 0 | 0 | 0 |
| | Argentina | -38.4161 | -63.6167 | 0 | 0 | 0 |
| | Armenia | 40.0691 | 45.0382 | 0 | 0 | 0 |
| Australian Capital Territory | Australia | -35.4735 | 149.0124 | 0 | 0 | 0 |
| New South Wales | Australia | -33.8688 | 151.2093 | 0 | | |
| Northern Territory | Australia | -12.4634 | 130.8456 | 0 | | |

Global Cases

| Shape * | OBJECTID | CNTRY_NAME |
|---|---|---|
| Polygon | 1 | Aruba |
| Polygon | 2 | Antigua and Barbuda |
| Polygon | 3 | Afghanistan |
| Polygon | 4 | Algeria |
| Polygon | 5 | Azerbaijan |
| Polygon | 6 | Albania |
| Polygon | | Armenia |
| Polygon | 8 | Andorra |
| Polygon | 9 | Angola |
| Polygon | 10 | American Samoa |
| Polygon | 11 | Argentina |
| ygon | 12 | Australia |
| ygon | 13 | Austria |
| ygon | 14 | Anguilla |

Map provided by ArcGIS

| case_country | country_arcgis |
|---|---|
| Bahamas | Bahamas, The |
| Belarus | Byelarus |
| Democratic Republic of Congo | Congo |
| Faeroe Islands | Faroe Islands |
| Gambia | Gambia, The |
| Cote d'Ivoire | Ivory Coast |
| Isle of Man | Man, Isle of |
| Myanmar | Myanmar (Burma) |
| Saint Kitts and Nevis | St. Kitts and Nevis |
| Saint Lucia | St. Lucia |
| Saint Vincent and the Grenadines | St. Vincent and the G |
| Tanzania | Tanzania, United Rep |
| United States Virgin Islands | Virgin Islands |
| Palestine | West Bank |

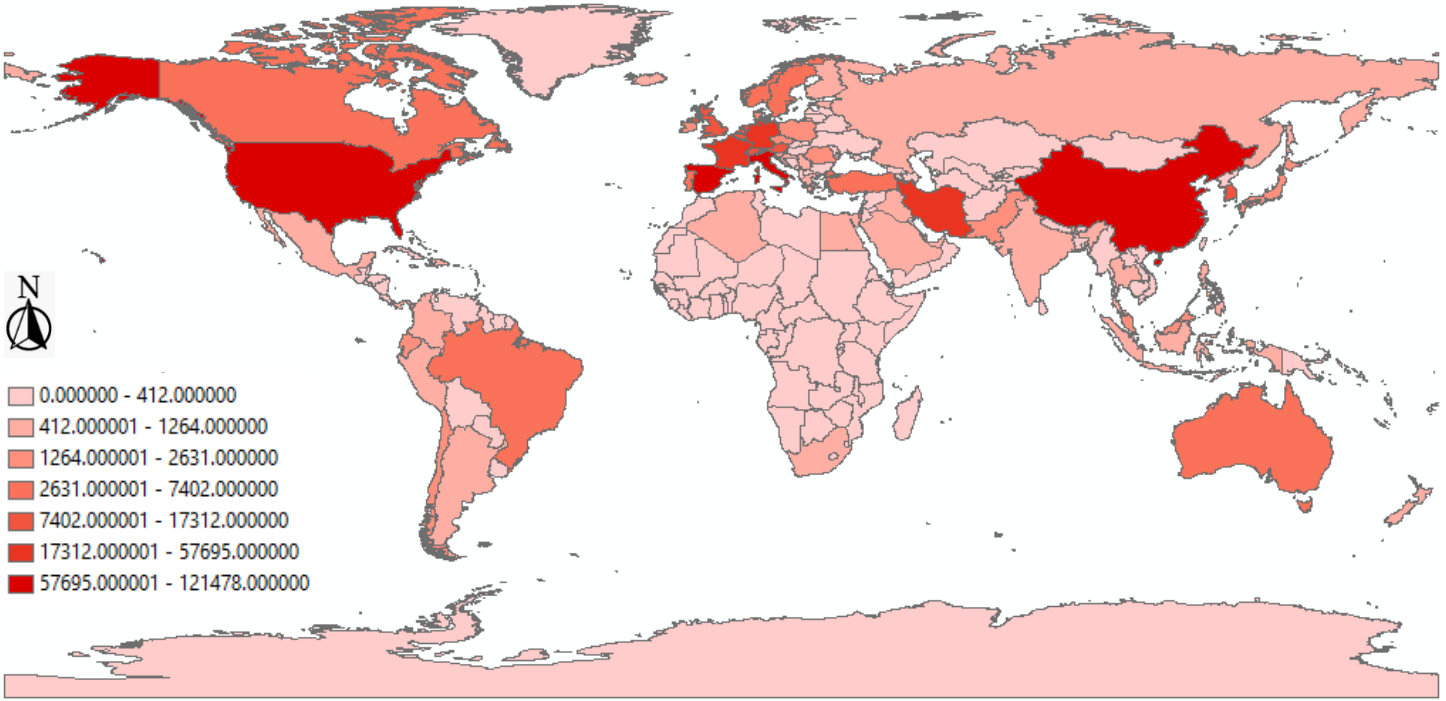
Country Mapping List

Kosovo, Vatican, Timor not found

https://github.com/CSSEGISandData/COVID-19/blob/master/csse_covid_19_data/csse_covid_19_time_series/time_series_covid19_confirmed_global.csv

# Sample Map of Virus Data by Country

The Choropleth Map of Confirmed Cases as of March 28, 2020



# The List of Base Data

| Data Title | File Name | File Type | File Path |
|---|---|---|---|
| Prefecture County Census Data with 2000-2010 GIS Maps | 2000-2010CountyCensus.shp | Shape File | public\Covid\Data\BaseData\China |
| Prefecture City Census Data with 2000-2010 GIS Maps | 2000-2010PrefectureCensus.shp | Shape File | public\Covid\Data\BaseData\China |
| Prefecture Province Census Data with 2000-2010 GIS Maps | 2000-2010ProvCensus.shp | Shape File | public\Covid\Data\BaseData\China |
| Base map, County | County0010.shp | Shape File | public\Covid\Data\BaseData\China |
| Base map, Prefecture City | City0010.shp | Shape File | public\Covid\Data\BaseData\China |
| Base map, Province | Prov0010.shp | Shape File | public\Covid\Data\BaseData\China |
| Base map, Country Boundary | chinaln.shp | Shape File | public\Covid\Data\BaseData\China |
| Index File for Province Census Data with 2000-2010 GIS Maps | List Maps three categories Prov 00-10.xlsx | Excel File | public\Covid\Data\BaseData\China |
| Index File for Prefecture Census Data with 2000-2010 GIS Maps | List Maps three categories City 00-10.xlsx | Excel File | public\Covid\Data\BaseData\China |
| Index File for County Census Data with 2000-2010 GIS Maps | List Maps three categories County 00-10.xlsx | Excel File | public\Covid\Data\BaseData\China |
| Base map, US States | ST CARTO.shp | Shape File | public\Covid\Data\COVID-19 Cases\US |
| Base map, US Counties | CO CARTO.shp | Shape File | public\Covid\Data\COVID-19 Cases\US |
| Base map, Countries | Countries.shp | Shape File | public\Covid\Data\COVID-19 Cases\World |

**Base maps**

- China: 2000-2010 comparable census maps (province, city and county/urban district)
- USA: 1970-2010 comparable census maps (state, county)
- World: World map by country

# The List of Virus Data

| Country | Data Title | File Name | File Type | File Path |
|---|---|---|---|---|
| China | City map with virus cases | City Map 0115-0308.csv | CSV file | public\Covid\Data\COVID-19 Cases\China |
| China | Province map with virus cases | Prov Map 0115-0308.csv | CSV file | public\Covid\Data\COVID-19 Cases\China |
| China | Individual virus cases | 腾讯看点-疫情小区0316V1.1.xlsx | Excel File | public\Covid\Data\COVID-19 Cases\China\Communities |
| China | Tracks of individual patients | 轨迹数据0316V1.0.xlsx | Excel File | public\Covid\Data\COVID-19 Cases\China\trajectories |
| US | Confirmed cases by US county | US County Confirm Cases 0311.csv | CSV file | public\Covid\Data\COVID-19 Cases\US |
| US | Recovered cases by US county | US County Recover Cases 0311.csv | CSV file | public\Covid\Data\COVID-19 Cases\US |
| US | Death cases by US county | US County Death Cases 0311.csv | CSV file | public\Covid\Data\COVID-19 Cases\US |
| US | Confirmed cases by US states | US State Confirm Cases 0311.csv | CSV file | public\Covid\Data\COVID-19 Cases\US |
| US | Recovered cases by US statss | US State Recover Cases 0311.csv | CSV file | public\Covid\Data\COVID-19 Cases\US |
| US | Death cases by US states | US State Death Cases 0311.csv | CSV file | public\Covid\Data\COVID-19 Cases\US |
| World | Virus by Countries0302.xlsx | Virus Cases by Countries | Excel File | public\Covid\Data\COVID-19 Cases\World |

**Note**: The virus data aggregated by city in China has been adjusted to the 2000-2010 comparable city map

# Data Depository: dataverse.harvard.edu

The Dataverse® Project

## Open source research data repository software

**Researchers**

Enjoy full control over your data. Receive *web visibility, academic credit,* and *increased citation counts.* A personal dataverse is easy to set up, allows you to display your data on your personal website, can be branded uniquely as your research program, makes your data more discoverable to the research community, and satisfies data management plans. Want to set up your personal dataverse?

**Journals**

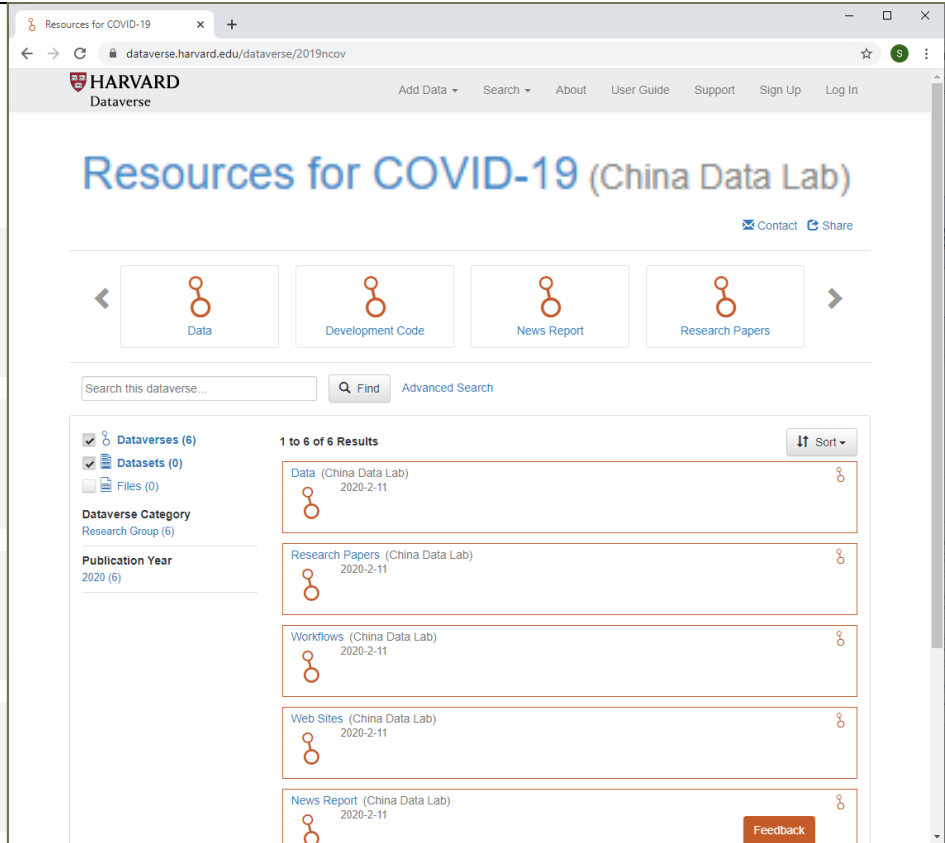
Seamlessly manage the submission, review, and publication of data associated with published articles. Establish an *unbreakable link* between *articles in your journal* and *associated data.* Participate in the open data movement by using Dataverse as part of your journal data policy or list of repository recommendations. Want to find out more about journal dataverses?

**Institutions**

Establish a research data management solution for your community. Federate with a growing list of Dataverse repositories worldwide for increased discoverability of your community's data. Participate in the drive to set norms for sharing, preserving, citing, exploring, and analyzing research data. Want to install a Dataverse repository?

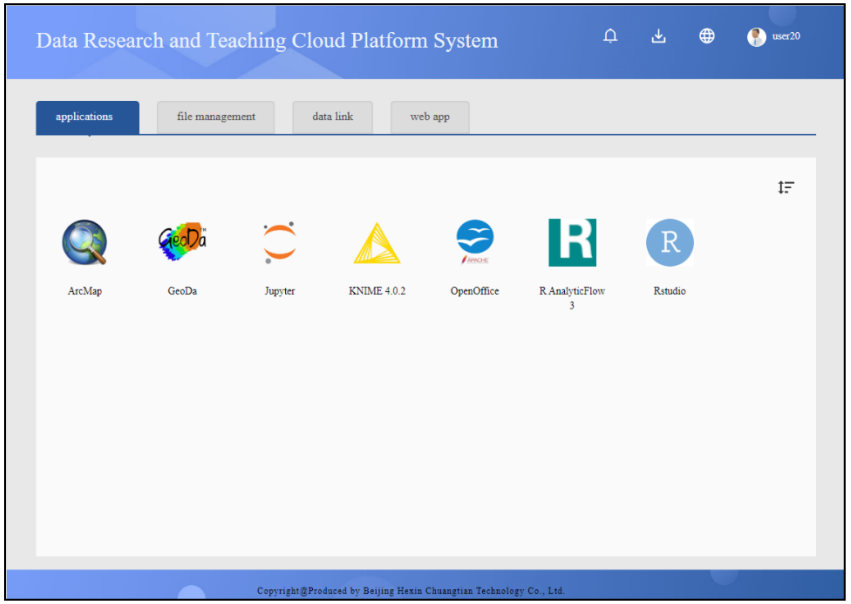
**Developers**

Participate in a vibrant and growing community that is helping to drive the norms for sharing, preserving, citing, exploring, and analyzing research data. Contribute code extensions, documentation, testing, and/or standards. *Integrate research analysis, visualization* and *exploration tools,* or other research and data archival systems with Dataverse. Want to contribute?



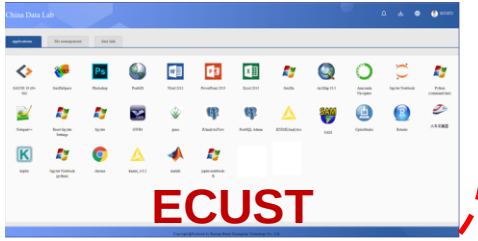
# Data Cloud

## CDL in Harvard



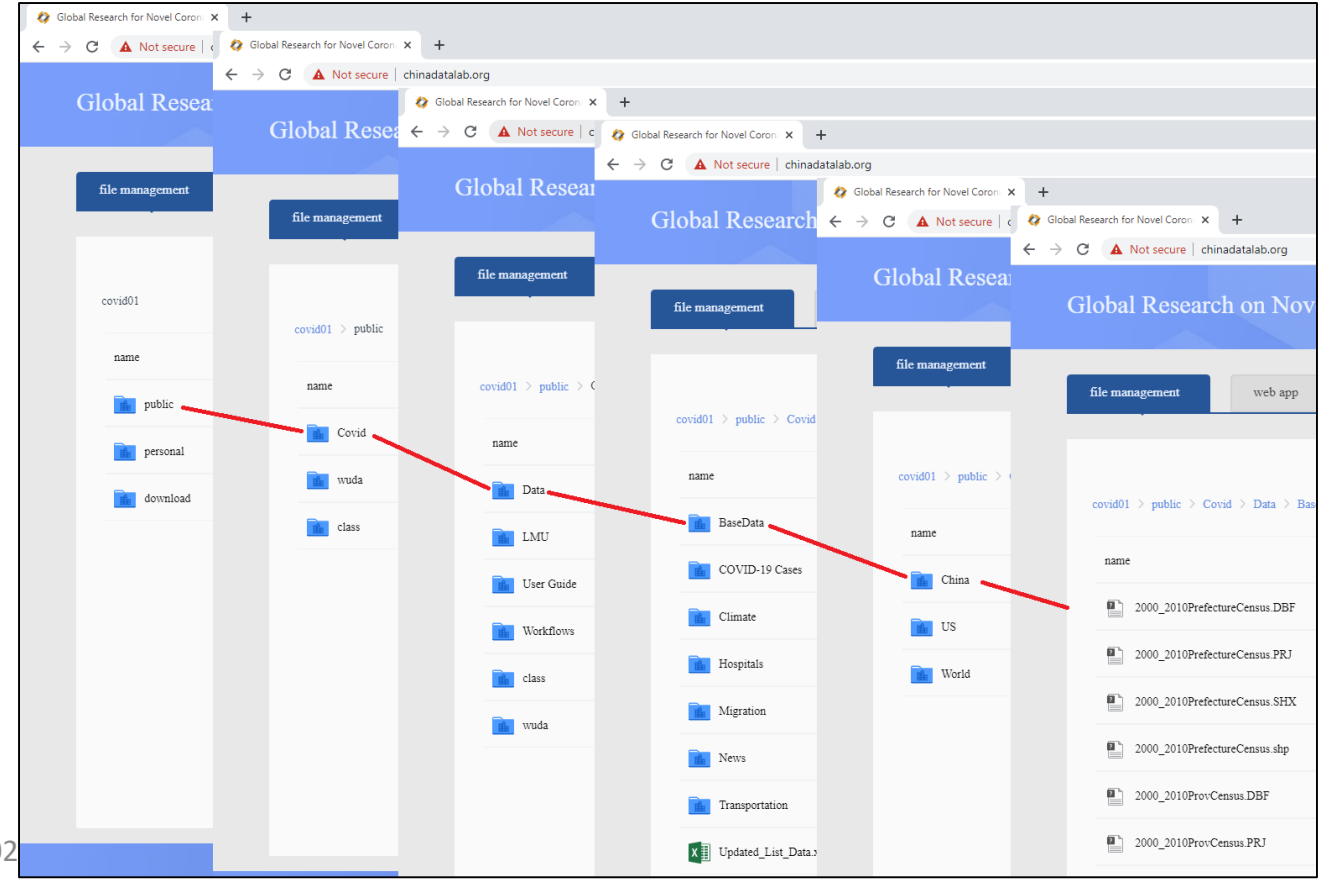

http://harvard.chinadatalab.org

## CDL in China



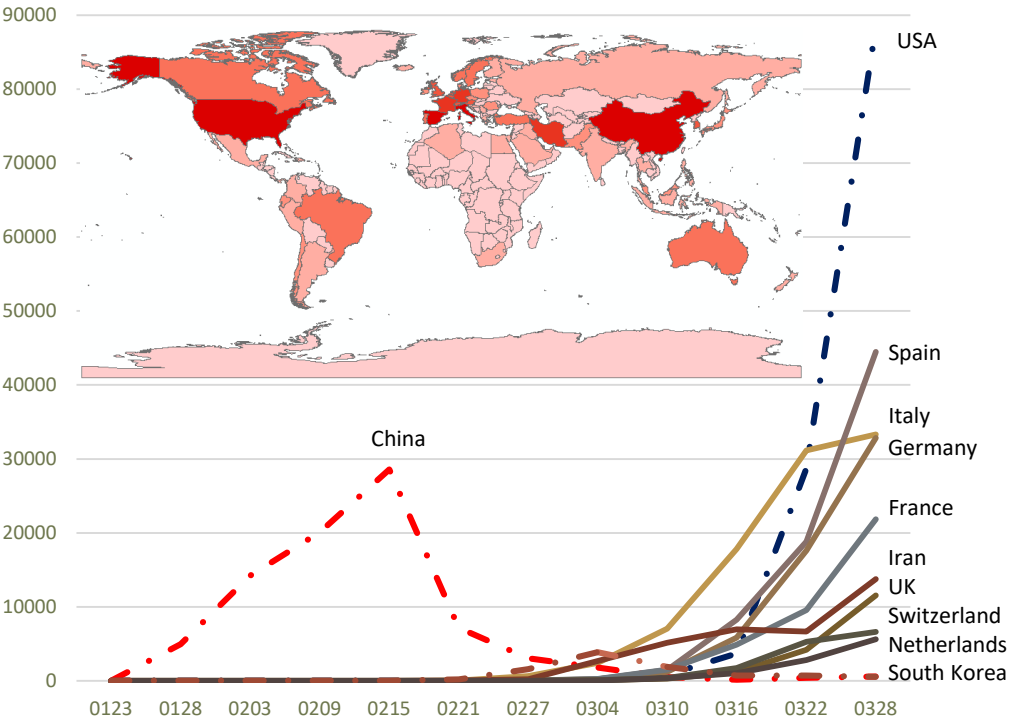

http://chinadatalab.org

# The Hierarchical Data Structure

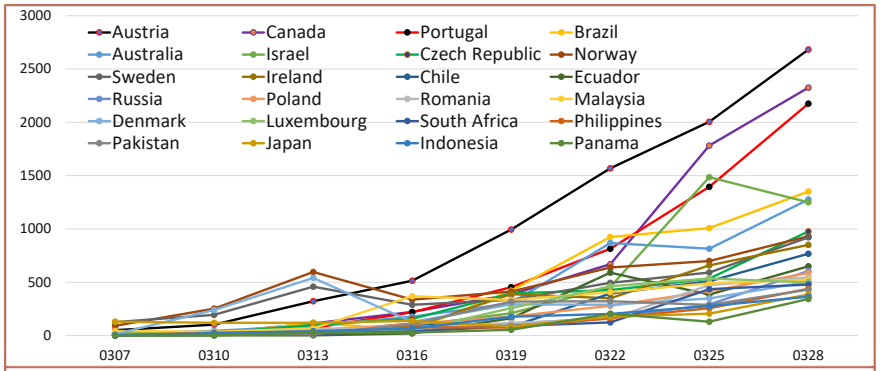


# Sample Work of Virus Data Analysis

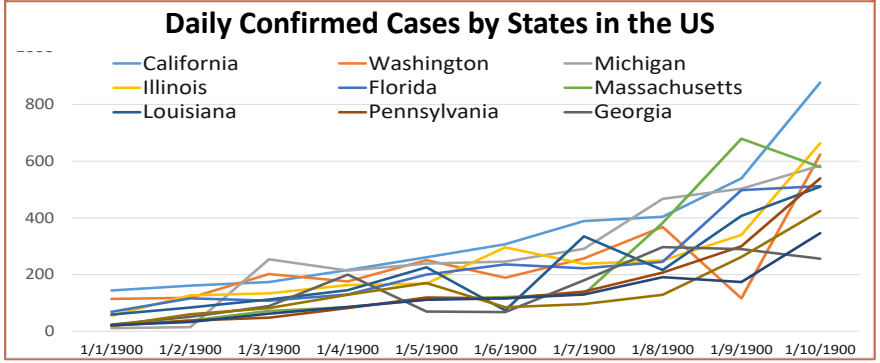
## Countries with Mostly Confirmed Cases (6-day average)



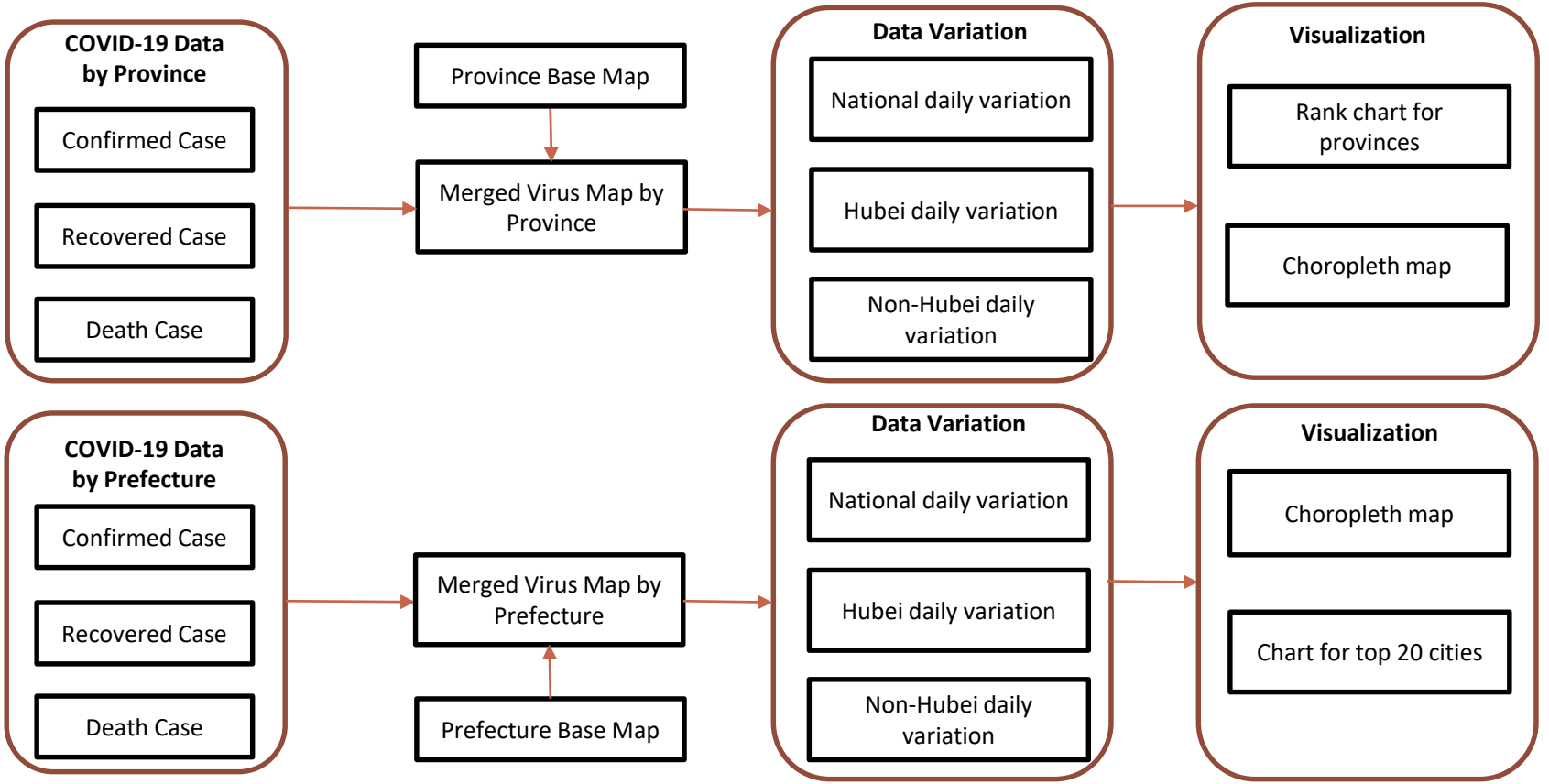

## Confirmed Cases by Other Countries (3-day average)



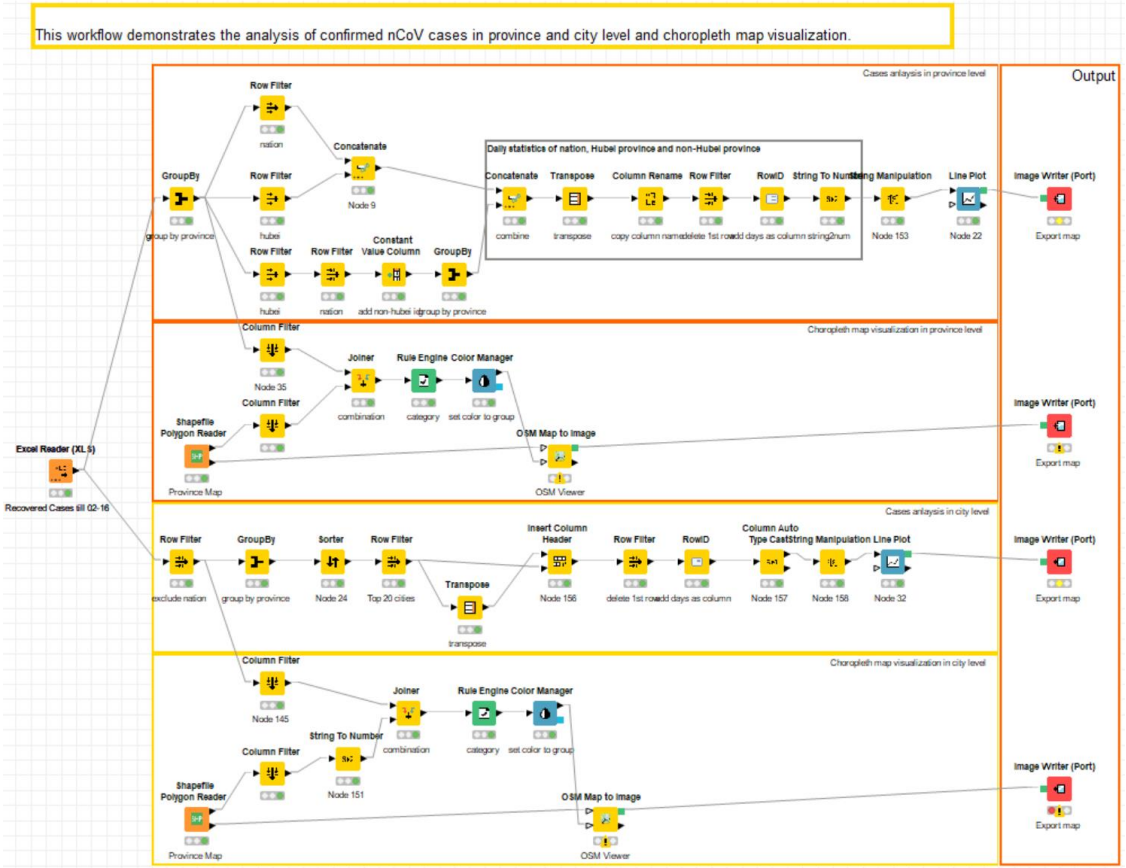

## Daily Confirmed Cases by States in the US



# The Flowchart for Virus Data Integration & Visualization



# The Workflow for Prefecture City Data Analysis




## Workflow in KNIME

Open for Innovation
KNIME

# The Case Study of City Virus Data Analysis

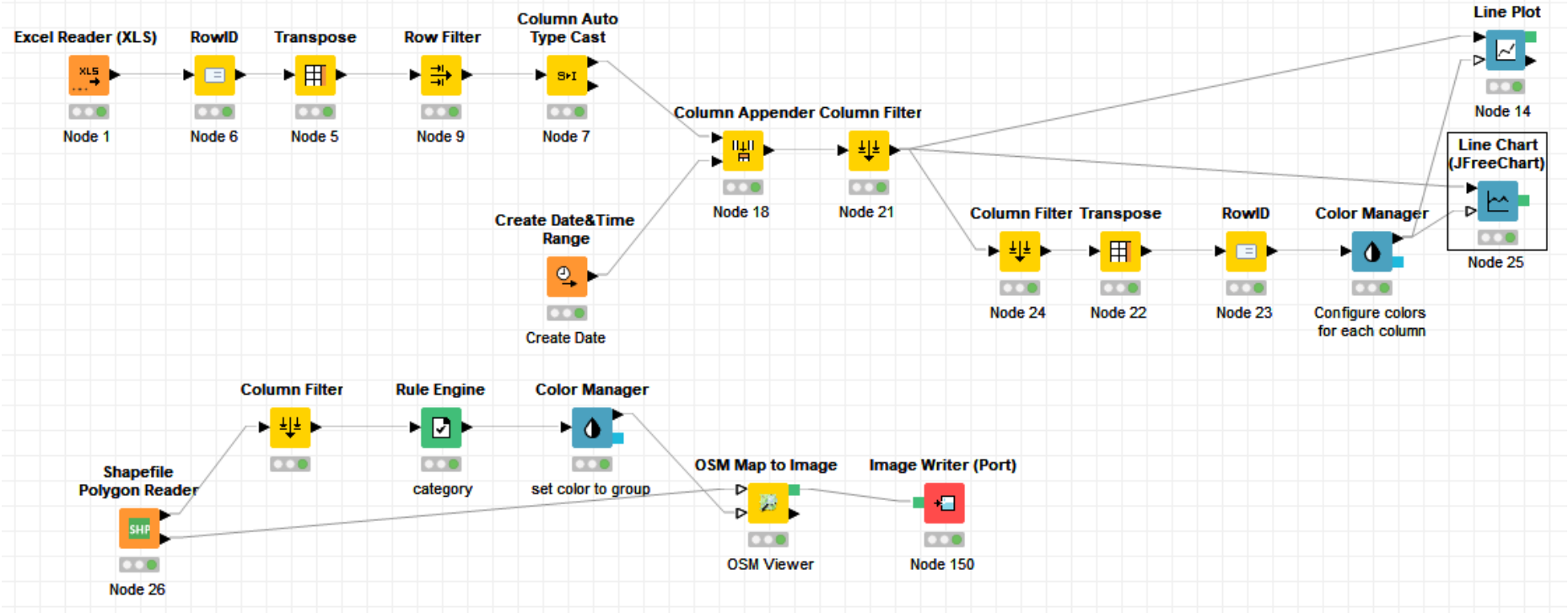
- Data for downloading from Harvard Dataverse

  https://doi.org/10.7910/DVN/FWOPW2

- Data available on the cloud for COVID-19 study

  /Covid/Workflows/00_cases_stats

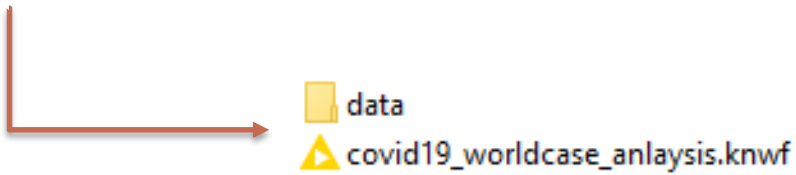
# The Workflow for Global Virus Data Analysis



# The Case Study of Global Virus Data Analysis

- Data available on the cloud for COVID-19 study

/Covid/Workflows/03_world_cases_anlaysis



# Discussion

**Possible impacts of the following factors on the data accuracy:**

- Changes in official standards for virus tests
- Changes in policies and regulations
- Changes in local leaderships

See "Policies and Regulations Timeline", https://doi.org/10.7910/DVN/OAM2JK

**Possible impacts of the following factors on the spatio-temporal patterns:**

- Economic linkages
- Migration
- Transportation
- Health facility
- Spatial distribution of population and business

# Websites and Contact

## Resources for Coronavirus Study

http://chinadatalab.net

## The Cloud for COVID-19 Study

Http://chinadatalab.org

## Webinars on Virus Study

https://dataverse.harvard.edu/dataverse/cdl_training

**covid-2019@umich.edu**