

## Covid-19 Changes Climate Patterns

[Featured at Public Health Post](#)

### Public Health Post

#### Covid-19 Changes Climate Patterns

FOLLOW PHPOD THE TURNING POINT MENU SEARCH

By Chaowei Phil Yang | Qian Liu  
February 22, 2021



Due to lockdown orders and travel restrictions implemented amid the COVID-19 pandemic, there have been many changes in environmental patterns worldwide. To better understand these short-term atmospheric changes, specifically in China and the United States, researchers Dr. Phil Yang and PhD candidate Qian Liu conducted a systematic study using satellite observations, ground-based in-situ sensors, and various other infrastructural observations. Results demonstrated that air pollution in China dropped by up to 20% and that there was a continuous decrease in air pollution over the days leading up to the Lunar New Year. Likewise, the United States also experienced reductions in air pollution with regional patterns mirroring that of China in Los Angeles and San Francisco, California. By researching climate patterns at a time when many human-based emission sources are down, this project hopes to better examine the impact of human activity in the environment and facilitate further research on achieving equal priority to economic rebound and climate control.

For further information and/or inquiries, email Dr. Phil Yang at [cyang3@gmu.edu](mailto:cyang3@gmu.edu) and/or Ms. Qian Liu at [qliu6@gmu.edu](mailto:qliu6@gmu.edu).

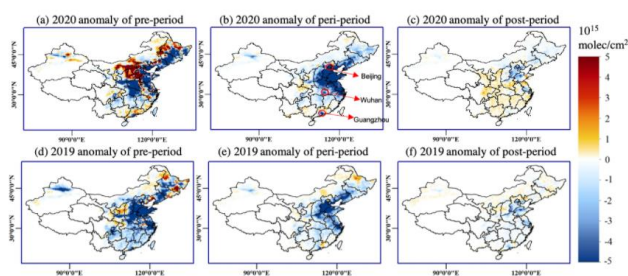


Figure 1. Spatial patterns of  $\text{NO}_2$  TVCD anomalies for pre-, peri- and post-period over China. (a)–(c) anomalies for 2019; (d)–(f) anomalies for 2020. Red circles are cities of Beijing, Wuhan and Guangzhou. Pixels with annual means smaller than  $1 \times 10^{15} \text{ molec/cm}^2$  are not plotted in the maps.

October 2020 – January 2021

## List of Contents

- Covid-19 Changes Climate Patterns
- Call for Papers for a Special Issue in the Annals of GIS “Spatiotemporal Analysis of the Impact of COVID-19”
- Webinar Series on COVID-19 Impact Analysis
- GIS-day Student Lightning Talks
- Introduction to Spatial Data Lab: Data, Tools, and Applications
- A State-Level Socioeconomic Data Collection of the United States for COVID-19 Research
- Updates: Developing an Online Spatial Data Sharing and Management Platform
- ArcGI Image Processing Service

## Call for Papers for a Special Issue in the Annals of GIS “Spatiotemporal Analysis of the Impact of COVID-19

While COVID-19 has posed huge challenges to society and has been reshaping our world, it has also brought forth new analytical tools and opportunities for spatiotemporal study, methodologies, and interdisciplinary research. This Special Issue in Annals of GIS “Spatiotemporal Analysis of the Impact of COVID-19” aims to organize and capture these new developments with a focus on the spatiotemporal analysis of the impact of the COVID-19 pandemic. Topics are to include related theories, methodologies, data and applications, and emphasis on understanding the short and long-term impacts that COVID-19 may have on health, socioeconomics, the environment, and politics.

Researchers interested in submitting papers should submit to Annals of GIS, a peer-reviewed journal managed by the Taylor & Francis Group, which publishes interdisciplinary research on theory, methods, development and applications in geo-information science. Individuals should use “Principles and Analytical Frameworks” to signify that the paper is for the special issue on COVID-19.

The submission link can be found [here](#) and the special issue is expected to be published in the fall of 2021. For further information and/or inquiries, email Dr. Shuming Bao at [sbao@umich.edu](mailto:sbao@umich.edu).

## Webinar Series on COVID-19 Impact Analysis

In continuation to the initiative on “Resources for COVID-19 Study,” the China Data Lab project sponsored a third webinar series with a focus on the impact analysis of the COVID-19 pandemic. Webinars took place from 10:30 AM to 12:00 PM ET every Friday between January 8, 2021 to January 29, 2021.

From research on “Intergenerational Residence Patterns and COVID-19 Fatalities in the EU and the US” to “Taking the Pulse of COVID-19: A Spatiotemporal Perspective,” this webinar series will feature scholars and professionals from the Center for Geographical Analysis at Harvard University, the Geo-Computation Center for Social Sciences at Wuhan University, the China Data Institute, the NSF Spatiotemporal Innovation Center, and RMDS Lab, among others. This project aims to provide data support for the spatial study of COVID-19 at local, regional and global levels, facilitate quantitative research on spatial spreading and impacts of COVID-19, and promote collaborative research on the spatial study of COVID-19 on the China Data Lab, Dataverse and WorldMap platforms. There are approximately 3000 person times participation for the webinars.

For further information and/or inquiries, email Dr. Shuming Bao at [sbao@umich.edu](mailto:sbao@umich.edu)

To access "Webinars on Modeling COVID-19 Pandemic: Resources, Methodology and Applications" from the Harvard Dataverse, click [here](#).

To access "Webinars for ‘Resources for COVID-19 Study’" from the Harvard Dataverse, click [here](#).

## GIS-day Student Lightning Talks

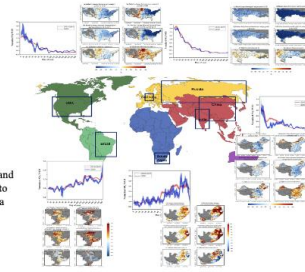


### COVID-19 Impact on Global NO<sub>2</sub>

Relative Difference (RD) of Global NO<sub>2</sub> emission, between before (pre-) and during (peri-), during (peri-) and after (post-) lockdown.

	Relative difference between peri- and pre-period (%)		Relative difference between post- and peri-period (%)	
	2020	2010-2019	2020	2010-2019
China	-50%	-38%	-23%	-41%
USA	-43%	-44%	4%	-8%
South Africa	33%	43%	6%	3%
Brazil	14%	17%	3%	4%
India	-9%	3%	5%	-10%
Germany	-60%	-50%	-39%	-44%
Russia	-67%	-66%	-30%	-20%

- Mean NO<sub>2</sub> emissions of most target countries **significantly decreased** (<-5% in RD between peri- and pre-period) during the lockdown in 2020 compared to previous 10 years, such as China, South Africa, India and Germany.
- Brazil and Russia **slightly declined** by 3% and 1% during lockdown.
- However, The USA **increased** by 1% during the lockdown.



The research on the Fine-Scale Urban Heat Island Detection & Prediction was presented by Jingchao Yang during the 2020 GIS-day Student Lightning Talks. The research introduced the latest framework and results for detecting and predicting block-level urban heat islands using the Internet of Things (IoT) dataset fusion. Predictions from different state-of-art ML techniques were compared and demonstrated, showing promising results. Models built for the research also proved to have high transferability, meaning it can be reutilized for other given regions for data shortage issue handling.

Qian Liu presented the latest results on the impacts of COVID-19 on natural environment, including air quality and nighttime light in China, air pollution level in California and global tropospheric nitrogen dioxide. Notable changes are found through the analytics and the research gained great attention among the GIS community in GMU.

For further information and/or inquiries, email Mr. Jingchao Yang at [jyang43@gmu.edu](mailto:jyang43@gmu.edu) and/or Ms. Qian Liu at [qliu6@gmu.edu](mailto:qliu6@gmu.edu)

## Introduction to Spatial Data Lab: Data, Tools, and Applications

Hosted at Harvard University, Spatial Data Lab (SDL) is a cloud platform for spatial data sharing and analysis, which is co-sponsored by the NSF Spatiotemporal Innovation Center, Geo-Computing Center for Social Sciences at Wuhan University, China Data Institute and Future Data Lab. It allows researchers access to research data tools and workflows for data analysis on the cloud and share the data and analytical results within the SDL user community. The platform provides an integrated data and tools environment for collaborative research and training. This webinar will introduce available data, tools, and workflow-based case studies on the SDL platform as well as how to apply for a user account on the Spatial Data Lab.

The current SDL platform offers the following primary data collections: Administrative Boundary Maps; Population Census Data; Economic Census Data; Patent Data; Health and Environment Data; Database for COVID-19 Study; Geotagged Tweets; GDELT News and more. Geographic extent of these data collections range from regional, national to global. The SDL platform also offers more than 50 workflow-based case studies on spatiotemporal data analysis.

For further information and/or inquiries, please feel free to contact the SDL project team at [spatialdatalab@lists.fas.harvard.edu](mailto:spatialdatalab@lists.fas.harvard.edu).

## A State-Level Socioeconomic Data Collection of the United States for COVID-19 Research

From late 2019, COVID-19 has jeopardized the health of humankind, but also, it influences public policies, economic behavior, and human behavior patterns substantially. For one to better understand the impact and to mitigate any future outbreaks, one must analyze the socioeconomic factors that play a significant role in: (1) determinant analysis for health care, environmental exposure, and health conduct; (2) policies driving human mobility analyses; (3) economic pressure and recovery analysis for administrative decisions; and (4) short to long term social impact evaluation for equity, diversity, and justice. To aid these analyses for swift impact results, the United States of America utilizes state-level socioeconomic factors, which are assembled and integrated within topic-based indicators including: daily quantitative policy stringency index; dynamic economic indicators with multiple time-frequency of Gross Domestic Product (GDP), international trade, individual salary, employment market, and others; the socioeconomic determinant baseline of the demographic, housing commercial situation and medical resources. This paper establishes the measurements and metadata of socioeconomic data collection, alongside the sharing platform, data warehouse groundwork, and quality control approach. This collection differs from existing COVID-19 related data commodities for it recognizes the geospatial and dynamic factors as essential dimensions of epidemiologic research and it scales down the spatial resolution of socioeconomic data collection from the country level to state level within the United States, along with high quality and a standard data format.

[Click Here to Read More](#)

For further information and/or inquiries, email Mr. Dexuan Sha at [dsha@gmu.edu](mailto:dsha@gmu.edu)

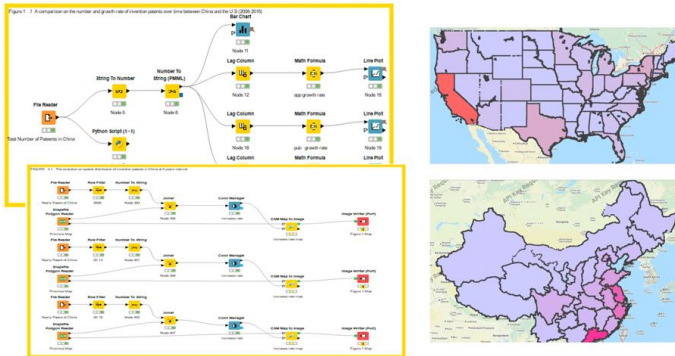
## Updates: Developing an Online Spatial Data Sharing and Management Platform

1. Achievements:
  - a. Weekly update on COVID-19 relevant datasets on Harvard Dataverse.
  - b. Collect global countries and united states vaccine data and share the data on Harvard Dataverse.
  - c. Update datasets and install new applications on Spatial Data Lab platform deployed at Harvard server.
  - d. Replicate 8 published papers using workflows, including
    - 1) Yu, D., & Wei, Y. D. (2008). Spatial data analysis of regional development in Greater Beijing, China, in a GIS environment. *Papers in Regional Science*, 87(1), 97-117.
    - 2) Gao, B., Huang, Q., He, C., & Ma, Q. (2015). Dynamics of urbanization levels in China from 1992 to 2012: Perspective from DMSP/OLS nighttime light data. *Remote Sensing*, 7(2), 1721-1735.
    - 3) Tripathy, B. R., Tiwari, V., Pandey, V., Elvidge, C. D., Rawat, J. S., Sharma, M. P., ... & Kumar, P. (2016). Estimation of urban population dynamics using DMSP-OLS night-time lights time series sensors data. *IEEE Sensors Journal*, 17(4), 1013-1020.
    - 4) Wu, W., Yuan, L., Wang, X., Cao, X., & Zhou, S. (2020). Does FDI drive economic growth? Evidence from city data in China. *Emerging Markets Finance and Trade*, 56(11), 2594-2607.
    - 5) Liu, F., & Sun, Y. (2009). A comparison of the spatial distribution of innovative activities in China and the US. *Technological Forecasting and Social Change*, 76(6), 797-805.
    - 6) Cheung, K. Y., & Ping, L. (2004). Spillover effects of FDI on innovation in China: Evidence from the provincial data. *China economic review*, 15(1), 25-44.
    - 7) Sun, Y., Lu, Y., Wang, T., Ma, H., & He, G. (2008). Pattern of patent-based environmental technology innovation in China. *Technological Forecasting and Social Change*, 75(7), 1032-1042.
    - 8) Sun, Y. (2000). Spatial distribution of patents in China. *Regional studies*, 34(5), 441-454.



# NSF Spatiotemporal Innovation Center

- e. Co-host four training webinars with CDI (China Data Institute) on regional and innovation data introduction and workflow-based case studies.
    - 1) December 17, 2020, Understanding the Administrative Maps and Regional Geography.
    - 2) December 3rd, 2020. Analysis of Economic Census Data & Industrial Change.
    - 3) January 21, 2020, Spatial Study of Innovation with Patent Data.
    - 4) January 7th, 2021. The Integration of Data and Maps for Spatial Analysis.
  - f. Dr. Tao Hu co-present “An overview of human mobility and COVID-19 transmission” in the webinar series on COVID-19 impact analysis.
2. A figure about paper replication using workflow tool KNIME.



3. In the next phase, we will release Spatial Data Lab cloud platform to users who submit applications, continue building case studies using workflows and co-host training webinars.

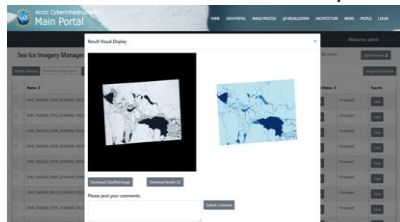
For further information and/or inquiries, email Dr. Tao Hu at [taohu@fas.harvard.edu](mailto:taohu@fas.harvard.edu).

## ArcCI Image Processing Service

Sea ice acts as both an indicator and an amplifier of climate change. High spatial resolution (HSR) imagery is an important data source in Arctic sea ice research for extracting the physical parameters of sea ice and calibrating/validating climate models. HSR images are difficult to process and manage due to their large data volume and complex spatiotemporal distributions. Arctic Cyberinfrastructure (ArcCI) is a developed platform that allows a reliable and efficient on-demand image batch processing on the web.

Users with a large number of images can leverage the service to process their image in a high-performance manner on cloud, and manage, analyze results in one place. The ArcCI platform web portal supports image preprocessing management functions such as uploading, deleting, searching and sorting, and other metadata management functionalities. Users can also perform batch processing, check the processing status, and visualize the results using this platform. This platform has also incorporated user management functionalities such as user registration and authorization for easy user access control.

For further information and/or inquiries, email Mr. Dexuan Sha at [dsha@gmu.edu](mailto:dsha@gmu.edu).



Content Providers: Phil Yang, Shuming Bao, Hu Tao, Dexuan Sha, Qian Liu, Jingchao Yang, Yun Li | Graphic Designer: Sisi Wang, Baiqing Zhang, Xiaoli Shi, Weijia Wang | Editors: Ziyue Xu, Michelle Ly, Eden Brunner, Jacqueline Chen, Jean Yu  
Point of Contact: Phil Yang: [cyang3@gmu.edu](mailto:cyang3@gmu.edu) Wendy Guan: [wguan@cga.harvard.edu](mailto:wguan@cga.harvard.edu)