NSF Spatiotemporal Innovation Center

June 2020 Monthly Newsletter

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July 10th, 2020

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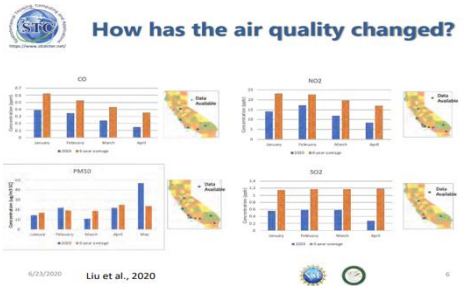

June IAB Meeting Briefing

The NSF Spatiotemporal Innovation Centre held its semi-annual Industrial Advisory Board (IAB) meeting on June 12th, 2020 virtually. Fifteen projects were introduced, including GMU-17-04: Integration and Applications of Geo-JPSS Flood Detection, GMU-19-01: Cloud Classification, and Harvard-17-01: Evaluating OmniSci, Open Source GPU-powered SQL. Since its establishment in 2013, the Center has placed over 10-tenure line faculty in phase 1 operation. Three obtained tenure, including one early tenure and one CAREER awardee. It has also conducted 12 professional training programs since 2012, hosting over 200 professionals and 100 speakers, as well as engaging three countries and approximately 20 organizations. The goal of the meeting was to review the newest research of the center, discuss progress and accomplishments made by funded projects, and present proposals that could benefit from increased support and collaboration. Companies and agencies interested in using geospatial and spatiotemporal research to advance computational infrastructure and advance human knowledge were welcomed, furthering the Center's goals to develop a spatiotemporal infrastructure extending from a regional to national to global levels.
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STC COVID-19 presentation for the National Academy of Sciences

On June 17, 2020, Dr. Yang from the NSF and GMU gave a presentation at the National Academy of Science's Mapping Science Committee webinar on pandemic resilience. By utilizing various data visualizations to analyze spatiotemporal patterns in relation to topics (e.g., human activity and the environment), Dr. Yang's presentation - "Spatiotemporal Patterns and Simulations for Fighting COVID-19" - acknowledges the current challenges facing countries amid the COVID-19 pandemic and seeks to answer core questions regarding the pandemic's social and environmental effects. These concerns include changes in air quality, demographic bias, sufficiency of medical resources, safety of reopening strategies, and the effectiveness of policies to mitigate and control the spread of COVID-19. Furthermore, Dr. Yang's presentation identified several geospatial CI needs, including transparency, quality, collaboration, and diversity, which can help geospatial researchers better understand the spread and effects of COVID-19. The geospatial information and guidance provided by this presentation can assist researchers, policymakers, and organizations to understand and develop effective societal, governmental, and infrastructural responses to mitigate and prevent the spread of COVID-19.
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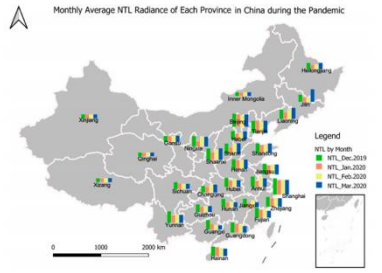

Figure 2. Monthly average NTL for each province from December 2019 to March 2020.

Spatiotemporal Patterns of COVID-19 Impact on Human Activities and Environment in Mainland China Using Nighttime Light and Air Quality Data

The outbreak of the COVID-19 pandemic brought drastic structural changes in China, as policies to mitigate and contain the spread of the pandemic disrupted everyday life, influencing working and living environments. Through an investigation of the spatiotemporal patterns in Nighttime Light (NLT) radiance and Air Quality Index (AQI) before and during the COVID-19 pandemic in mainland China and its provinces, a STC team of researchers supported by the NSF COVID-19 Rapid Response project aimed to comprehensively understand the impacts of COVID-19 on the atmospheric environment and human activities.

The NTL has three classes (residential area, transportation and public facilities, and commercial centers) with radiance ranges (5–20, 20–40, and greater than 40 [$nW \cdot cm^{-2} \cdot sr^{-1}$], in series). By comparing the monthly mean NTL radiance and monthly mean AQI before and during the pandemic, this study provides a spatiotemporal perspective on the consequences of the implemented prevention and mitigation measures (e.g., lockdown, quarantine). These findings provide policymakers and researchers a better understanding of the impacts of COVID-19 on people's lives, activities, and natural environment, helping inform policy makers of competing options consequences (e.g., economy, city reopening, allocation of medical resources). This study offers guidance on the current challenges and uncertainties in understanding the full impacts of COVID-19 on related topics including air pollutants (e.g., SO_2, CO, and ozone), climatic, virus-spread factors).
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Webinars on COVID-19 Data Analysis

As a joint effort by scholars from more than 20 universities and institutions across the United States and China, this webinar series on COVID-19 data analysis was organized in response to the ongoing COVID-19 pandemic. It featured 24 webinars and attracted over 4,000 people globally. The webinars focused on COVID-19 data analysis including epidemic cases, Baidu mobility, health facility, social media, high speed railway and airplane data, news, policies, climate, QQ location data, policy index data, hospital POI Data, environmental data, Twitter data, and country dynamics (e.g., India, Brazil, Russia, Italy). The webinars discussed data collation and integration, data visualization and sharing, spatiotemporal data analysis, epidemiological models and predictions, and international comparative data studies. Those webinars not only provided online exchange opportunities but fosters further discussions and cooperation offline.
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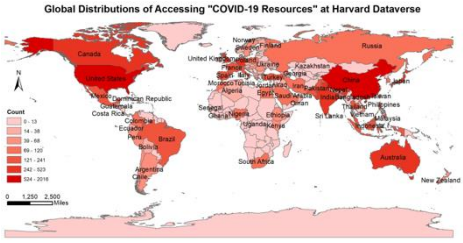
Collaborated by Shuming Bao of CDI, Aaron Williams of OmniSci, Carol Xu of FDL



Compiled Data Repository

The Sars-CoV-2 (use COVID-19 instead) pandemic at the end of 2019 threatened the lives and health of people around the world. Its impact is global and affects political, economic, and social sectors while simultaneously creating new industries and technologies. To promote resource sharing and collaboration on COVID-19 research, the China Data Institute teamed up with experts and scholars from Harvard University, Wuhan University, RMDS Labs, Microsoft China VEsystem Technology Co.Ltd, Knowledge Sharing Technology Inc., All China Marketing Research, and others to launch the Resources for COVID-19 and Global Research Project. The ‘s goal is to provides an information infrastructure for the spatial study of the new novel coronavirus (COVID-19). The objectives include the following: provide data to support the spatial study of COVID-19 at local, regional and global levels with information collected and integrated from different sources; facilitate quantitative research on spatial spreading and impacts of COVID-19 with advanced methodologies and technologies; promote collaborative research on the spatial study of COVID-19; and to build research capacity for future collaborative projects. The project has received support from many other research institutions and companies for data, methodology, technology, and cloud platforms.

The NSF Spatiotemporal Innovation Center created visualizations and data sets that account for 22 countries. The final data are deployed to covid-19.chinadatalab.net for research sharing. While the multi-scale daily reports provide automated and updated information on COVID-19 cases and their related attributes, summary data shows the case timeline. Included in this data repository are COVID-19 virus cases and their associated natural and social factors, including environmental observations and policy indices. Using a multi-scale platform based on ISO (International Organization for Standardization) standards and aggregating the datasets by region area (ranging from global to countries specified within the GitHub), summary and multi-scale daily reports are organized individually. Public data are shared on the Harvard Dataverse, with some restricted data shared on the Spatial Data Lab cloud platform (requires a login). Users from 150 countries and regions have completed more than 250,000 data downloads to assess past, present, and future impacts of COVID-19 pandemic.
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STC Awarded an NSF COVID-19 Rapid Project

The Spatiotemporal Innovation IUCRC works to develop novel spatiotemporal analytical tools to promote applications of national and global importance. To combat the COVID-19 crisis, Harvard University, George Mason University, and other university sites within this IUCRC proposed a collaborative project to collect and share COVID-19 related data in real time, conduct spatiotemporal analyses, and mine for socioeconomic and environmental knowledge to facilitate decision support systems.

The project is building a unique, cloud-based platform composed of global, high quality COVID-19 related data. Spatiotemporal analytics tools analyze disease evolution and socioeconomic patterns whereas modeling tools assess medical supplies and logistics. Through web access services the platform provides accessible data and access to spatiotemporal analytical and modeling tools which help produce quicker data-based decisions support systems for community preparedness. More than 50 international researchers participated in developing the proposed platform and aided in data collection and validation, environmental impacts, policy effects on outbreaks, and managing the economy's reopening while controlling the disease spread in the U.S. based on evidence from Asia and Europe. Over 200 undergraduate volunteers of multiple ethnic backgrounds are involved in the project through Harvard's Coronavirus Visualization Team.

All data, information, and knowledge accumulated in the project is archived in a comprehensive gateway (see covid-19.stcenter.net) including spatiotemporal distribution of confirmed cases, relevant social, economic and natural information from authoritative reports, news releases, Earth observation, and social media. Software and tools developed are accessible on GitHub. Current online collaboration is produces replicable research by using spatiotemporal analyses to mimic and locate patterns and relations between COVID-19 and social and natural factors for community response and preparedness.
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