NSF Spatiotemporal Innovation Center

Dec 2021 Monthly Newsletter

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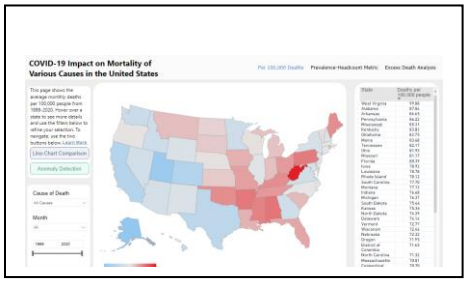
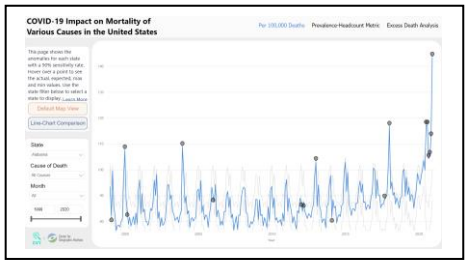




Successful 2021 November IAB Meeting

The semi-annual Industrial Advisory Board (IAB) for the I/UCRC for Spatiotemporal Thinking, Computing and Applications (a.k.a. NSF Spatiotemporal Innovation Center) was held on November 9th, 2021 virtually to the outbreak of COVID-19. This meeting had 71 registered guests and a total of 52 participants. The center reported progress on 9 different projects, and also introduced another 8 project proposals.

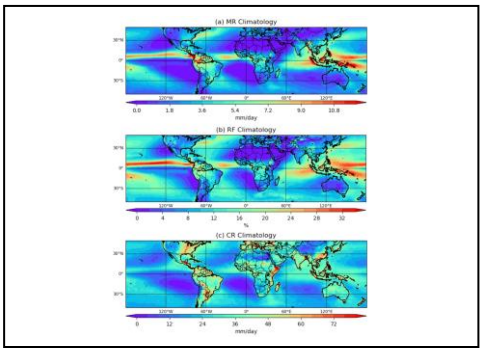
All center research results are freely shared among members to boost their products, services, or businesses. All companies or agencies with interest in geospatial and spatiotemporal research themes are welcome to participate in future meetings to become familiar with cutting-edge research results, leverage the innovative outcome for your future products and services, increase your efficiency, improve your competitiveness, and boost your business.

COVID-19's Impact on Excess Deaths of Various Causes in the United States

This project analyzed CDC published mortality data of a dozen major causes since 1999 and applied the Exponential Smoothing (ETS) algorithm to simulate the 2020 mortality rates per cause, per month, and per state, assuming there was no COVID-19 pandemic. The difference between the simulated rates and the actual rates revealed COVID-19 impacts on mortality of various causes in the United States. Findings from this project led to a public dashboard and a peer-reviewed paper accepted by the Annals of GIS special issue on Spatiotemporal Analysis of the Impact of COVID-19 (DOI: 10.1080/19475683.2021.1982001). The project team includes Harvard CGA and CVT student researchers.

For further information and/or inquiries, email Dr. Wendy Guan at wguan@cga.harvard.edu.

Spatiotemporal Trends and Variations of the Rainfall Amount, Intensity, and Frequency in TRMM Multi-satellite Precipitation Analysis (TMPA) Data



TMPA climatological (1998-2016) (a) mean precipitation rate (MR), (b) precipitation frequency (RF) and (c) precipitation intensity (CR)

Our recently paper published in the journal, *Remote Sensing*, conducts a thorough and quantitative analysis on the means, trends/patterns, and categories of three precipitation parameters. The mean rain rate (MR), rain frequency (RF), and conditional rain rate (CR) reflect the precipitation amount, frequency, and intensity, respectively, at a global scale (50°N~50°S). To learn more, follow the link below.

KEYWORDS: precipitation, rain frequency, mean rain rate, conditional rain rate, EOF analysis

For further information and/or inquiries, please email Ms. Qian Liu at qliu6@gmu.edu.

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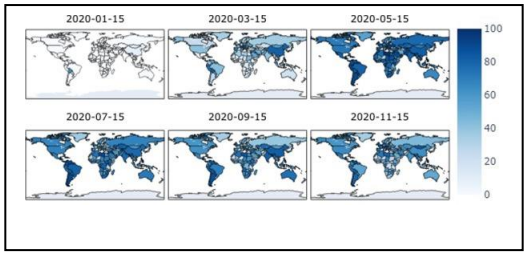
Impact of COVID-19 containment and closure policies on tropospheric nitrogen dioxide: A global perspective



The evolution of policy stringency worldwide.

This recent publication in *Environmental International* focuses on the impact of COVID-19 containment and closure policies over nitrogen dioxide in the troposphere from a global perspective. This paper explores the outcomes that COVID-19 mitigation efforts have had on the environment, both positive and negative. The NO_2 emission changes are analyzed through qualitative and quantitative analyses cross several clusters at the global and regional levels. Spatiotemporal panel regression analyses were conducted to quantify the effects of several containment and closure policies in each cluster respectively.

Keywords: Nitrogen dioxide, COVID-19, machine learning, clustering, panel regression, policy analysis, spatiotemporal analysis

For further information and/or inquiries, email Ms. Yun Li at yli38@gmu.edu and/or Dr. Phil Yang at cyang3@gmu.edu.

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Implementation of OmniSci, an Open-Source GPU-powered SQL

Harvard's Center for Geographic Analysis (CGA) has updated OmniSci Enterprise license and container's version on the FAS High-Performance Computing Cluster and is using it to compute geography (global admin2 boundaries) as an added attribute for billions of tweets in CGA's geotweet archive since 2010. OmniSci is also being used to create an interactive dashboard to visualize the relationship between climate change and people's sentiment across space and time based on geotweets from the archive.

For further information and/or inquiries, email Devika Kakkar at kakkar@fas.harvard.edu.

GMU Graduate Student, Qian Liu, Wins Two AAG Awards

Graduate student Qian Liu from George Mason University won two prestigious awards from the American Association of Geographers:

- AAG-Middle Atlantic Division (MAD)'s Annual Geography Meritorious Award
- AAG Council Award for Outstanding Graduate Student Paper

These AAG awards require a competitive graduate paper submission process. This award-winning paper is titled "Cross-track Infrared Sounder Cloud Fraction Retrieval Using a Deep Neural Network".

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NSF Funded the first I-Corps project to the Spatiotemporal I/UCRC to conduct customer discovery

Due to the sudden outbreak of COVID-19, college campuses and school systems were shut down globally to slow down the spread of the disease. Despite being largely successful in controlling the spread of COVID-19, school closings caused health problems, including physical and psychological stresses, for students, staff, and faculty in addition to direct economic impacts. This project develops a system to better support school re-openings with specific policies based on scientific data and information. The potential product can simulate the trajectory of COVID-19 cases and provide potential customers with a reliable method to scientifically monitor the status of their campuses. This product has the potential to be used globally and can be used to manage large events with a focused gathering site setting.

This I-Corps project is based on a spatiotemporal simulation/prediction system developed to address the urgent campus reopening questions caused by the COVID-19 pandemic. The system integrates investigation on spatiotemporal infrastructure including big data, cloud computing, analytics, and community outreach. Human behavior simulation, campus spatiotemporal dynamics, and public health data are combined to predicate possible viral case trajectories. The novel spatiotemporal simulation integrates agent-based people movement and public health risks as well as control policies (such as mask mandates, classroom size restrictions, test and tracking, and vaccination status) to derive accurate predictions. The system has been validated using data from several college campuses.

The project includes four key participants with support from the center members, faculty, staff and interns: Zifu Wang (EL), zwang31@gmu.edu, Hai Lan (TL), hlan5@gmu.edu, Qyana Stewart (IM), and Phil Yang (PI)