National Aeronautics and Space Administration

EARTHDATA

The Many Layers of City Life: Urban Datasets from SEDAC

12/04/2024

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Socioeconomic Data and Applications Center - SEDAC

What is SEDAC?

- SEDAC is one of 12 NASA Distributed Active Archive Centers (DAACs) under the Earth Science Data and Information System (ESDIS)
- SEDAC has been managed by the Center for Integrated Earth System Information (CIESIN) at Columbia University since 1998
- CIESIN's offices are in the Geoscience Building on Columbia's Lamont Campus in Palisades NY
- SEDAC has a staff of social and natural scientists, GIS specialists, data scientists, data management experts, programmers, and systems engineers

COLUMBIA CLIMATE SCHOOL
CENTER FOR INTEGRATED
EARTH SYSTEM INFORMATION

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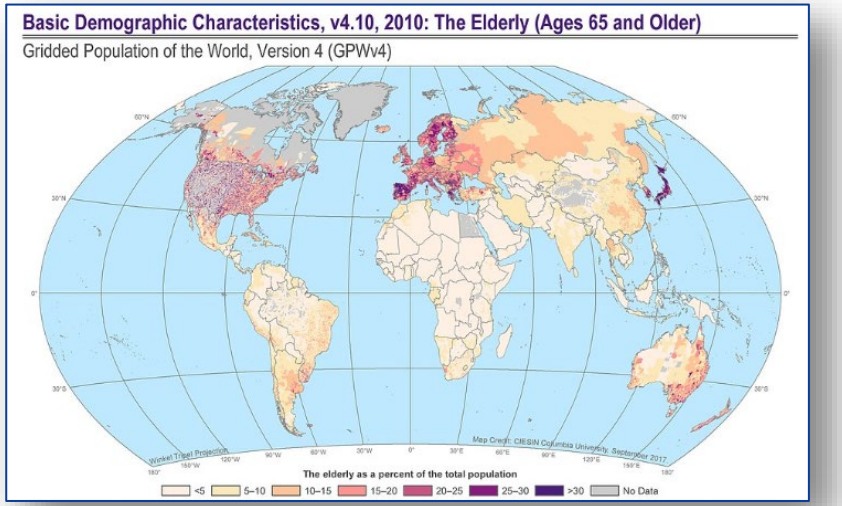
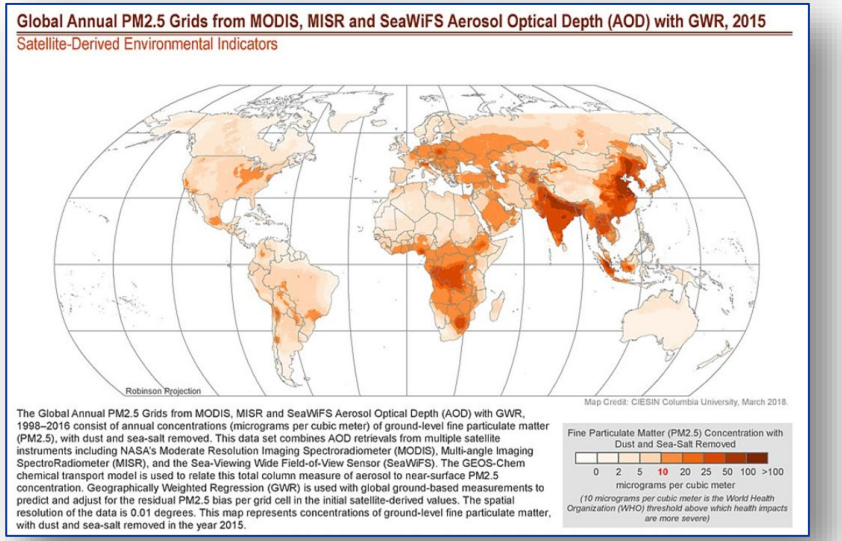
What is SEDAC's mission

- SEDAC data provide the ground level context for NASA's remote sensing data
- Serve as a gateway/bridge between Earth and social sciences with focus on human-environment interactions
- Big emphasis on integration of RS & socioeconomic data
- Direct support to scientists, applied and operational users, decision makers, and policy communities
- Strong links to geospatial data community





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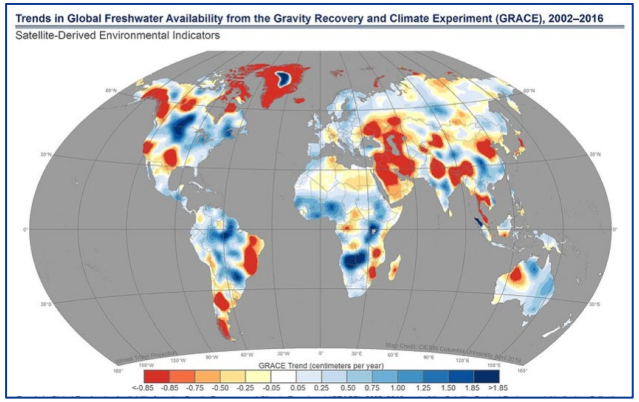
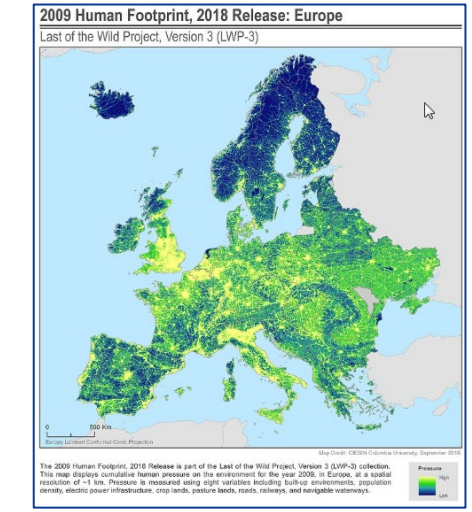
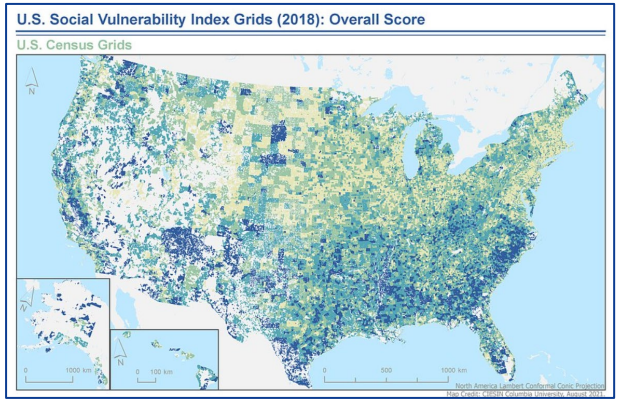
SEDAC develops and distributes many different data sets across a range of topics and application areas

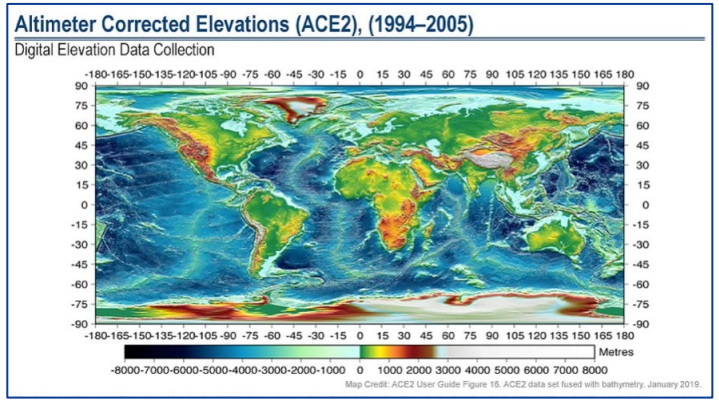


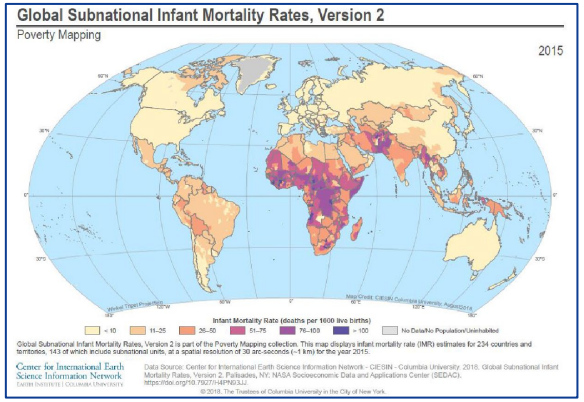
Current SEDAC Mission Areas

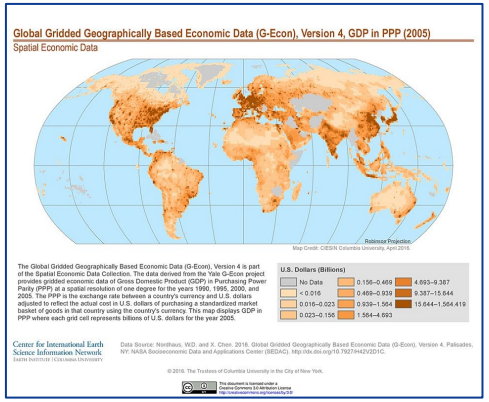
- Population Land-Use and Emissions (PLUE)
- Mitigation, Vulnerability and Adaptation (MVA)
- Hazard Vulnerability Assessment (HVA)
- Poverty and Food Security (PFS)
- Environment and Sustainable Development (ESD)











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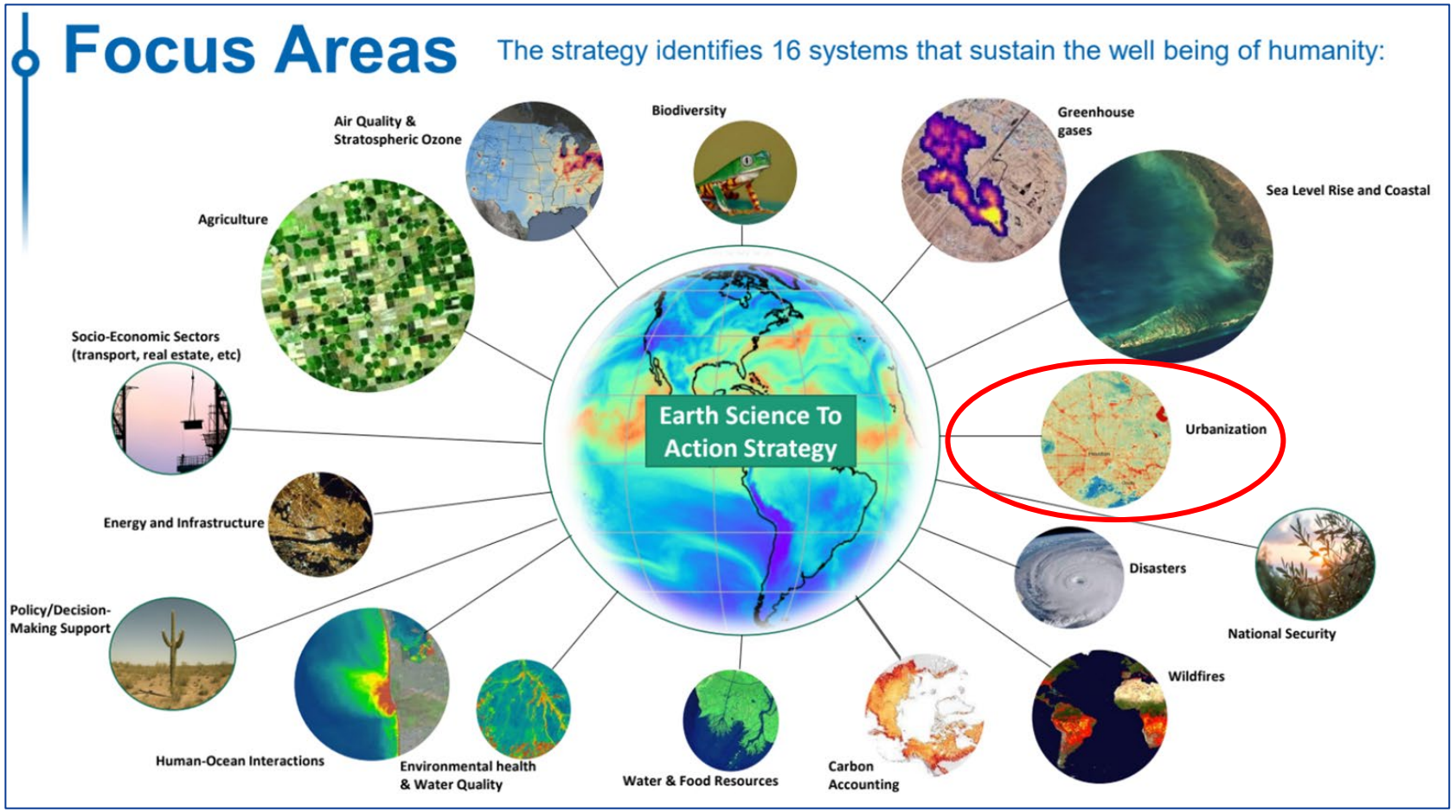
NASA 16 Earth Action Focus Areas for a "Thriving World"



- Earth Action Vision: a **"thriving world, driven by trusted, actionable Earth science"**
- 16 systems, sustain economic success, intellectual progress, social prosperity, personal well-being, & scientific exploration

https://science.nasa.gov/earth-science/earth-science-to-action/

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Topics for today's webinar

- Released Urban Datasets
- Forthcoming Urban Datasets
- How to get the data?
- Use of SEDAC urban datasets: a sampler

Released Urban Datasets

Domain	Dataset
Air quality	- Annual PM2.5 Concentrations for Countries and Urban Areas, 1998-2016 https://www.earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-sdei-apm25-urban-1.00
Air quality	- Annual Mean PM2.5 Components (EC, NH4, NO3, OC, SO4) 50m Urban Area Grids for Contiguous U.S., 2000-2019 v1 (US-specific) https://earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-aqdh-pm25com-us-1km-1.00
Heat	- Yale Center for Earth Observation (YCEO) Surface Urban Heat Islands, Version 4, 2003-2018 https://www.earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-sdei-yceouhi-v4-4.00
Heat	- Global High Resolution Daily Extreme Urban Heat Exposure (UHE-Daily), 1983-2016 https://www.earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-sdei-uhe-1.00
Location and size	- GRUMP Global Rural Urban Mapping Project: Urban Extents and Settlement Points https://www.earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-grumpv1-ext-1.00 https://earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-grumpv1-stlmnt01-1.01
Location and size	- Global Urban Points and Polygons Dataset (GUPPD), v1 https://www.earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-uspat-guppd-v1-1.00
Location and size	- VIIRS Plus DMSP Change in Lights (VIIRS+DMSP dLIGHT), v1 (1992, 2002, 2013) (a measure of urban change distinct from the population measure of GUPPD, which uses a static definition of city size based on 2015 GHS-SMOD definitions) https://www.earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-sdei-vdl-1.00
Location and size	- Global Human Settlement Layer: Population and Built-Up Estimates, and Degree of Urbanization Settlement Model Grid GHS-SMOD https://www.earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-ghsl-pbsmod-1.0
Projections	- Urban growth projections to 2030: Global Grid of Probabilities of Urban Expansion to 2030 https://www.earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-lulc-puexpans-2030-1.00
Projections	- Global One-Eighth Degree Urban Land Extent Projection and Base Year Grids by SSP Scenarios, 2000-2100 https://earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-ssp-1-8thdulepbygssp-1.00
SDGs	- SDG Indicator 11.7.1: Urban Public Space, Availability and Access, 2023 Release, https://earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-sdgi-upsae-2023-2023.00
SDGs	- SDG Indicator 11.2.1: Urban Access to Public Transport, 2023 Release, https://www.earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-sdgi-uapt-2023-2023.00

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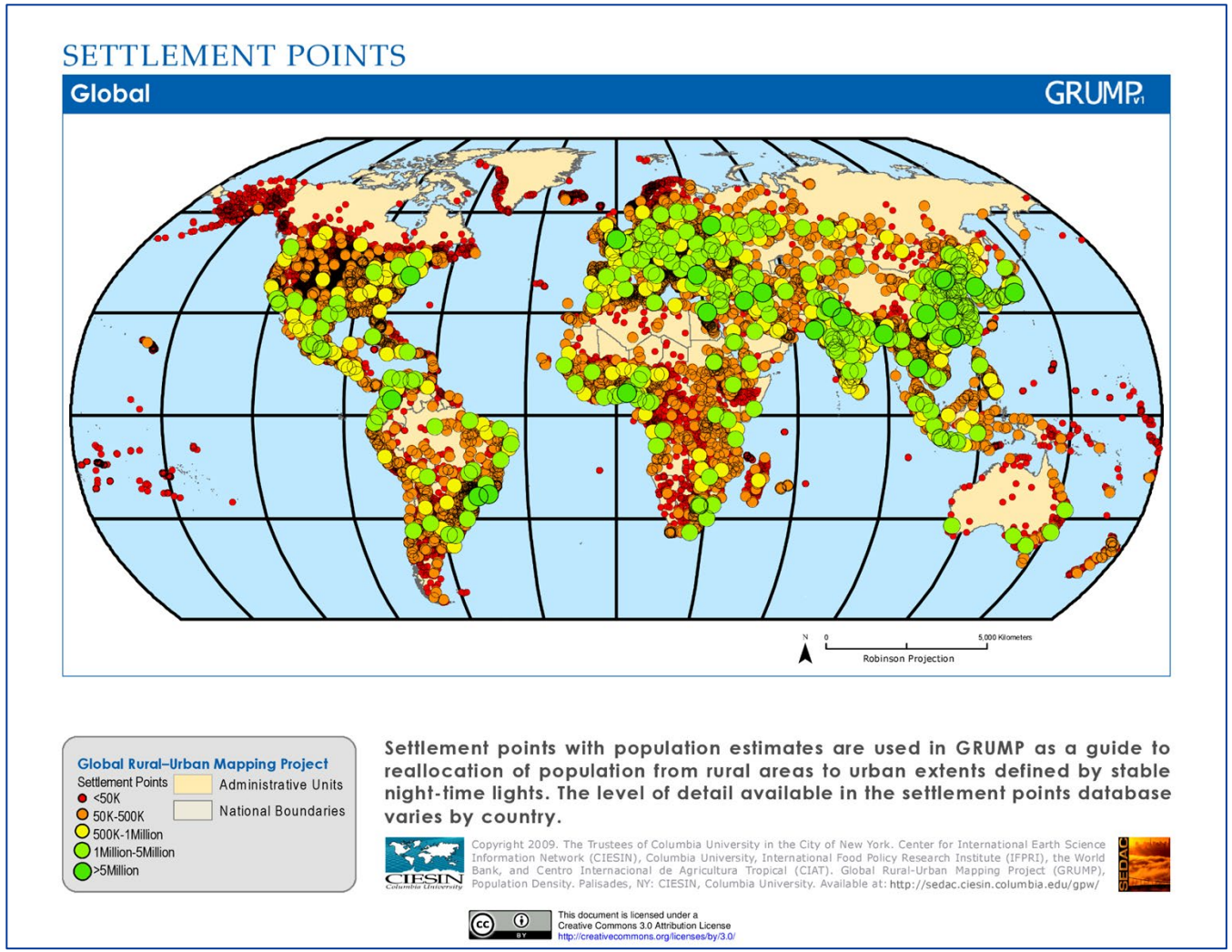
Global Rural Urban Mapping Project, Version 1 (GRUMPv1)

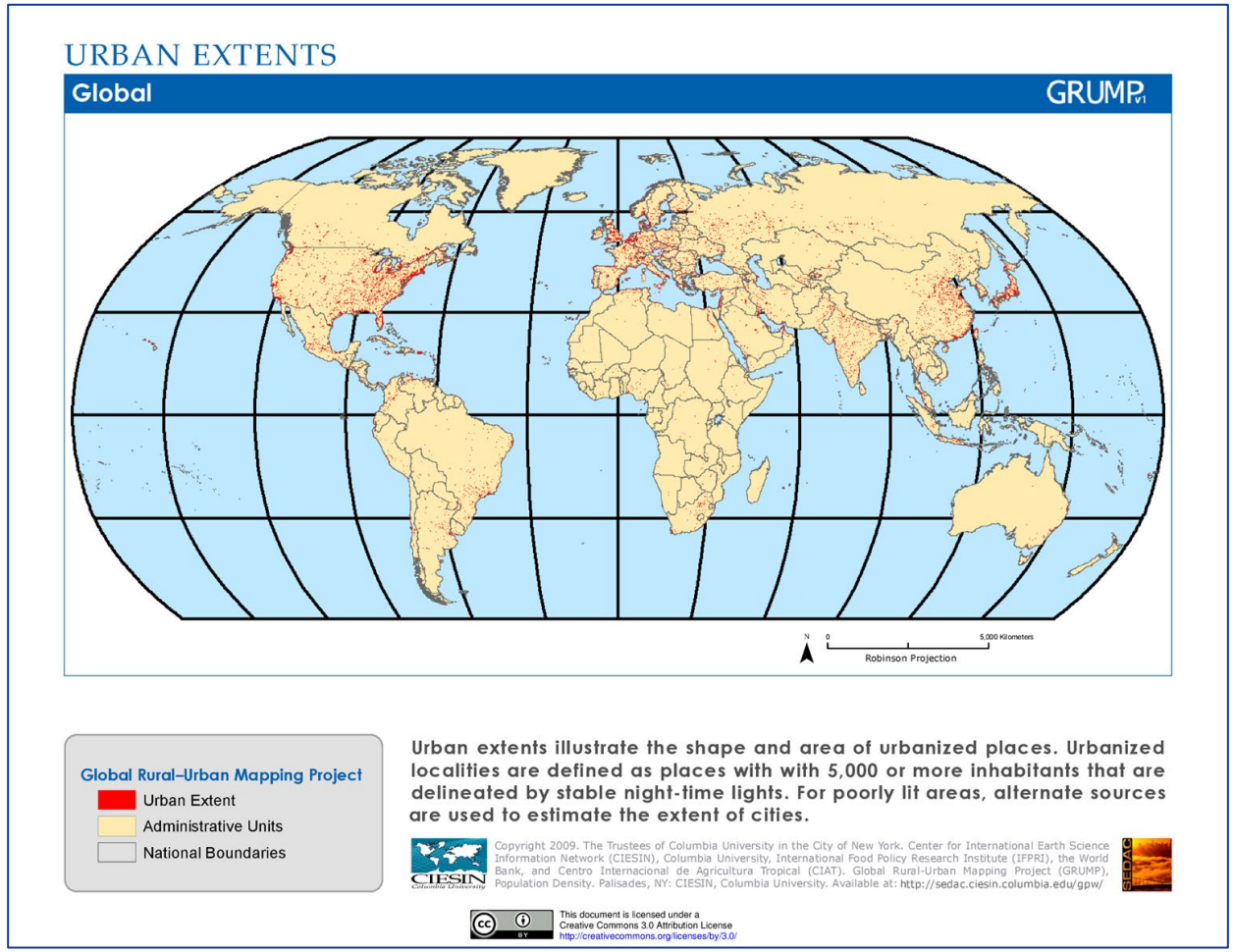
- A widely-used collection of ten spatial datasets:
  - **Urban/rural extent grid** (1-km resolution)
  - Population count/density grids
  - Land/geographic unit grid,
  - National boundaries and grid
  - Coastlines
  - **Settlement points + population estimates.**
- Focus on urban-rural continuum
- Support analyses of human-environment interactions.
- First versions released in 2010-11



https://earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-grumpv1-stlmnt01-1.01

GRUMPv1 - Urban Extent Grids

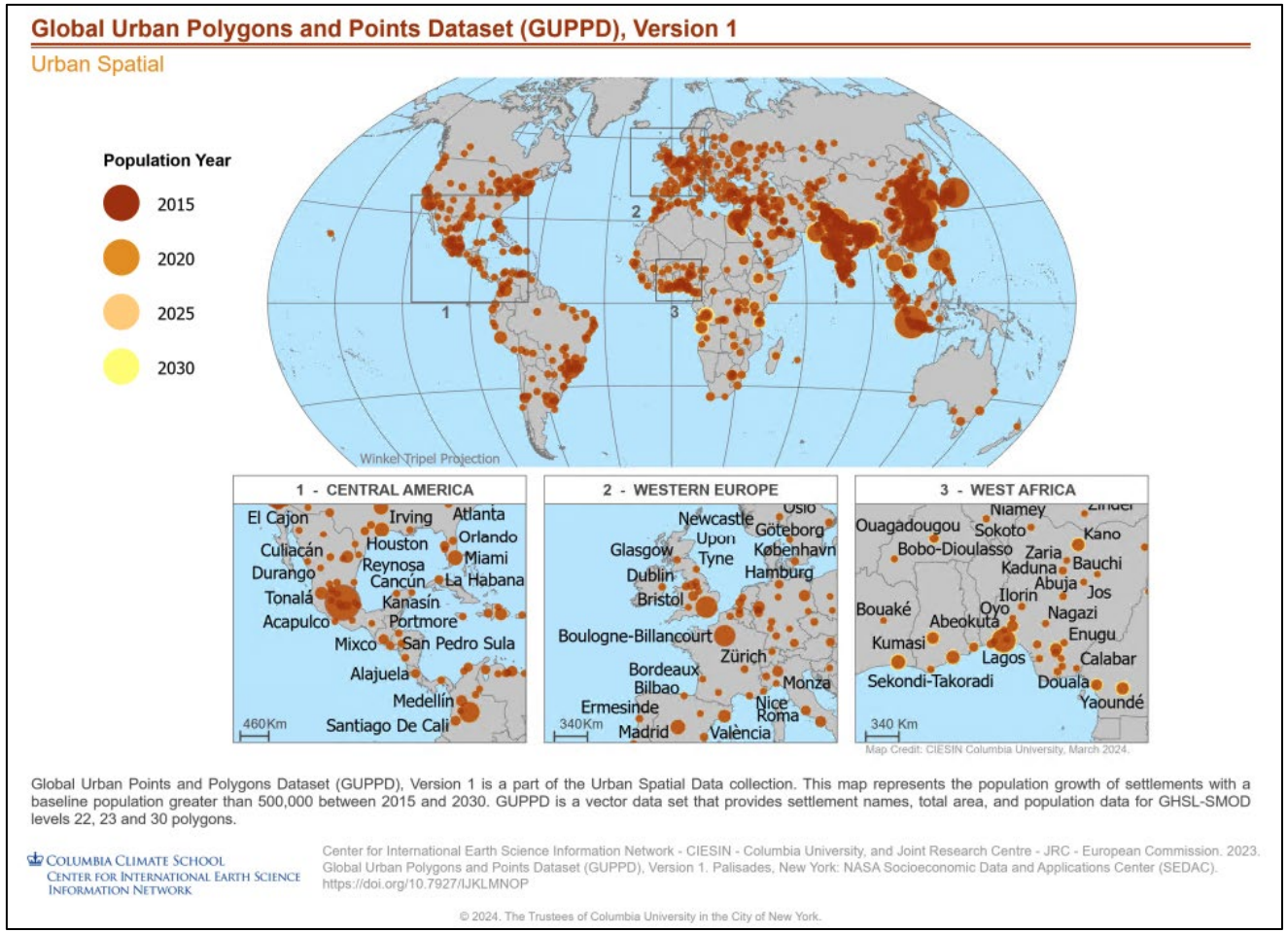
- Defines urban areas (contiguous nighttime lights or buffered settlement points) for which the total population is greater than 5,000 people.
- Input data:
  - Defense Meteorological Satellite Program Operational Linescan System (DMSP-OLS) Nighttime Lights
  - Gridded Population of the World v3 (GPWv3) Population Density and Administrative Units Boundaries
  - GRUMPv1 Settlement Points
  - MODIS and Advanced Very High-Resolution Radiometer (AVHRR) Land Cover Data



https://earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-grumpv1-ext-1.00

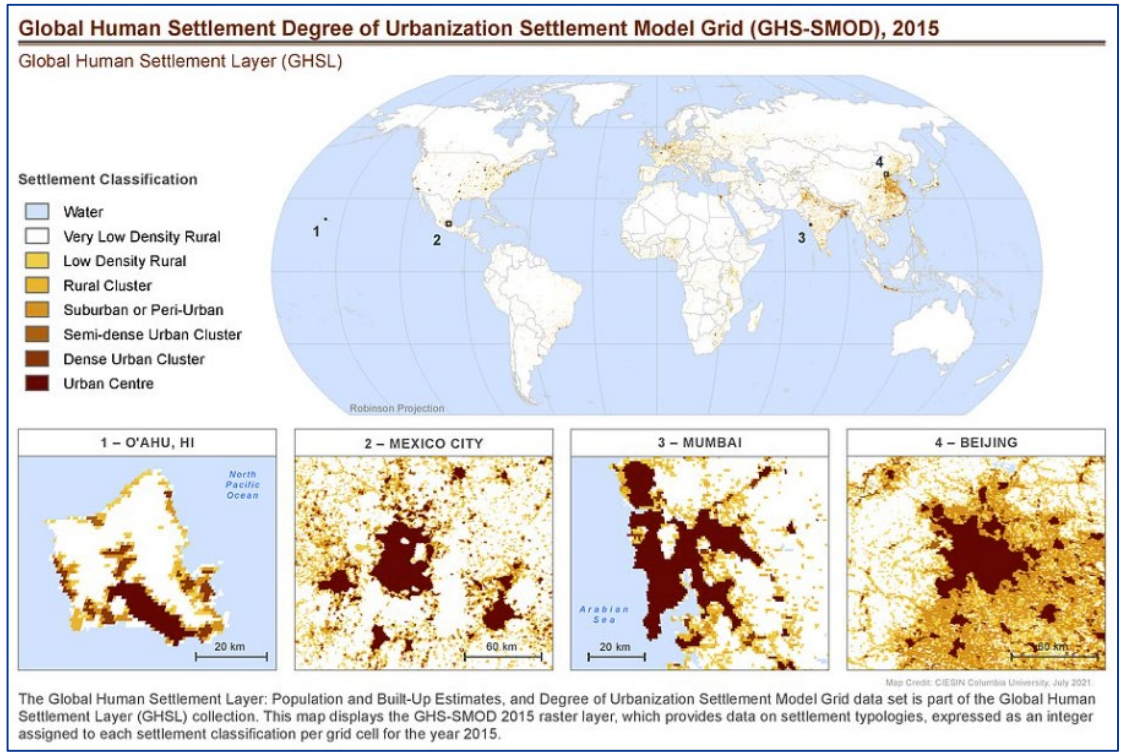
Global Urban Polygons and Points Dataset (GUPPD), v1

- A global point dataset of 123,058 urban settlements with place names and population for the years 1975-2030 in five year increments.
- Improves hierarchy of settlements,
  - from urban center (level 30), dense urban cluster (level 23), to semi-dense urban cluster (level 22).
- GUPPD uses open data sources validate the names that JRC (Joint Research Center, European Union) assigned to its Global Urban Centers Database (UCDB) polygons and to label the newly added settlements.
- Key inputs: UCDB, Global Human Settlement - Settlement Model (GHS-SMOD) and Population (GHS-POP) R2023.
- Released in 2024



https://earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-uspat-guppd-v1-1.00

Global Human Settlement Layer: Settlement Model (SMOD) and Urban Centres Database (UCDB)



JRC & CIESIN. 2021. Global Human Settlement Layer: Population and Built-Up Estimates, and Degree of Urbanization Settlement Model Grid. https://doi.org/10.7927/h4154f0w

JRC EUROPEAN COMMISSION

JRC. 2019. Urban Centres Database. https://ghsl.jrc.ec.europa.eu/ucdb2018visual.php

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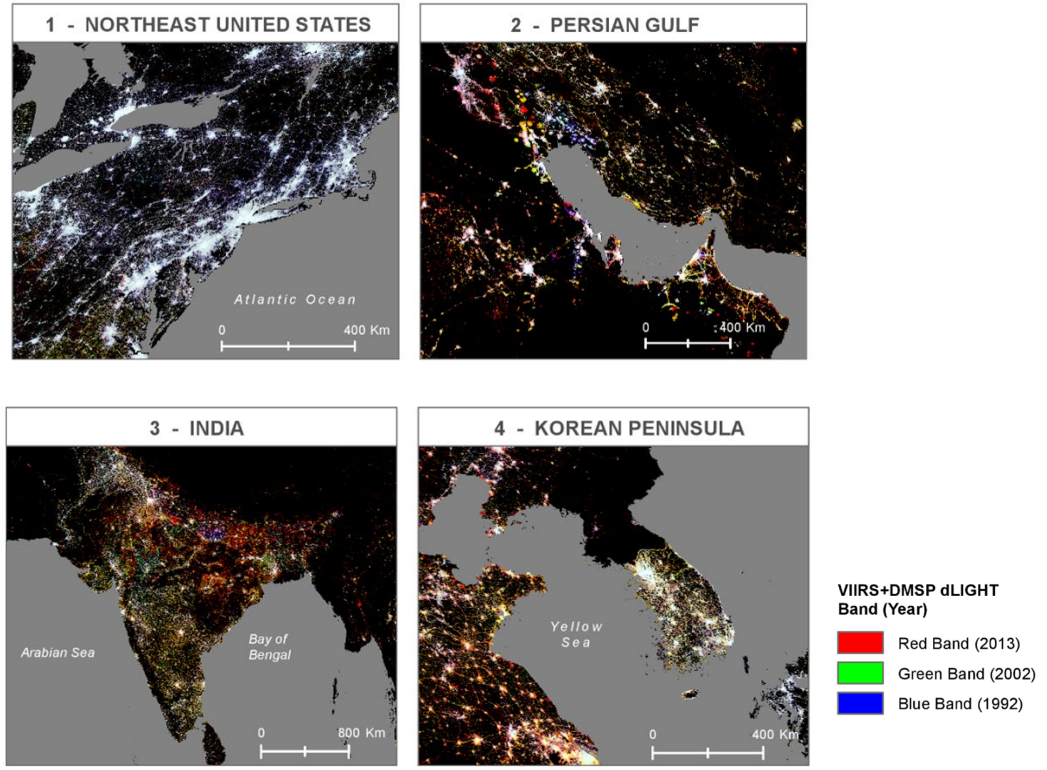
VIIRS Plus DMSP Change in Lights (VIIRS+DMSP dLIGHT)

- Global dataset tracking changes in nighttime light brightness between 1992 - 2015.
- Seamless comparison from DMSP-OLS (1992 - 2013) to VIIRS (2012-2015+).
- Provides insights into urbanization, infrastructure development by capturing changes in lit areas.
- Released in 2020
- Resolution: 15-arc-second (450 meters)



The VIIRS Plus DMSP Change in Lights (VIIRS+DMSP dLIGHT) data set is part of the Satellite-Derived Environmental Indicators collection. This data set fuses nighttime lights imagery from the U.S. Air Force Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS) with a stable night light composite from the next generation Suomi National Polar-orbiting Partnership (NPP) Visible Infrared Imaging Suite (VIIRS) Day-Night Band, visualizing change in both brightness and extent of global nocturnal low lights between 1992 and 2015. Fusion with the VIIRS day-night band composite resolves bright-saturated sources, increases spatial resolution, and reduces overglow, enabling more accurate and detailed registration of inter-decadal spatiotemporal dynamics. In this map, the red band represents the 2013 annual composite, the green band represents the 2002 annual composite, and the blue band represents the 1992 annual composite.

Center for International Earth Science Information Network
Earth Institute | Columbia University

Data Source: Small, C., and Center for International Earth Science Information Network - CIESIN - Columbia University. 2020. VIIRS Plus DMSP Change in Lights (VIIRS+DMSP dLIGHT). Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC). https://doi.org/10.7927/9ryj-6467.

https://earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-sdei-vdl-1.00

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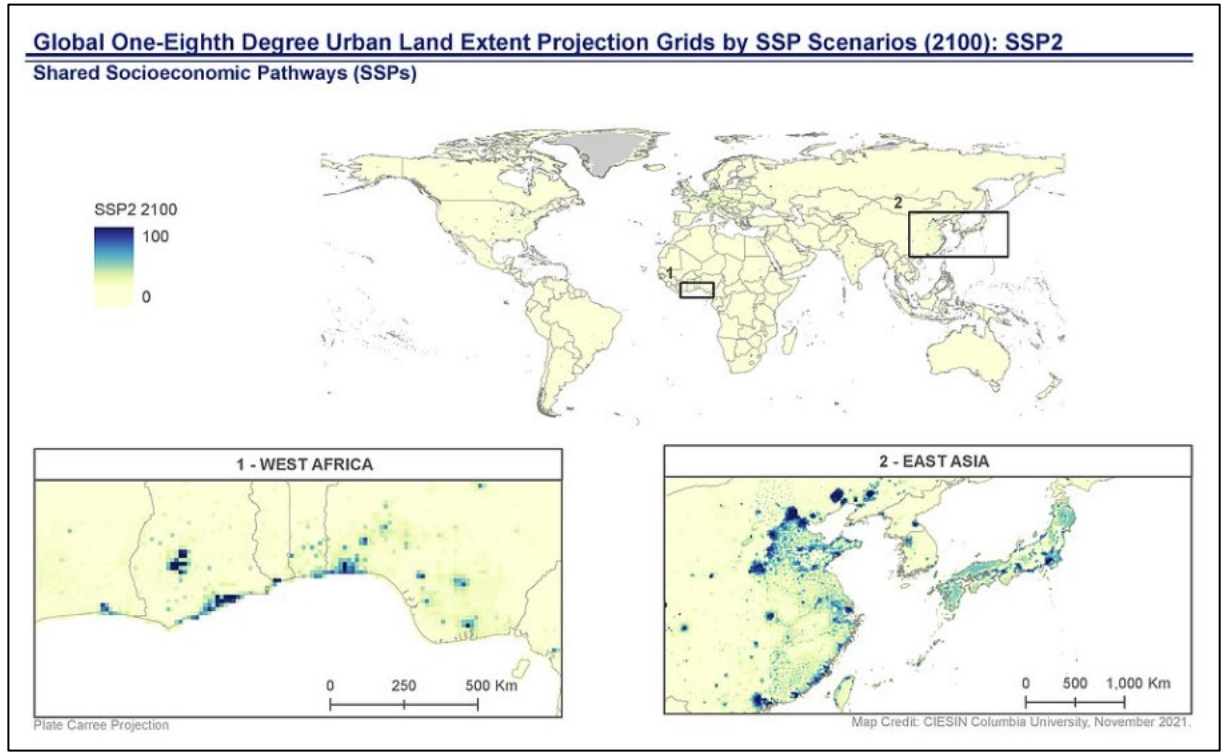
Urban Expansion Projections (1)



Gao, J. and B. C. O'Neill. 2021. Global One-Eighth Degree Urban Land Extent Projection Grids by SSP Scenarios, 2000-2100. https://doi.org/10.7927/nj0x-8y67.

- The Global One-Eighth Degree Urban Land Extent Projection and Base Year Grids by SSP Scenarios, 2000-2100 consists of global SSP-consistent spatial urban land fraction data for the base year 2000 and projections at ten-year intervals for 2010-2100 at a resolution of one-eighth degree (7.5 arc-minutes, about 14 km). (Released 2016)

- Shared socioeconomic pathways are scenarios that describe how global society, demographics, and economics might change over the 21st century, combining challenges to mitigation and adaptation to climate change

https://earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-ssp-1-8thdulepbygssp-1.00

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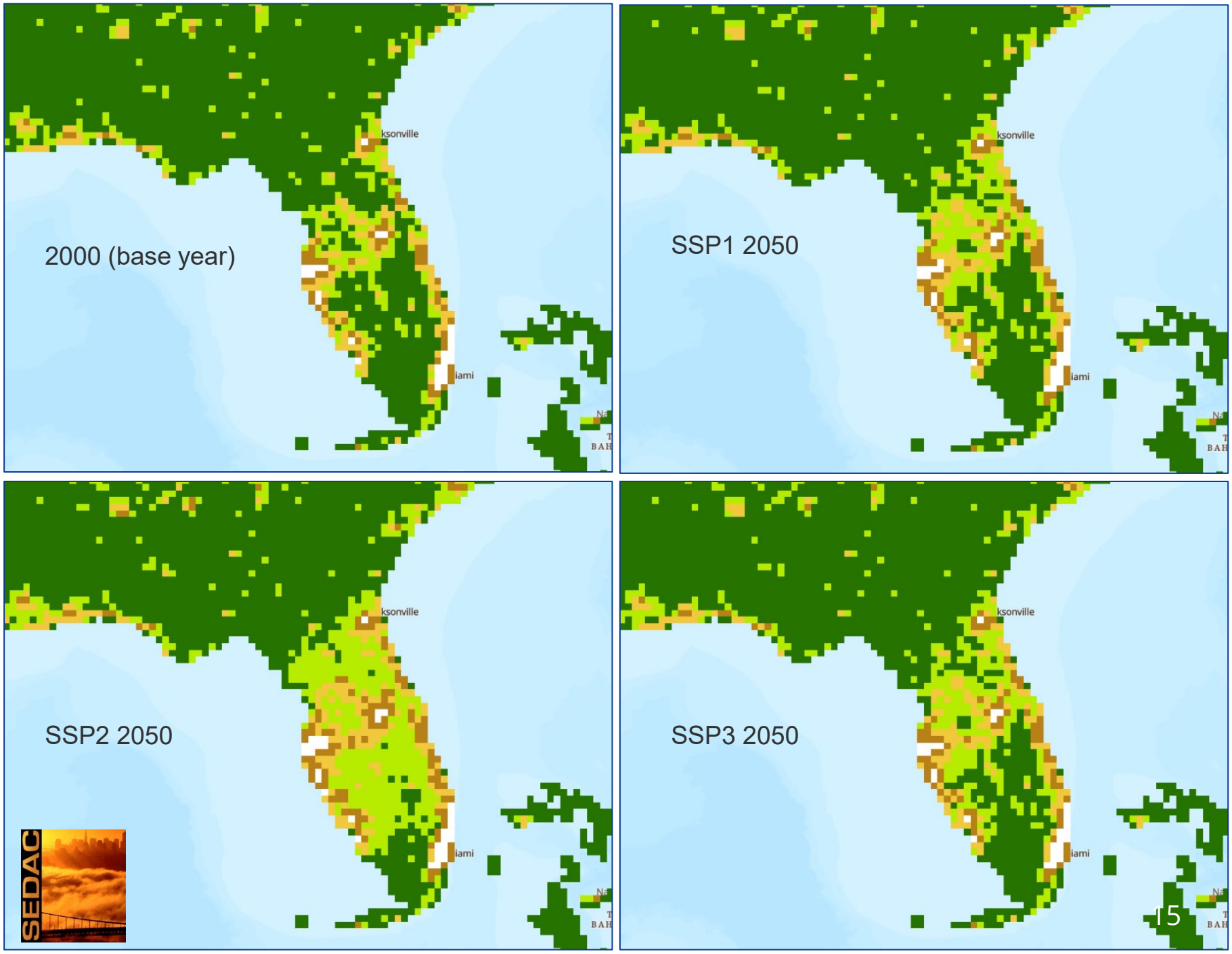
Urban Land Extent Projections for Florida, 2050

Fraction of urban land within each grid cell

	0.001 - 0.031
	0.032 - 0.125
	0.126 - 0.298
	0.299 - 0.62
	0.621 - 1



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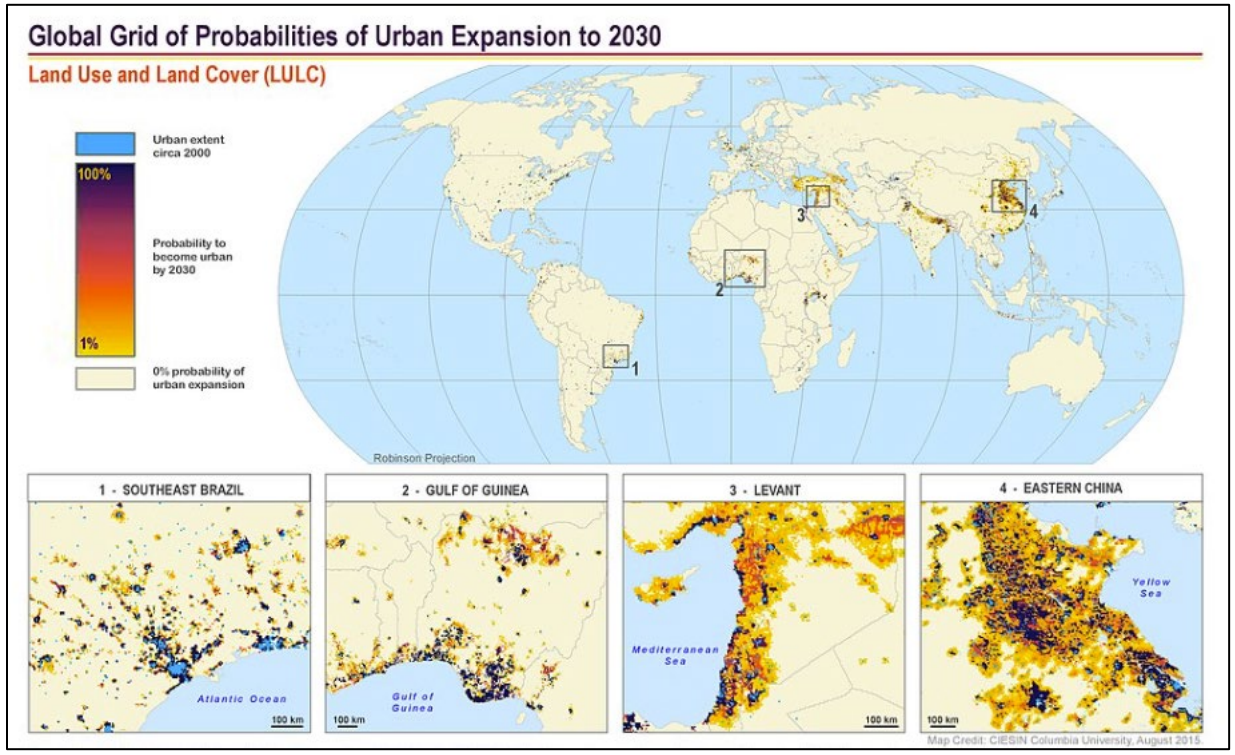
Urban Expansion Projections (2)



Seto, K., et al. 2016. Global Grid of Probabilities of Urban Expansion to 2030. https://doi.org/10.7927/H4Z899CG.

- The Global Grid of Probabilities of Urban Expansion to 2030 presents spatially explicit probabilistic forecasts of global urban land cover change from 2000 to 2030 at a 2.5 arc-minute (~4.1 km) resolution.
- Released: 2016
- Inputs:
  - urban extent circa 2000 from the NASA MODIS Land Cover Type Product Version 5, which provides a conservative estimate of global urban land cover.
  - population densities from the Global Rural-Urban Mapping Project, Version 1 (GRUMPv1) to create the population density driver map.

https://www.earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-lulc-puexpans-2030-1.00

Yale Center for Earth Observation (YCEO) Surface Urban Heat Islands, v4 (2003–2018)

- Measures surface urban heat island intensity (SUHI) from 2003 to 2018 in monthly, seasonal, to annual scales for over 10,000 urban clusters
- Developed using a simplified urban-extent (SUE) algorithm based on satellite observations of land surface temperatures.

  Released 2023
- Inputs:
  - MODIS Land Surface Temperature (LST)
  - GRUMPv1 Urban/Rural grids
  - MODIS Land Cover Type
- Applications: Urbanization's impact on climate, climate adaptation and mitigation strategies, health and heat stress, and urban design policies

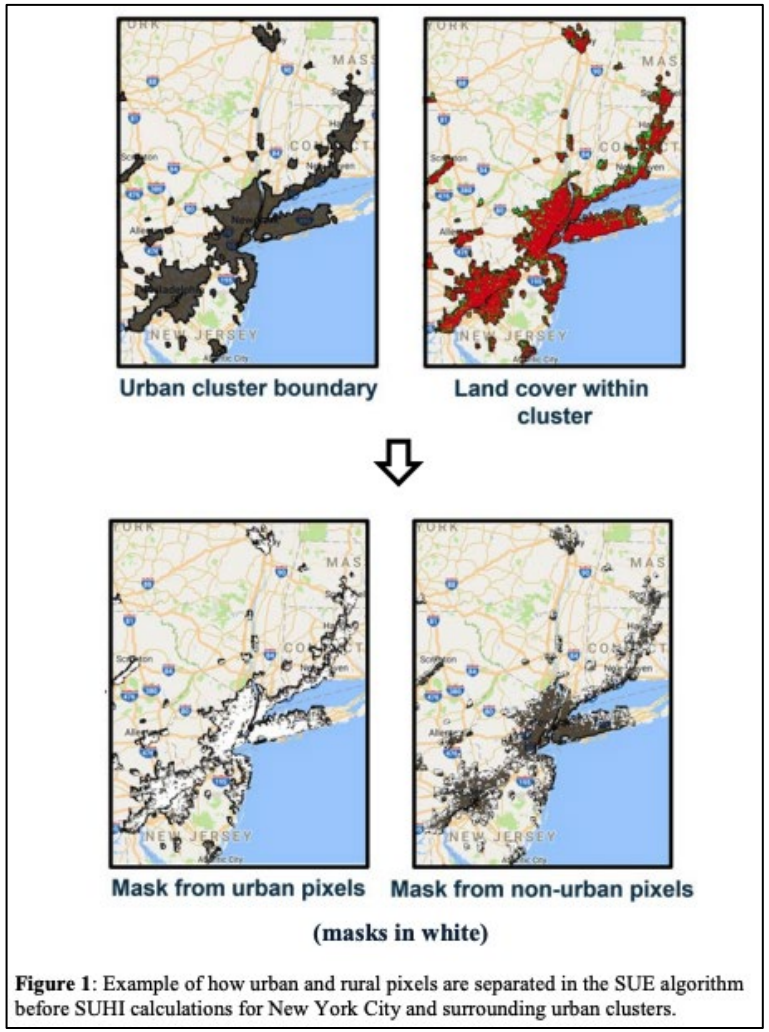


Figure 1: Example of how urban and rural pixels are separated in the SUE algorithm before SUHI calculations for New York City and surrounding urban clusters.

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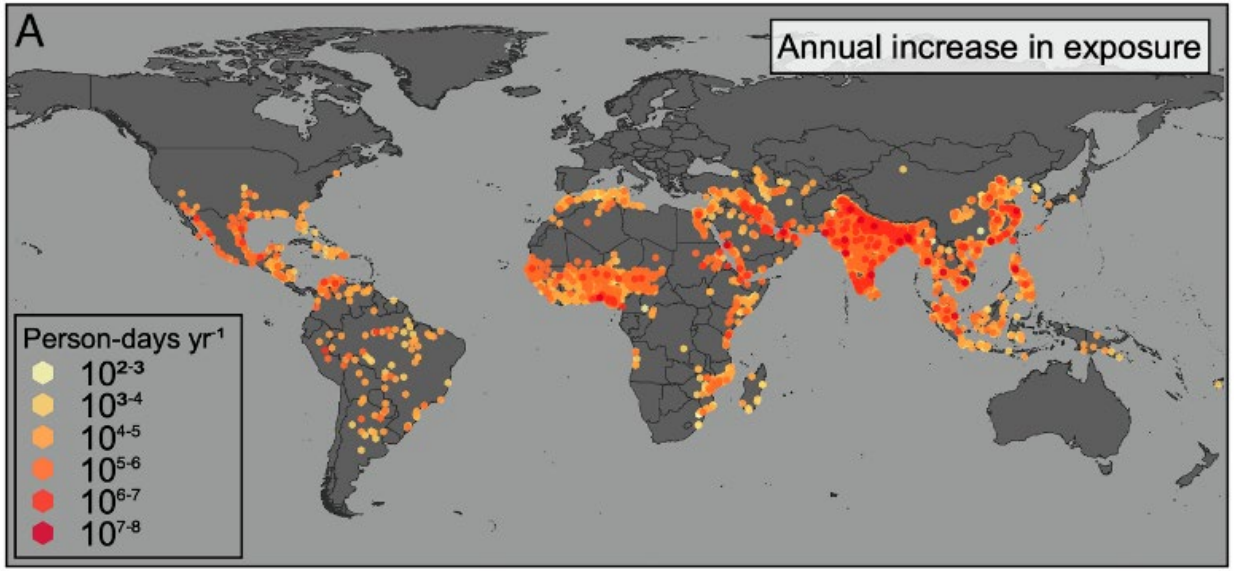
https://www.earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-sdei-yceouhi-v4-4.00

Derived Product: Global High Resolution Daily Extreme Urban Heat Exposure (UHE-Daily), v1 (1983–2016)

- High-resolution, longitudinal global record of geolocated urban extreme heat events and urban population exposure estimates for more than 10,000 urban settlements worldwide for 1983-2016.

- Several combined temperature-humidity thresholds:
  - two-day or longer periods where the daily maximum Heat Index (HImax) > 40.6 °C;
  - one-day or longer periods where HImax > 46.1 °C; and
  - one day or longer periods where the daily maximum Wet Bulb Globe Temperature (WBGTmax) > 28 °C, 30 °C, and 32 °C.

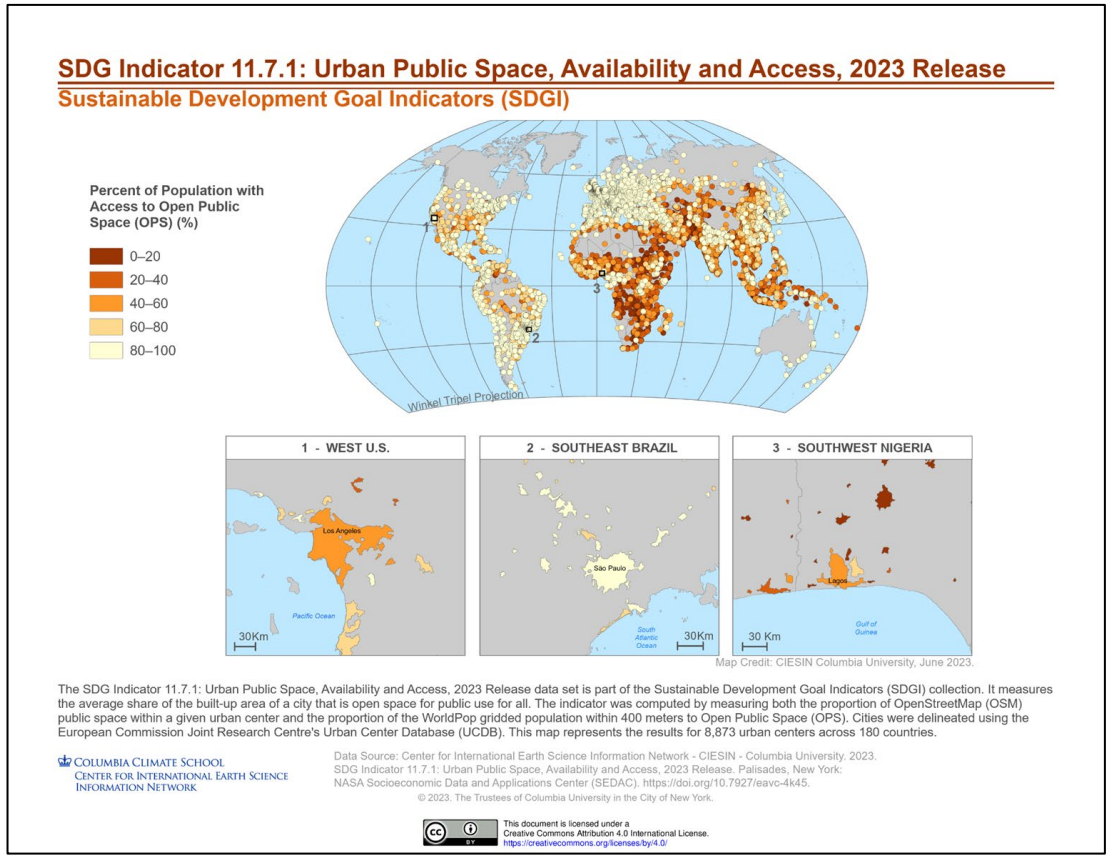


Source: Tuholske, C., K. Caylor, C. Funk, A. Verdin, S. Sweeney, K. Grace, P. Peterson, and T. Evans. 2021. Global Urban Population Exposure to Extreme Heat. *Proceedings of the National Academy of Sciences* 118(41), e2024792118. https://doi.org/10.1073/pnas.2024792118

https://www.earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-sdei-uhe-1.00
https://doi.org/10.7927/fq7g-ny13

SDG Indicator 11.7.1: Urban Public Space, Availability and Access, 2023 Release (2015–2022)

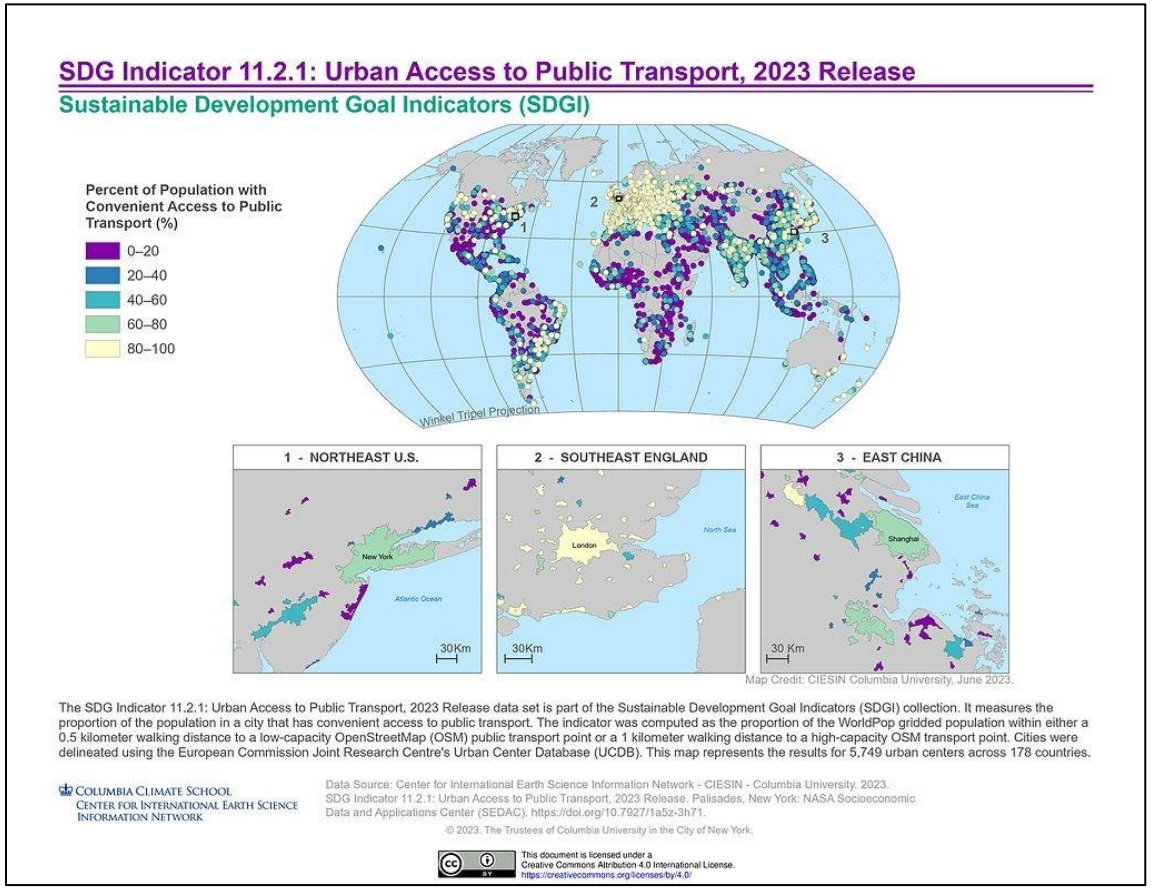
- Measures proportion of open public spaces in urban centers. Quantifies public space availability and evaluates access for different population groups.
- Inputs:
  - GHS-UCDB
  - OpenStreetMap (OSM) public spaces and roads
  - WorldPop (Comparable in POPGRID Viewer tool)
- Applications: Sustainable urban planning, and monitoring progress toward SDG Target 11.7: universal access[illegible]e, inclusive, and accessible green and [illegible] spaces.



https://earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-sdgi-upsae-2023-2023.00

SDG Indicator 11.2.1: Urban Access to Public Transport, 2023 Release (2015–2022)

- Measures proportion of urban populations with convenient access to public transport.
- Developed using geospatial analysis of population distribution, public transport networks, and accessibility metrics to determine urban mobility.
- Inputs: OSM road/pathway & public transport networks, WorldPop, UCDB.
- Applications: Urban transport planning, and monitoring progress for SDG 11.2: Access to safe, affordable, accessible and sustainable transport systems for all.



https://www.earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-sdgi-uapt-2023-2023.00

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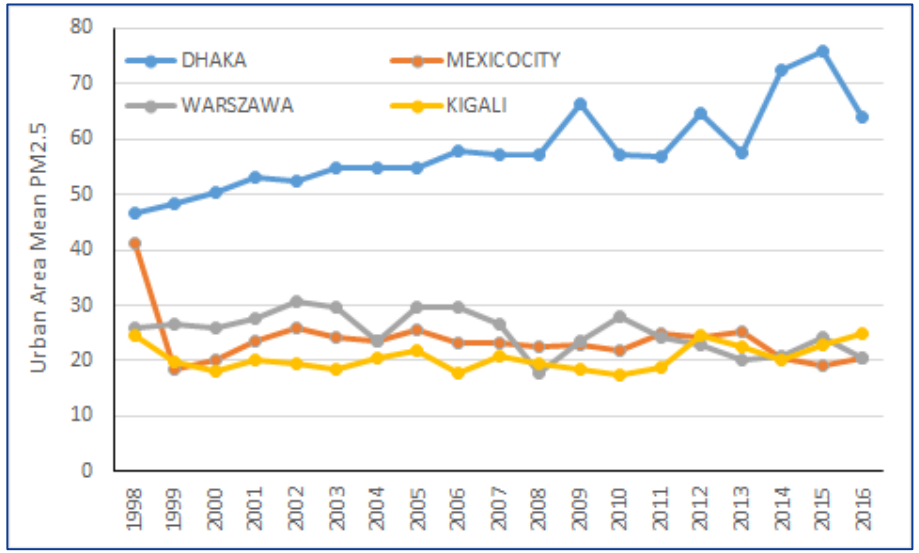
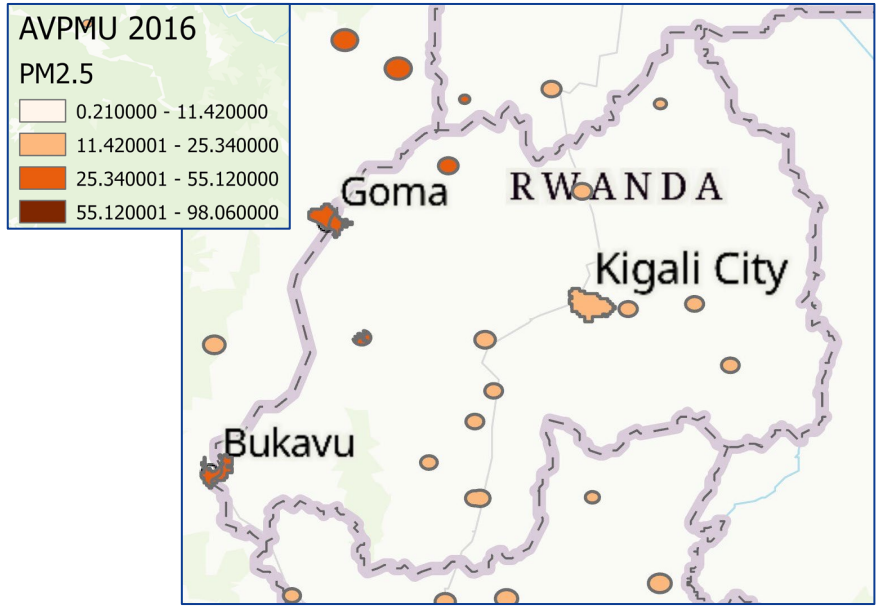
Annual PM2.5 Concentrations for Countries and Urban Areas, v1 (1998–2016)

- Estimates annual average fine particulate matter (PM2.5) concentrations for countries and urban areas globally.
  - Formats: shapefile and table.
- Developed using satellite-based aerosol optical depth (AOD) retrievals, chemical transport models, and ground-based measurements.
  - Inputs:
    - Global Annual PM2.5 Grids from MODIS, MISR and SeaWiFS Aerosol Optical Depth (AOD) with GWR, 1998-2016
    - GRUMPv1: Urban Extent Polygons, Revision 02
- Applications: Monitoring air quality and health risks, environmental policy development, and tracking SDG indicator 11.6.2: *Urban planning for sustainable development.*





https://www.earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-sdei-apm25-urban-1.00

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Annual Mean PM2.5 Components (EC, NH4, NO3, OC, SO4) 50m Urban and 1km Non-Urban Area Grids for Contiguous U.S., v1 (2000–2019)

- Annual mean concentrations of PM2.5 components (Elemental Carbon (EC), Ammonium (NH4), Nitrate (NO3), Organic Carbon (OC), Sulfate (SO4)).
- Using Machine-Learning (ML), Generalized Additive Model (GAM) Ensemble Geographically-Weighted-Averaging (GAM-ENWA), Super-Learning (SL) models for hyperlocal prediction.
- Inputs:
  - NASA TERRA/AQUA MODIS Land Cover, NDWI, AOD, LST.
  - Multiple sources with monitoring site data of PM2.5 components.
  - U.S. EPA walkability index.
  - USGS Enhanced vegetation index, NDVI .
- Applications: Air quality management. Source attribution for PM2.5 pollution. Environmental health impact studies. Policy-making for air pollution adaptation and mitigation.
- Released: 2023

https://earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-aqdh-pm25com-us-1km-1.00

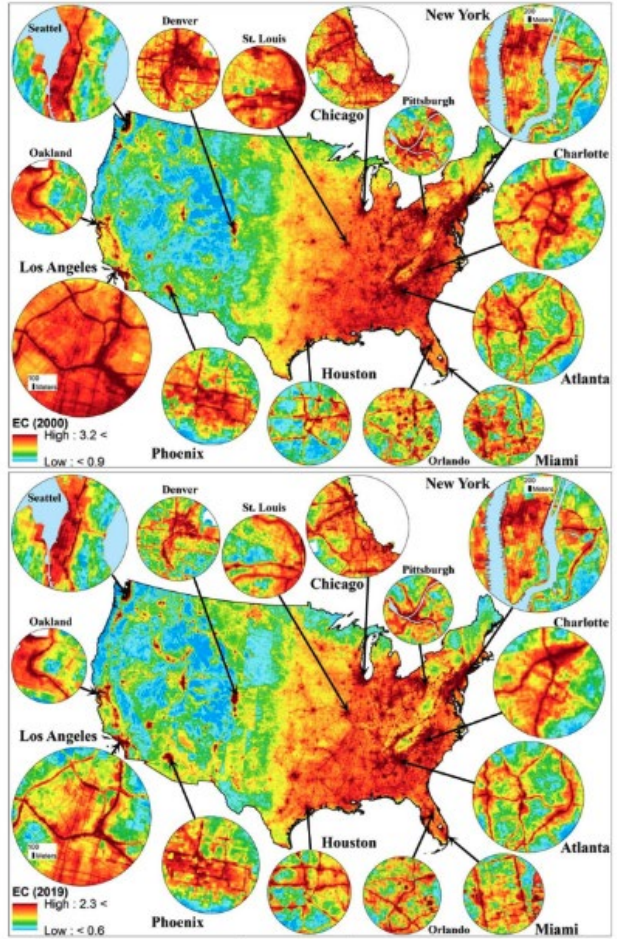

Fig. 1. Predicted annual mean $PM_{2.5}$ EC across the US non-urban and urban areas for 2000 and 2019. The spatial resolution is 1 km × 1 km in non-urban areas and 50 m × 50 m across 3,535 urban areas. The map breaks are based on quantile method—ventiles for non-urban areas and 32 classes for urban areas. These predictions are available for each $PM_{2.5}$ component (EC, NH_4^+, NO_3^-, OC, and SO_4^{2-}) across 20 years.

(Source: Amini et al., 2022)

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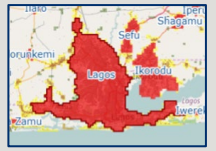
Forthcoming Urban Datasets

City & Sub-city Datasets on Urban Climate Vulnerability and Risk (*forthcoming*)

- Binary classification of environmental vulnerability and risks for 11,422 cities in 2025 GHSL Urban Centres Database (UCDB)
- Sub-city 500x500m grids with high-resolution environmental variables and classifications

City Dataset



1. Characteristics

- GDP
- Pop density, growth, total, age
- Location (e.g., elevation, proximit

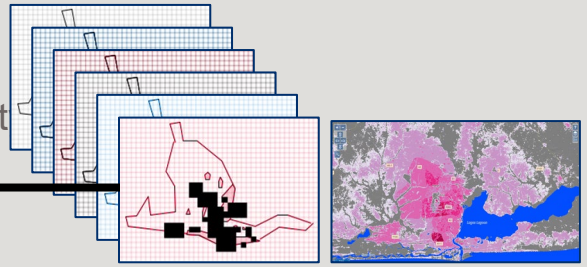
2. Current Environmental Vulnerability

- % Population Vulnerable to Multiple Exposures

3. Future Urban Climate Risk

- Extreme heat(Temperature, WBGT) cyclones (wind), storm surge flooding, seasonal/riverine flooding, water unavailability, landslide susceptibility

Sub-City Dataset



Subcity Environmental Vulnerability

- Heat, Water scarcity, cyclones (wind), storm surge flooding, riverine flooding, air Pollution

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Acknowledgement: Early work on this dataset was supported by the USAID Climate Adaptation Support Activity (CASA)

Socio-economic Vulnerability in City Segments (SES) (*forthcoming*)

- Create, classify, and identify city segments with “limited accessibility” using open-source global data.

- Potential use this dataset for SDG 11.1.1 monitoring.
  - *% urban population living in slums, informal settlements, and inadequate housing.*

- *Evolution of the dataset:*
  - CASA (v0): 2,304 cities
  - Mercy Corps (v1): 5,275 cities
  - SEDAC (2025): Global cities (GHS-UCDB R2024A)

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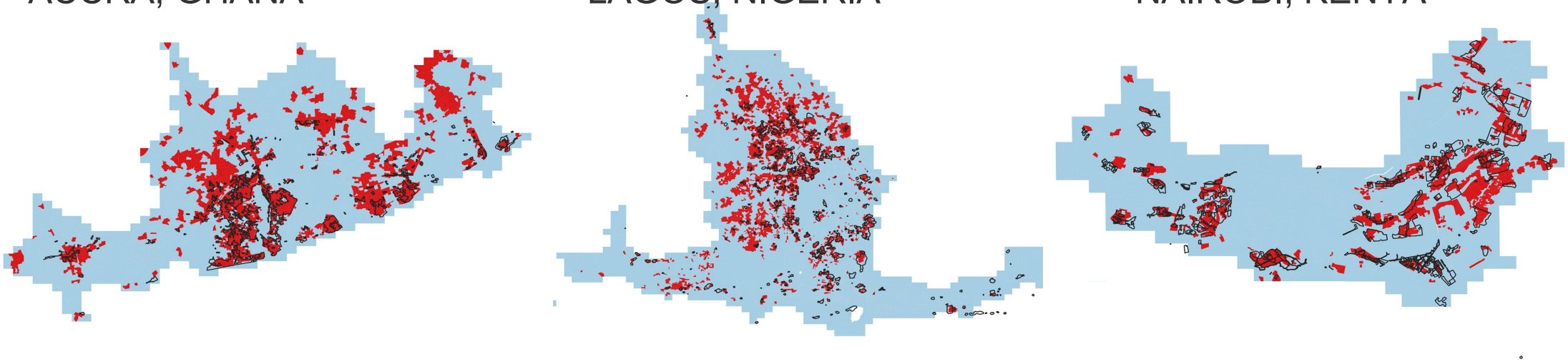
Acknowledgement: Early work on this dataset was supported by the USAID Climate Adaptation Support Activity (CASA) and NASA - Mercy Corps funding

Development and Validation of the SES Vulnerability Metric

ACCRA, GHANA

LAGOS, NIGERIA

NAIROBI, KENYA



SES Vulnerable areas (red): Neighborhoods with higher building density and less road connectivity than other segments in the same city

Validation (black boundary): SES vulnerable areas strongly correlate with community maps and modelled locations of “slums” & informal settlements

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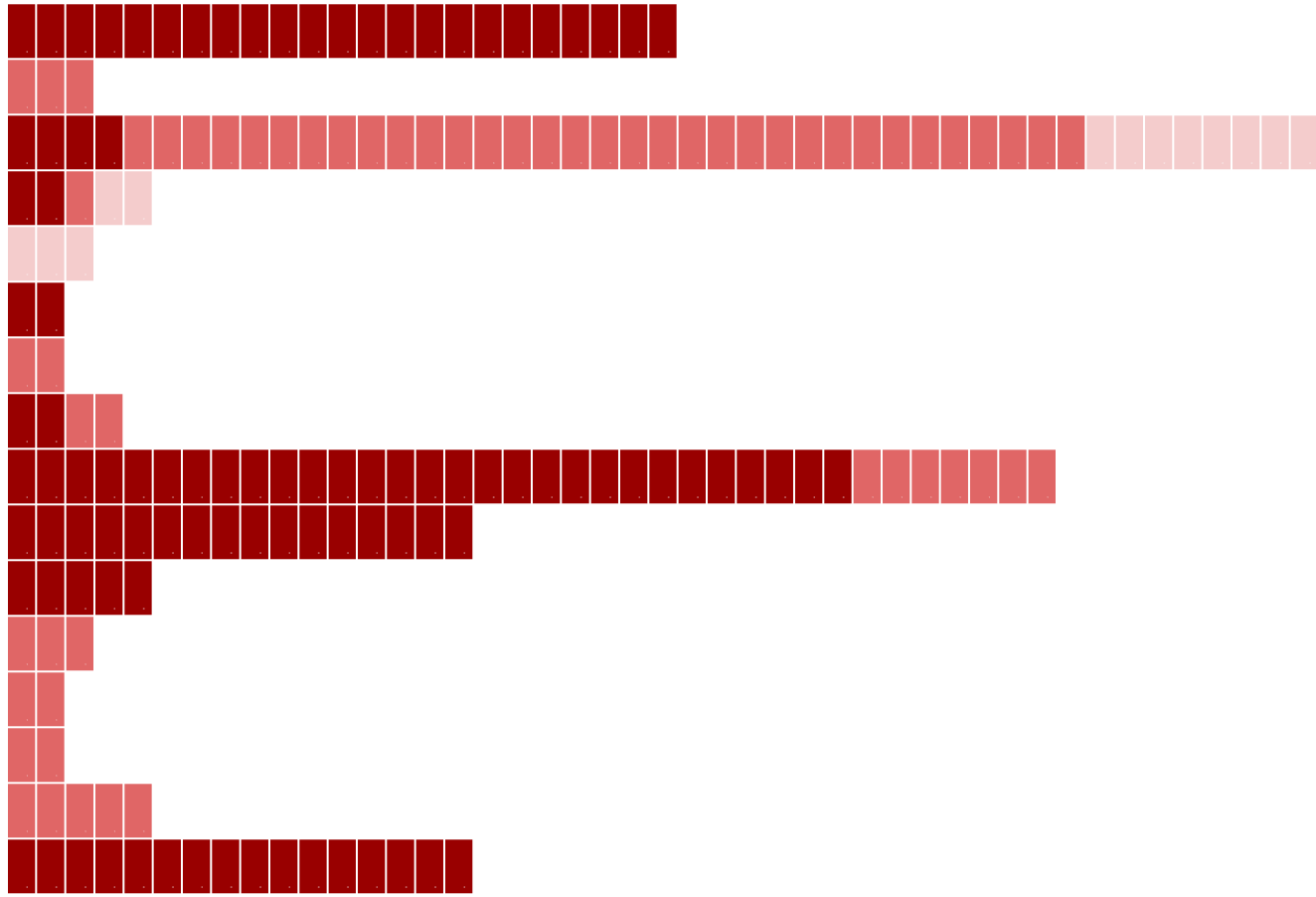
Acknowledgement: Early work on this dataset was supported by the USAID Climate Adaptation Support Activity (CASA) and NASA - Mercy Corps funding

Multi-country Results - Asia

Number of SES-Vulnerable Urban Pop who have 1, 2, or 3+ environmental vulnerabilities.

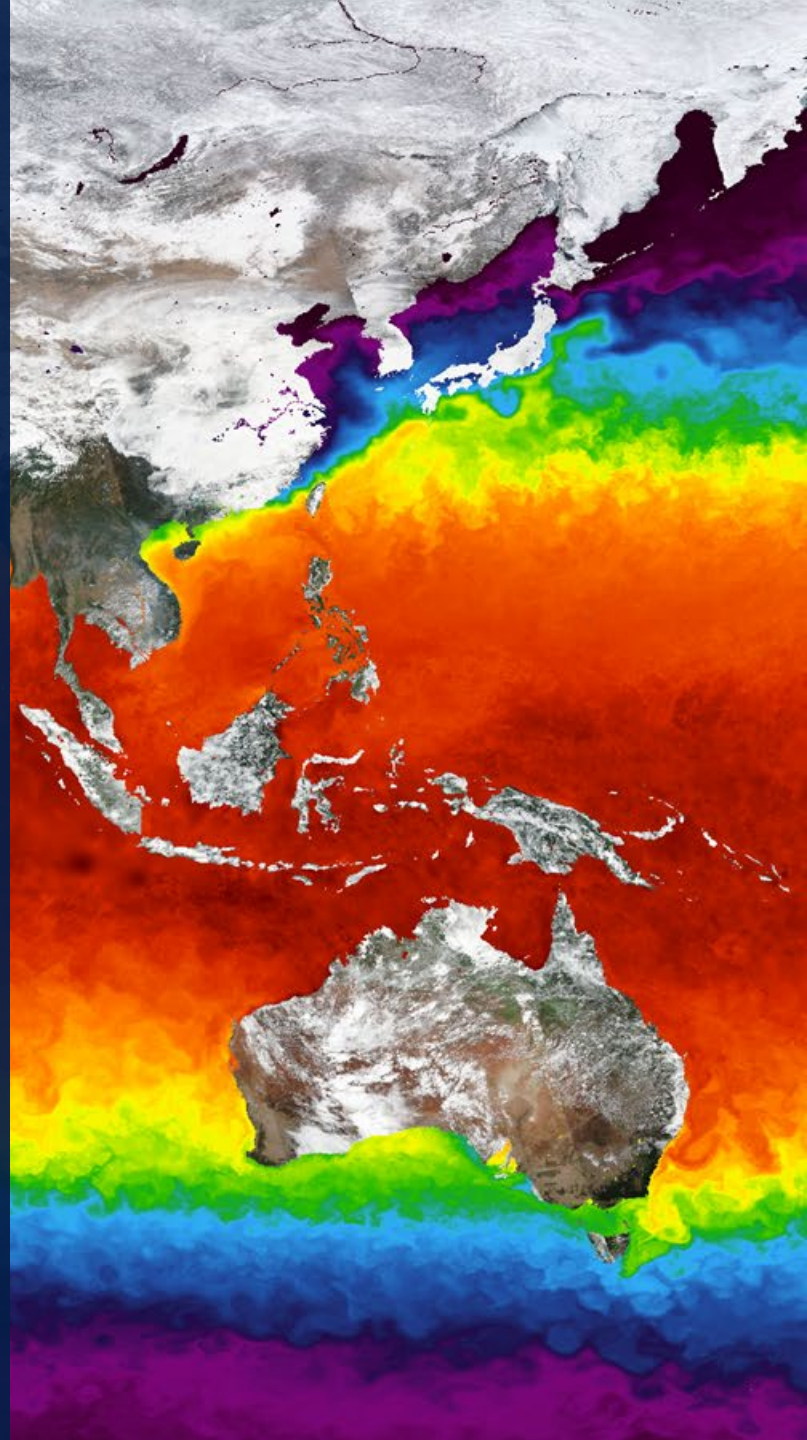


Country	Overall Urban Climate Risk (circa 2050)					
	Extreme heat	Water scarcity	Cyclone wind	Storm surge	River flood	Land-slides
Bangladesh	5	3	3	1	4	1
Cambodia	5	0	3	0	4	1
Indonesia	3	3	2	1	1	1
Kazakhstan	0	2	0	0	1	1
Kyrgyzstan	0	1	0	0	0	1
Laos	5	0	2	0	5	1
Mongolia	0	4	0	0	2	2
Nepal	1	4	0	0	0	3
Pakistan	5	4	0	0	1	1
Philippines	5	3	4	0	1	1
Sri Lanka	4	0	4	1	0	2
Tajikistan	1	3	0	0	1	1
Timor-Leste	2	0	4	0	0	3
Turkmenistan	2	5	0	0	2	1
Uzbekistan	1	4	0	0	3	1
Vietnam	5	3	4	1	3	1

***Scale: First 3 cells are in increments of 50k, 100k, and 500k; the remaining cells are in increments of 1 million**

Acknowledgement: Early work on this dataset was supported by the USAID Climate Adaptation Support Activity (CASA) and NASA - Mercy Corps funding

How to Get the Data?



A new SEDAC website

(NEW) SEDAC Website:

https://earthdata.nasa.gov/centers/sedac-daac/data-access-tools

NASA Earthdata:

https://earthdata.nasa.gov/

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Use of SEDAC Urban Datasets: a Sampler

A Diversity of Uses

- Among them:
  - Input in a variety of models, for example as control for the influence of population variables
  - Assessing population exposure to hazards / infectious disease / pollutants
  - Developing population weighting of exposure to create indices for health / hazards research
  - Identifying vulnerability of populations exposed to natural hazards / climate impacts

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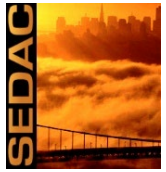

Input in a Variety of Models (e.g., as control for the influence of population variables)

Datasets used:

- GHS-SMOD
- GRUMPv1

"To generate the hierarchically classified layer of global settlements, we synthesised two data sources: GHS Settlement Model layers (GHS-SMOD) and the **Global Rural-Urban Mapping Project: Settlement Points, Revision 01 (GRUMP)** [...]. The main advantage of the GRUMP dataset is that it uses direct census population data, rather than being an estimation [...]. The urban towns and regional cities were therefore sourced from GRUMP, while rural towns (cells coded 13)—the smallest scale of human settlements in our mine-town systems, were sourced from GSH-SMOD."

Svobodova, K., Owen, J.R., Kemp, D. *et al.* Decarbonization, population disruption and resource inventories in the global energy transition. *Nat Commun* **13**, 7674 (2022). https://doi.org/10.1038/s41467-022-35391-2
https://www.nature.com/articles/s41467-022-35391-2

Highlights (from the authors)

- The potential impacts on populations associated with ramping up all available energy transition metals, or even only those with known Reserves and Resources, could intersect with significantly larger populations than the ramping down of coal.
- Estimates 3.5 million people could be affected by the phase-out of coal and another 70 million affected if only energy transition metals projects with known Reserves and Resources become operational, and 115.7 million people affected if all available energy transition metals projects become operational.


nature communications

Article

https://doi.org/10.1038/s41467-022-35391-2

Decarbonization, population disruption and resource inventories in the global energy transition

Received: 16 May 2022

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Published online: 15 December 2022

Kamila Svobodova[1,2,3], John R. Owen[4], Deanna Kemp[1], Vítězslav Moudrý[3], Éléonore Lèbre[1], Martin Stringer[1] & Benjamin K. Sovacool[5,6,7]

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Assessing Population Exposure to Hazards / Infectious disease / Pollutants

Datasets used:

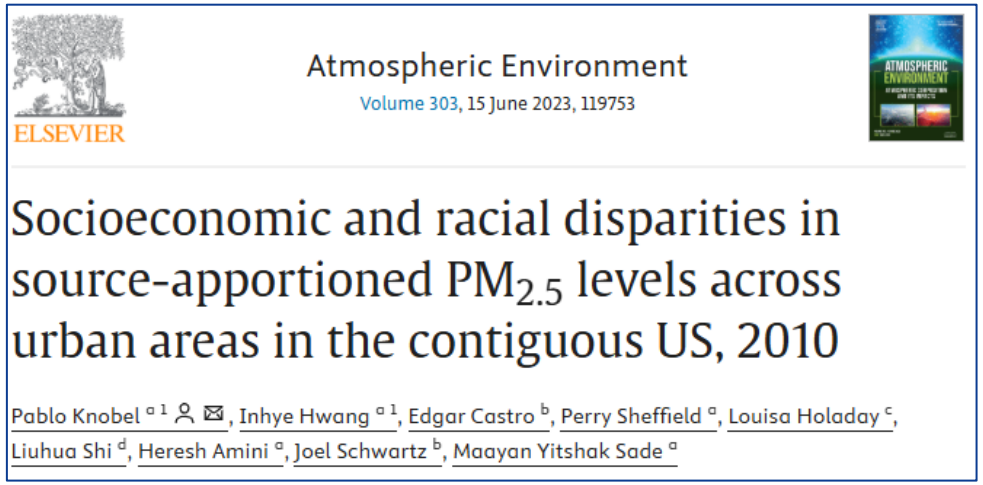
- Annual Mean PM2.5 Components (EC, NH4, NO3, OC, SO4) 50m Urban and 1km Non-Urban Area Grids for Contiguous U.S., v1
- Annual Mean PM2.5 Components Trace Elements (TEs) 50m Urban and 1km Non-Urban Area Grids for Contiguous U.S., v1

"We used non-negative matrix factorization (NMF) to attribute the 14 **PM2.5** chemical components to sources (Yan et al., 2019) across the contiguous US using the nmf R package (Gaujoux and Seoighe, 2010). This reduces the dimensions of the data and produces factors more translatable to policy action. Due to its non-negative constraint, NMF is an efficient method for dimension reduction of a matrix of PM2.5 chemical components into a lower dimension non-negative matrix that best approximates the original components data (Jin et al., 2022)."

Knobel, P., Hwang, I., Castro, E., Sheffield, P., Holaday, L., Shi, L., . . . Yitshak Sade, M. (2023). Socioeconomic and racial disparities in source-apportioned PM2.5 levels across urban areas in the contiguous US, 2010. Atmospheric Environment, 303, 119753. doi:https://doi.org/10.1016/j.atmosenv.2023.119753 https://doi.org/10.1016/j.atmosenv.2023.119753

Highlights (from the authors)

- There are socioeconomic and racial exposure disparities in $PM_{2.5}$ and its components
- Exposure disparities differ amongst US regions.
- "In conclusion, racial, socioeconomic, and geographic inequalities in exposure to $PM_{2.5}$ and its components are driven by systematic differences in component sources that can inform air quality improvement strategies."



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Developing Population Weighting of Exposure to Create Indices for Health / Hazards Research

Datasets used: GHS-POP, GHS-SMOD, dLIGHT, GRUMP

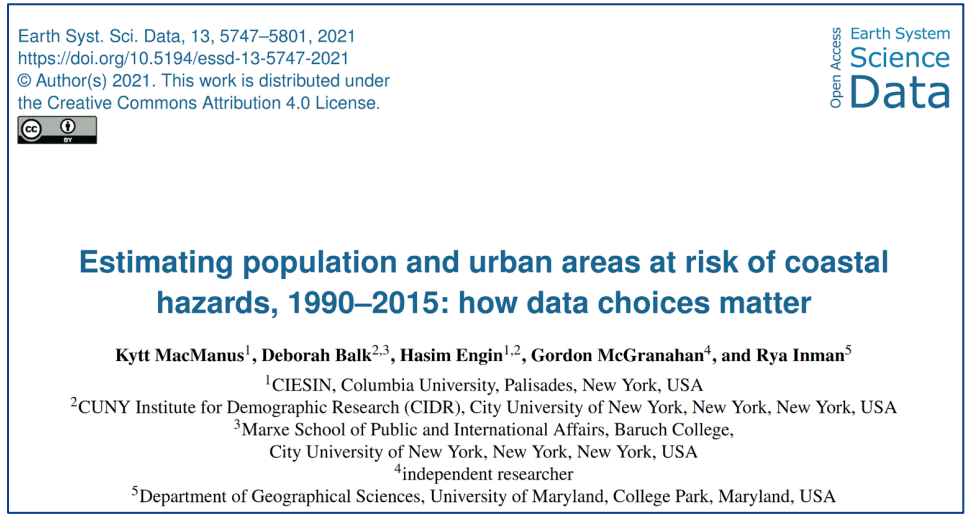
"We chose **GHS-POP** as our core population data set because it does not use elevation to reallocate population (as do LandScan and WorldPop) and represents the longest time series (back to 1990) in that it uses built-up data for each of its target years to allocate population (rather than interpolating or extrapolating estimates of population based only on growth rates, as in GPW) and was acceptable in other regards as mentioned above."

"Two of the data sets we consider represent physical processes whose spatial concentration is closely related to urban settlement (**dLIGHT** and **GHS-BUILT**), while two are more heavily modeled with the goal of urban classification (**GRUMP** and **GHS-SMOD**). All of the new underlying inputs (not including GRUMP) can be expressed as continuous data, which is important for representing a fuller urban–rural continuum (Dorélien et al., 2013); here we classify the urban-proxy inputs into three large classes."

https://doi.org/10.5194/essd-13-5747-2021

Highlights (from the authors)

- The population of the LECZ is disproportionately more urban and less rural than the global population is.
- Urban population has grown more in the LECZ than outside of it.



Earth Syst. Sci. Data, 13, 5747–5801, 2021
https://doi.org/10.5194/essd-13-5747-2021

Open Access Earth System Science Data

Estimating population and urban areas at risk of coastal hazards, 1990–2015: how data choices matter

Kytt MacManus[1], Deborah Balk[2,3], Hasim Engin[1,2], Gordon McGranahan[4], and Rya Inman[5]

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[5]Department of Geographical Sciences, University of Maryland, College Park, Maryland, USA

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Identifying Vulnerability of Populations Exposed to Natural hazards / Climate Impacts

Datasets used:

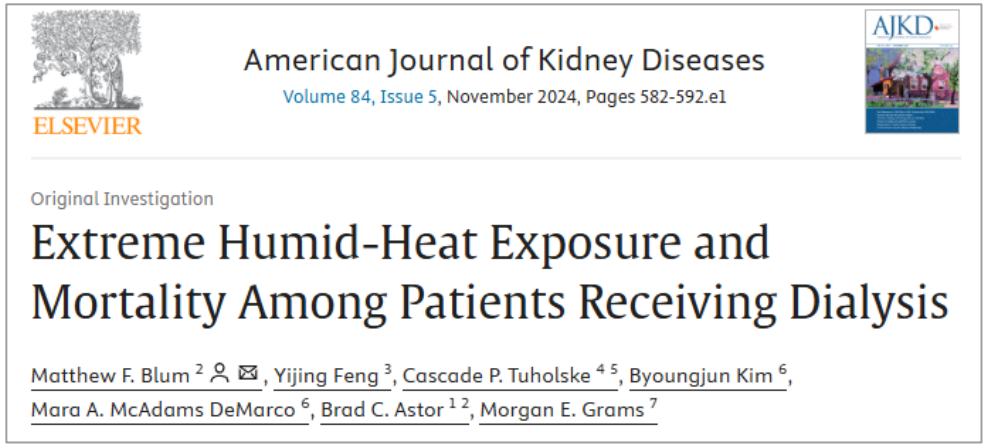
- Global High Resolution Daily Extreme Urban Heat Exposure (UHE-Daily), 1983-2016
- UCDB

“Urban settlement, as defined in the G**lobal Human Settlement Layer Urban Centre Database 2015**, consisted of a contiguous region with a density of at least 1,500 individuals per km2 and at least 50,000 individuals.”

“We derived extreme humid-heat events from the [**NASA SEDAC UHE-Daily**]. [...] For each extreme humid-heat event, we derived the urban settlement, event dates, duration, daily maximum heat index or wet bulb globe temperature (*T*max), and average *T*max. We also determined the maximum *T*max for each event (ie, the highest reported heat index or wet bulb globe temperature during each event).”
https://doi.org/10.1053/j.ajkd.2024.04.010

Highlights (from the authors)

- Exposure to a humid-heat event was associated with a 16% higher risk of death.
- Humid-heat exposure was associated with elevated risk of death when models were adjusted for demographic and additional socioeconomic variables.
- Relative risk of death decreased over time after the extreme humid-heat event, reaching a null effect by approximately 6 days after the end of the event



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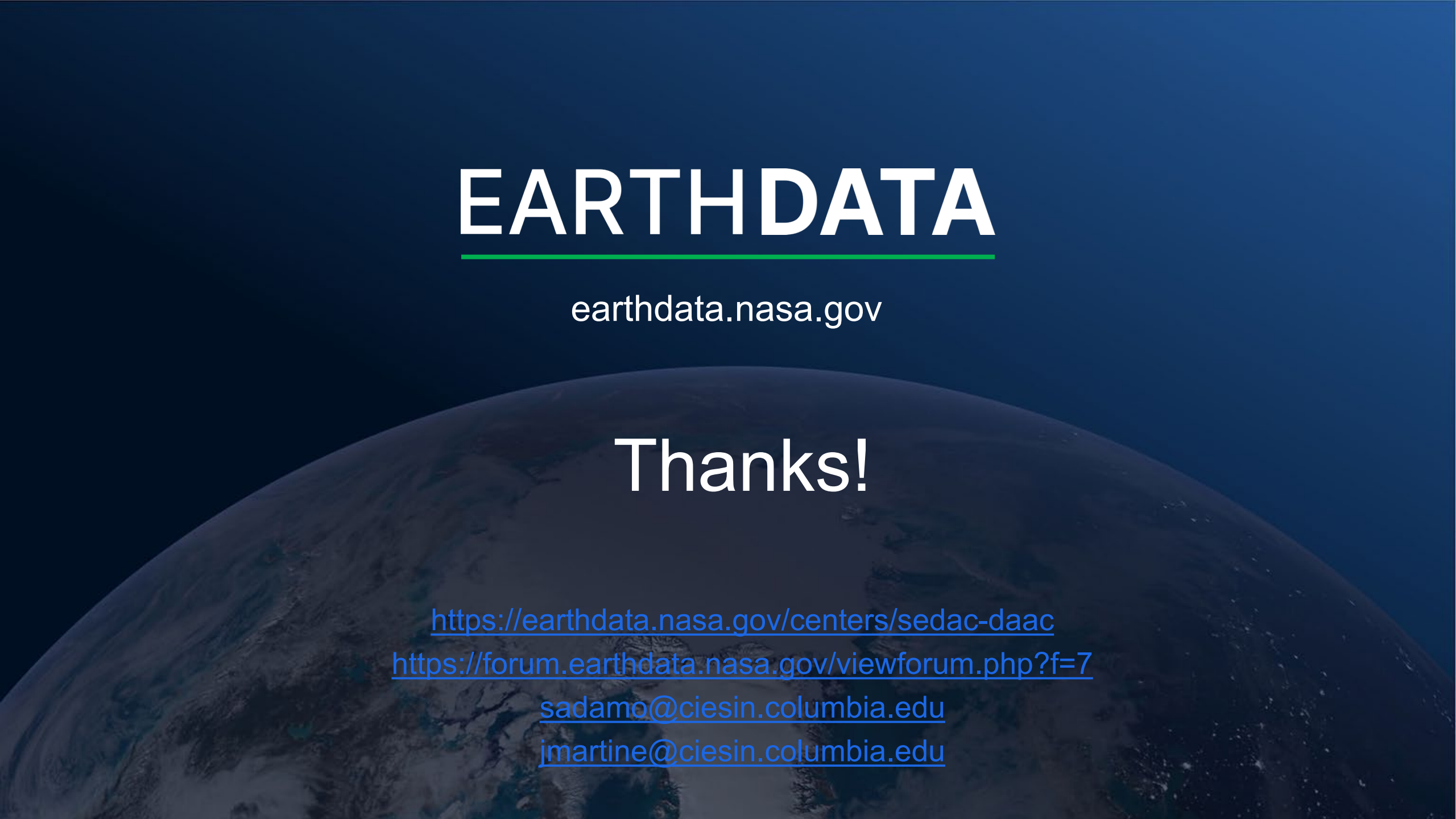
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