Satellite Data: A Game Changer in GHG Monitoring

Leveraging satellite data to bridge the gap in global GHG monitoring

Highlights:

- The Bank set an ambitious goal at COP28 to allocate 45 percent of its annual financing to climate-related projects by 2025. For effective mitigation, new metrics are essential for monitoring greenhouse gas (GHG) emissions. Satellite readings offer a global solution to the lack of accurate and consistent emissions data, providing independent, objective, and international data collection.
- Satellite-based emissions measurements have inspired the creation of comprehensive global databases showing long-term trends, short-term variations, and specifically - urban emissions.
- To support existing country-level efforts, the Bank announced plans to launch 15 national programs within 18 months, aiming to reduce up to 10 million tons of methane emissions. World Bank research with satellite readings will aid in monitoring emission-reductions from top emitters.

In their efforts to tackle climate change, countries have committed to curbing their carbon emissions through Nationally Determined Contributions (NDCs). Also, the Global Methane Pledge, backed by over 120 nations, aims to substantially reduce methane emissions levels by 2030.

The Challenge

The lack of accurate and consistent carbon dioxide (CO_2) and methane (CH_4) emissions data has hindered these and other efforts to rapidly reduce emissions. Recognizing the urgent need for a

comprehensive and reliable GHG monitoring scheme, a multi-disciplinary team at the World Bank launched an initiative to leverage advancements in satellite based GHG measurements to fill the global information gap.

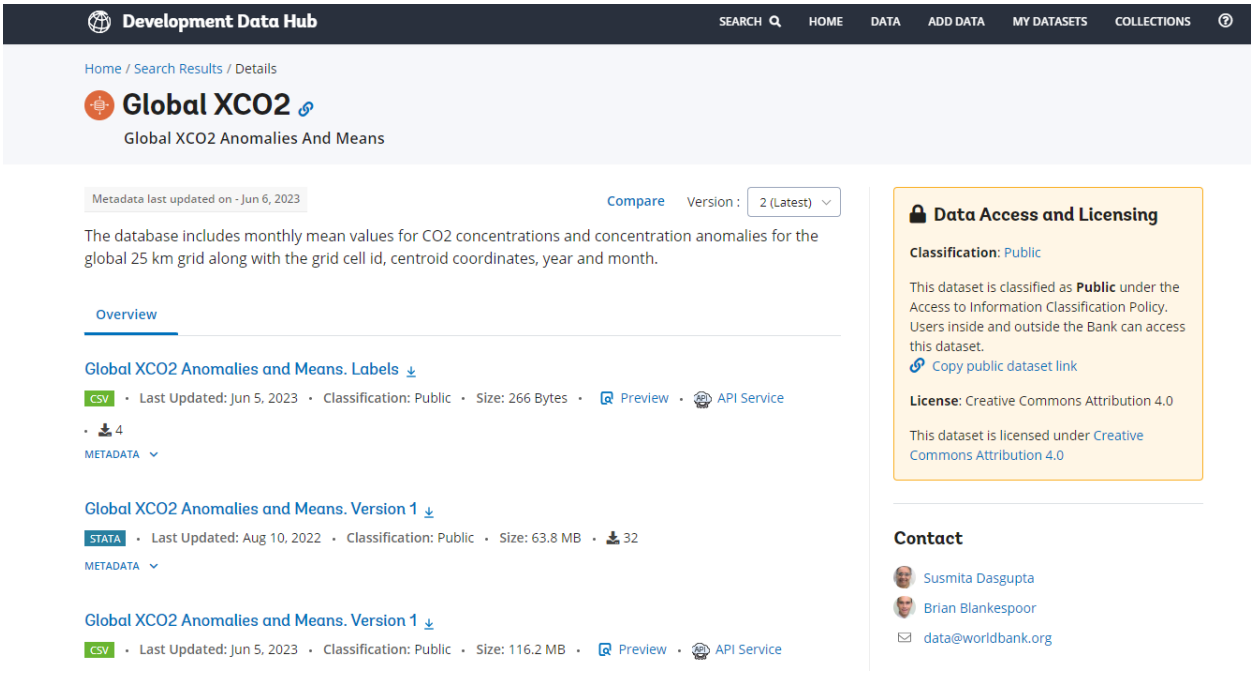
"*In recent years, the satellite-based GHG emission measurements have emerged as potentially a game-changing solution, offering independent, objective, and international data collection,*" says **Dr. Susmita Dasgupta**, a Lead Environmental Economist in the Development Research Group who coordinates the project.

Dasgupta and her team analyzed and processed data from NASA's (National Aeronautics and Space Administration) Orbiting Carbon Observatory-2 (OCO-2) and ESA's (European Space Agency) TROPOMI.

To make the complex satellite data useful for policymaking, the team developed a robust and transparent data framework with baselines and tools to monitor changes worldwide. This enormous undertaking resulted in the creation of **two global CO_2** and **three global CH4 databases** containing data that are comparable across space and time.

Measuring Carbon Dioxide Levels

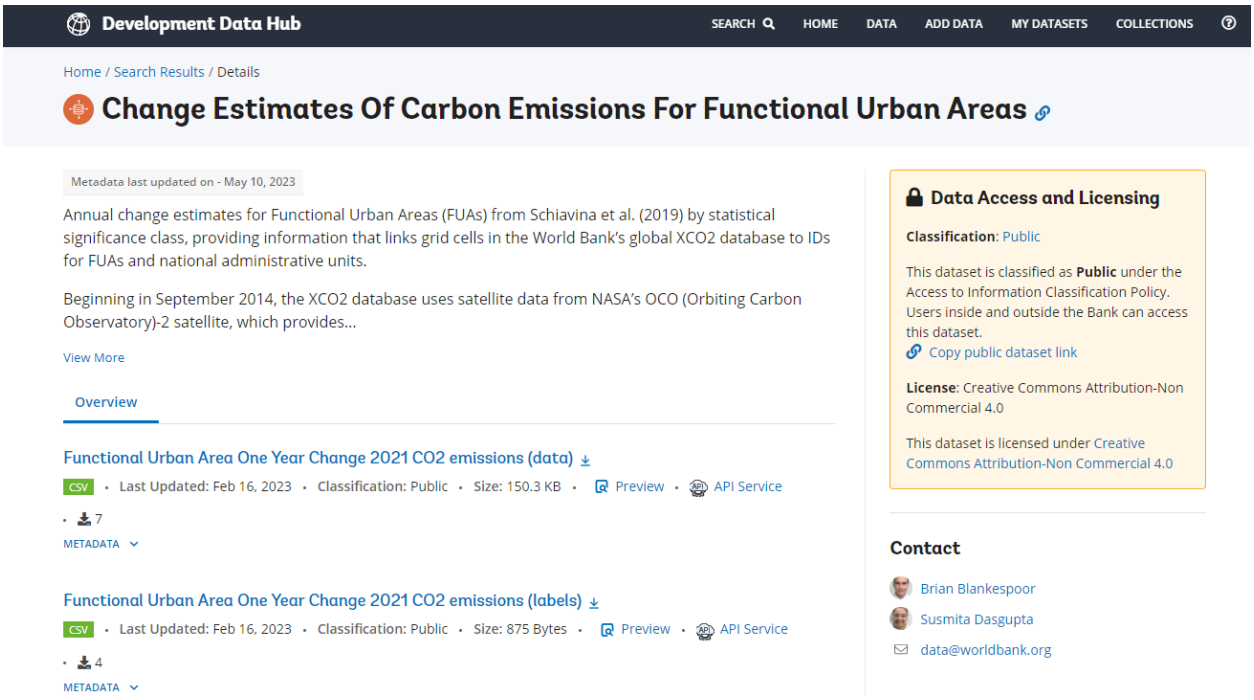
The first database focuses on global CO_2 anomalies and mean values. The database provides a comprehensive understanding of CO_2 emissions worldwide over the past decade that is mapped across a 25-kilometer global grid. The data allows World Bank teams as well as researchers and policymakers around the world to assess long-term trends and short-term variations in CO_2 emissions.



The 'X' refers to the observation taking place from a satellite.

Urban areas account for over 70% of global CO_2 emissions, yet very few, primarily in developed countries, have access to consistent CO_2 emission data. To address this gap, the team utilized multi-year CO_2 estimates from NASA's OCO-2 to monitor 1,799 urban areas with populations exceeding 500,000.

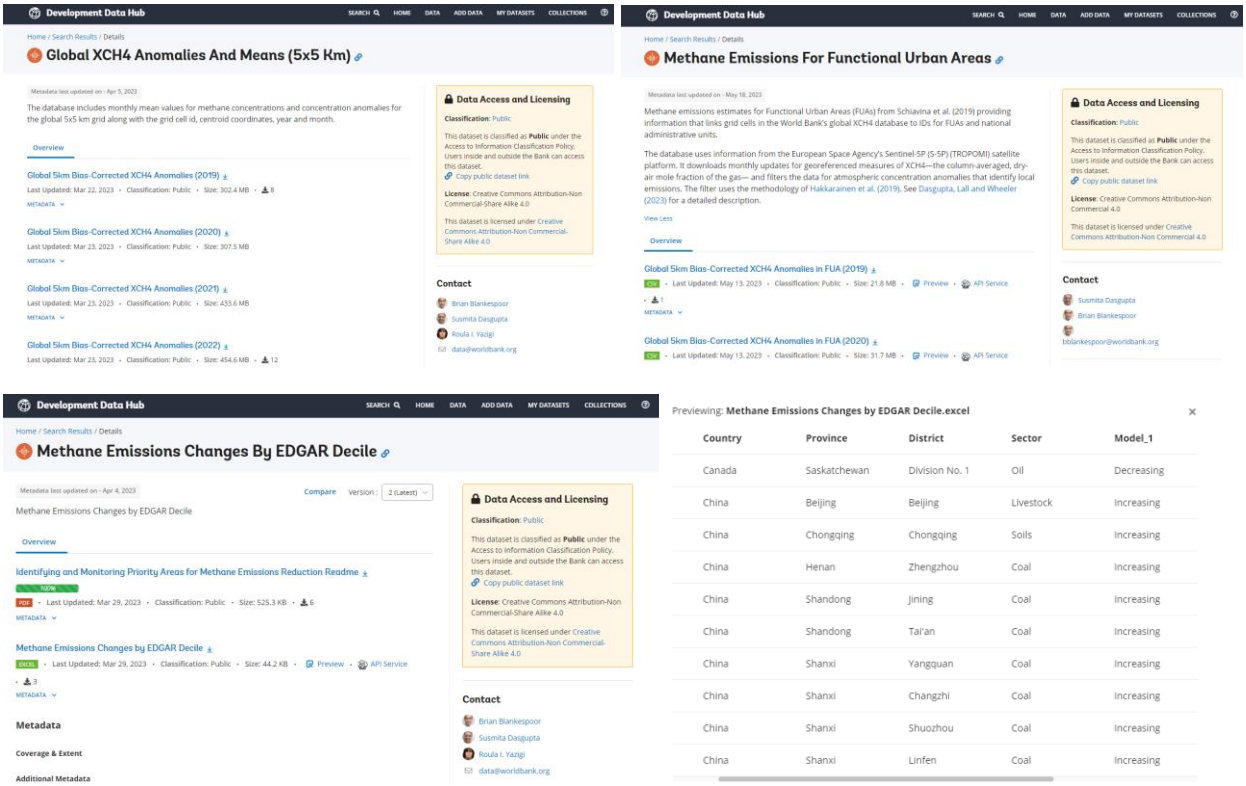
To present this data, the second database was set up, summarizing changes in CO_2 specifically within functional urban areas (densely inhabited cities plus less densely populated zones with populations that are highly integrated with the cities). The goal here is to offer valuable insights into CO_2 emission sources and patterns in the biggest urban areas around the world.



Analyzing Methane Data

The team also looked at ways to analyze methane emissions. ESA's TROPOMI satellite data has been instrumental in identifying methane "hot spots" by location and sector. This data can aid in establishing baselines and in tracking the progress of over 100 nations that have pledged to reduce methane emissions. To present this data, three databases were developed.

The first database involves satellite-derived data on anomalies and mean values in methane emissions worldwide at a 5 km global grid for the past five years. The second database summarizes CH_4 changes within large urban areas. The third database identifies the location of the top 50% methane emitters and their sectors (agricultural soils, livestock, gas, oil, coal, landfills, and wastewater) along with changes in their emissions over time.



Why Does It Matter?

The value of these databases lies in their versatility and accessibility—with their structure allowing for seamless integration of other geospatial data. They enable increasingly precise measurements—monthly changes in mean levels of emissions at nearly any point on the globe, for example, and provide useful estimates of how emissions are changing in large urban areas.

"By processing satellite readings, we were able to generate emission estimates that are comparable across space and time and make them open to anyone interested," says **Brian Blankespoor**, a member of the team. "*The data can be used to understand CO_2 and CH_4 emission trends in urban areas across the world."*

The World Bank's pioneering efforts, in collaboration with NASA and ESA, can be transformative in the fight against climate change by providing a valuable input to designing effective strategies to curb GHG emissions paving the way for a more climate-friendly approach to urban planning and infrastructure development.

Related Links:

Global XCO2 Anomalies and Means
Change Estimates of Carbon Emissions for Functional Urban Areas
Global XCH4 Anomalies and Means (5x5 Km)
Methane Emissions for Functional Urban Areas
Methane Emissions Changes by EDGAR Decile

Reports:

Identifying and Monitoring Priority Areas for Methane Emissions Reduction
Scalable Tracking of CO2 Emissions: A Global Analysis with Satellite Data