



STATISTICS

**IMF** BIG DATA CENTER

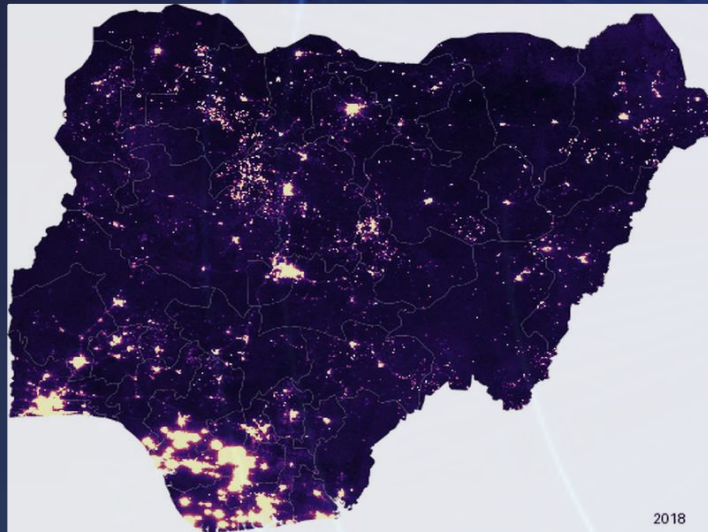
# **Big Data in Macroeconomic Statistics - From Innovation to Capacity Development**

**JUNE 22, 2026  
D4D FUND STEERING COMMITTEE MEETING**

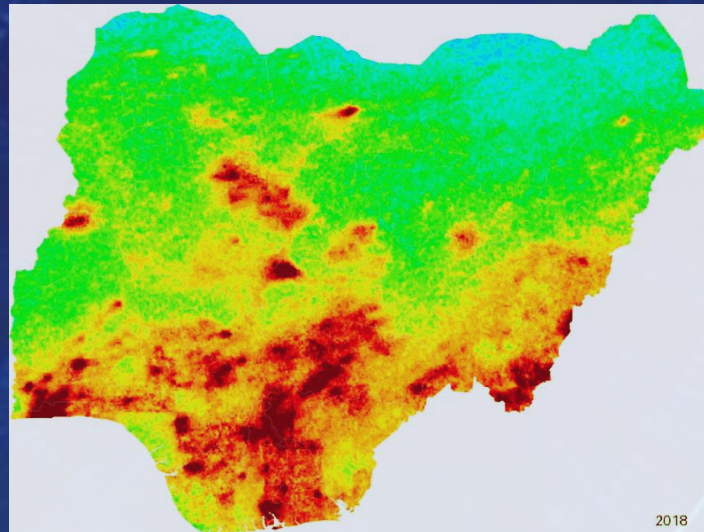
Iyke Maduako, Data Scientist

Big Data Center, Statistics Department, IMF

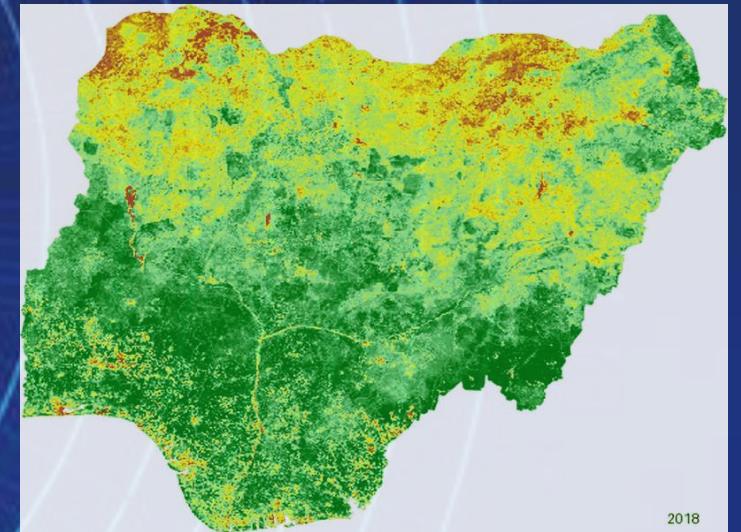
# EVERY ECONOMIC ACTIVITY LEAVES A DIGITAL TRACE



NIGHTLIGHTS



NO2 EMISSIONS



VEGETATION INDEX

# Big Data Sources for Macroeconomic Statistics



Satellite Imagery



Sensors on Maritime Vessels  
i.e. AIS/PortWatch  
(data on trade flows)



Labor market data  
on hiring and skills



Scanner data (*prices*)



Digital Transactions  
(e.g., *mobile money*)



Text Data



Passengers on Board /  
FlightRadar24



Internet connectivity



Mobility



Administrative Data  
(e.g., *tax records*)

Other sources, including:

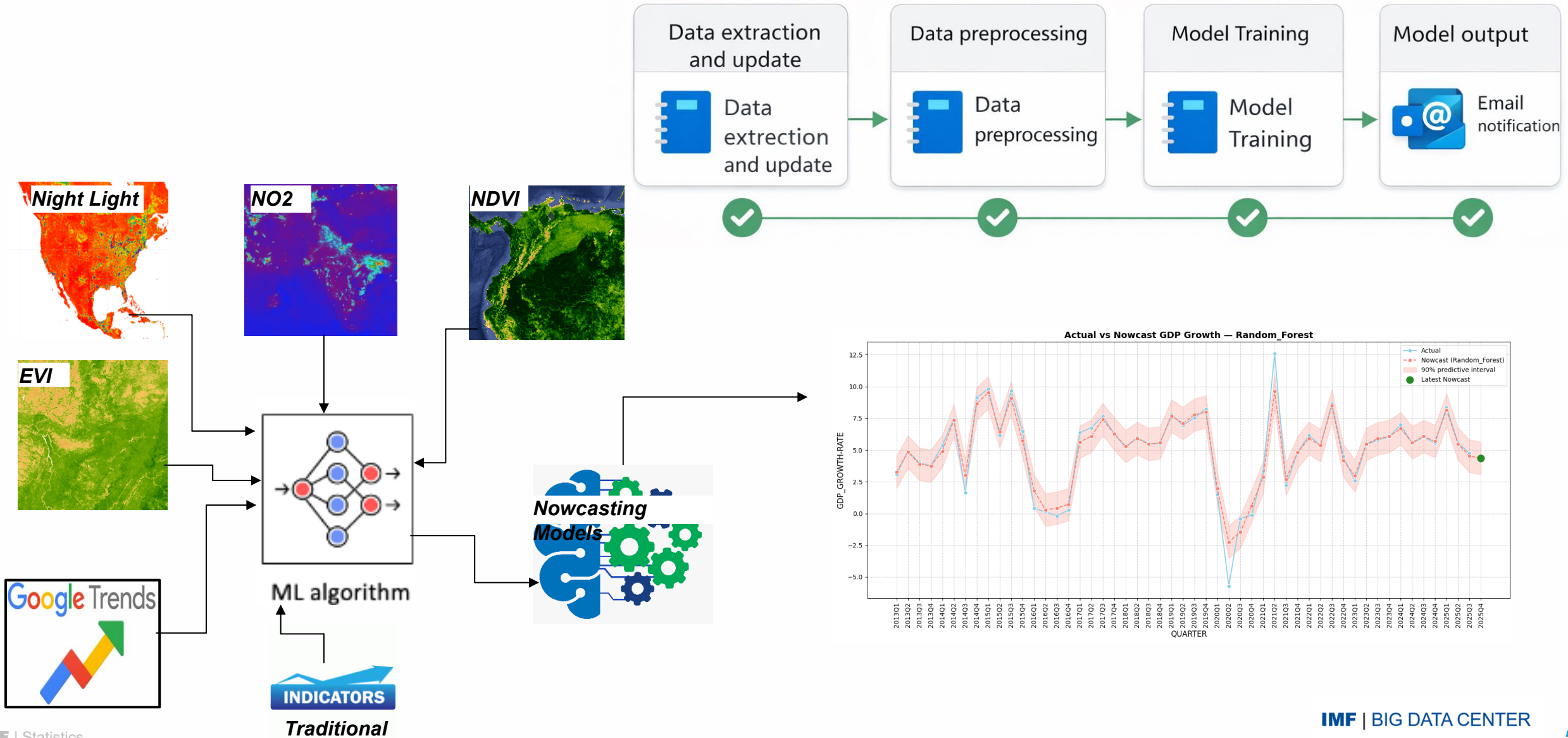


# IMPACT ON CAPACITY DEVELOPMENT

## BIG DATA FOR MACROECONOMIC STATISTICS

### EXPERIENCE FROM IMF

# Bank of Uganda: An end-to-end automated and scheduled Nowcasting Framework



# Somalia National Bureau of Statistics: AI for Improving Production Workflows

An AI-enabled, end-to-end workflow for trade statistics: from raw customs records to validation and visualization.

## AI to lower the technical barrier (Gemini in Google Colab)

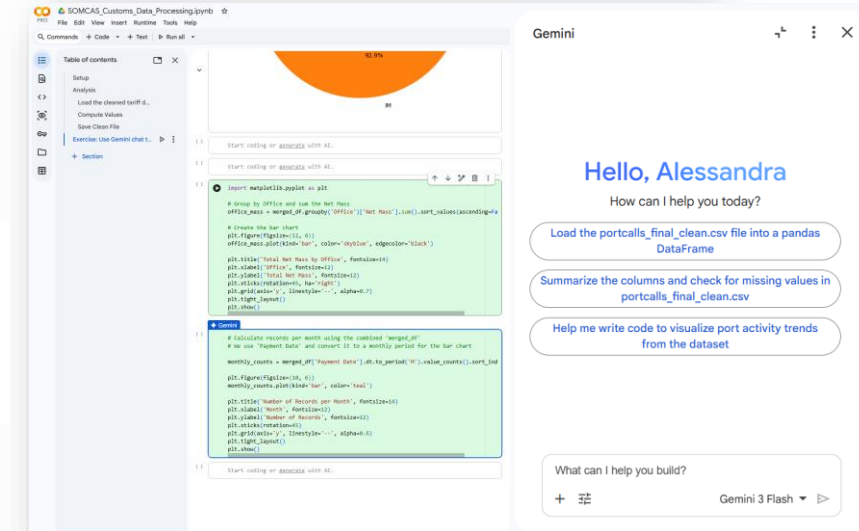
- Staff process customs data with AI help
- Automated inconsistency checks
- Reproducible, transferable workflow

## Analysis & quality assurance (Power BI dashboard)

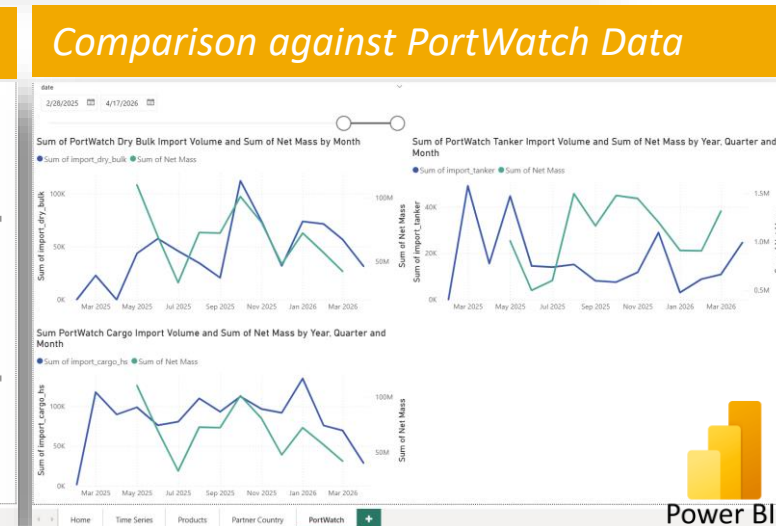
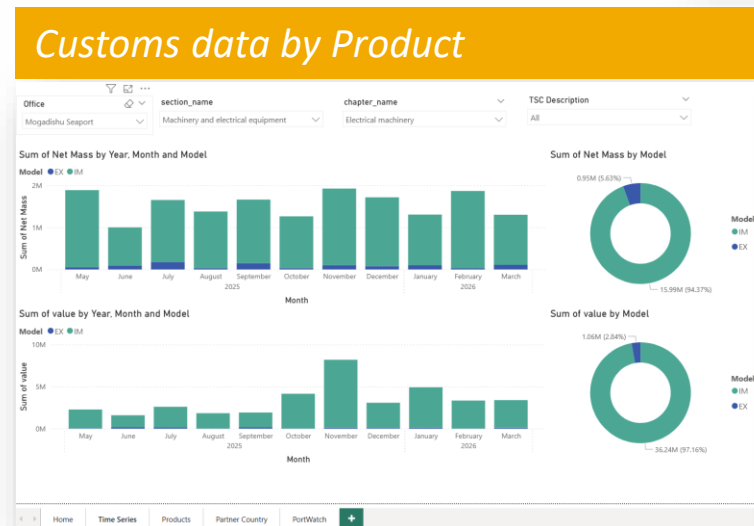
- Trade indicators dashboard
- Validation against PortWatch estimates
- Production-ready, SNBS-led tools

Prioritizing durable capacity in a fragile, data-constrained (FCS) setting. Built with MoF Customs through hands-on sessions

Figure 1. Creating AI-enabled workflows with Gemini in Google Colab.



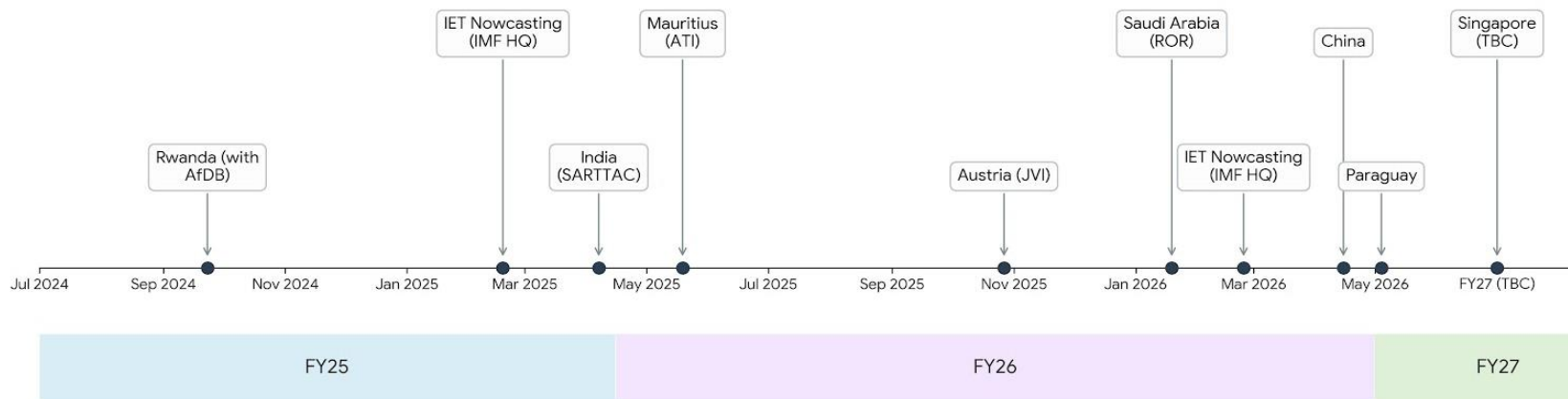
is & QA (Power BI)



Power BI

# Empowering Member Countries through Big Data Workshop

Big Data Center has trained more **180 officials** from member country institutions across all regions, including central banks, national statistical offices, ministries of finance, and ministries of planning.



## Key topics covered:

- Overview of big data sources and relevant analytical methods for satellite data, ship tracking data, unstructured/Text data, and online searches
- Nowcasting GDP
- PortWatch and AIS data to monitor trade disruptions and estimate trade
- Natural Language Processing / Text Analysis
- Strategic Planning for Big Data
- Partnerships and Collaborations on private sector data

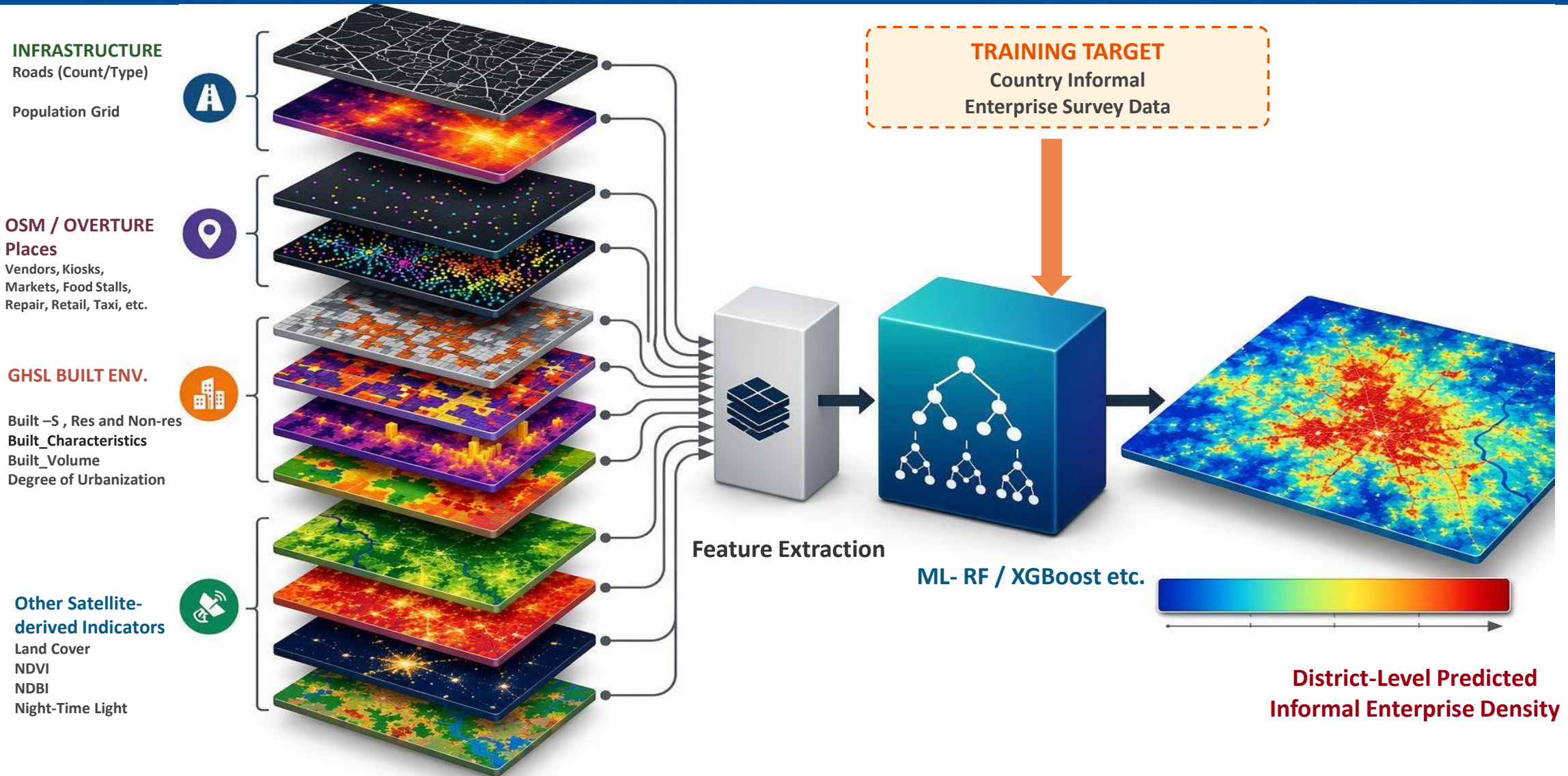


# BIG DATA APPLICATIONS FOR NATIONAL ACCOUNTS



# Predicting Informal Activity at Granular Level

A Multi-Layer ML Pipeline Using Satellite, Infrastructure, Places, Population, GHSL data at District Level



# Census of Buildings

## Leveraging Open-Source Buildings Data for Economic Measurement

**Timely and granular data** on residential buildings are **scarce** (especially from official data sources)

### **Housing Census:**

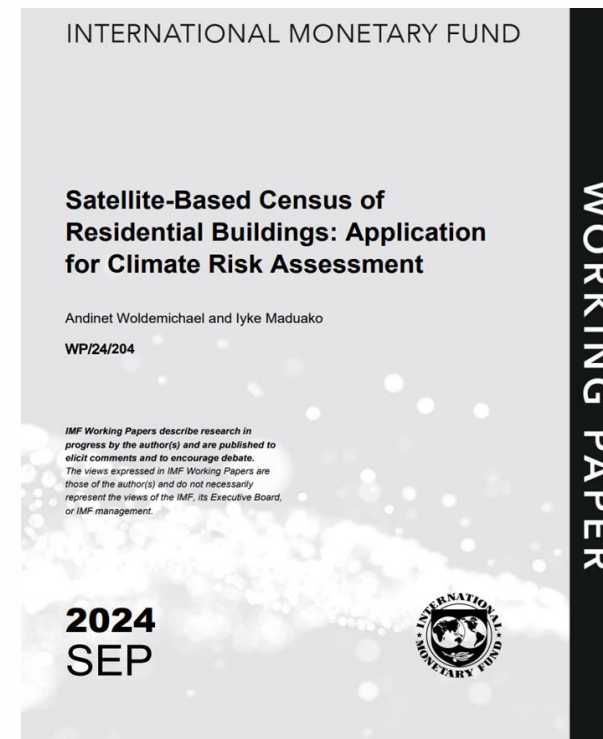
- Not always conducted
- Outdated
- Not geotagged



# Methodology:

Working paper, which explores one of the applications of [Satellite-Based Census of Residential Buildings](#)

Authors: Andinet Woldemichael & Iyke Maduako



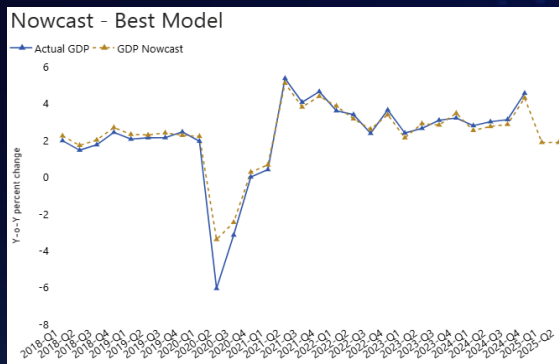
# BIG DATA APPLICATIONS FOR HIGH FREQUENCY INDICATORS



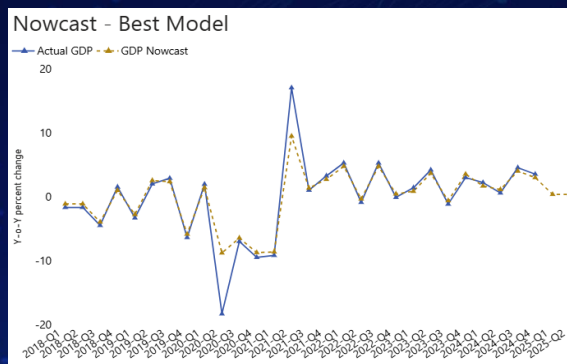
# Nowcasting Scalable Framework

For countries where quarterly GDP data is unavailable or available with significant delays, use of satellite data and machine learning-driven nowcasting play a crucial role in providing access to timely GDP estimates.

## Nigeria



## Lesotho



- **Input:** Traditional and non-traditional (e.g. **nighttime lights**, **NO2**, **vegetation indices** etc.) high-frequency indicators.

- **Methodology:** Horse racing over **15 Machine learning** models and selecting the best model based on the out-of-sample RMSE.

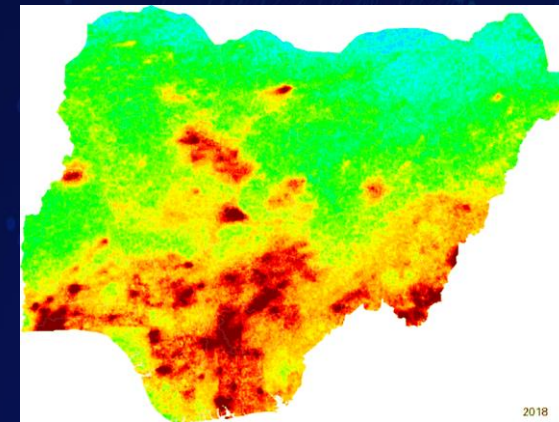
- **Output:** Timely **YoY GDP growth nowcasts**.

- **Capacity Development and Training:** IMF Staff and country authorities in AFR, APD, MCD, EUR, and WHD have been trained on methodology.

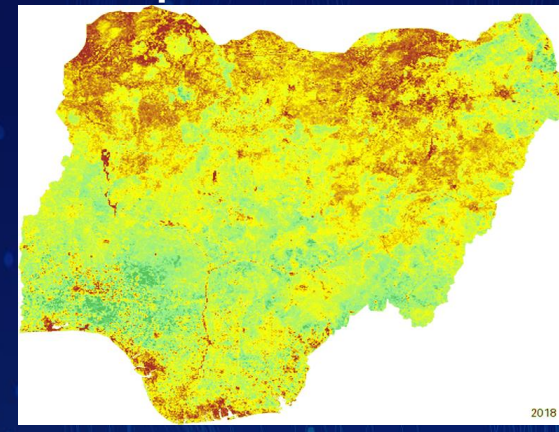
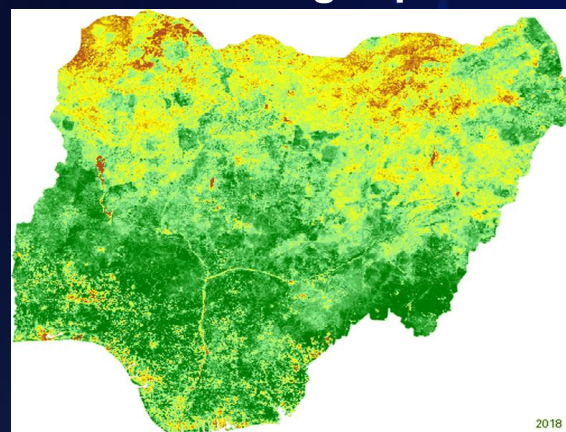
## Economic Activity



## Manufacturing, Industry and other fossil fuel combustion

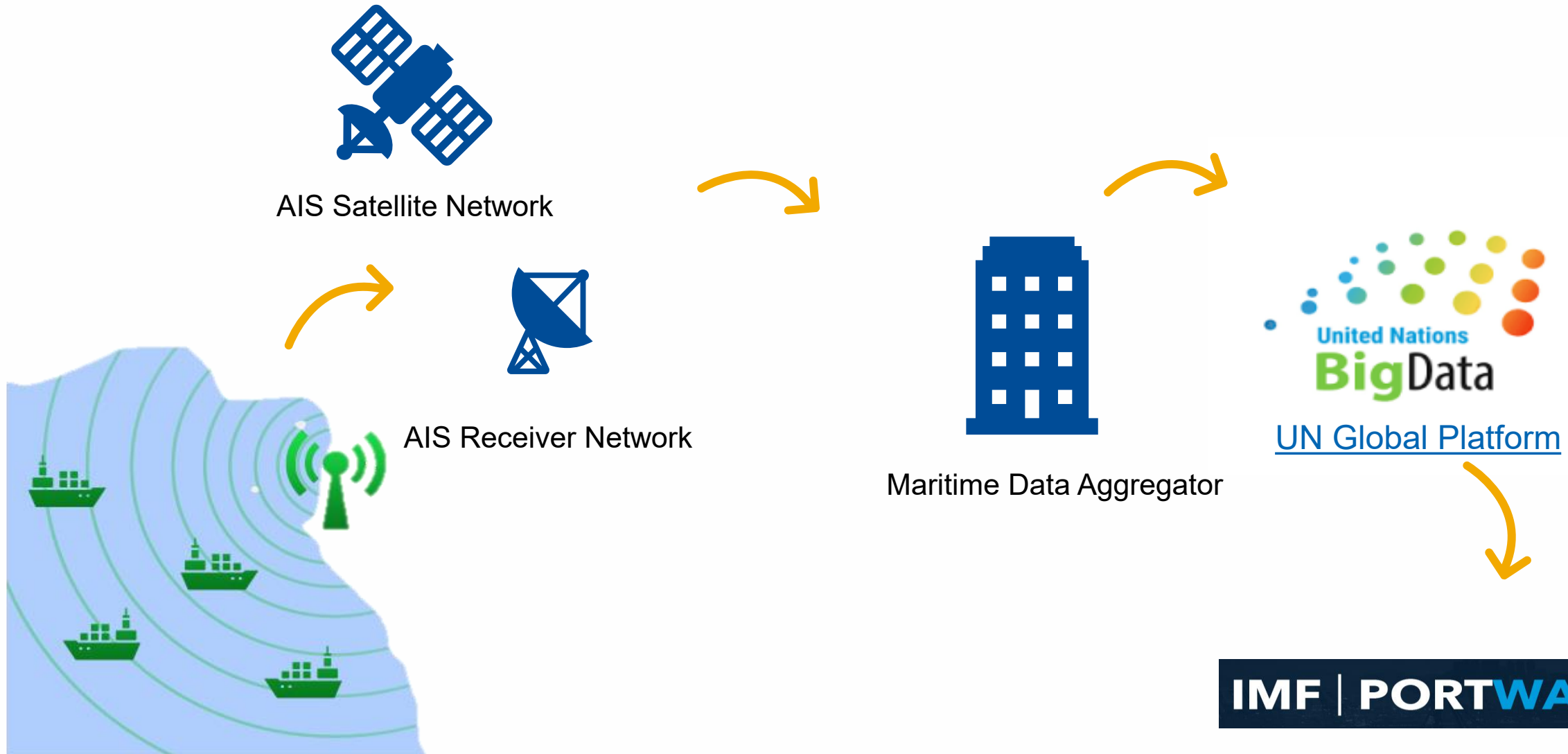


## Agro-potential and Yield proxies



*NowHub is a collaboration between STADS / Big Data Center, AFR, RES, and other depts.*

# AIS and PortWatch Data for Trade Nowcasting



# Trade Measurement using PortWatch - Methodology

## Goal

- Build monthly [global trade estimates](#) (value & volume) aligned with how official statistics are compiled.

## Approach

### 1. Physical Volume

- Use AIS data to estimate cargo volume (in metric tons) by vessel type: tankers, dry bulk, and containers.

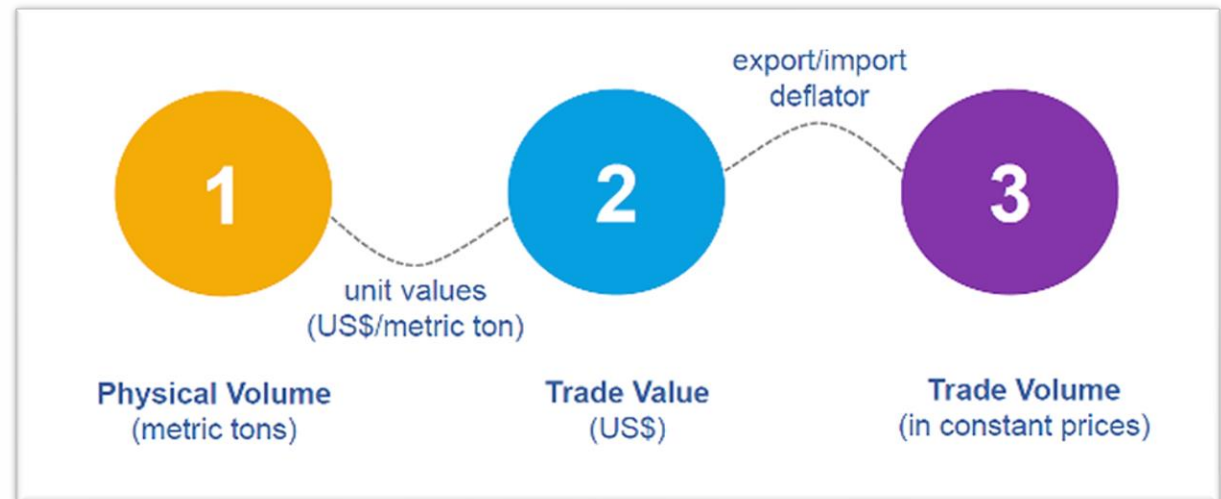
### 2. Trade Value

- Multiply physical volume by vessel-type-specific unit values (US\$/ton), derived from trade data.

### 3. Trade Volume

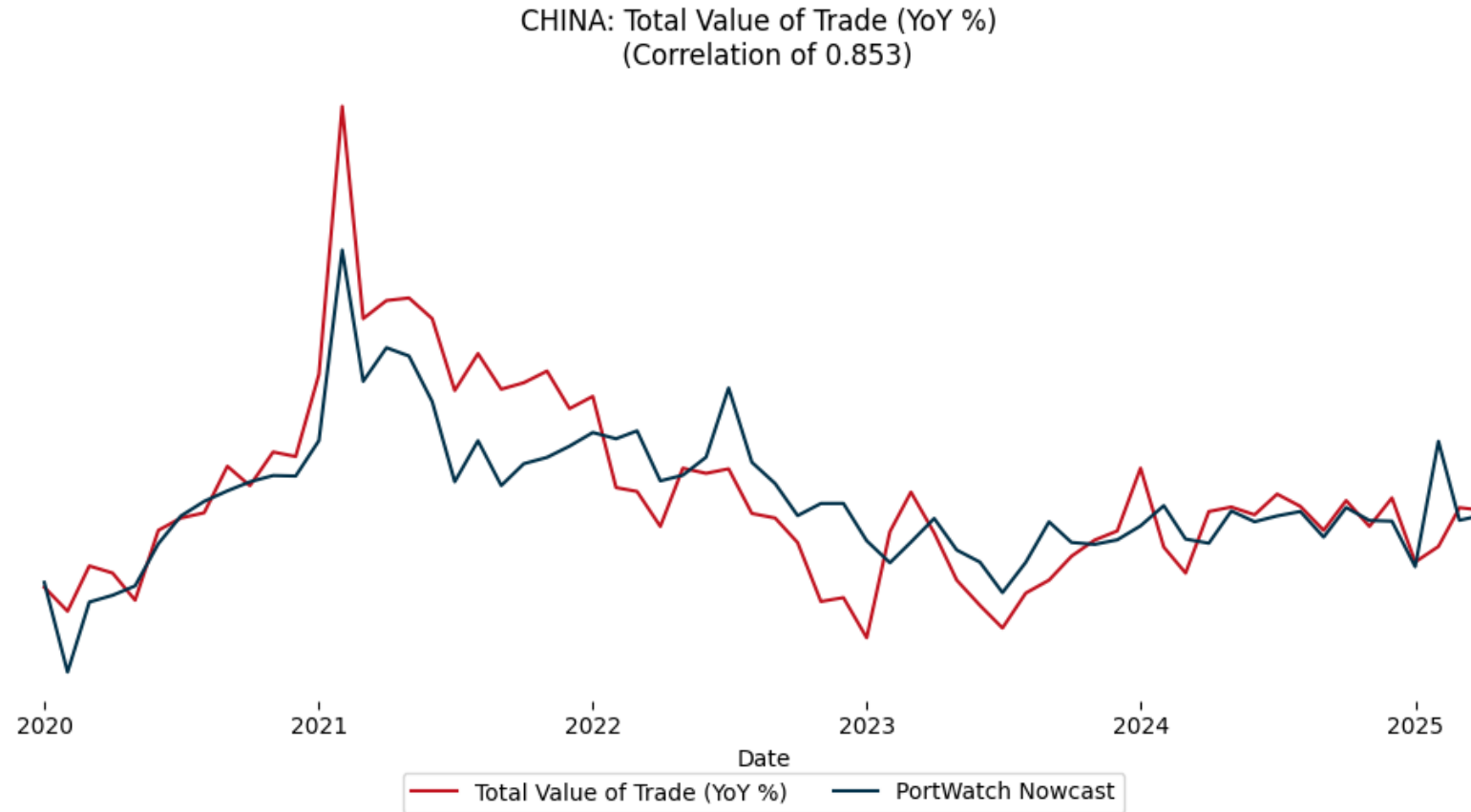
- Deflate trade value using export/import price indices to obtain trade volume in constant prices.

## From Physical Volume to Trade Estimates



[Arslanalp et al \(2025\)](#)  
[Nowcasting Global Trade from Space](#)

# Strong Correlation Between PW Estimates and Official Trade: Opportunities for Countries



Source: China National Bureau of Statistics / IMF PortWatch

**Trade nowcasting:** PortWatch enables early detection of trade patterns well before these changes are reflected in official customs data.

# BIG DATA APPLICATIONS FOR CLIMATE RISK INDICATORS

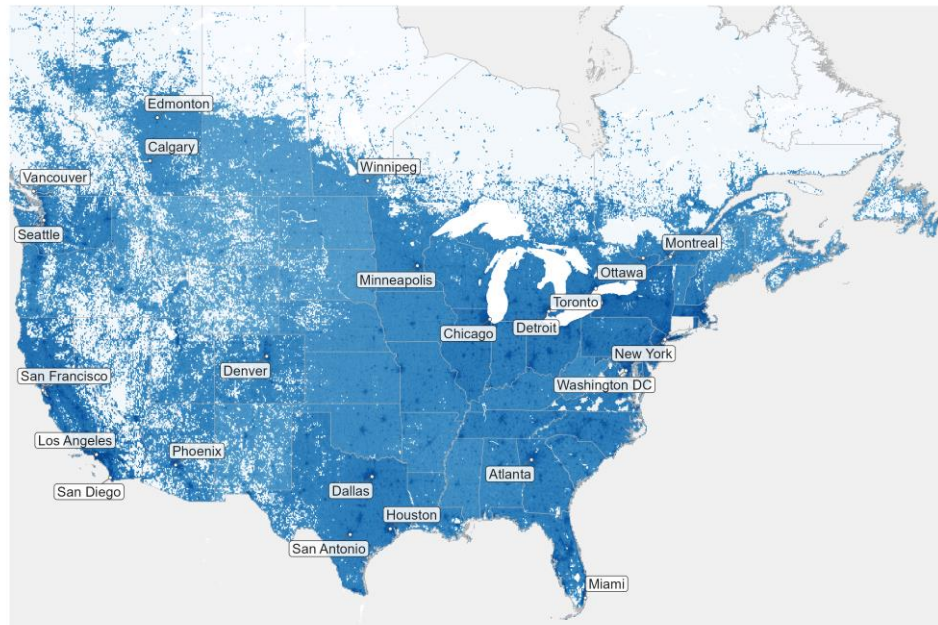


# Ongoing Projects: Gridded GDP

## Gridded GDP | US and Canada

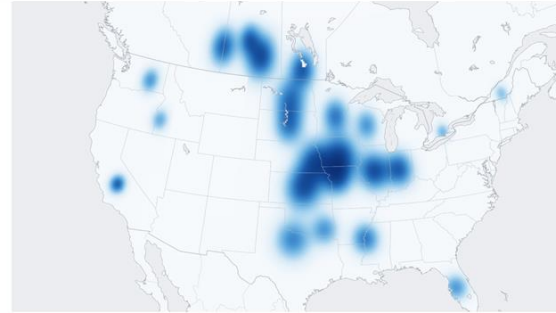
Gridded GDP, Total Economy, Canada and United States

Year: 2021 | Total Economy | Post-Benchmarking

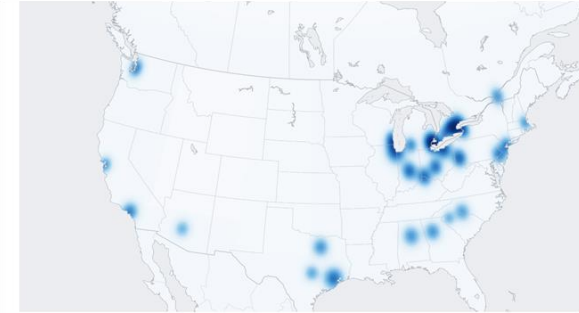


Gridded GDP

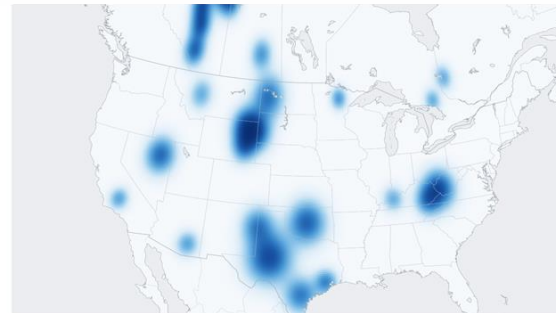
Agriculture



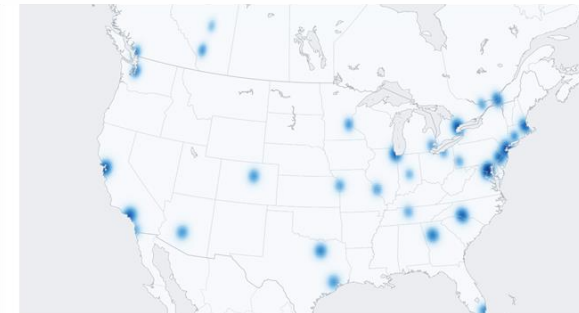
Manufacturing



Mining



Financial Intermediation

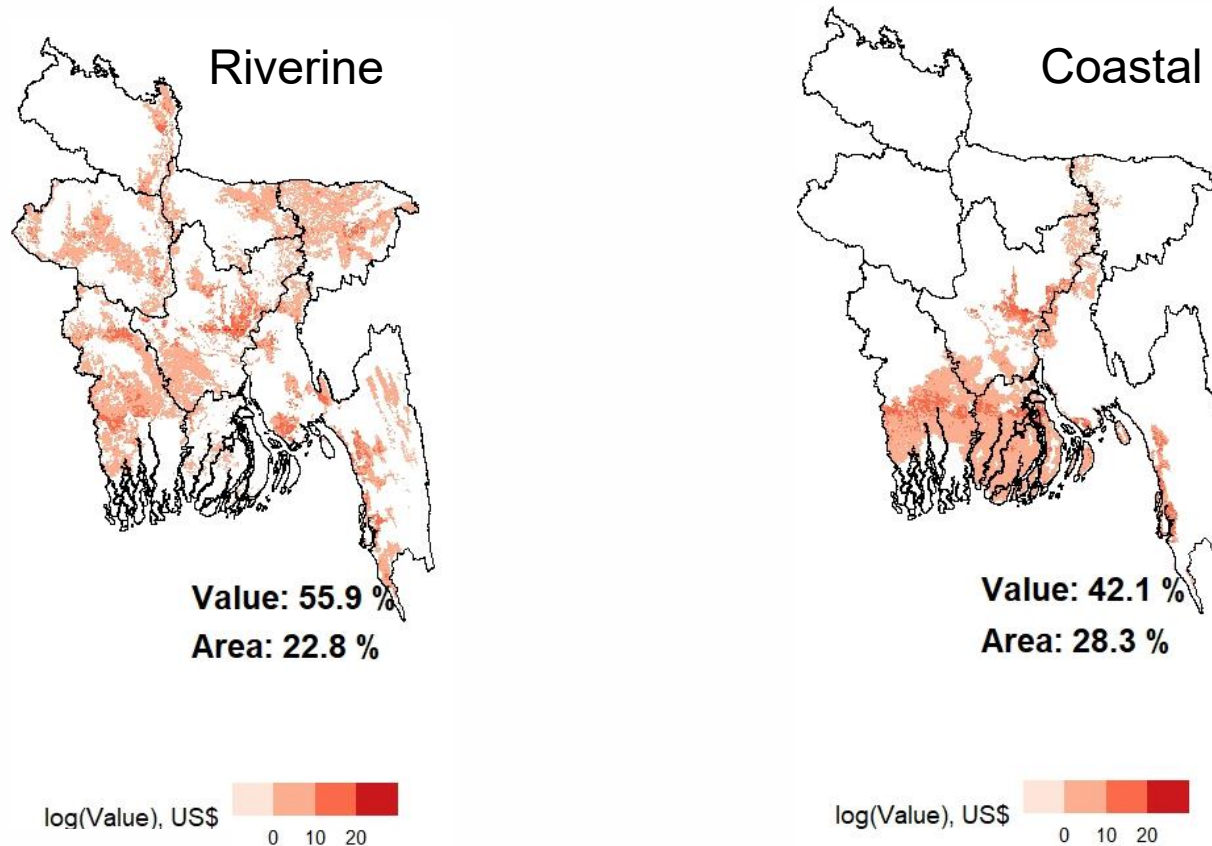


Gridded GDP by industry

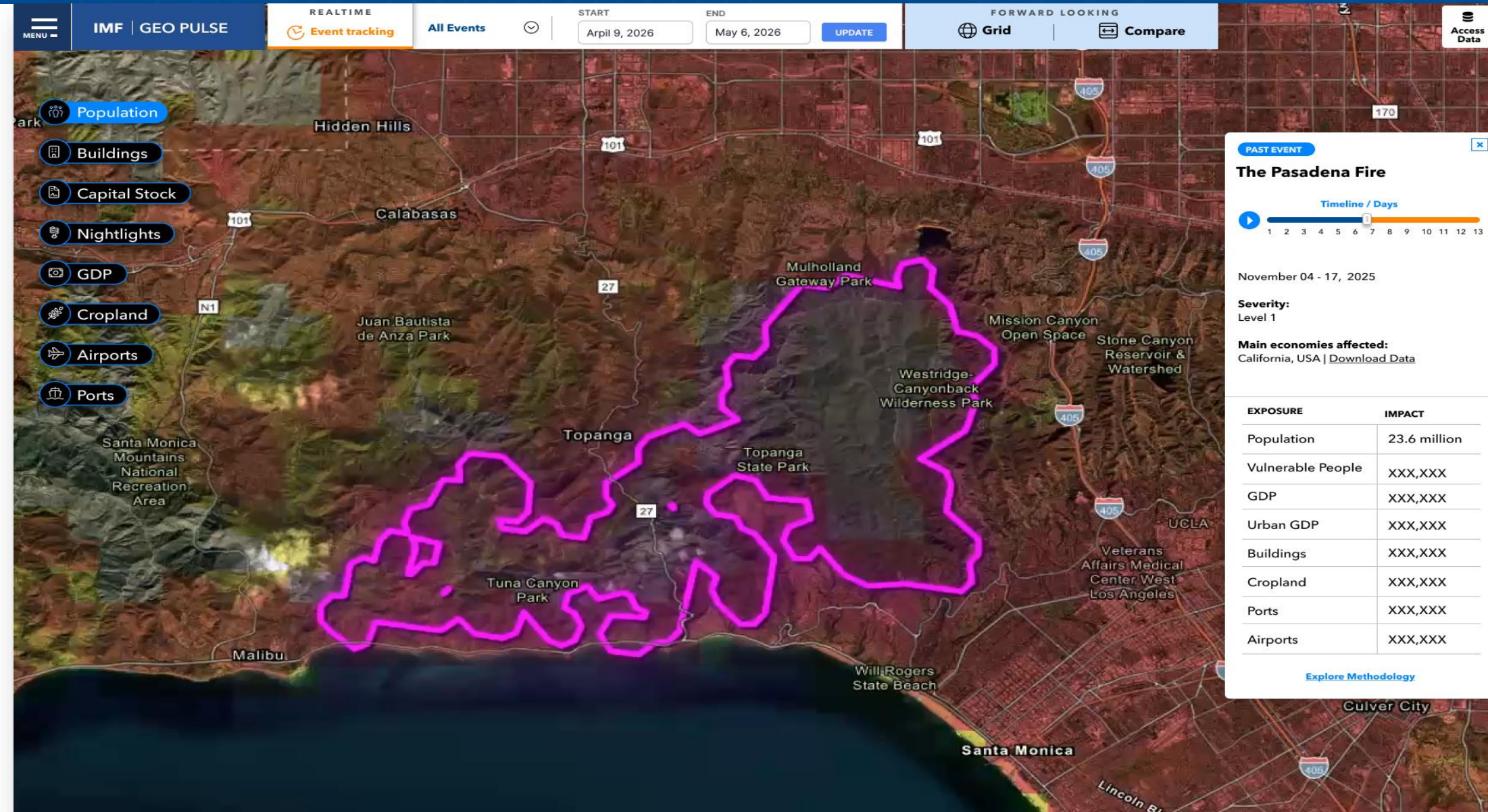
# Ongoing Projects: Gridded Capital Stock

## Gridded Capital Stock | Bangladesh

Percentage Buildings exposure to flooding by Area vs Value



# GeoPulse Event-Tracking: Measuring Exposure in Near Real-Time



# Conclusion

*With Big Data, we are providing support to country teams and authorities—regardless of local statistical capacity—with timely and trusted signals of economic activity to guide surveillance and policy advice.*

