GeoAI & Climate Digital Twins for Climate-Resilient Urban Development

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Urban Planner | GeoAI | Climate Resilience

About Innpact Solutions

We are

2020

Registered Start-up

#startupindia

Completed over

40 projects across **8** countries –

India, Bangladesh, Nepal ,Sri Lanka, Thailand, Saudi Arabia, UAE and Mozambique

Core members of :

esri | IWA the international water association | NFSSM ALLIANCE | AUTODESK Technology Impact

Team includes Data scientist, Geo-Informatics Expert, Planner, Tourism Expert, Civil engineer, and Economist

Verticals includes Climate change, Geo AI, WASH, and Tourism

Collaboration with:

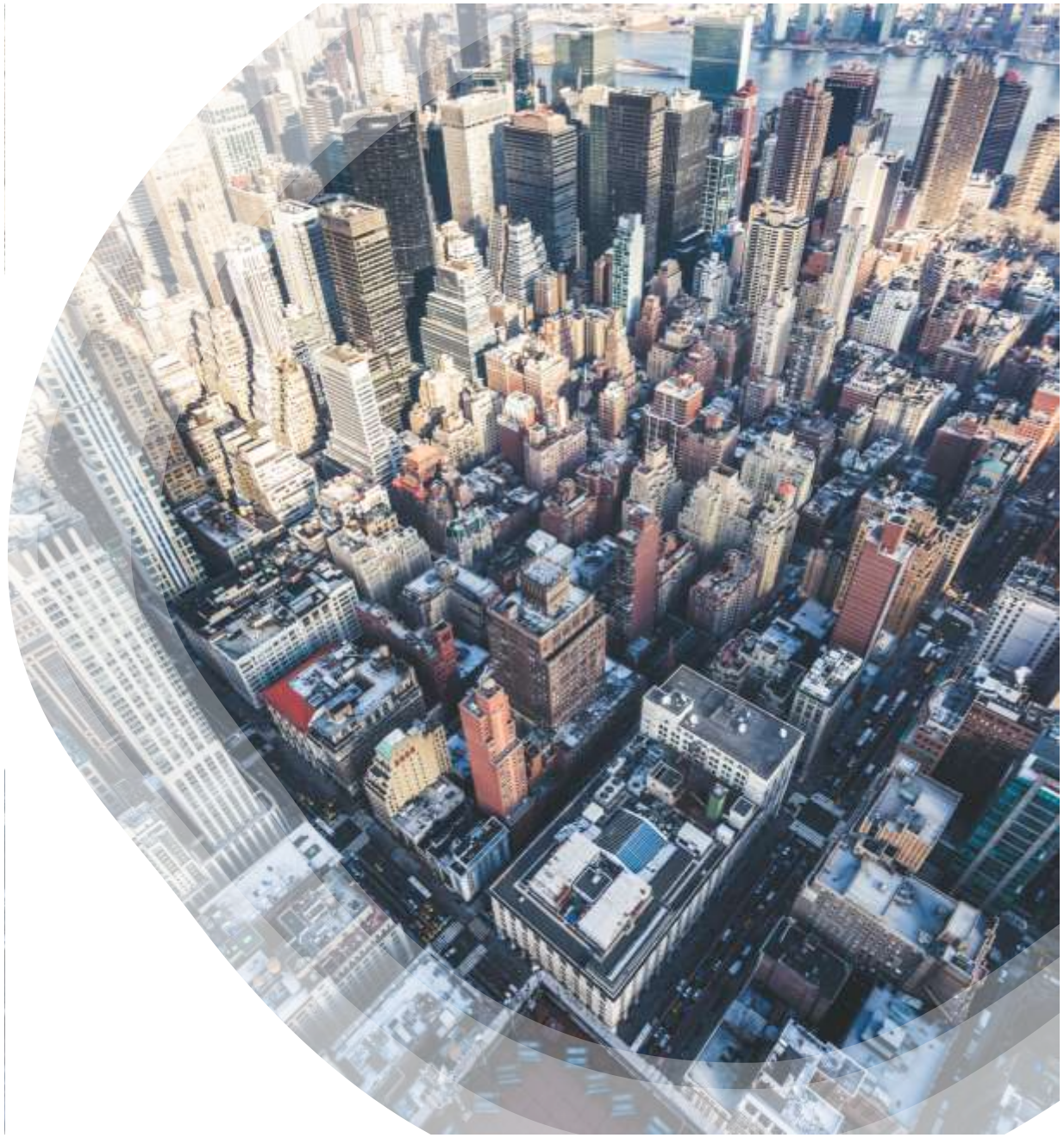
BILL & MELINDA GATES foundation | GWSC Global Water & Sanitation Center | THE WORLD BANK | ADB ASIAN DEVELOPMENT BANK | AIIB | USAID FROM THE AMERICAN PEOPLE | AFD | IsDB Islamic Development Bank

Why Cities Need Climate-Risk Intelligence

- Cities face escalating climate extremes — heatwaves, floods, pollution.
- Planning systems, zoning regulations, and drainage networks are still based on outdated baselines.

Key Impacts:

- *Lack of real-time, high-resolution climate data*
- *Intensifying heatwaves & expanding heat islands*
- *Frequent urban floods & chronic waterlogging*
- *Built-up expansion over natural drainage & wetlands*

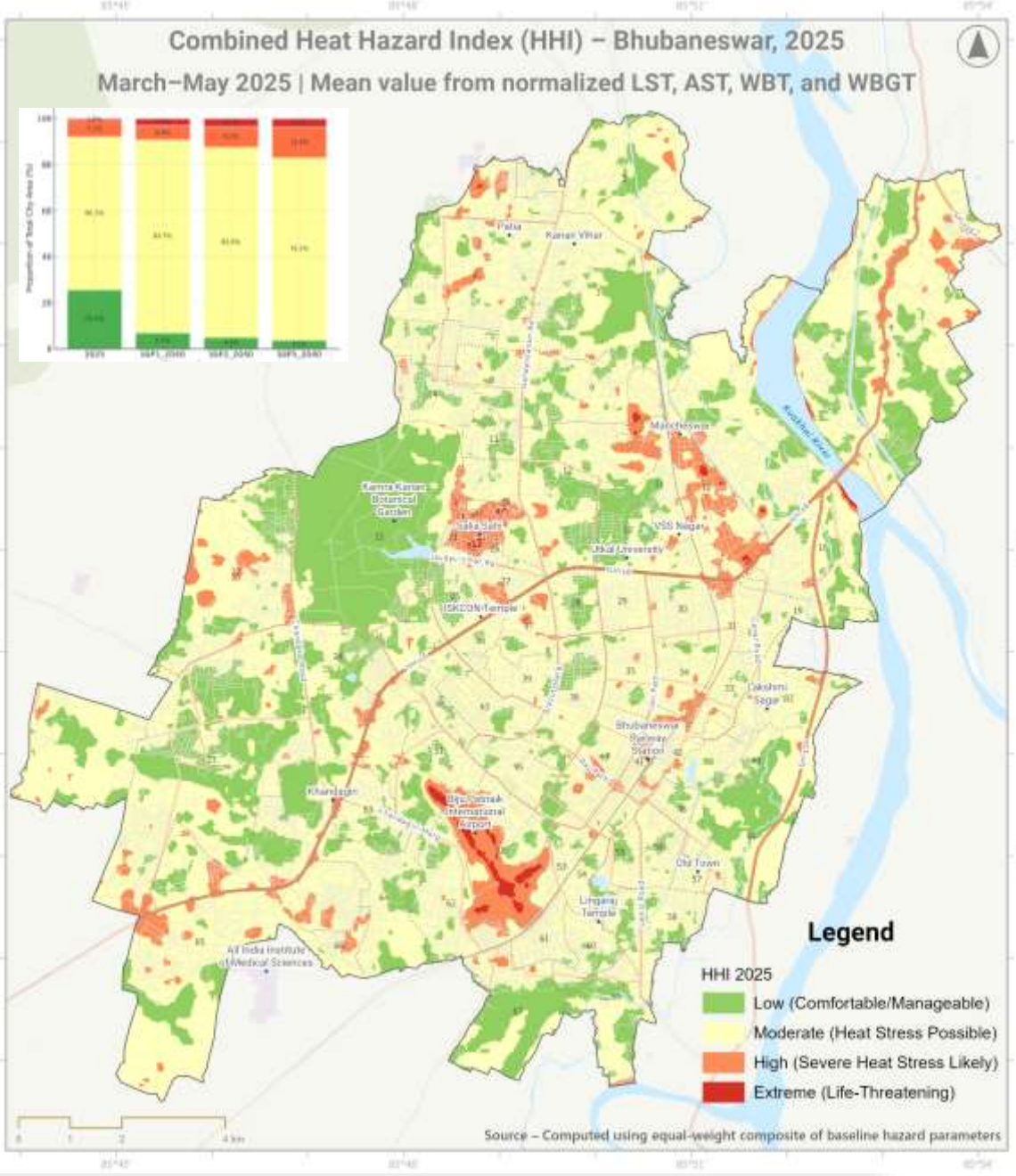


Next Gen Tools For Climate-Ready Cities

The Solution Framework

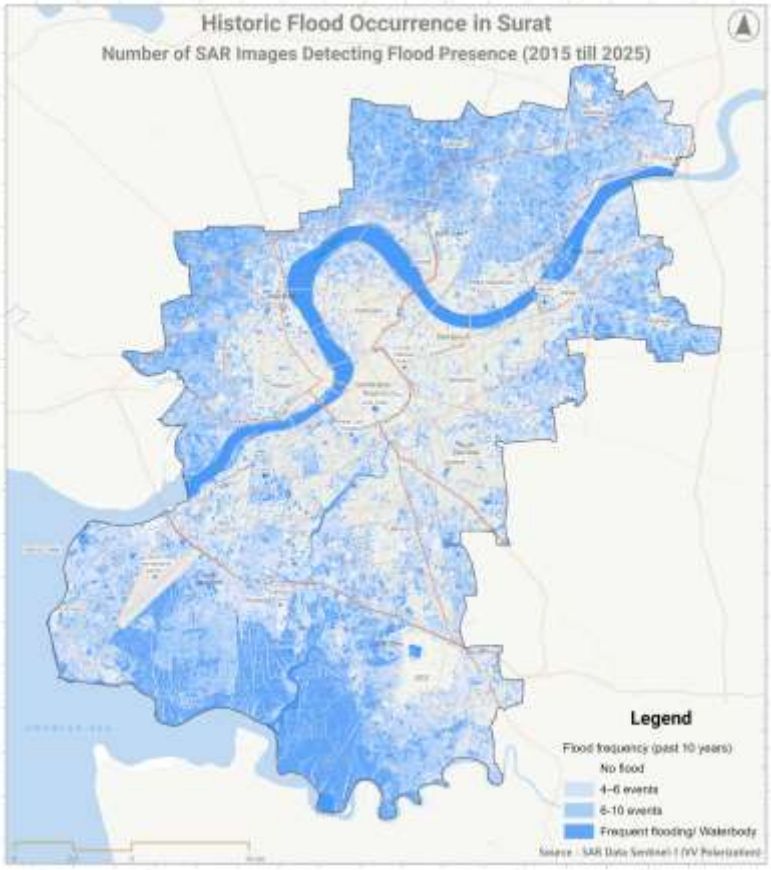
(1) Remote Sensing for Hazard Detection

- Multi-year satellite analysis to identify climate hazard hotspots
- Flood detection using Sentinel-1 SAR
- Heat stress mapping using Landsat and MODIS
- Air pollution hotspot detection using Sentinel-5P
- Seasonal trend monitoring using Sentinel-2 optical imagery
- Enables long-term climate zoning and hotspot prediction

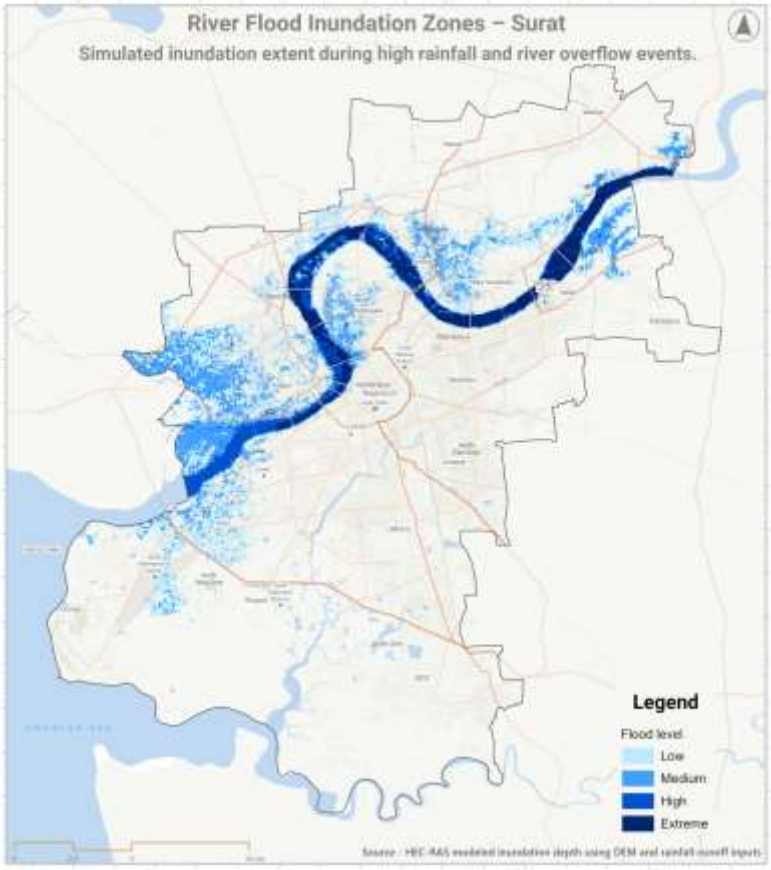


(1) Remote Sensing for Hazard Detection

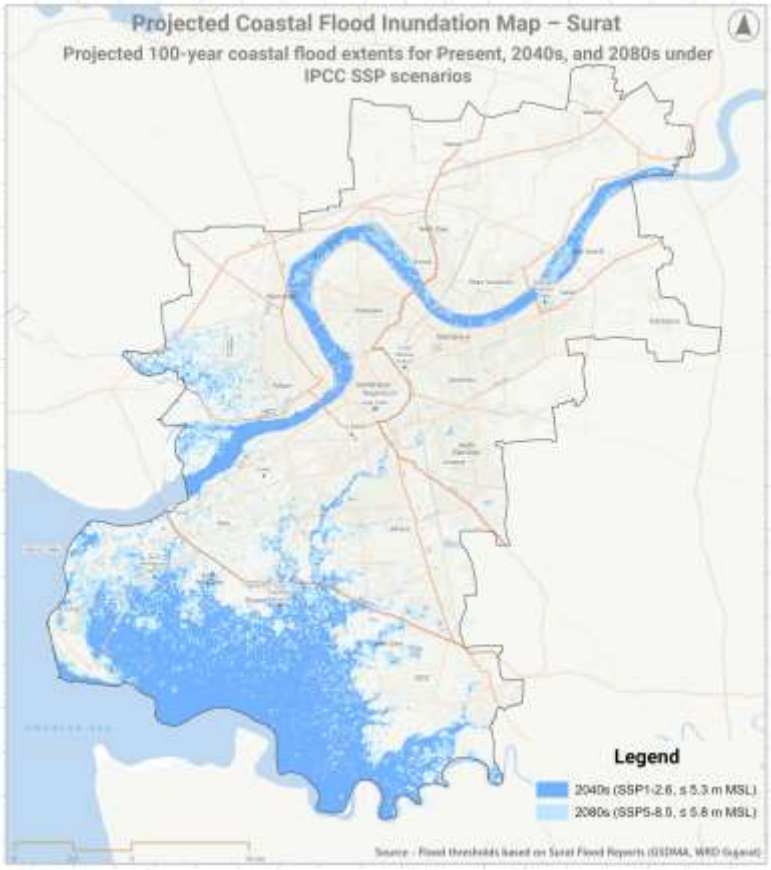
*Illustration showing flood hazard maps for **Surat** developed using **satellite and hydrological modelling**.*



10-year **Sentinel-1 SAR** analysis for flood



Riverine Flooding using HEC RAS



Coastal Flooding (Sea Level Rise & Storm Surge Hazard)

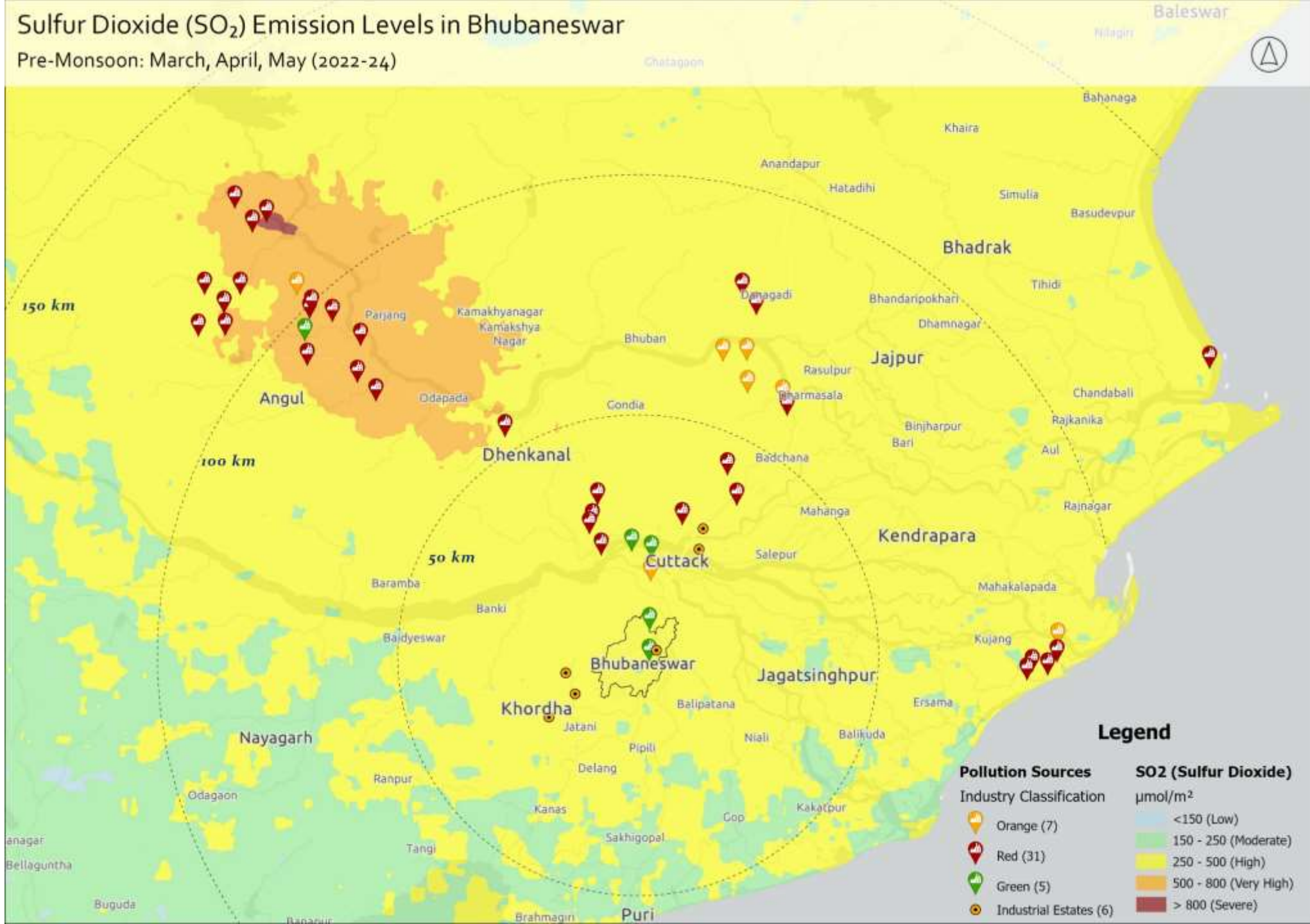
SO_2

Parameter

SO_2
(Sulfur Dioxide)

Causes:
Burning of fossil fuels, Industrial emissions, power plants, diesel vehicles

Health Impacts:
Irritation to respiratory system, cough, bronchoconstriction, and worsening of asthma and chronic lung diseases



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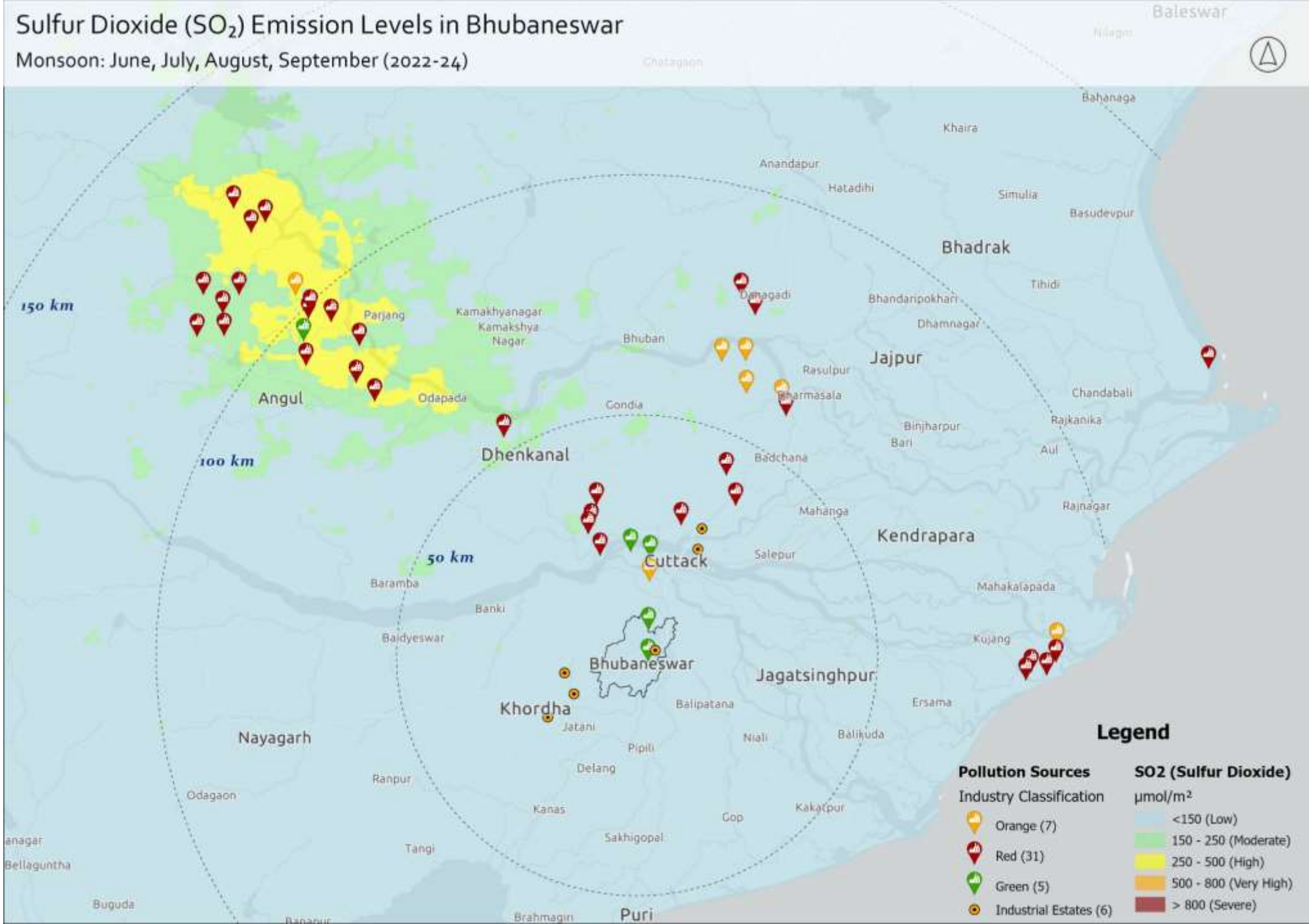

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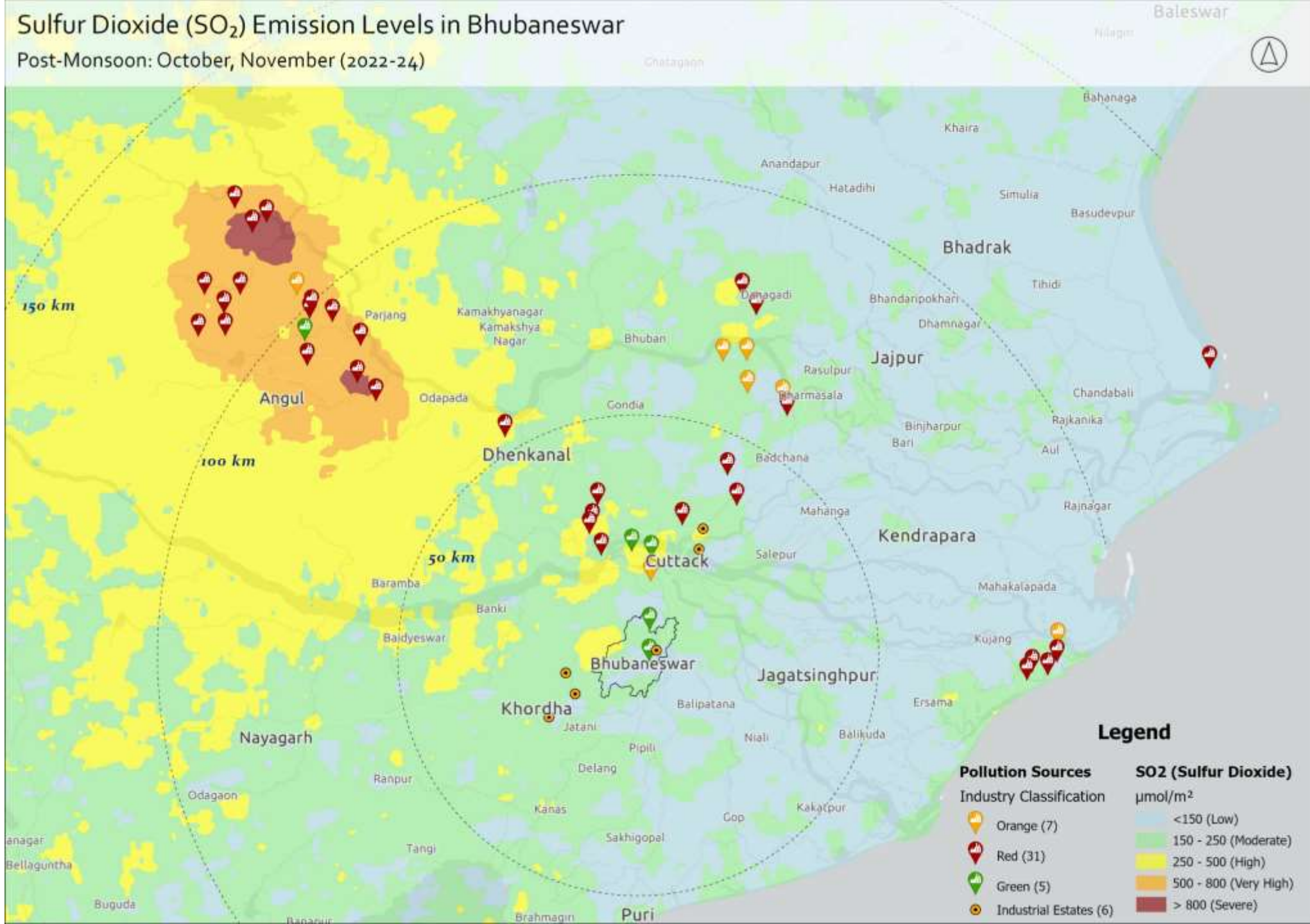

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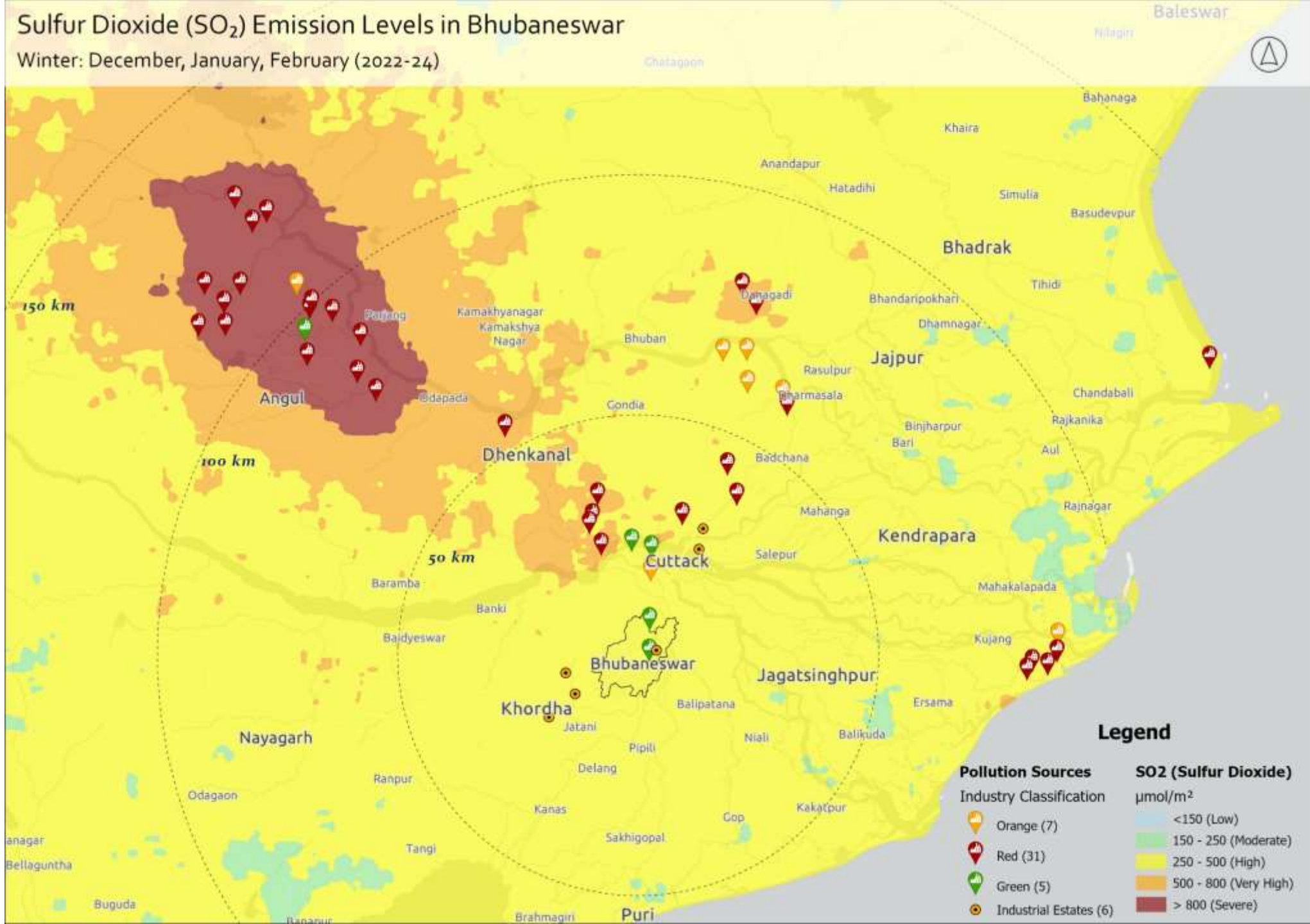


(2) GeoAI for Urban Exposure & Vulnerability

- AI-driven extraction of buildings, roads, drains, wetlands
- Impervious surface & land-cover classification using RS + ML
- Encroachment and blocked drainage detection
- Microzone hotspot clustering (heat, flood, AQI)
- Urban expansion & wetland loss analysis
- Builds risk layers essential for Climate Digital Twin input

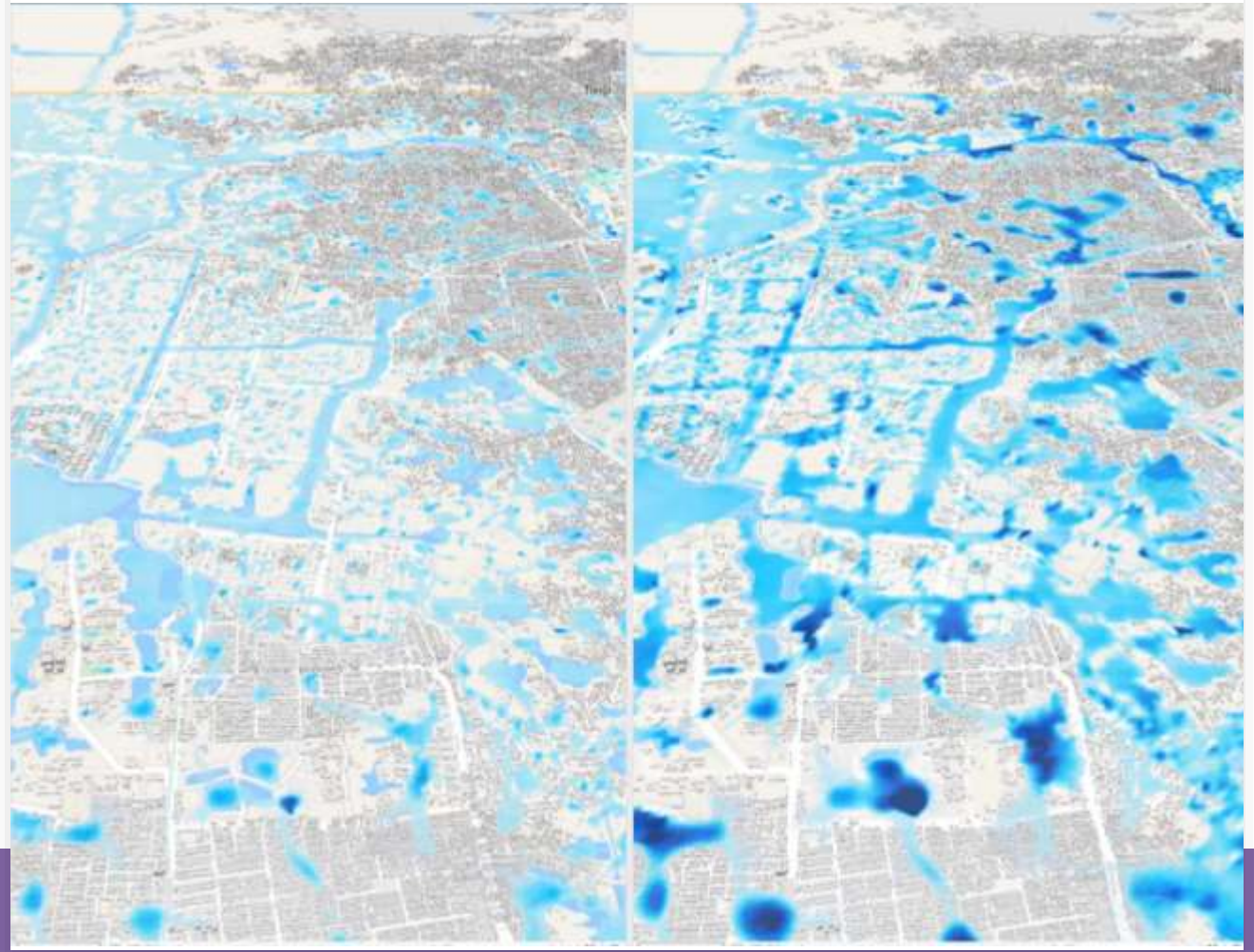
*Illustration showing identification of economic vulnerable houses in **Mozambique** using **GeoAI***

(3) Hydrology & Microclimate Modelling

- Simulates how water & heat behave in real urban environments
- SWMM for runoff, drainage capacity, waterlogging stress
- HEC-RAS for riverine floods, dam release scenarios
- PALM-4U for urban microclimate, airflow, heat island modelling
- Models cooling, runoff reduction, and flow patterns under interventions
- Tests how NbS + grey infrastructure combinations perform

Urban Flood Prediction – Dhaka City

Scenario 1	**Scenario 2**
100 mm rainfall for 2 hrs	*200 mm rainfall for 2 hrs*



(4) Climate Digital Twins for Scenario Planning

- Integrates hazards + exposure + modelling + real-time IoT
- Simulates city-wide scenarios: heatwaves, floods, AQI surges
- Predicts infrastructure stress (roads, drains, utilities)
- Supports real-time monitoring using sensor fusion
- Enables “Grey vs Green vs Hybrid” scenario comparison
- Helps policymakers select the most effective interventions

The Tool Ecosystem

Our Digital Engine Room

GeoAI Climate Risk Engine

AI that reads every roof, material and hotspot.

- Detects heat / flood / AQI risks
- Prioritizes vulnerable buildings
- API integrations + live field integrations with CPCB and IMD

SWMM Hydrological Simulator for NBS

Street-level drainage + NBS impact modelling.

- Reduces runoff & peak flow
- Quantified recharge benefits + NBS application
- Evaluates NBS combinations under varying rainfall intensities

ENVI + PALM-4U Micro-Climate Suite

Neighbourhood cooling and comfort simulations.

- Tree / roof cooling impact
- Future climate scenarios
- Pedestrian comfort mapping under heat-stress conditions

HECRAS + Urban Flood GIS Tool

Integrated river–city flood intelligence.

- Breach & inundation maps
- Frequency-based flood zones
- Applicable for both river floods and storm surge

CWIS WASH Planning Intelligence

Rapid sanitation planning for real constraints.

- Sewer vs non-sewer suitability
- Optimisation across the sanitation value chain
- Building-level service gap identification

Digital Twin Studio

Infrastructure made immersive.

- Real-time 3D city scenes
- VR/AR walkthroughs
- Gamification of different scenarios

impact SOLUTIONS

The Future of Urban Resilience

The Way Forward for Climate-Ready Cities

- Integrate climate-risk layers into master plans and zoning
- Use Climate Digital Twins for predictive decision-making
- Quantify and compare the impact of NbS vs grey infrastructure
- Redesign drainage, transport, and public assets using modelling
- Build real-time climate intelligence through IoT + satellite fusion