

Predicting the Unpredictable:

AI & Data for
Enhanced Climate
Resilience

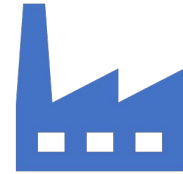
Daniil Mintc
OpenWeather



Extreme Weather
Events Mitigation



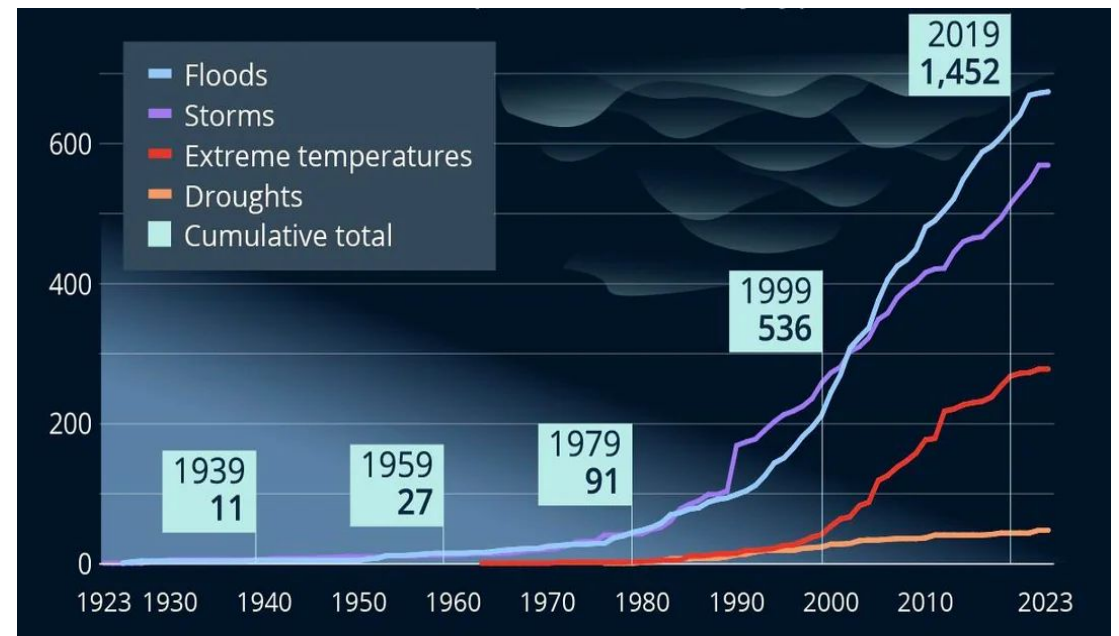
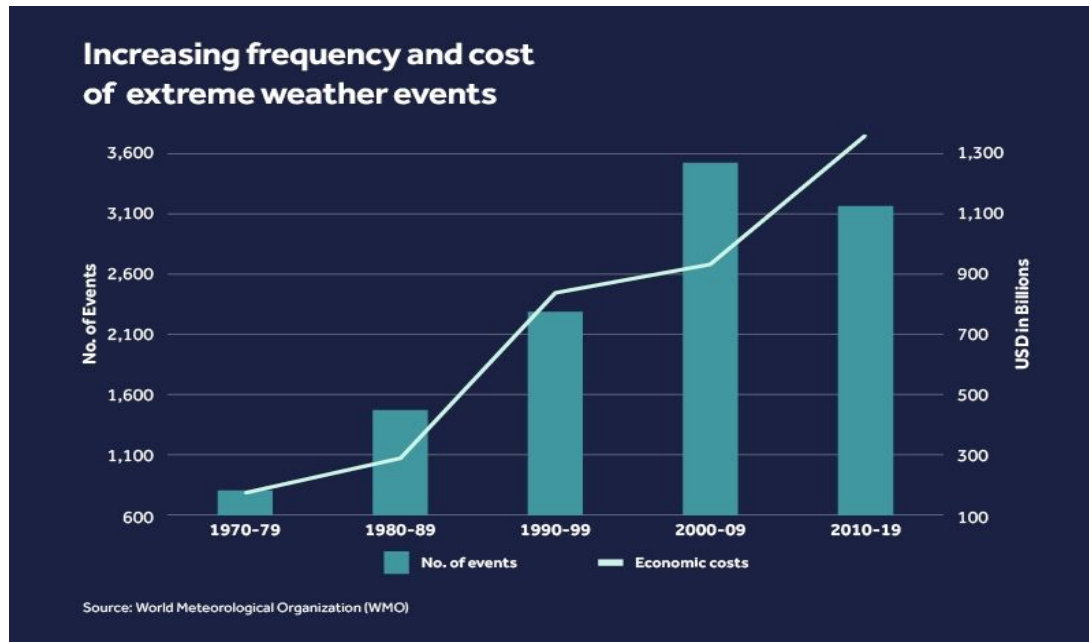
Advanced Climate
Resilience



Broad Sector
Impact

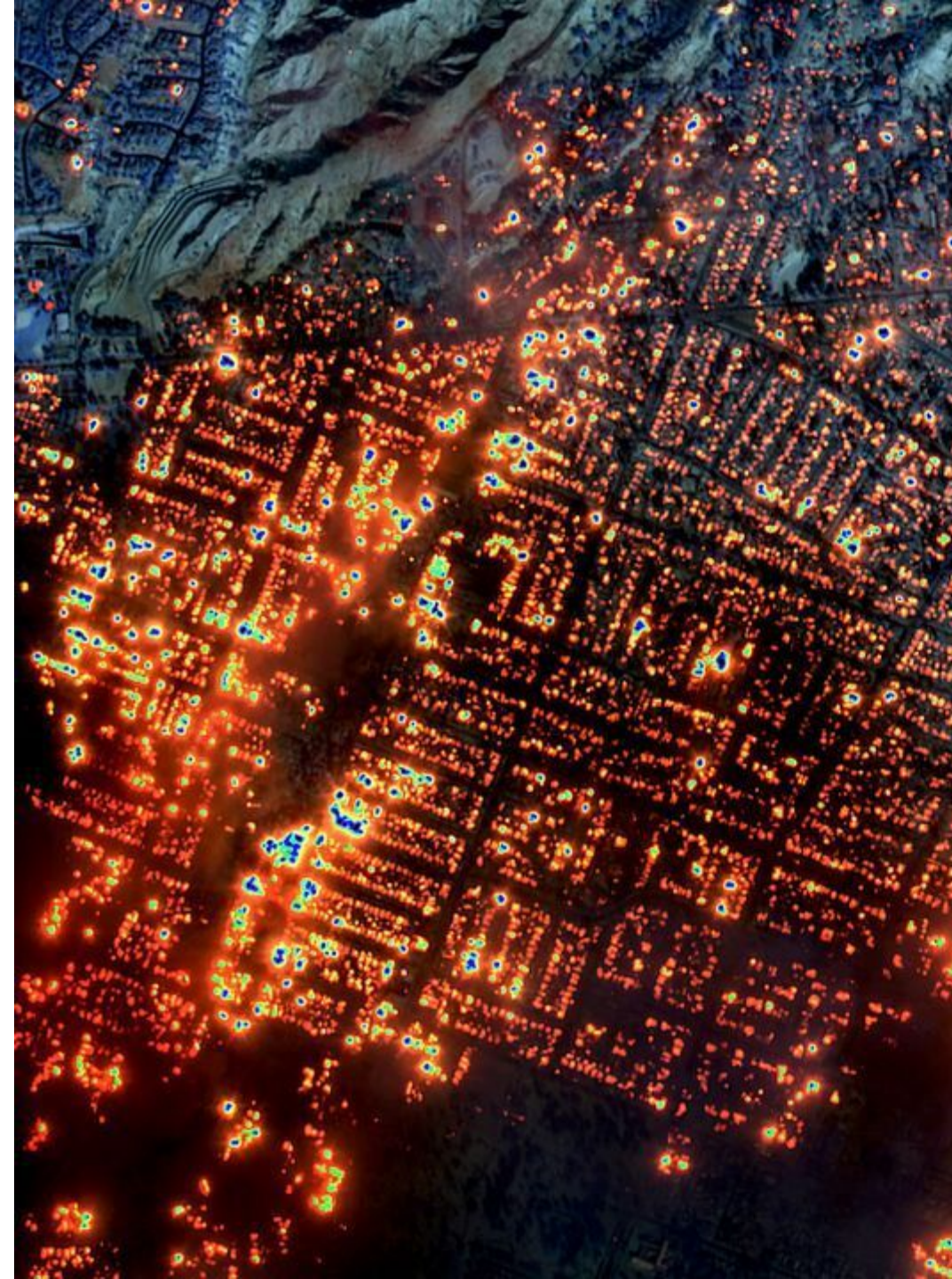
The Growing Threat of Extreme Weather

- According to the World Meteorological Organization, the number of climate-related disasters has **increased fivefold over the last 50 years**.
- Based on Munich Re, the total economic losses from natural disasters in 2024 exceeded **\$320 billion globally**.
- Climate-related disasters have displaced over **20 million people** annually in the past decade.



Real-World Examples

- **The Valencia floods** in Spain saw unprecedented rainfall overwhelm the city's drainage systems, claiming over 200 lives and \$21.6 billion in damages
- **Wildfires in Los Angeles County** during January 2025 claimed at least 28 people lives and more than \$250 billion in damages.
- In June 2024, nearly **five billion** people worldwide endured unprecedented extreme heat, affecting 60% of the global population.





Urbanisation & Climate Vulnerability

Dense Build & Materials

- Concrete & asphalt intensify urban heat island effects
- High building density restricts airflow and limits natural ventilation.

Old Infrastructure

- Drainage, power grids, and transport networks were not designed for today's extreme weather.
- Older buildings & transit systems lack climate resilience, increasing structural risks and economic losses.

Lack of Communication Capabilities

- Limited real-time weather monitoring leaves cities unprepared for floods, storms & heatwaves.
- Gaps in climate data & communication systems delay emergency response, evacuation, and disaster mitigation.

Case Study: Valencia Flooding

Causes:

- **Intense Rainfall:** A "cold drop" storm dumped a year's worth of rain in 8 hours, overwhelming drainage systems.
- **Urbanisation:** Rapid development in flood-prone areas reduced land absorption, worsening runoff.
- **Inadequate Forecasting and Emergency Planning:** Despite warnings, alert systems failed, leading to high casualties.
- **Aging Infrastructure & Lack of Climate Adaptation:** Outdated drainage & lack of flood adaptation intensified the disaster.

Impacts:

- **Human Toll:** 232 deaths, making it one of Spain's deadliest floods.
- **Economic Losses:** \$21.6B in damages, exposing infrastructure & coordination failures
- **Displacement and Health Risks:** Thousands people displaced, with floodwaters increasing disease outbreaks.
- **Environmental Impact:** Floods devastated ecosystems, polluted water sources, and disrupted local agriculture production.

Lessons Learned

Early Warning Systems Are Crucial:

- The delay in flood warnings led to high mortality figures, underscoring the need for timely and effective alert systems to prepare residents and authorities.

Smart Infrastructure and risk analysis

- Cities must utilise advanced flooding maps and risk analysis tools, so urban planners can identify vulnerable areas, ensuring that investments and mitigation strategies are effectively targeted.

AI and Data Can Improve Response:

- Leveraging advanced technologies can enhance predictive capabilities and facilitate more effective emergency responses, minimizing losses and safeguarding communities.



Early Warning Systems Are the First Line of Defense

Global organisations like the WMO, ESA, UN, WFP, ITU and others consider **Early Warnings for All** a critical priority.

- OpenWeather is engaged with ESA's SSC (Civil Security from Space) program, aimed at integrating space-based solutions to enhance extreme weather prediction.

Advanced warnings allow cities to act before a crisis occurs.

- Emergency services can mobilise resources ahead of time.
- Businesses and homeowners can secure assets and infrastructure.
- Residents can evacuate flood-prone areas, reducing fatalities and injuries.

24-hour advance flood warning can reduce damages **by 30%** and death rate **by 85%** by enabling early evacuation and protective measures.

New investment required to advance towards **early warnings** for all within five years:

USD 3.1 BILLION

*Estimate based on consultations with pillar lead partners



Source: WMO

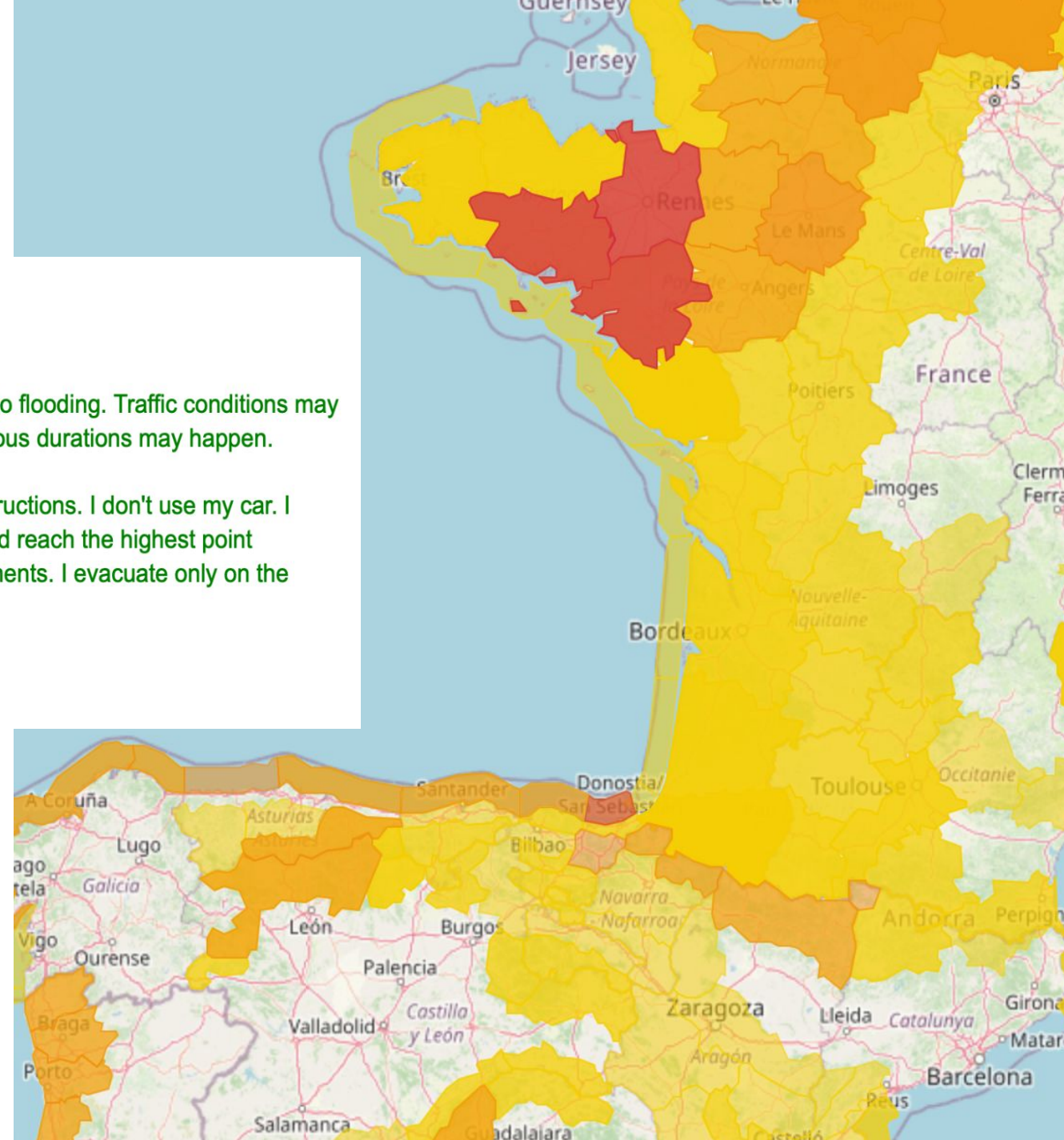


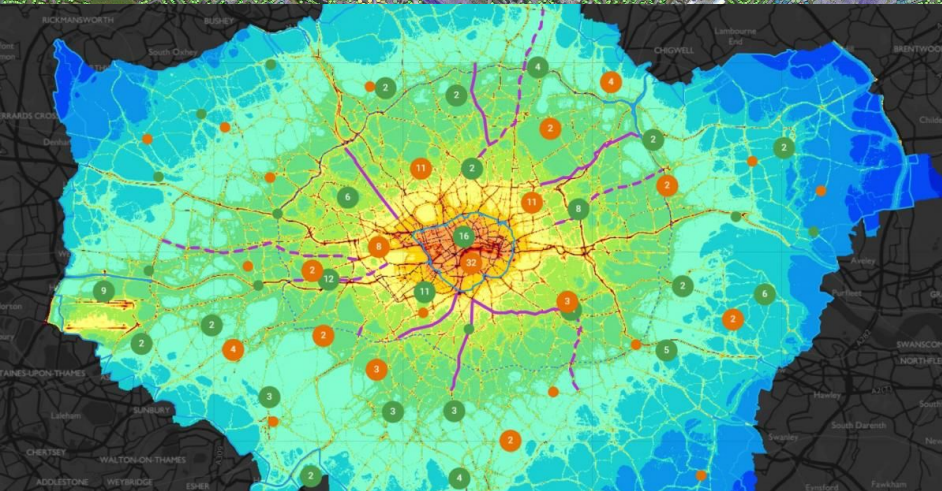
How AI & Real-Time Data Enhance Early Warning Systems

- Traditional alerts lack precision, causing false alarms & delays.
- AI integrates real-time weather, satellite & IoT data for faster, hyperlocal alerts.
- Machine learning detects anomalies, improving early disaster prediction.
- Tailored, easy-to-understand alerts enhance public response & emergency action.
- Automated notifications reach responders & businesses, ensuring timely, data-driven decisions.

AI Weather Alert Assistant

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"language": "en-GB",  
  "event": "Extreme flooding warning",  
  "headline": "Extreme flooding warning",  
  "description": "Very large floods are possible, including in areas rarely prone to flooding. Traffic conditions may  
be extremely difficult across the entire road or railway network. Power outage of various durations may happen.  
Dykes may break or be overwhelmed.",  
  "instruction": "I stay at home and keep myself informed of the authorities' instructions. I don't use my car. I  
don't drive my children to school. I keep away from rivers, low points and bridges and reach the highest point  
possible. I take shelter upstairs, as a last resort on the roof, I don't go down to basements. I evacuate only on the  
order of the authorities and take my emergency kit."  
},  
"country": "France",
```





Enhanced AI Climate Analysis

Urban Heat Mapping

- AI identifies hotspots using satellite & temperature data.
- Enables targeted cooling strategies:
 - Tree planting & green spaces to lower temperatures.
 - Reflective surfaces & cool pavements to reduce heat absorption.

AI-Enhanced Flood Prevention

- AI predicts flood risks using real-time rainfall & soil data.
- Enhanced physical modeling of flood pathways
- Smart flood barriers auto-activate before disasters strike.

AI-Powered Air Quality Management

- Monitors pollution in real time using satellites, sensors, and urban infrastructure data.
- Analyses streets & buildings' impact on air circulation and pollution dispersion.
- Optimises policy & urban planning for emissions control and public health.

\$2 trillion

in global damages
from adverse weather
events
over the past decade

7%

average industry
savings from employing
climate data and analytics

3%

of all sales are
weather-sensitive

£3bn

in UK retail sales could shift
due to a 1°C temperature
change

80%

of major power outages are
caused by
adverse weather conditions

23%

of all route delays
happen due to weather
conditions, resulting in
\$23 billion loss (U.S.)

Real Estate

- **First Street Foundation** integrated climate risk modeling into Zillow & Realtor.com, helping buyers assess property risks and avoid future damage.
- **45 Broadway, Manhattan** implemented AI-driven HVAC optimisation, cutting energy use by 15.8% and lowering operational costs.

Retail

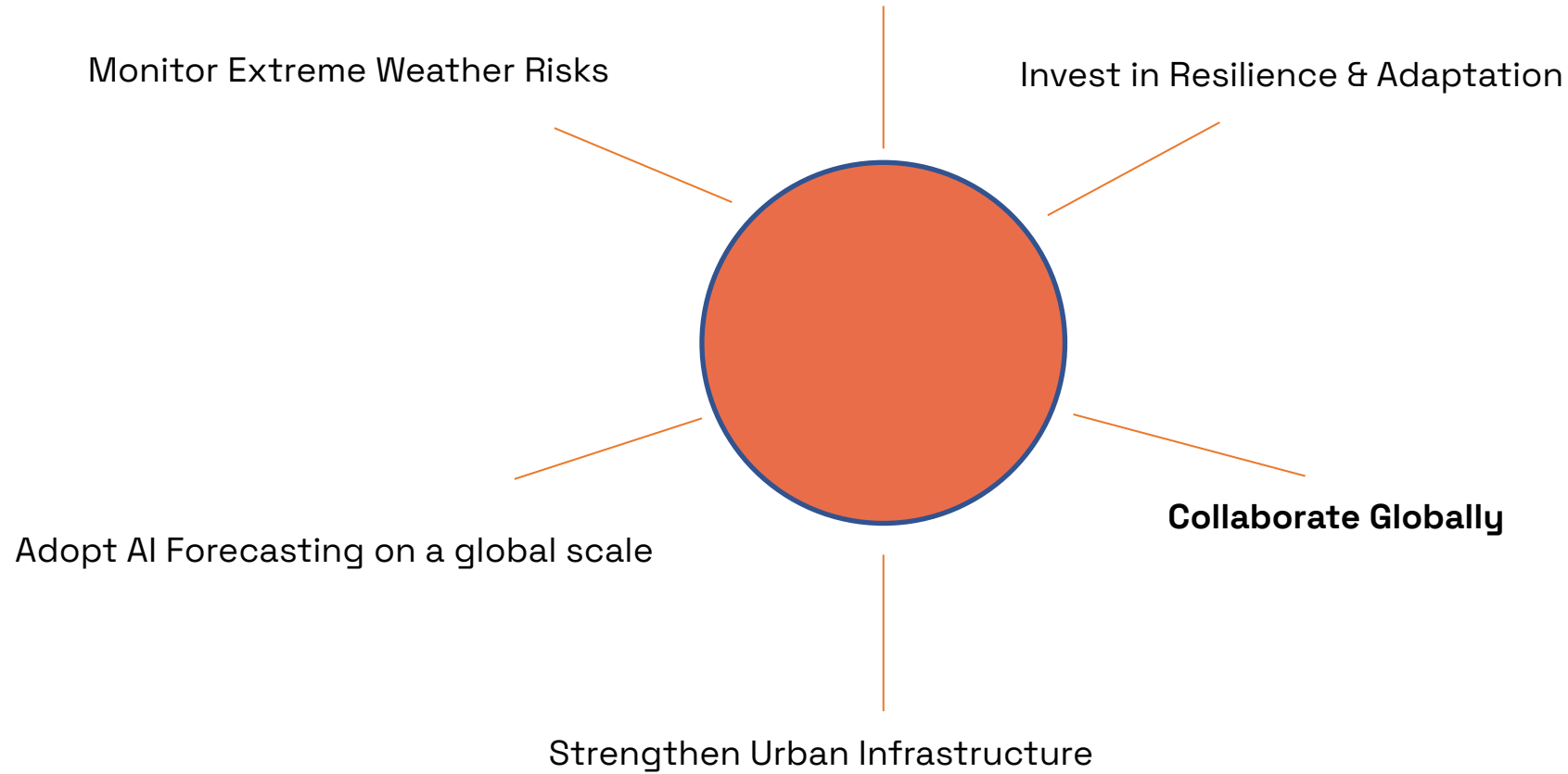
- **Walmart** optimised AI-driven inventory & pricing strategies using weather analysis, reducing waste & boosting sales.
- **Stella Artois** used weather-targeted advertising, driving a 65.6% sales increase during the campaign.

Insurance

- **Parsyl** leveraged sensor & climate data to reduce marine cargo losses, achieving substantial annual growth through improved supply chain resilience.



There Is Much More To Do



"It is not the strongest of the species that survive, nor the most intelligent, but the one most responsive to change."

— Charles Darwin

About Us

- ✓ 10 years on the market
- ✓ 7+ million customers worldwide
- ✓ Experts in ML/AI
- ✓ 5+ billion data requests a day
- ✓ 500 000+ data sources
- ✓ 2+ billion forecasts a day
- ✓ 5 PB of environmental data
- ✓ 2500+ new daily subscriptions

