ESCAP
Economic and Social Commission for Asia and the Pacific

Transforming Data into Decisions, Innovation to Impact: The Case of SatGPT

The 29th Session of the Intergovernmental Consultative Committee (ICC) on the Regional Space Applications Programme for Sustainable Development for Asia and the Pacific (RESAP)

THE PLAZA, Seoul, Republic of Korea

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Large Language Models and Agents

- **Large Language Models (LLMs)** are advanced computer programs trained on vast amounts of text data to understand and generate human-like language. They can answer questions, write stories, translate languages, and assist with tasks by predicting the next words based on context. Think of them as very smart, digital assistants for **language-related tasks.**

- **Agents** are computer programs or tools designed to act on your behalf. They can perform specific tasks, make decisions, or respond to situations automatically based on the information they are given. Think of them as digital helpers that follow instructions to **get things done** for you.

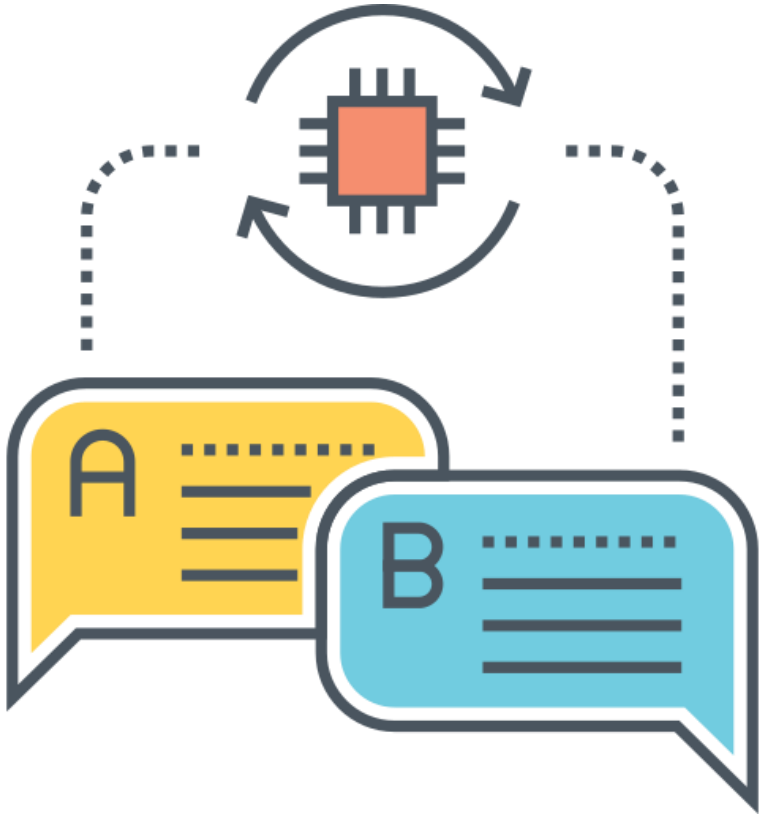
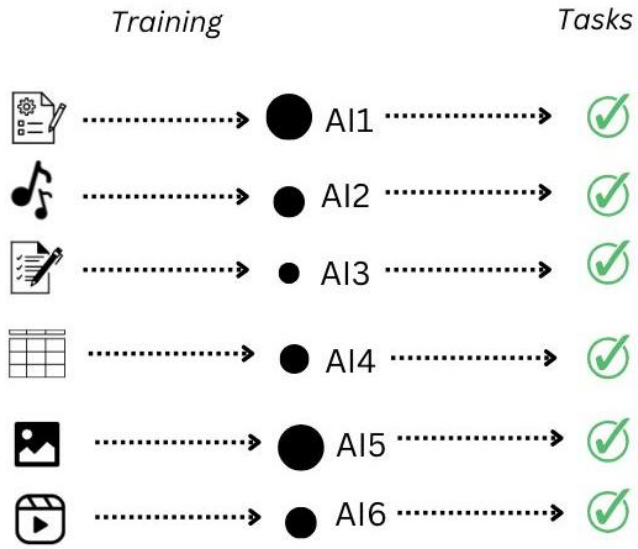


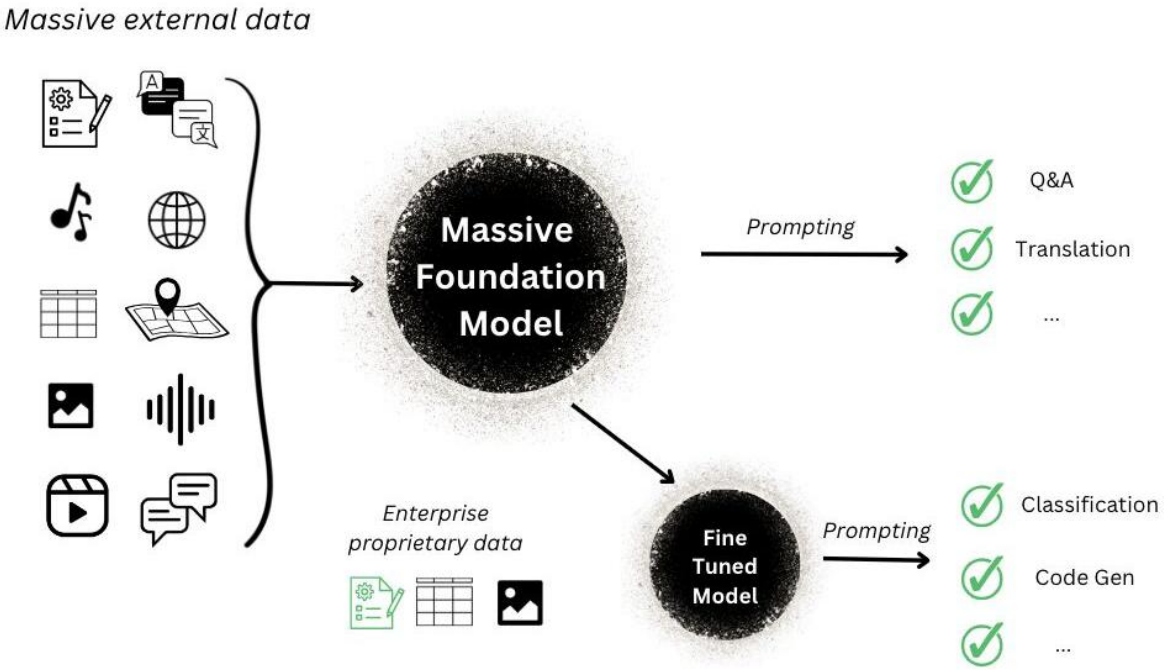
Photo credits: DSMatics and Otter.ai

Traditional ML



- Individual siloed models
- Require task-specific training
- Lots of human supervised training

Foundation Models

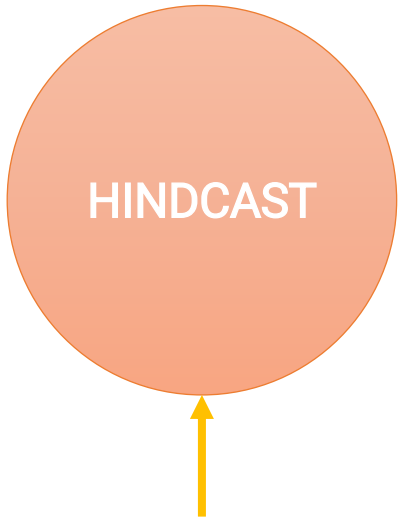


- Massive multi-tasking model
- Adaptable with little or no training
- Pre-trained unsupervised learning

Source: Armand Ruiz; Humanloop

Bigger Picture

Types of Tools and Applications







- We need to **look back** to **move forward**
- Understand *what* needs to be **"built back better"**
- Generate critical data to train **artificial intelligence** models

Most importantly, understand the SYSTEMIC RISK, the WHERE and the HIDDEN LINKS

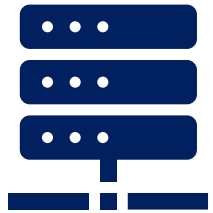
How did SatGPT evolve?

2020 → 2024 → **2025**

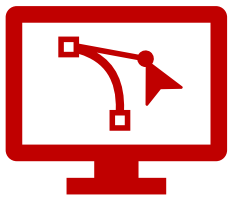
SatGPT: a **web-based quantitative tool** that allows a user to *spatially map any flood event* from **1984 to present** in near-real time, using cloud computing, big Earth data and large language models



- **Google Earth Engine** is used as the cloud computing platform



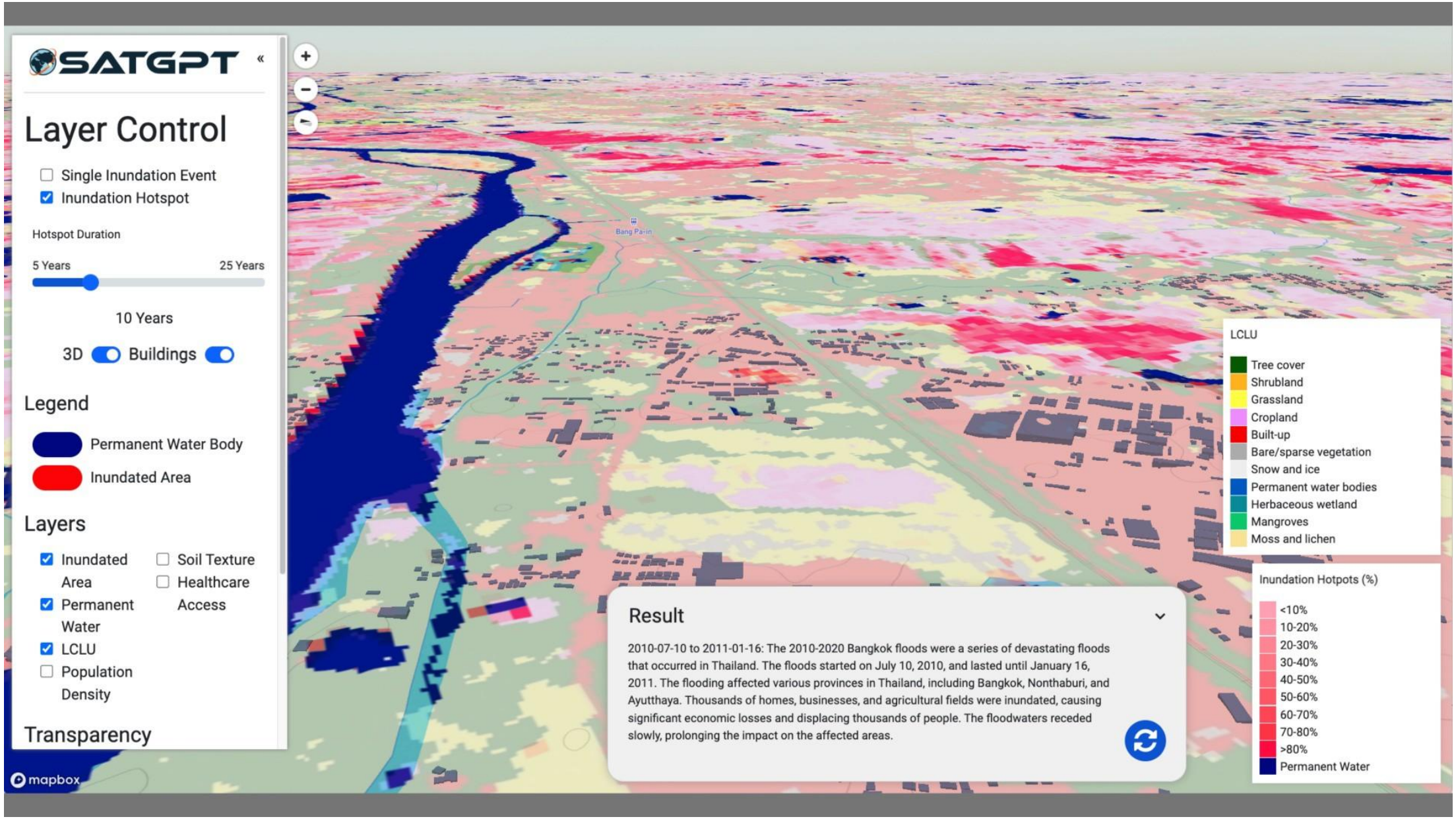
- Access to **a massive data catalog of Earth observation data**



- **Large language models generate the code** to *process data in less than* **1 minute to** *generate a* **single flood map**

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The Evolution of SatGPT in the Last 6 Years



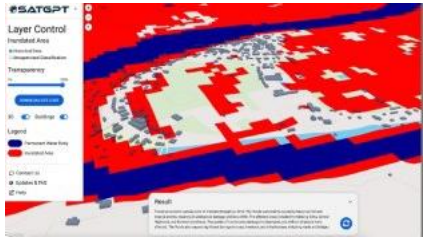
How SatGPT Works

Ethical AI

Participatory AI Modelling

End User

Customized UI



ChatGPT Query to Generate Code



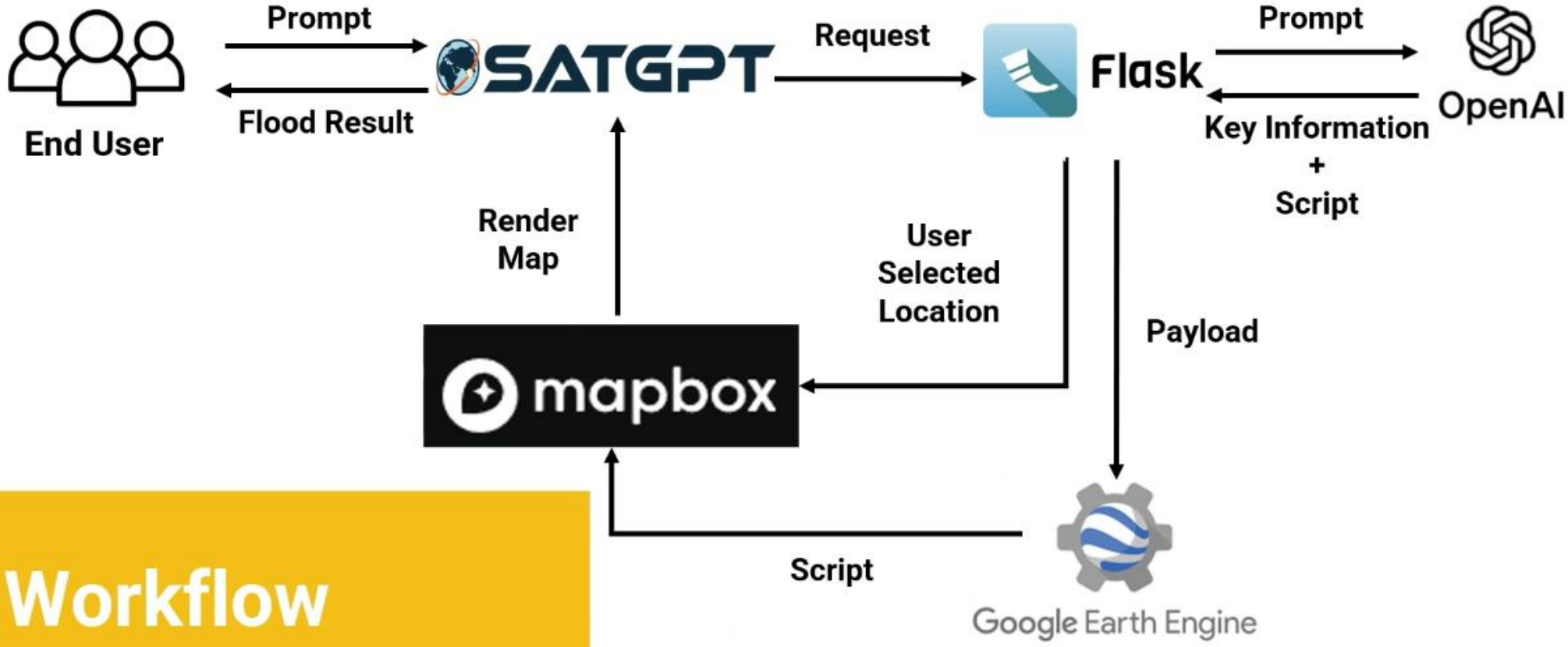
Computing on GEE



Infrastructure

SATGPT

The SatGPT Workflow



Workflow

SatGPT Case Studies

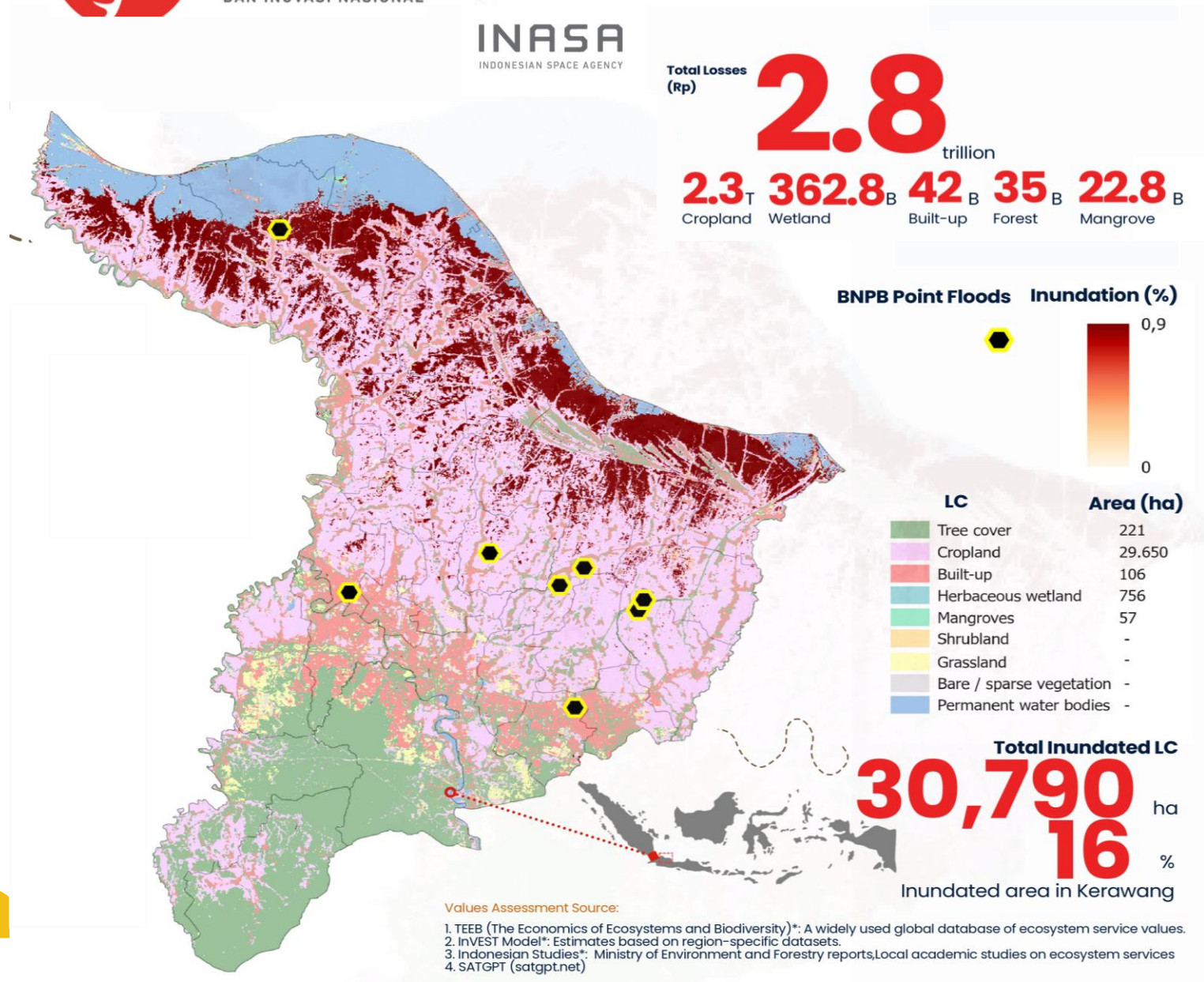
This case study was developed during the training hosted in November 2024 in Jakarta, Indonesia.

Participants proceeded to publish this as a conference paper, which showcased **the use of SatGPT with socioeconomic data for estimating economic losses**.

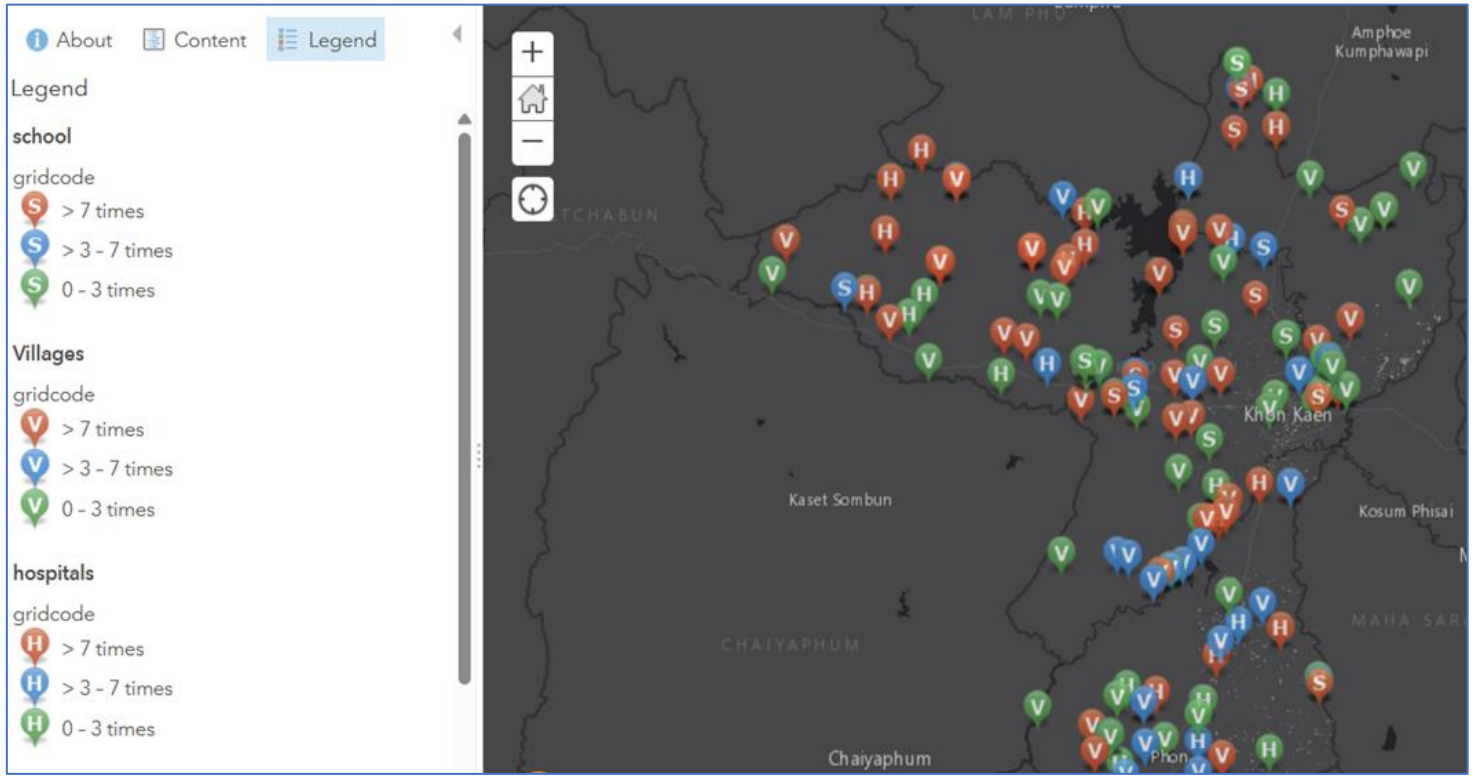
2024 Best Paper Award of the IEEE Aerospace & Electronics Systems and Geoscience and Remote Sensing Joint Chapter

0.1109/AGERS65212.2024.10932922

Flood Impact Analysis: Karawang, Indonesia



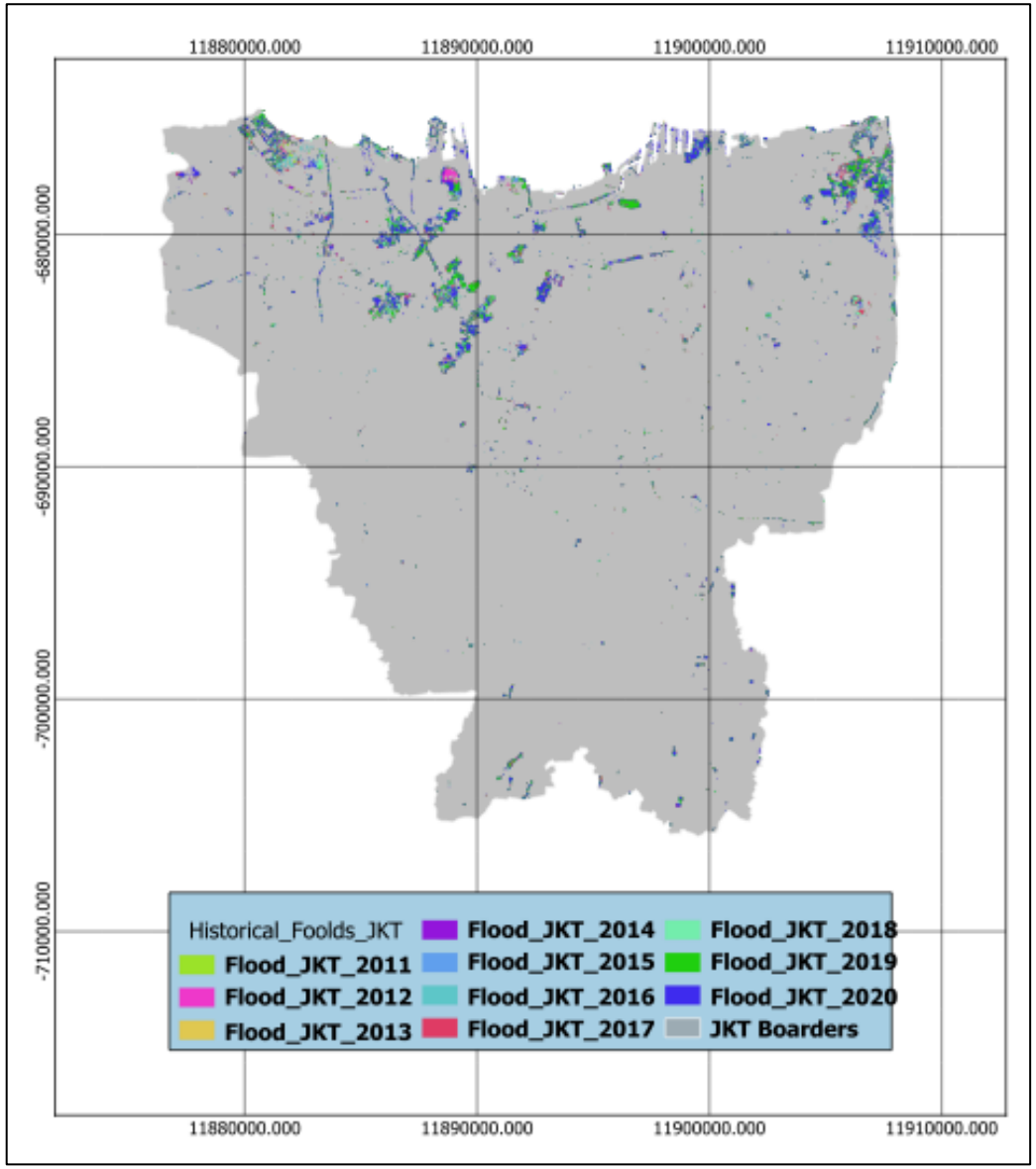
SatGPT Case Studies



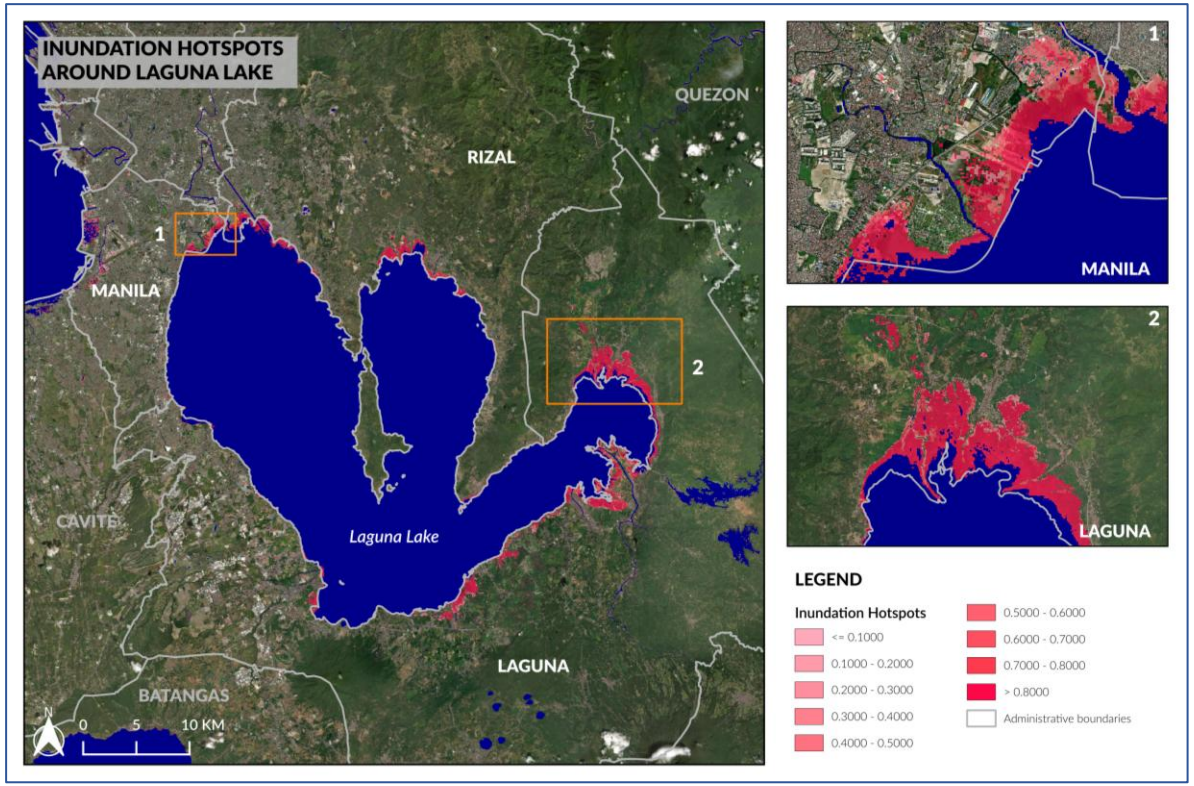
▲ SatGPT inundation hotspot data can help in **identifying villages, schools, and critical infrastructure that can support disaster preparedness and recovery**.

Urban Flooding: Khon Kaen, Thailand and Jakarta, Indonesia

► **SatGPT can help map annual historical flooding and determine its relationship with weather related events**. It also allows the identification of healthcare facilities that are frequently affected by floods.

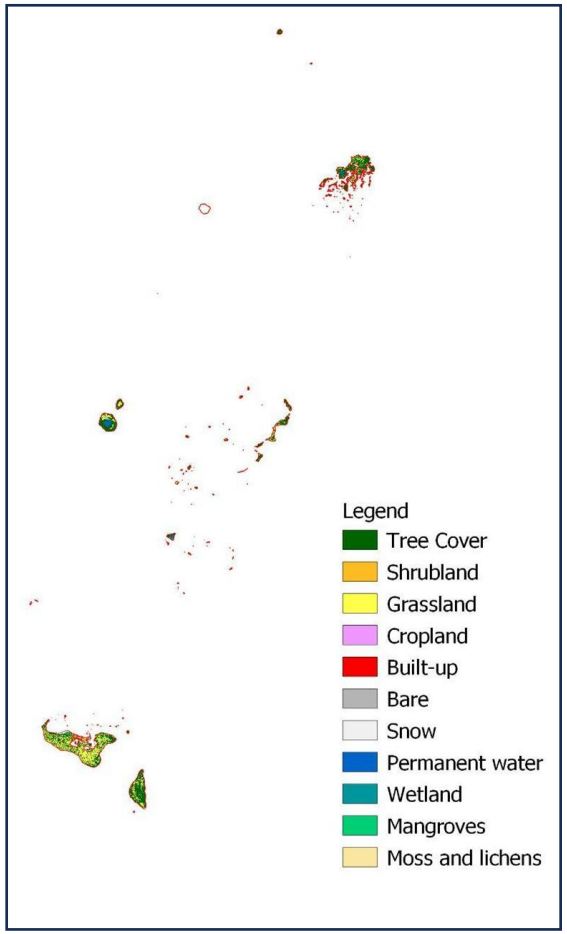


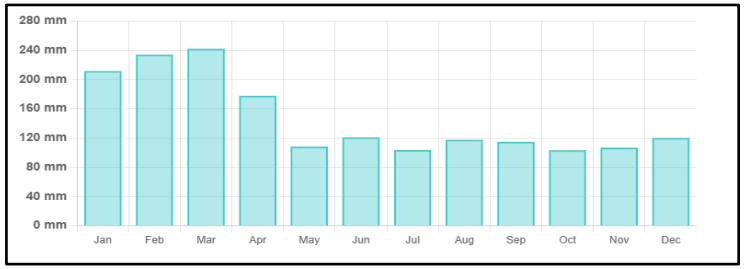
SatGPT Case Studies



▲ Mapping inundation hotspots around **Laguna Lake (2010–2020)** with SatGPT **helps inform spatial planning and infrastructure development.**

Effect of Flooding in Land Use and Land Cover: Laguna Lake, Philippines and Tonga





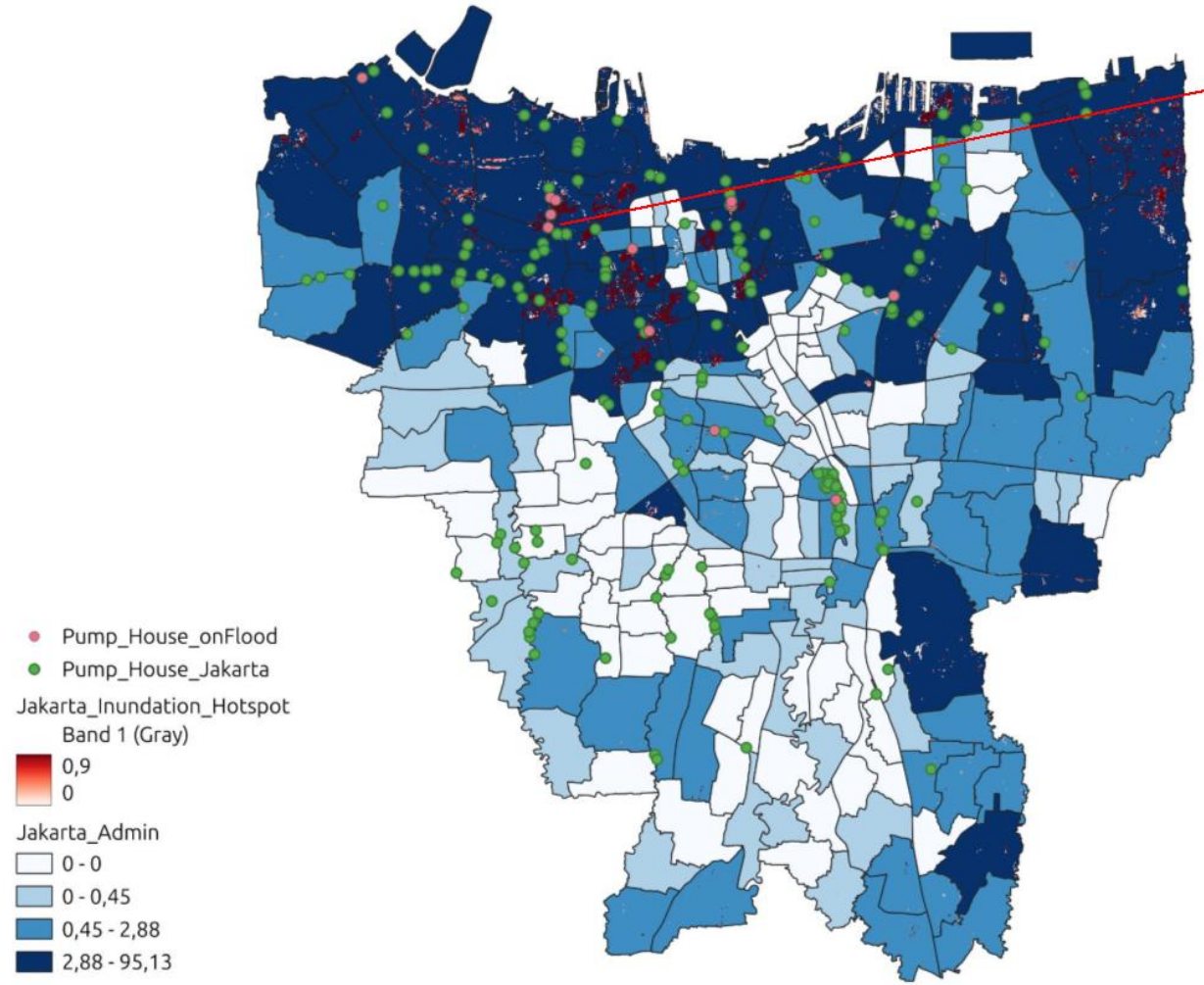


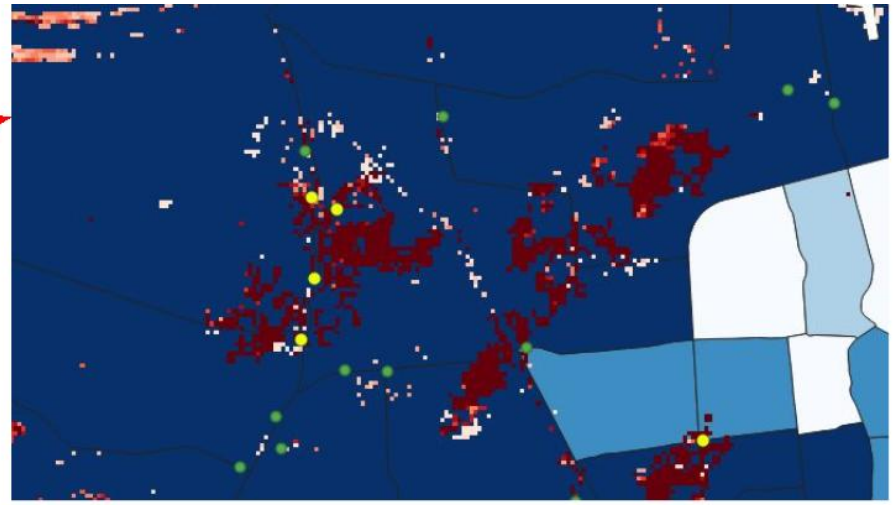




▲ Using the inundation hotspot generated by SatGPT, **the impact of heavy rainfall events in poorly drained lowland and urban areas can be determined.**

SatGPT Case Studies





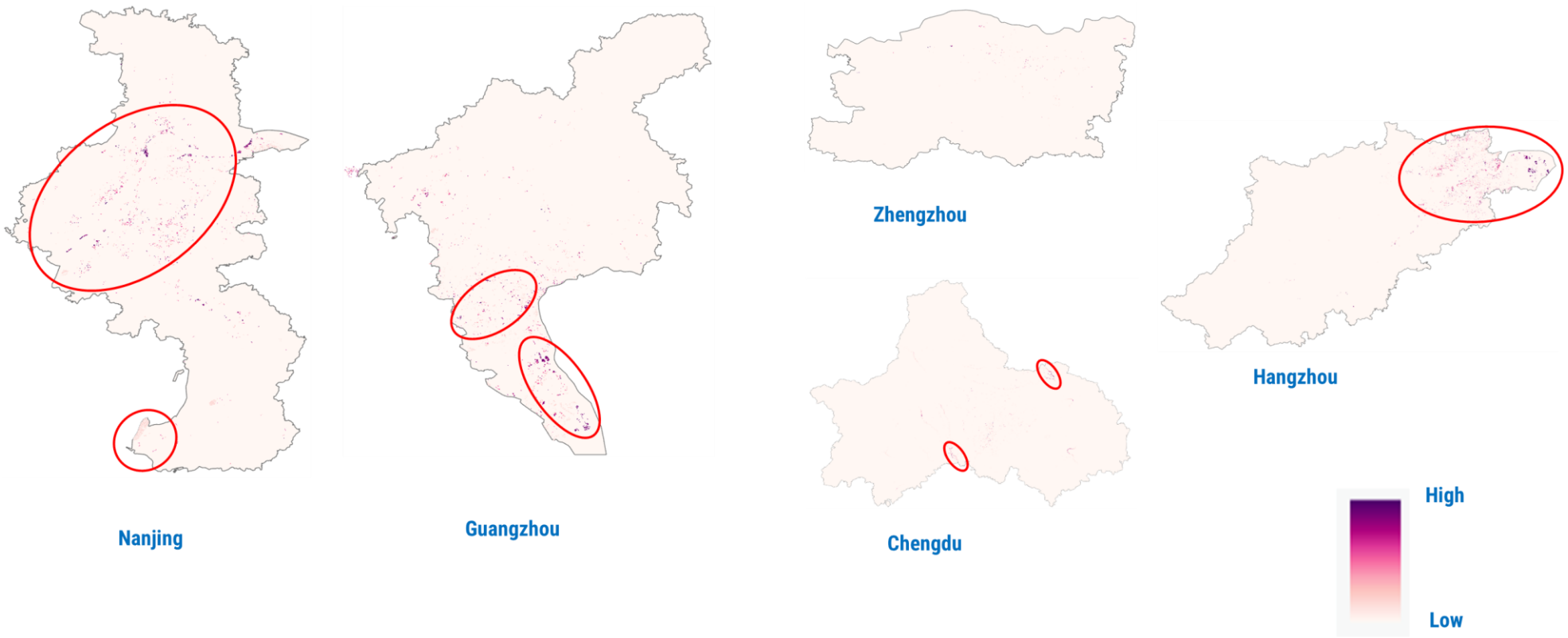
13	Pump Station Affected

Urban Flooding: Pump Exposure in Jakarta

▲ Pump houses are critical infrastructure to evacuate excess water from low-lying areas. Improper pump capacity may lead to inefficiency or failure in flood response. **By mapping the inundations hotspots in Jakarta using SatGPT, a total of 13 pumps and 30 pump houses were revealed to be at risk due to flooding.**

GDP – Flood Frequency Exposure

SatGPT Case Studies



◀ Using SatGPT flooding data coupled with economic parameters such as Gross Domestic Product (GDP), economic losses can be estimated. **In this example, the cities of Nanjing, Guangzhou, and Hangzhou show the highest potential economic losses caused by flooding.**

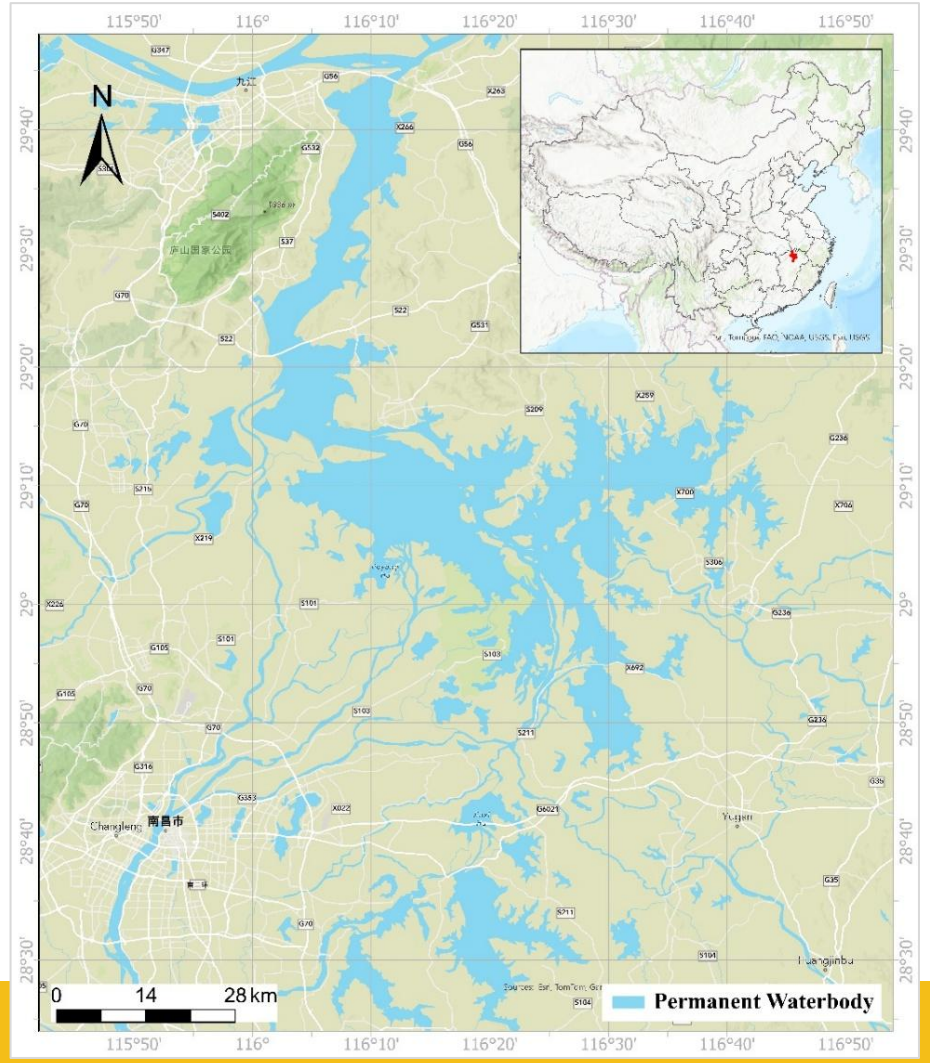
Urban Flooding: Economic Losses in Chinese Cities

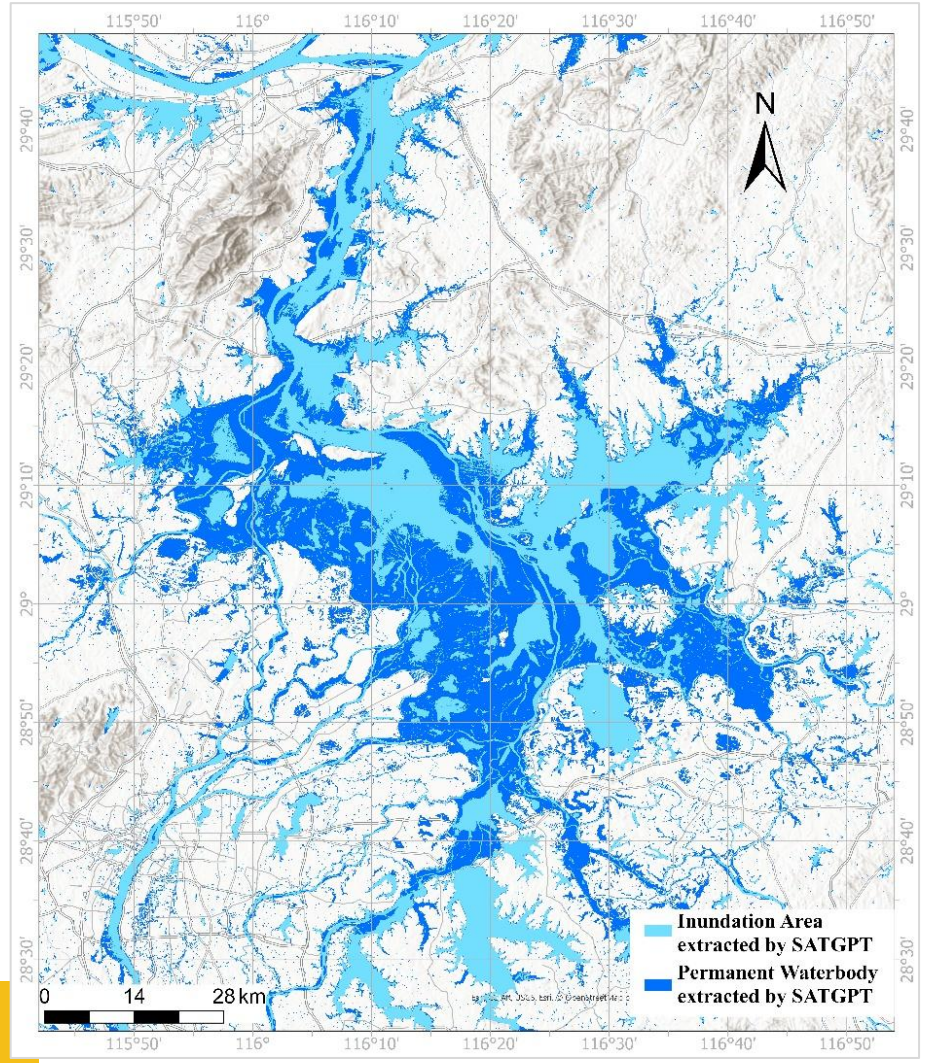
$$GDP\ flood\ exposure = f * GDP$$

$$Economic\ losses = f * V * D * (1 + I)$$

f - Flood frequency (SatGPT)
V - Economic value per unit area

D - Direct flood loss rate
(based on Land Use Type & flood Depth, set as 0.5)
I - Indirect flood loss rate
(based on Land Use Type & flood Depth, set as 0.25)





2020 Flood in Poyang Lake, China

The potential of SatGPT as a rapid flood mapping tool was also tested in **Poyang Lake, the largest freshwater lake in China**, during the 2020 flooding. Comparison with satellite-derived flood data using Sentinel-1 showed that **SatGPT was able to capture about 80 % of the flooding**.

Promoting SatGPT

Development of Case Studies

Development of relevant case studies based on **SatGPT flood data used with relevant auxiliary datasets and locally defined scenarios** showcasing the potential applications of SatGPT

Trainings

Conduct training sessions (online or in-person) focused on the use of digital technologies, **especially AI applications in geospatial analytics, with a specific emphasis on SatGPT**

User Feedback

Map identified needs to new functionalities for SatGPT, ensuring that future updates align with country priorities

Promoting SatGPT

Partnerships & Collaborations

Coordinate with partner countries and institutions to enable the **integration of AI solutions**, particularly SatGPT, into their existing systems for disaster risk management and resource monitoring

Youth Forum

Facilitate knowledge sharing among the youth to promote the independent usage of SatGPT, as well as **highlighting its impact and potential for advancing sustainable development**

SatGPT Training Resources

- Introduction to Google Earth Engine and ChatGPT for Flood Mapping
- SatGPT Training Resources (by country, based on the in-person trainings delivered as of June 2025)
- Please fill out the form: **https://bit.ly/SatGPT_Training_Resources**

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