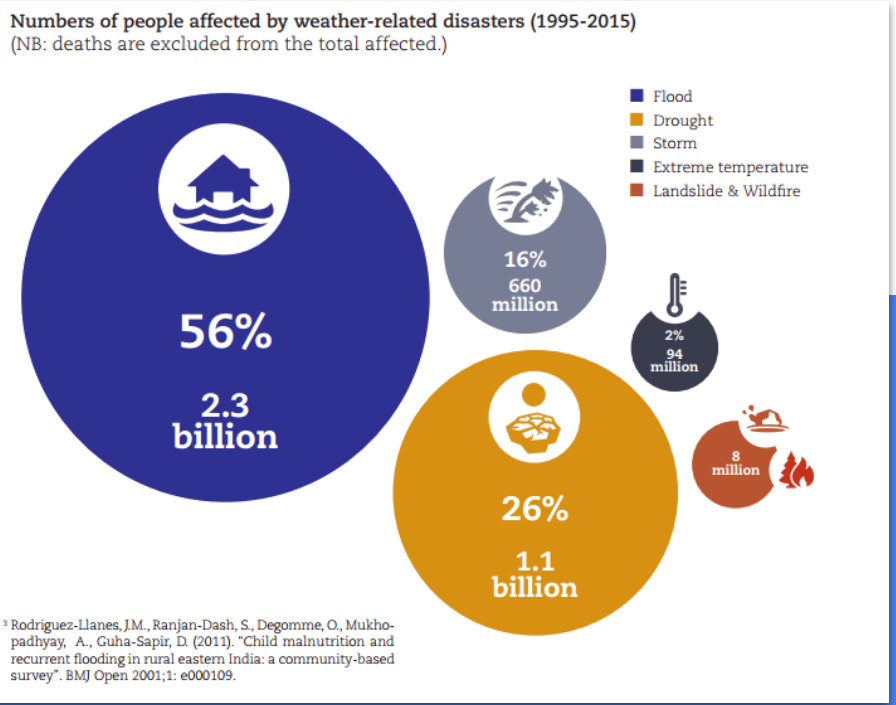
Flood Forecasting Initiative

Guy Shalev

Flooding impact



The Google Flood Forecasting Initiative

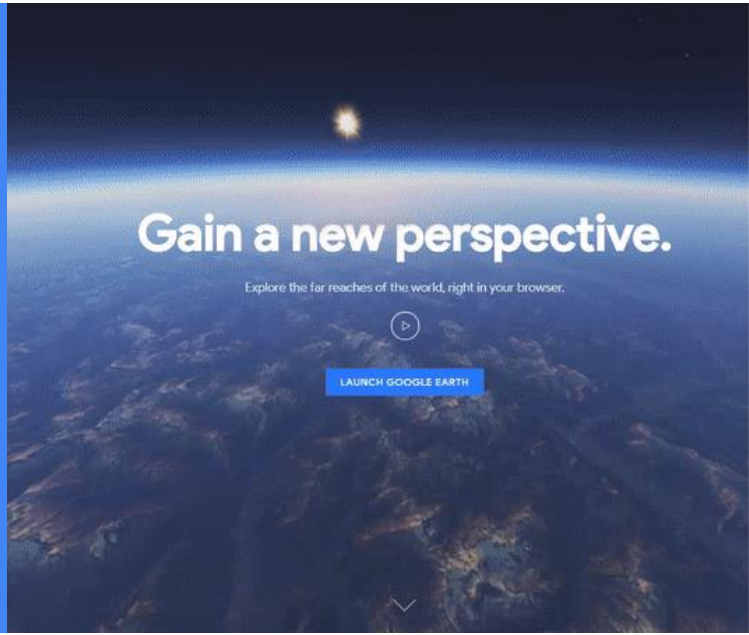
The Google Flood Forecasting Initiative

Why Google?

- → Public-facing interfaces
- → Computational resources
- → Access to global data (Elevation, user-generated data, etc.)
- → Scalability
- → Machine learning expertise

Why not (just) Google?

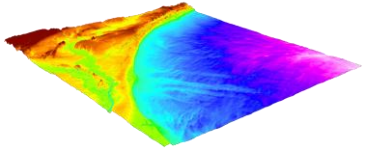
- → Governmental mandate
- → Hydrologic expertise
- → Operational expertise
- → Relationship with organizational consumers



Hydraulic model - Goal

Hydraulic model - Overview

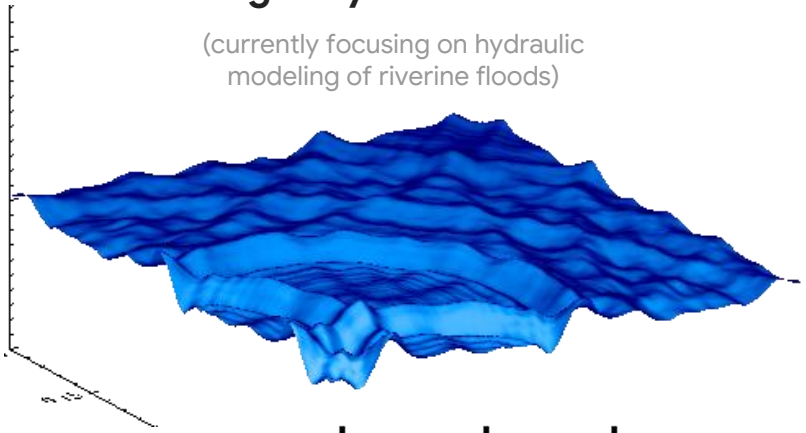
Satellite imagery
(Multiple sources)



Google DEM generation

Google Hydraulic Model

(currently focusing on hydraulic modeling of riverine floods)



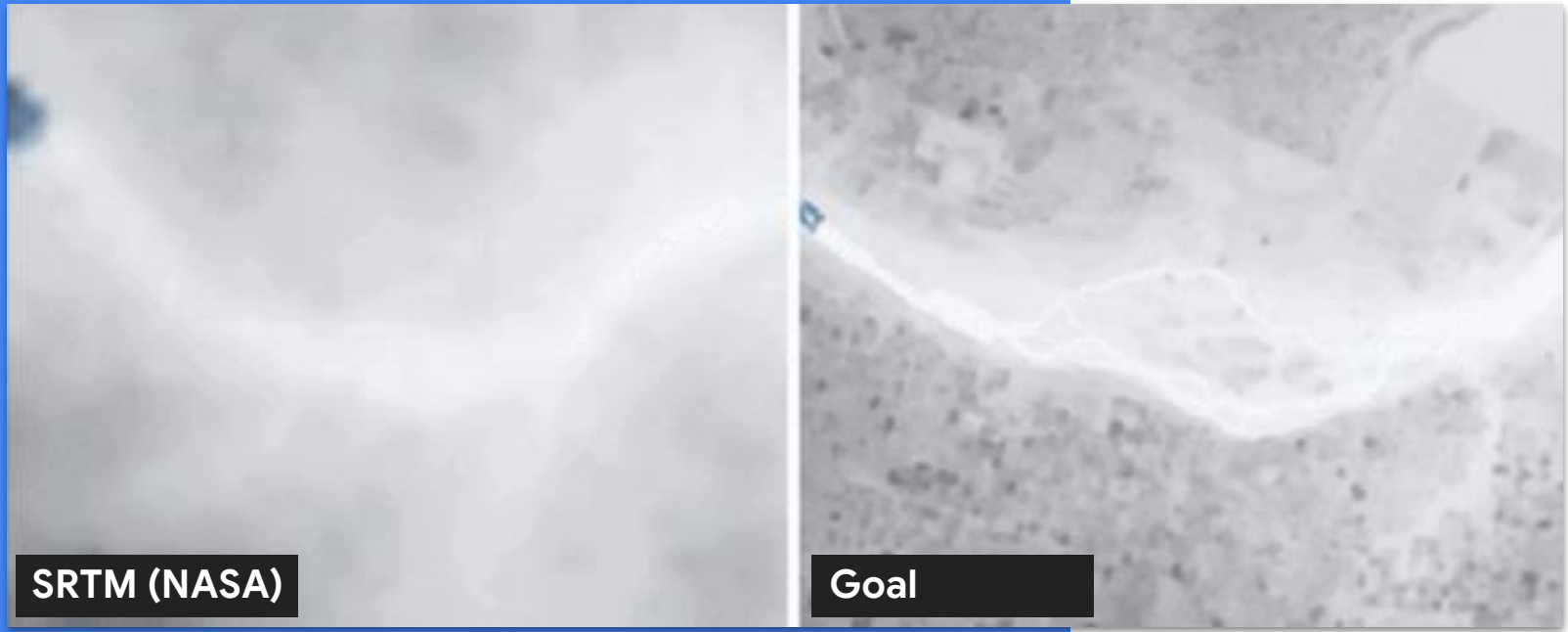
Government

Gauge measurements & forecasts

Inundation Map

Flood Forecasting Initiative

Challenge: Elevation Maps

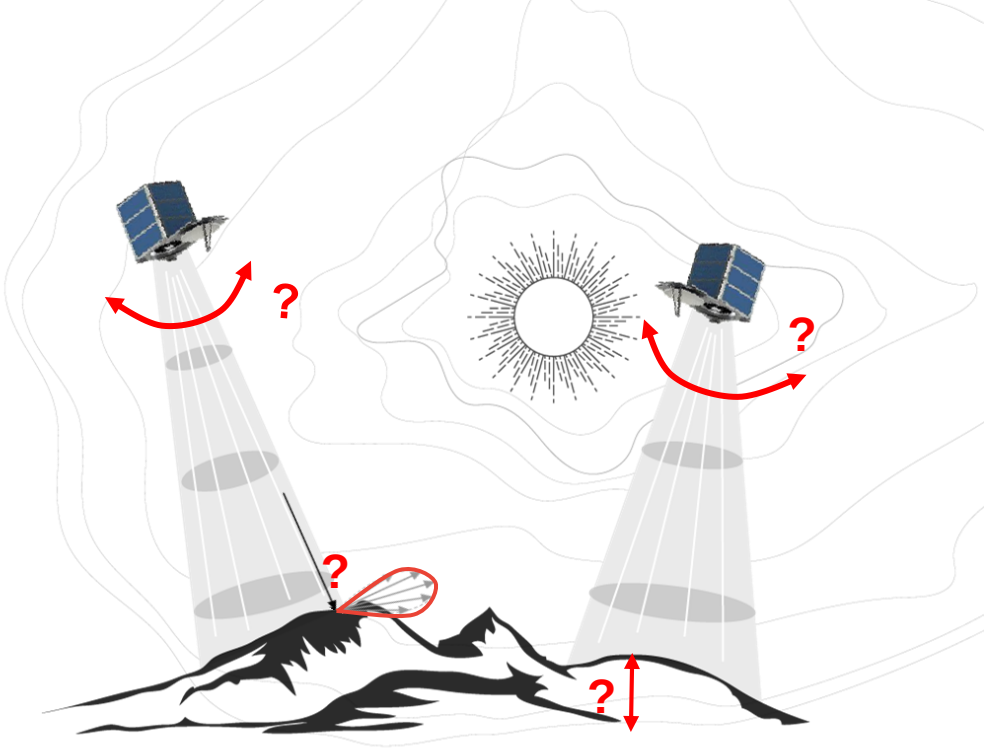


Challenge: Elevation Maps

Producing Elevation Maps

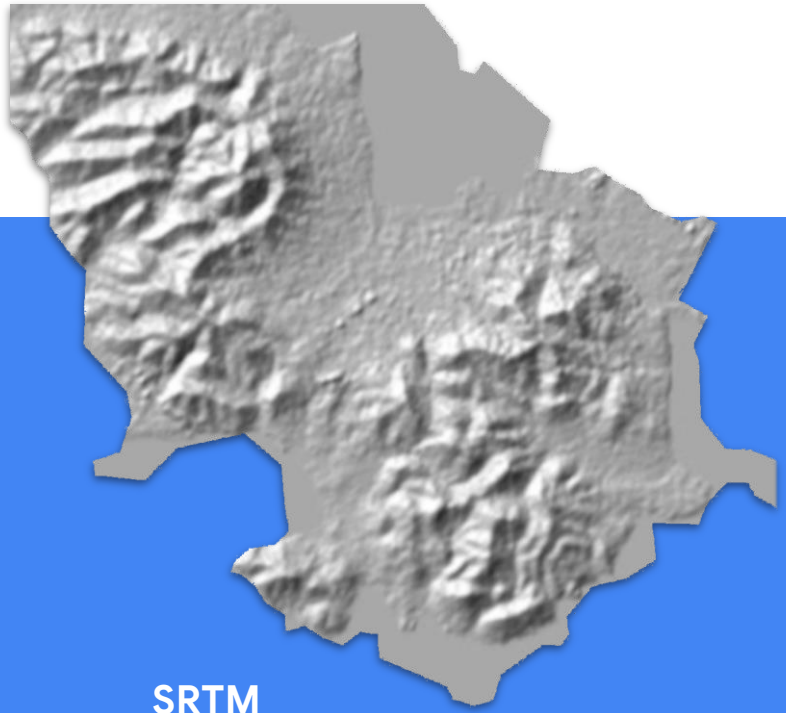
Multi-Asset Spatial Alignment

- → Achieve 1 meter resolution & vertical accuracy
- → Also allows annual updates

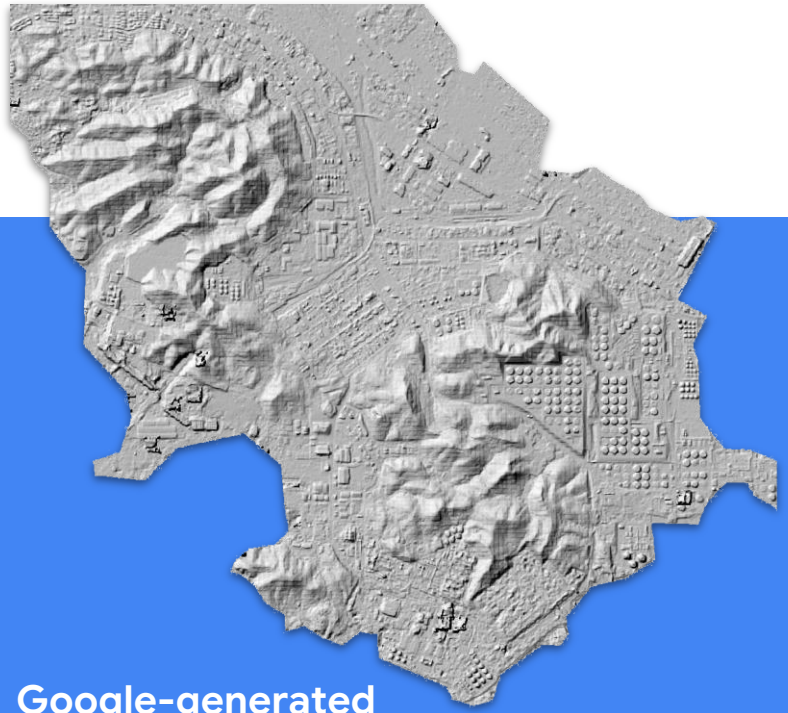


- → Where are the cameras pointing?
- → What is the surface geometry?
- → How does light reflect?

Elevation Map Example



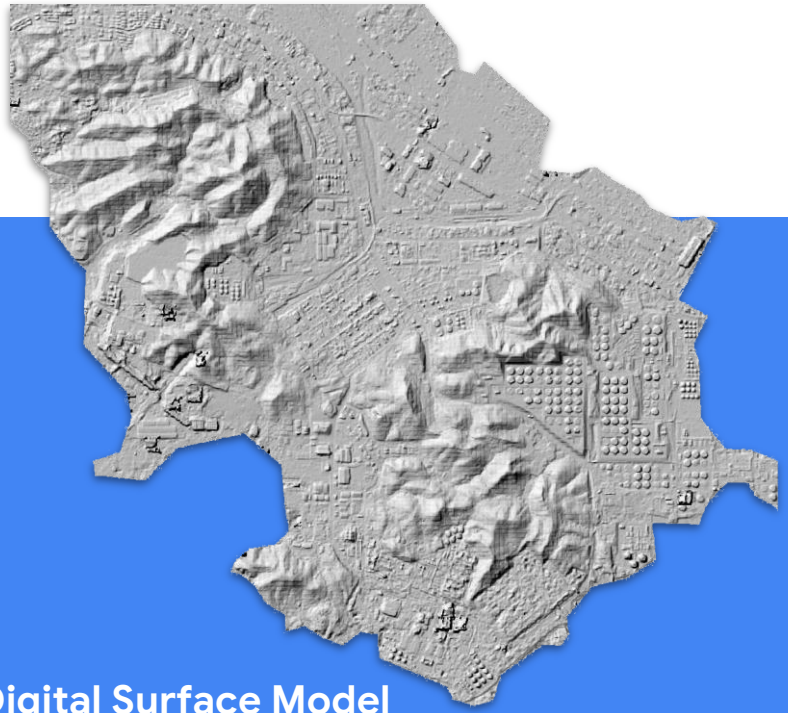
SRTM



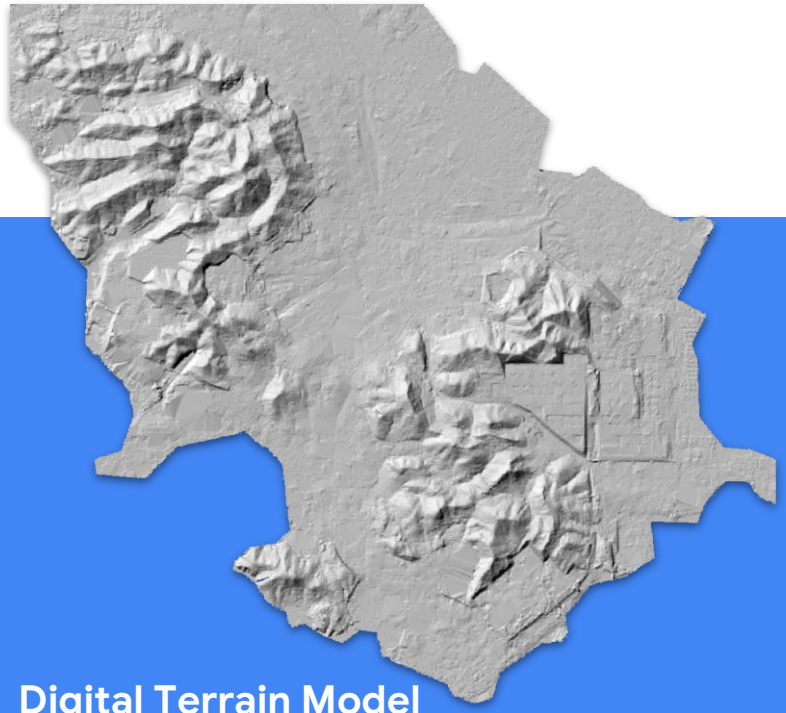
Google-generated Elevation Map

Flood Forecasting Initiative

Surface to Terrain Generation



Digital Surface Model



Digital Terrain Model

Flood Forecasting Initiative

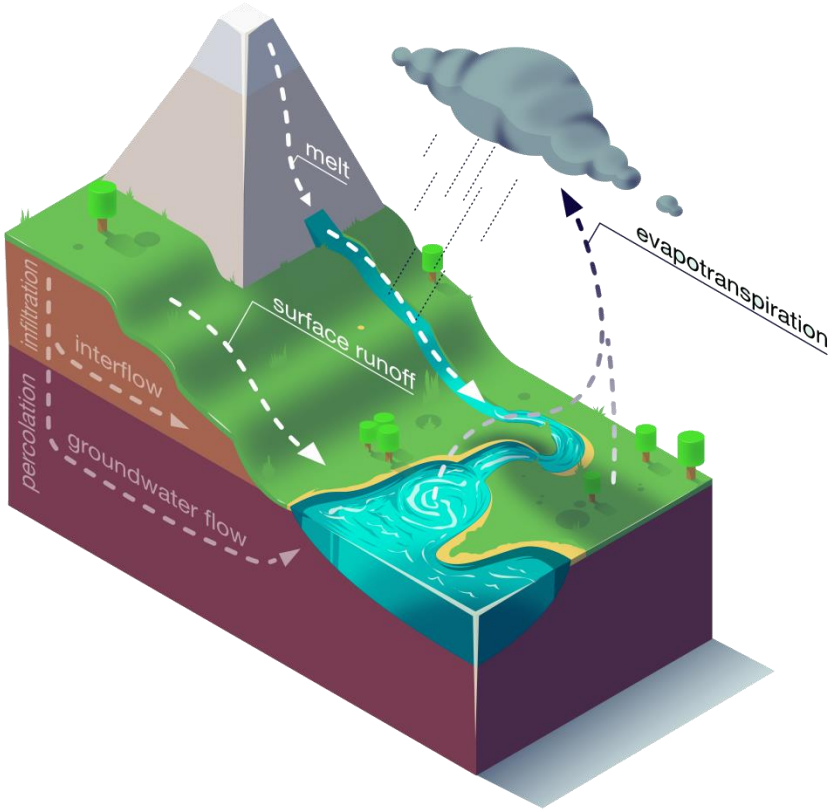
Challenges

→ Computational costs rise with higher resolution

→ Embankments and river bed

Hydrologic Model Classic Approach

- → Components are divided to physical and conceptual
- → They continuously interact with each other over time



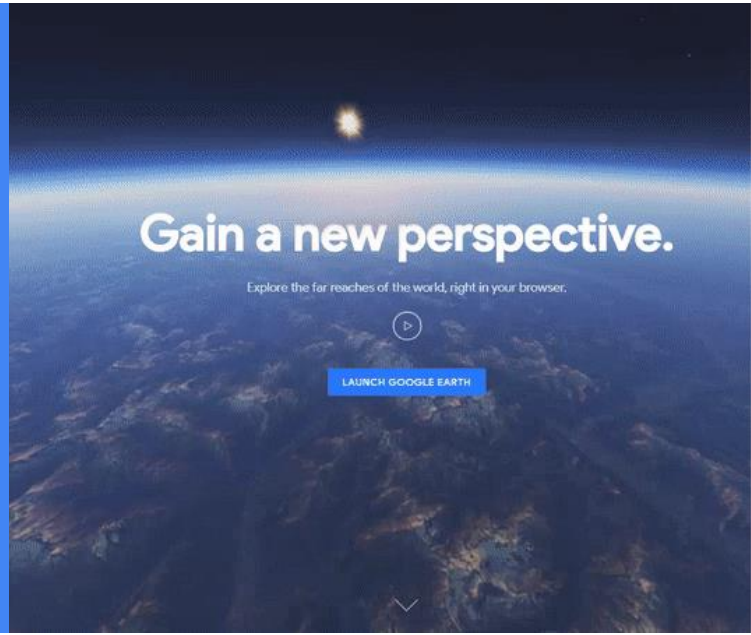
A Regional Hydrologic Model Using ML

Why Regional + ML?

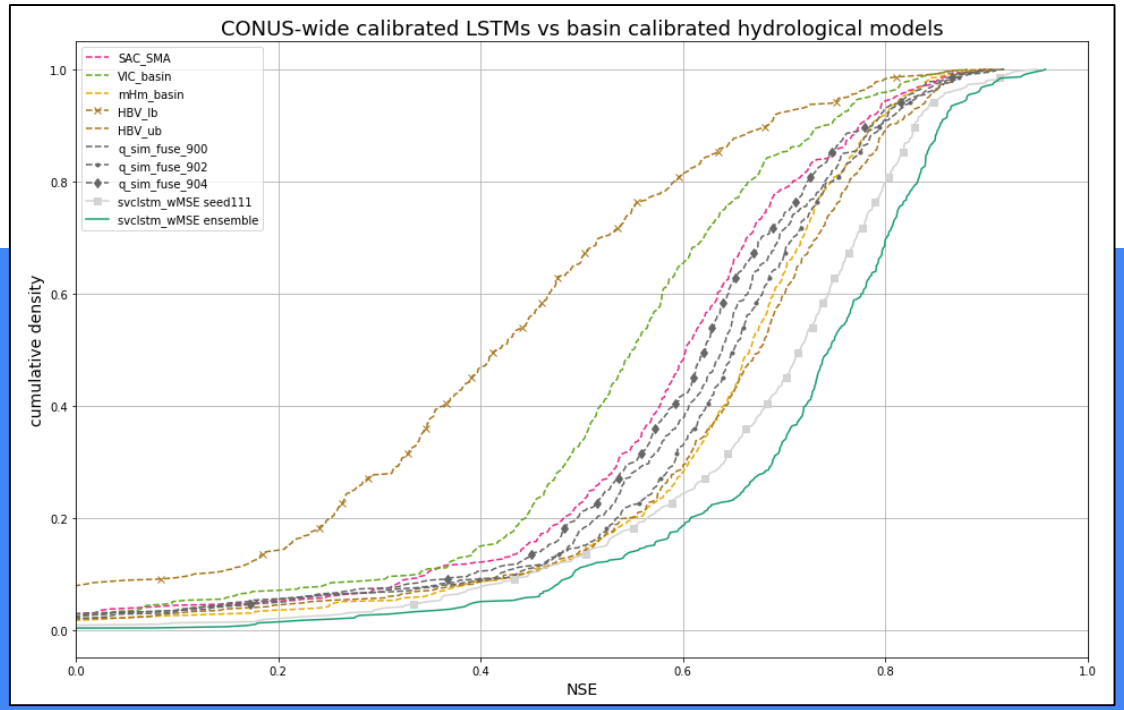
- → Complex, non-linear process
- → Abundance of data
- → Scalability
- → Ungauged basins

Main Challenges

- → Using the right metrics
- → Data quality disparity
- → Interpretability and uncertainty



Encouraging Results



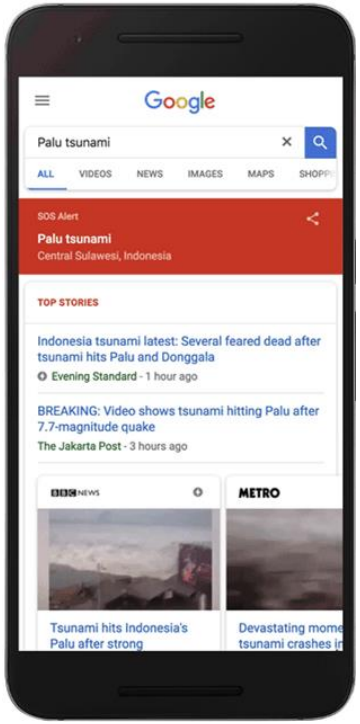
Kratzert et al. – Work in progress

Flood Forecasting Initiative

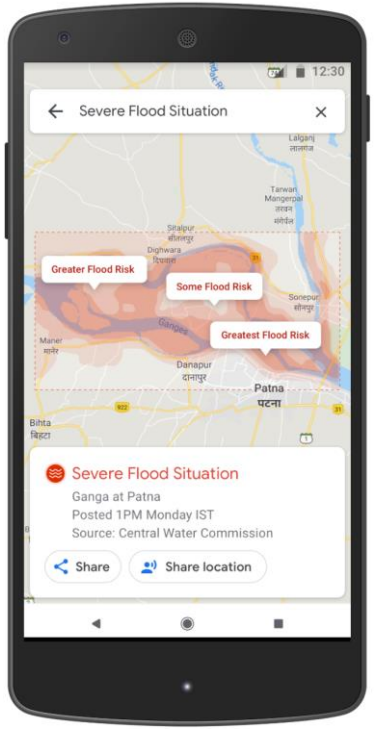
Informing the Public

Google Public Alerts

Search

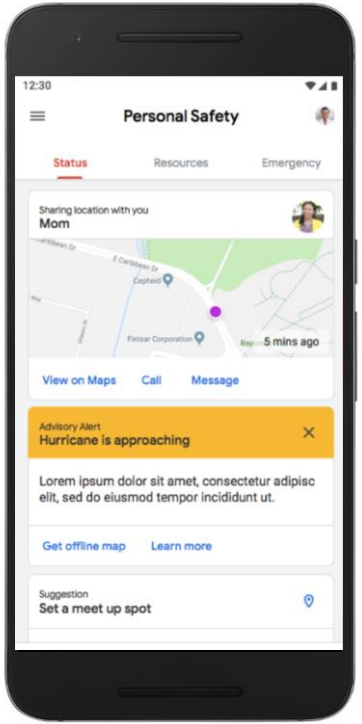


Maps



Android

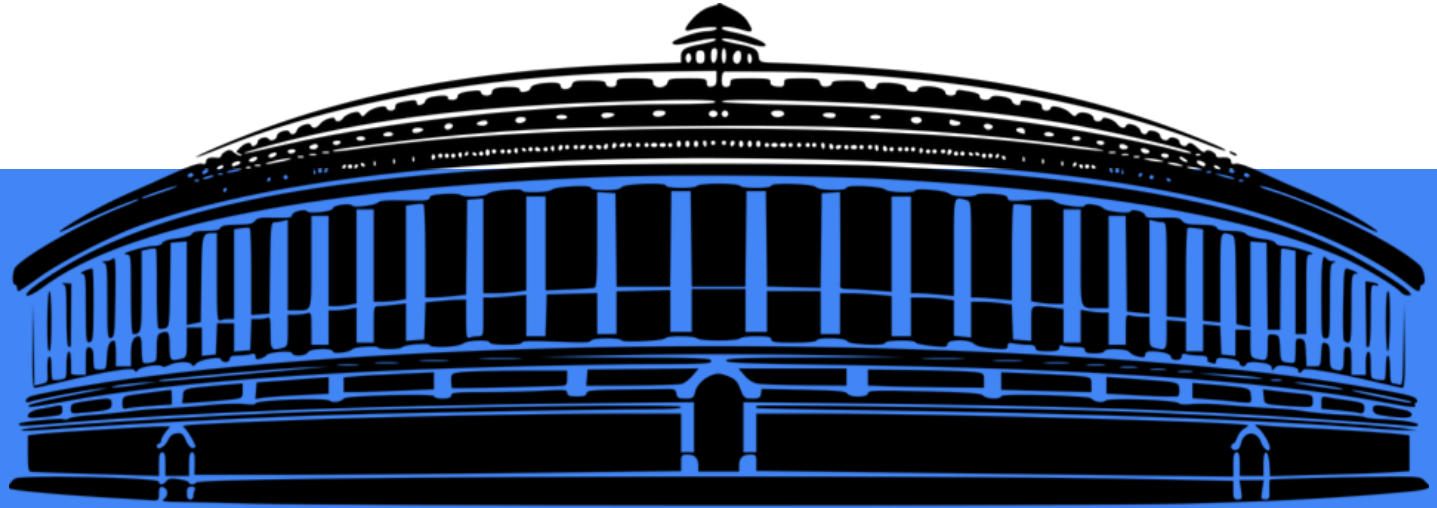
In Progress



→ Help local and public authorities communicate emergency messages

→ Public Alerts have already provided 100,000s of alerts to over 2 billion people

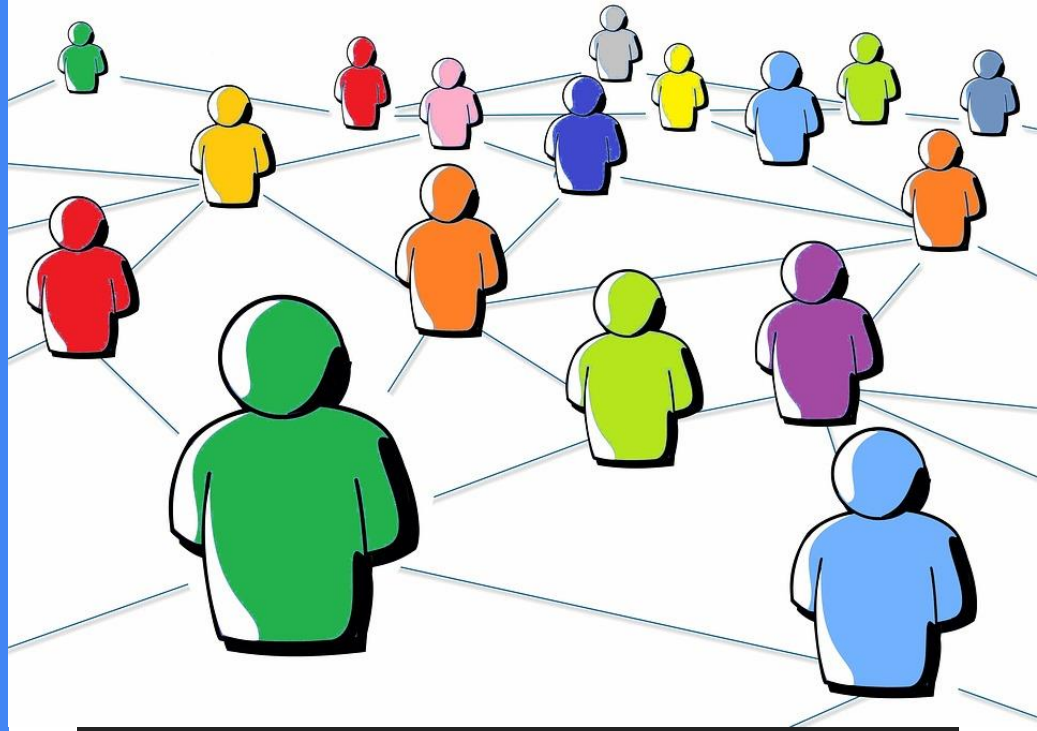
Informing Governments



Outsourcing Alerts

→ Provide information to local NGOs to distribute to the community

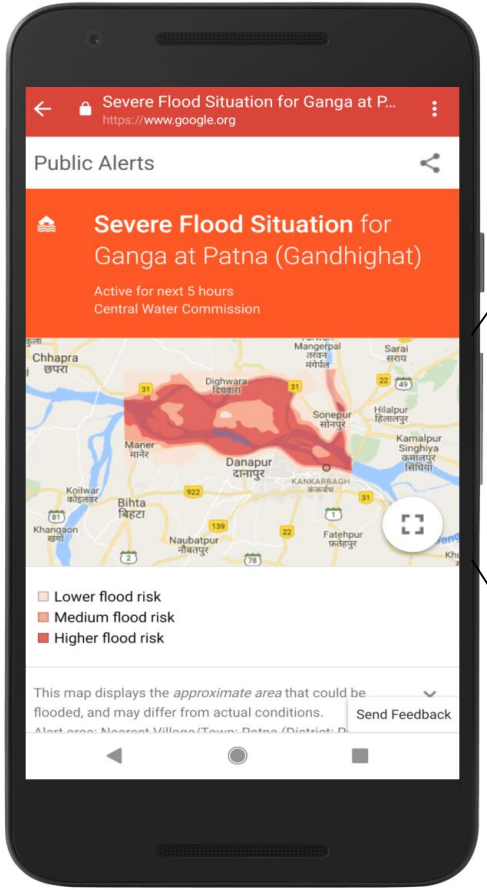
→ Funded by Google.org

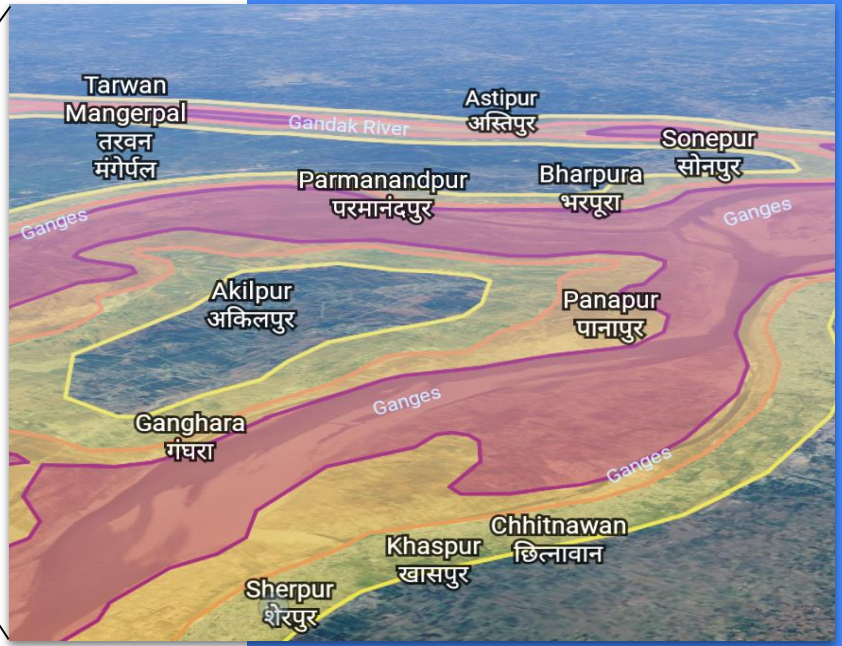


All our alerts are publicly available in human- and computer-readable formats

Flood Forecasting Initiative

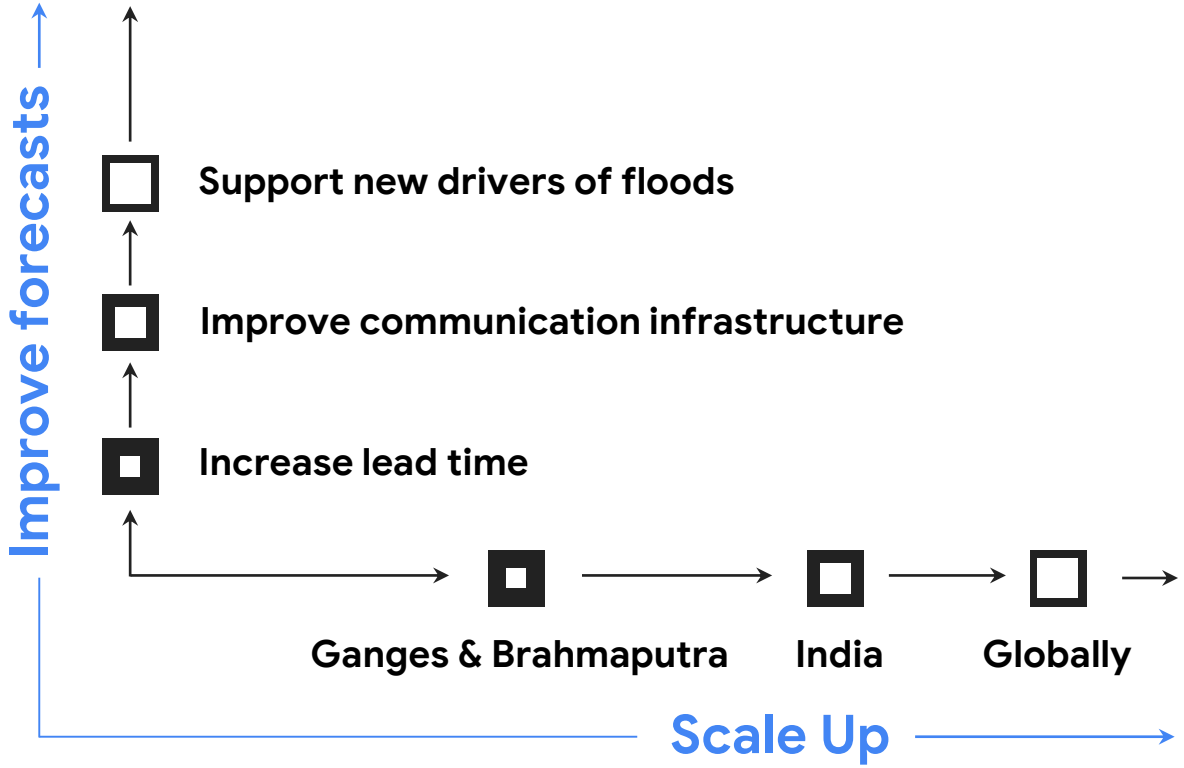
Patna Pilot





Flood Forecasting Initiative

Next Steps


Improve forecasts
Support new drivers of floods
Improve communication infrastructure
Increase lead time
Ganges & Brahmaputra
India
Globally
Scale Up

Thank You!