# A Digital Twin for near real time flood insights

NHRA October Hazardous Webinar | 21 October 2025

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RMIT UNIVERSITY Ready for what's next


Near Real-Time Responsive Flood Event Representation: Interactive Web App
Australia, Melbourne, Maribyrnong and City of Moonee Valley Local Government Areas
This Cesium-based interactive web application represents flood extent in real-time based on live river height and rainfall data. A flood water representation dynamically raises or lowers in height based on these data feeds to simulate and visualise flood extents.
Click the green buttons below to fetch data feed readings. Once both green buttons have been clicked and the returned readings exceed pre-determined thresholds, a flood extent visualisation will be automatically added to the viewer. The number of flood affected buildings will then be counted and displayed.
Fetch Live River Level Height
0.032 m
Fetch Rainfall for last 24-hours
0.000 mm
Count of Flood Affected Buildings
1576
Legend
River Height Sensor
Rainfall Sensor
Both
Normal Water Bodies
Flood Visualisation
Buildings
Flooded Buildings
Study Area Outline
CESIUM ion
Upgrade for commercial use
Data attribution

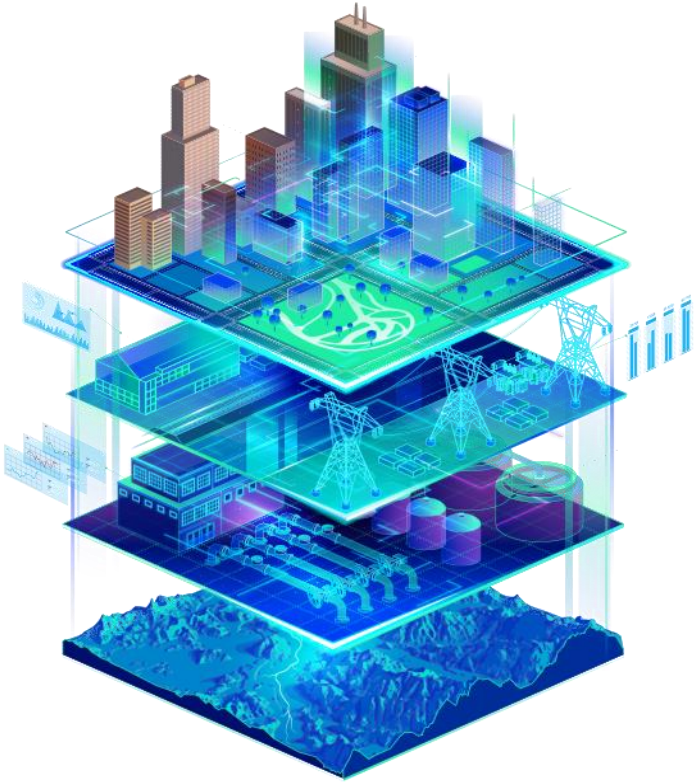
# Flooding Disasters in Australia

Bradley Richardson/Australian Defence Force/AFP/Getty Images.
https://www.theguardian.com/australia-news/2022/mar/04/are-eastern-australias-catastrophic-floods-really-a-one-in-1000-year-event

A man wades through floodwaters amidst evacuation orders in the Maribymong suburb of Melbourne, Australia, October 14, 2022. AAP Image/Erik Anderson.
https://www.reuters.com/world/asia-pacific/flood-waters-swamp-melbourne-heavy-rains-slam-three-australian-states-2022-10-14/

# **The Disaster** Opportunity

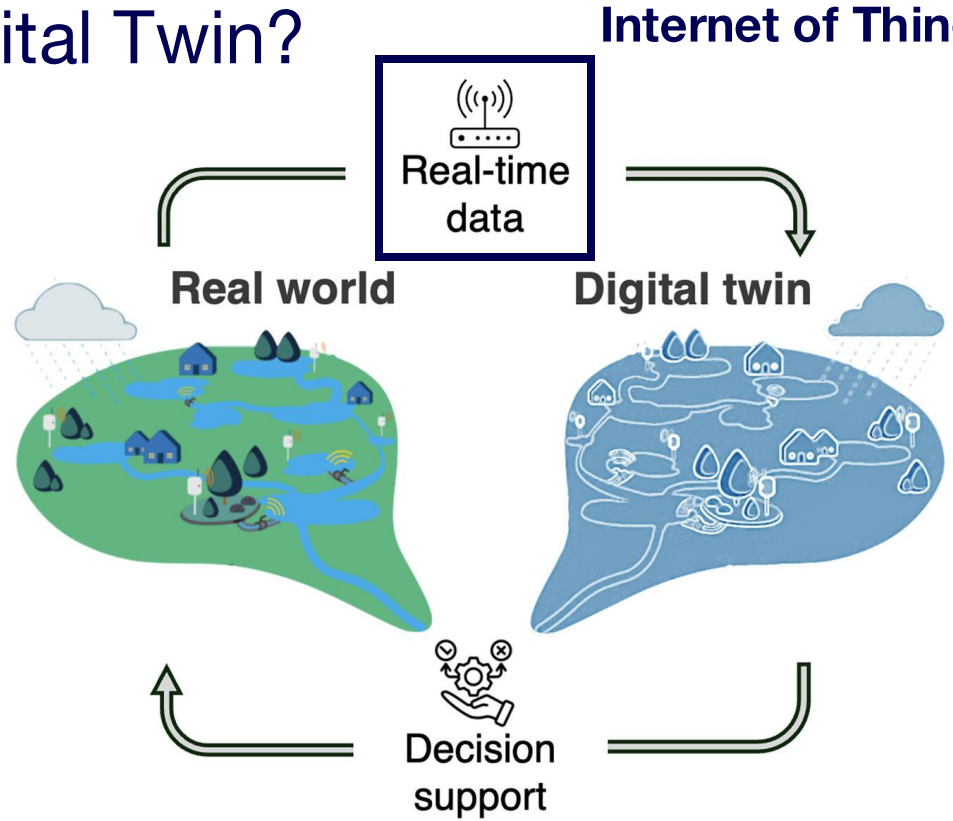
- Data driven solutions can help better manage and respond to flooding disasters in Australia.
- Advances in Digital Twin technology now enable the realisation of high-resolution and high-frequency insights into the urban environment.



ArcGIS: The Foundation for Digital Twins. 2025. https://www.esri.com/en-us/lg/industry/infrastructure/arcgis-the-foundation-for-digital-twins

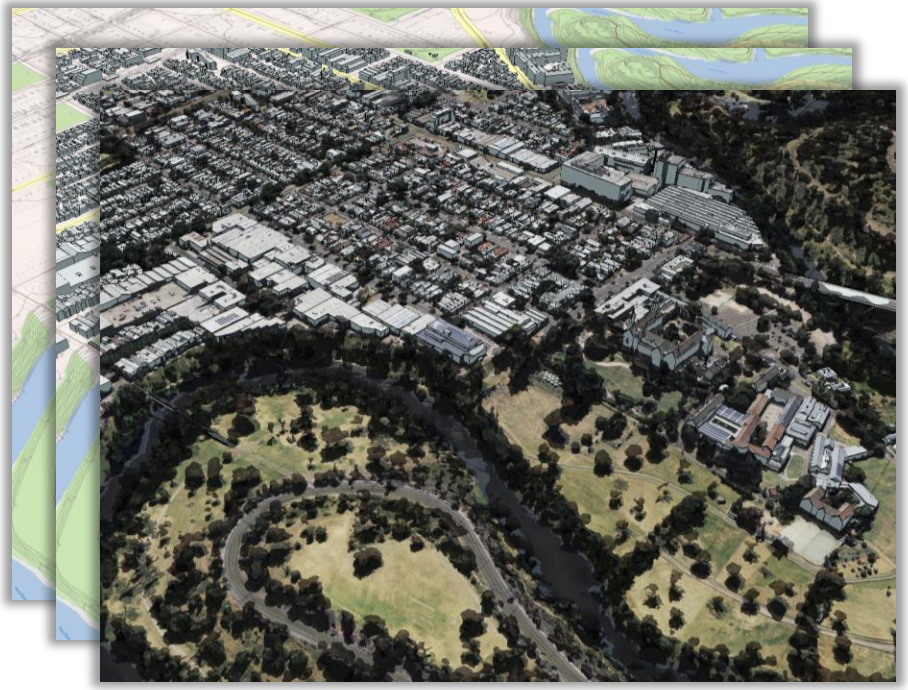
# Digital Twin

## What is a Digital Twin?



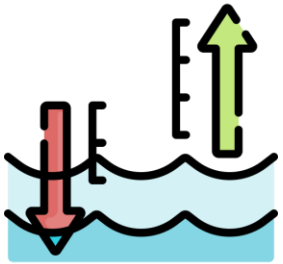

Kim, Y., Oh, J., & Bartos, M. (2025). Stormwater digital twin with online quality control detects urban flood hazards under uncertainty. *Sustainable Cities and Society*, 118, 105982. https://doi.org/10.1016/j.scs.2024.105982

# Flood Digital Twin
## Data Requirements

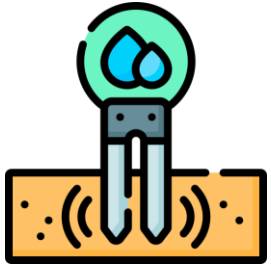


**Static Data**

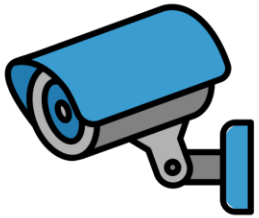
Digital Twin Victoria. 2025. https://digitaltwin.vic.gov.au/public/



Rainfall and river gauges



Soil moisture sensors

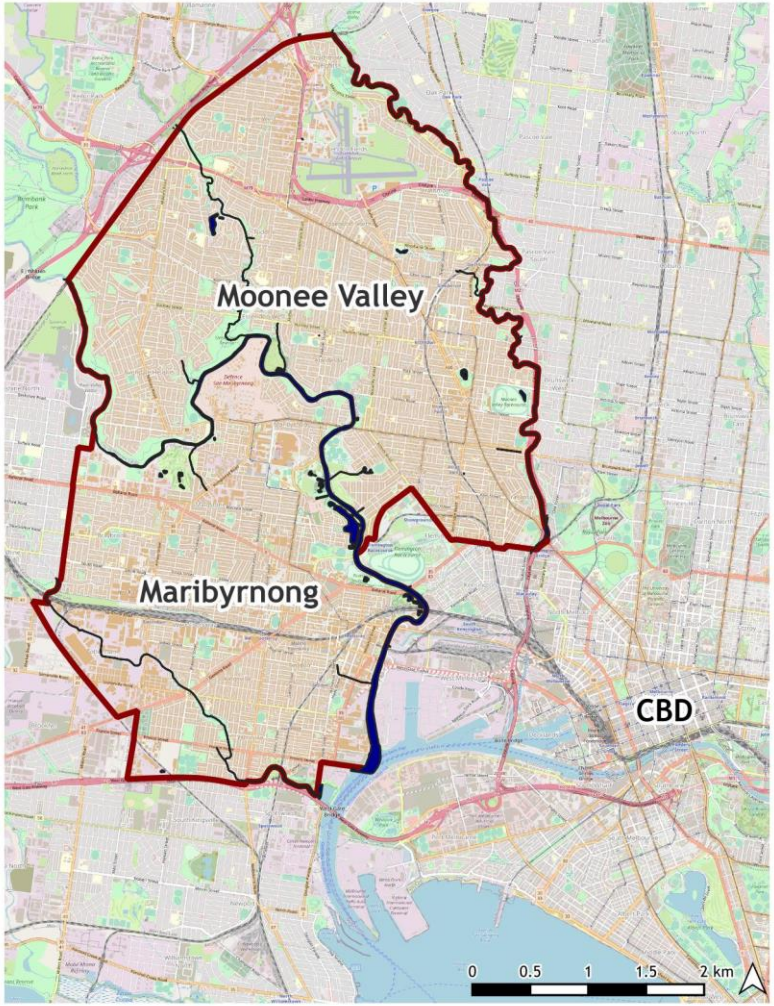


CCTV cameras

**Live Data**

# **Case Study**
# Study Area

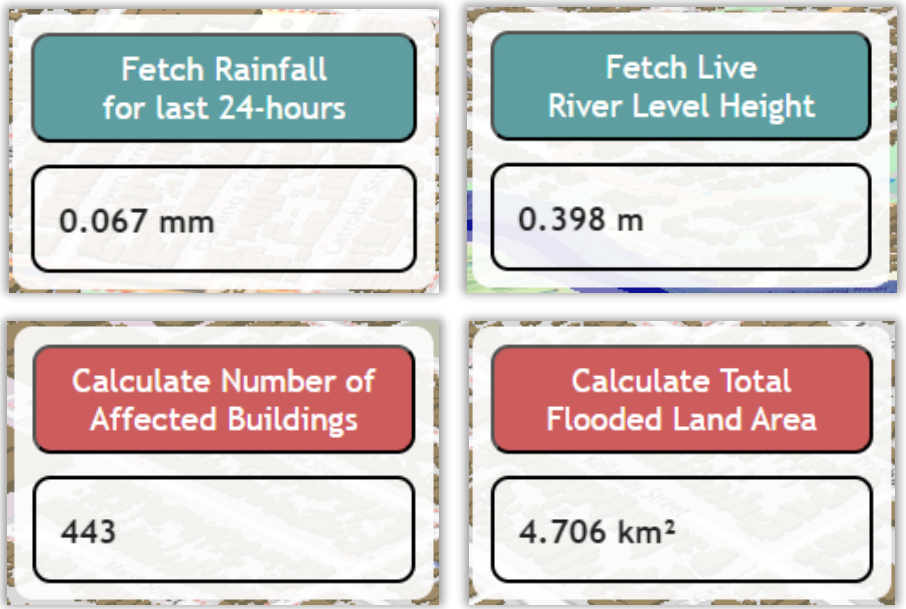
- The area of interest was the two Local Government Areas of Moonee Valley and Maribyrnong, north-west of Melbourne's CBD.




Turner, R., & Sun, C. (2024). Near Real-Time Responsive Flood Event Representation: An Open-Source Interactive Web Application Architecture. *ISPRS Ann. Photogramm. Remote Sens. Spatial Inf. Sci., X-4-2024*, 365-372. https://doi.org/10.5194/isprs-annals-X-4-2024-365-2024

# Case Study
## On-Demand Analytics

- Fetch live rainfall and river height data from the appropriate sensors.
- Compute statistics in near real time.
- Sensor data updates every **6 minutes**

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# Case Study
## Online Tool Interface v1

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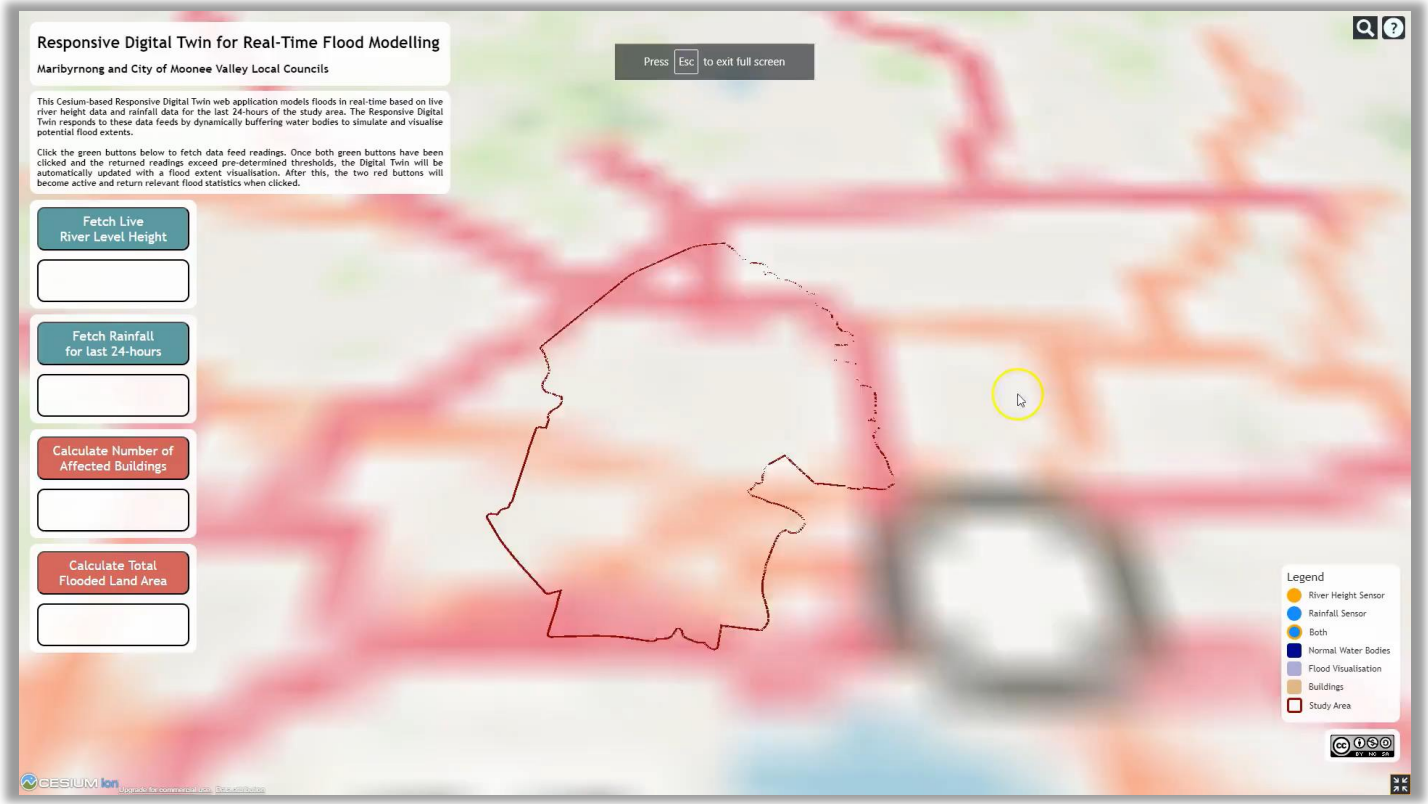

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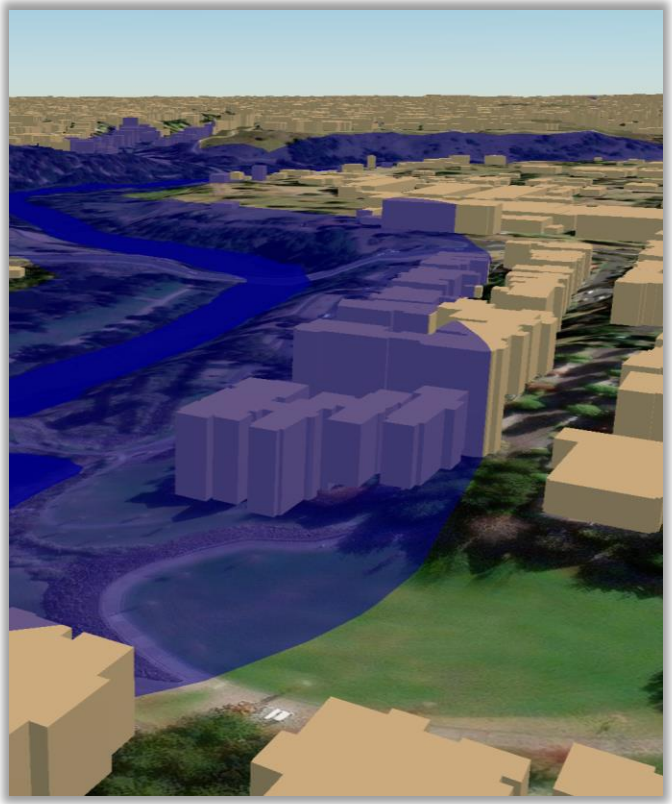
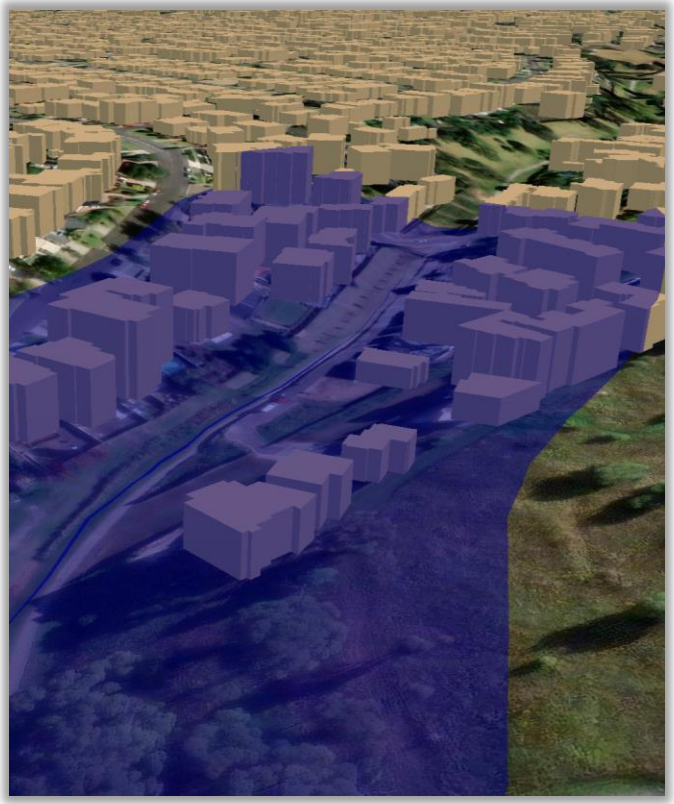
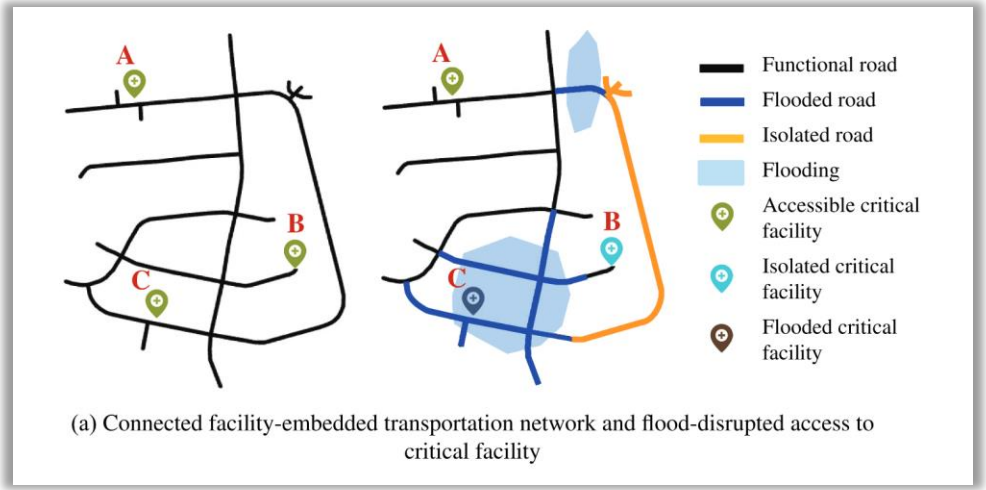




# What future opportunity does all this present for Australia?

# Three core functions
## 1. Live flood tracking

- Emergency services need this kind of functionality to better manage flood disaster response.
- On-demand, data driven insights such as flood-disrupted access to critical facilities such as hospitals.

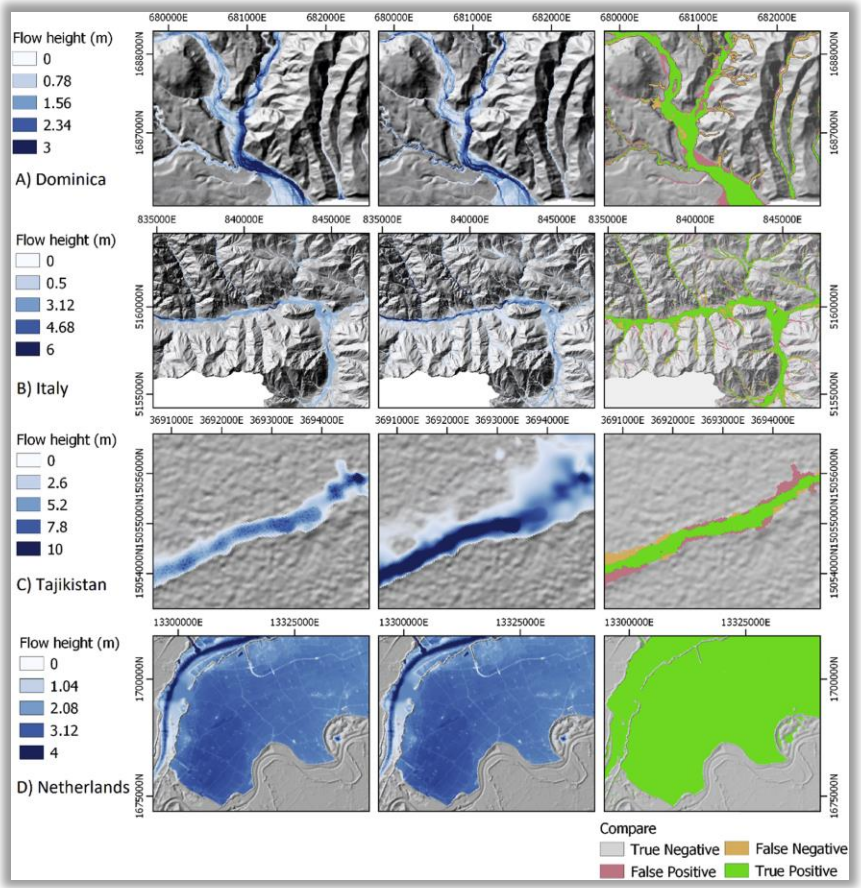



(a) Connected facility-embedded transportation network and flood-disrupted access to critical facility

Gangwal, U., Siders, A. R., Horney, J., Michael, H. A., & Dong, S. (2022). Critical facility accessibility and road criticality assessment considering flood-induced partial failure. *Sustainable and Resilient Infrastructure*, 8(sup1), 337–355. https://doi.org/10.1080/23789689.2022.2149184

# Three core functions
## 2. Future flood prediction

- To ensure flood warnings are timely and targeted, weather agencies require advanced flood modelling techniques that quickly enable testing of various flooding scenarios.
- Recent advances perform up to 1500 times faster that traditional physics-based flood modelling.

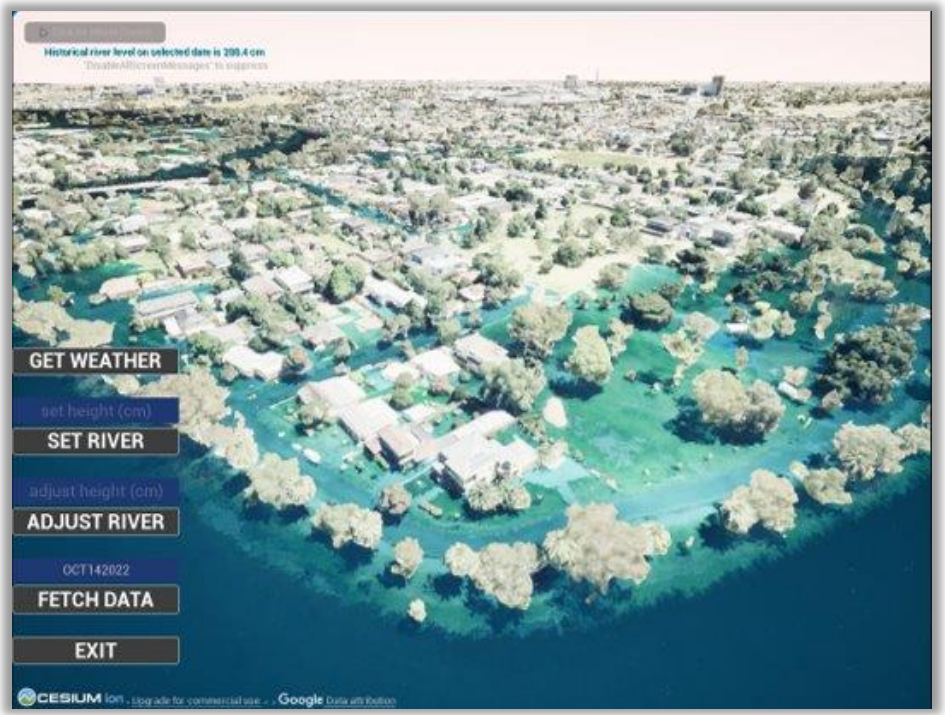



Comparison between advanced fast flood methodology (left) and traditional modelling (middle)

van den Bout, B., Jetten, V. G., van Westen, C. J., & Lombardo, L. (2023). A breakthrough in fast flood simulation. *Environmental Modelling & Software*, 168, 105787. https://doi.org/10.1016/j.envsoft.2023.105787

# Three core functions
## 3. Historical flood viewer

- Effective communication is an important task for insurance companies and education providers.
- Combination with VR and game engines is another feasible possibility that immerses users into locations personally known to them.




October 2022 flood event visualised in VR game engine. Kris Co. 2024. RMIT Master of Geospatial Science Dissertation.

# Impact on Infrastructure

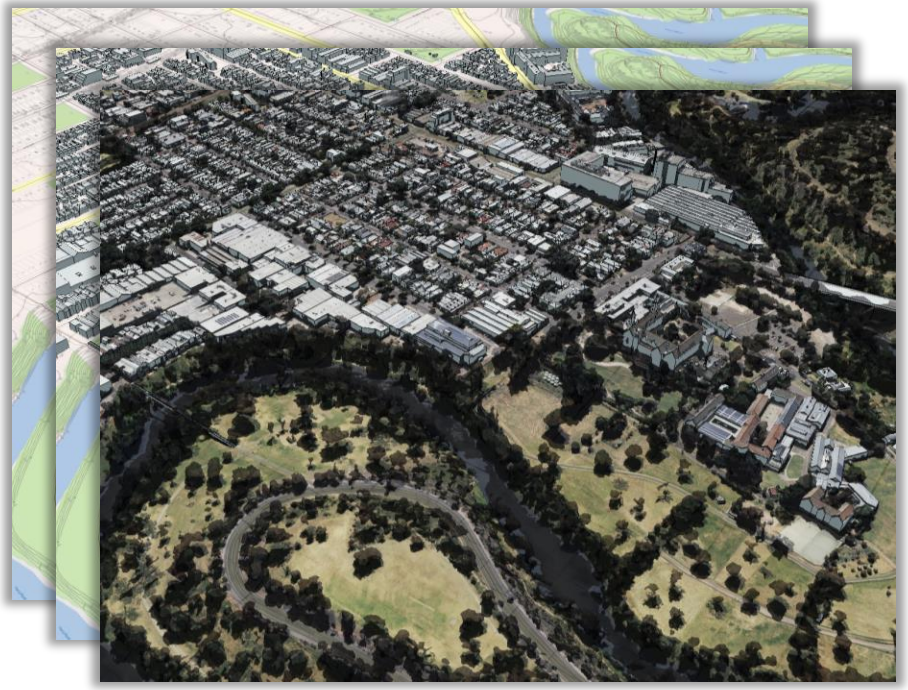
## Physical

- IoT sensors.
- Already existing, non-obtrusive entities within the urban environment.
- IoT sensor technology is only becoming cheaper and more accessible.

## Social & Community

- Being able to interact with flood visualisations in locations personally known the user.
- Provides tangible experience of flood impacts.
- Promotes awareness.
- Urban planning.

# Need for collaboration



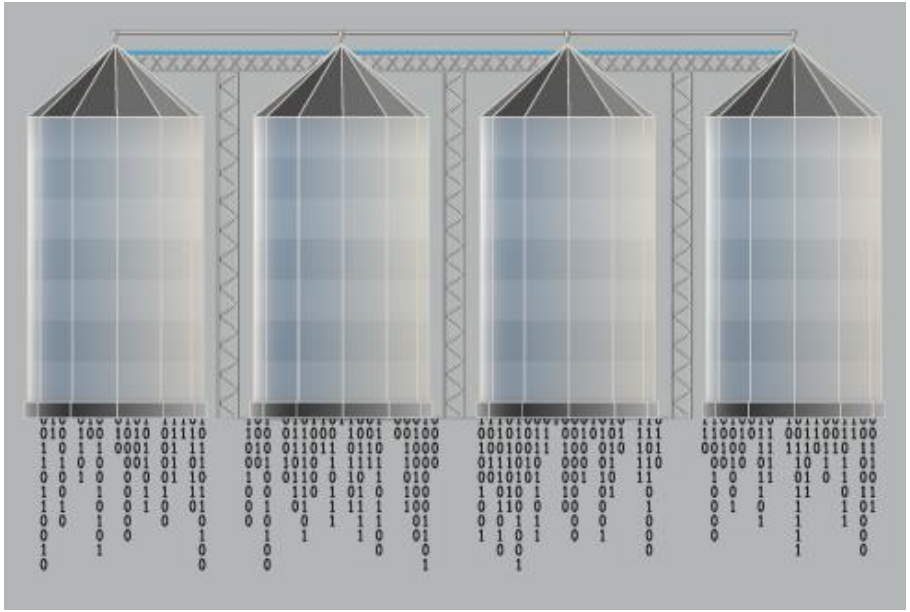
**Static Data**

Digital Twin Victoria. 2025. https://digitaltwin.vic.gov.au/public/

- Across various organisations, metropolitan Melbourne already possesses all the static and live components necessary to realise a Flood Digital Twin.

# Refreshed data governance frameworks

- Great potential is being missed due to the concept of ‘data silos’.
- Refreshed data governance frameworks can help promote more transparency and tighter collaboration between organisations across industries to pool together resources.
- Digital Twin technology shows promising potential that simply could not have been possible without enrichment from multiple data sources.



What are Data Silos? 2020. https://www.goanywhere.com/blog/what-are-data-silos

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