臺北國際水環境論壇
2020 TIWEF

Resilient Sustainable Vibrant

2020 TAIPEI INTERNATIONAL WATER ENVIRONMENT FORUM

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Dealing with Weather Extremes in a sustainable Design of the City (using advanced IT tools)

荷蘭商青蛙科技有限公司

(Frog Technology)

Branch Office Nelen & Schuurmans, Taiwan

Nelen & Schuurmans

Fons Nelen

director

Nelen & Schuurmans

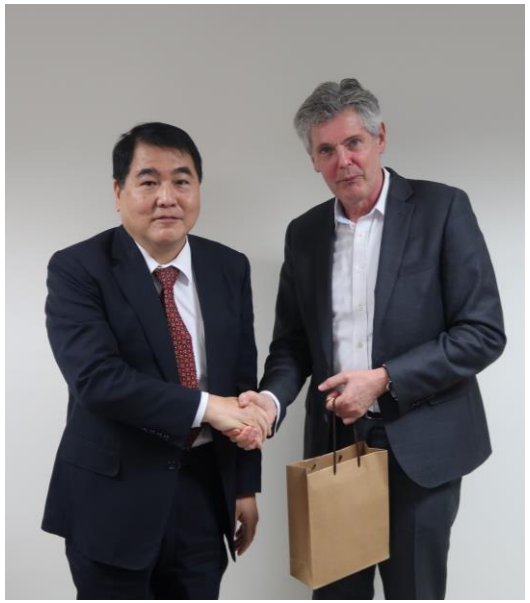
- Knowledge Bureau on Water & IT,
  based in the City of Utrecht
- Staff: 75 people (MSc & PhD)
- IT-services
  - Lizard: data warehouse and analytics platform
  - 3Di: hydrodynamic modelling instrument
- Consultancy-services
  - Climate and Environment
  - Urban Water Management
  - Energy and Operational Systems
  - Flood Risk Management
  - Water & Agriculture

The Old Canal in the center of Utrecht

The team in Taiwan

Kuan-Wei, Chen

Meeting with Prof. Liu
Commissionar of Taoyuan, 2018



Yung-Chia, Hsu

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- The challenges for the urban planner
- More data …
- … and how to use this to get better insight?
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- Towards a new design approach

The challenges for the urban planner




- Globally, over 50% of the population lives in urban areas today. As cities grow, and severe weather conditions will continue to intensify, flood risks and drought risks in urban areas will drastically increase.
- The economic risks due to coastal, fluvial and pluvial flooding is estimated by the WB at trillions of dollars. Heat waves and droughts have great impact on the quality of life in the city
- Building inclusive, healthy, resilient and sustainable cities requires intensive policy coordination (with all stakeholders involved) and well-founded decisions on the possible solutions and the large investments needed to reach our goals.

Better insight -> better decisions

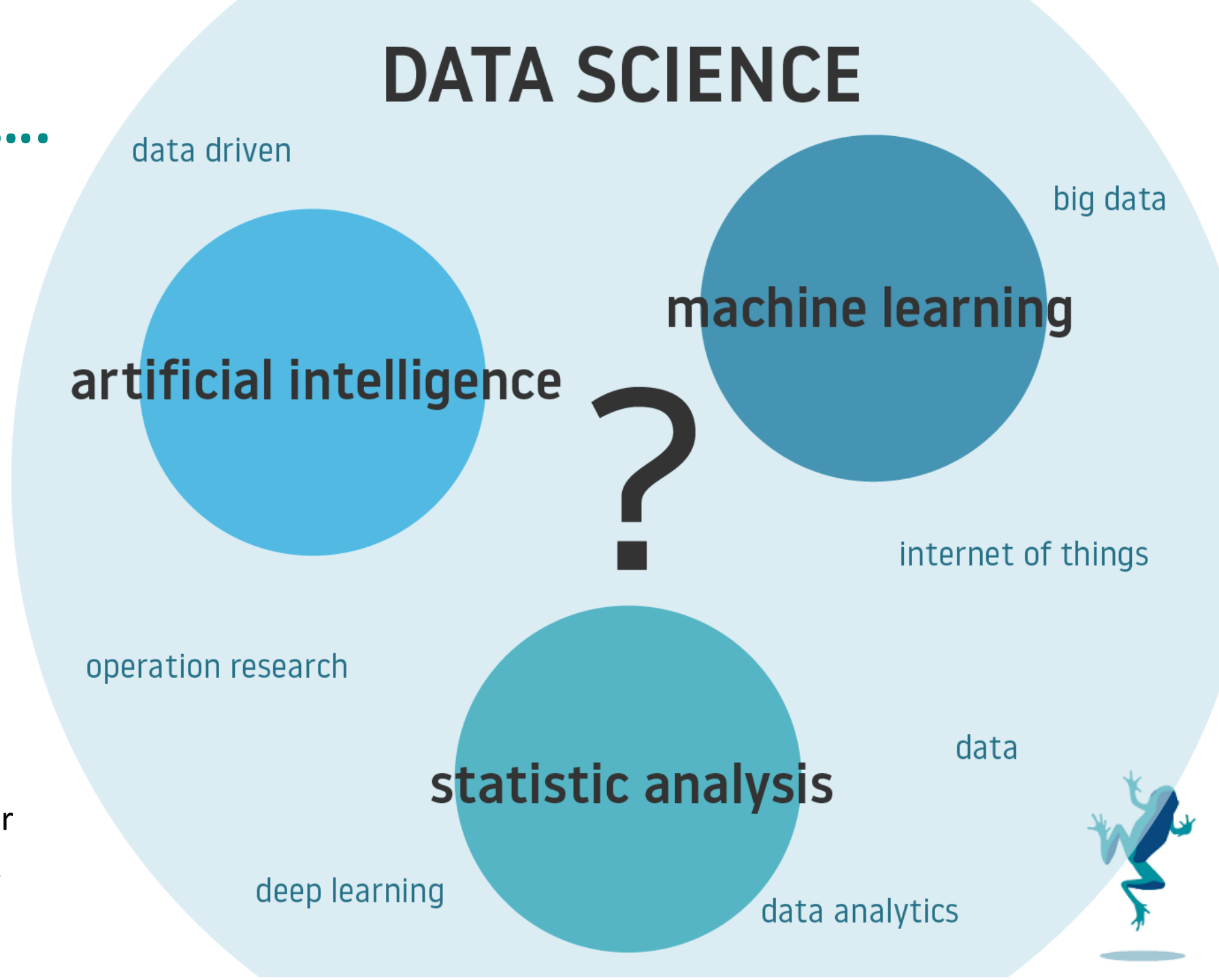
- Increased ***awareness*** of coastal, fluvial and pluvial flood risks, and other effects of extreme weather conditions - among decision makers, engineers and the public - is critical to prevent devastating loss of life and property worldwide.
- To create this awareness and to built resilient and sustainable cities, we need ***better information*** to understand the risks and to make the right decisions
- Due to the complexity of the urban environment, we need ***better tools*** to help assess the available data and information.

More data ....

We gather a lot of data.
The terms IoT, Big Data, ML, AI, and others (see figure) have become very trendy.

Every design or analysis has always been “data driven” (for centuries !)

Added value (= better insight) can be created through data integration and new analysis techniques. The possibilities for this are increasing very rapidly.



More data …. better insight (?)

Rainfall
Evaporation
Wind
Temperature
Terrain data
Land use
Elevation
Vegetation
Buildings
Structures
Vulnerable objects
Roads
Traffic
Soil
Sewerage system
Groundwater
Drains
Canals
Rivers
Sea (tide)
Basins
Retention facilities
Water levels
Water quality
Energy consumption
Flows
Pumping stations
Weirs
Other assets
etc.

Proper mapping of all characteristics of the city and monitoring of weather and water system is very important, but not enough to understand the behavior of the system and to predict the effect of measures.
This requires *data integration* and *integrated systems analysis*.

Resistance to innovation

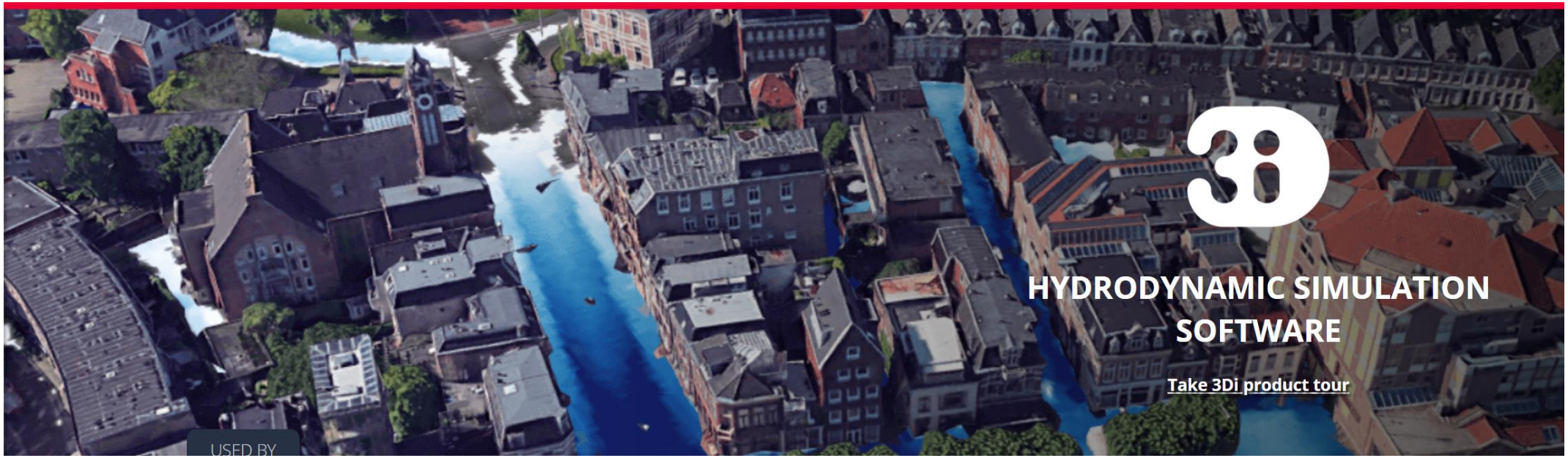
- A sustainable design and management of urban areas require new design standards and methods; which are not based on a "design storm" or "design load" with a certain return period, but on risk assessment and risk management.

  Observation 1: The implementation of 'risk based' standards requires time;
  Policymakers don't like to change and try to avoid uncertainty

- To get insight into the risks, we need new tools. In the past, we had models but no data to run the models. At present, we have a lot of data, but the traditional models which are still widely used, are not able to handle these data.

  Observation 2: The implementation of new design tools requires time;
  Engineers don't like to change and love known methods

The next generation of hydrodynamic simulation software



Digitization can improve the quality and efficiency of decision-making (and therefore reduce costs)

Awareness

Interactive modelling
Communication

Decision makers
Engineers
The Public

Prevention

Integral modelling
Better Insight

Better Design
Better Urban Planning
Better Operation

Response

Real Time Information
Flood Early Warning

Calamity management
Restore measures
Recovery

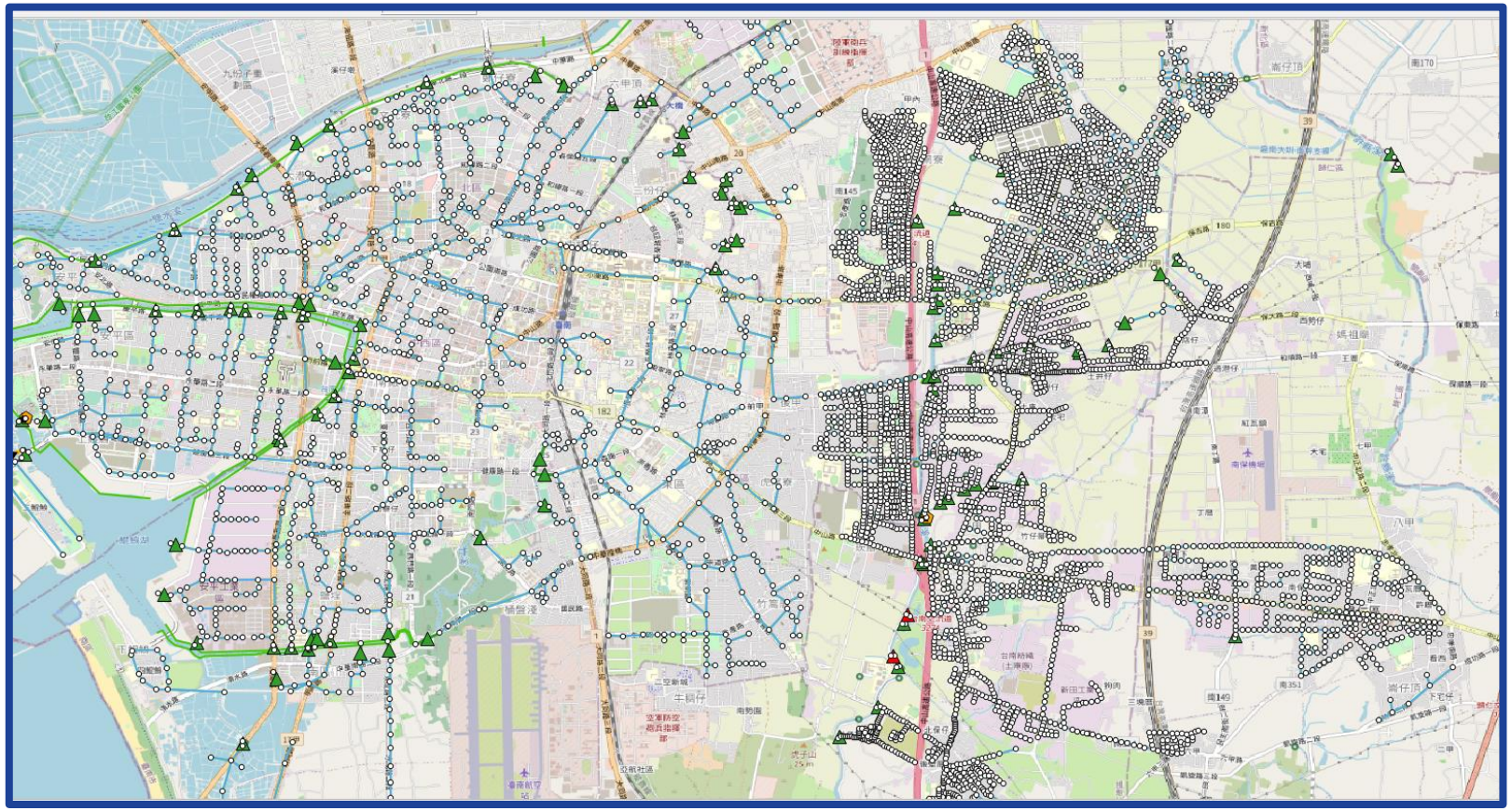
Flood risks in Tainan

A research into flood risk management in Tainan, in collaboration with the Research Center for Hazard Mitigation and Protection of National Central University (NCU), Taipei and the City of Tainan.

Fort Zeelandia

(Old Dutch fort, Formosa, 1624 - 1662)

Demo: Flood risks in Tainan



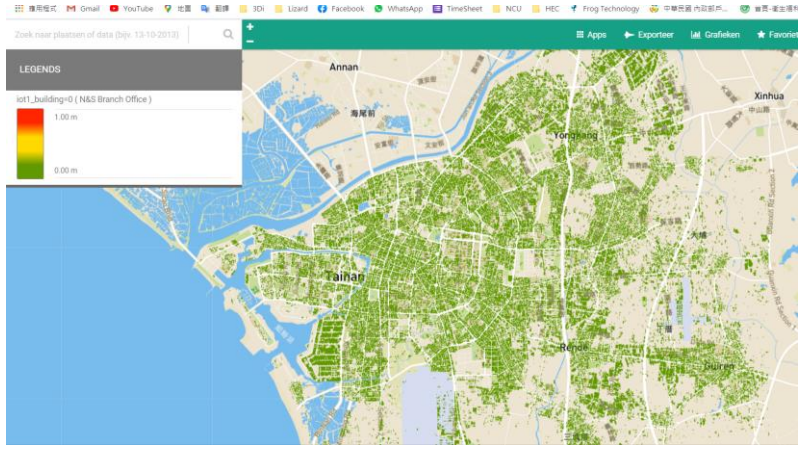
Terrain (DEM)
Storm sewer network

Pumping stations
Weirs + other structures

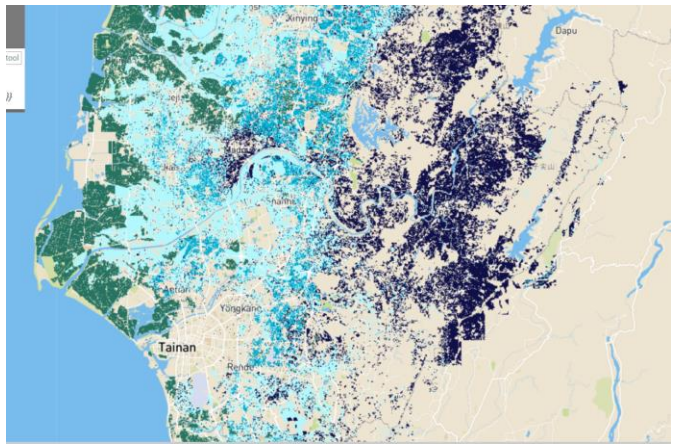
Roads
Buildings
Landuse

Weather data
IoT sensors

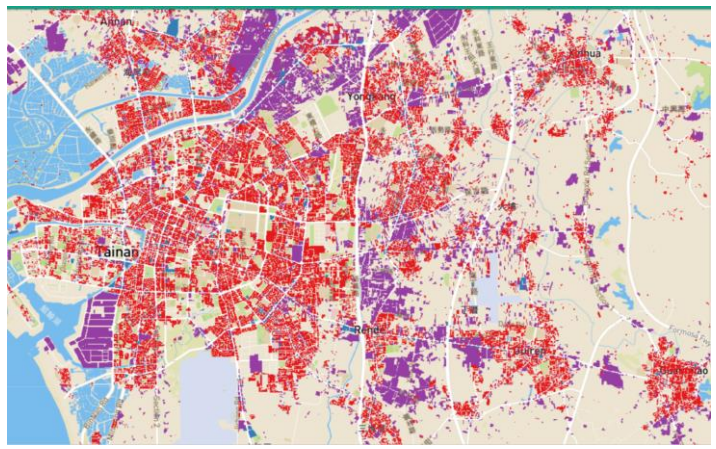
Different data layers



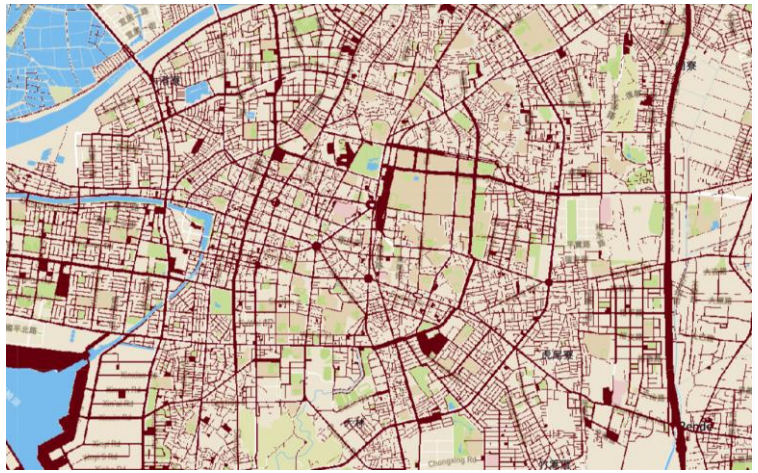
Landuse



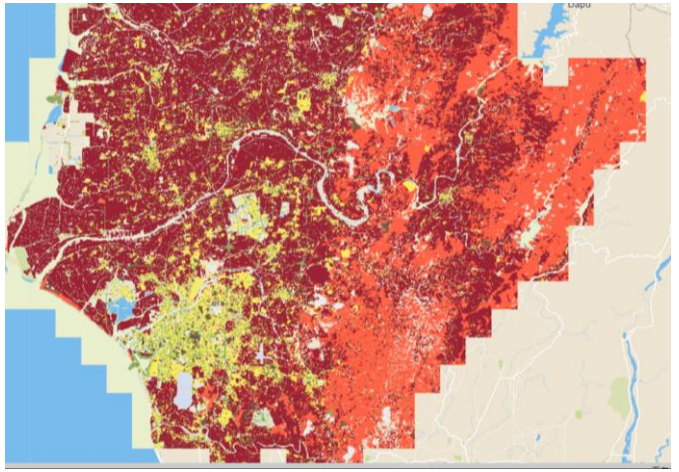
Farms



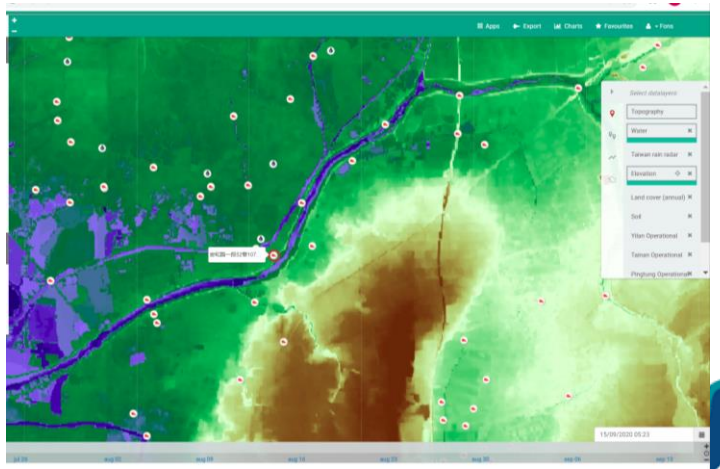
Business, industry and households



roads

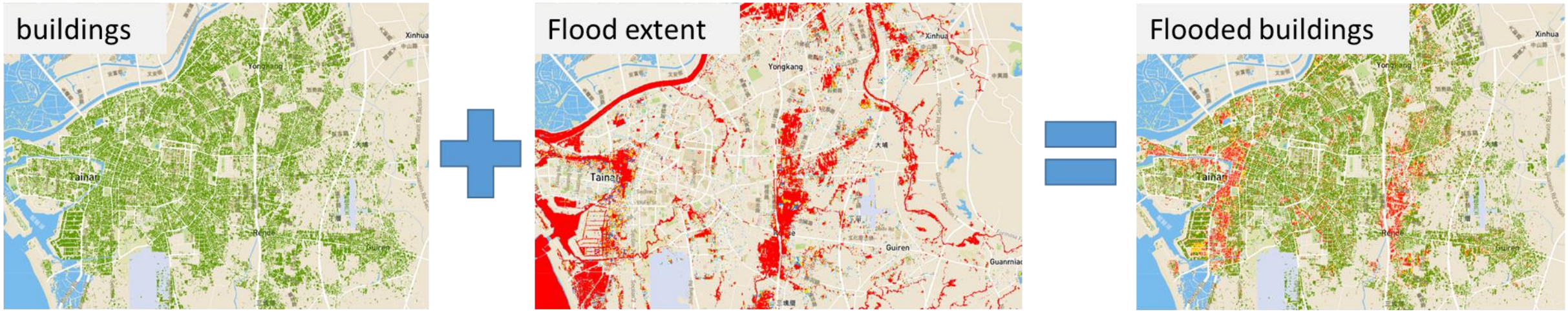


Buildings (topographic map)



Terrain (elevation)

Flood risk analysis on household level



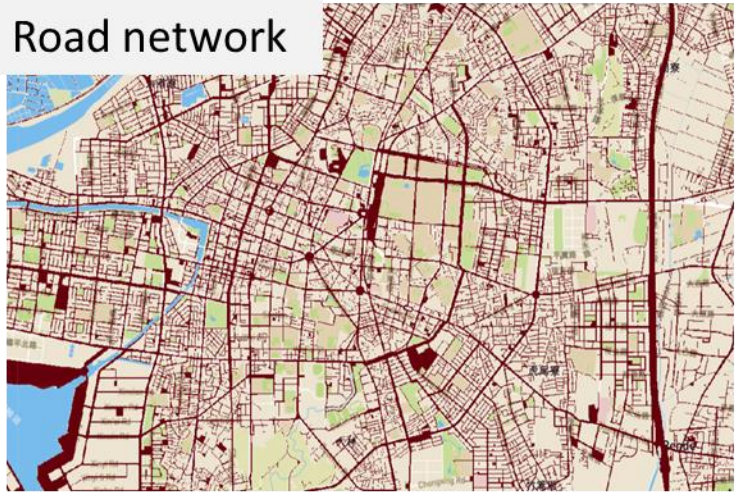
Combine data on buildings, terrain, landuse and water to obtain insight into flood risks and effects of meausres, for different scenario's

Flooded buildings

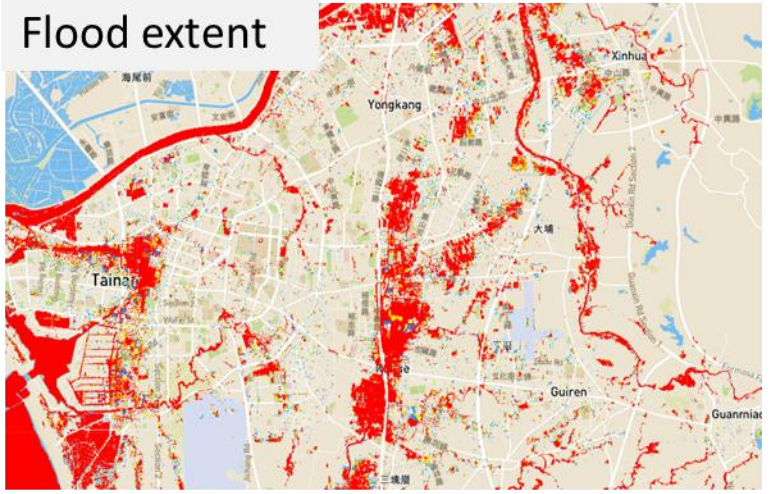
Assessment of measures for flood risk reduction on household level

Flood risk analysis: accessibility

Road network



Flood extent



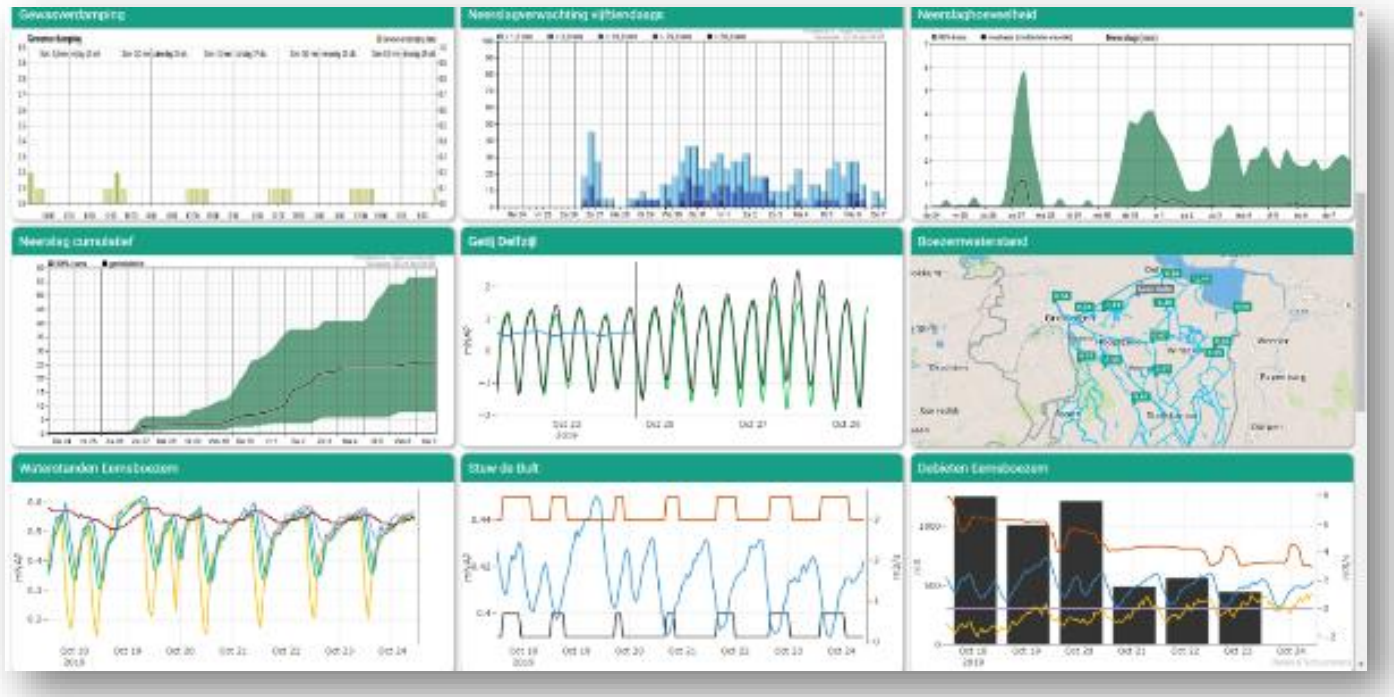
Accessible roads

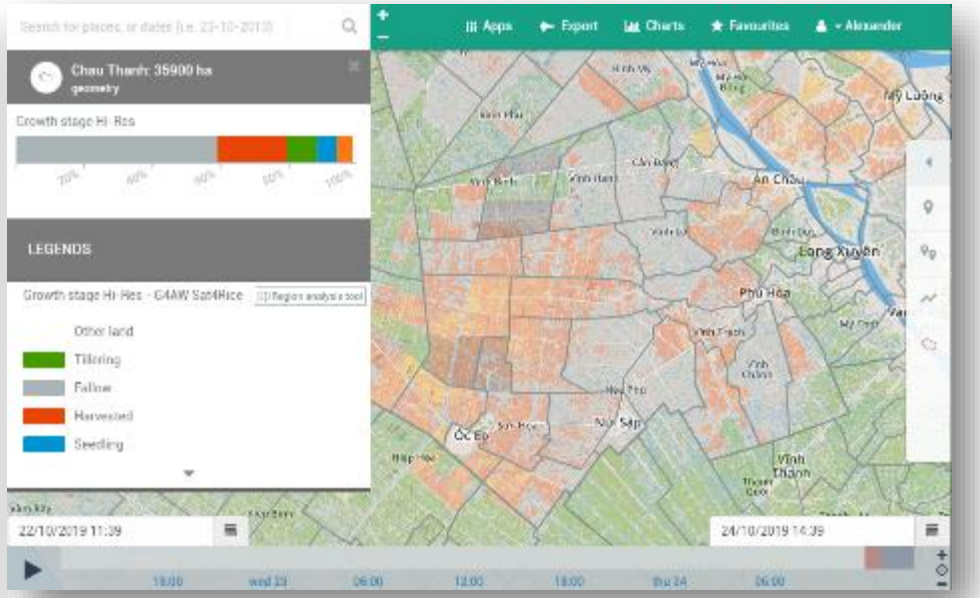
Using data on roads, elevation, and water depth to obtain accessible/inaccessible roads immediately

accessibility maps (in near real time)

Optimize accessible routes for police, ambulances, fire brigade, etc and/or to warn the public to move their car on time

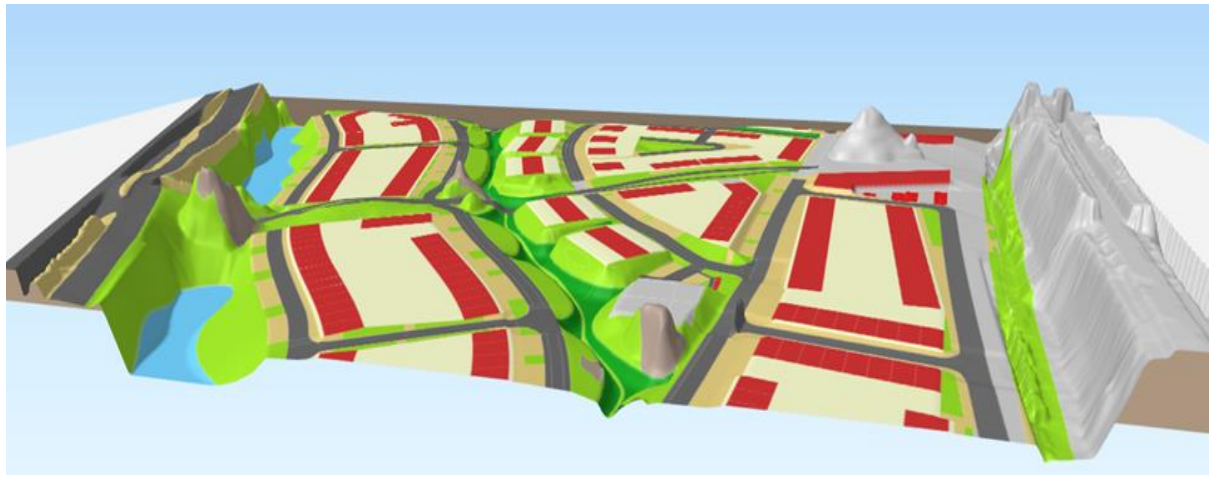
Configurable dashboard (for various user groups)

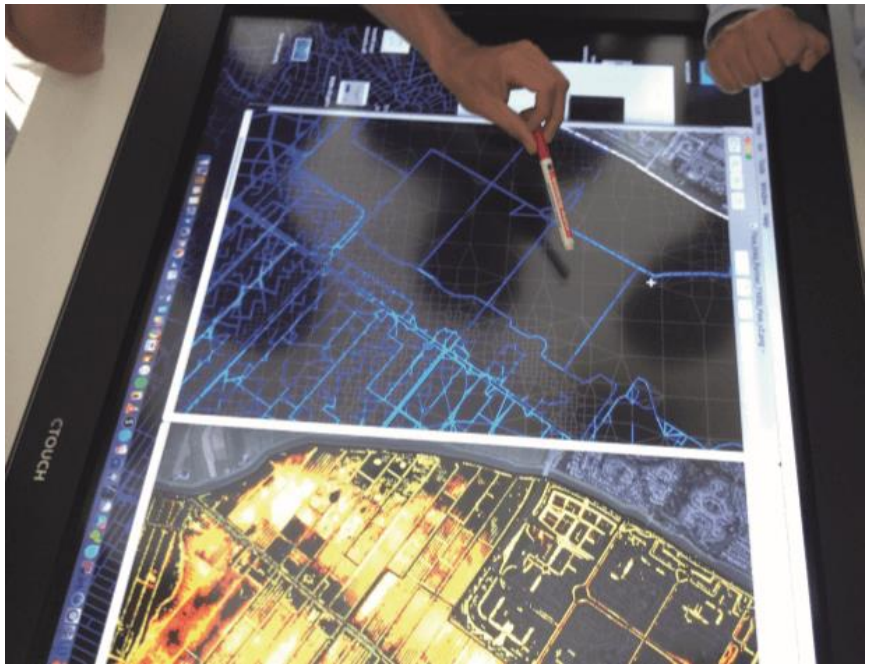




Weather data, rainfall (nowcasting + prediction), actual floodmaps, IoT sensors, flows, results of different scenario's, KPI's, emergency plans, etc

Integrated design and urban planning





Awareness (public) + improved decision making

Traditional reports …. or a digital twin ?