國立中央大學
National Central University

GWF 2023 GEOSPATIAL WORLD FORUM
THEME: GEOSPATIAL CARAVAN EMBRACING ONE AND ALL
2-5 May 2023, Rotterdam, The Netherlands

An interactive geospatial platform for earth environmental data visualization and real-time mathematical modeling

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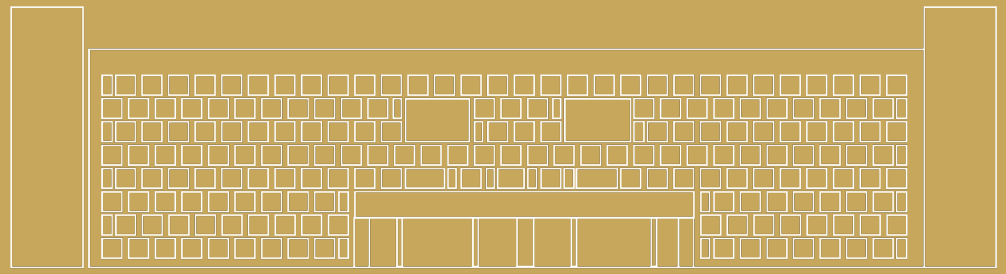
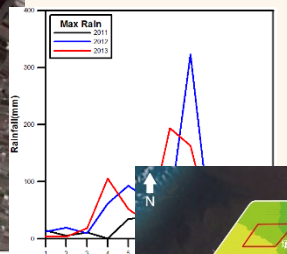
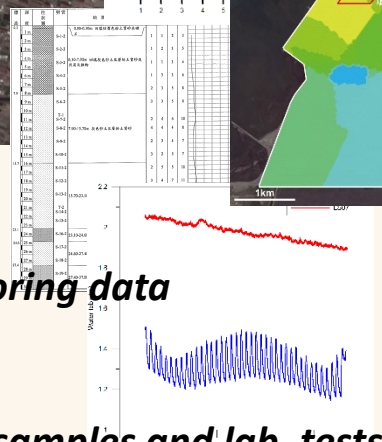
ease-x.com

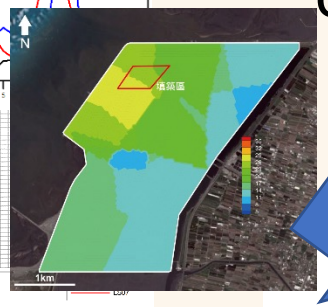


Motivations

1. Maps are essential for the assessment & presentation throughout the entire workflow in modeling projects
2. Integrating online maps and models is beneficial to project management
3. 3D interactive visualization enhances the understanding of model results





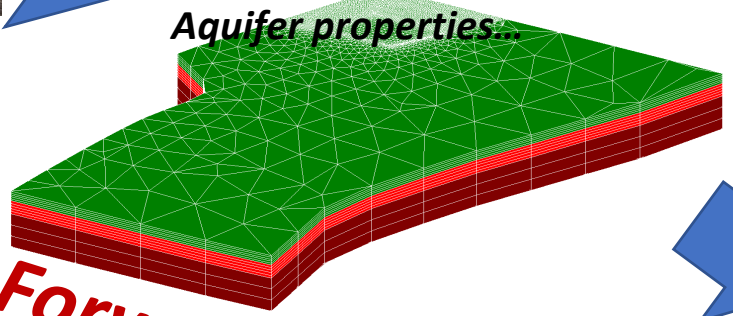


Input

Hydrological monitoring data
Soil samples
Field tests
Surface /sea water samples and lab. tests

Model

Geological model
Numerical mesh/cells
Aquifer properties…

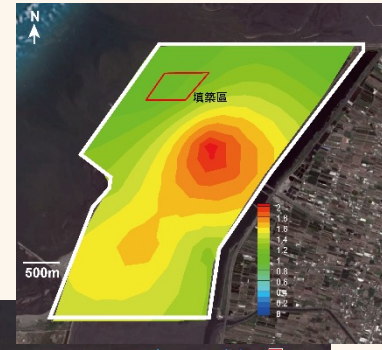


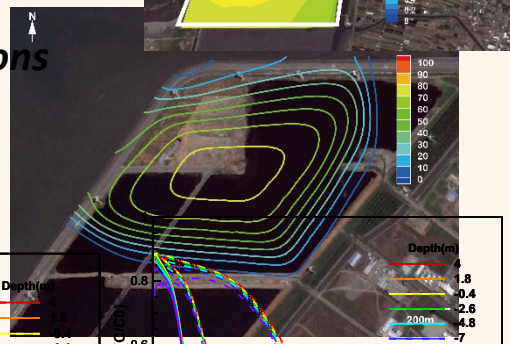
Forward workflow

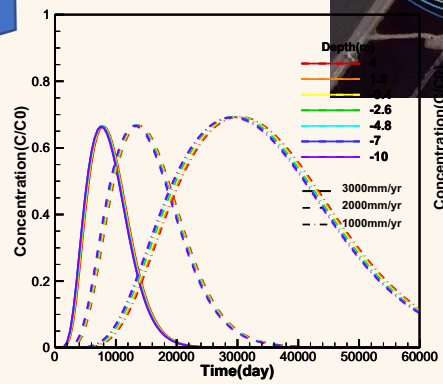
Inverse workflow

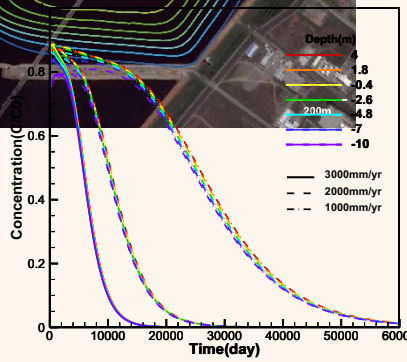
Output

Numerical solutions
Reporting…

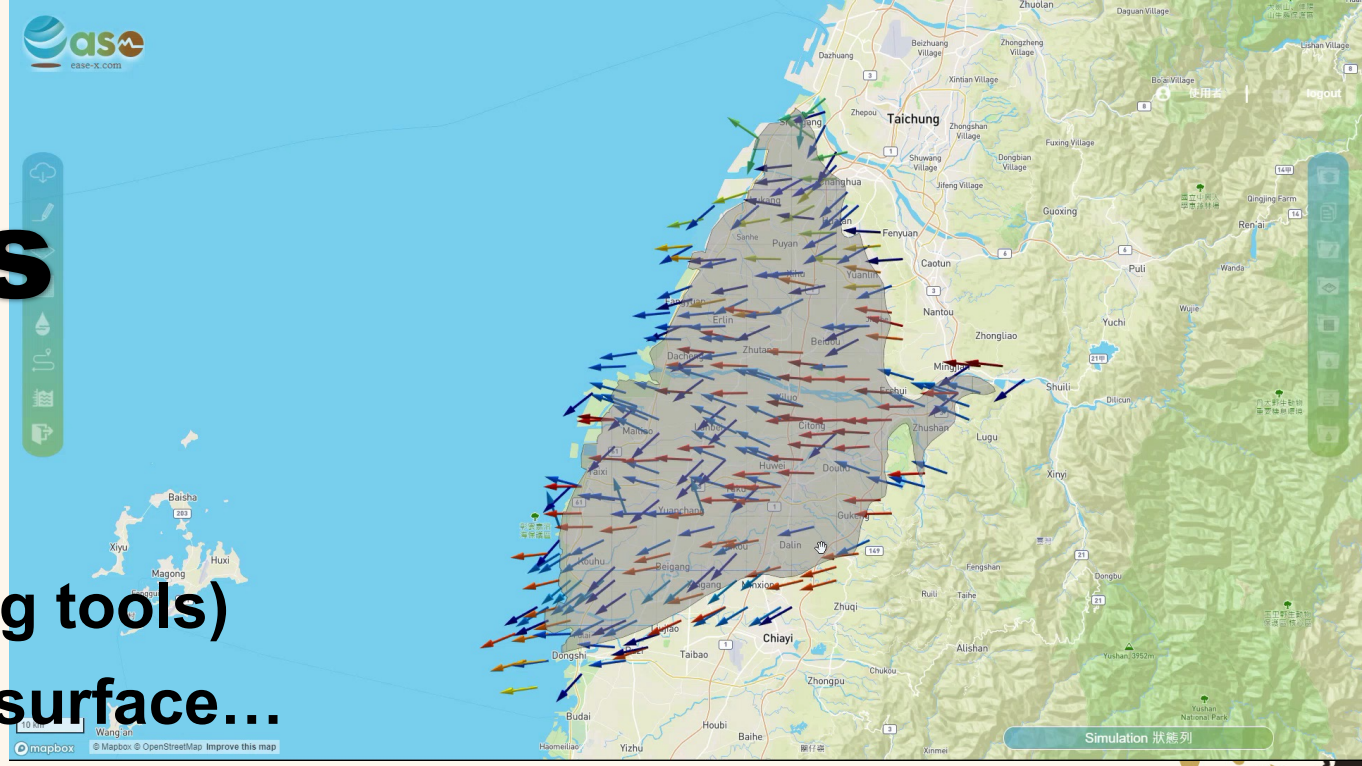








Tasks & Features



- Interactive Map
- 3D visualization (Professional plotting tools)
- Real 3D, including 3D mesh/cell, iso-surface…
- 3D physical model, machine learning, time series analysis...

- IoT-enabled data visualization (time series and animation)

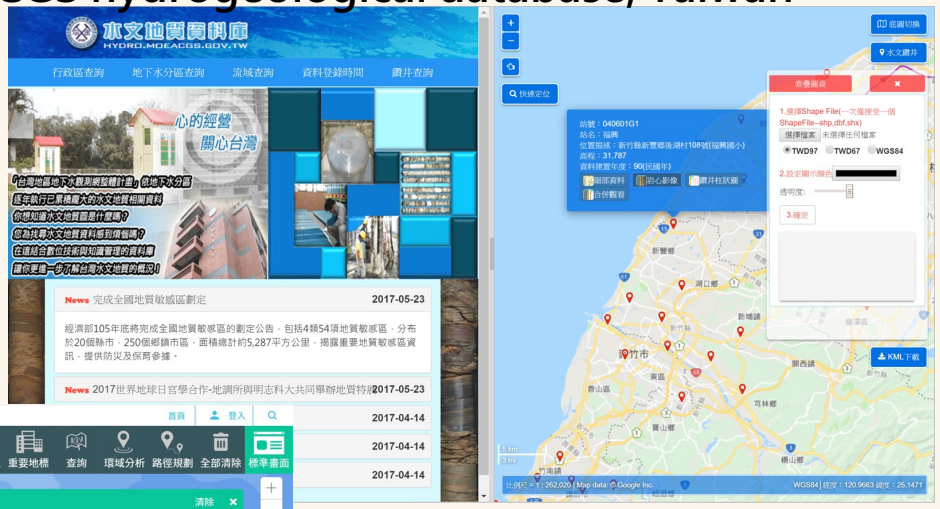
- Open source
- Data sharing, project workspace,…. complex collaboration activities
  Similar concept: Dropbox, Google Workspace, or Microsoft 365…

Available Monitoring Data (open) and Interactive Visualization (Taiwan)

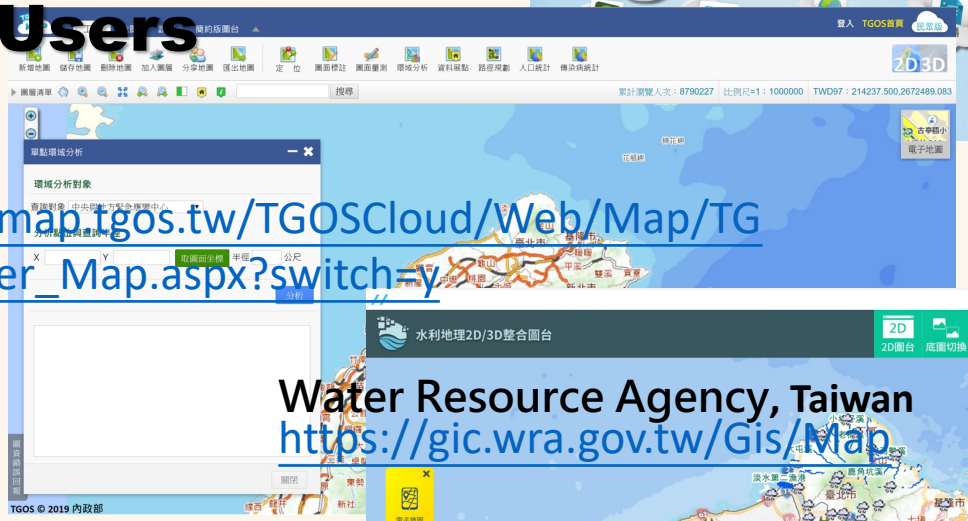
Database & Users

http://hydro.moeacgs.gov.tw/plain/

CGS hydrogeological database, Taiwan



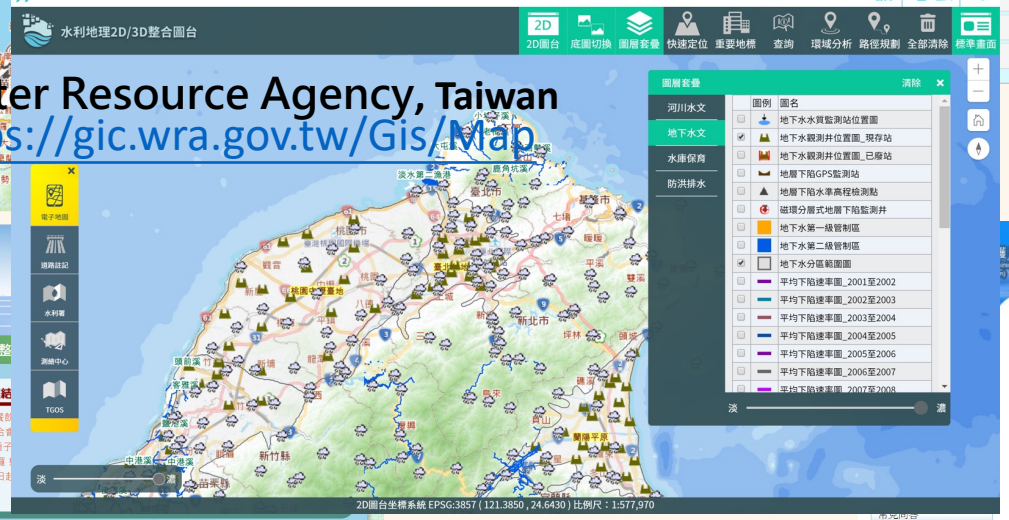
TGOS(Taiwan Geospatial One Stop), Taiwan



https://map.tgos.tw/TGOSCloud/Web/Map/TGOSViewer_Map.aspx?switch=y

Water Resource Agency, Taiwan

https://gic.wra.gov.tw/Gis/Map



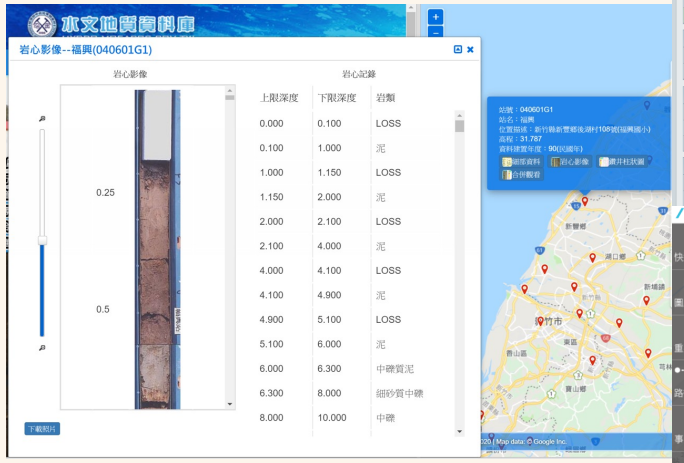
https://sgw.epa.gov.tw/public/

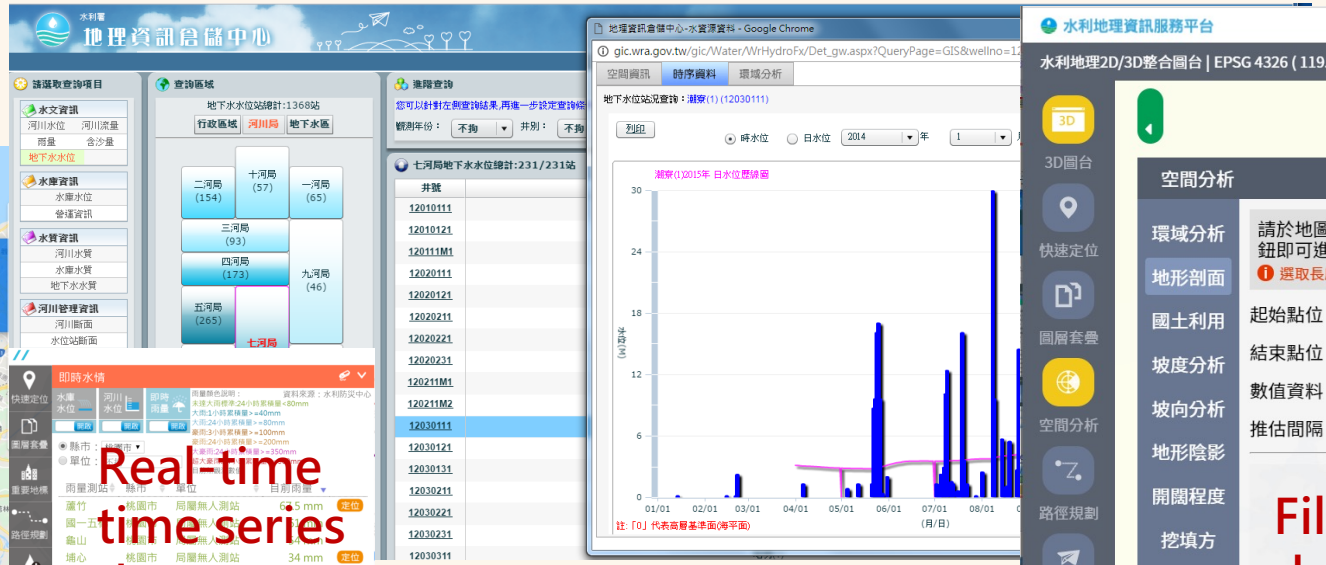
Soil & Groundwater Remediation, Taiwan

https://wq.epa.gov.tw/Code/Default.aspx?Water=Gdwater

EPA, Taiwan

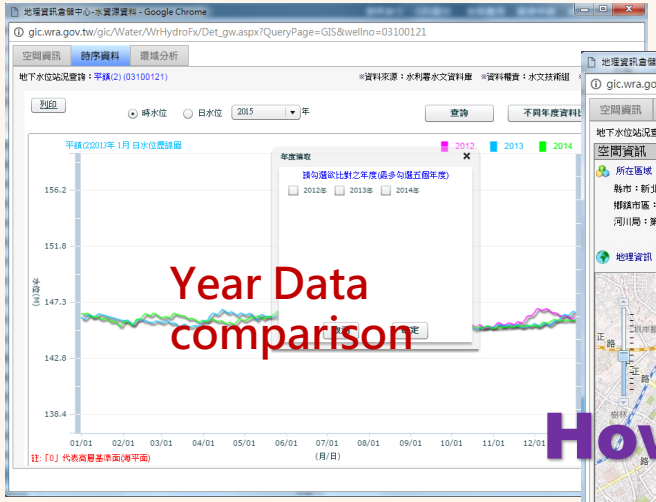
Online Analysis Tools → Data filtering & visualization



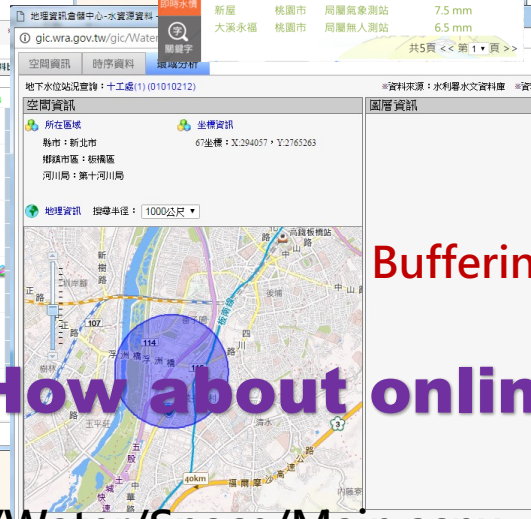


Real-time time series data!

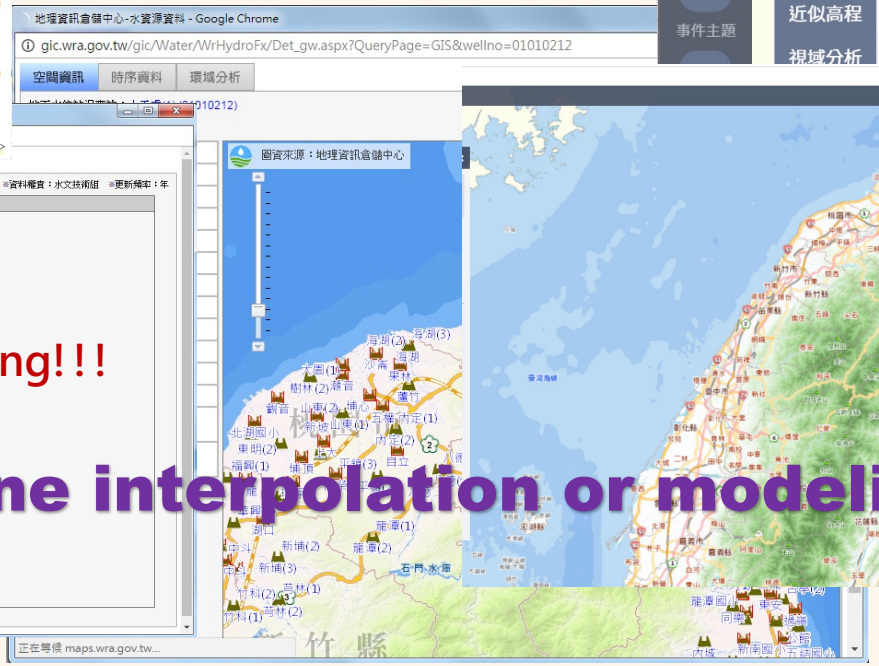
Filtering and data extraction!

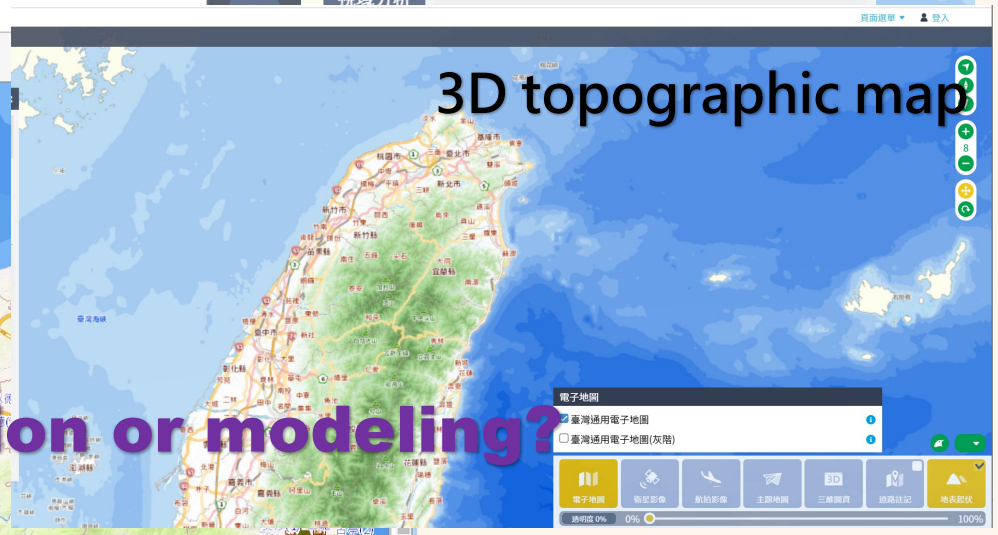


Year Data comparison



Buffering!!!



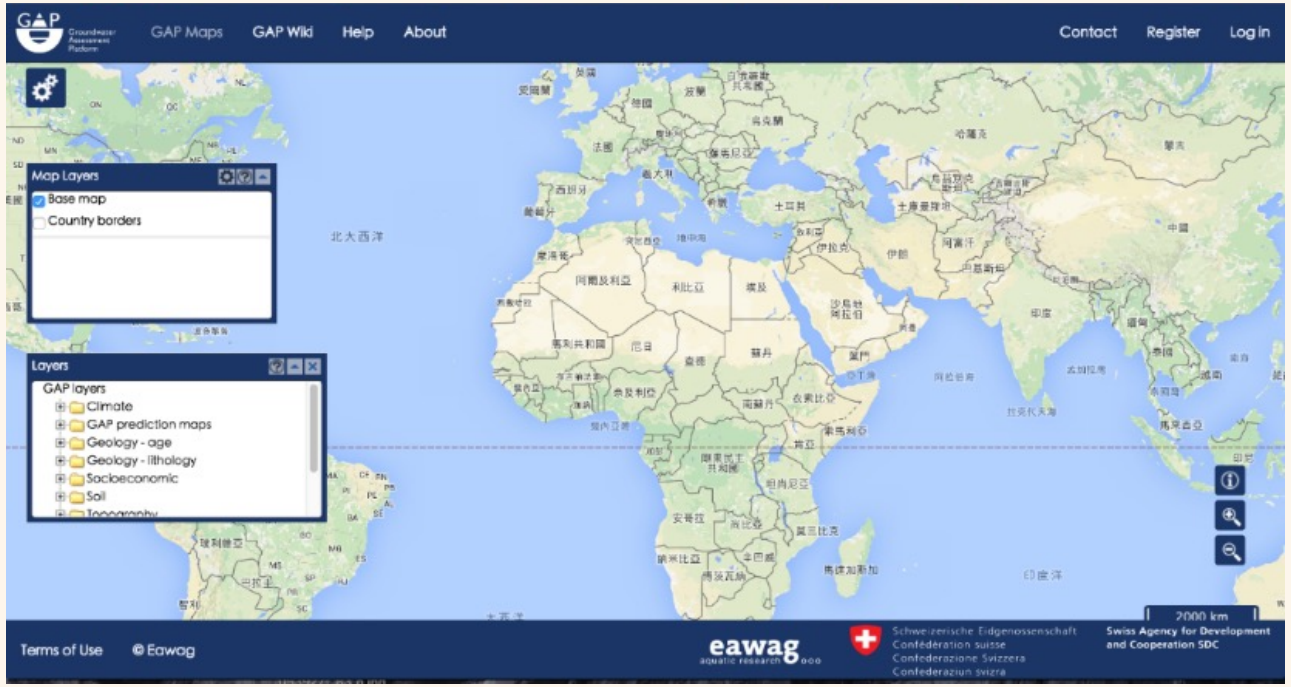


How about online interpolation or modeling?

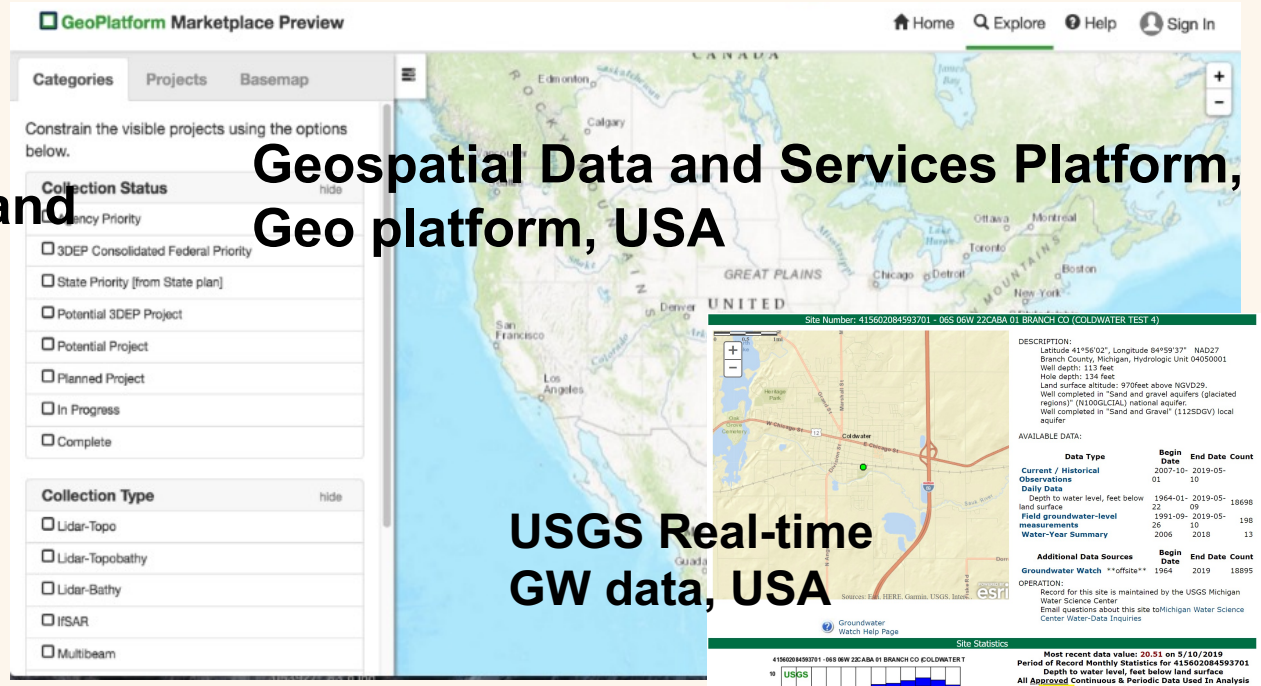
Data source：
http://gic.wra.gov.tw/gic/Water/Space/Main.aspx

Other cases

Groundwater Assessment Platform, GAP, Switzerland

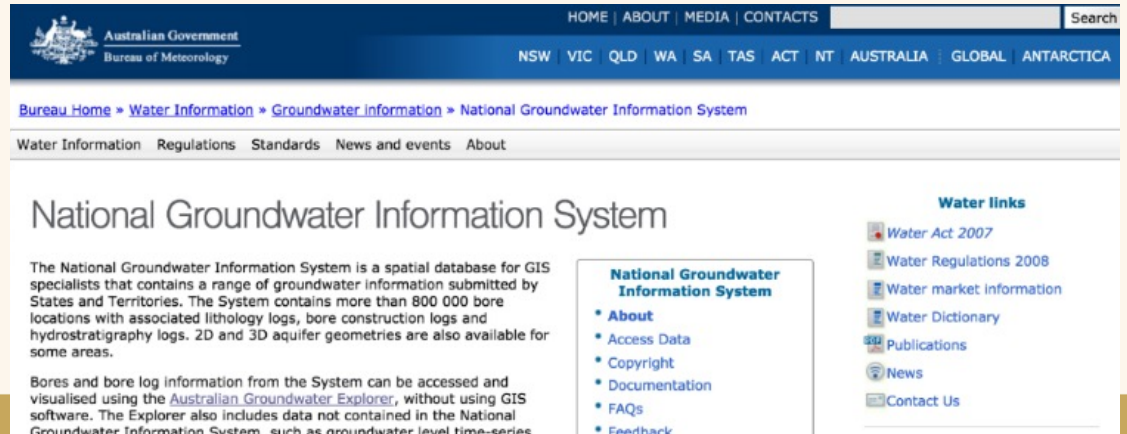


Geospatial Data and Services Platform, Geo platform, USA

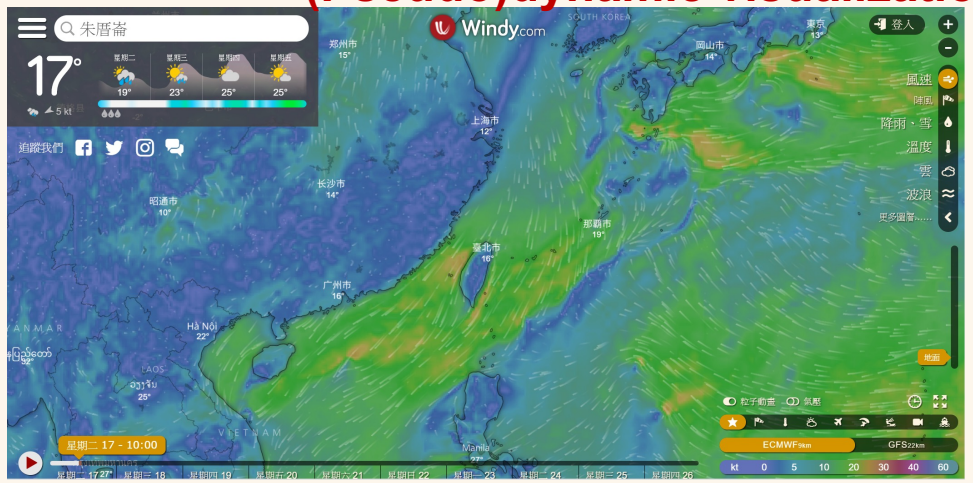


USGS Real-time GW data, USA

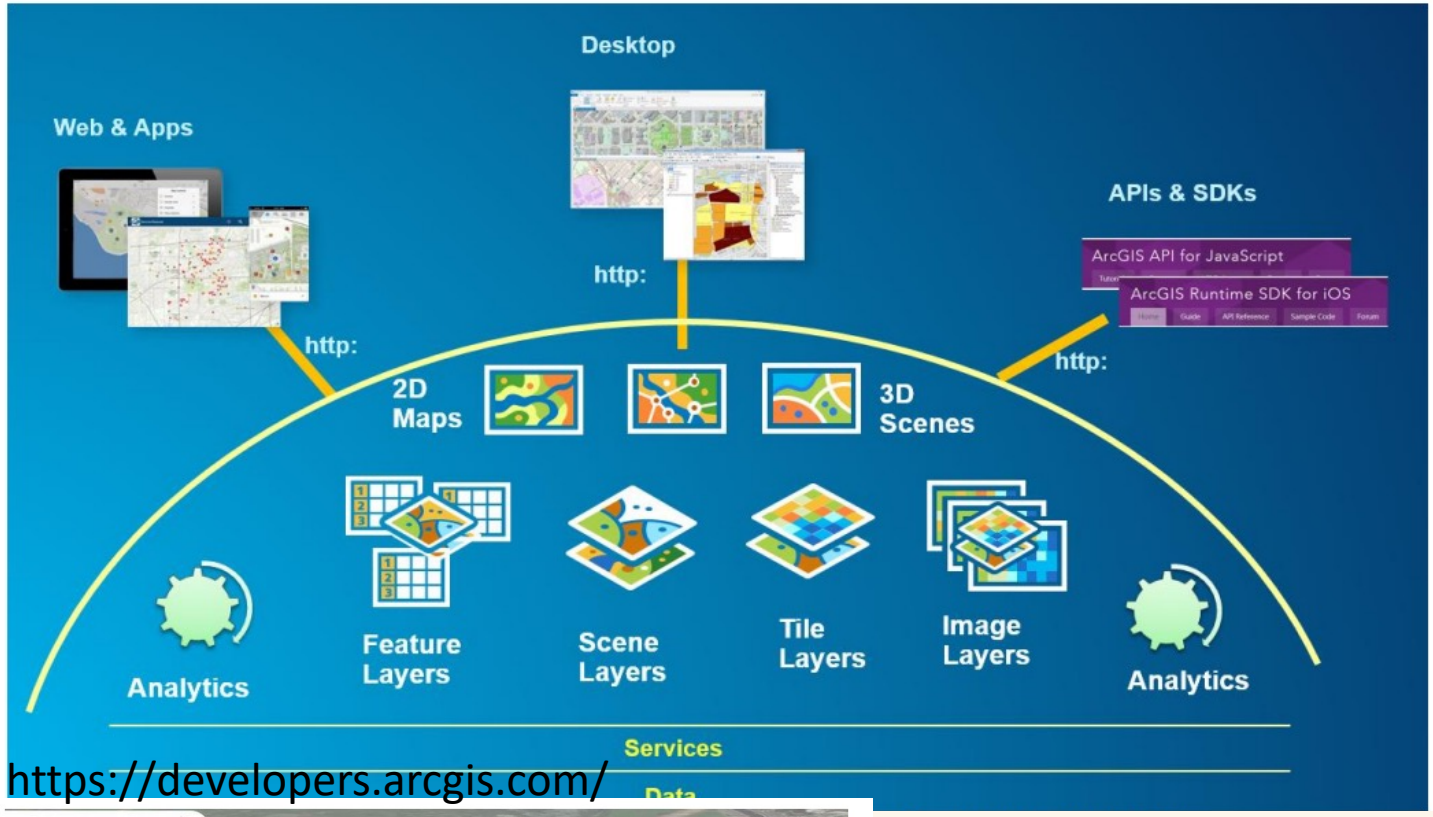
National Groundwater Information System, Australia



Windy.com (Pseudo)dynamic visualization!



Potential Solution for 3D Objects on a Map



https://developers.arcgis.com/

UAV+BIM+3D GIS

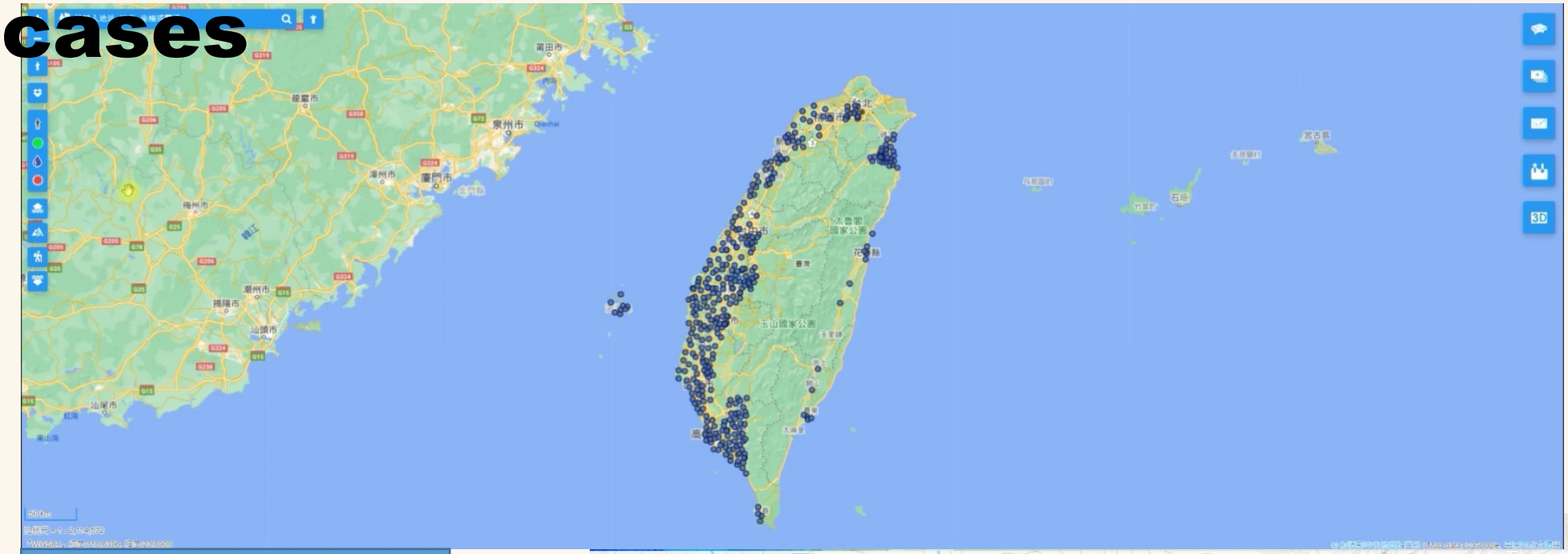
Integration and application of Building Information Modeling (BIM) and 3D GIS, Architecture and building research Institute, MOI, Taiwan

3D scene layers - CityEngine SDK

Realistic 3D Object Scene Layer w/wo textures

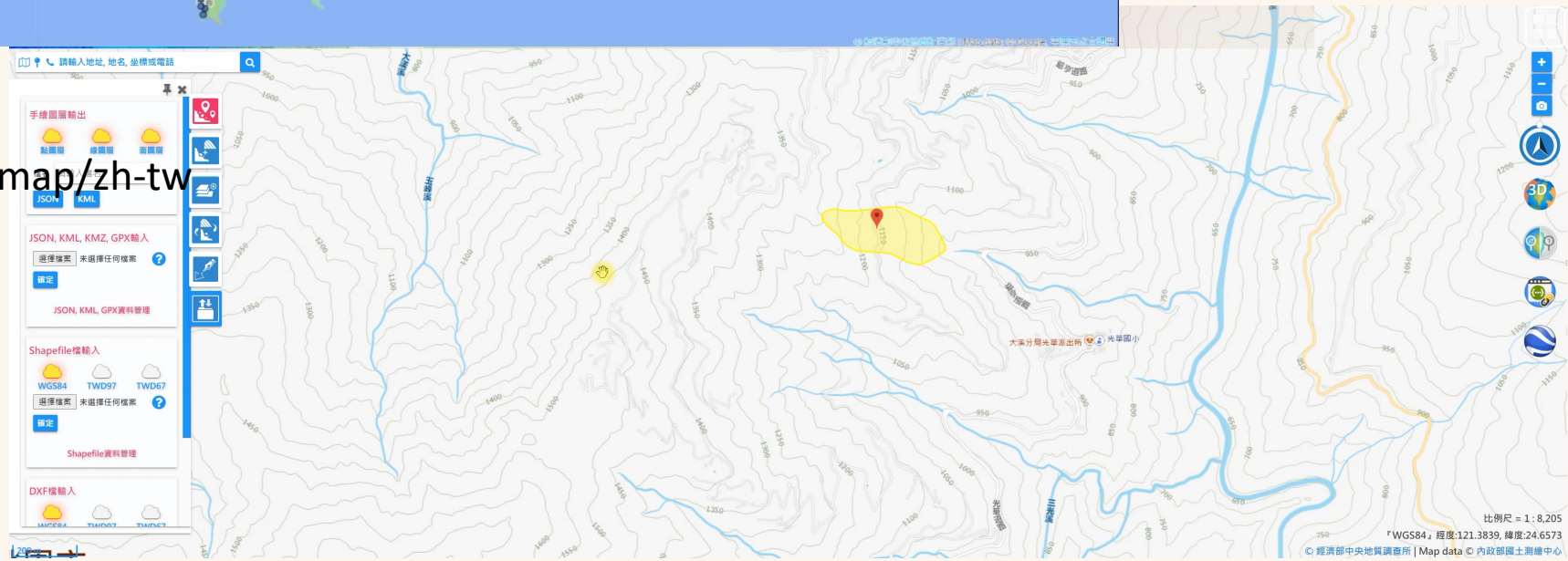
https://github.com/Esri/i3s-spec/blob/master/docs/1.9/3Dobject_ReadMe.md

3D Online, Interactive visualization – Taiwan's cases



Geological data cloud

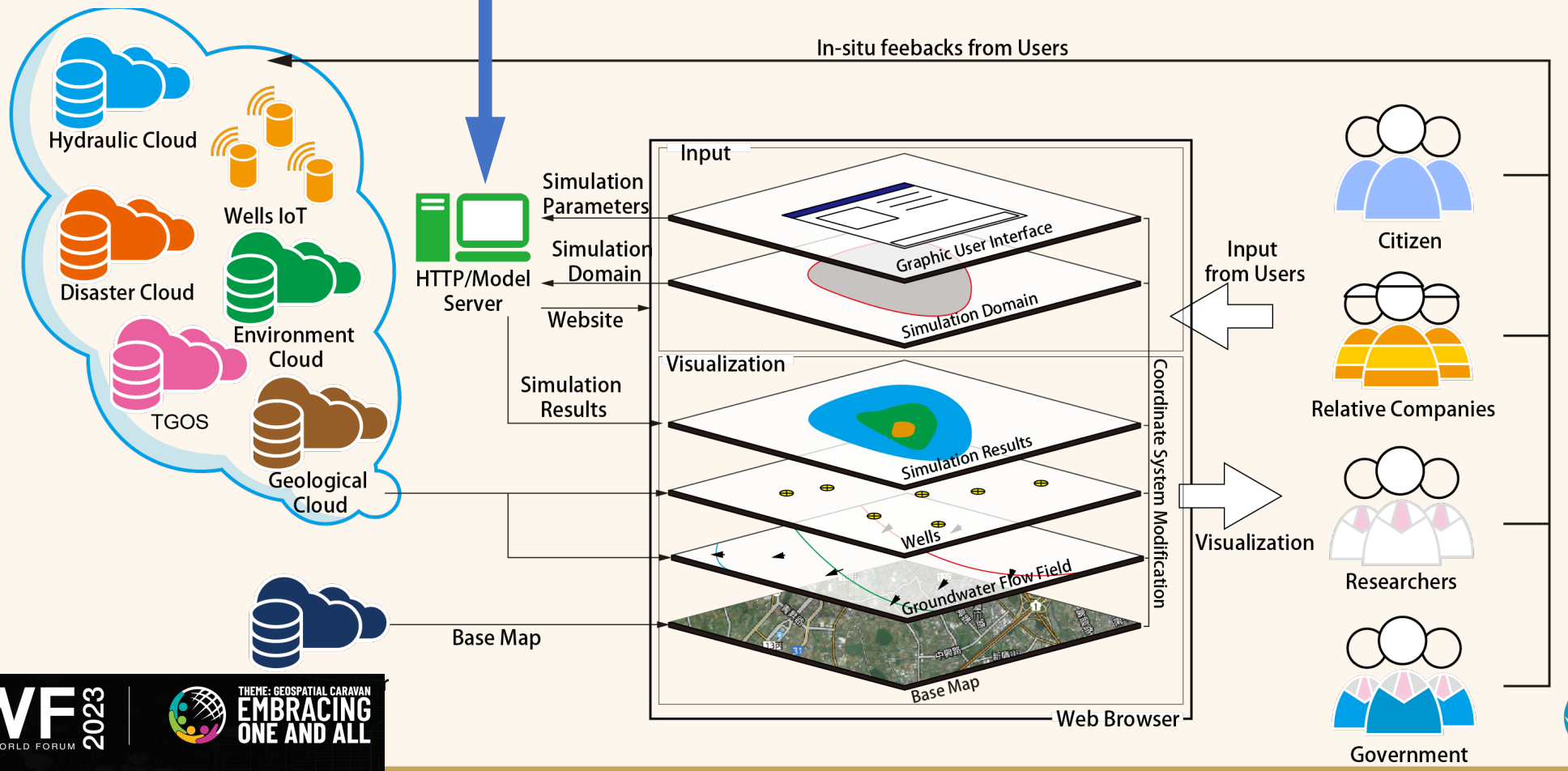
https://landslide.geologycloud.tw/map/zh-tw



Cut an area of the map for a 3D scene

The Idea of Our Web-based Modeling & Visualization Framework

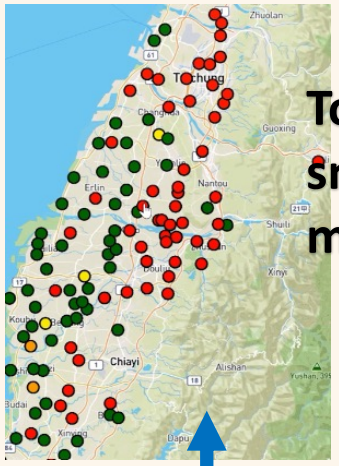
Data format, coordinate system converter, base map.	Output format, coordinate system converter, real-time visualization
Data analysis, particle tracking, mesh generation, discretization, flow and transport models, ML.	UI/UX (2D/3Dvisualization, layer management, file management, security…)



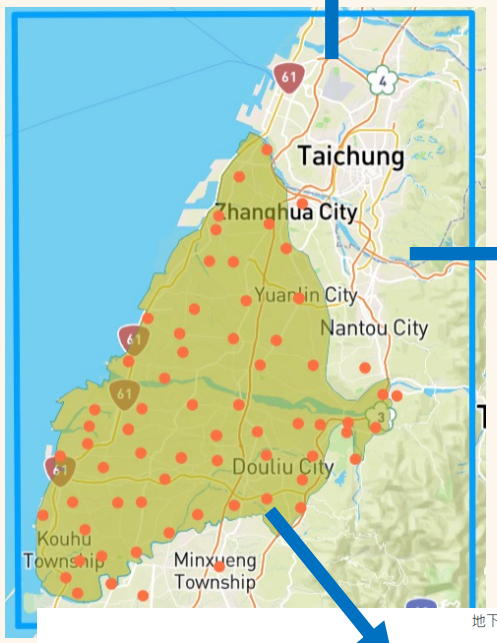
AIoT and more

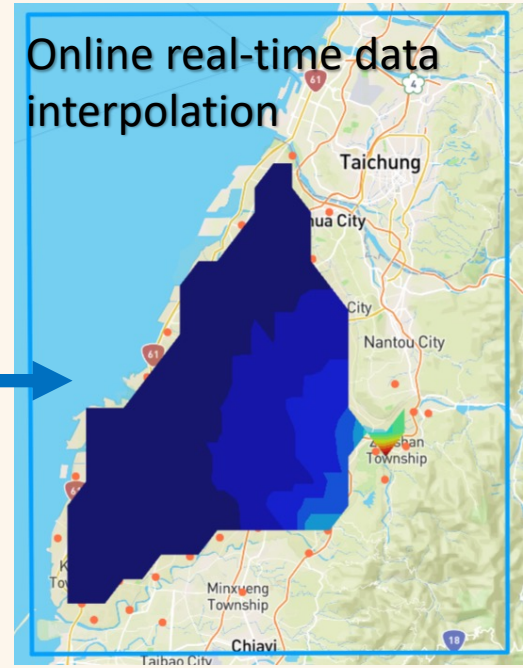
- The platform provides easy access to connect types of IoT devices on a map project.
- Editable functions, user-defined interpolation models, and AI/ML algorithms are available to improve the professional visualization.

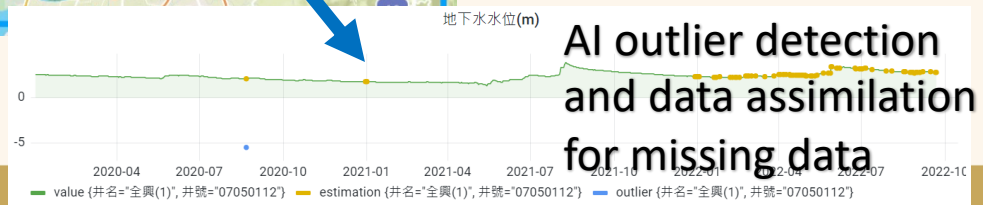
NB-IoT, 3G, 4G..



Total solution for smart monitoring and management





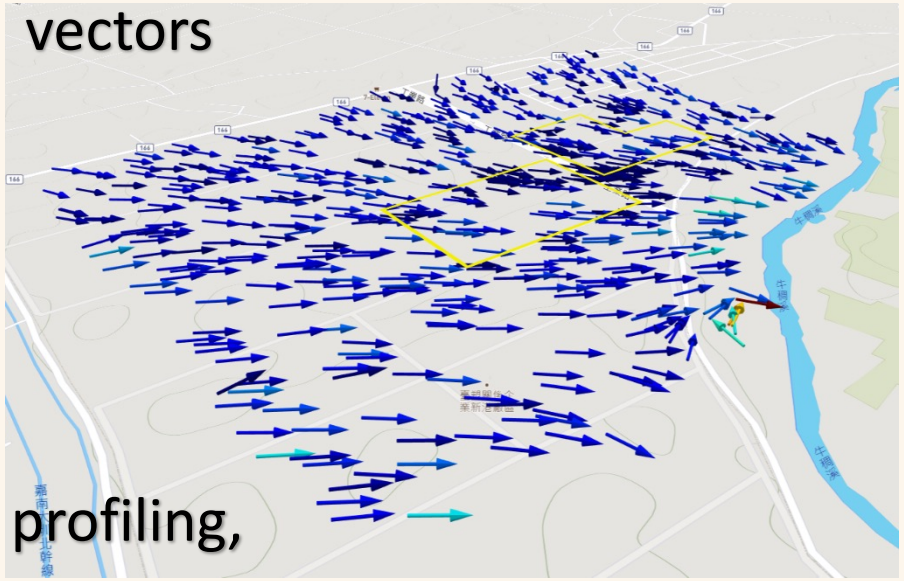


AI outlier detection and data assimilation for missing data

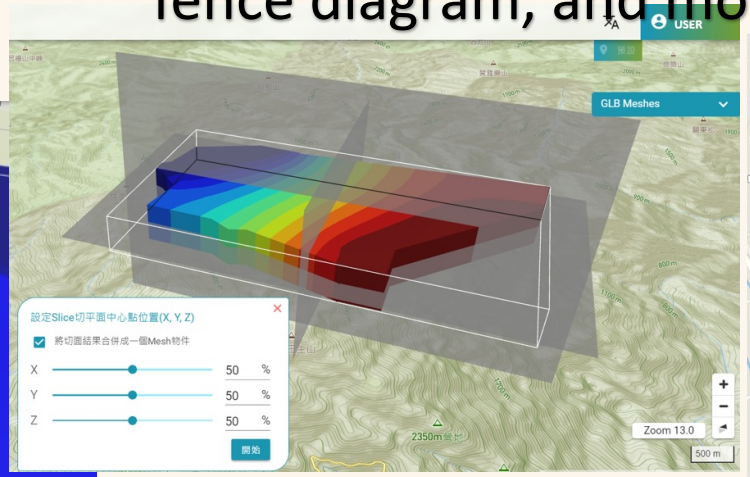
3D map + professional visualization

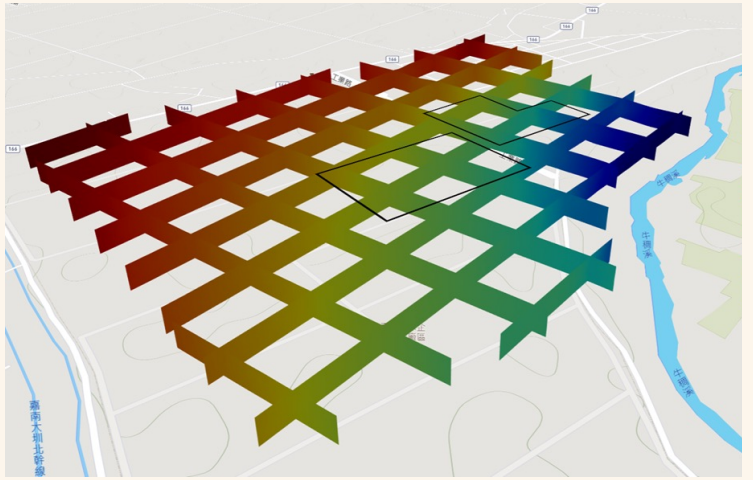
- The advanced 3D interactive visualization modules enable professional presentation for multiple data types on map projects.
- Interactive and professional plotting features make real-time adjustments feasible.

3D high-resolution velocity vectors

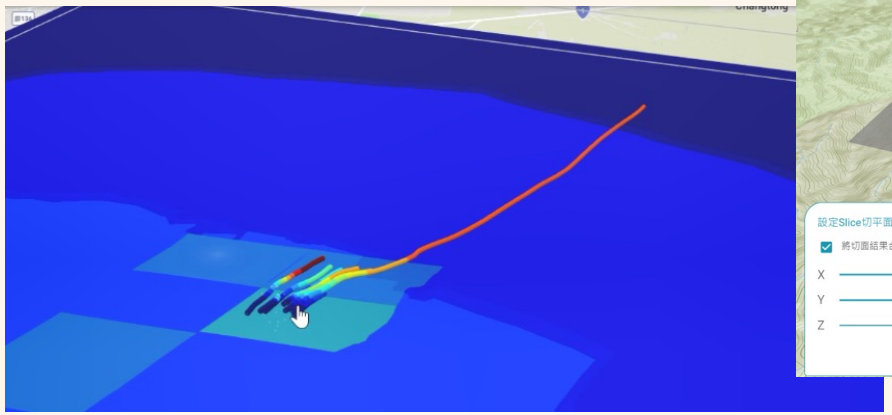


Interactive visualization, profiling, fence diagram, and more

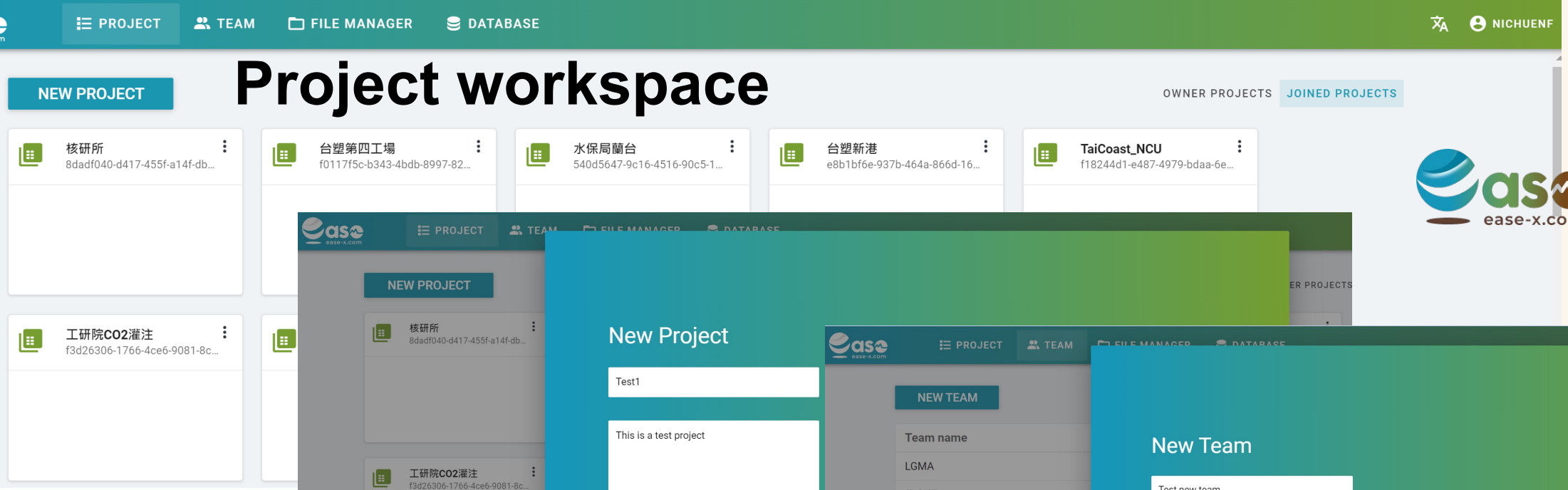




3D particle traces and tubes

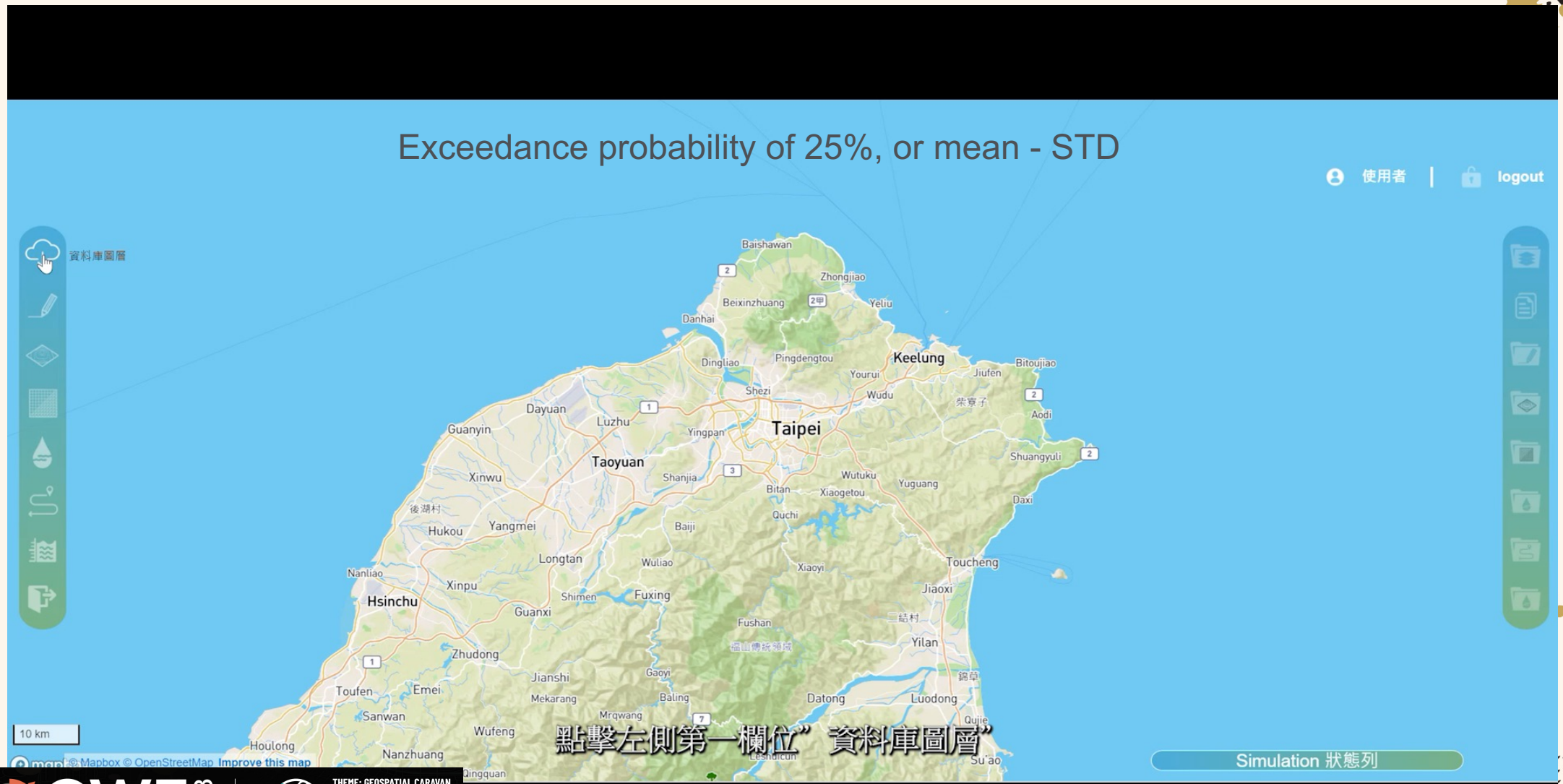


Project workspace

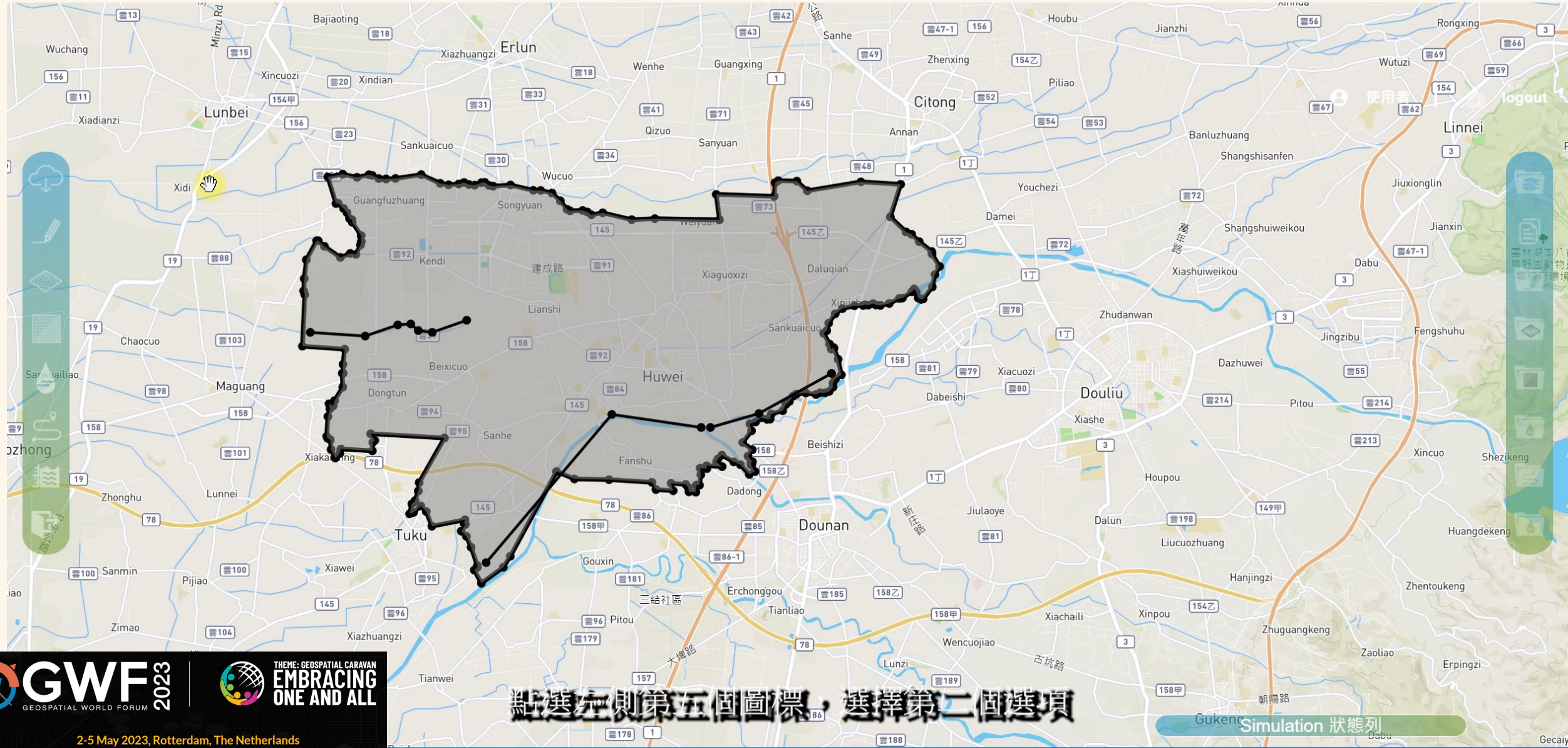


Few clicks to create teams and collaborative projects

Groundwater Management



Online numerical modeling and visualization



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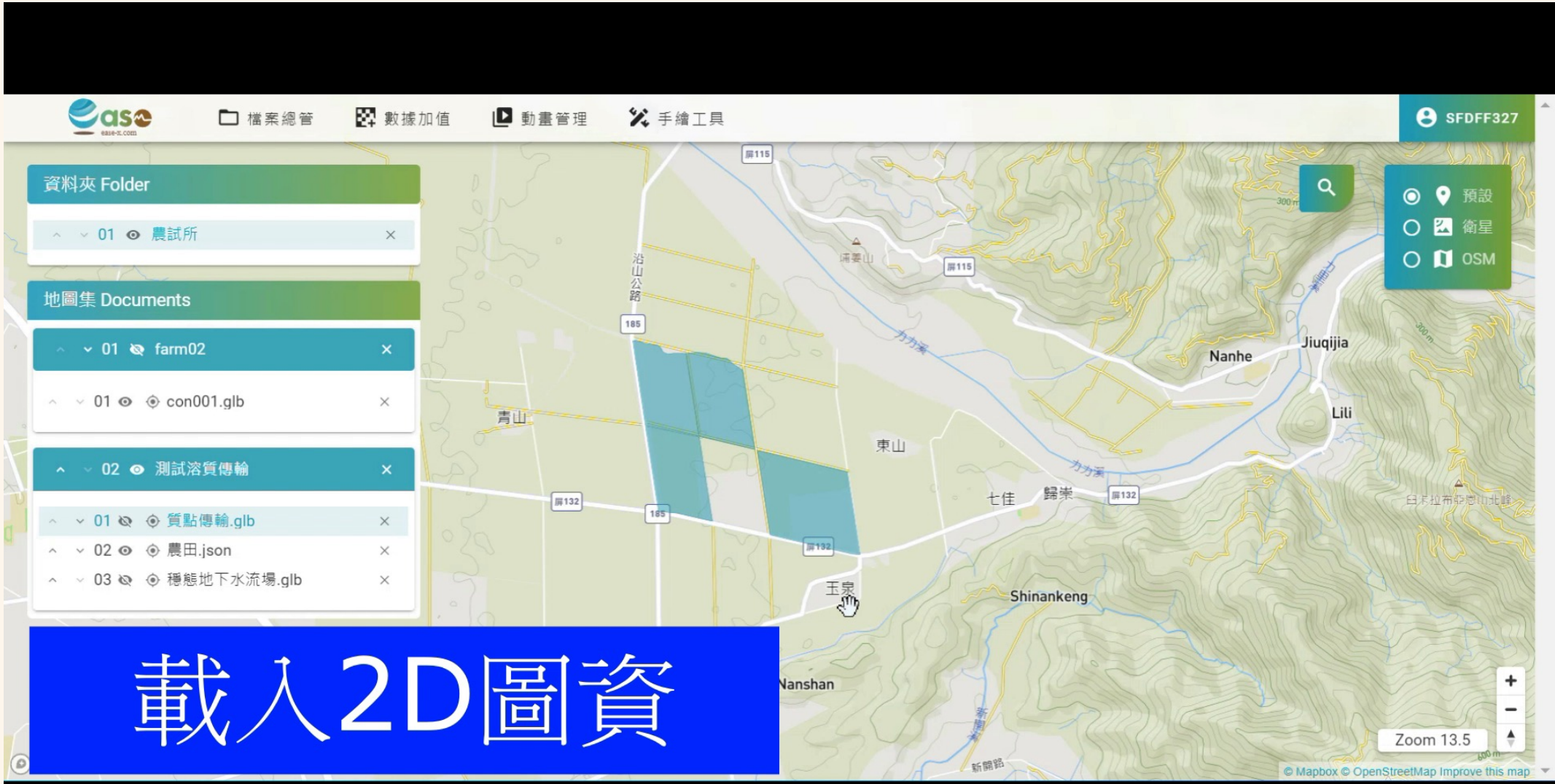
Online pollution tracking



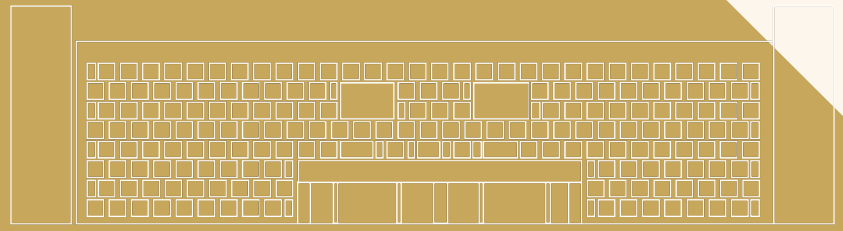
Challenges & Remain issues

- **Technical solutions for** Interactive Map, 3D visualization, 3D mesh/cell, iso-surface…
- 3D physical model, machine learning, IoT-enabled data visualization (time series and animation)
- Data sharing, project workspace for collaboration activities

- **Underground visualization integrated with map**
  → layers vs. 3D

- **3D scenes for real-time interactive visualization, especially for time-varied (transient) simulations**

- **Other fields: surface water, oceanic sciences, air pollution, and geophysical surveys..**



CONTACT/JOIN US

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