



The Digital Twin of the Ocean



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Digital Twins of the Ocean: 2D/3D/4D Microparticle Flow Visualisations

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| Location: | Rome, Italy |
| Date: | 20 th October 2023 |



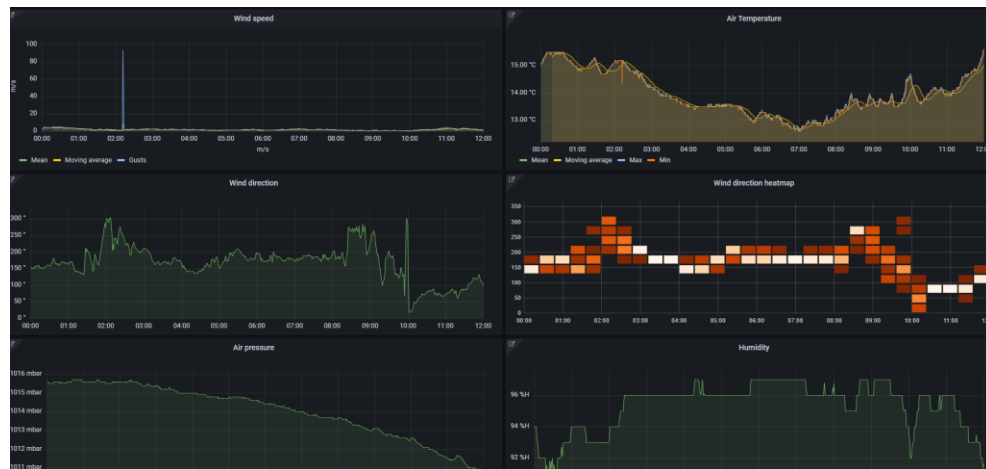
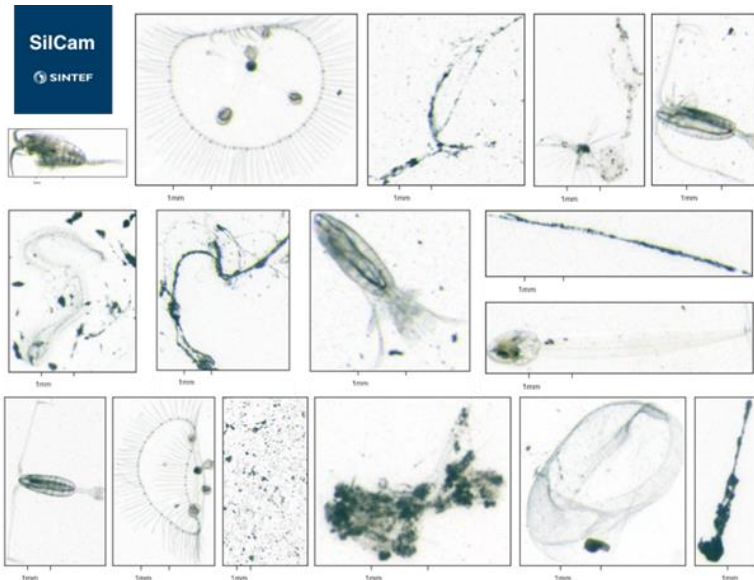
- R&D laboratory
- Game Engines (Unreal Engine, Unity)
- Developers
 - Programmers, Artists, Designers, Producers
- Researchers
- Professors



CRADLE

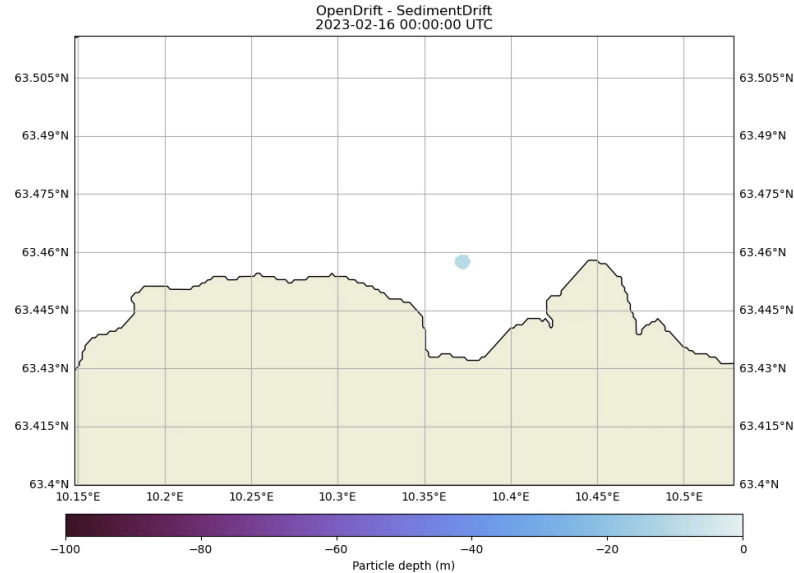
Which data?

- Real Data (from Sensors and Camera)

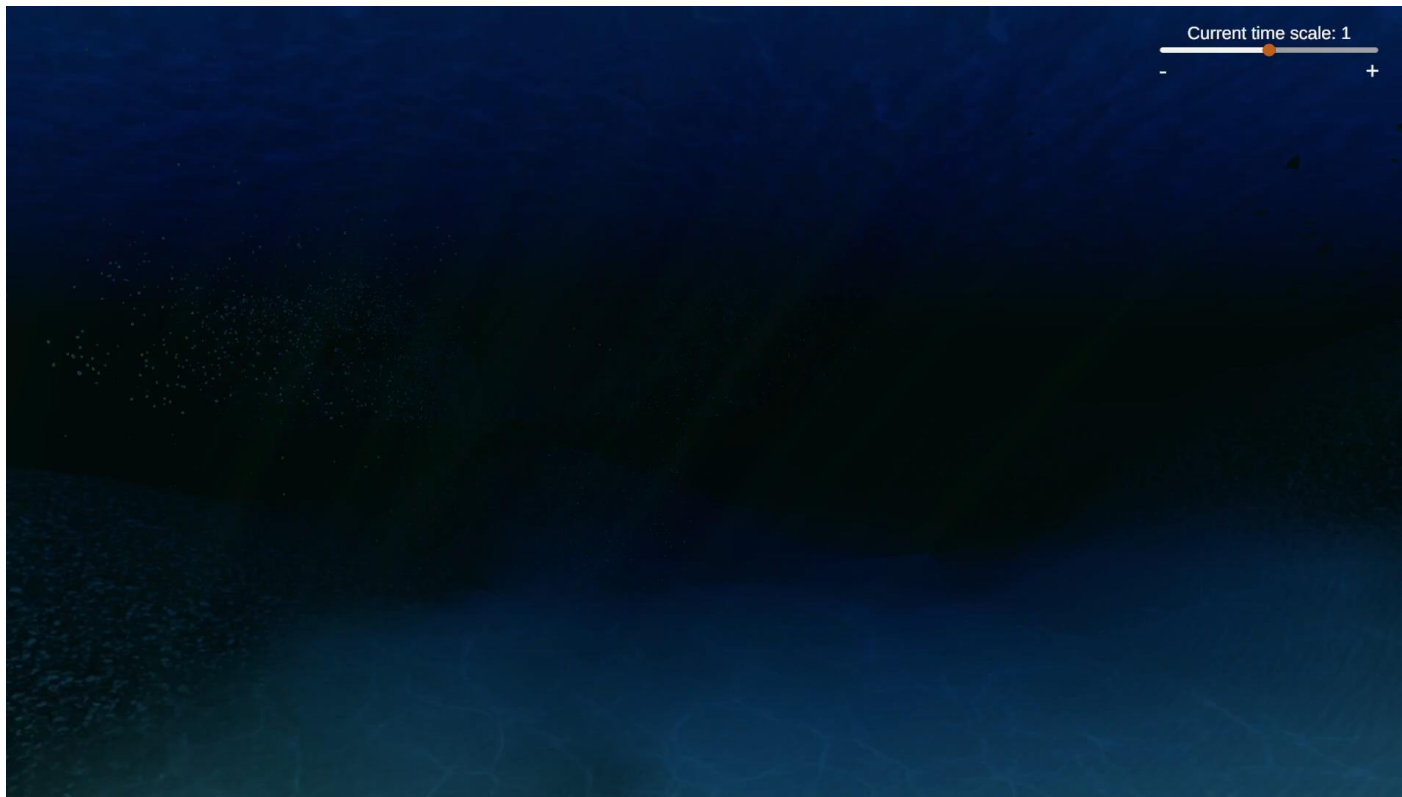


Which data?

- Simulated Data (from OpenDrift simulations)
 - NetCDF format

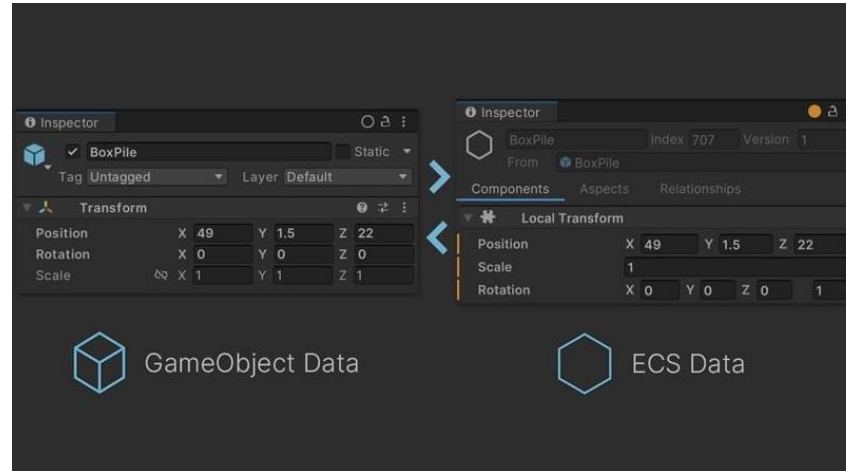


Unity 3D demonstration



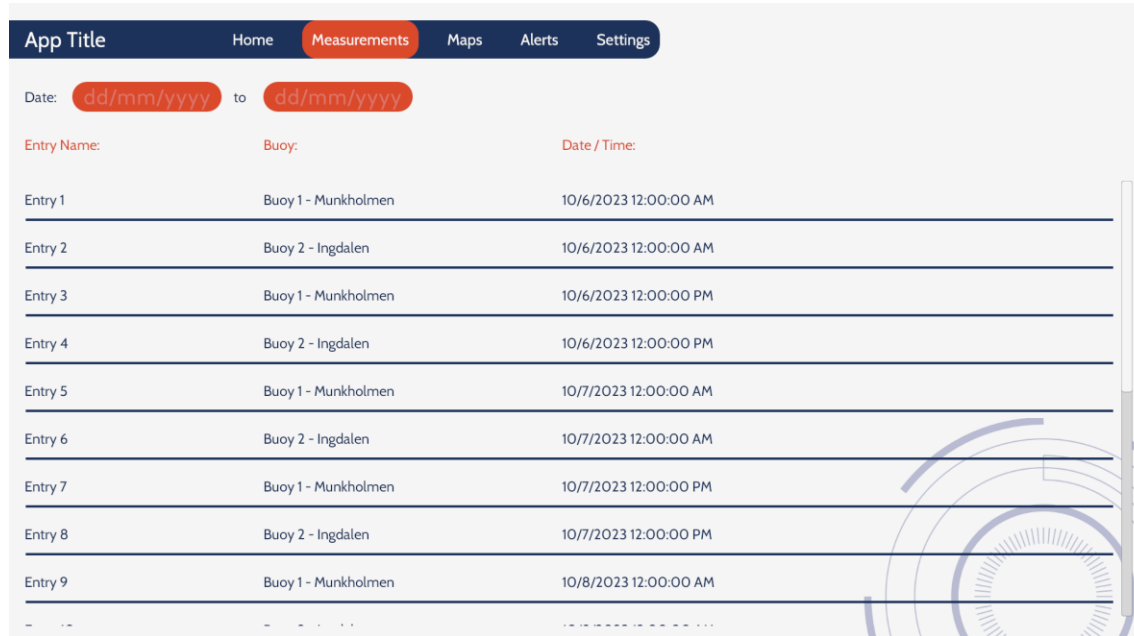
How to represent the data?

- Unity Entity Component System
 - Data-oriented framework, compatible with GameObject system.



Optimized for large-scale simulations.

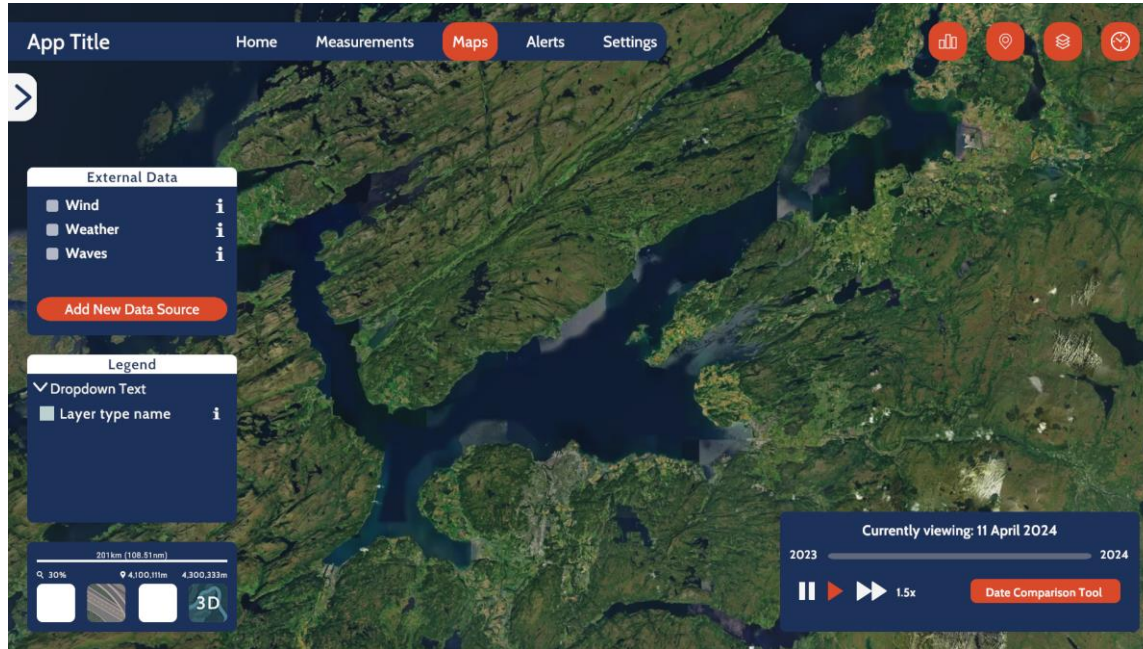
Connection with real data measurement



The screenshot shows the 'Measurements' tab of an application. At the top, there is a navigation bar with 'App Title', 'Home', 'Measurements' (highlighted), 'Maps', 'Alerts', and 'Settings'. Below the navigation bar, there are two date input fields labeled 'Date:' with the format 'dd/mm/yyyy'. The main content is a table with three columns: 'Entry Name', 'Buoy', and 'Date / Time'. The table contains 9 entries, alternating between 'Buoy 1 - Munkholmen' and 'Buoy 2 - Ingdalen' with dates from 10/6/2023 to 10/8/2023. A decorative graphic of concentric circles is visible in the bottom right corner of the table area.

| Entry Name | Buoy | Date / Time |
|------------|---------------------|-----------------------|
| Entry 1 | Buoy 1 - Munkholmen | 10/6/2023 12:00:00 AM |
| Entry 2 | Buoy 2 - Ingdalen | 10/6/2023 12:00:00 AM |
| Entry 3 | Buoy 1 - Munkholmen | 10/6/2023 12:00:00 PM |
| Entry 4 | Buoy 2 - Ingdalen | 10/6/2023 12:00:00 PM |
| Entry 5 | Buoy 1 - Munkholmen | 10/7/2023 12:00:00 AM |
| Entry 6 | Buoy 2 - Ingdalen | 10/7/2023 12:00:00 AM |
| Entry 7 | Buoy 1 - Munkholmen | 10/7/2023 12:00:00 PM |
| Entry 8 | Buoy 2 - Ingdalen | 10/7/2023 12:00:00 PM |
| Entry 9 | Buoy 1 - Munkholmen | 10/8/2023 12:00:00 AM |

External Data visualization



Functionalities



Alerting over simulated and real data

The screenshot displays a web application interface for managing alerts. At the top, a navigation bar includes 'App Title', 'Home', 'Measurements', 'Maps', 'Alerts' (highlighted), and 'Settings'. Below the navigation, a 'Create New Alert' button is visible. The main content area is divided into two sections: 'Real-Time Alerts' and 'Simulated Alerts'. Each section contains a table with columns for 'Alert ID', 'Monitored Variable', and a delete icon. A 'New Alert' modal dialog is open, allowing the user to configure a new alert. The modal includes fields for 'Alert's name', 'Monitored Variable' (set to 'Microplastics'), 'Type of Alert' (with radio buttons for 'Real-Time' and 'Simulated'), and 'Rule's name'. An 'Implement' button is located at the bottom of the modal.

| Real-Time Alerts: | |
|-------------------|---------------|
| Alert 01 | Copepods |
| Alert 02 | Microplastics |

| Simulated Alerts: | |
|-------------------|---------------|
| Alert 01 | Copepods |
| Alert 02 | Microplastics |

New Alert

Alert's name:

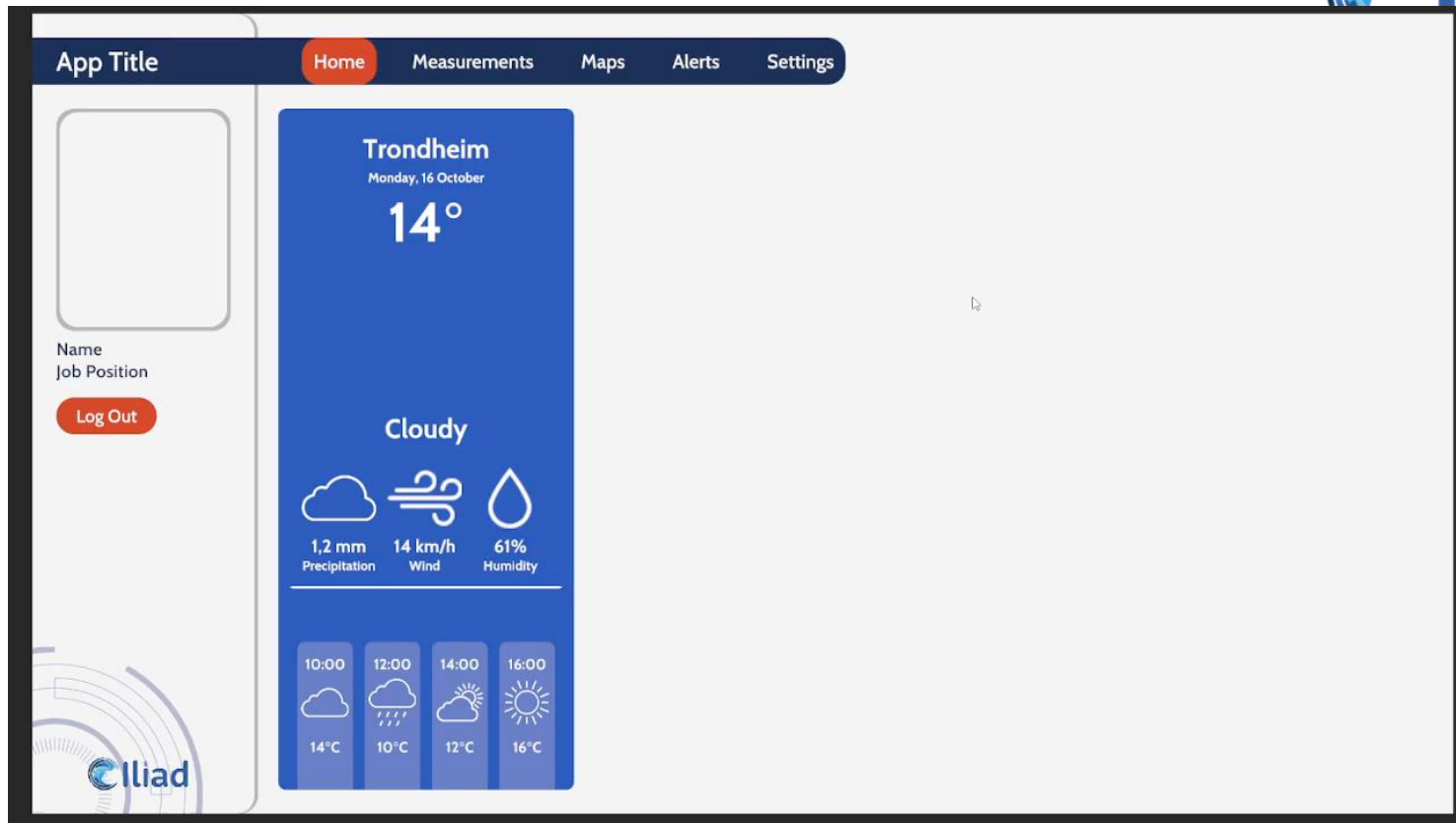
Monitored Variable: Microplastics

Type of Alert: Real-Time Simulated

Rule's name:

Implement

- Abstraction in the representation of microparticles
- Correlation between geographical coordinates and Unity transforms
- Integration of external frameworks
 - Propagation Model (INESC TEC)
 - StreamHandler (Intrasoft)
 - NIMBUS (UAB)



The screenshot displays a mobile application interface with a dark blue header containing navigation tabs: "App Title", "Home" (highlighted in red), "Measurements", "Maps", "Alerts", and "Settings".

The main content area is divided into two columns. The left column features a profile section with a placeholder for a profile picture, the labels "Name" and "Job Position", and a red "Log Out" button. The right column is a weather dashboard for "Trondheim" on "Monday, 16 October", showing a temperature of "14°" and a "Cloudy" condition. Below this, three weather metrics are displayed with icons: "1,2 mm Precipitation", "14 km/h Wind", and "61% Humidity". At the bottom of the dashboard, a four-hour forecast is shown:

| 10:00 | 12:00 | 14:00 | 16:00 |
|-------|-------|-------|-------|
| | | | |
| 14°C | 10°C | 12°C | 16°C |

The Iliad logo is visible in the bottom left corner of the application frame.

Thank you!

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