Connecting the data

A collaborative approach to Geo-data information and environmental digital twins

The importance of environmental digital twins

1 Data-driven Decision-making

Environmental digital twins provide real-time, data-driven insights into conditions and trends. This information empowers decision-makers to make informed choices.

2 Public Awareness and Education

By visualizing and demonstrating environmental processes and challenges in an accessible way, digital twins can raise public awareness and promote environmental education.

3 Regulatory Compliance

Digital twins help organizations comply with evolving environmental regulations by providing tools for monitoring and reporting environmental data accurately.

4 Global Collaboration

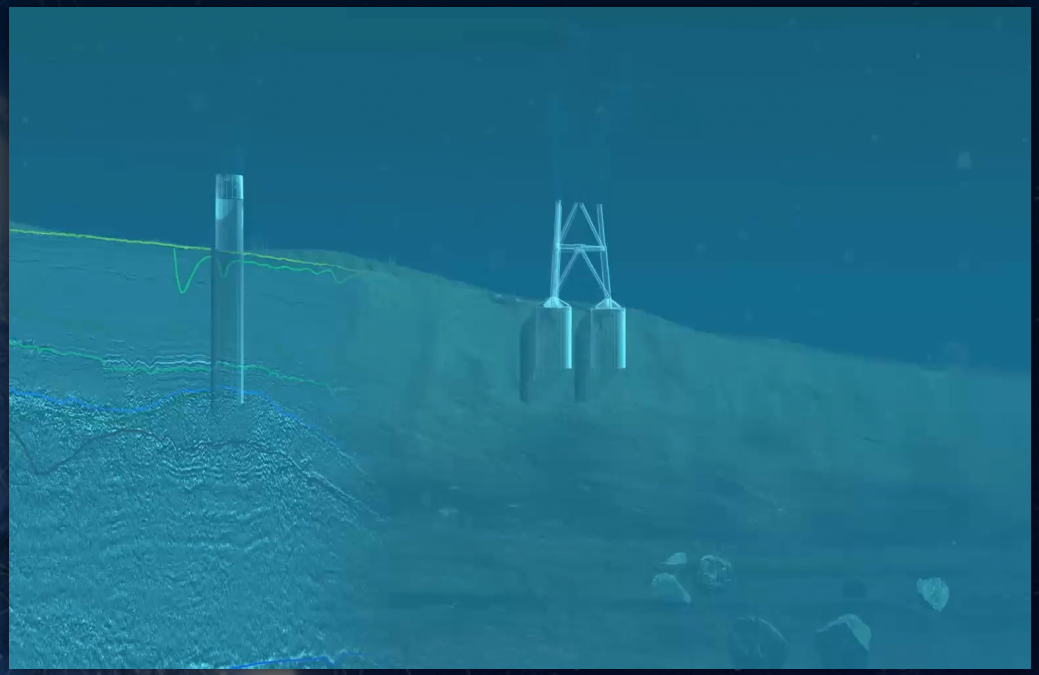
Environmental issues cross borders. Digital twins facilitate global collaboration by providing a common platform for sharing data, models, and best practices.

FUGRO

What is an environmental digital twin?

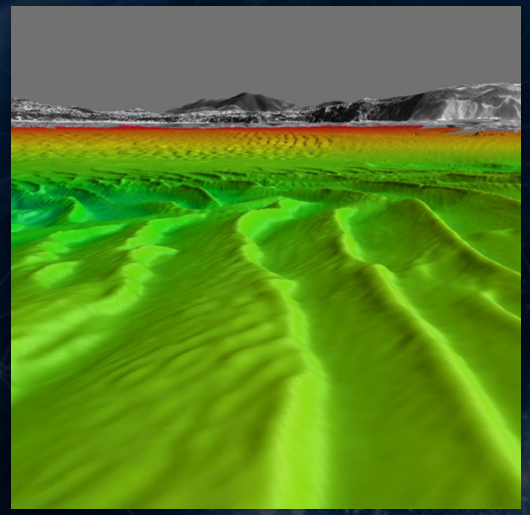
Environmental digital twins are virtual replicas of physical environments or ecosystems that aim to replicate the behavior or processes of the real-world in a virtual or digital format.

This model can be used to simulate potential changes, test interventions, and develop sustainable solutions. An example of this is a digital twin of the ocean (DITTO)

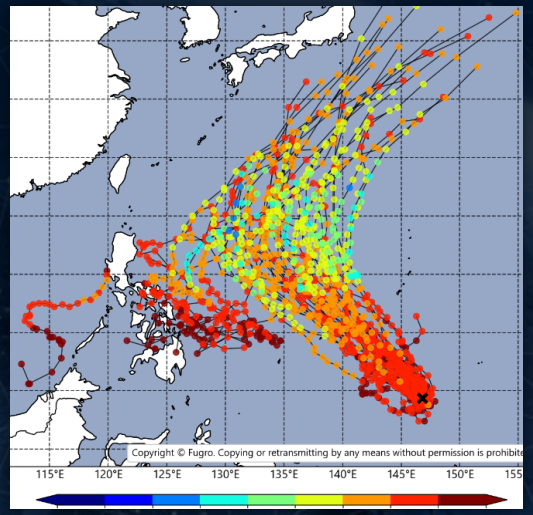


Working toward a Digital Twin of The Ocean (DITTO)

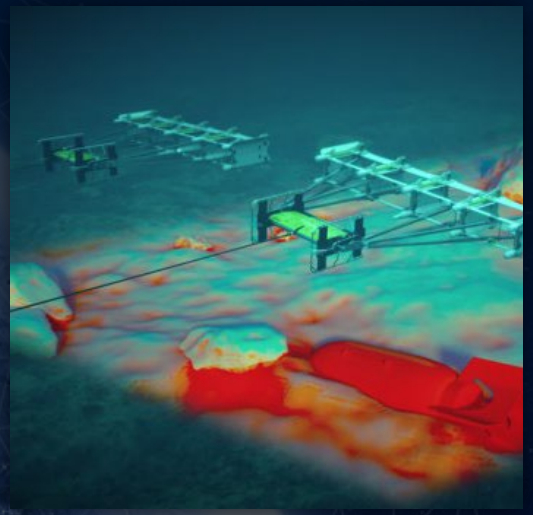
Measuring the four ocean dimensions



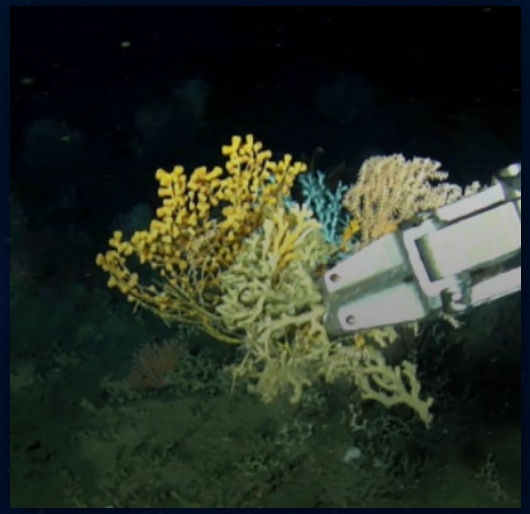
The space (3D)



The processes (4D)



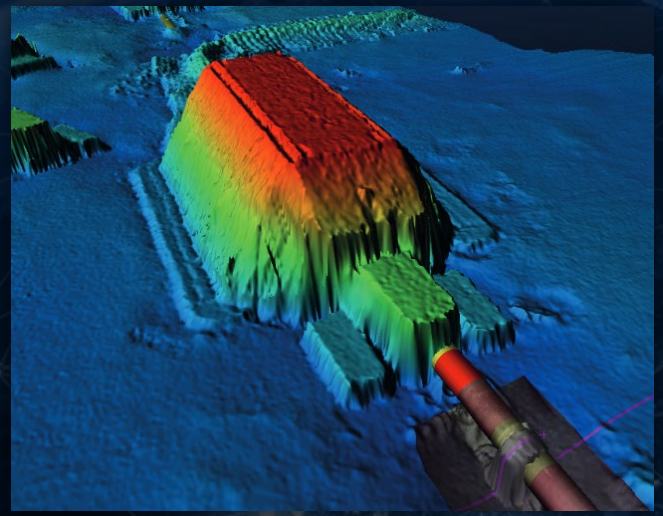
The sub-seabed



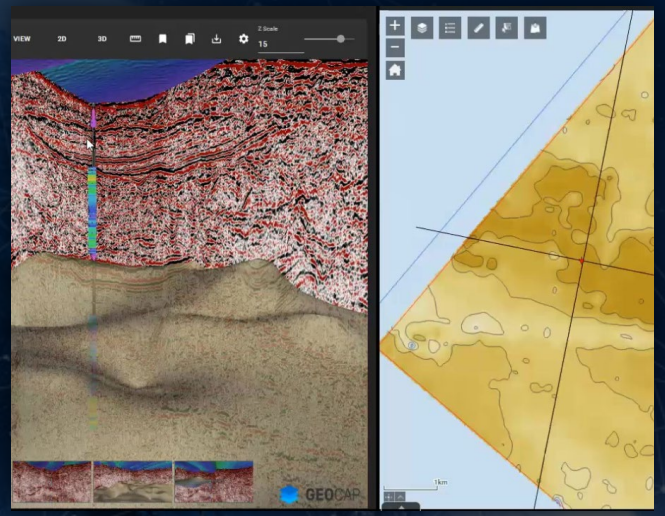
The living ocean (ecosystems)

Working toward a Digital Twin of The Ocean (DITTO)

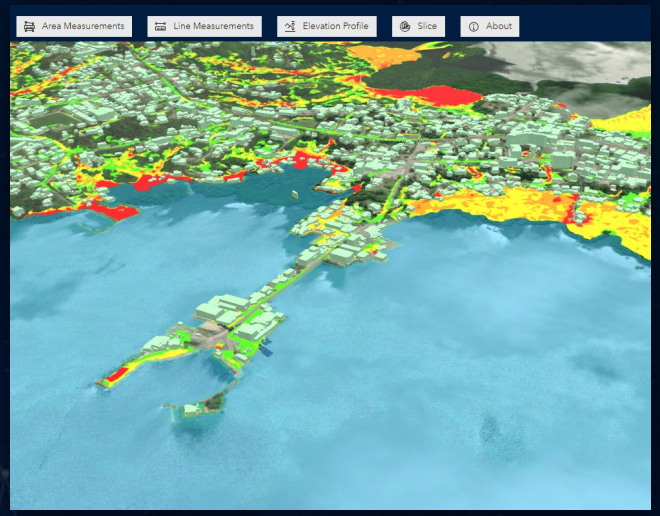
Connecting existing technologies to support sustainable oceans



Oil And Gas



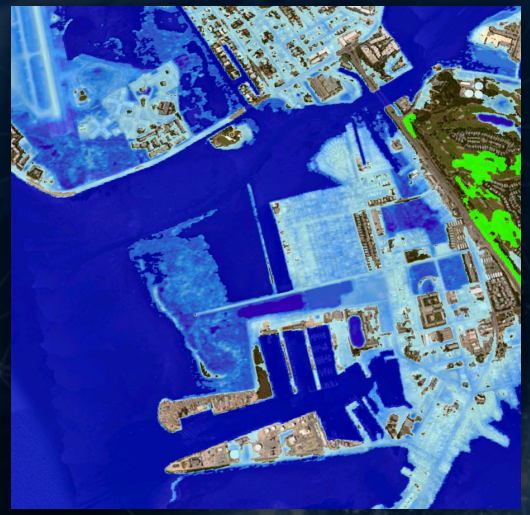
Offshore Wind



Coastal Resilience

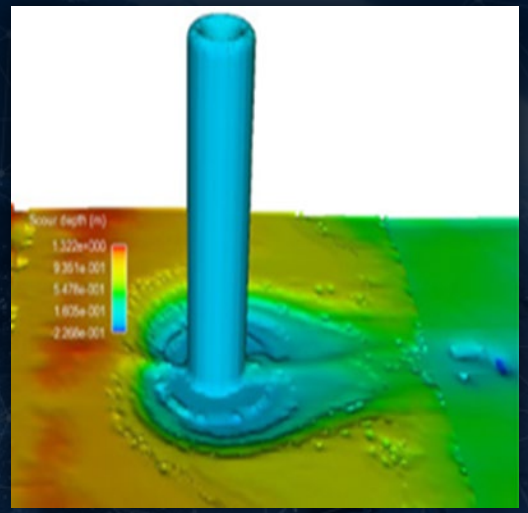
Working toward a Digital Twin of The Ocean (DITTO)

Building sustainable oceans with Integrated Geo-insights



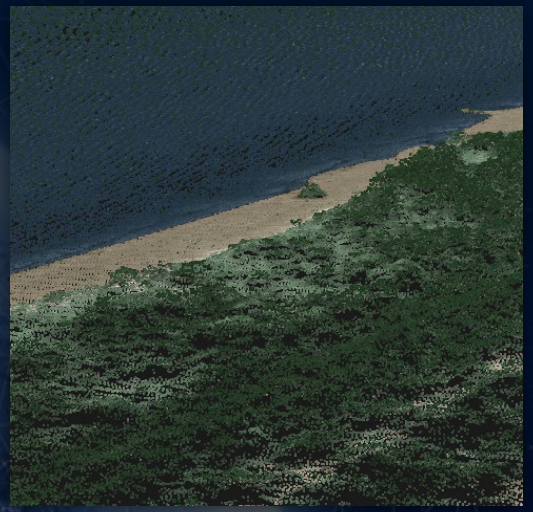
Ocean simulation models (SIM)

Understanding marine processes and its impacts



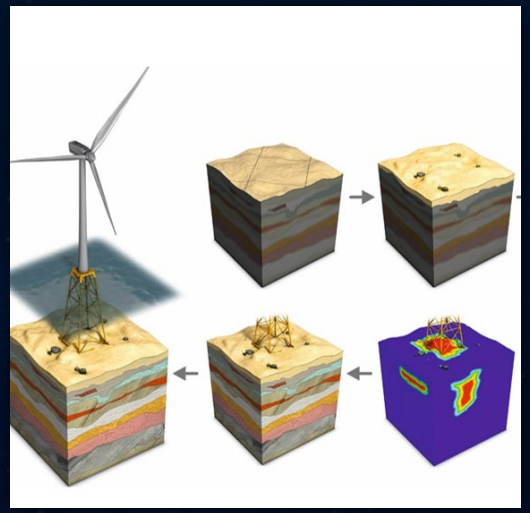
Building information models (BIM)

Organizing Geo-data over time to provide insights about marine and coastal infrastructure



Natural environment information models (NIM)

Organizing Geo-data over time to provide insights about marine and coastal ecosystems



Ground information models (GIM)

Organizing Geo-data over time to provide insights about ground conditions / behaviour

FUGRO

Working toward a Digital Twin of The Ocean (DITTO)

Challenges of Creating and Maintaining an Evolving Digital Twin

1 **Data Quality and Integration**

Obtaining high-quality data efficiently across multiple systems can be challenging, while the added integration of data on the digital twin requires significant expertise.

2 **Hardware Limitations**

Real-time simulation of large assets can place significant demand on hardware and cloud infrastructures while still requiring a minimum level of accuracy.

3 **Data Security and Privacy Concerns**

Due to large amounts of data flowing between the physical and digital worlds, protecting and securing sensitive data becomes crucial.

FUGRO

Geo-data Framework

Geospatial Core

Centralized Geo-data Management

Geo-data Visualization

Geo-data Integration

Geo-data Interpretation

Applied-Use Case Modules

Permitting Optimization → Optimizing permitting process by increasing efficiency and providing assessment analyses

Foundation Design Simulation → Simulated foundation concepts derived from integrated earth models to aid in the engineering design of optimal foundations

Routing Simulation → Simulating behavior of potential cable routes in their surroundings and therefore reducing risk and finding best cable route

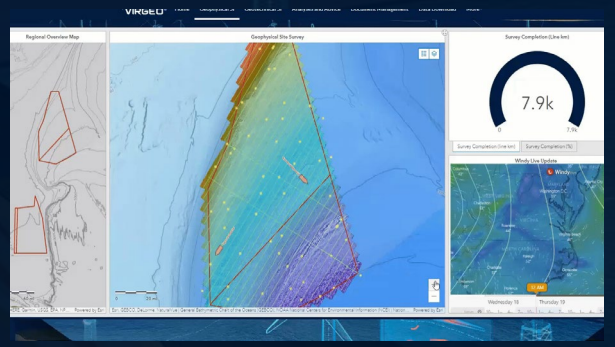
Coastal Adaptation Simulation → Improving asset design, decreasing risk and optimizing geo-monitoring efforts through hazard modeling of potential coastal risks to enabling early warning systems and coastal adaptation plans

Potential Site Identification → Supporting governments in selecting a plot and/or developers in reducing uncertainty regarding their bid by using existing Geo-data

Acquisition Survey Tracking → Near real-time access to Geo-data survey progress and results

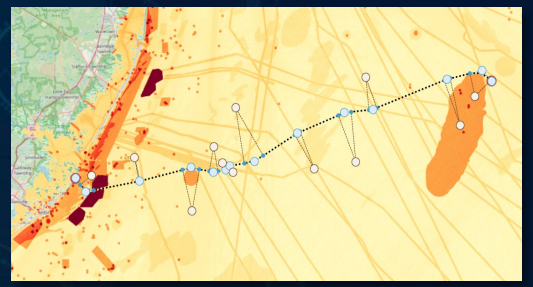
FUGRO

Applied Use Case Examples



Routing Simulation

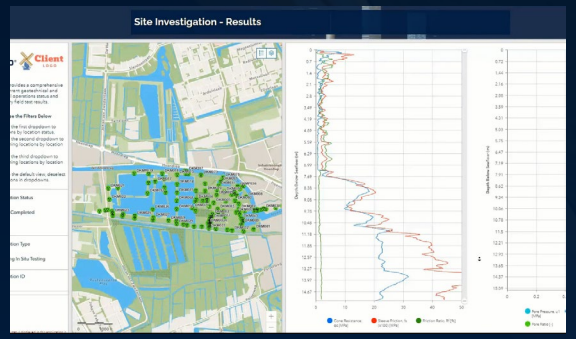
Automated tool that incorporates constraints into its primary algorithms for the development of least-cost routing.



Acquisition Survey Tracking

Preliminary processed results

Collaboration dashboards provide rapid access to field data supporting optimized field acquisition and accelerating project decisions.



Potential Site Identification

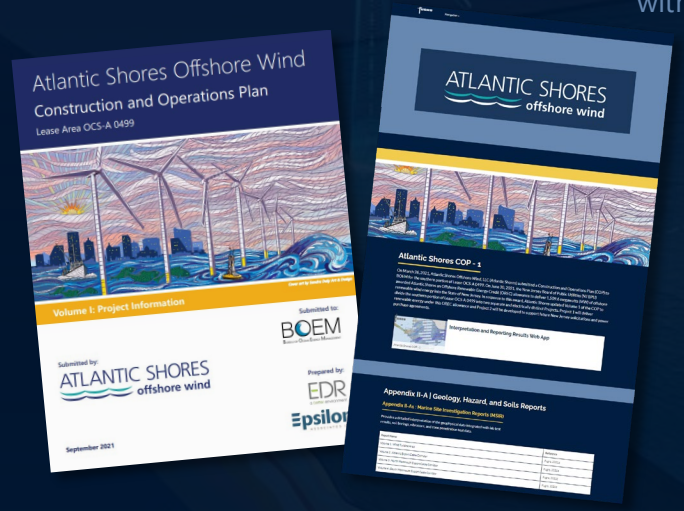
Early-stage insights and planning tools utilizing interactive geospatial elements

Digital desktop studies allow site interrogation without mining and aggregating Geo-data in house.

Applied Use Case Examples

Optimized Permitting Discussions/Decisions

Digital deliverables supplementary to hard copy submissions support inter-agency discussions/decisions with collaborative analysis.



3D Ground Modelling Visualization
Automapping and Feature Detection
Temporal Analysis and Predictive Modelling

Time-enabled imagery for visual playback of change over time. Effective for sediment mobility and scour condition studies.