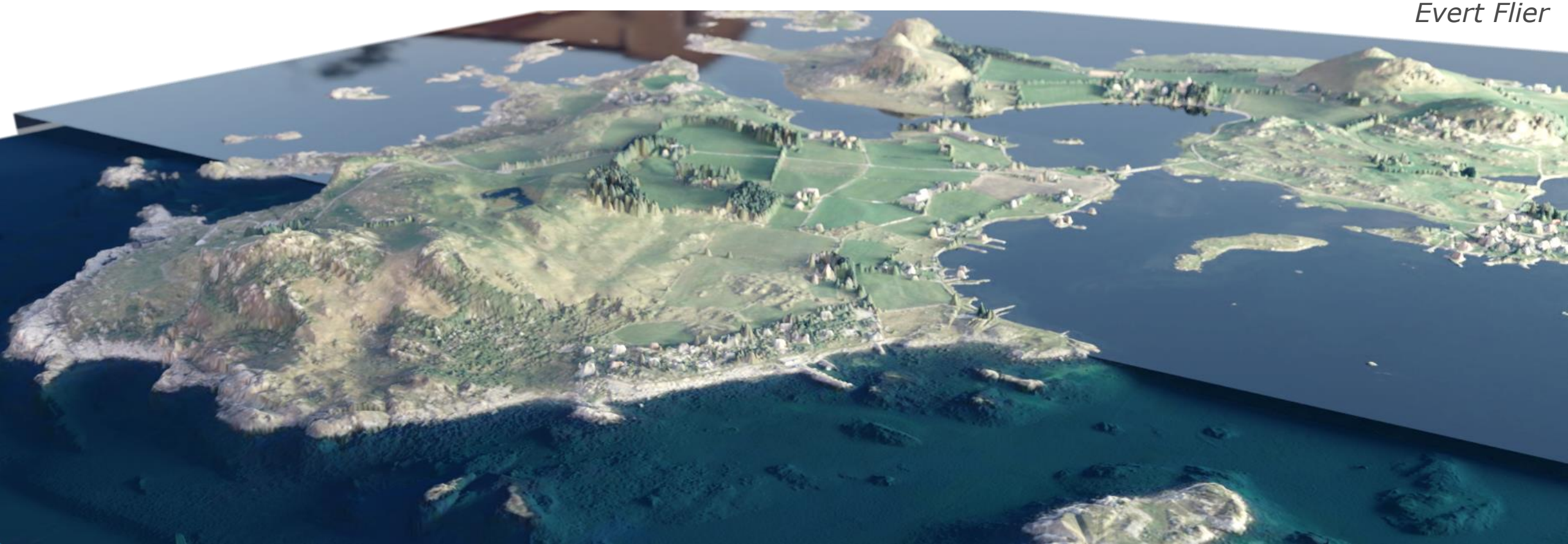
Kartverket

Survey technology developments in Norway

ARHC11

Evert Flier



Marine Base Maps for the Coastal Zone, Norway

No: Marine grunnkart i kystsonen

- The *Marine Base Maps for the Coastal Zone, Norway* project was officially announced October 2019.
- 3 years duration as a pilot project, focusing on three locations along the coast.
- .. then hopefully established as a program in 2023.
- The Norwegian Hydrographic Service (NHS) leads the pilot.
- Partners:
  - Geological Survey of Norway (NGU)
  - Institute of Marine Research (HI)

https://www.kartverket.no/en/Prosjekter/marine-grunnkart-i-kystsonen/

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Marine Base Maps for the Coastal Zone, Norway

No: Marine grunnkart i kystsonen

A Marine Basemaps program will depend on new sensors and platforms. As well as software that allows us to process and distribute data more efficient.

- Data will be acquired with several areas of use in mind. Historically the NHS collect data *primarily* to serve as a basis for nautical charts.
- Surveying shallow areas and the shoreline will have a much higher priority.
- Shorter duration from data collection to distribution.

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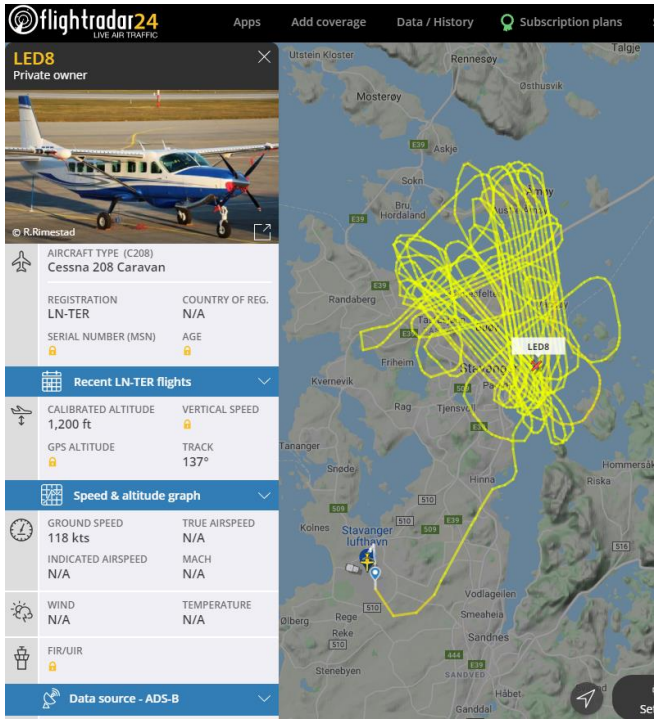
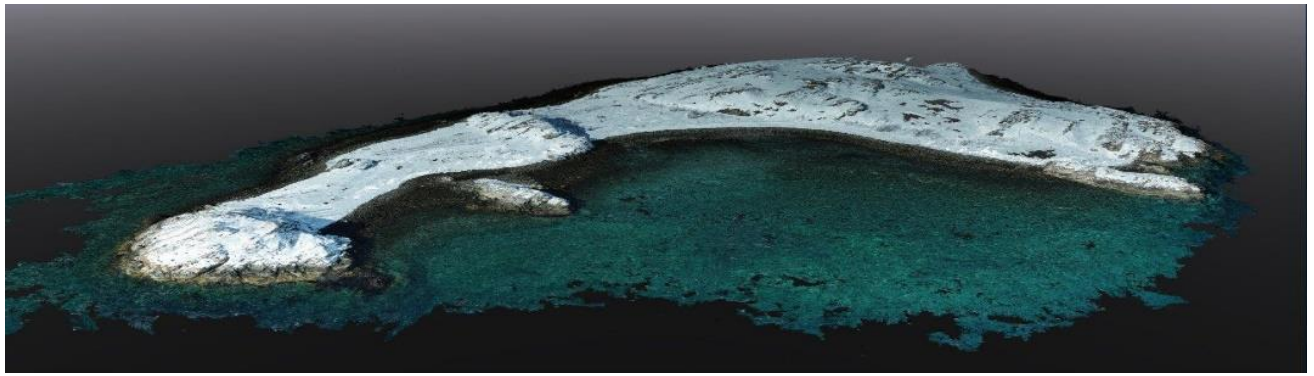
Shallow water activities in 2020-21





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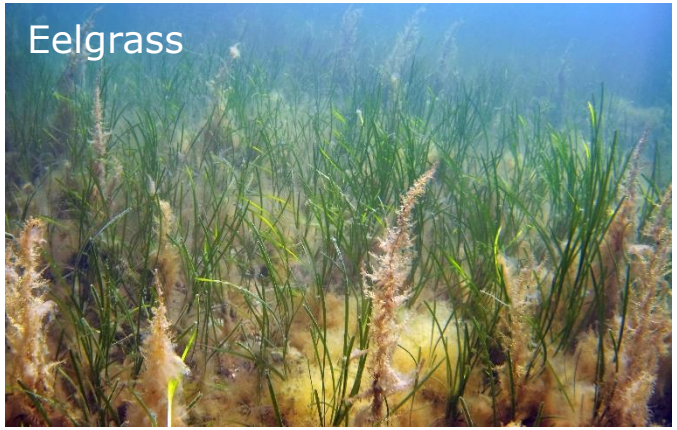
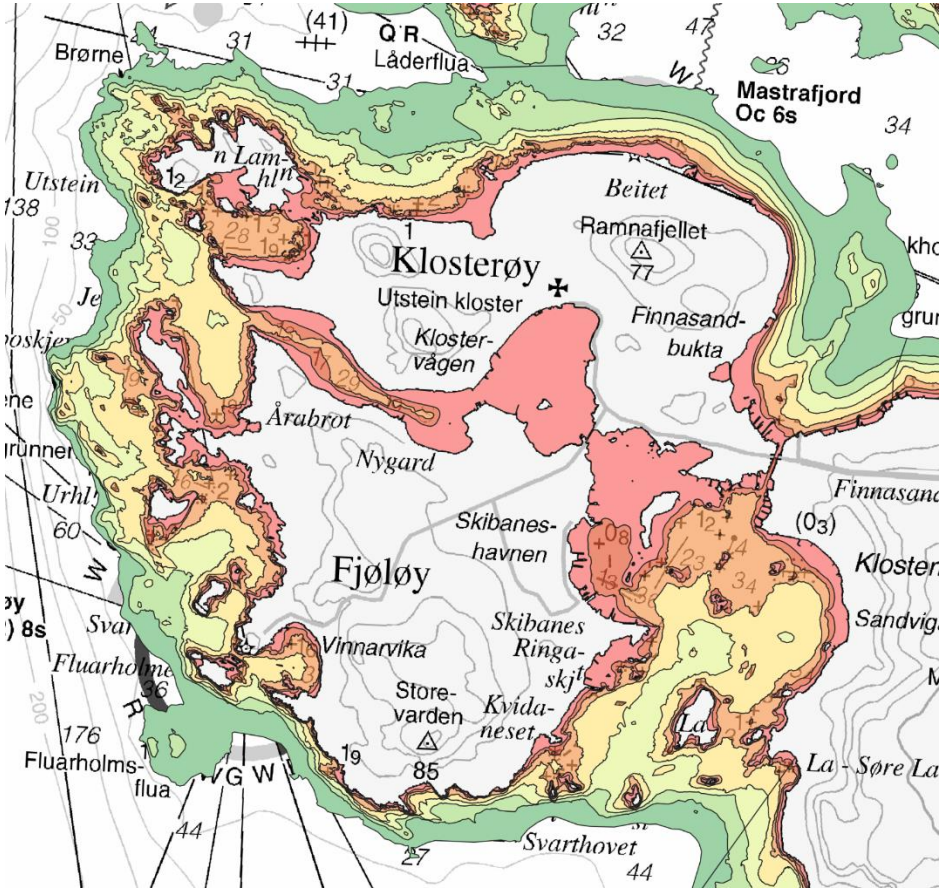
The Fjøløy test site

- Developed for testing sensors and platforms suitable for shallow water surveying.
- Declassified 0-30 meters (until 2022).
- Both sheltered and exposed areas.
- Big variation in types of seabed and marine vegetation, representative for conditions along the Norwegian coast. These conditions can be tricky for all kinds of sensors and platforms.
- Examples from ROV footage from the site:





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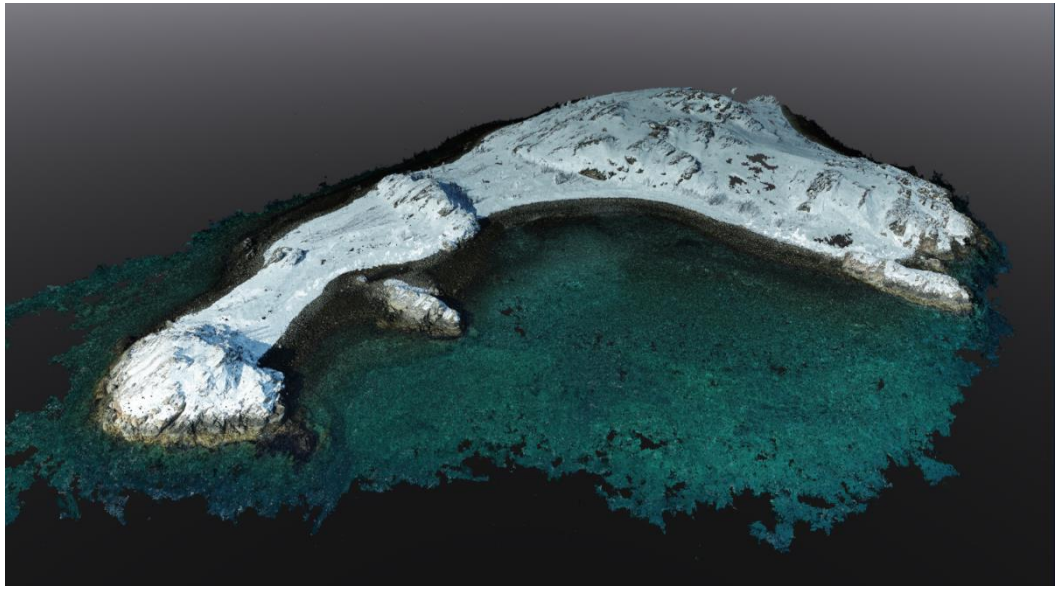
Mapping smaller areas with drones



Left:
Digital Terrain Model of *Lille Haukøya* in *Troms og Finnmark*, northern Norway.

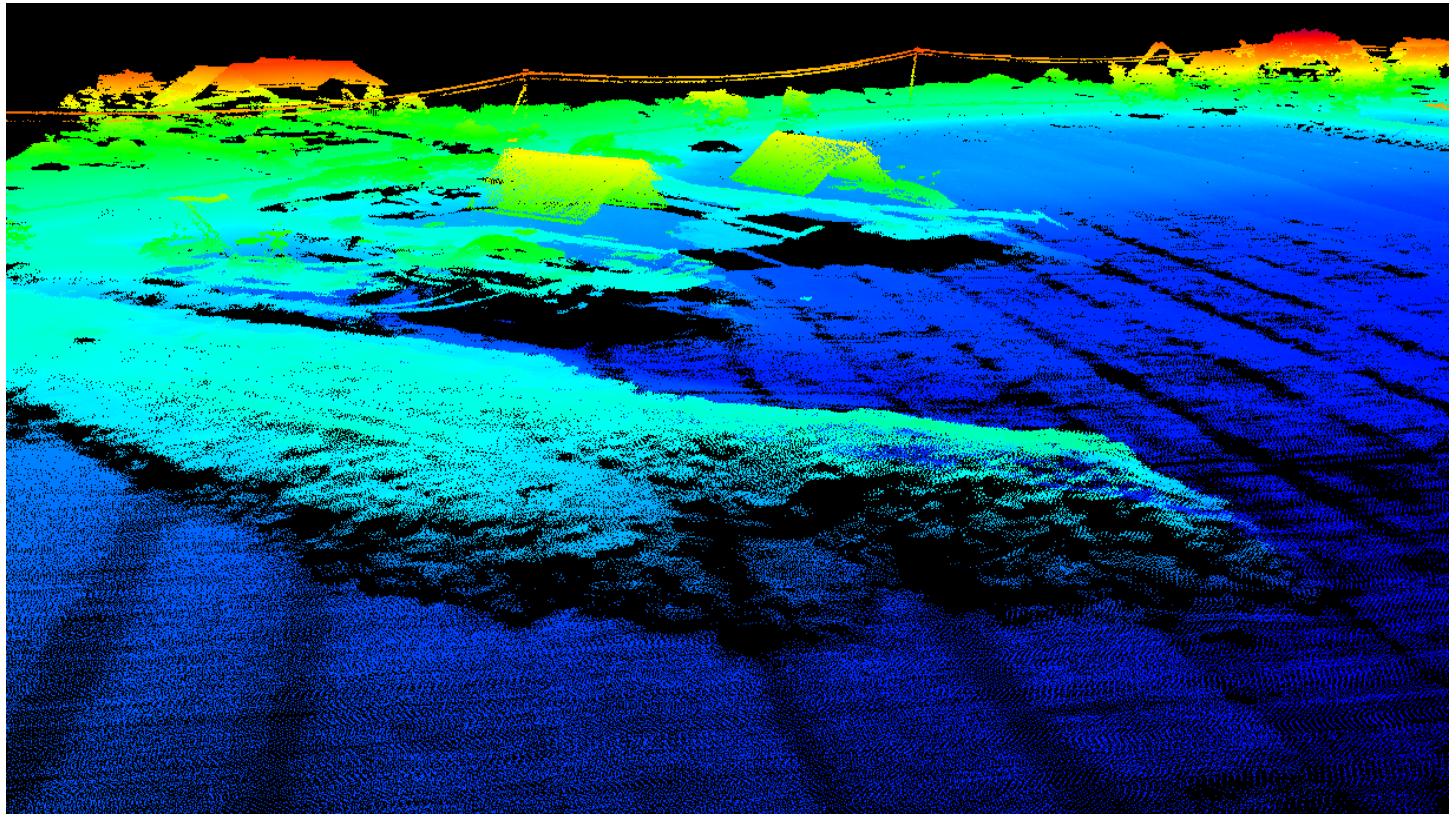
The model is based on images taken with a smaller (DJI) drone on **low tide**.

The images have been post-processed using a photogrammetric technique called *Structure from Motion* (SFM) in Pix4D.

Right:
Digital Terrain Model from *Fjøløy* test site.

Data was collected using a bathymetric (green) LIDAR on a Nordic Unmanned drone.

In the foreground of the model you can see the seabed and shore. On land you can see power lines, houses, boats and boathouses.



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Drone-borne bathymetric LIDAR

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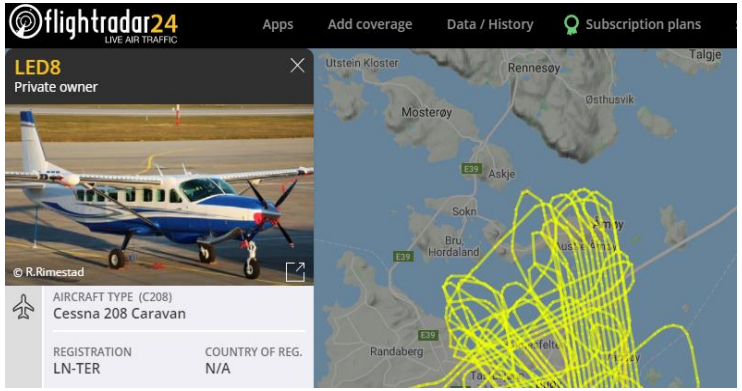
Dronefoto: Tobias Johler, Kartverket

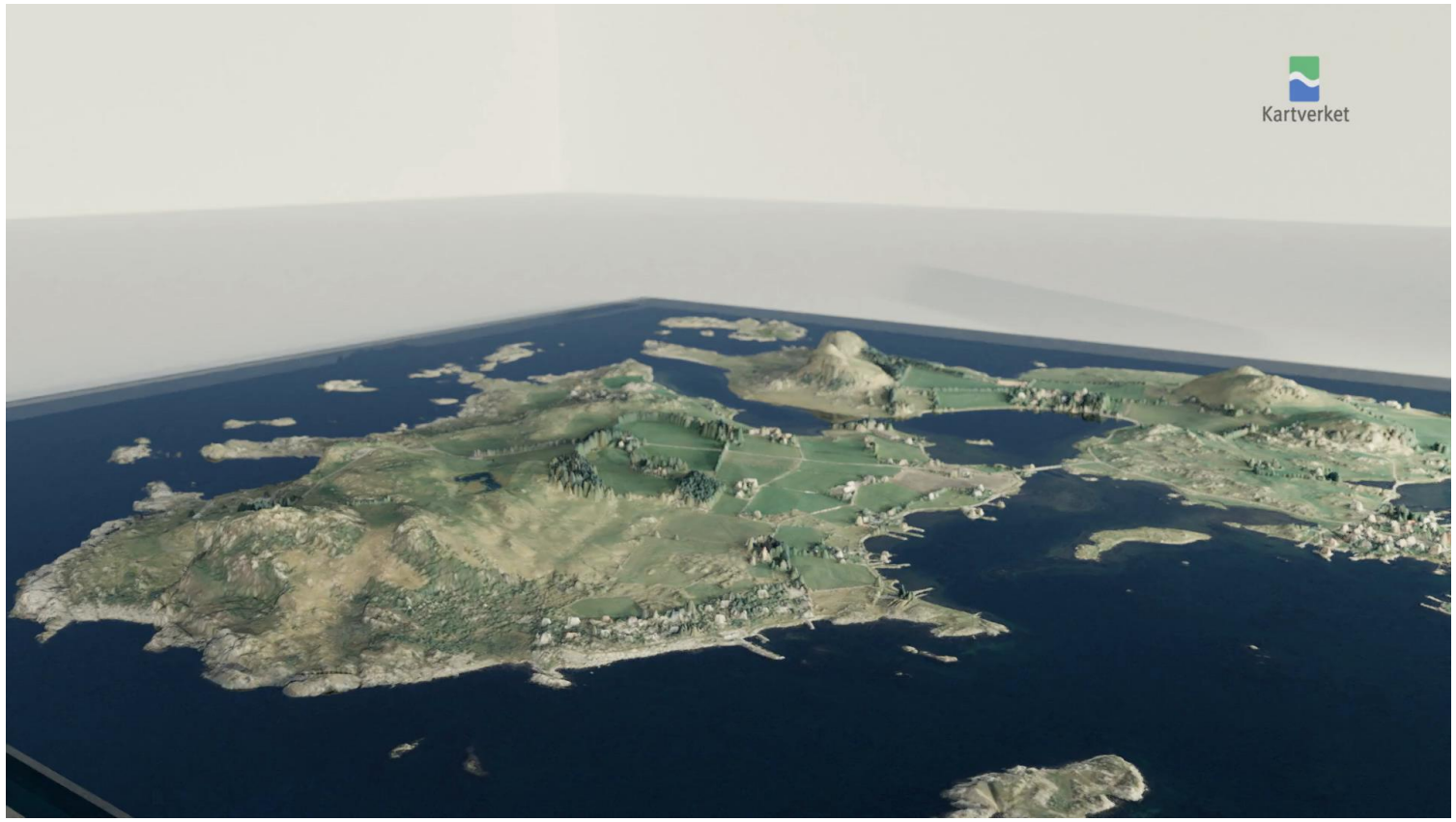
Airborne LIDAR

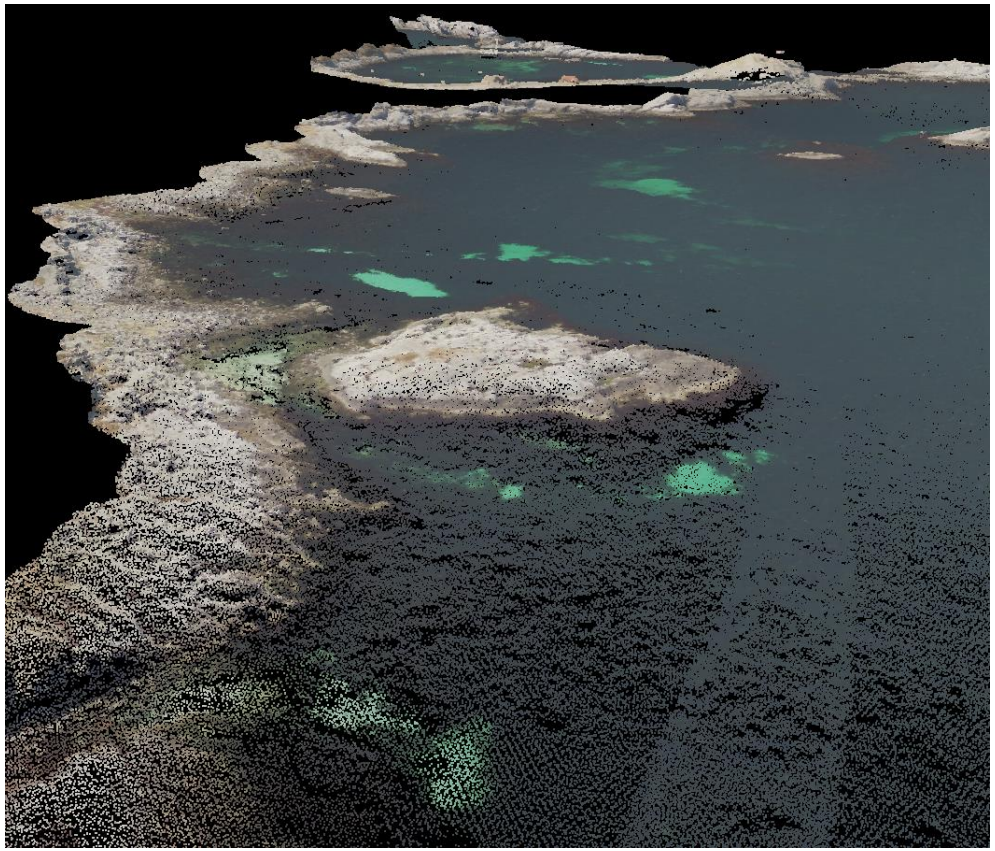


These 3D models are based on data collected by Terratec using airborne bathymetric LIDAR plus existing data from topographic LIDAR on land.

Almost the entire municipality of Stavanger is now fully covered with LIDAR along the shoreline. Very good result: Full coverage down to 10 meters depth, 10 points/m2 (5 points seabed + 5 points marine vegetation).

Terratec also collected hyperspectral images in July 2021. Hyperspectral images can potentially be used to map marine vegetation.



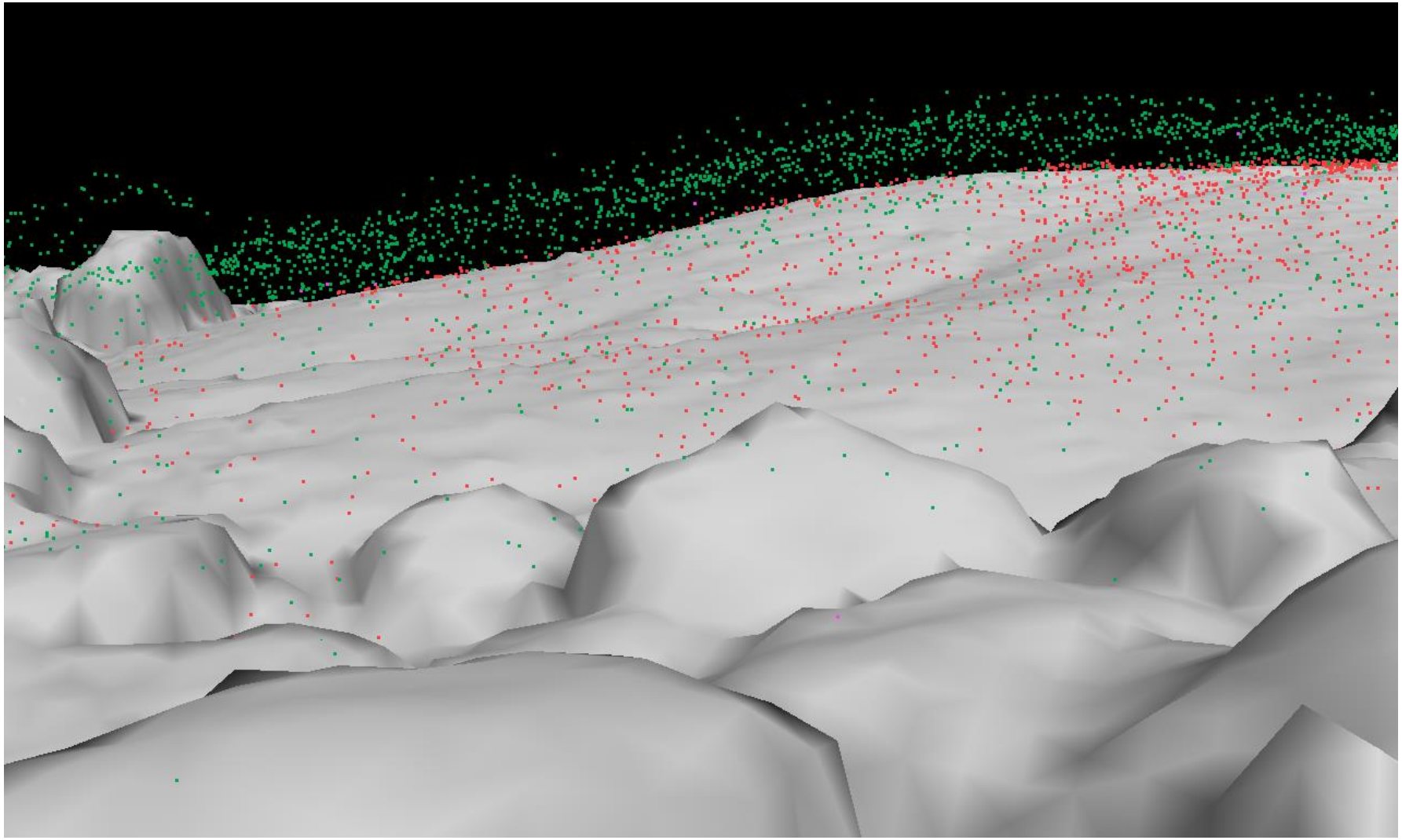


Airborne LIDAR

Uses of bathymetric LIDAR data :

- .. to make DTMs of the seabed by using only the red LIDAR points in the illustration to the right.
- .. and to model the distribution and height of marine vegetation. The green laser points that "float" approx. 1 meter above the bottom, we believe is the top of a kelp forest.

The illustration also includes echosounder data in gray, which gives a slightly more detailed picture of the seabed than LIDAR data.



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Terratec Use Case: Survey around Stavanger

Project: Marine Base Maps for the Coastal Zone (Marine Grunnkart)

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HAVFORSKNINGS INSTITUTTET

NORGES GEOLOGISKE UNDERSØKELSE - NGU -

Kopervik

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Tananger

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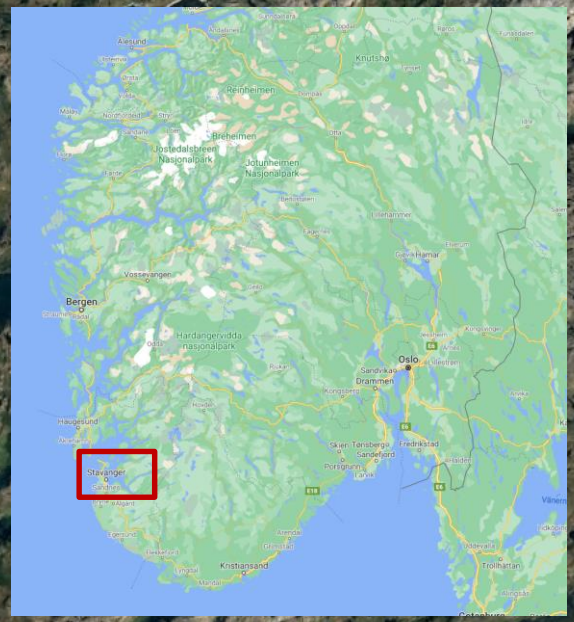
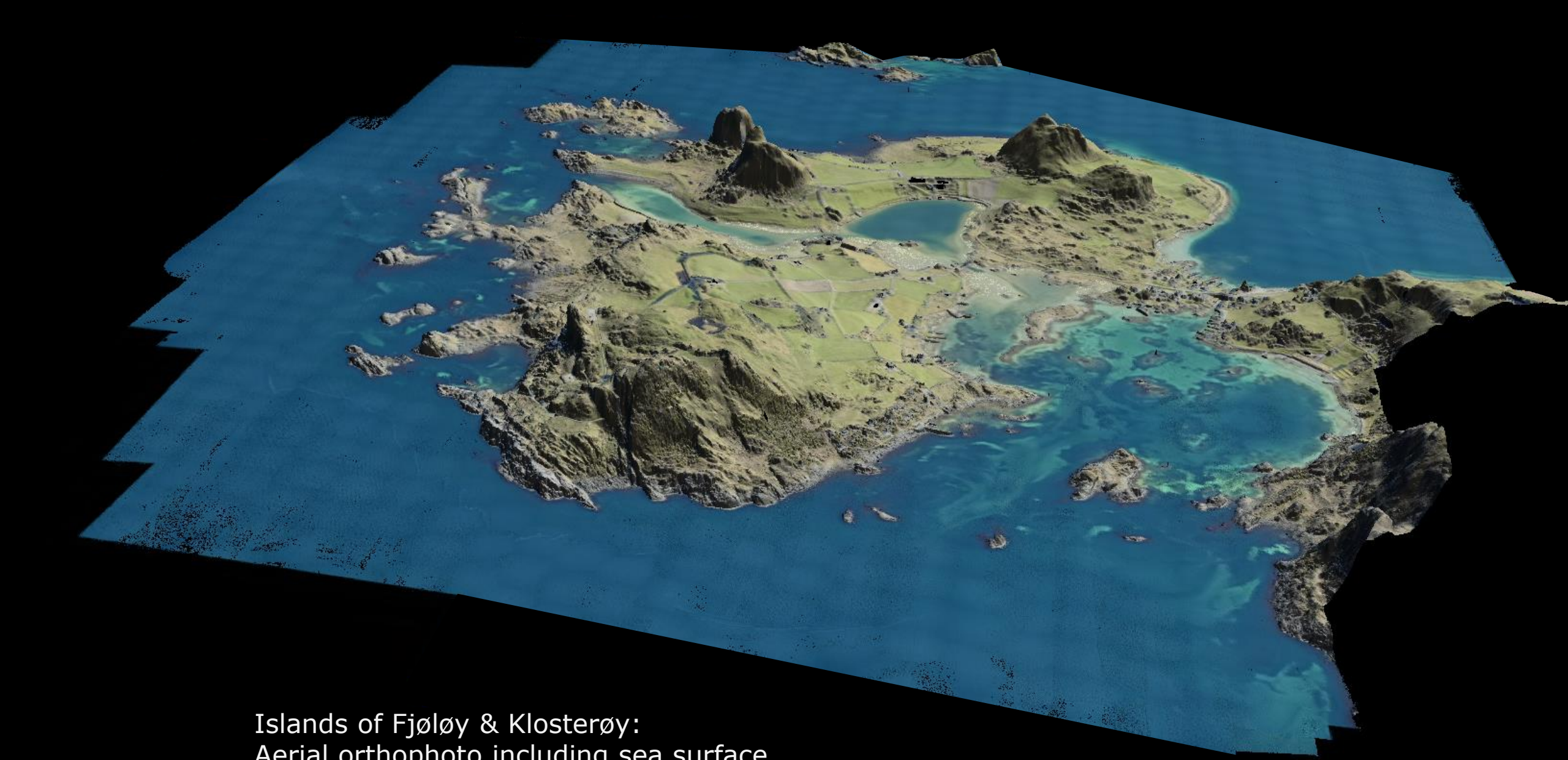
Forsand

Sandnes

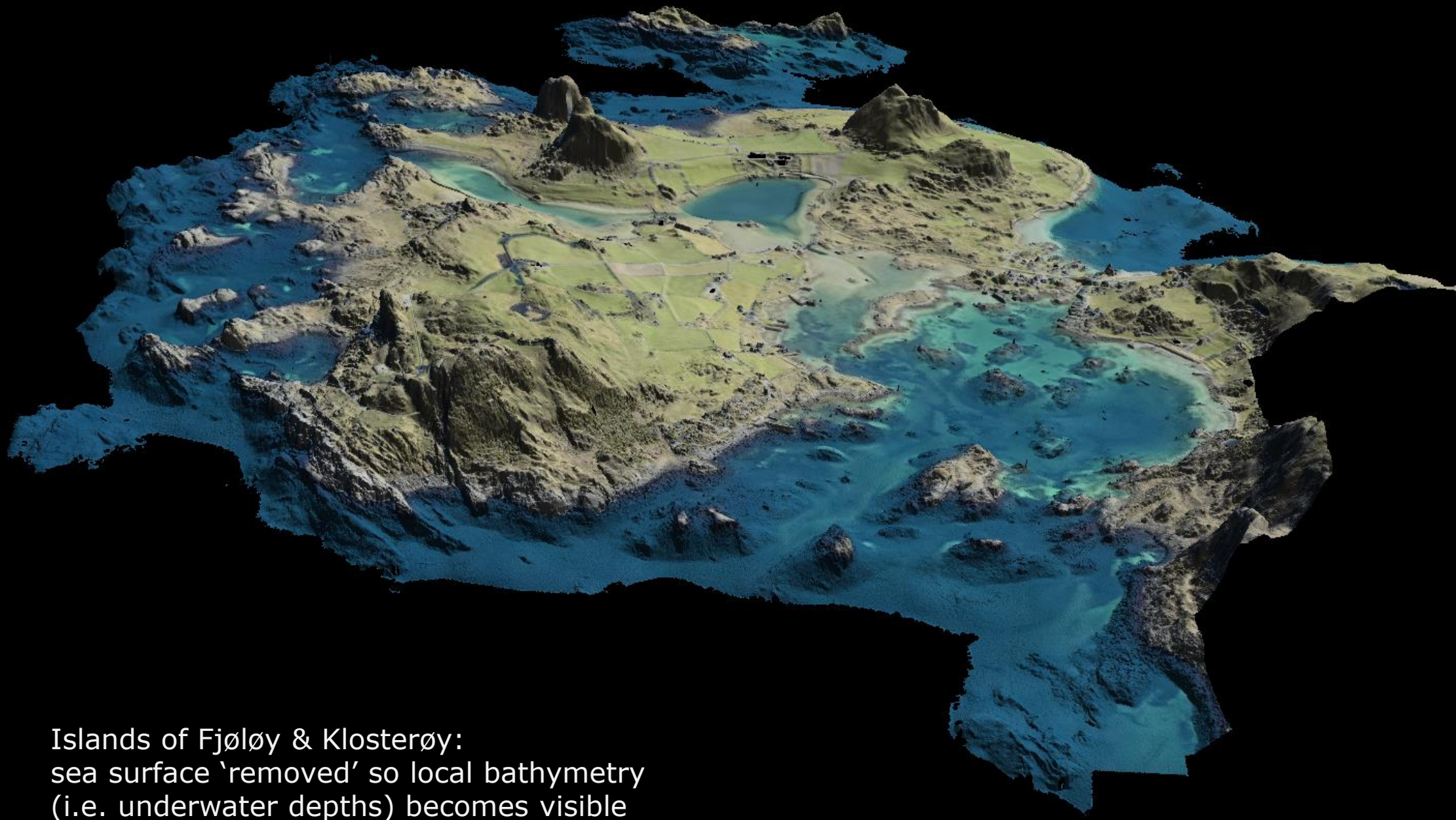


TERRATEC



Islands of Fjøløy & Klosterøy:
Aerial orthophoto including sea surface

TERRATEC



Islands of Fjøløy & Klosterøy:
sea surface ‘removed’ so local bathymetry
(i.e. underwater depths) becomes visible

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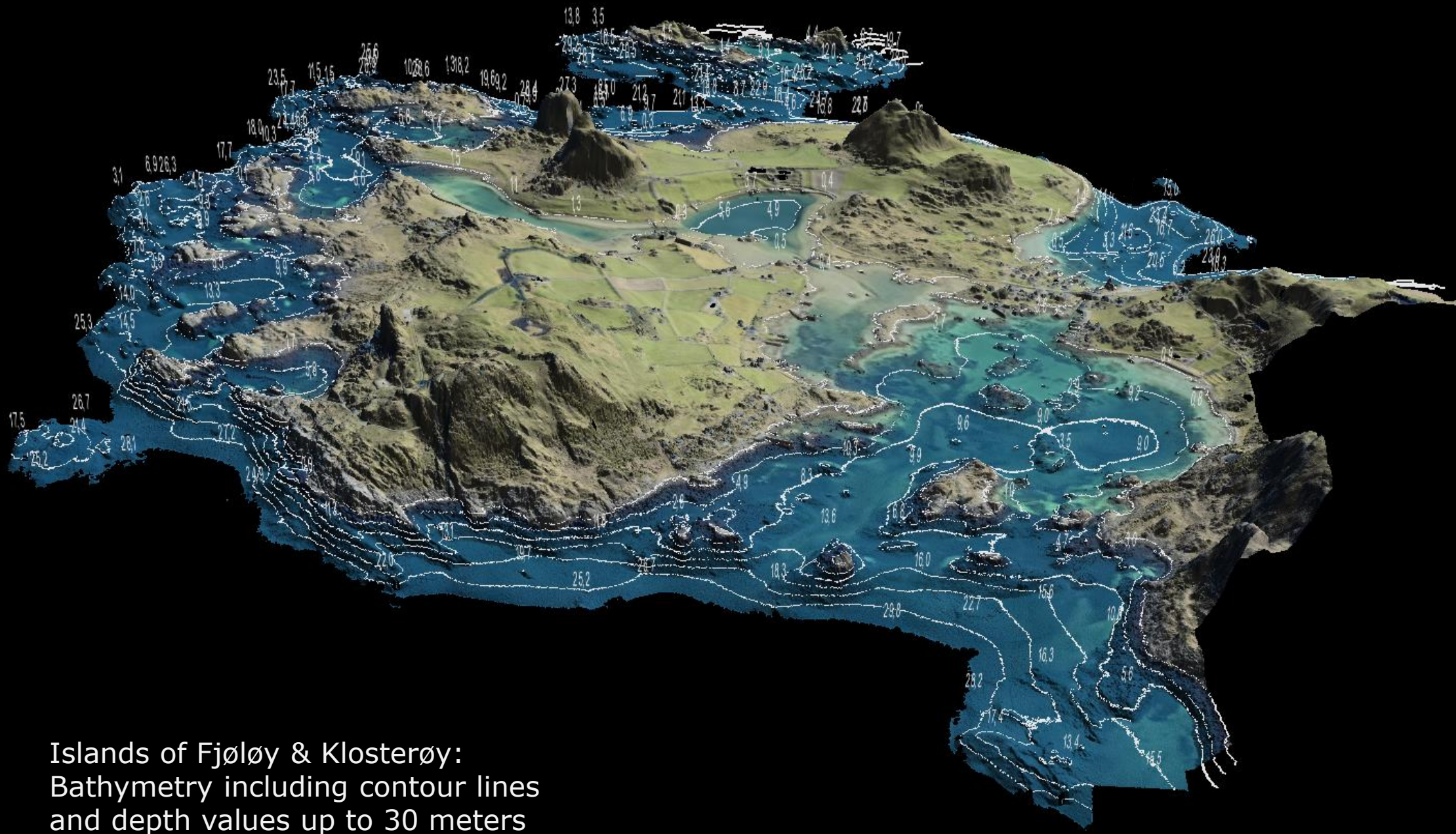


Islands of Fjøløy & Klosterøy:
Bathymetry including contour lines
and depth values up to 30 meters

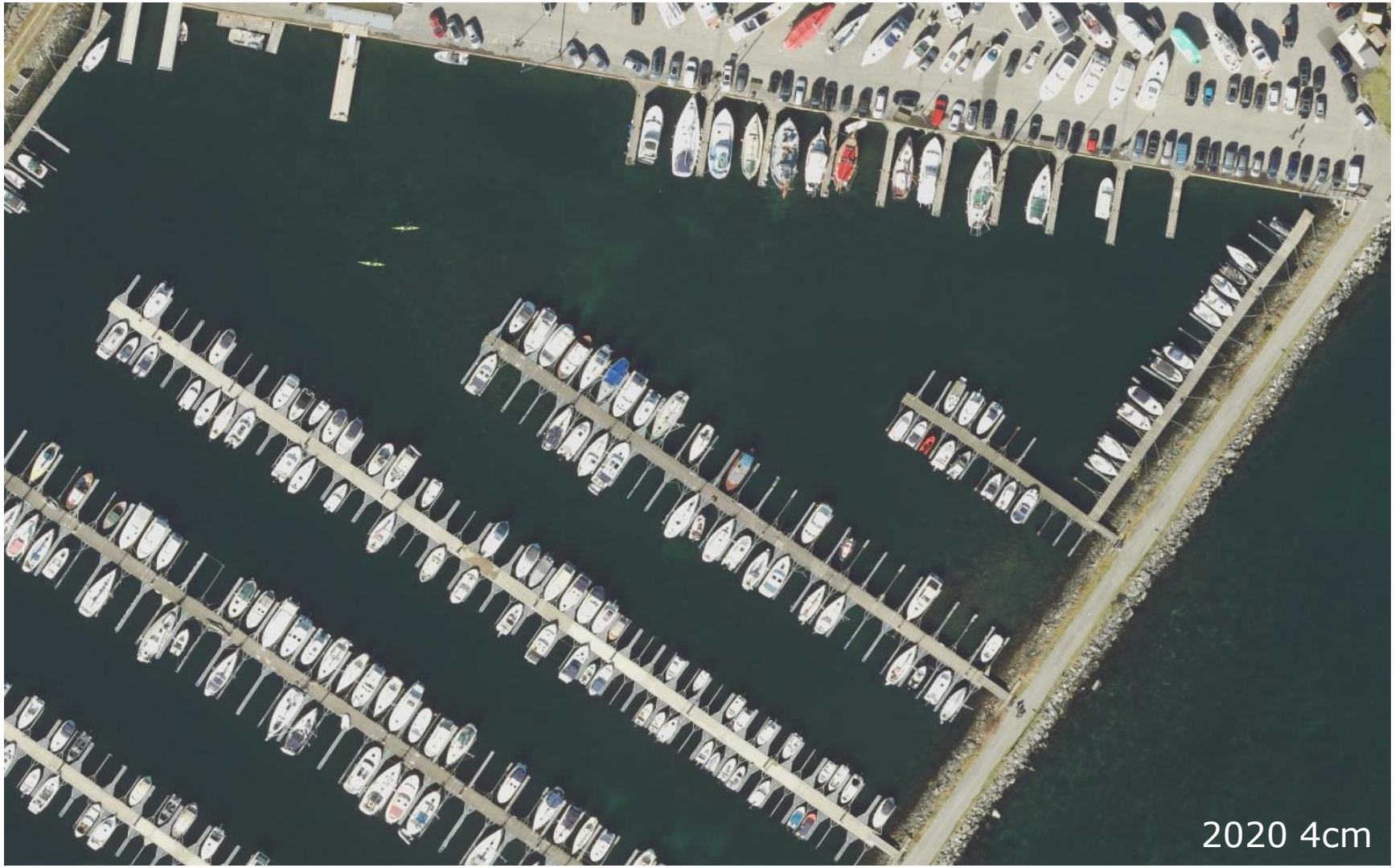
TERRATEC

High quality RGB: an added bonus from flying LIDAR

2021 2.5cm

- Lower flight altitude (400m vs. approx. 6000m in 2019)
- Optimal turbidity (water clearity) in April
- Post-Processed for optimal visibility in the water

High quality RGB: an added bonus from flying LIDAR



2021 2.5cm

The SyriUS project

The SyriUS project, concept

EOMAP

MARITIME ROBOTICS

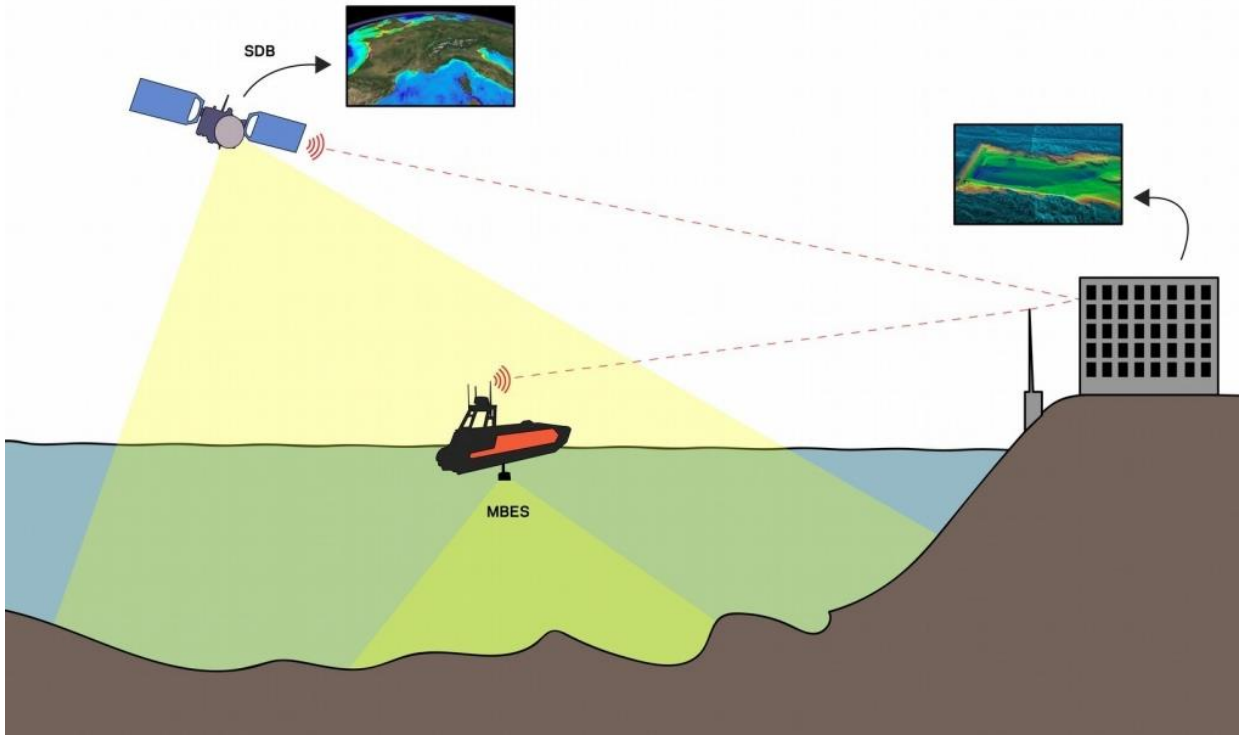
EOMAP
processes data from satellite
uses USV data to calibrate
& validate
delivers data product to customer

Customer
requests data
for a certain region

Satellite
collects data

USV Operator / Surveyor
oversees USV survey
off-loads & post-processes data

Maritime Robotics' USV
runs mission to collect
in-situ data



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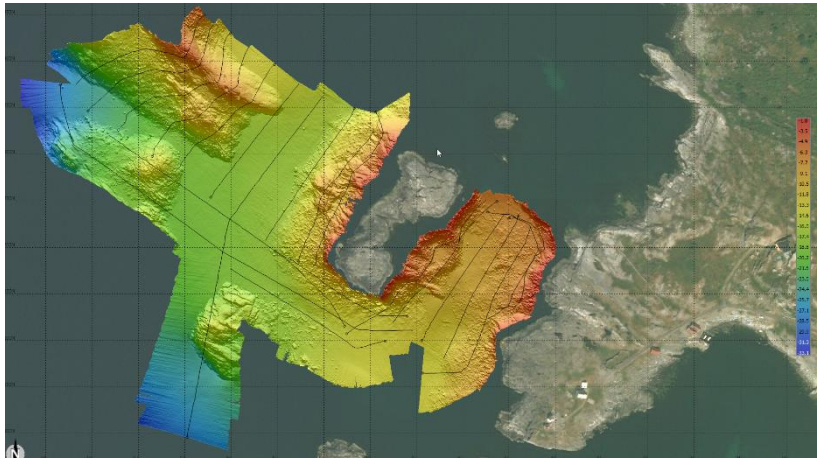
XOCEAN demo