Flyvende droner – et fugleperspektiv på morgendagens miljøovervåkning

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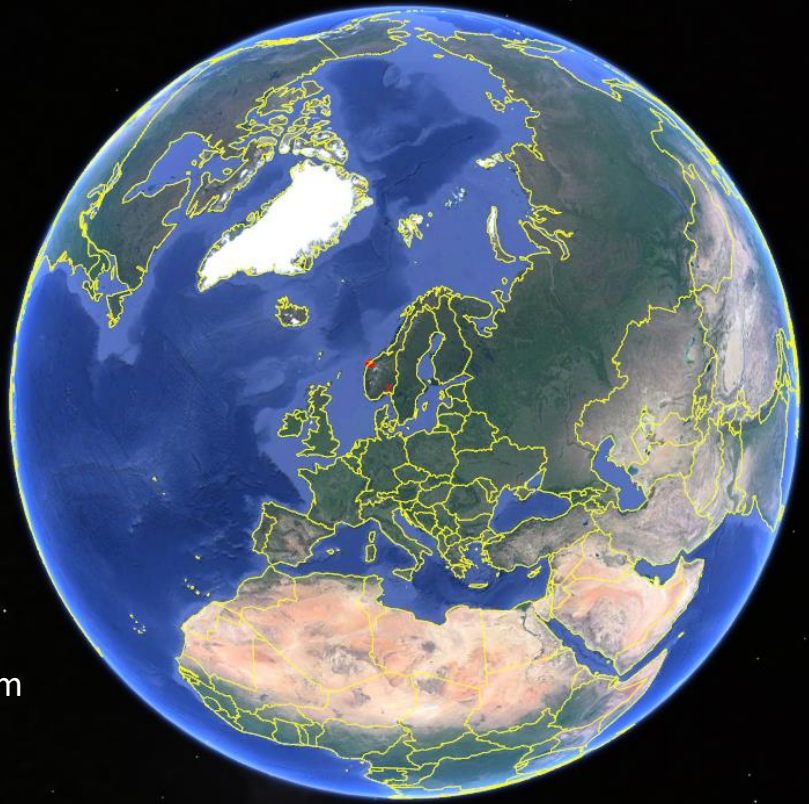
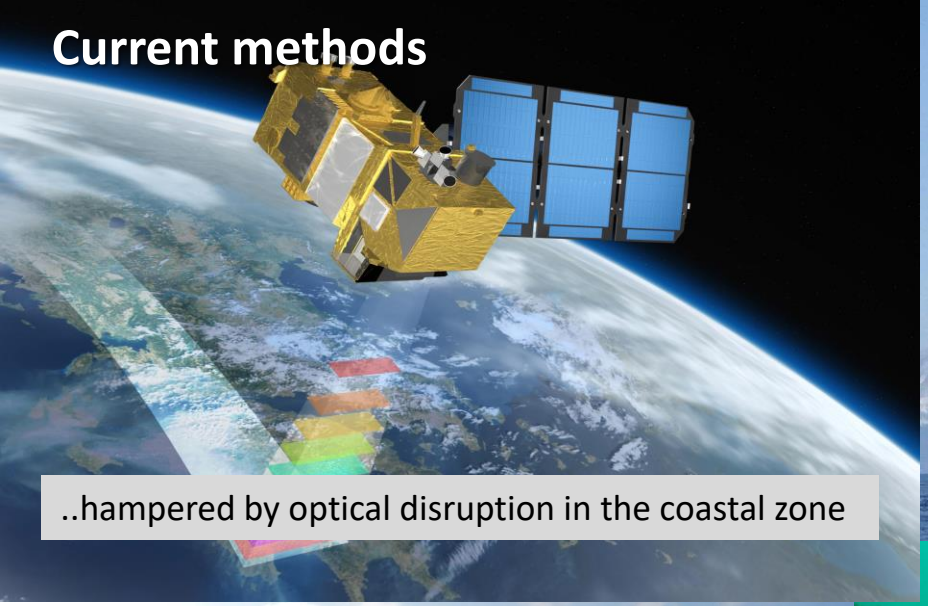
The content and challenge

- **The global coastline is 2.44 million km ~ 58 times the Equator** (30 m resolution, Sayre 2018.)
- **75% of the world's population** is projected to be living within 100 km of the coast by 2025 (Neumann et al. 2015).
- Coastal ecosystems yield 90 % of global fisheries and ~80 % of known species of marine fish (13,200 species).
- Kelp forests cover ~25% of the global coastline and 8.000 km2 along the Norwegian coast
- 86% of European coastal ecosystems are threatened
- 1/3 of coastal regions run a high risk of degradation, from infrastructure development and pollution (UN/UNEP Earth Watch)



Current methods



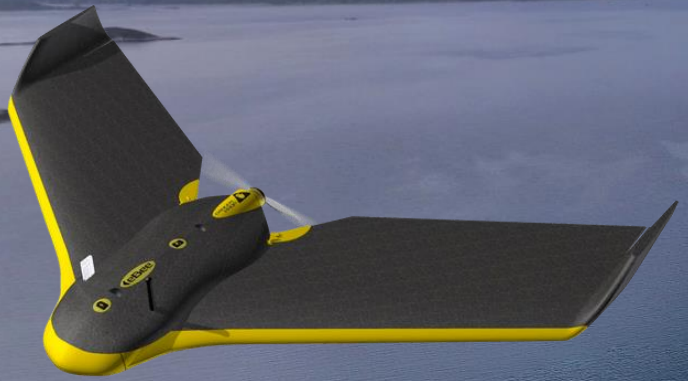
..hampered by optical disruption in the coastal zone

.. don’t go shallow (<10m)

.. labor intensive and cumbersome

.. limited spatial coverage

Drones offer a macroscopic view on the coastal zone



Equipped with

- color sensitive (multispectral) high-resolution cameras,
- accurate flight planning, and
- state-of-the-art data image analysis tools,

drones can provide a **hawk-eyed assessment** of the costal zone with a high spatial and temporal coverage.

How does it work? - Drones and sensors

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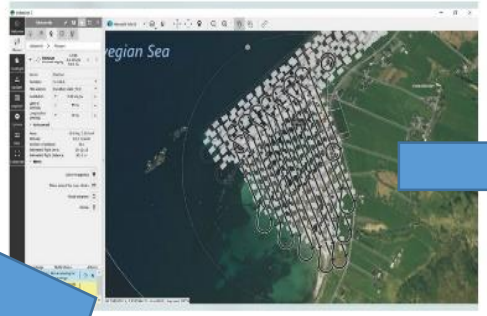
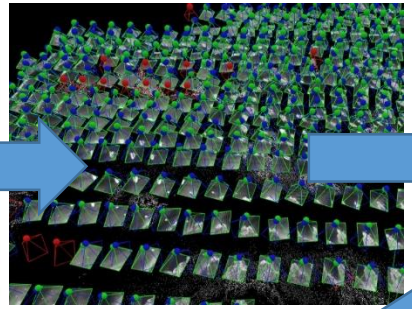
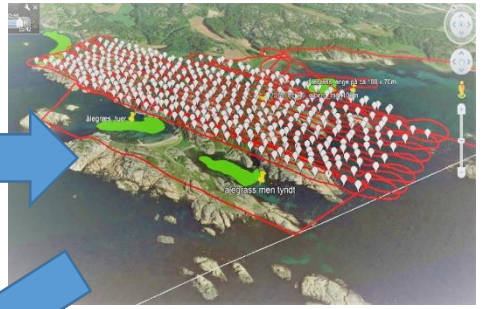
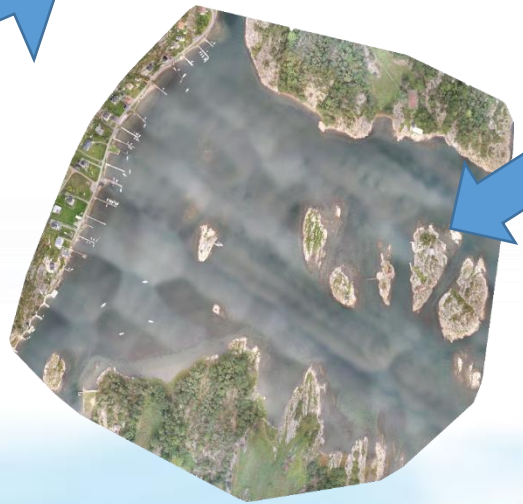








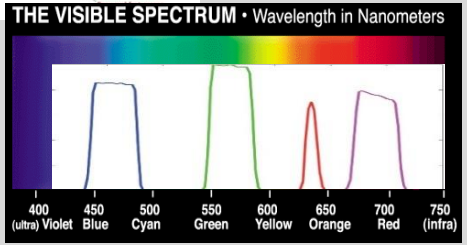
DRY FACTS

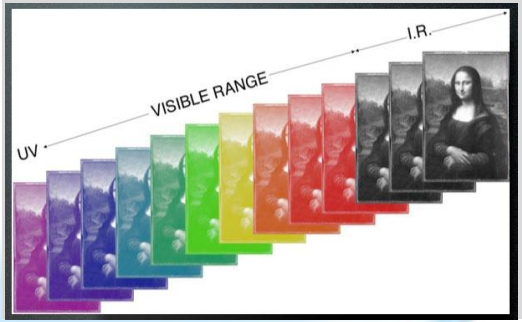
- **Drones**: Fixed-wing and rotor-drone
- **Fly height**: 10 to 120 meters
- **Areal coverage**: 0.3 to 2 km^2
- **Images**: ~3000 RGB/spectral per km^2
  (video only for demonstration and visual overview)
- **Spectral coverage**: VIS + NIR
  (490, 550, 670, 700, 720, & 840 nm)
- **Spatial image resolution**:
  0.5 to 12 cm $pixel^{-1}$
  (dependents on fly height)
- **Fly time**: 0.2 to 4 hours

How does it work? - Image analysis

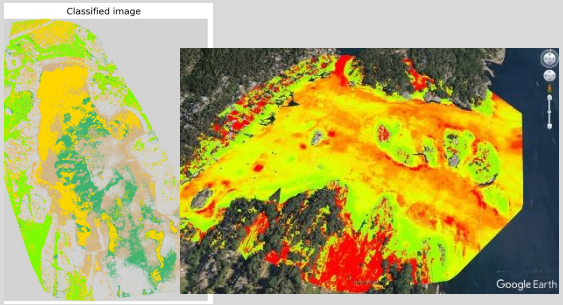
‘Ordinary’ RGB analysis

Multispectral analysis





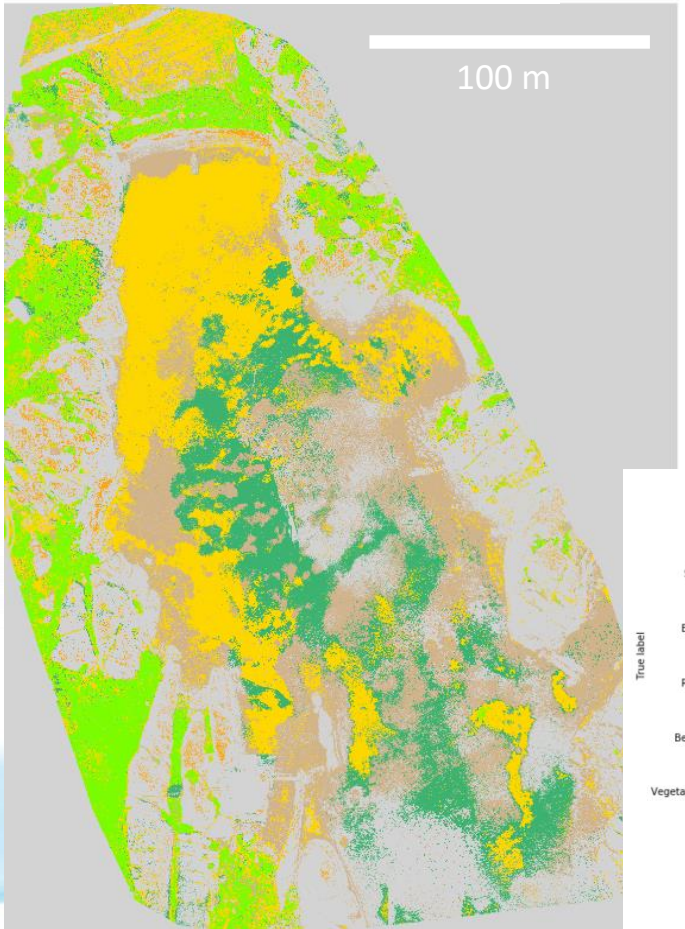
Machine Learning

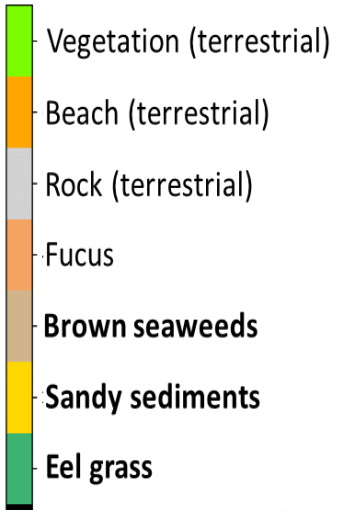


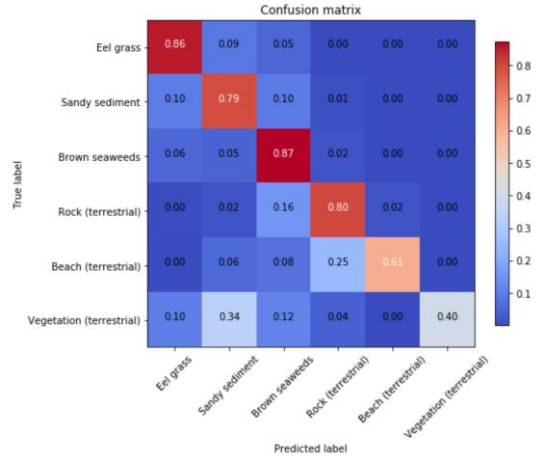
Applications: Eelgrass and seaweed coverage mapping

Orthomosaic image (~500 single images)

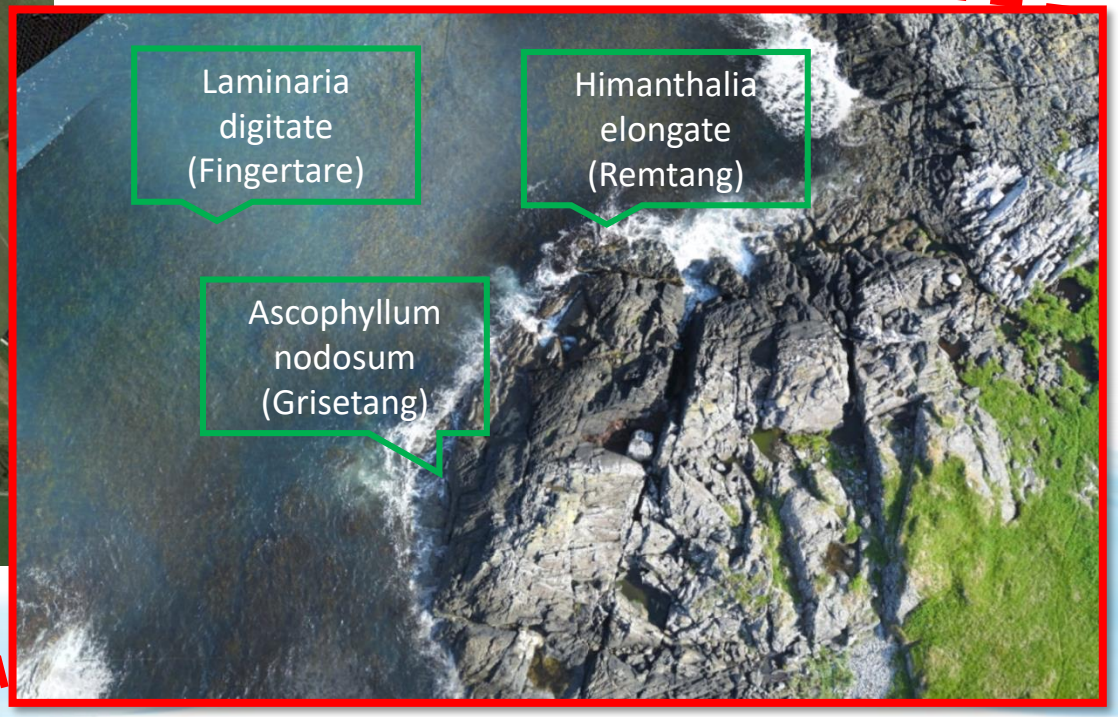
Categorized mosaic image







Application: Kelp forest and seaweed mapping



Hancke et al. unpubl.

Additional applications

3D terrain modelling

Identification of marine litter/plastics

30 pieces of plastic were identified

Coastal vegetation and landscape modelling

Invasive species detection

83 % recognition

SeaBee –a drone-based coastal zone observatory vision

Collaborators:

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NINA

NTNU
Kunnskap for en bedre verden

Norsk Regnesentral
NORWEGIAN COMPUTING CENTER

UN environment

GRID ARENDAL

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