LIVE PRESENTATION

Seagrass meadow dynamics from dense time-series of Sentinel images

or

Watching grass grow in the Venice Lagoon

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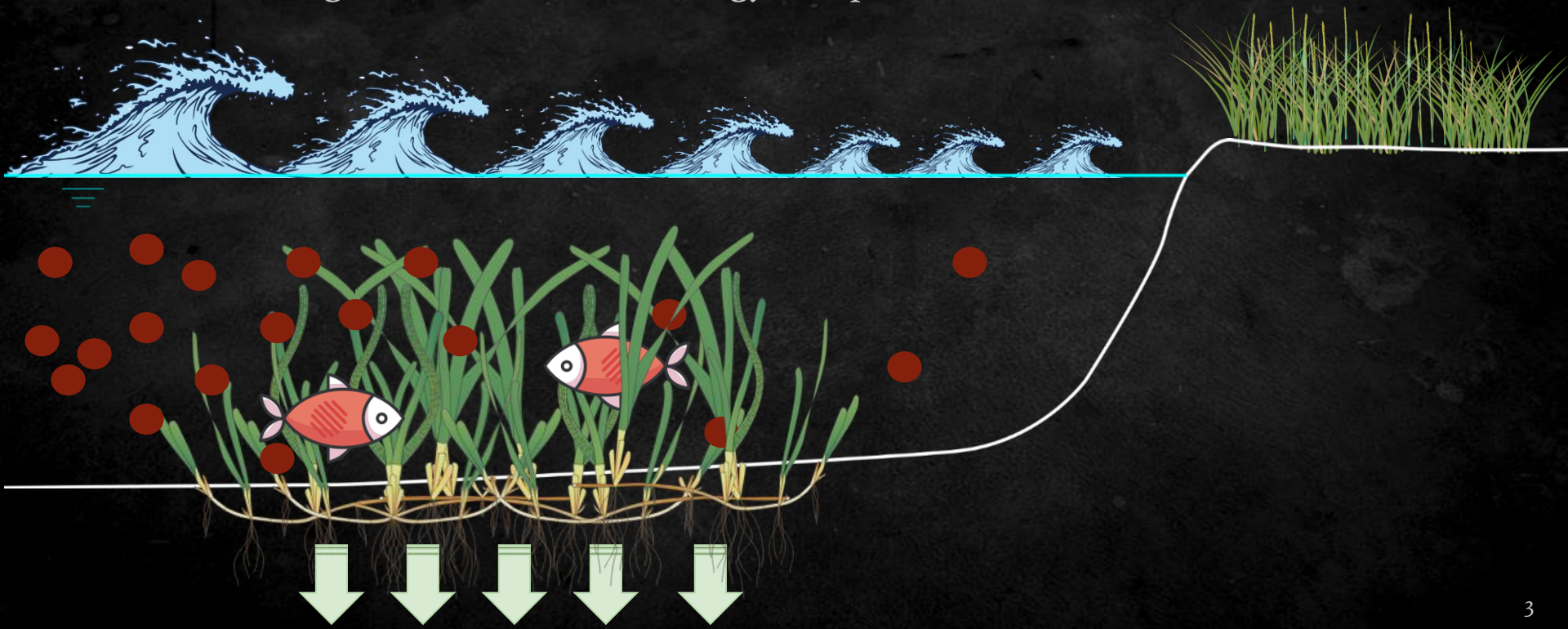
The role of seagrass meadows in tidal systems

- Biodiversity hotspot
- Carbon storage
- Trapping / Shielding
- Wave energy dissipation



The role of seagrass meadows in tidal systems

- Biodiversity hotspot
- Carbon storage
- Trapping / Shielding
- Wave energy dissipation

Causes of degradation

- Scouring
- "Burning"
- Competition

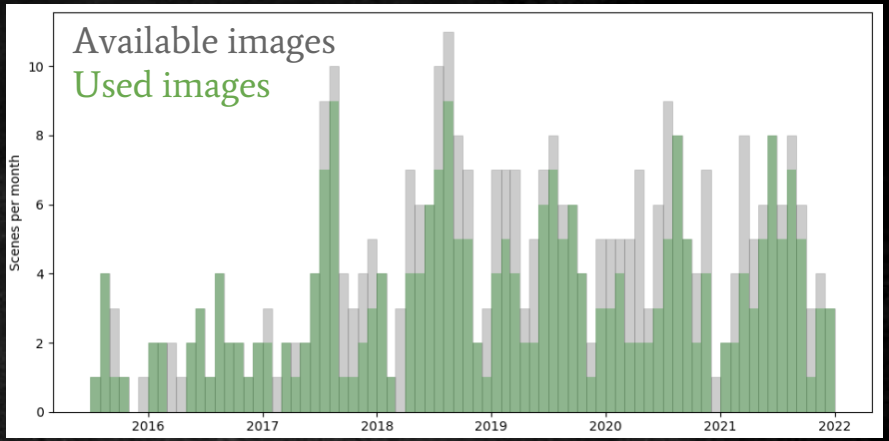
Can we detect spatial and temporal patterns of seagrass meadow dynamics?

- Seasonality ?
- Speed of clonal colonisation ?

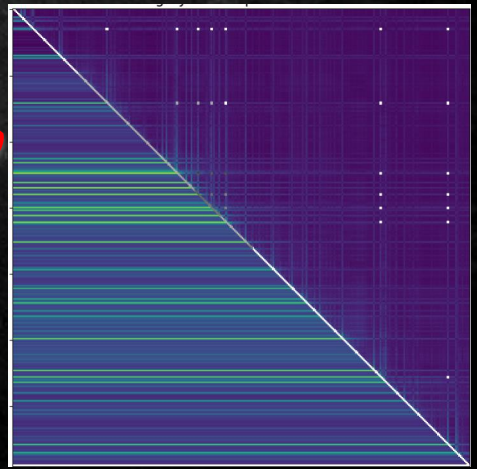
Methodology

- Data:
  - Sentinel 2 images
  - Bathymetry
  - Field surveys of seagrass cover

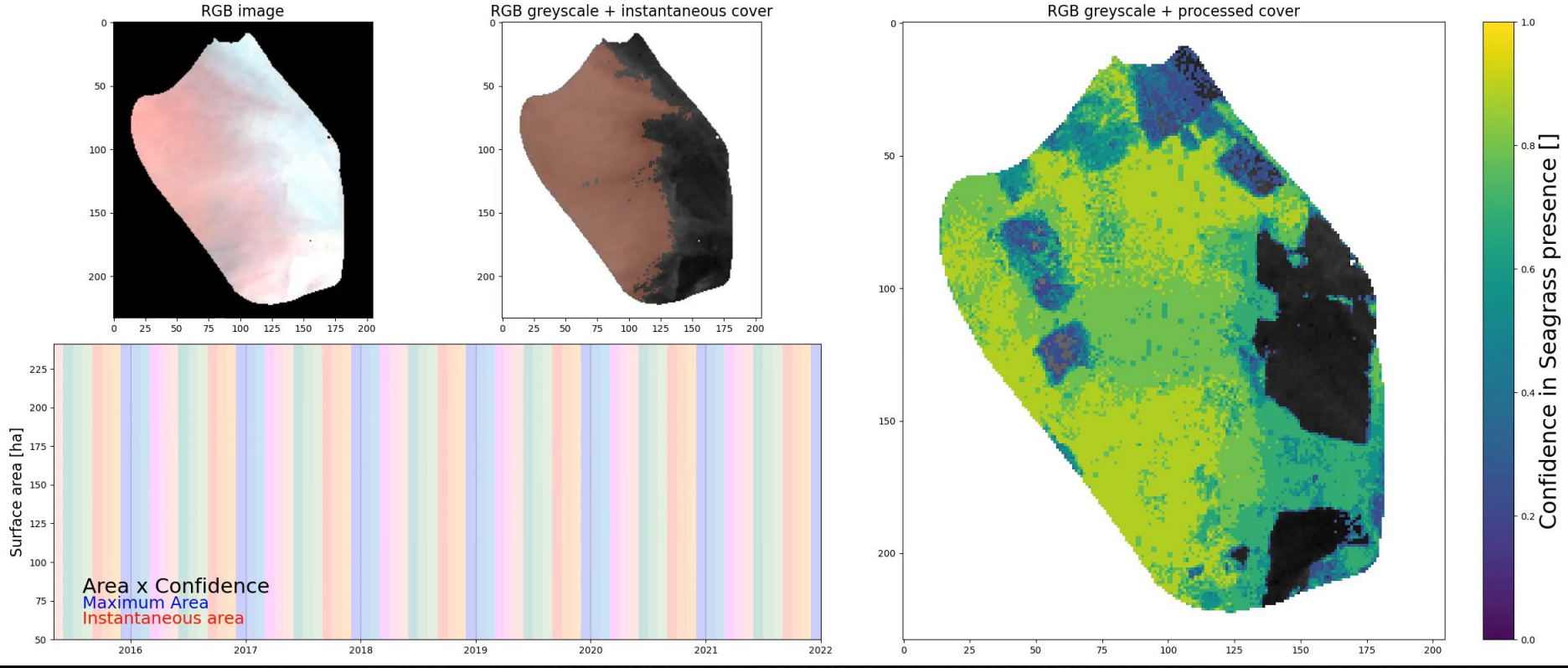
- Tools:
  - Noise filtering
  - Image segmentation
  - Random Forest Classifier
  - Temporal averaging
  - Self-similarity



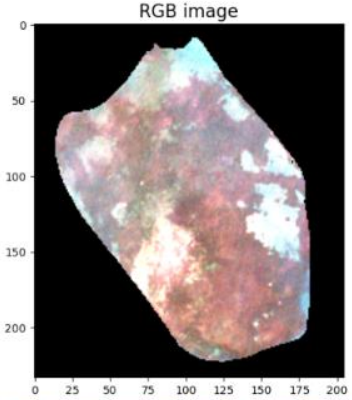
Curious?
Visit the display materials

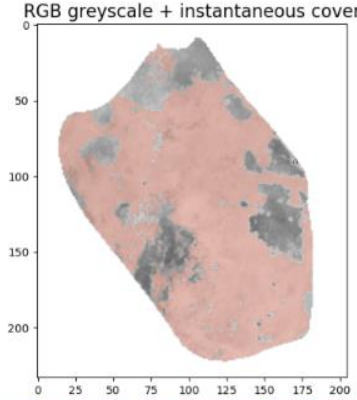


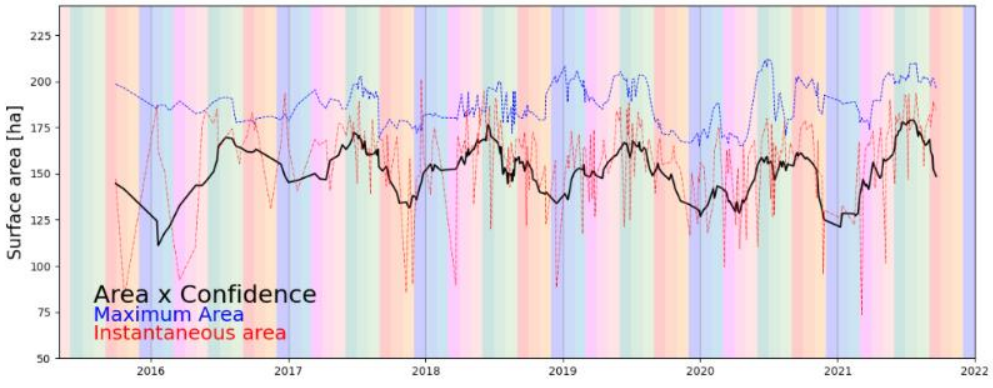
Overview of dynamics

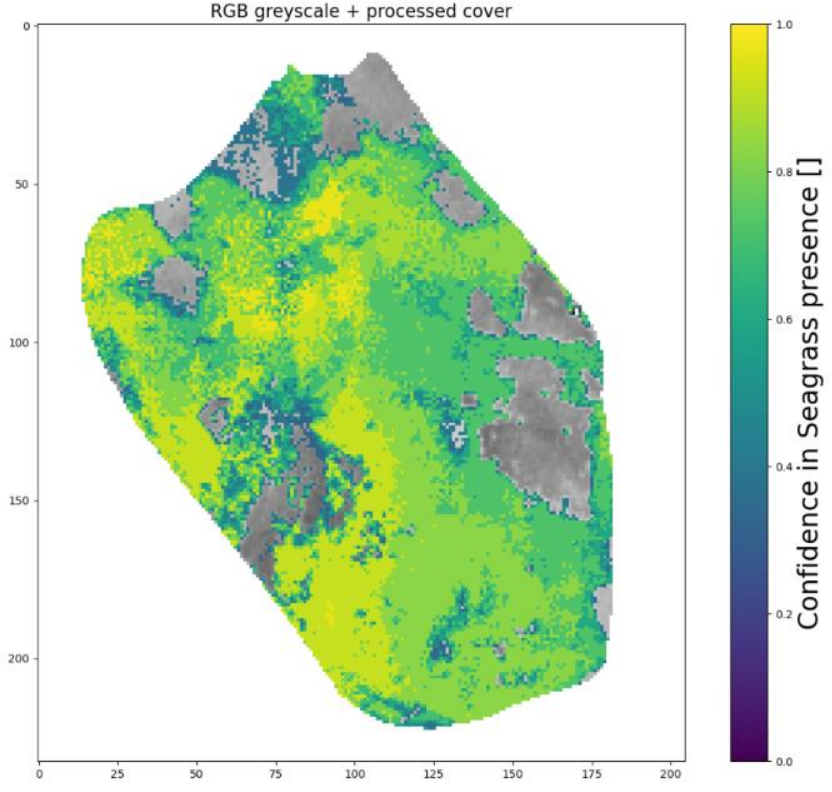


Overview of dynamics

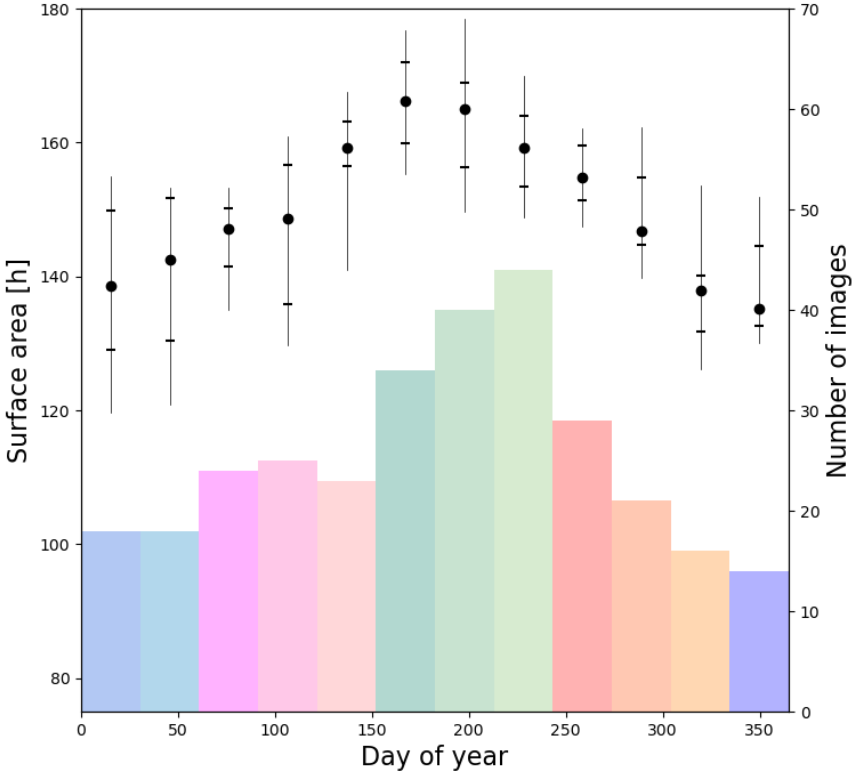


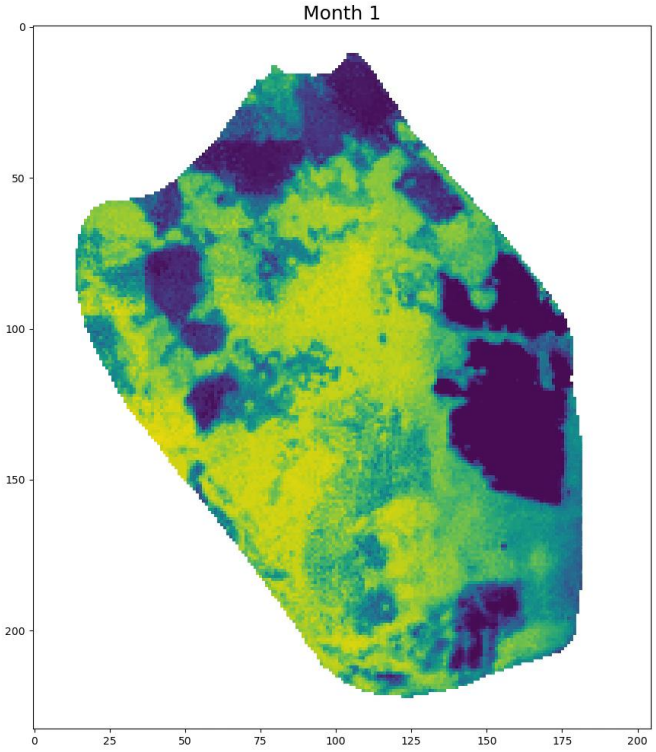




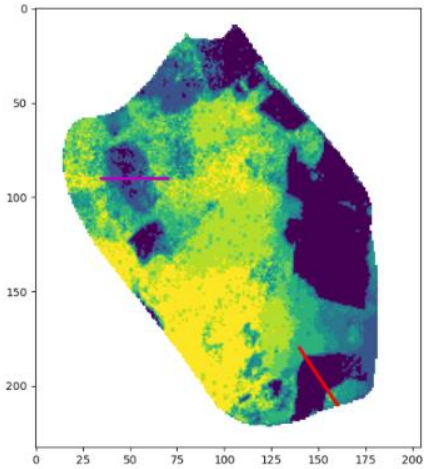


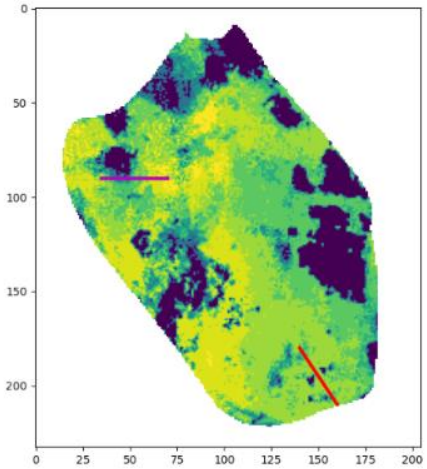
Application 1: Seasonal cover variations





Application 2: Clonal encroachment rates





What to remember

- Dense time-series & nuanced classification yield useful predictions
- Seagrass meadow extent displays a clear seasonal behaviour
- Highly variable patches may be signs of algae coverage or high SSC
- Clonal reproduction allows encroachment progression of the order of 10m/yr

Thanks very much! Any questions?

I will follow methods debates in the display materials:

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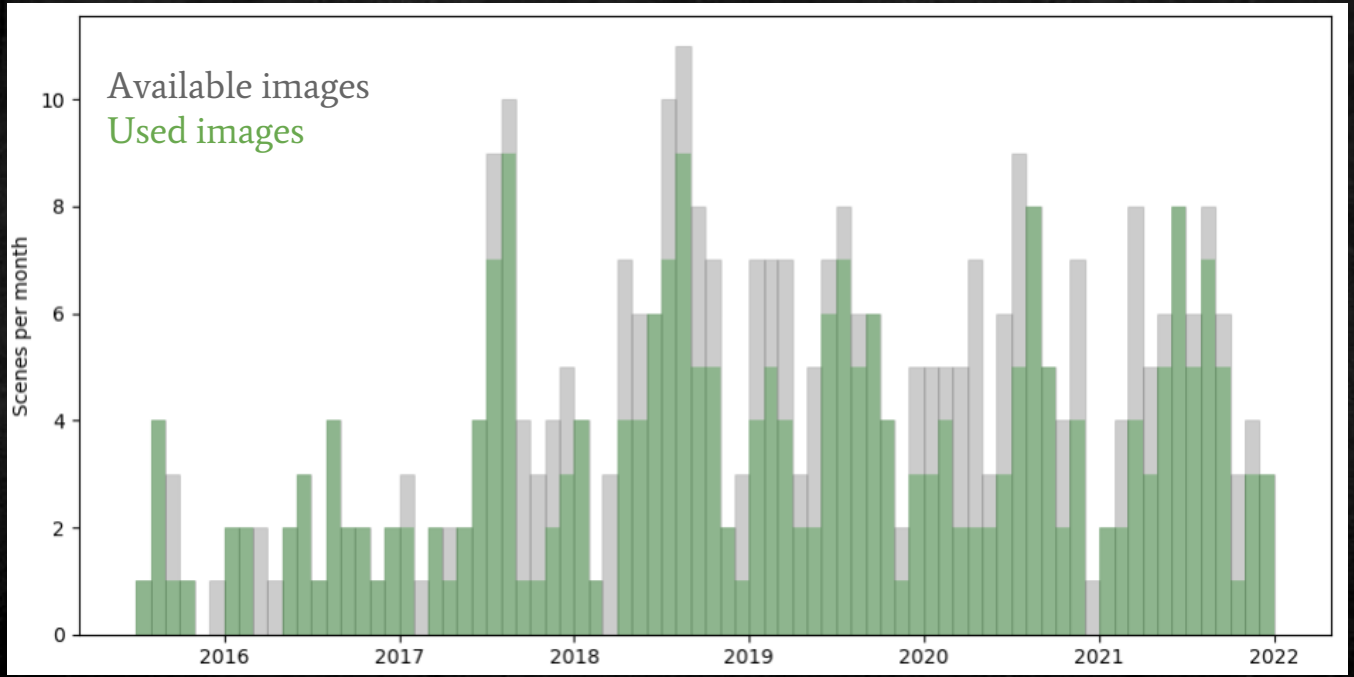
DISPLAY MATERIALS

Methodology

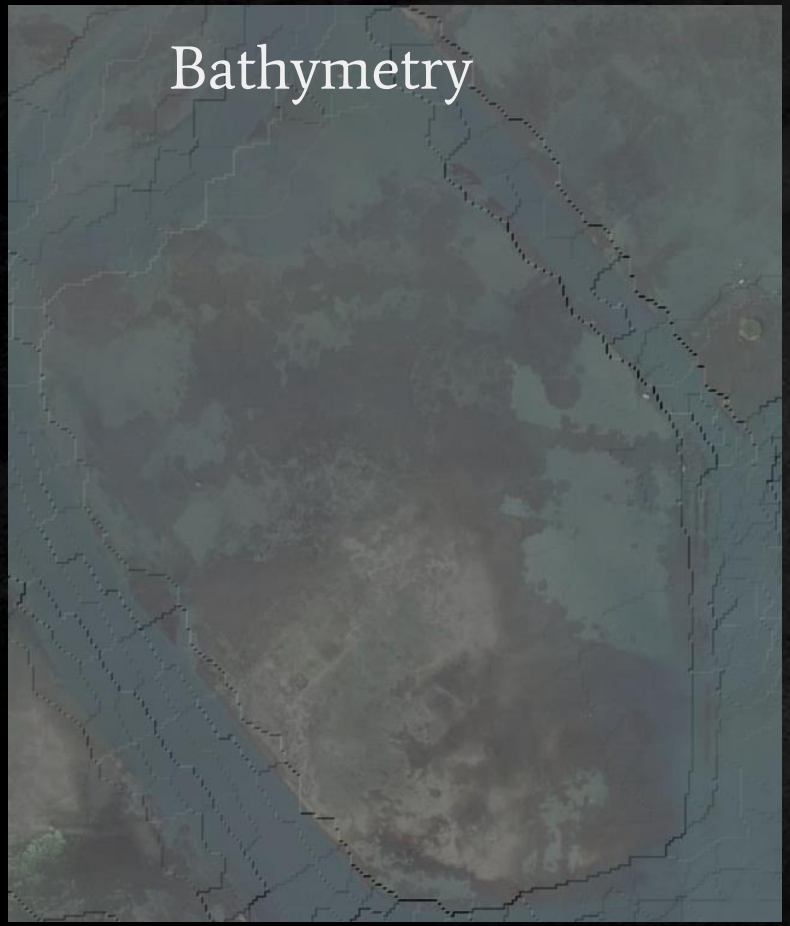
- Data:
  - Sentinel 2 images
  - Bathymetry
  - Field surveys of seagrass cover

- Tools:
  - Noise filtering
  - Image segmentation
  - Random Forest Classifier
  - Temporal averaging
  - Self-similarity

Sentinel 2 images



Data



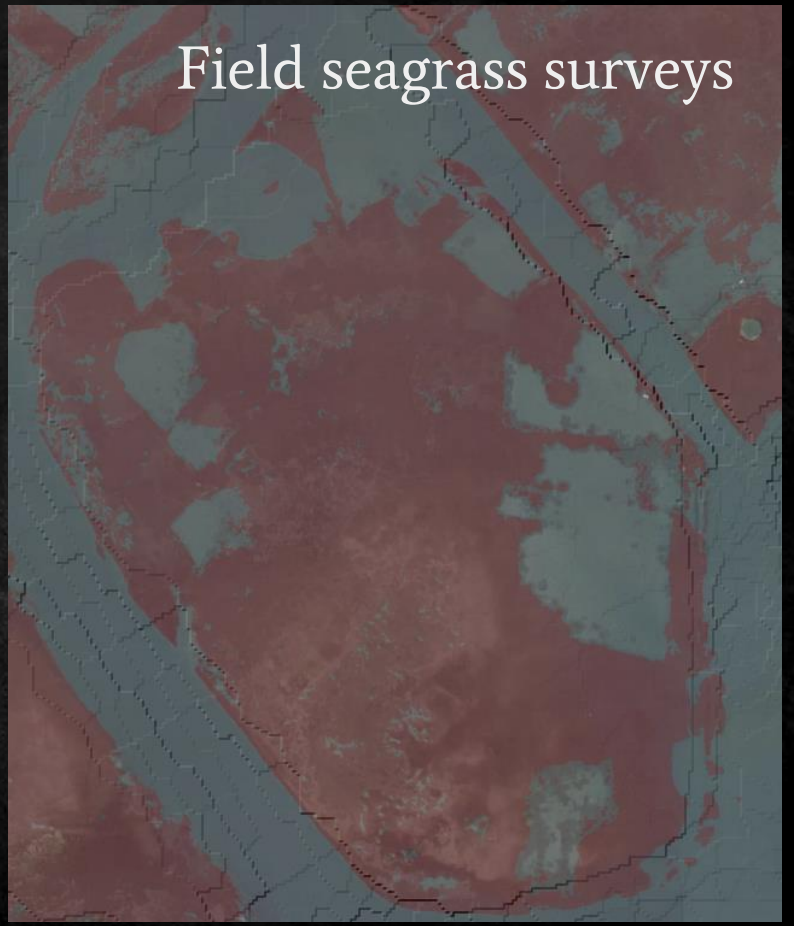
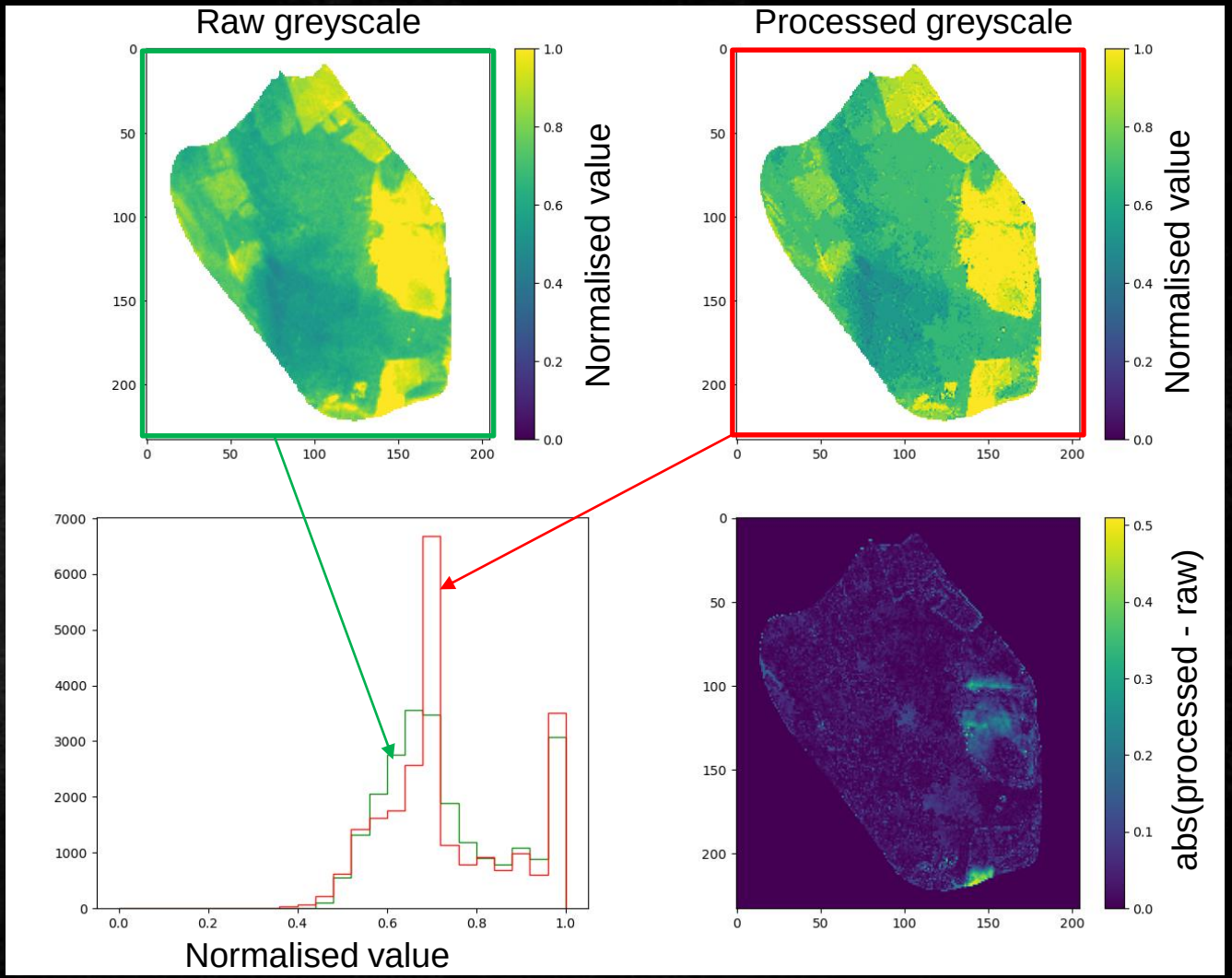


Image processing

1. Canny edge detection
2. Contiguous area segmentation

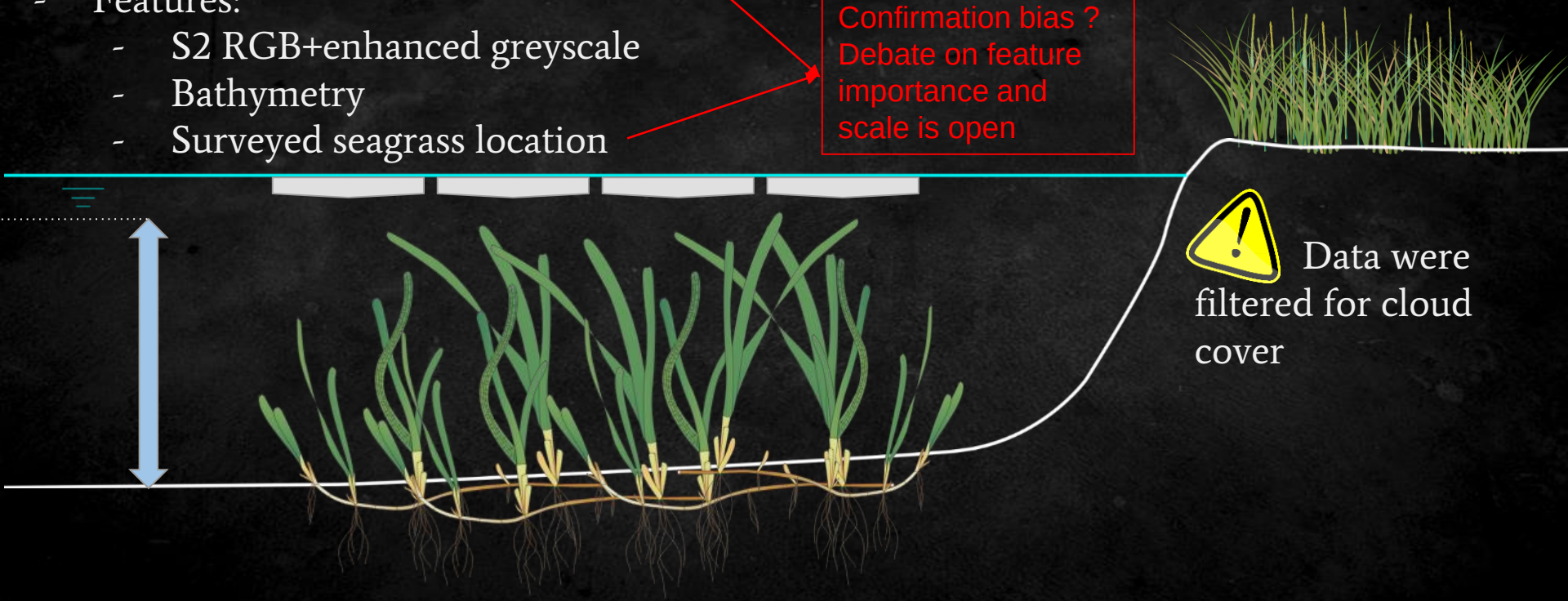
=> Greyscale is «sharpened»: modes are better separated



The Random Forest Classifier

- Tool: Random Forest Classifier
- Target : Surveyed seagrass location
- Features:
  - S2 RGB+enhanced greyscale
  - Bathymetry
  - Surveyed seagrass location

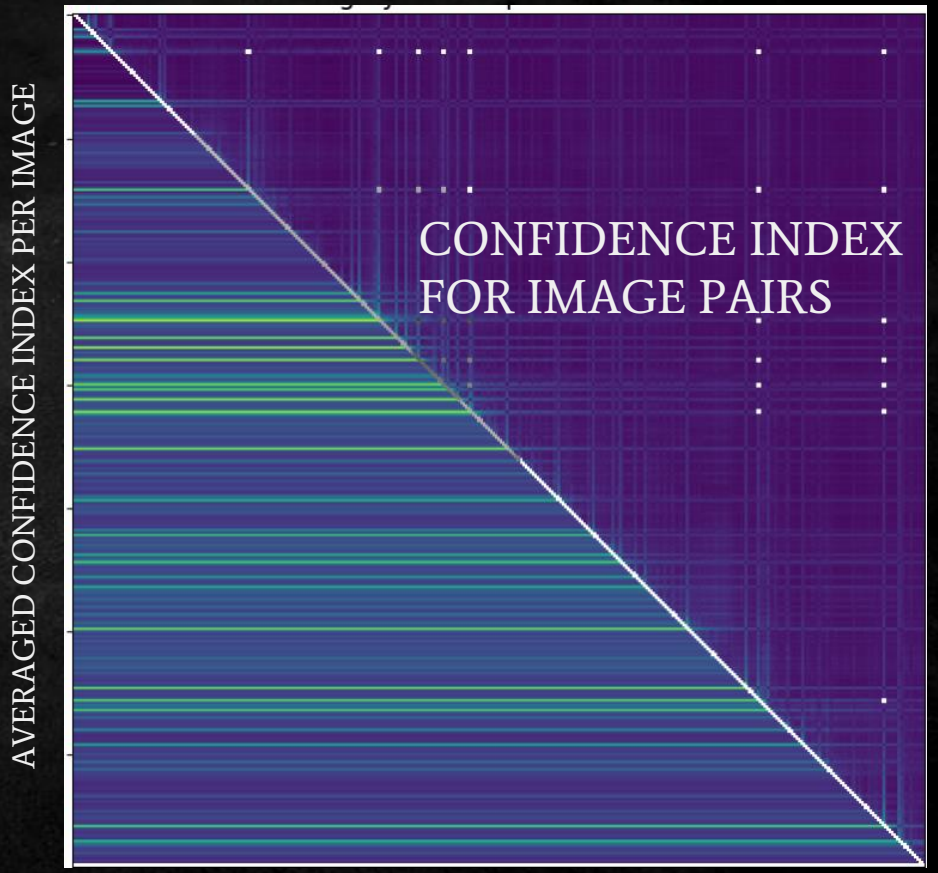
Confirmation bias ? Debate on feature importance and scale is open



Data were filtered for cloud cover

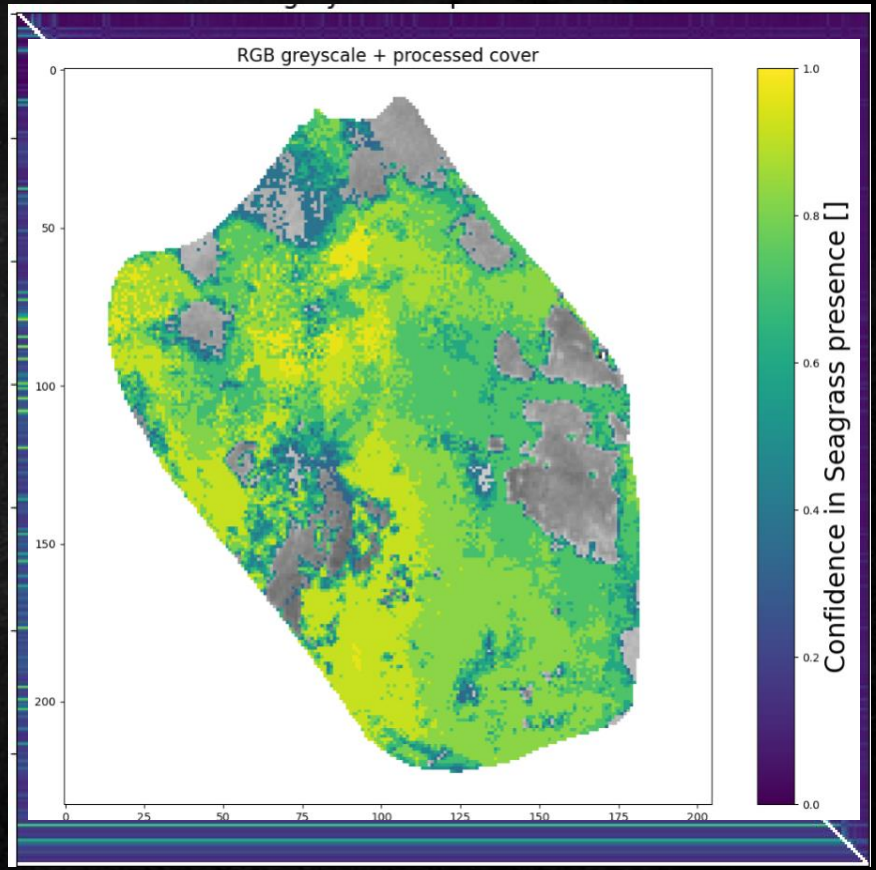
(ab)Using self-similarity

- Seagrass meadows rarely significantly change in the interval between S2 images (5 days – 1 month depending on cloud cover)
- Hence, consecutive images with very different classifications are likely unreliable. (particularly if this change is not confirmed by other images at close time intervals)
- Each image can be given a **CONFIDENCE INDEX** based on its similarity to its neighbours and weighted by the time lapse between image pairs



Time averaging

- Each pixel has the average value of the confidence index over 10 neighbouring images



Perenniality of seagrass patches