Quantification of blue carbon in seagrass ecosystems from high resolution commercial imagery

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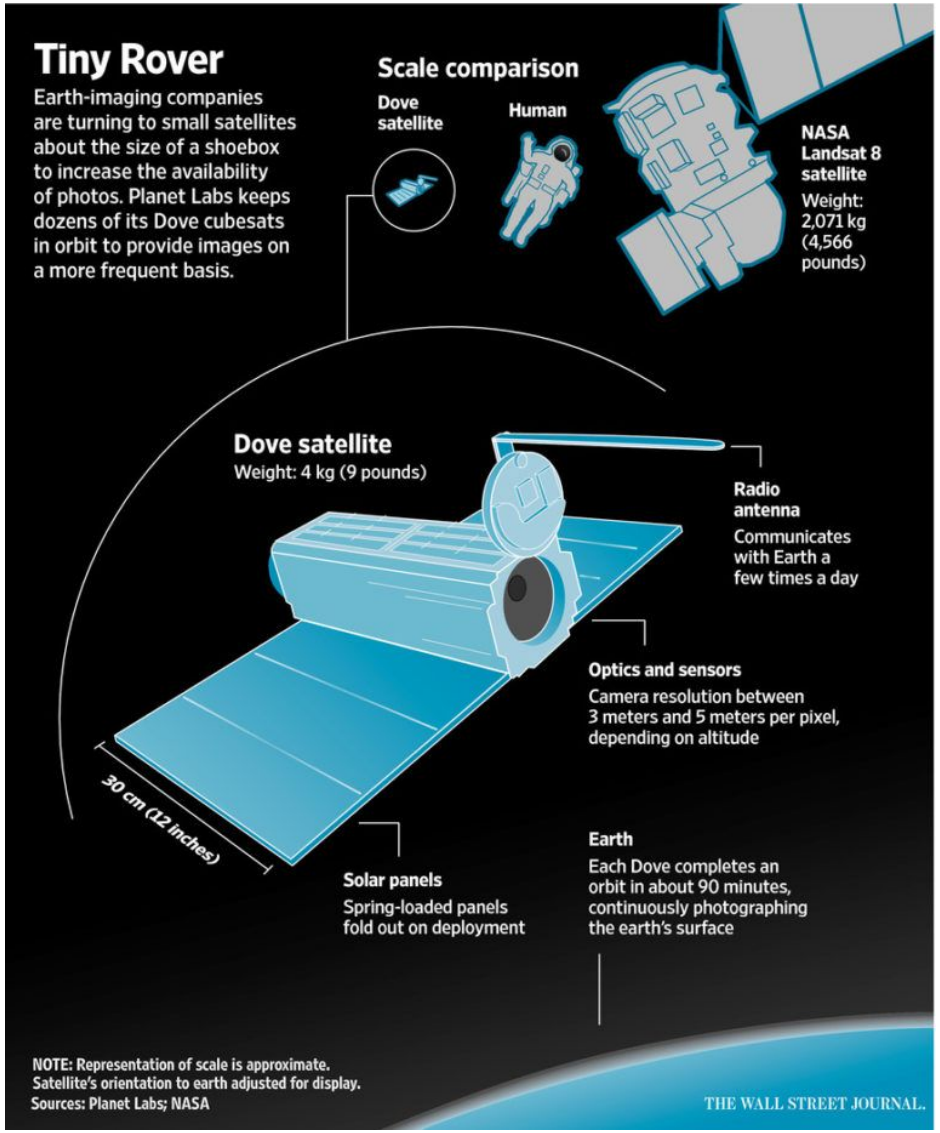
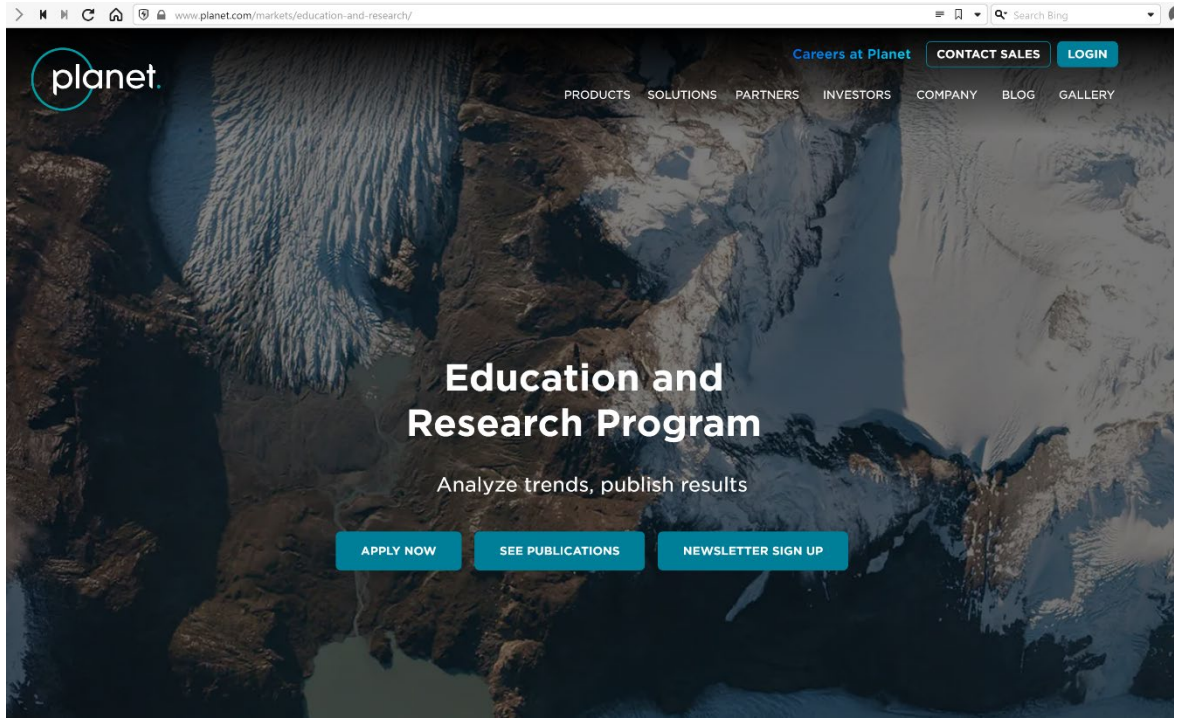
PlanetScope

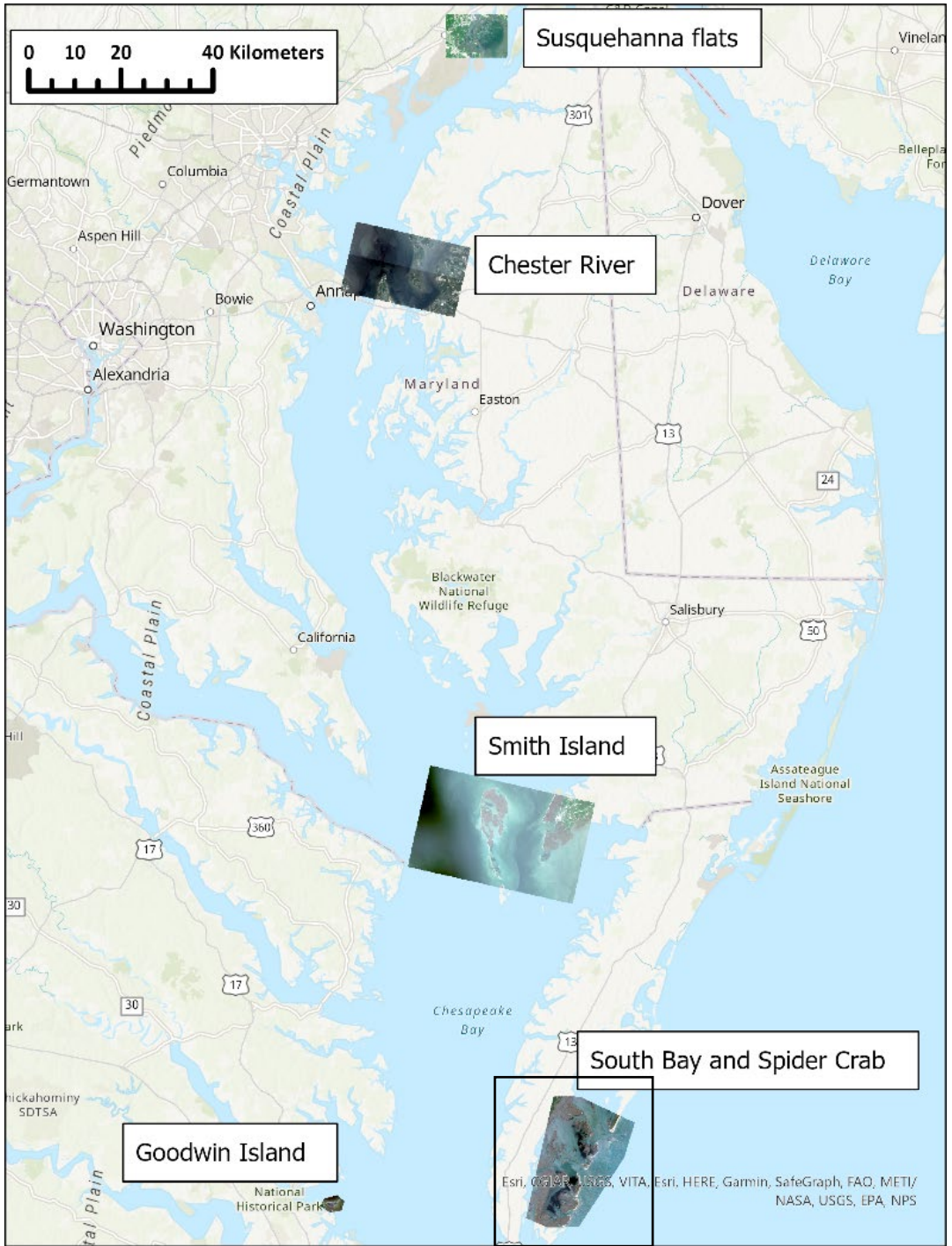


- Multispectral, high spatial resolution
  - 3 m multispectral (RGB & NIR bands)
  - 1 m multispectral (skysat)
  - New 8 band sensors already launched
- Almost daily coverage (Over 100 satellites)



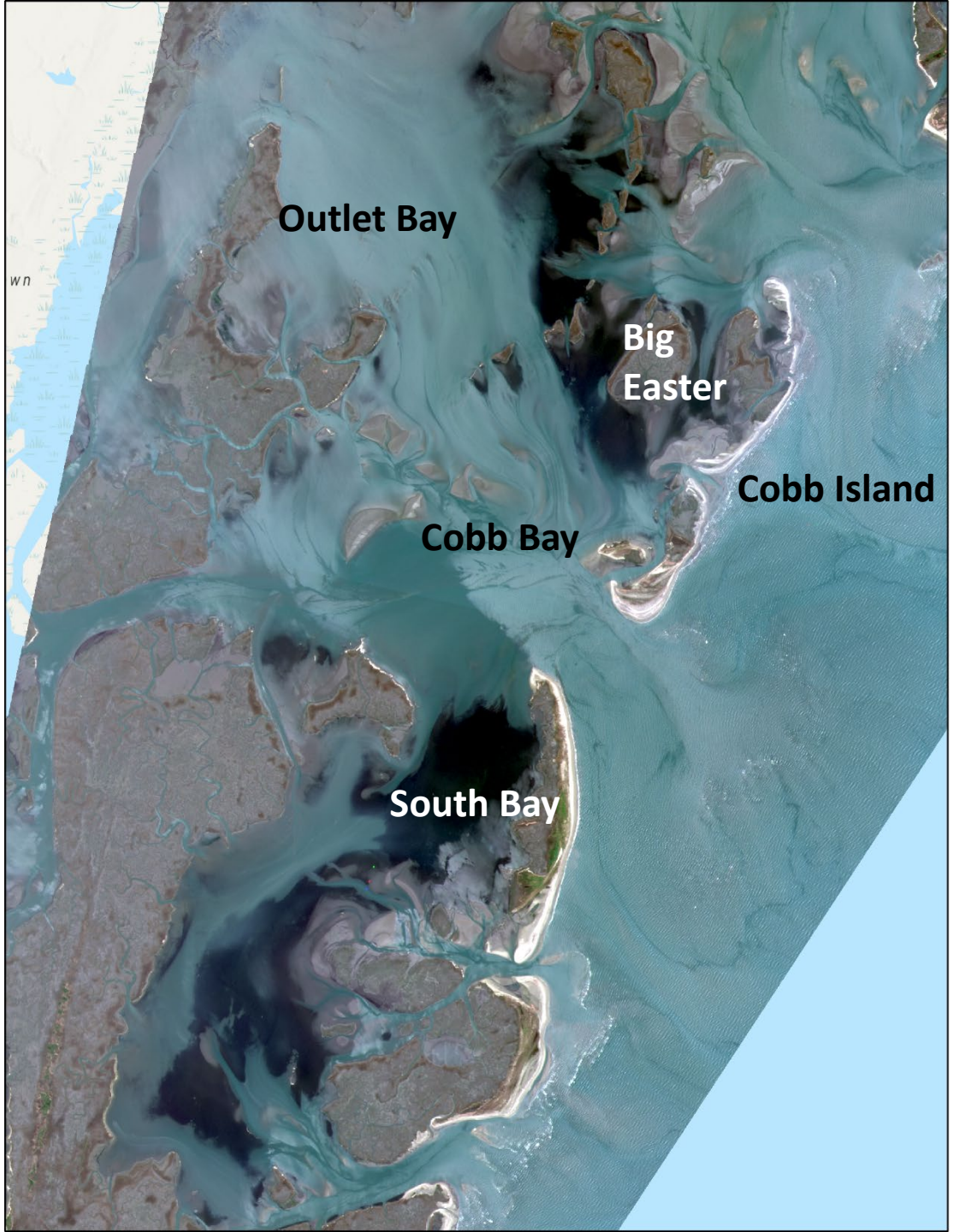
Chesapeake Bay sites of interest.

- 5 sites
- Ranging from saline to fresh
- Supervised classification
  - Expert advise for training patches

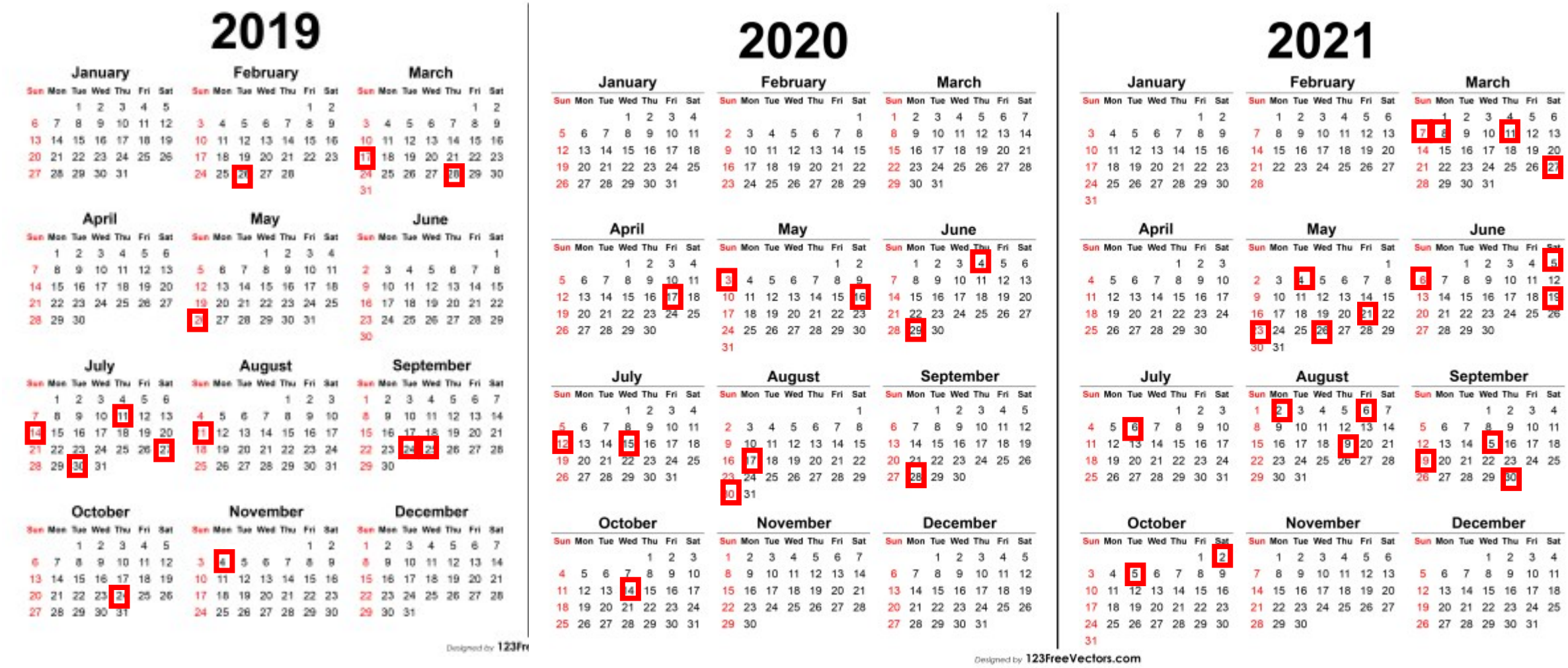


South Bay & Spider Crab

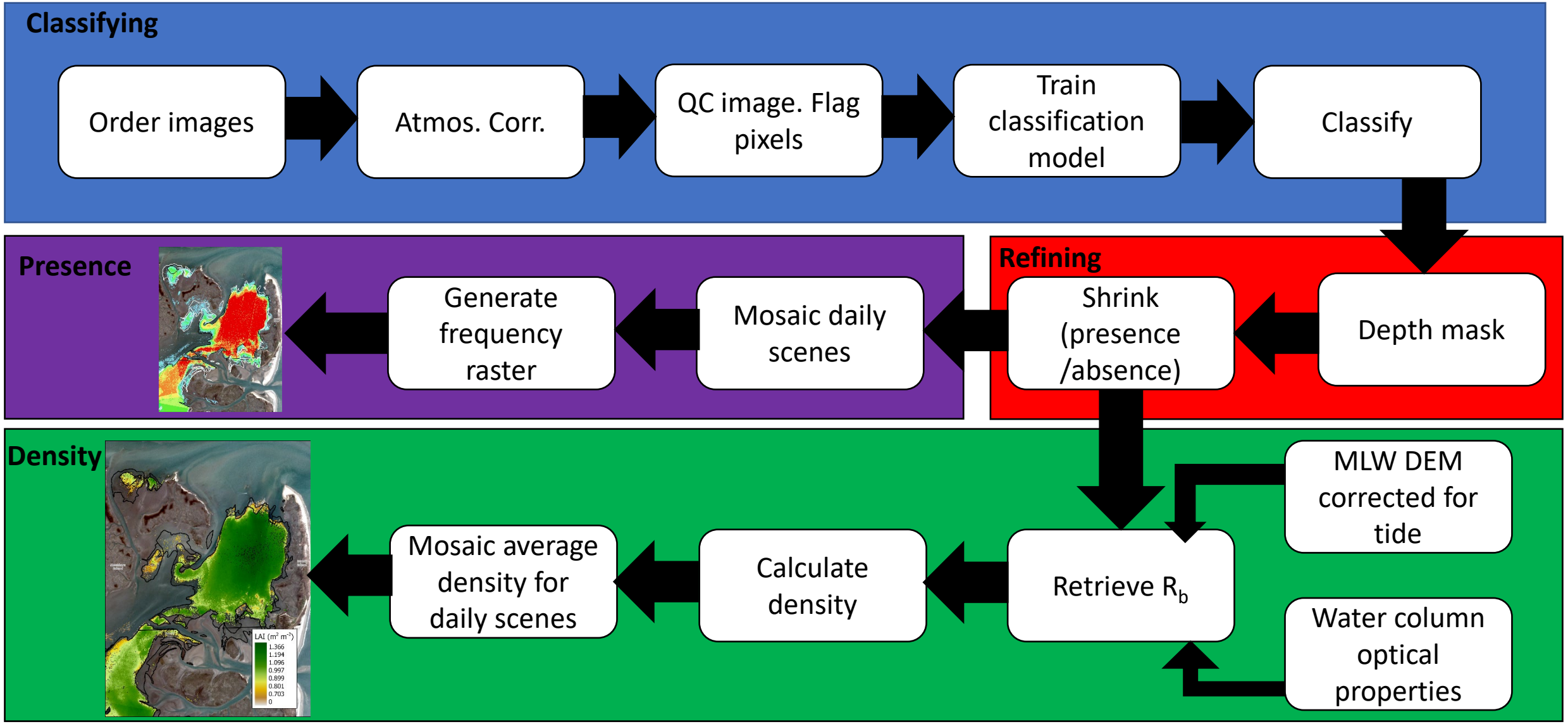
- Planet passes every day, often multiple passes from different sensors.
- Images good for seagrass identification.
  - Low tide
  - Low turbidity
  - Low cloud cover.



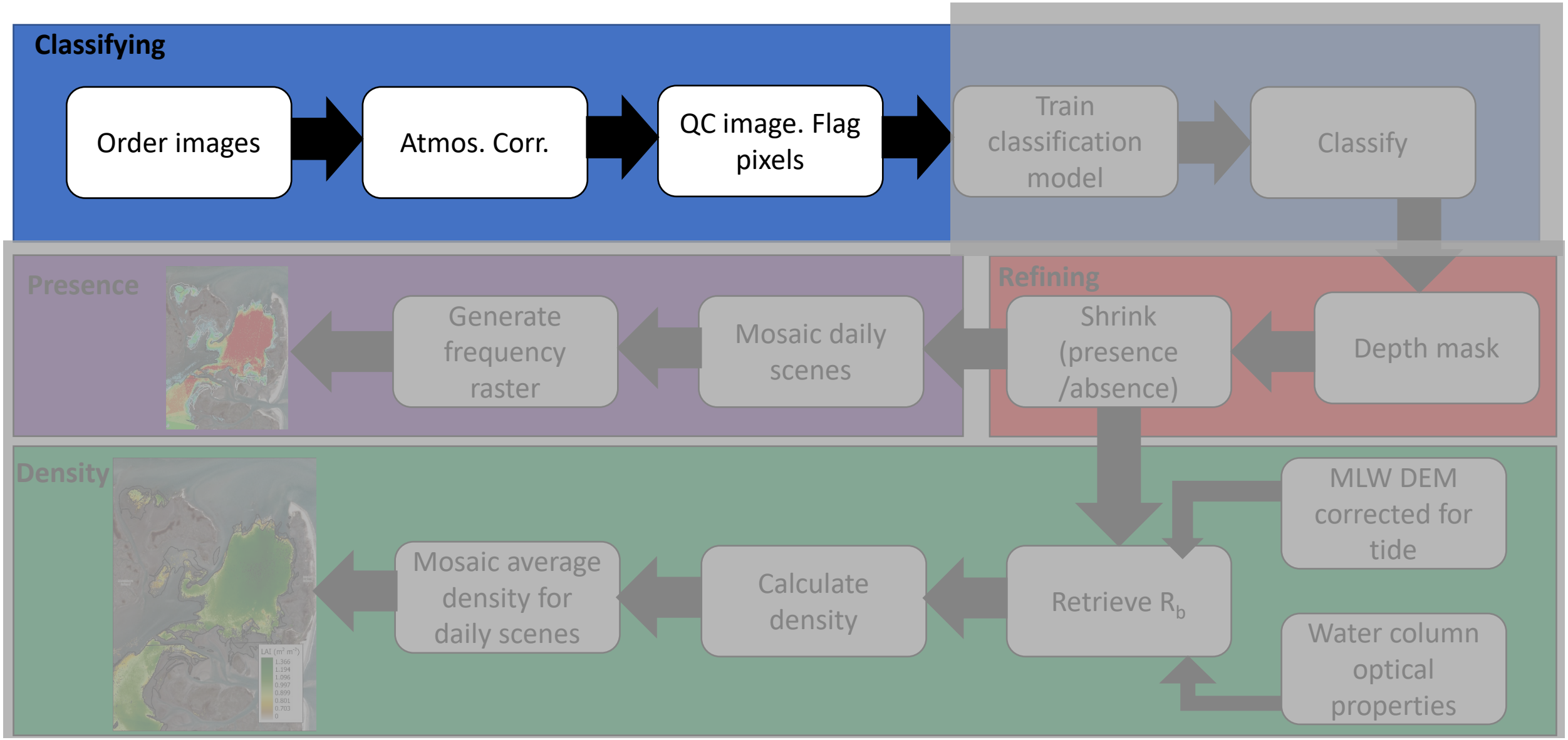
South Bay & Spider Crab



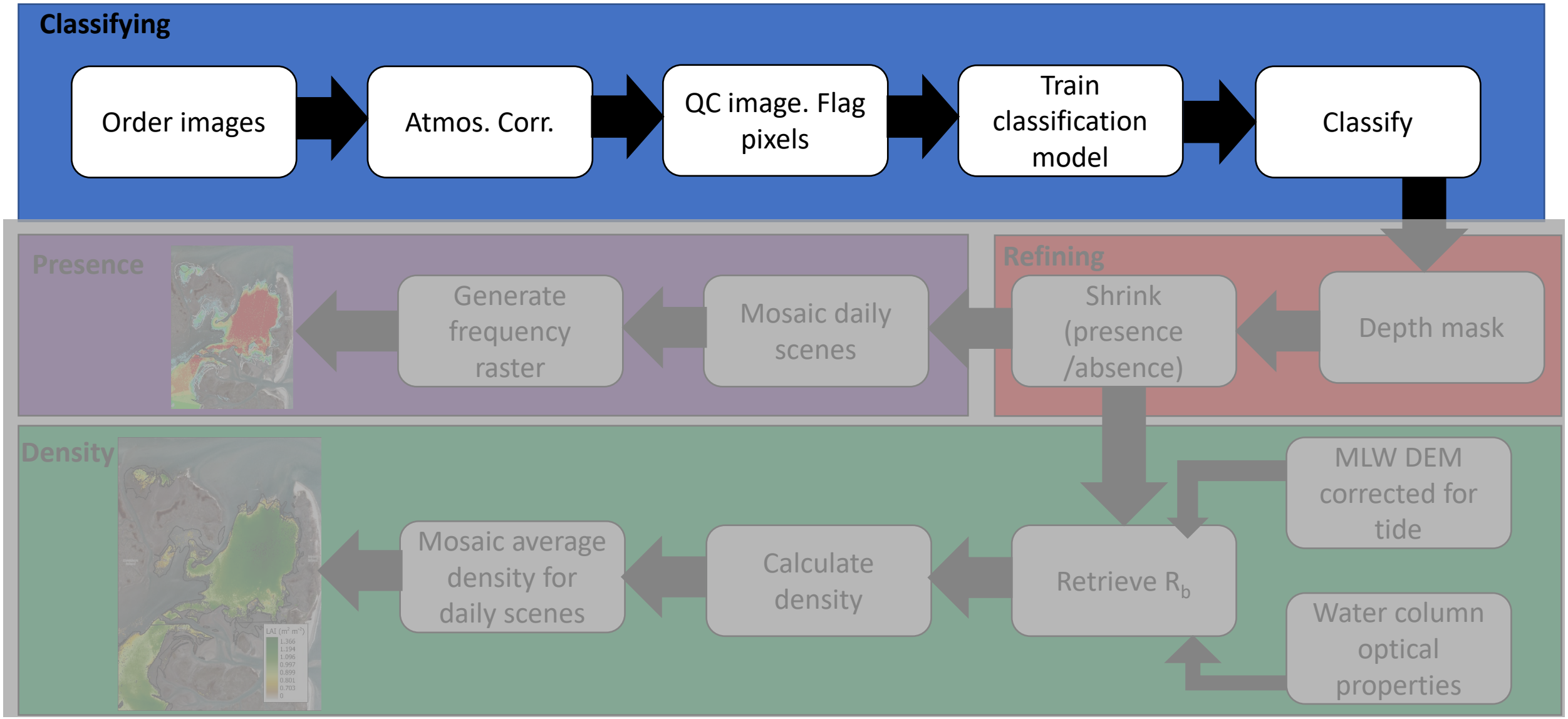
Processing workflow



Processing workflow

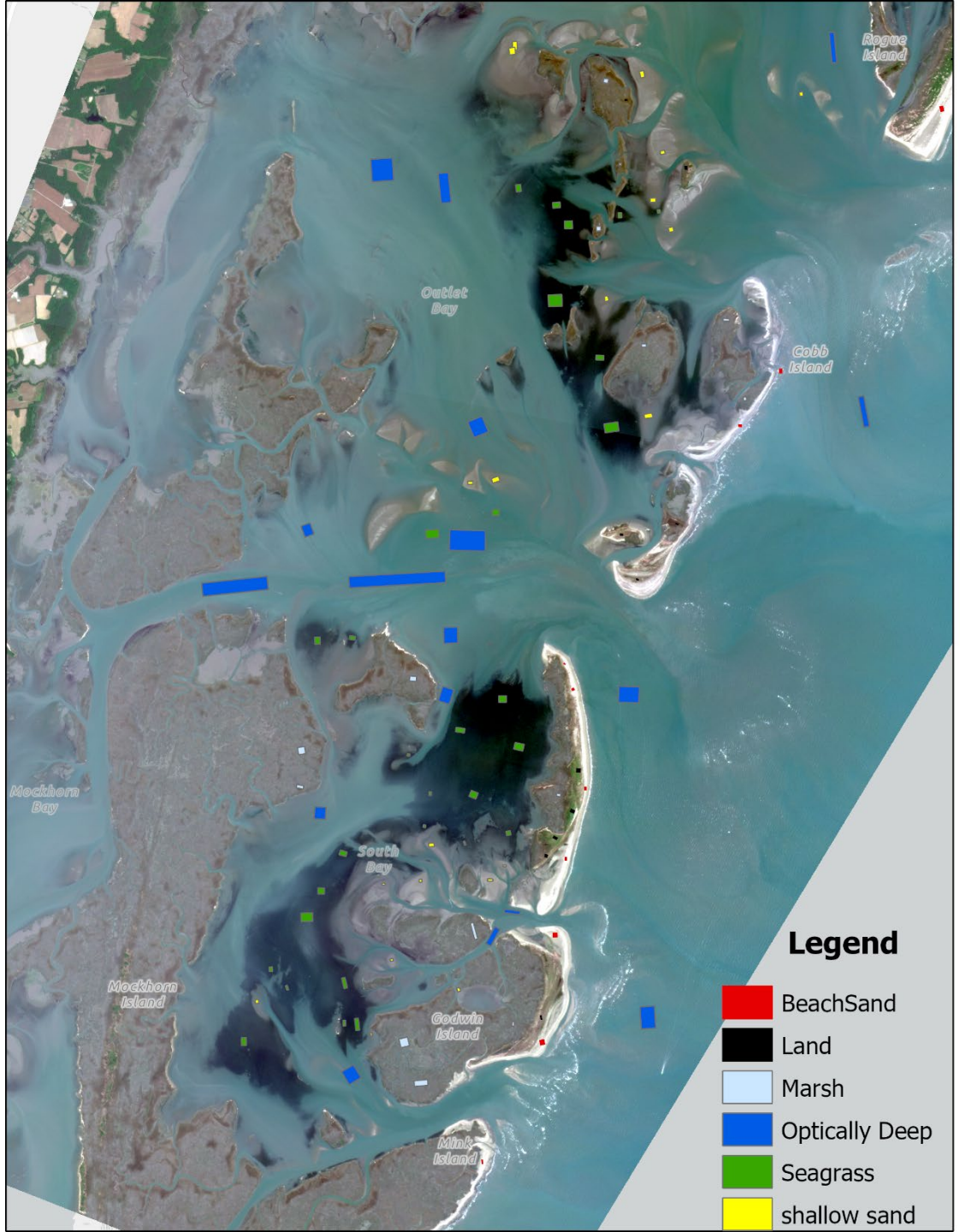


Processing workflow



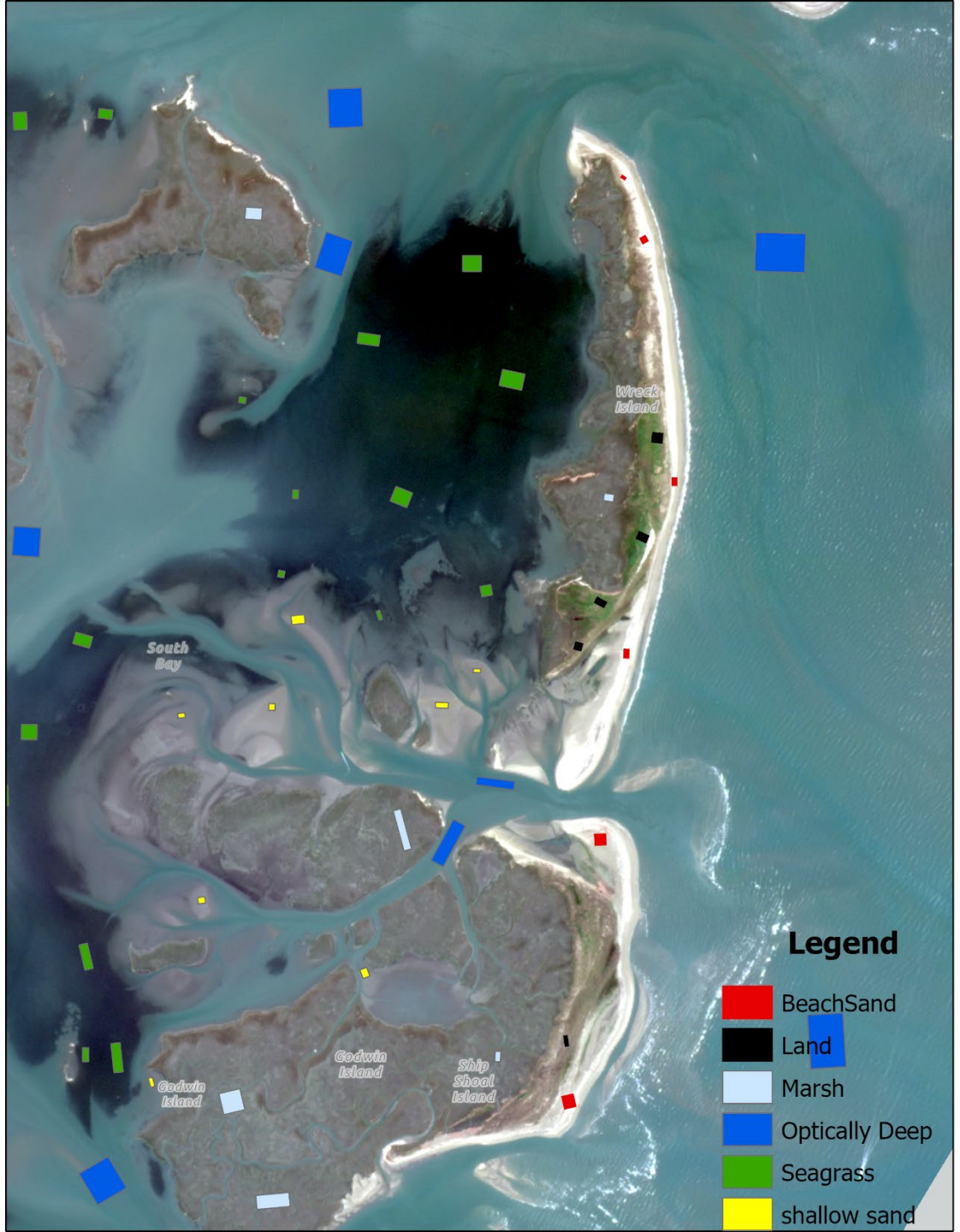
Classification

- Generate training patches for each target
  - Beach
  - Land
  - Marsh
  - Optically deep
  - Seagrass
  - Shallow sand

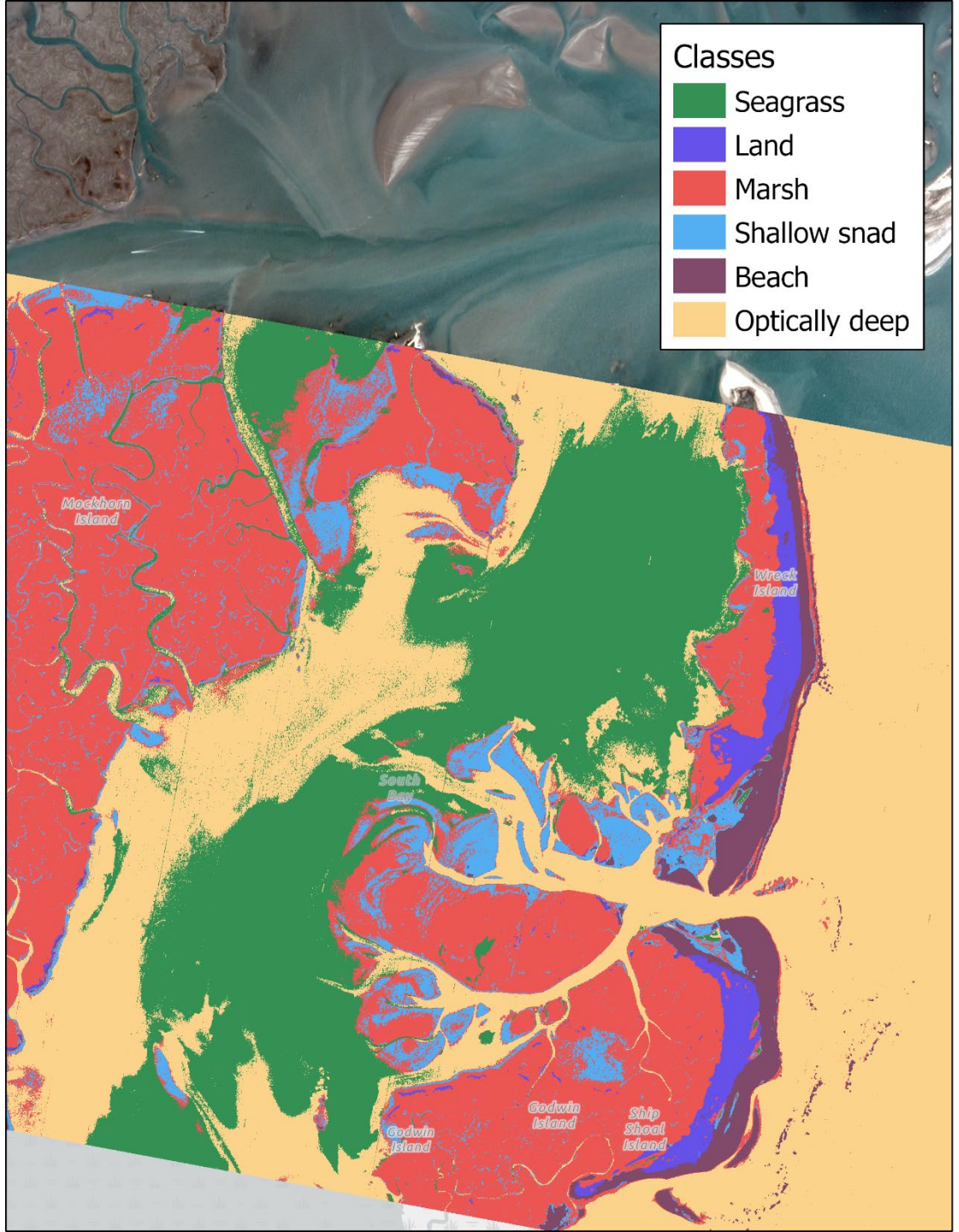


Classification

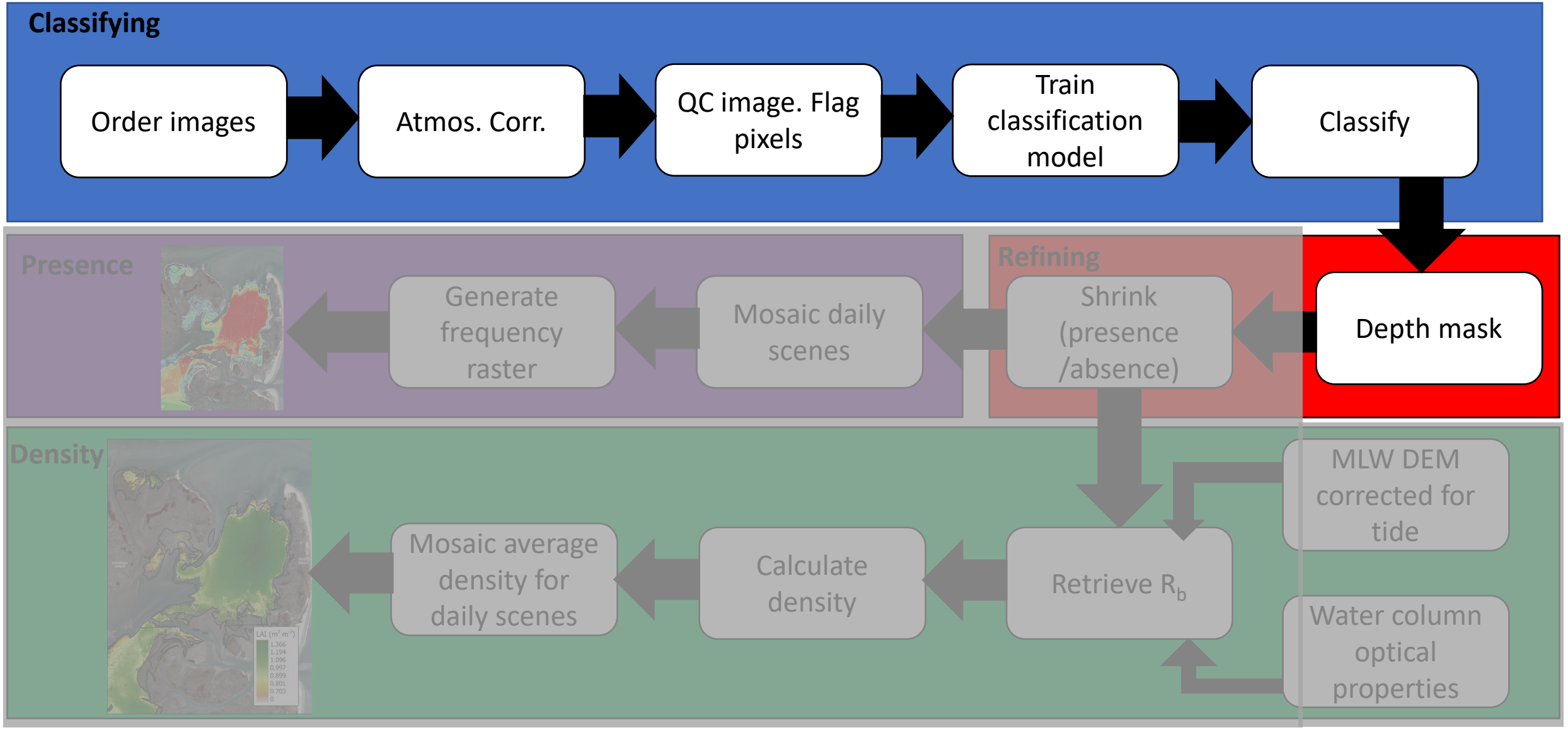
- Generate training patches for each target
  - Beach
  - Land
  - Marsh
  - Optically deep
  - Seagrass
  - Shallow sand
- Training patches for each image, or select areas that are consistent over time.
- Batch process using same patches.
- Each individual image is trained and classified.



Classification

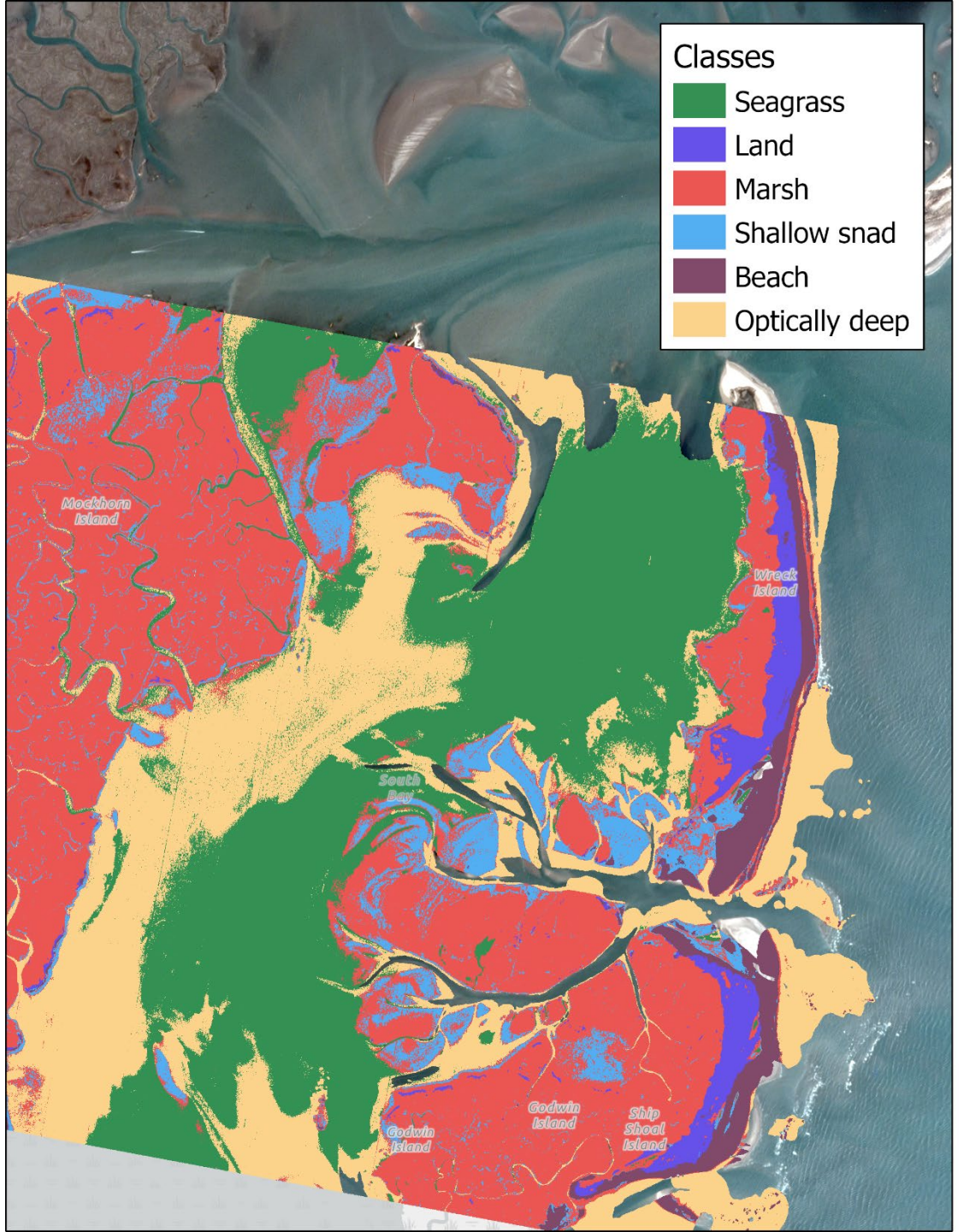


Processing workflow

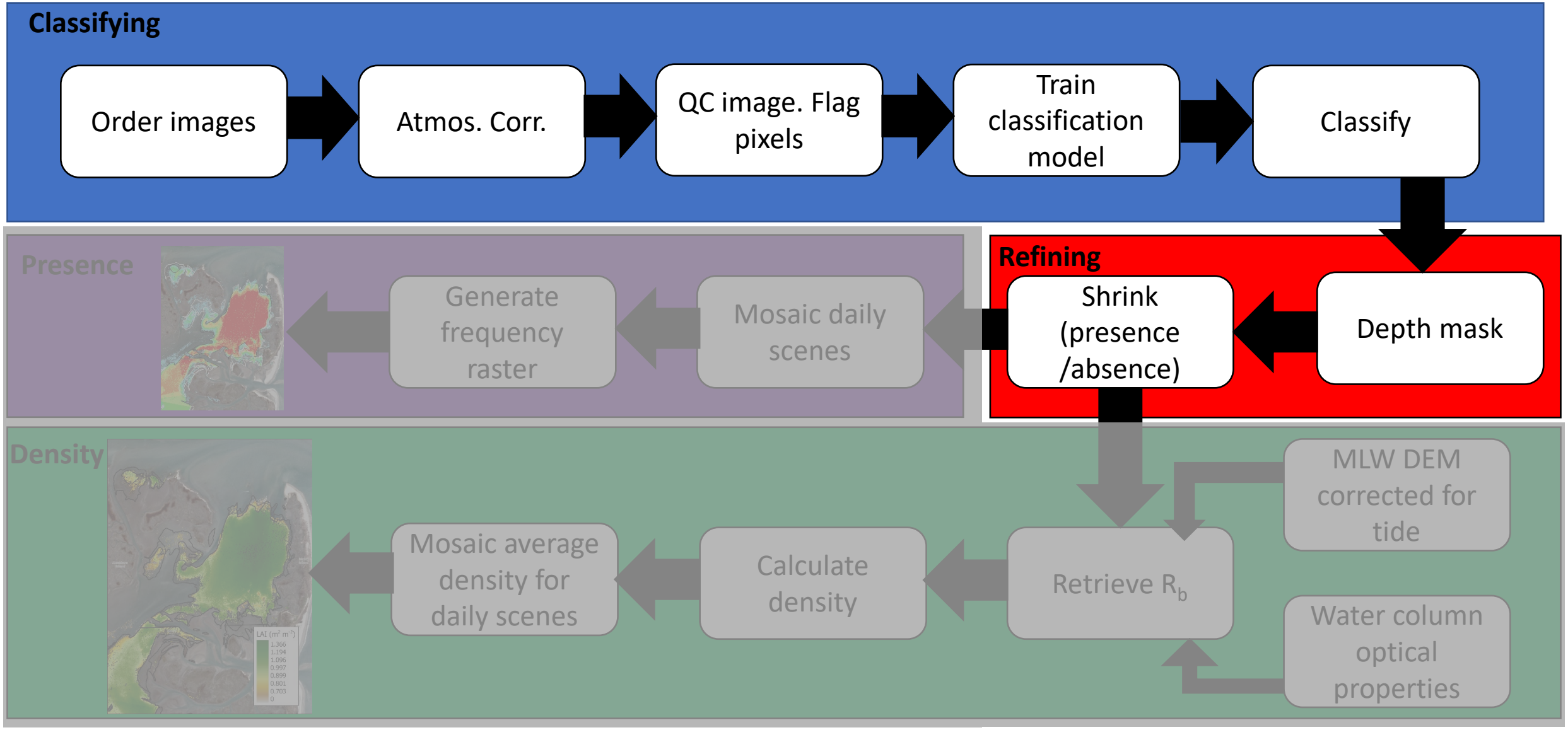


Classification

Depth mask removes green optically deep water.



Processing workflow



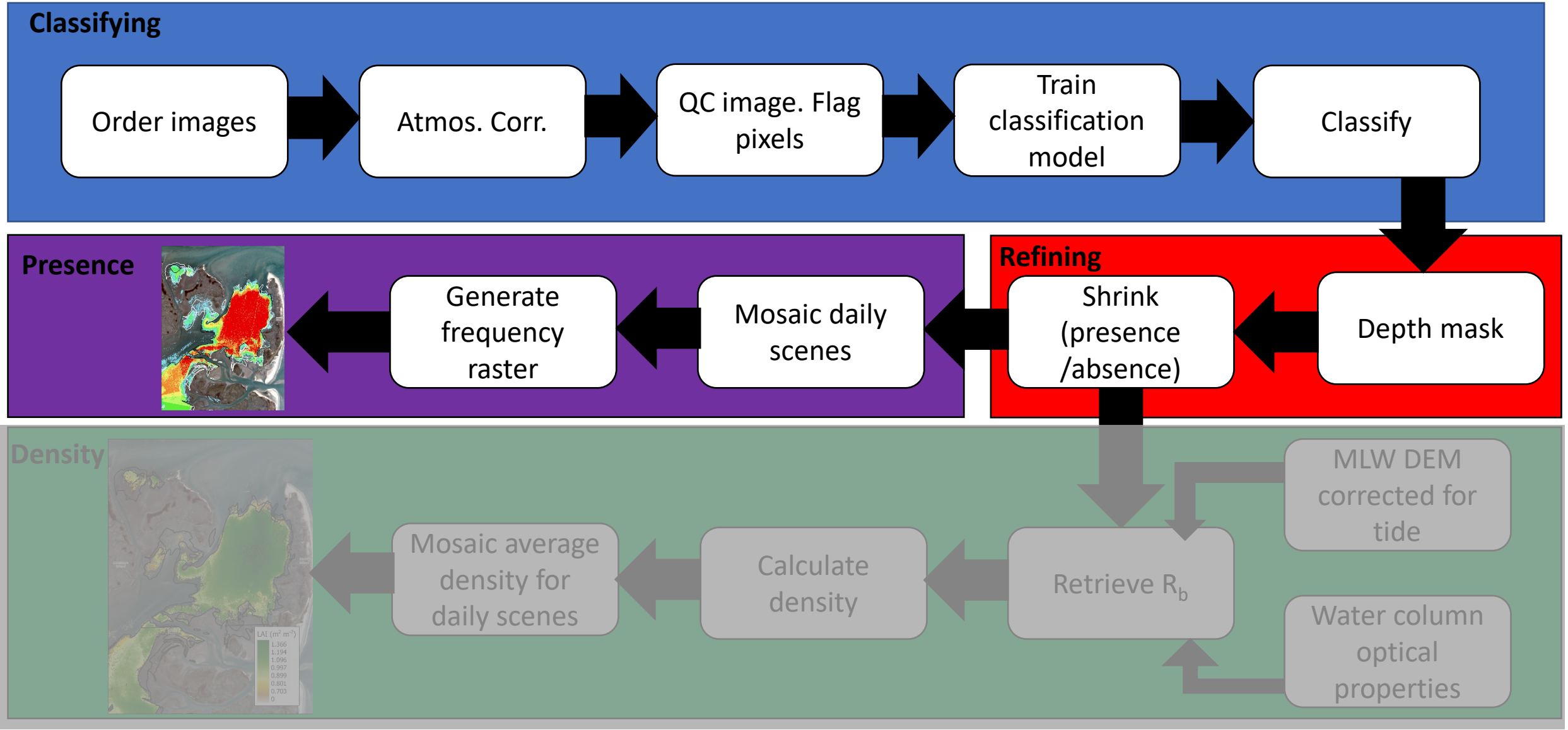
Shrink

Removes single seagrass pixels with no neighbouring pixels

Shrink

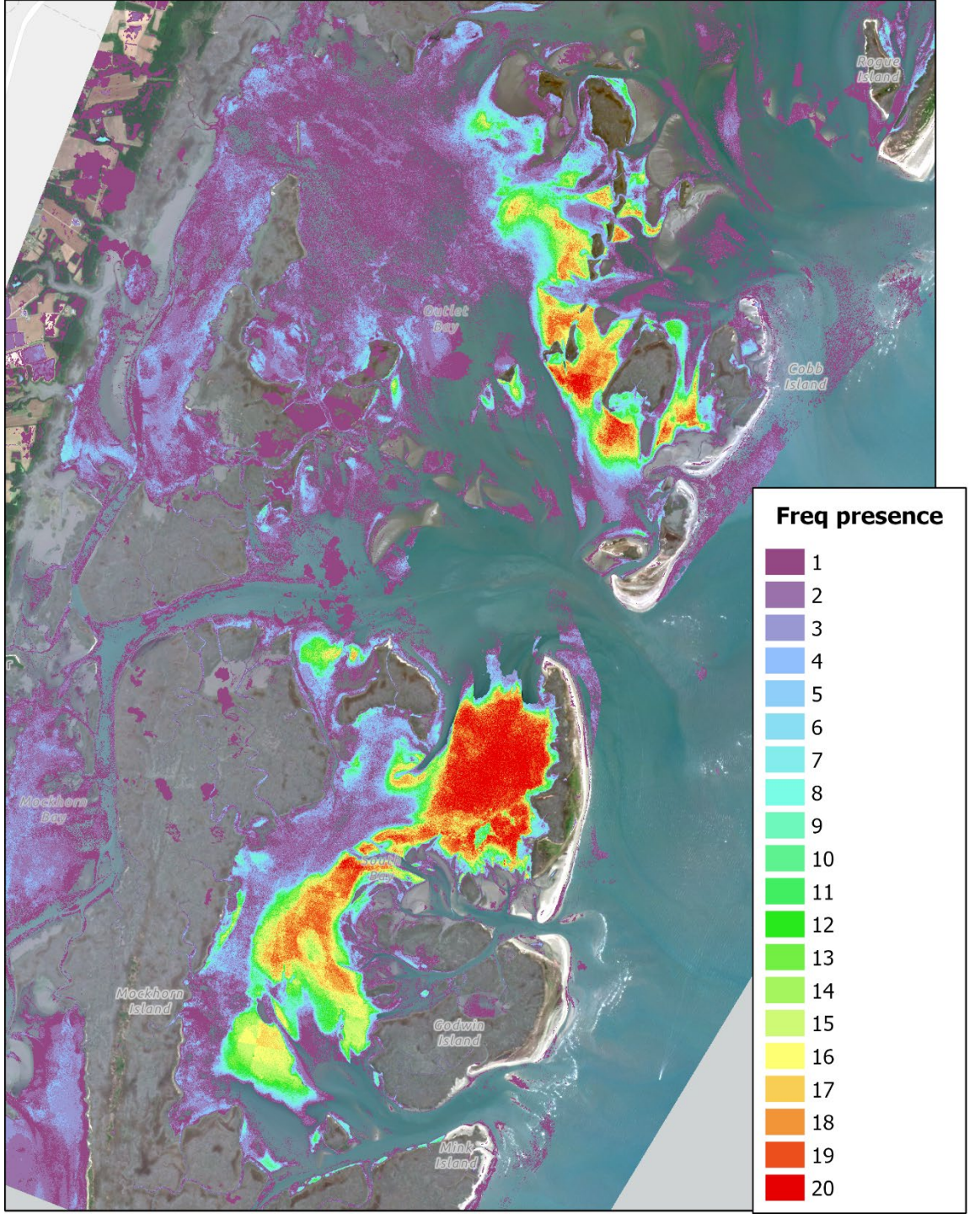
Removes single seagrass pixels with no neighbouring pixels

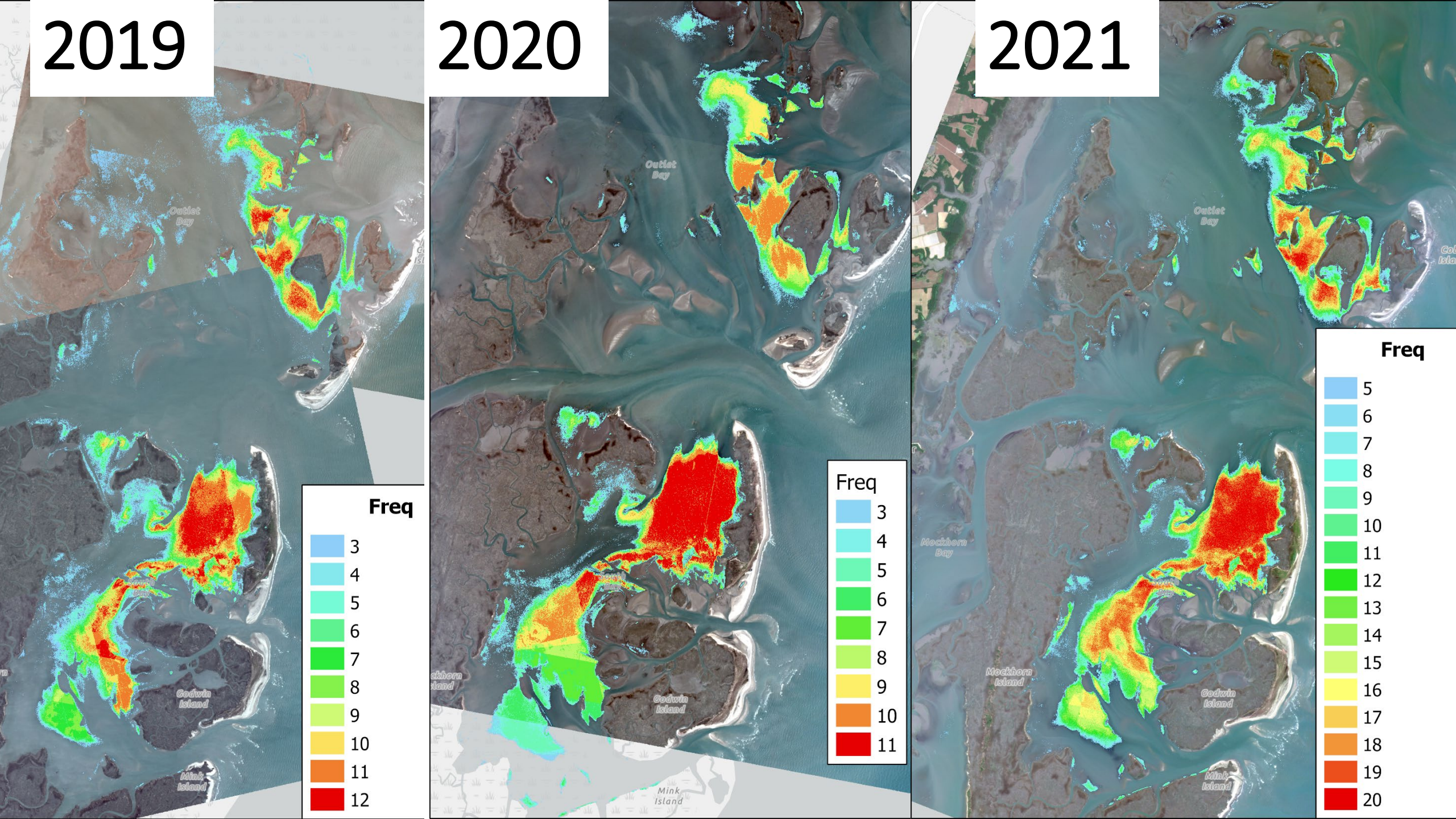
Processing workflow



2021 – frequency presence

- Some areas have very low frequency. These are images with increased turbidity close to land.
  - Remove with a mask?
  - Generate seagrass habitat areas and use to mask
  - Not use those images – but they produce good classification in the seagrass meadows.
- Set a threshold for frequency presence.




2019
2020
2021
Freq
3
4
5
6
7
8
9
10
11
12
Freq
3
4
5
6
7
8
9
10
11
Freq
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13
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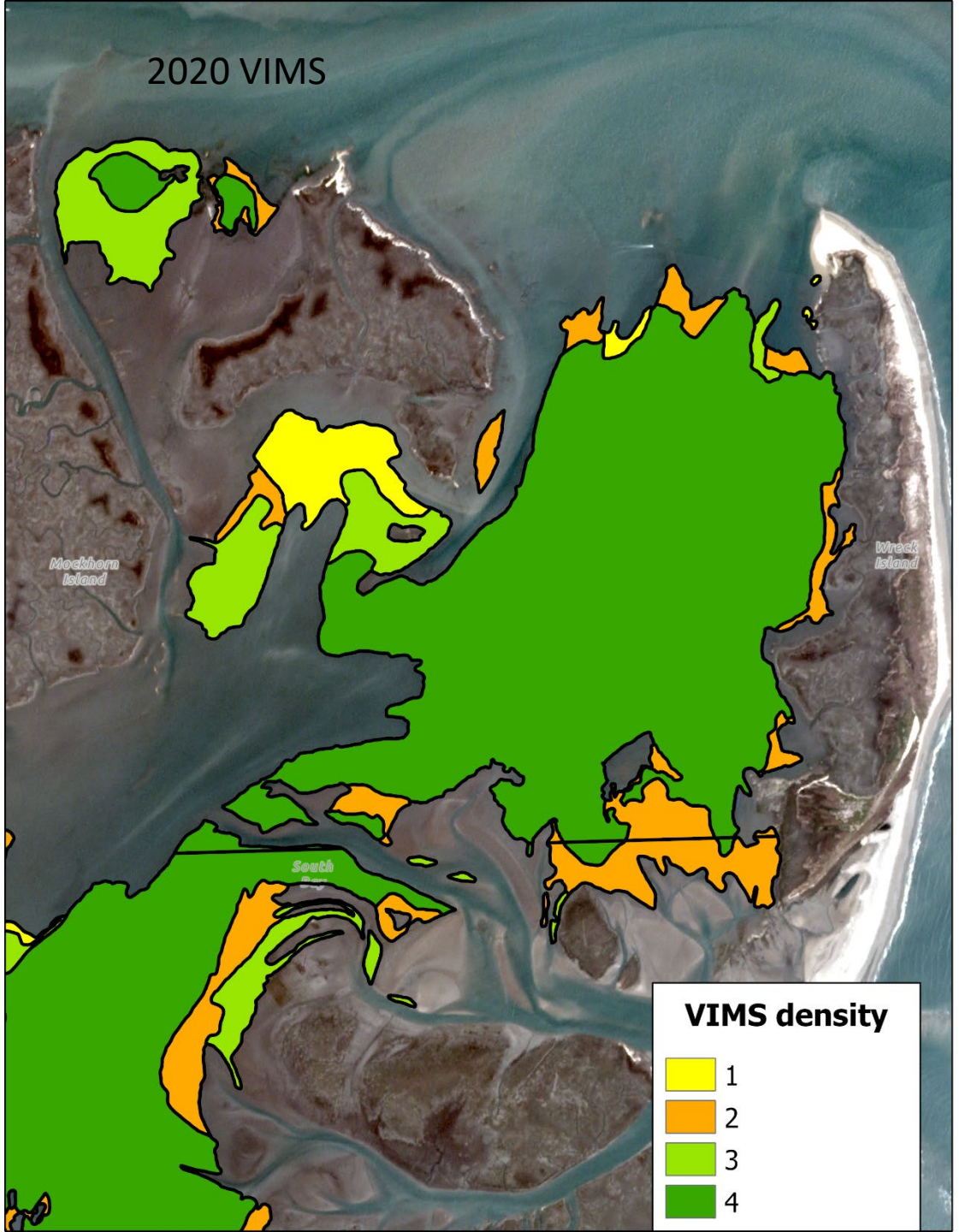
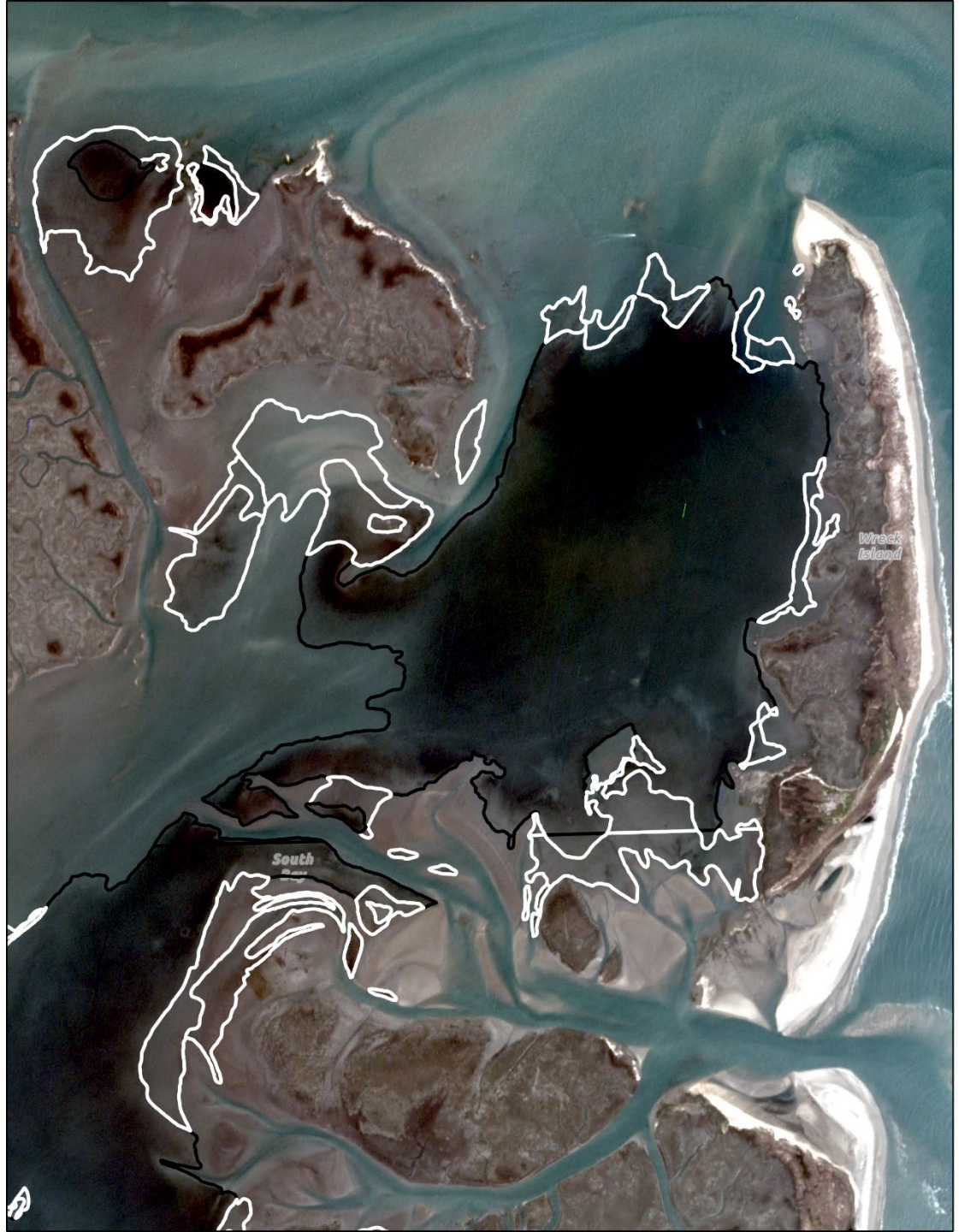
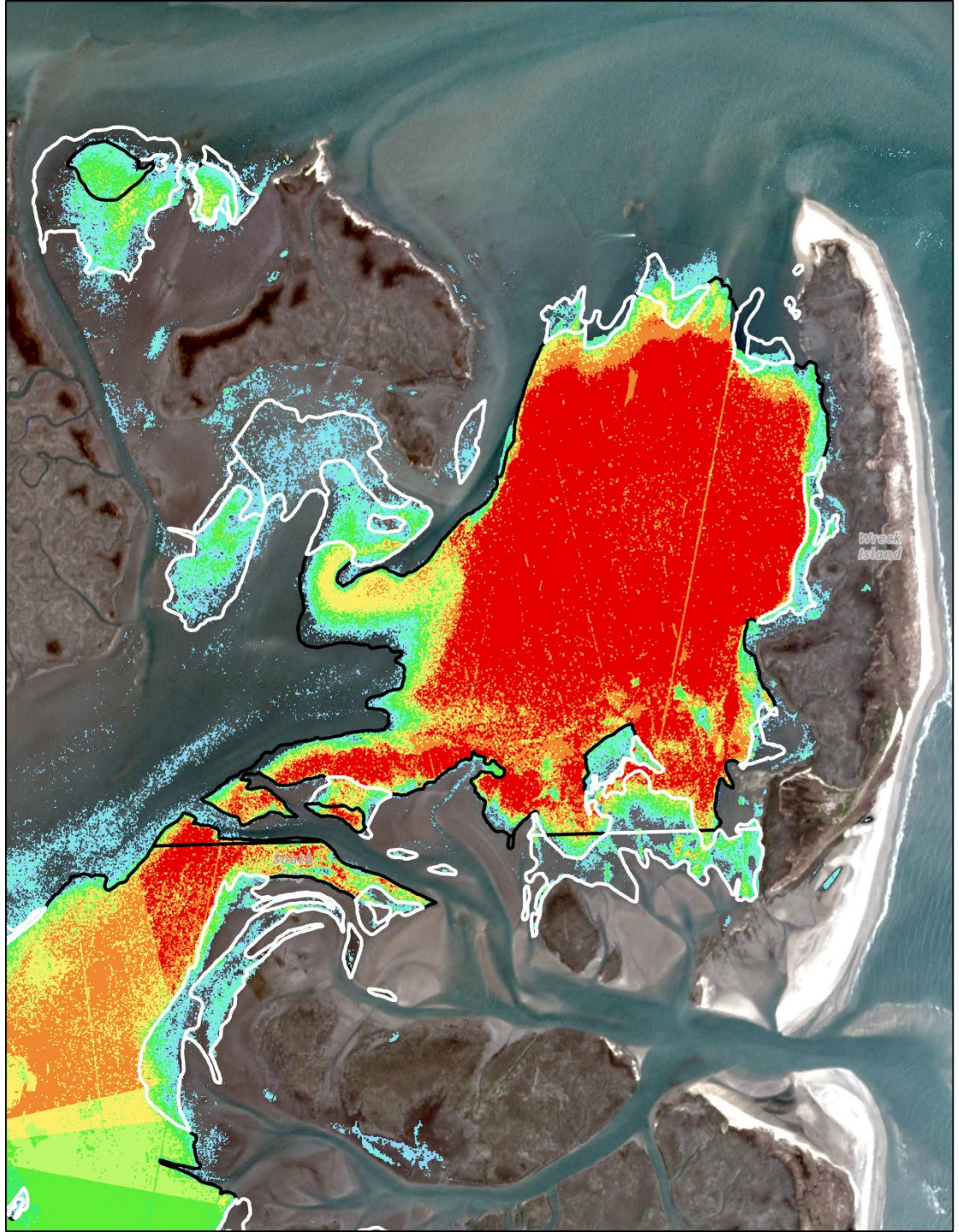
15
16
17
18
19
20
Outlet Bay
Godwin Island
Mink Island
Mockhorn Bay
Mockhorn Island

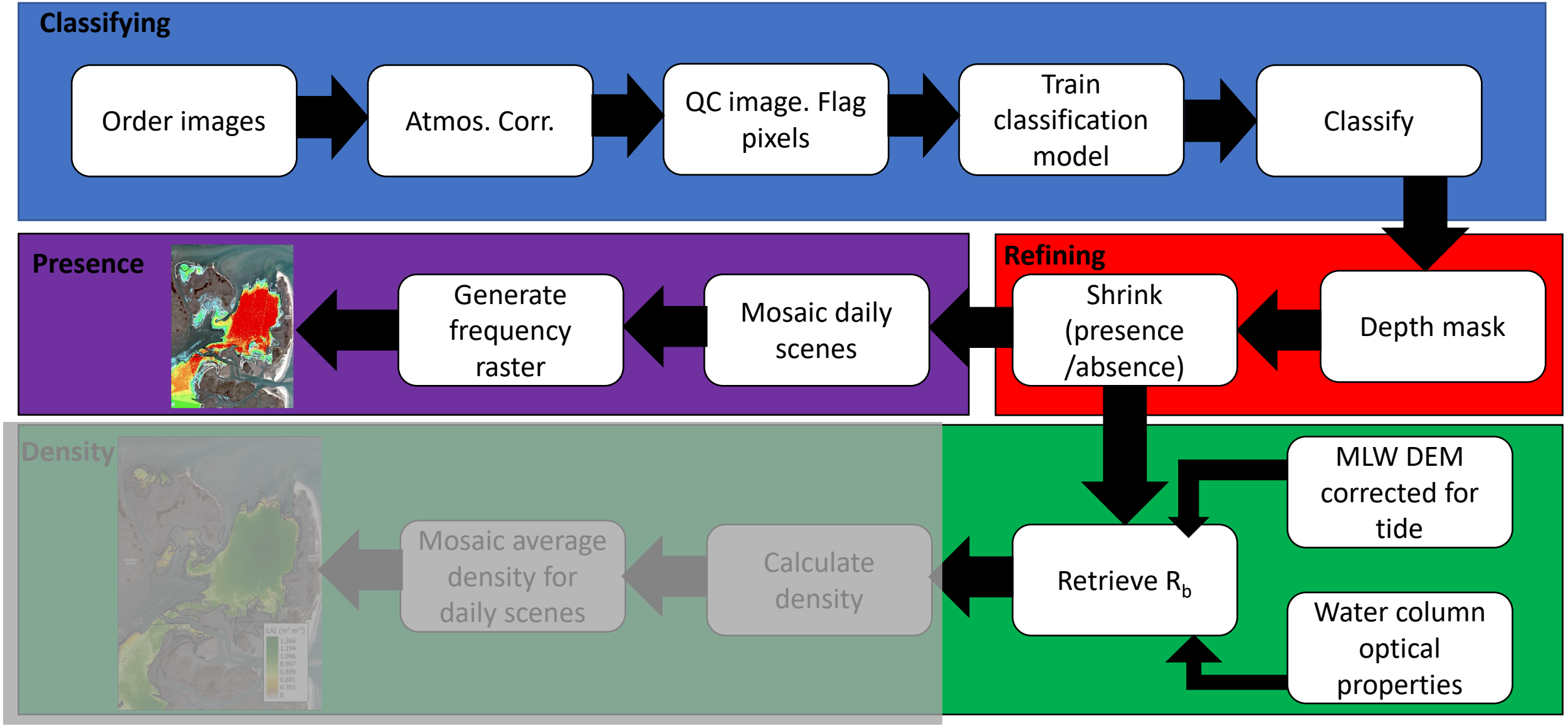

May 2020
Mockhorn Island
Wreck Island
South Bay


2020 VIMS
Mockhorn Island
Wreck Island
South Bay
VIMS density
1
2
3
4

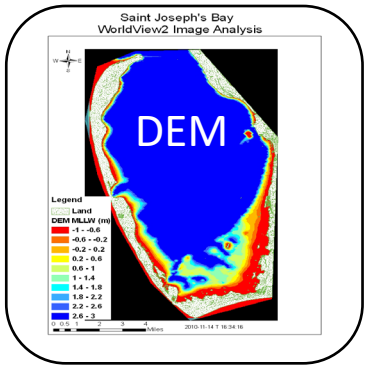

Wreck Island
South

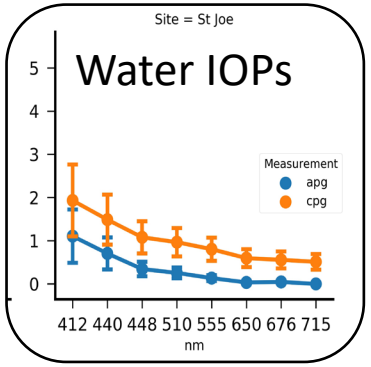

Wreck Island

Processing workflow



From distribution to density

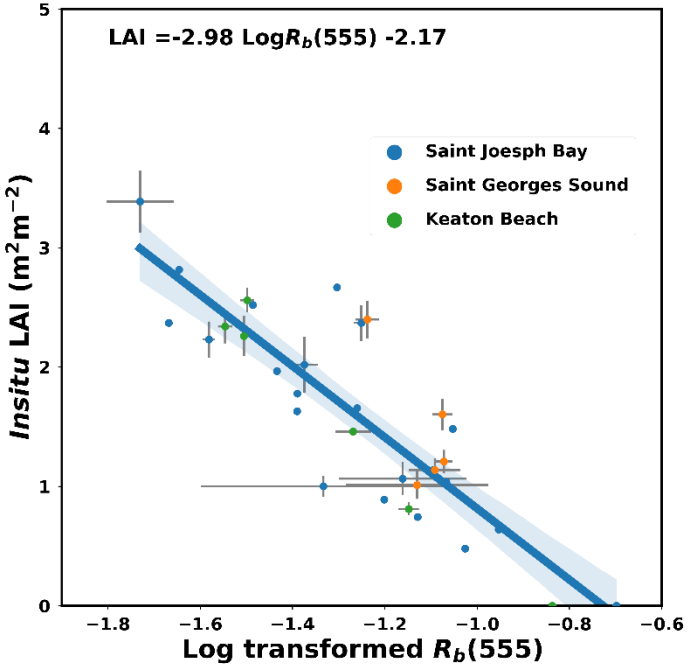




- ***Atmospherically corrected*** R_{rs} from imagery
- $Q_b = E_u(z_b)/L_u(z_b) = \pi$
- K_{Lu} & K_d from *Hydrolight* using measured IOPs
- Water depth, DEM + tide

$$R_b = \frac{R_{rs} Q_b}{t} \frac{\exp\left[-K_{Lu} z_b\right]}{\exp\left(K_d z_b\right)}$$

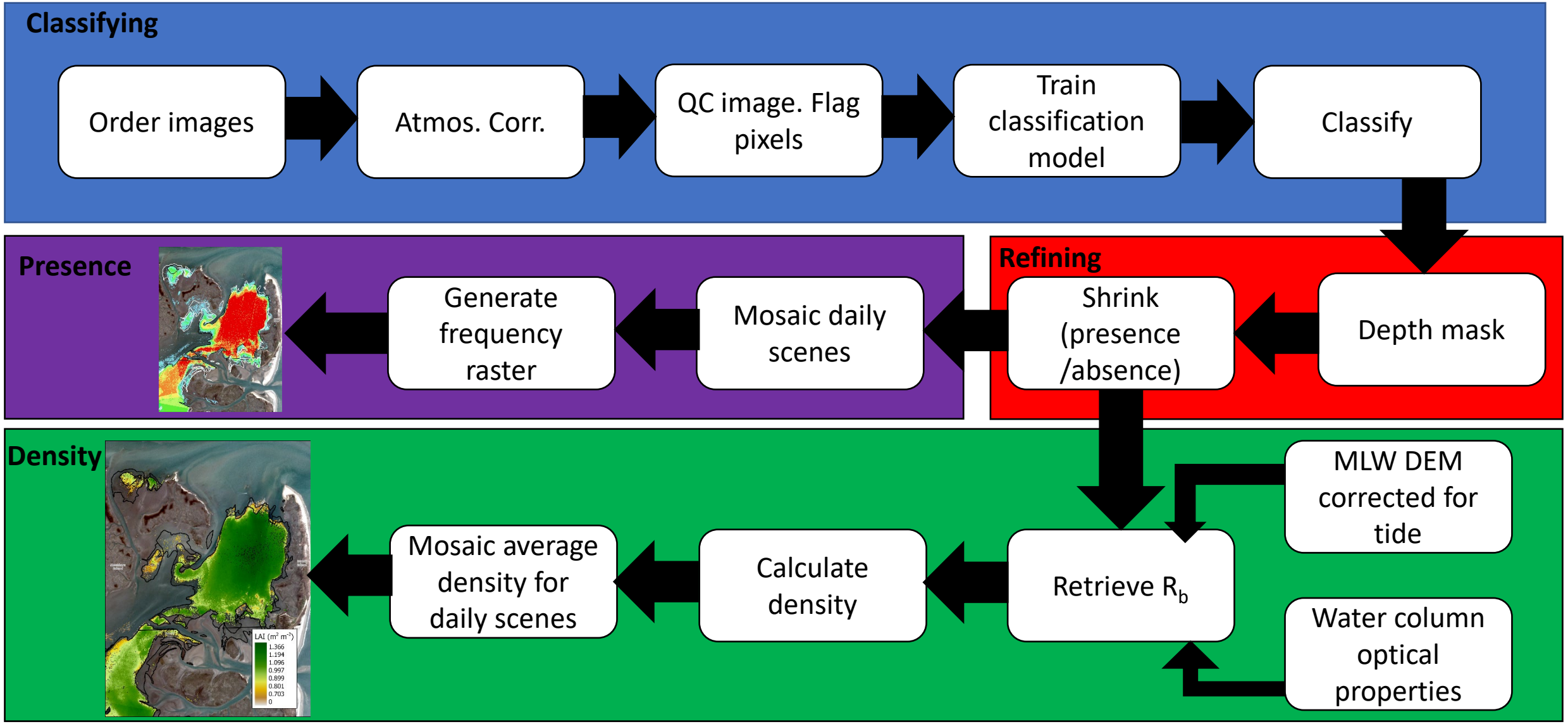
- z_b – bottom depth from acoustic survey
- t – air/sea transmittance of $L_u(0.54)$



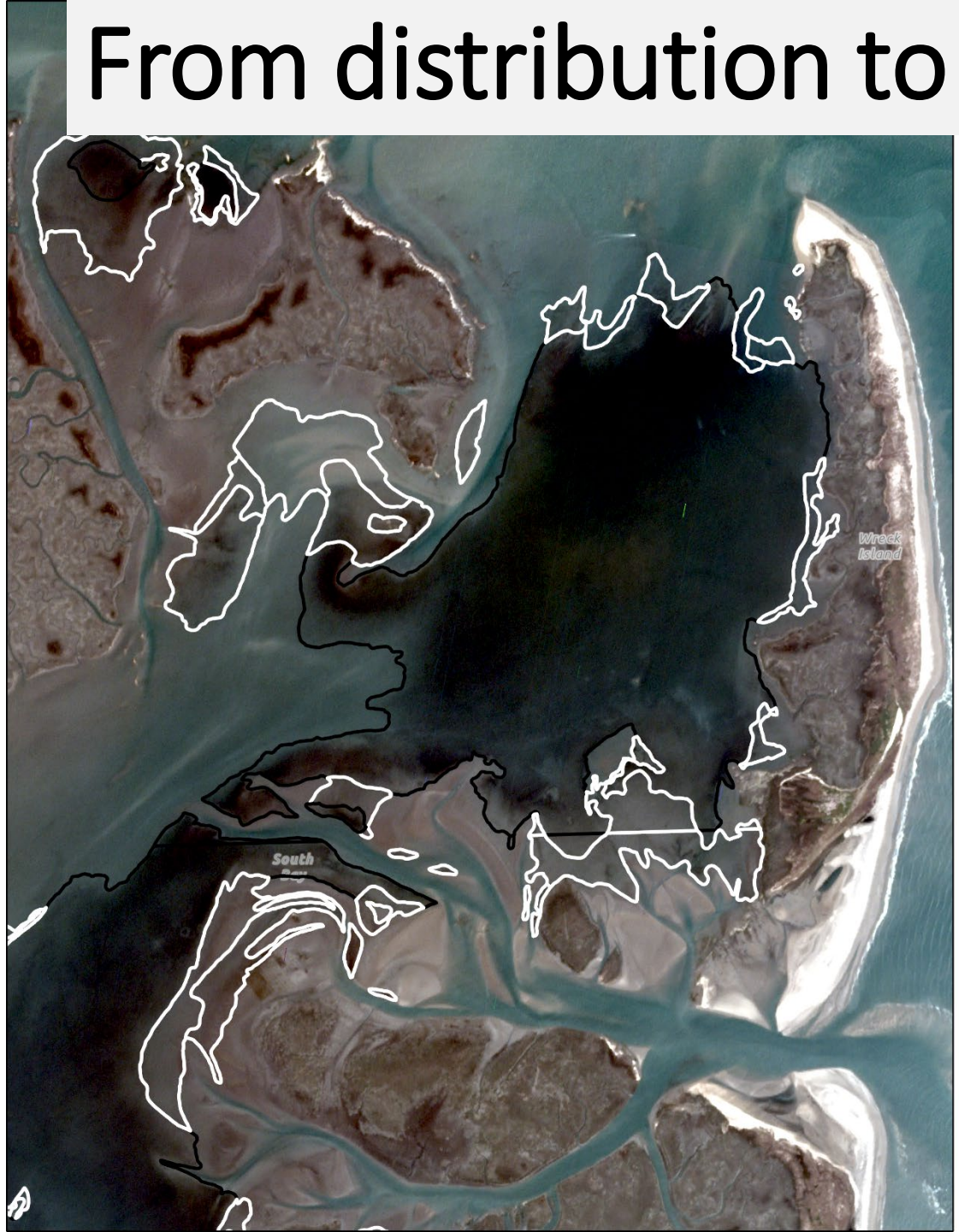
Hill, V. J., Zimmerman, R. C., Bissett, P., Dierssen, H. M., & Kohler, D. (2014). Evaluating Light Availability, Seagrass Biomass, and Productivity Using Hyperspectral Airborne Remote Sensing in Saint Joseph's Bay, Florida. *Estuaries and Coasts, 37*. doi:DOI: 10.1007/s12237-013-9764-3.

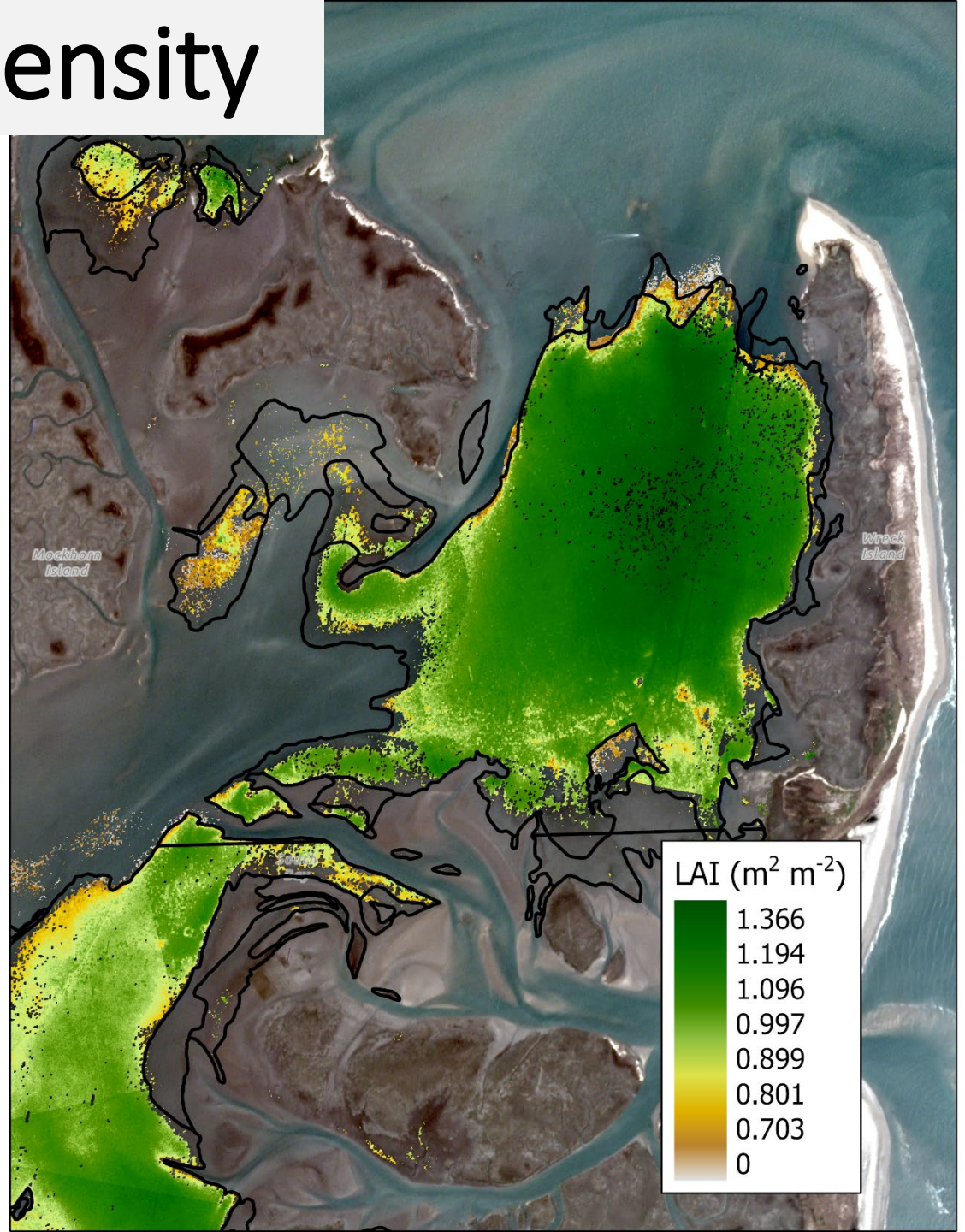
Dierssen, H., R. Zimmerman, R. Leathers, T. Downes, and C. Davis. 2003. Remote sensing of seagrass and bathymetry in the Bahamas Banks using high resolution airborne imagery. Limnol. Oceangr. **48: 444-455.**

Processing workflow

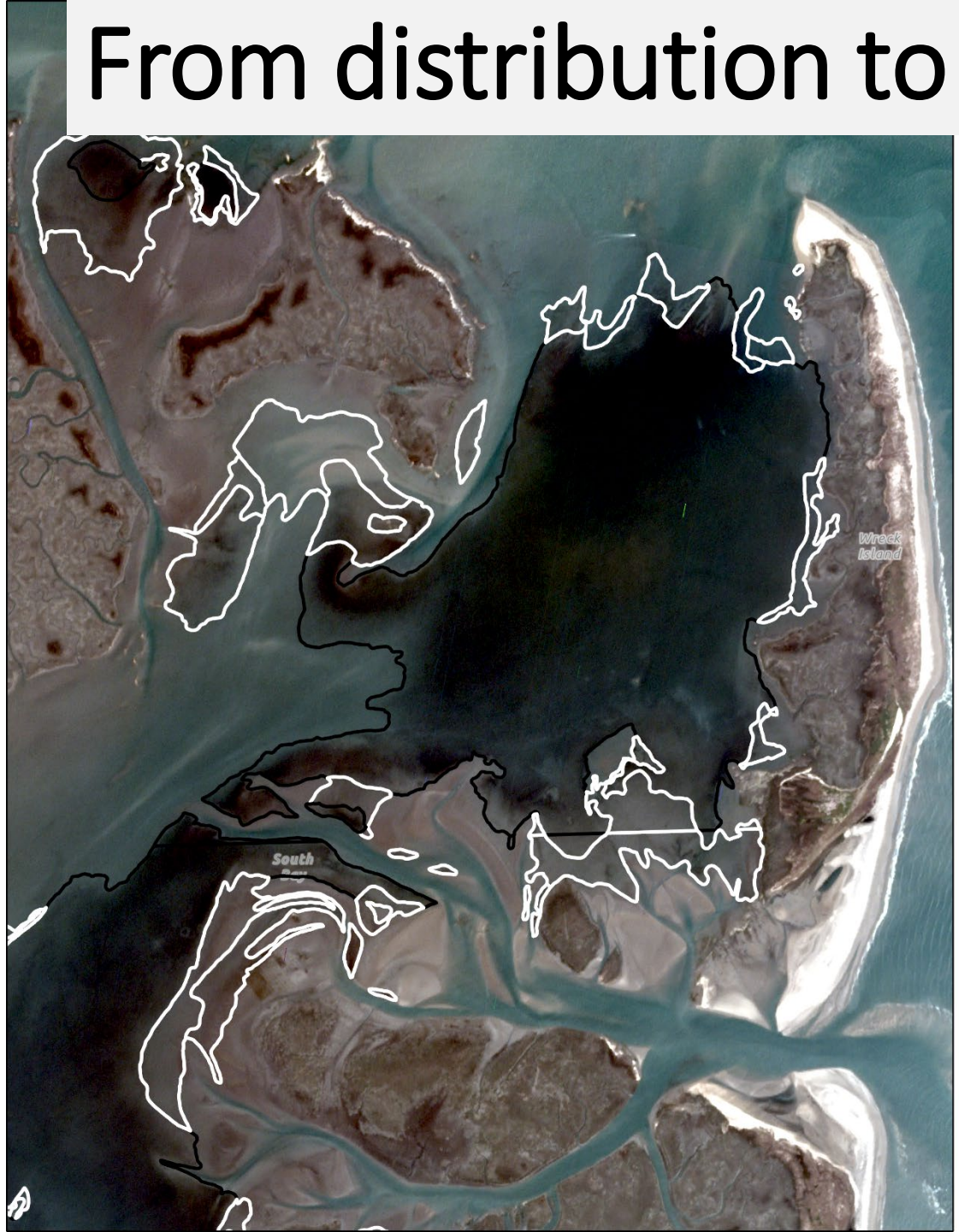


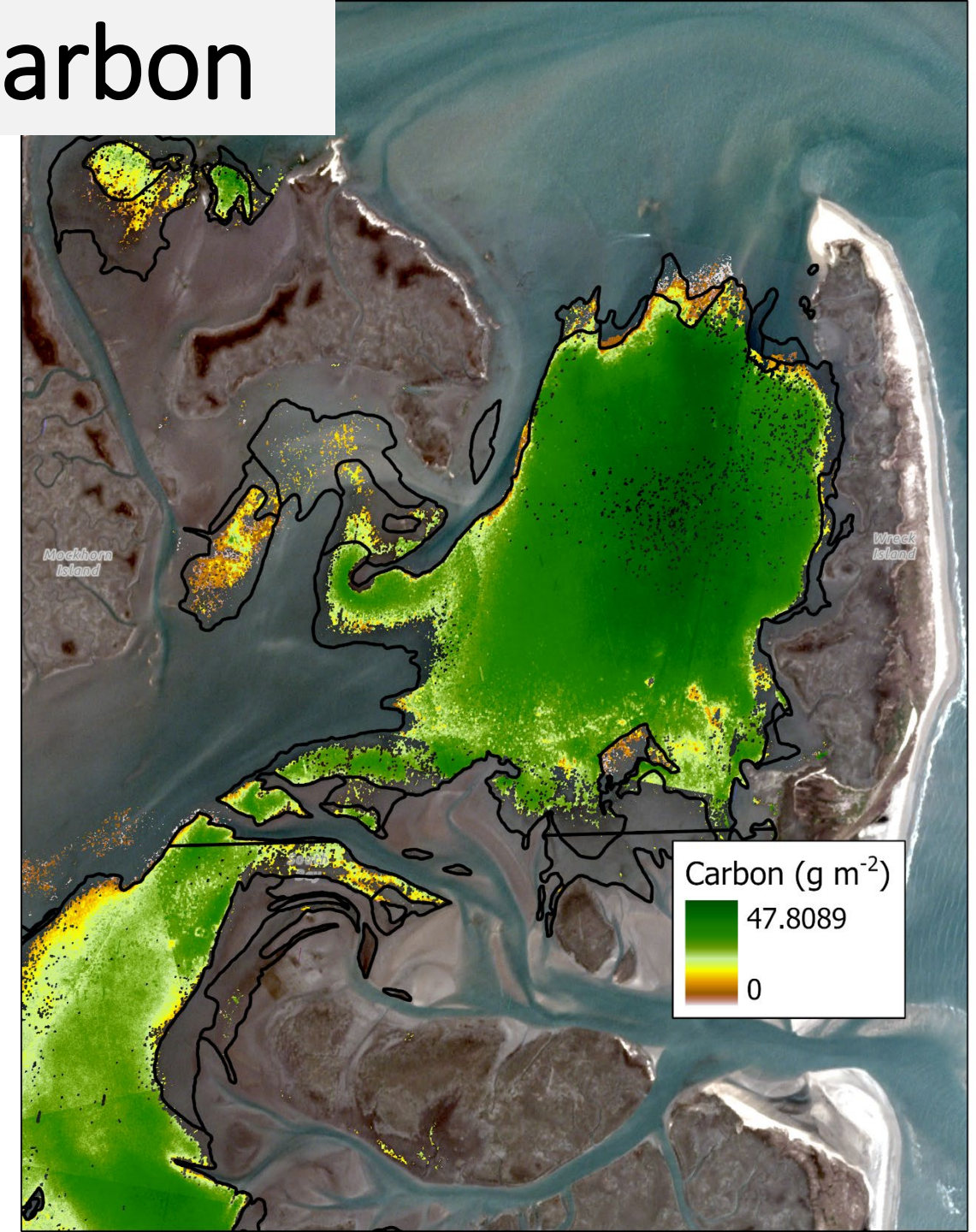
From distribution to density

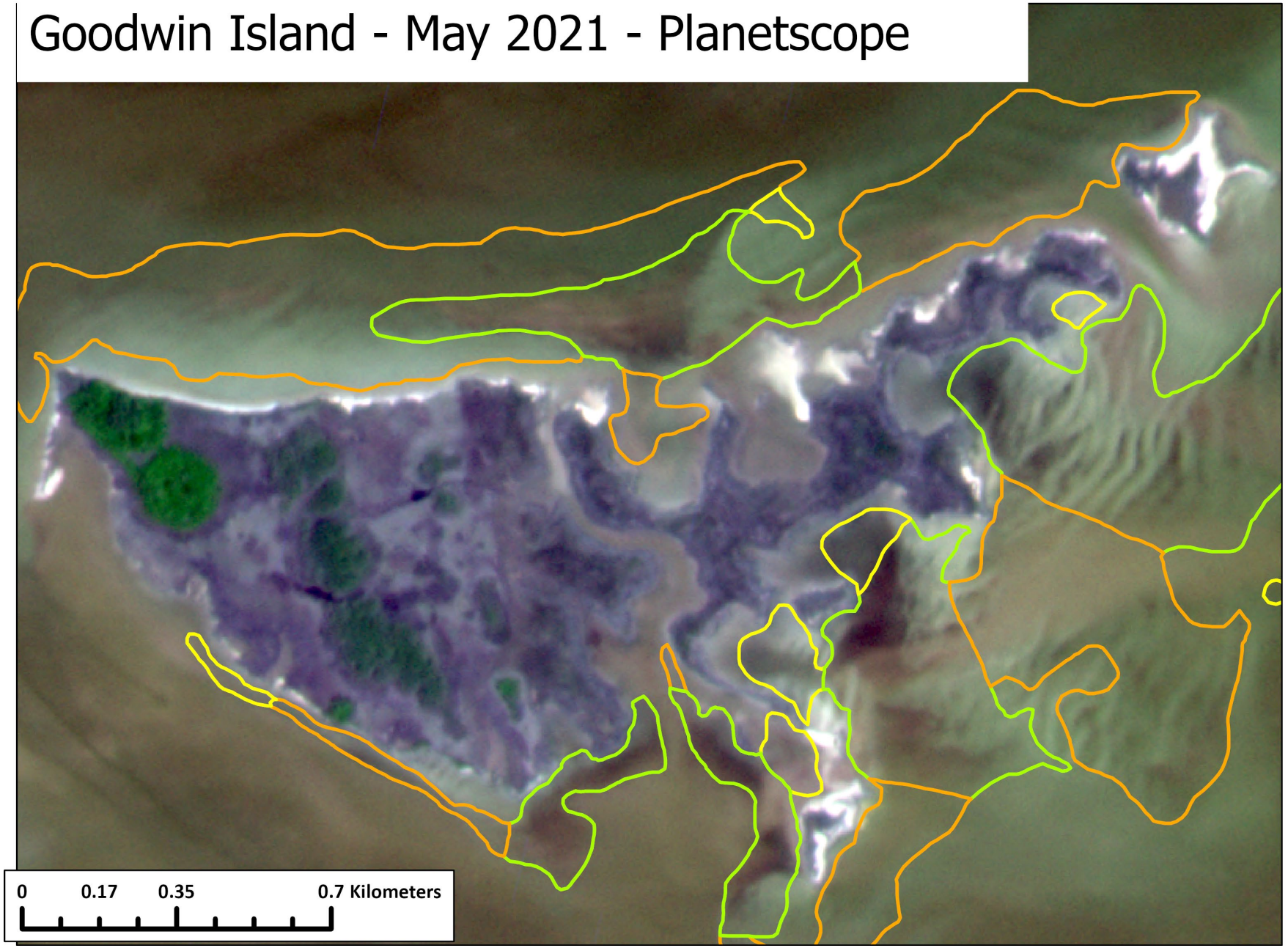




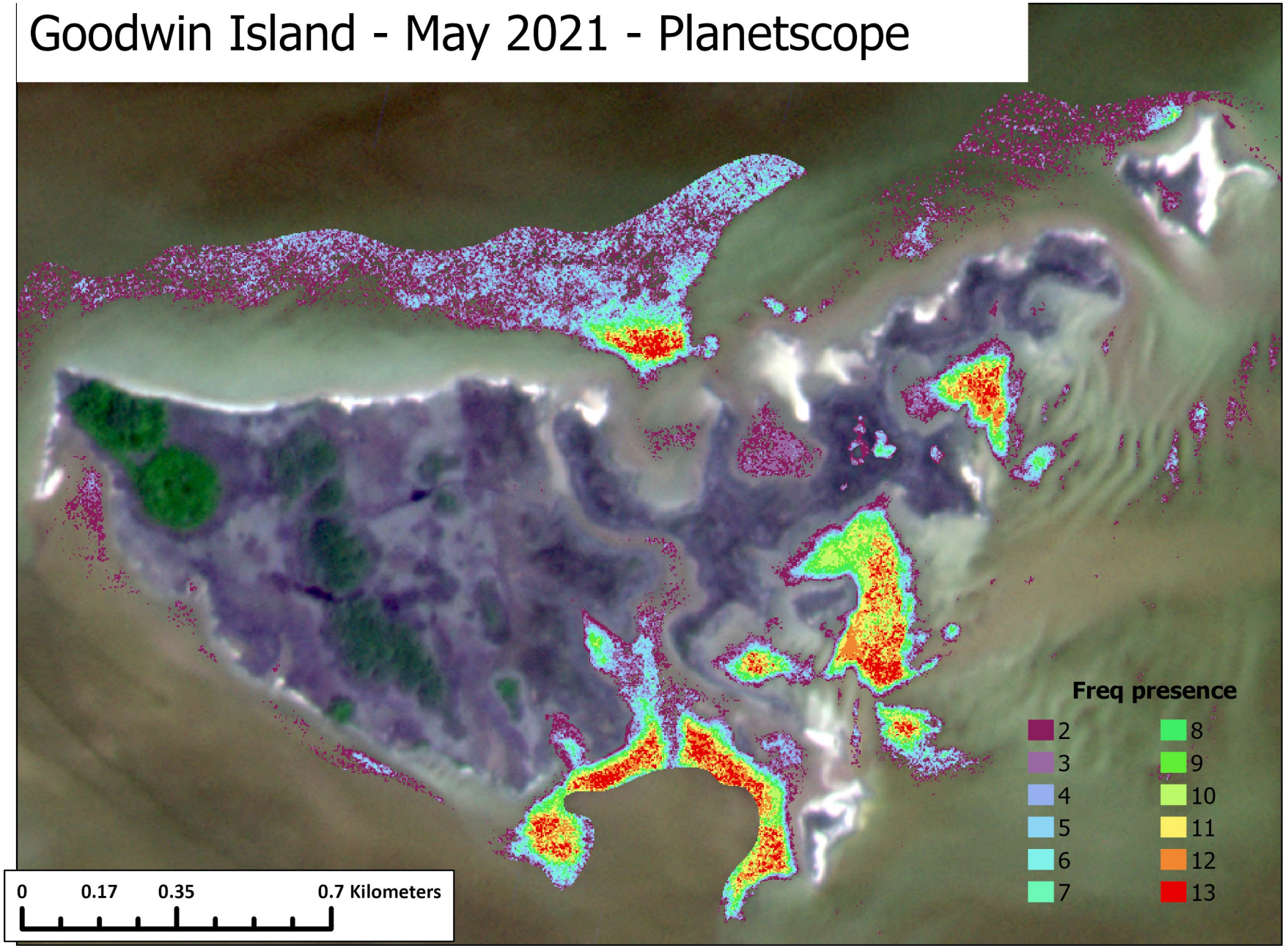
From distribution to carbon





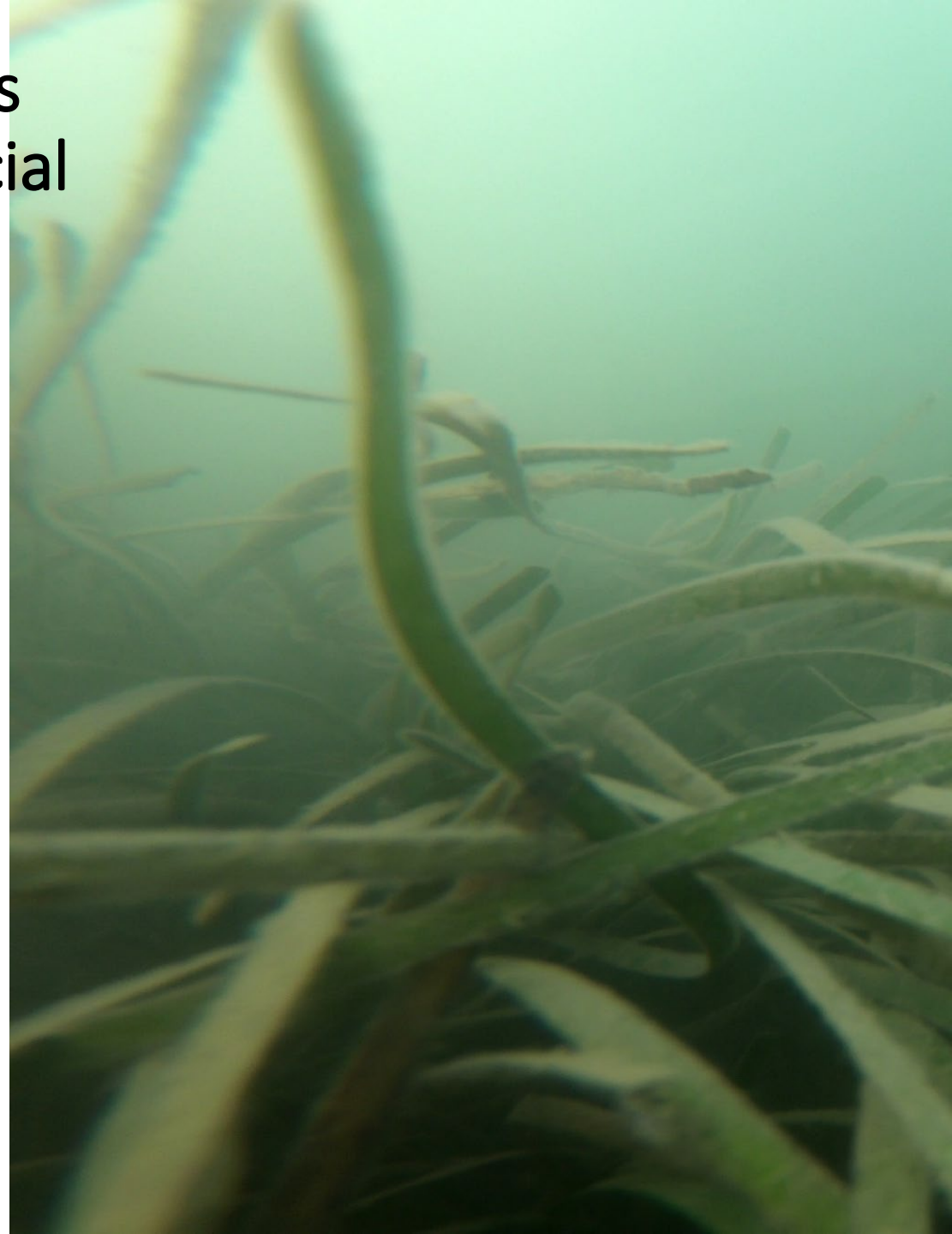

Goodwin Island - May 2021 - Planetscope
0
0.17
0.35
0.7 Kilometers

Goodwin Island - May 2021 - Planetscope



Quantification of blue carbon in seagrass ecosystems from high resolution commercial imagery

- Partly automated processing.
- Reprocess when needed
- Refine techniques for each region.
- Frequency ~ density?
- Use high frequency of images to overcome turbidity and sparse areas.
- Sparse areas are still identified.
- Atmospheric correction needs to be addressed.



Quantification of blue carbon in seagrass ecosystems from high resolution commercial imagery

- Follow along with our group in learning how to process the Planet/WorldView imagery.
- Spring 2022 semester.
- Monday's ~4.30 – 5.30 pm