Improving the predictions of environmental variables of tidal flats using object-based image analysis and deep-learning features

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CONTEXT

- Tidal flats are ecologically rich coastal ecosystems
- They provide habitat & ensure food security for migratory birds & fishes
- Sediment & Biodiversity monitoring
- They are dynamic in space & and time
- Remote sensing provides continuous spatial & and temporal coverage

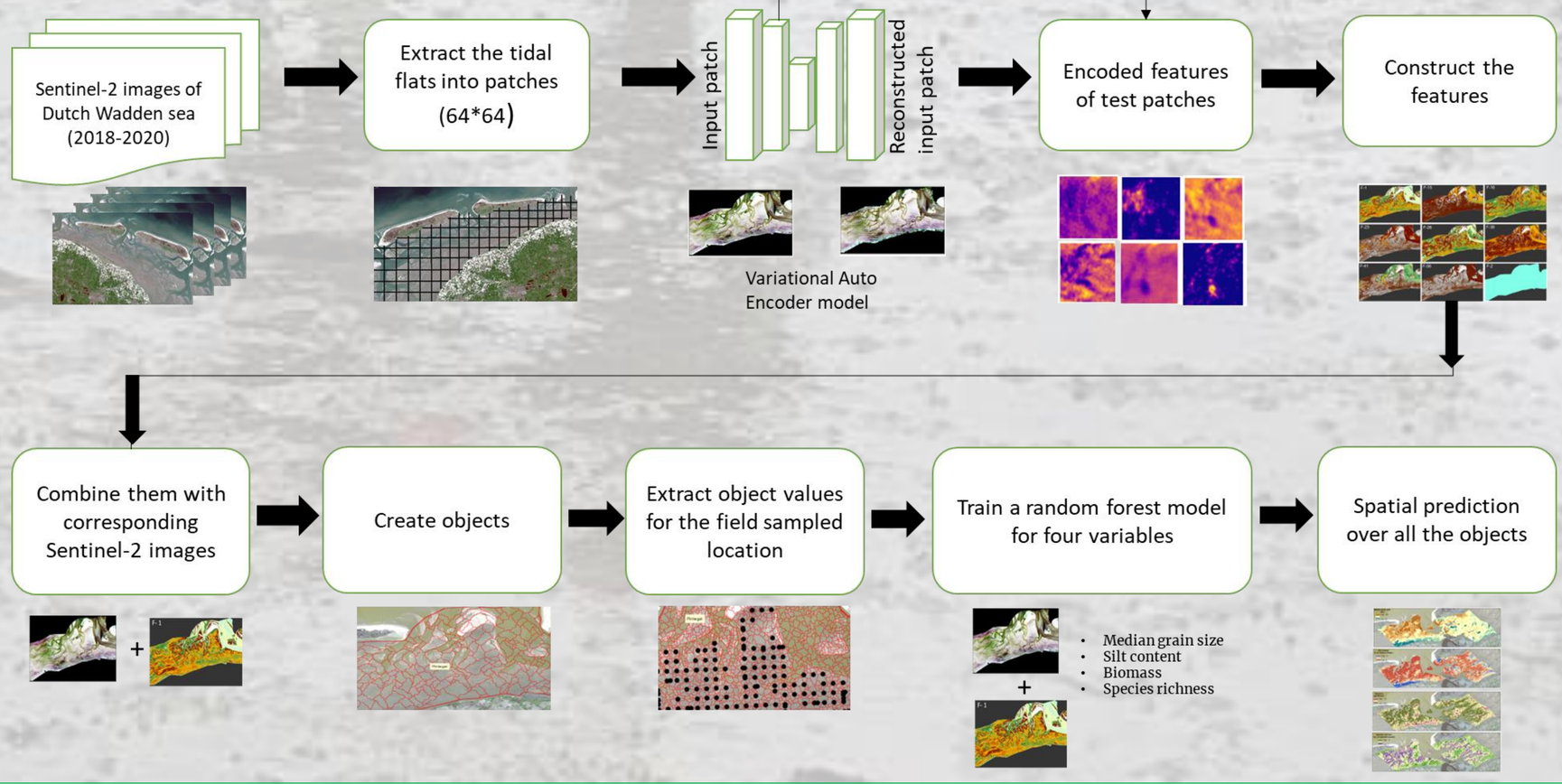
AIM

- Make use of deep-learning features
- Object-based mapping
- Prediction of the environmental variables

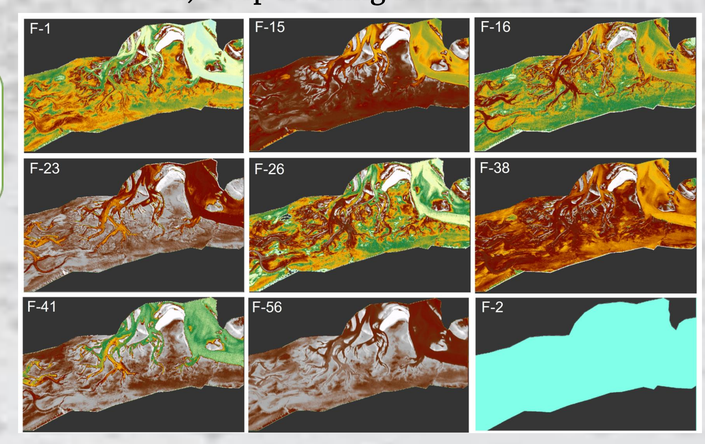
DATA

- SIBES by NIOZ @ 500 x 500 m grid
- Variables
  - Median Grain size (µm)
  - Silt Content (%)
  - Benthic biomass (gAFDM/m2)
  - Species richness (no. of species/sample)
- Sentinel-2 (B,G,R,NIR)

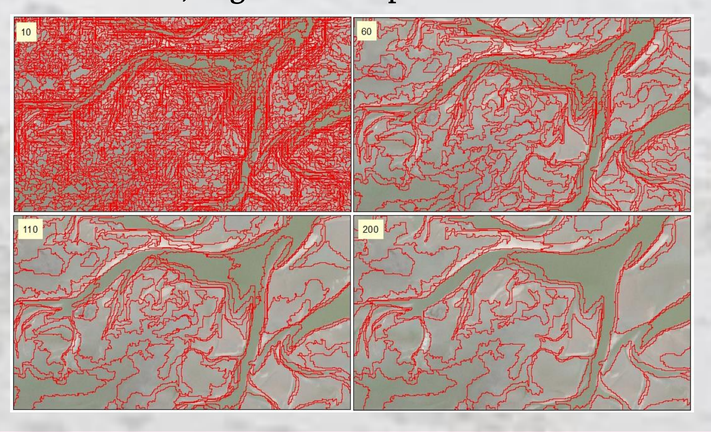
WORKFLOW



1) Deep learning features

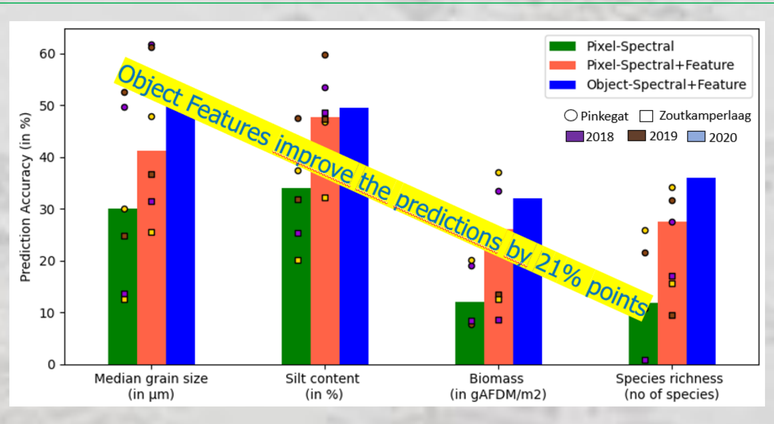


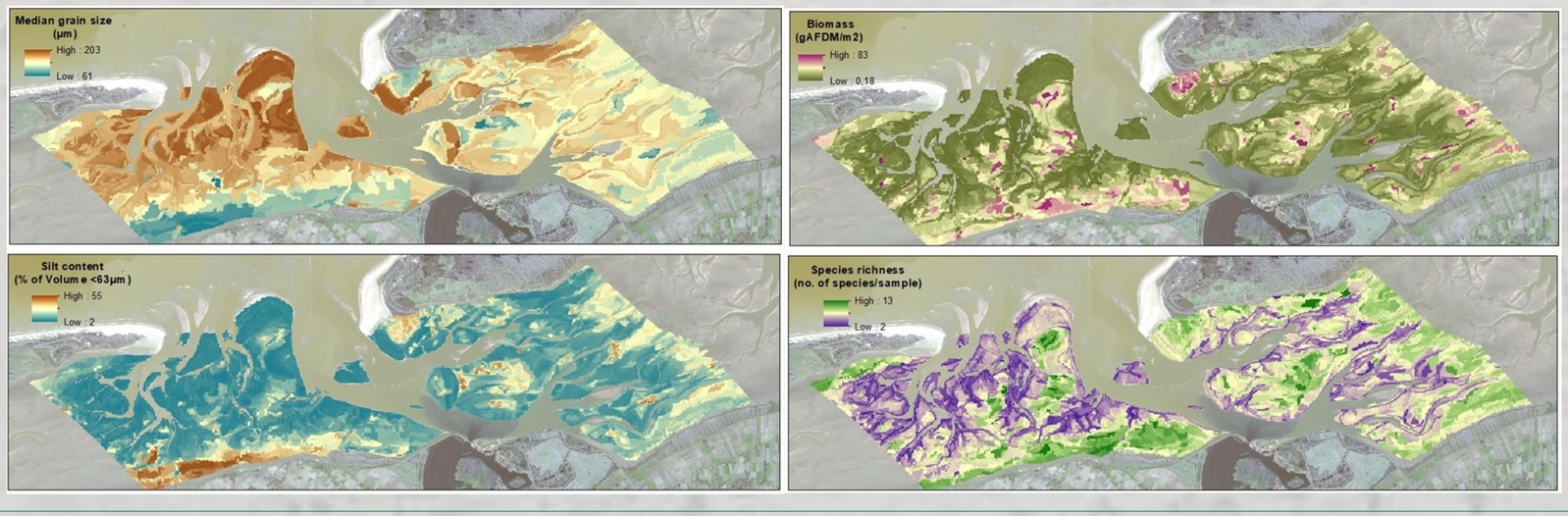
2) Segmentation process



RESULTS

- Predictions using deep-learning features outperformed the spectral bands.
- Median grain size predictions were best with object size (12 ha) larger than the other three variables (silt content & species richness-2 ha, biomass-2.6 ha).
- A negative correlation between the median grain size and silt content is evident in the predictive maps
- The prediction maps show biomass and species richness in low energetic zones in line with the field data.





CONCLUSIONS

- **Deep learning features showed consistent improvement.**
- **21% point improvement over pixel-based**
- **Predicted maps to aid in coastal planning & management.**
- **Useful approach for other similar spectrally deficient regions**

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