

Our Focus: Addressing Coastal Erosion

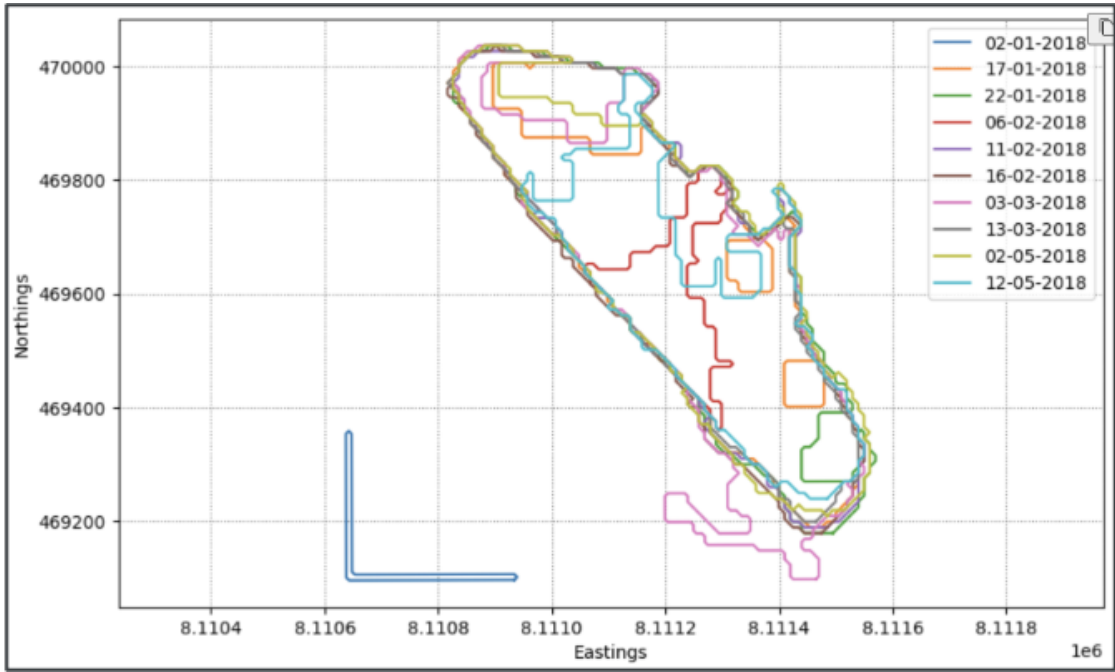
The Growing Islands project facilitates sand deposition by placing underwater structures — piloted in the Maldives. But how do we know which part of the shoreline is eroding the fastest? Which parts are the most vulnerable? *Where* do we prioritize?

Satellite images are the key, containing decades of information showing change over time. Analyzing these images would allow us to monitor coastlines. However, reliably extracting the coastline from the images is a non-trivial task.



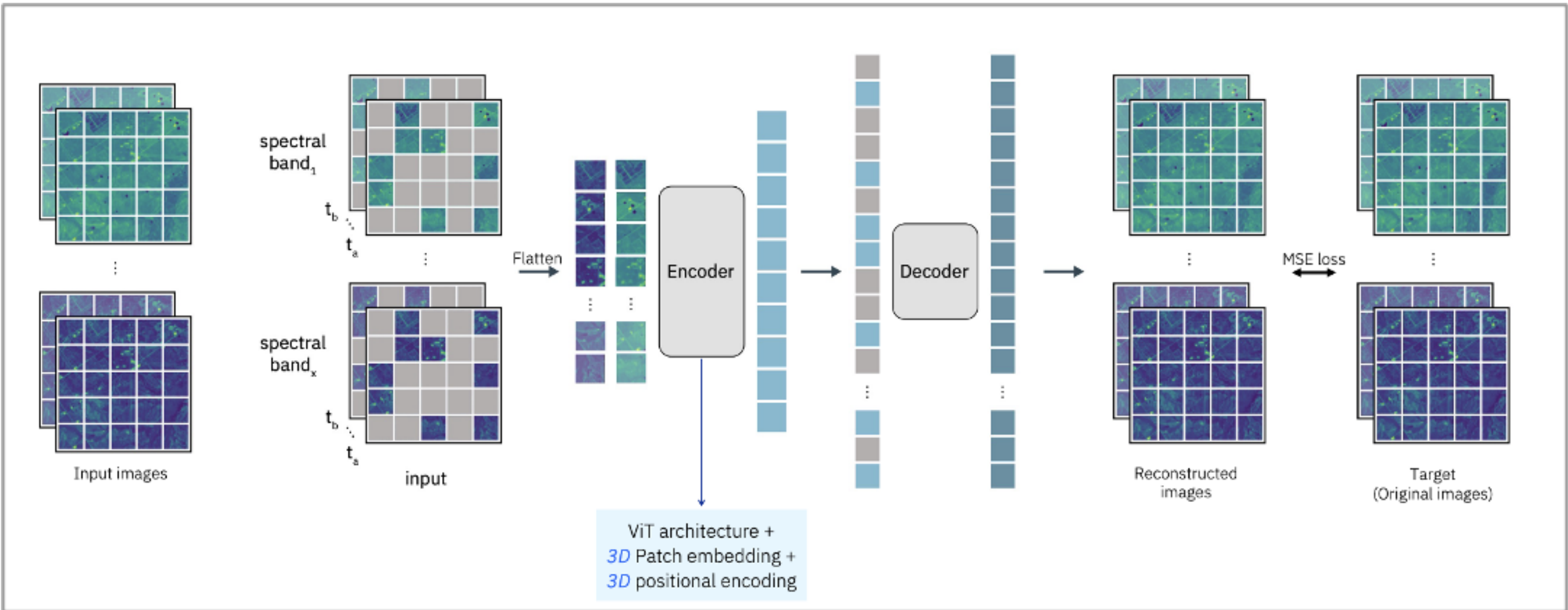
Zooming in: Coastline Delineation.

Existing tools, such as CoastSat and CoastSeg, work well on long coastlines.



But with small sandy islands like the Maldives, they struggle to delineate the island versus the atoll it sits on.

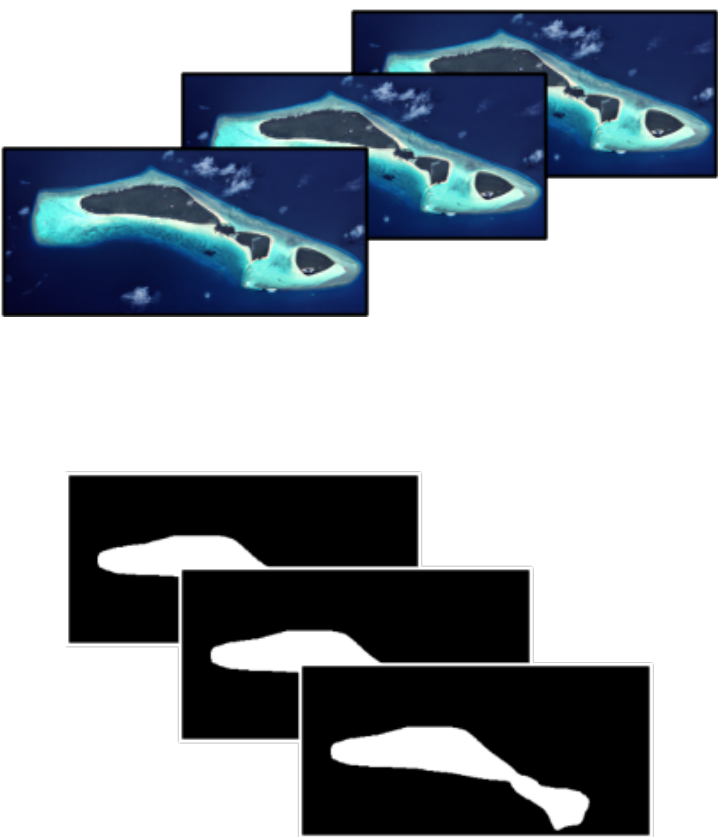
Tool: Prithvi, a Geospatial Foundation Model.



- 300M and 600M versions released by NASA and IBM in December 2024.
- Pre-trained on 4.2 million HLS images containing 6 bands with a diverse sampling strategy.
- Pre-training strategy: Masked Auto Encoder approach with MSE loss.
- Downstream tasks: pixel-wise classification, segmentation, and regression.
- Compatible w/ TerraTorch (useful toolkit built on PyTorch for geospatial analysis).

The Data

- 225 Sentinel-2 images of two islands in the Maldives
- 5 optical bands, 5 years
- Hand-labeled in Kili Technology
- Released on Github
- Split into random subsets of varying sizes: 5, 10, 25, 50, 75, 100, 125, & 150.



Key Aspect: Real World Constraints

Communities that need to understand their coastlines may not have thousands of dollars to train for 100's of epochs on multiple GPUs.

- We set up our evaluation to understand whether Prithvi can perform well under:
- a) limited data
 - b) limited computational resources

The Results

Training Dataset Size	Prithvi 300M IoU Scores	Prithvi 600M IoU Scores	Prithvi 300M F1 Scores	Prithvi 600M F1 Scores
5 images	0.8509	0.7977	0.9612	0.9429
10 images	0.8720	0.8927	0.9664	0.9743
25 images	0.9423	0.9311	0.9870	0.9845
50 images	0.9427	0.9475	0.9871	0.9880
75 images	0.9470	0.9538	0.9881	0.9896
100 images	0.9536	0.9577	0.9896	0.9905
125 images	0.9593	0.9616	0.9908	0.9913
150 images	0.9570	0.9529	0.9904	0.9894
181 images	0.9529	0.9553	0.9894	0.9899

