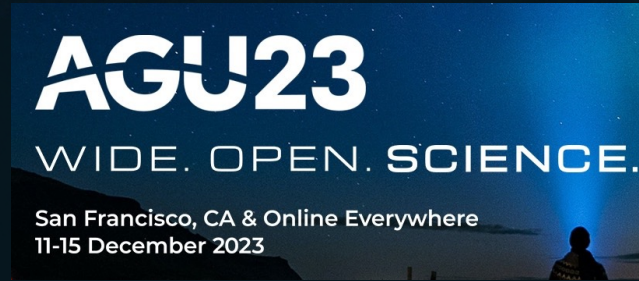


Geomorphic signatures of coastal change from multiple satellite-derived change indicators

Freya Muir¹, Martin Hurst¹, Luke Richardson-Foulger¹, Larissa Naylor¹, and Douglas Pender¹

¹Affiliation not available

February 26, 2024



Geomorphic signatures of coastal change from multiple satellite-derived change indicators

Freya Muir

PhD: "The Construction of a Real-time Coastal Erosion Monitoring and Forecasting System"

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Why is coastal change important to measure?

1.3% of global pop.
currently impacted by
100-year flood events

(Muis et al., 2016)

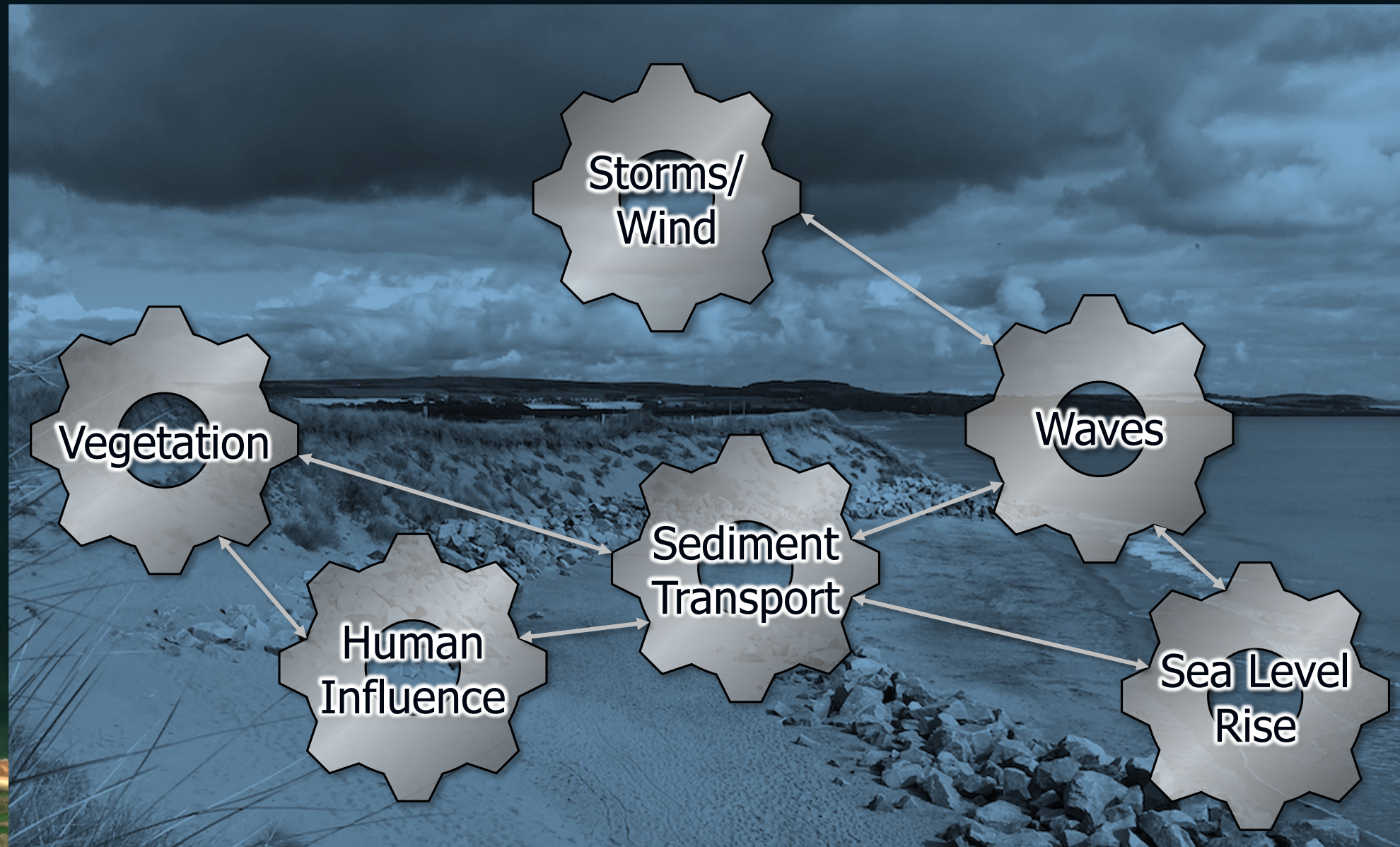
Increased exposure +
no adaptation =
10% of global GDP in
damage costs by 2100

(Hinkel et al., 2014)

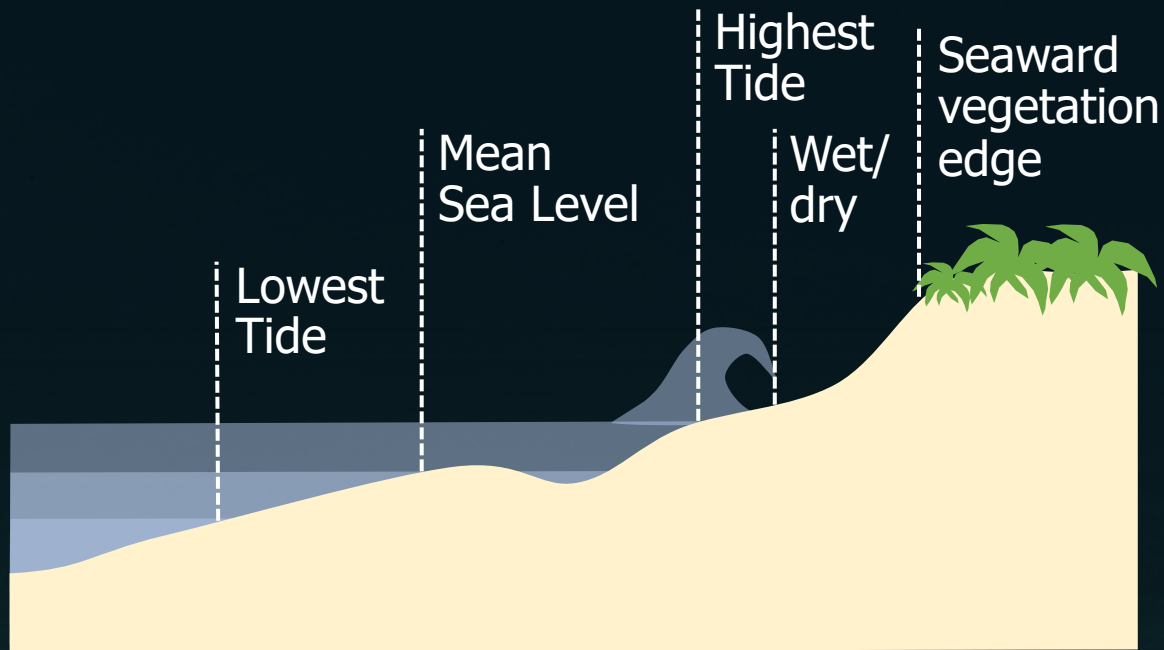


BBC: "Storm Ciarán to bring up to 80mph winds in wake of Storm Babet clean-up"

Why is coastal change important to measure?

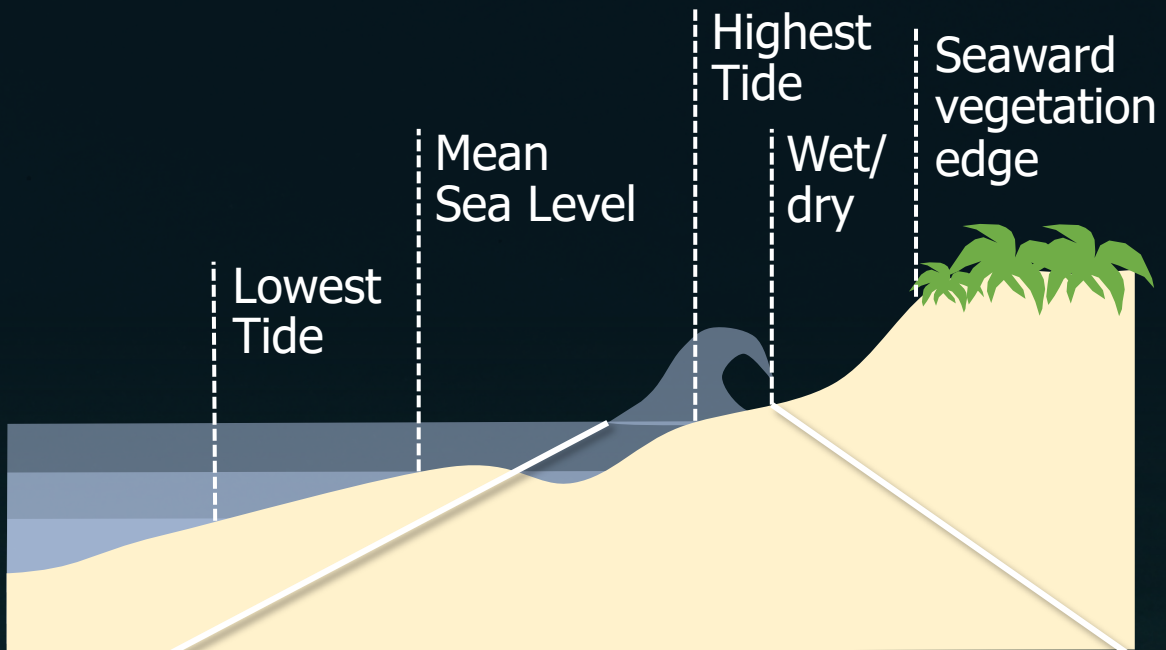


Coastal change indicators: only part of the story?

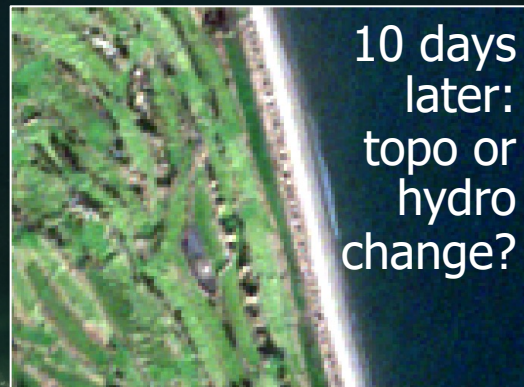
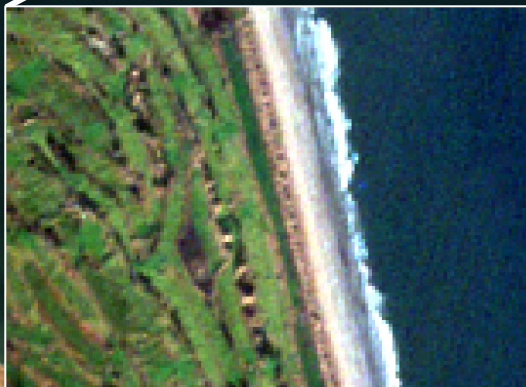


- Instantaneous shorelines (CoastSat, SHOREX, CASSIE)
- Yearly composite shorelines (ShorelineMonitor, HighTide-SDS)

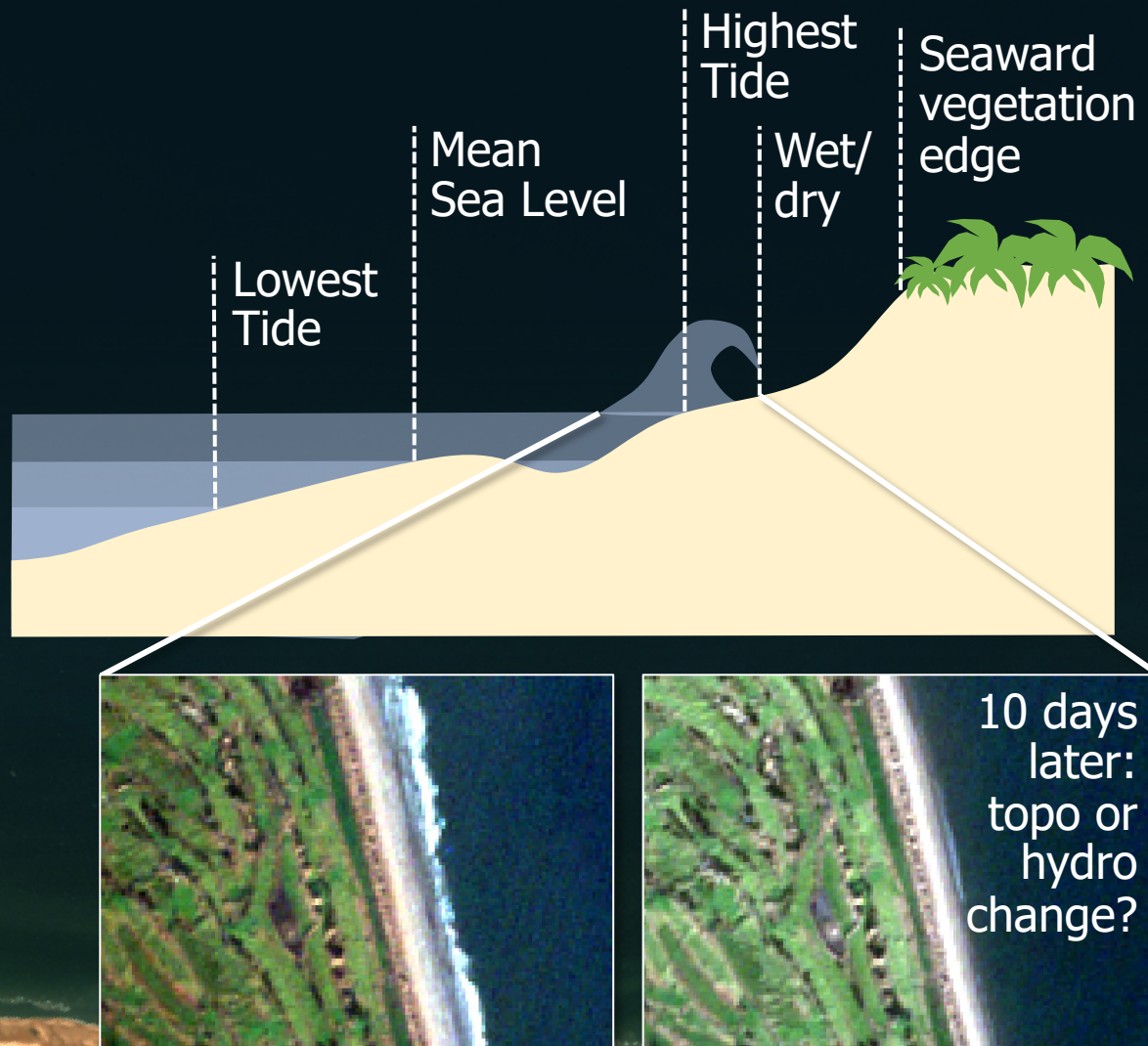
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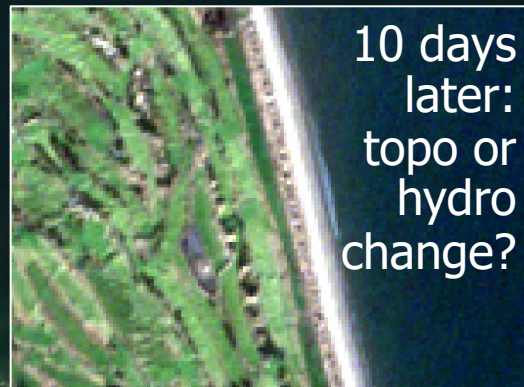
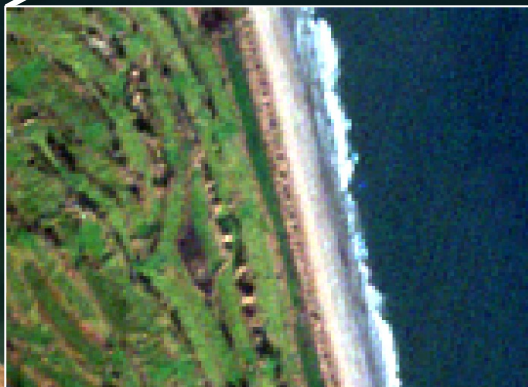
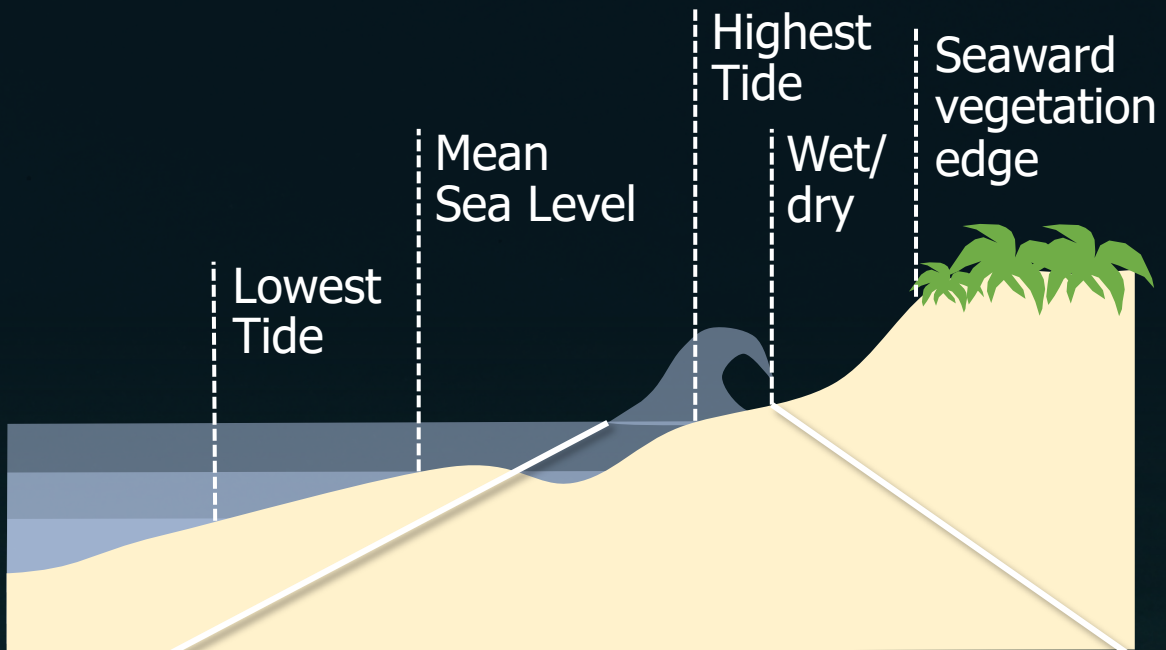
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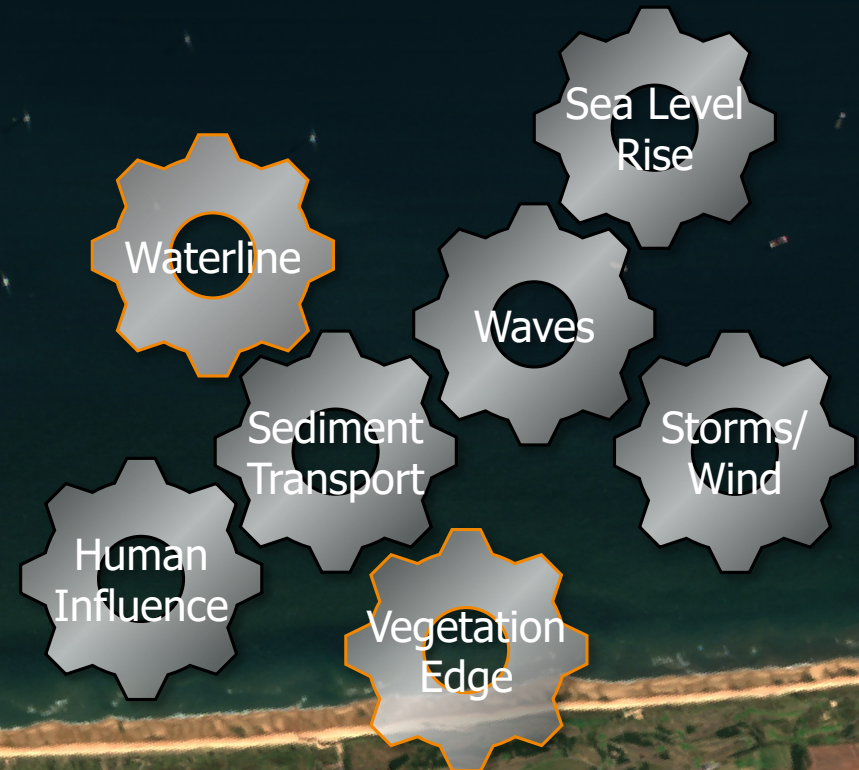
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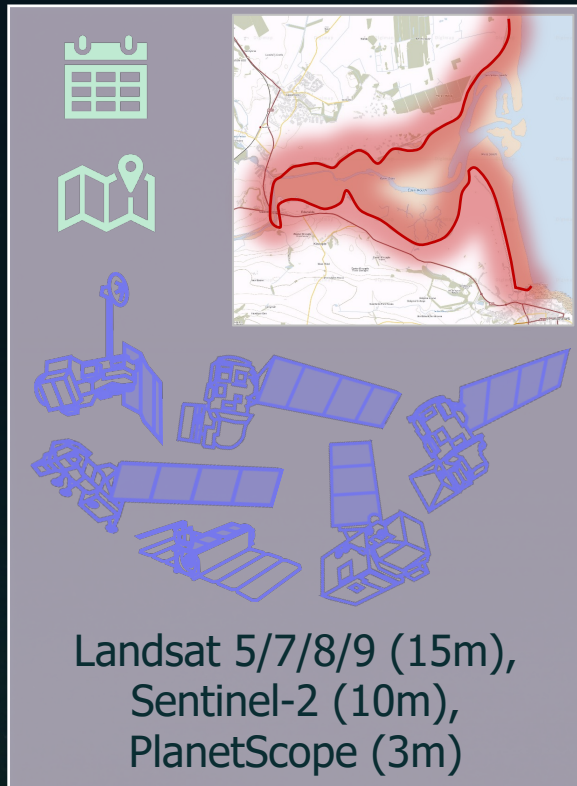
Coastal change indicators: only part of the story?



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Watching the grass grow: Framework of VedgeSat



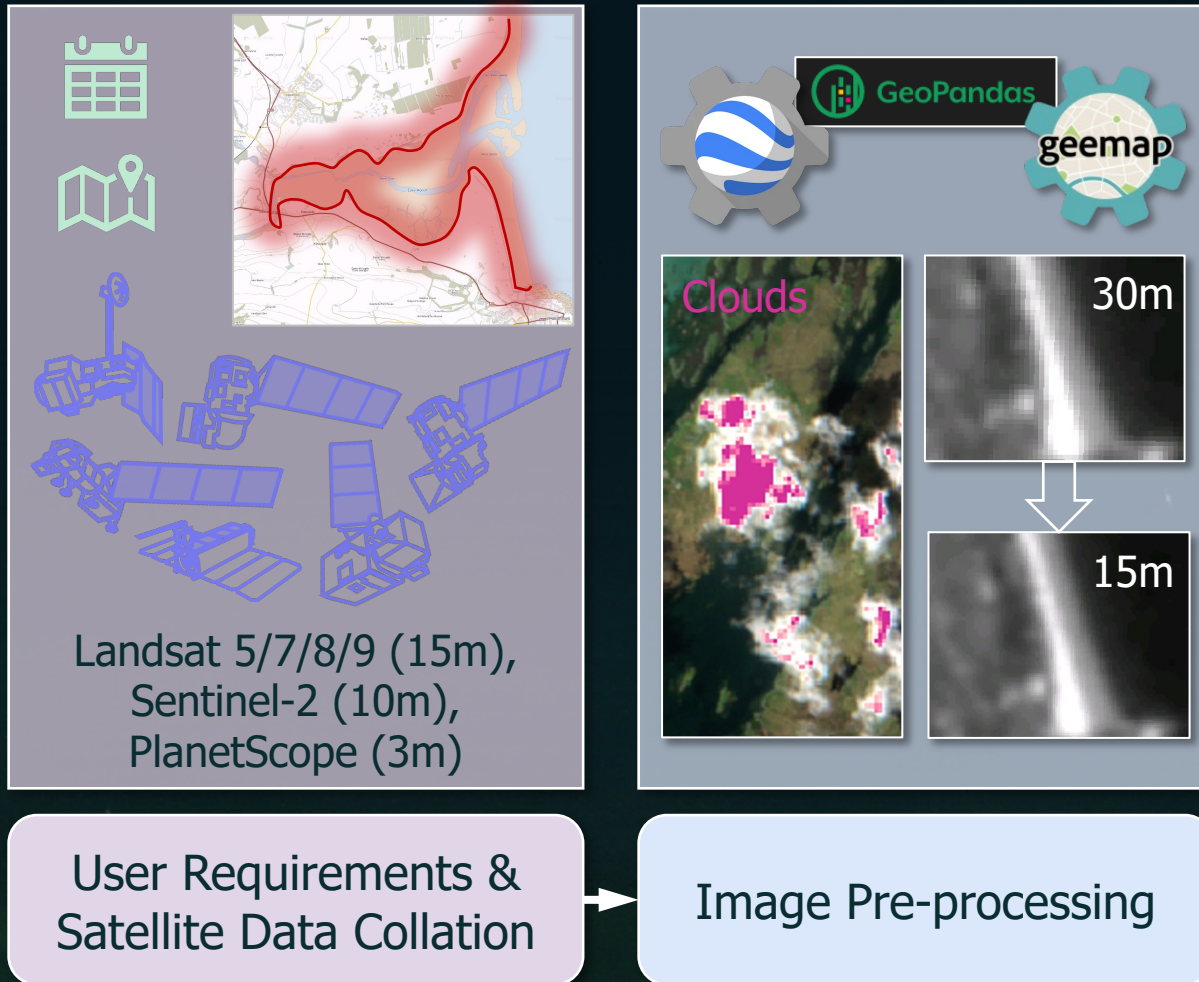
User Requirements &
Satellite Data Collation

Based on CoastSat
(Vos et al., 2019)

More details on the poster!

Board EP43C-2429, Poster Hall A-C, Thurs 14th 2:10PM–6:30PM

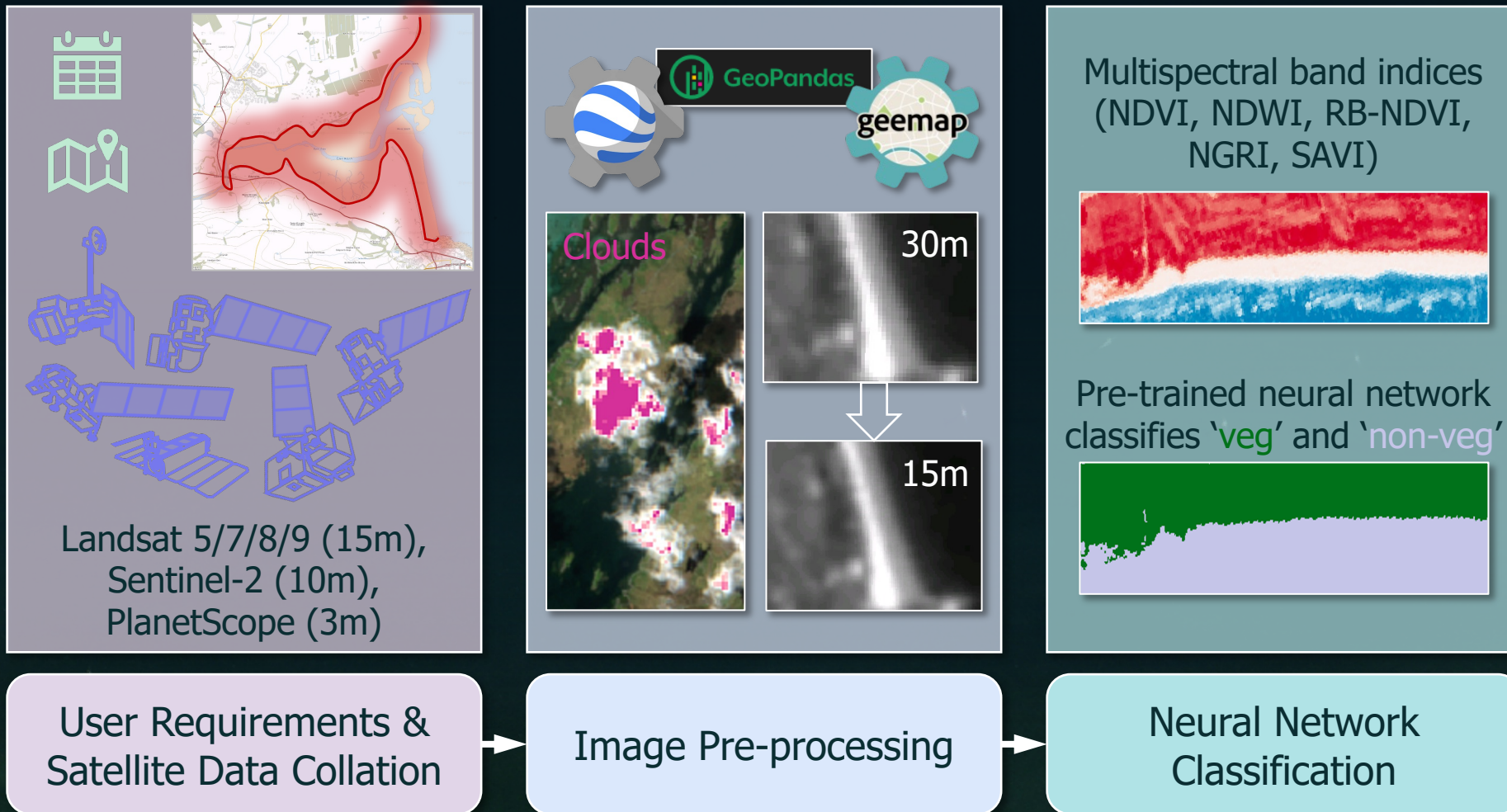
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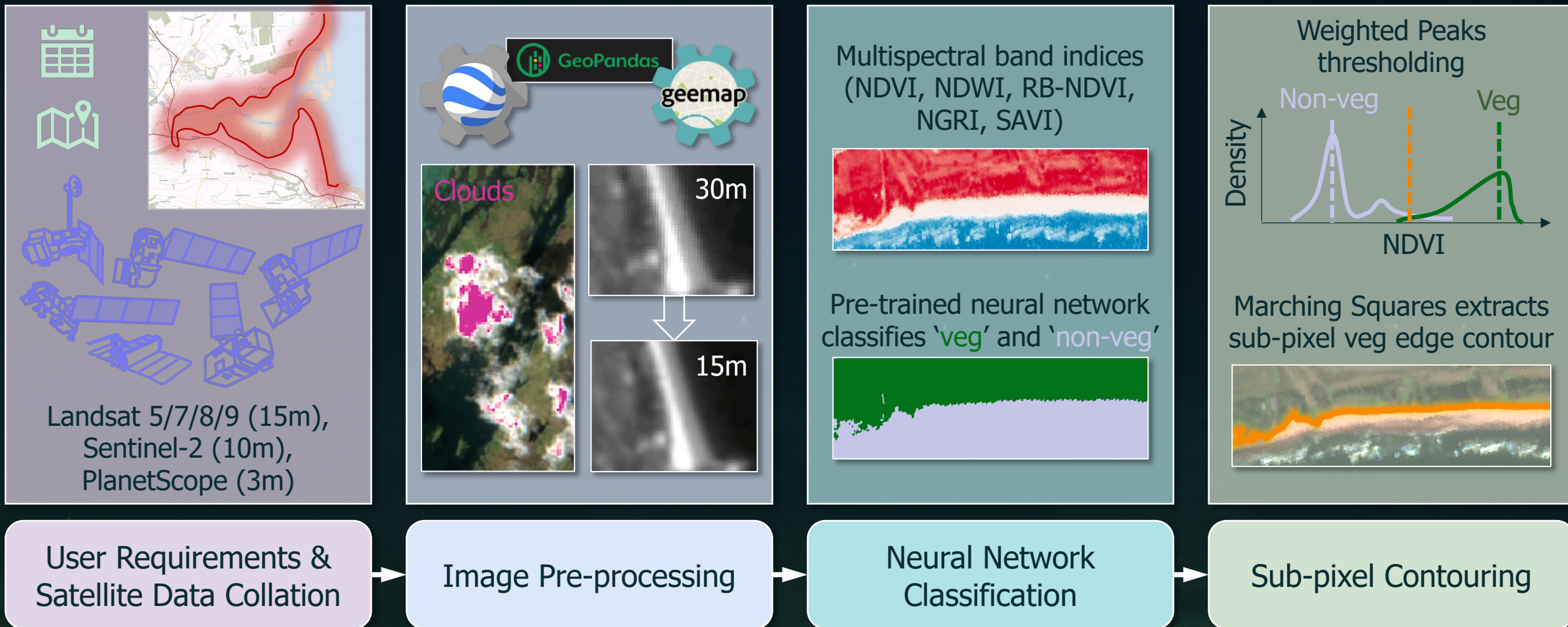
Watching the grass grow: Framework of VedgeSat



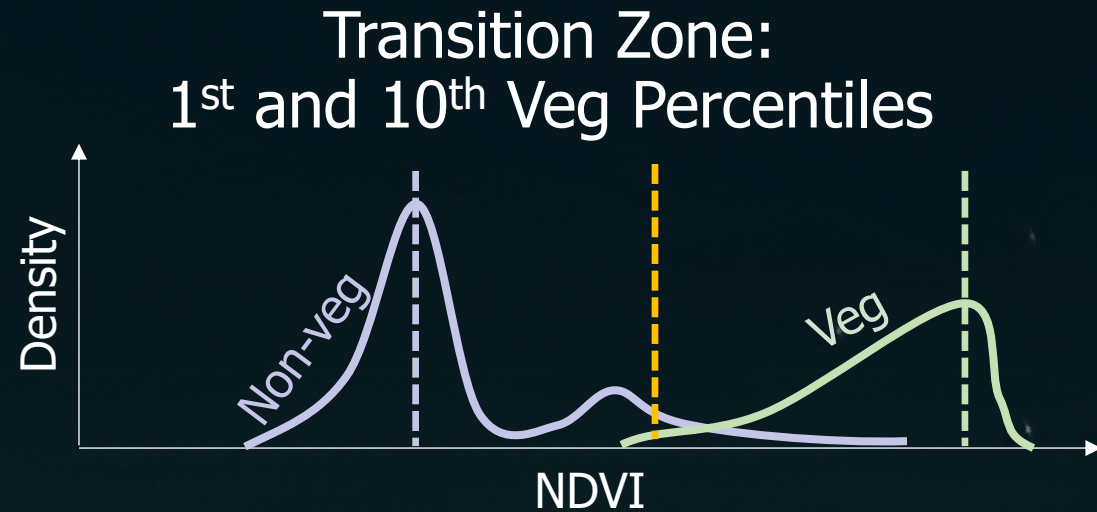
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Watching the grass grow: Framework of VedgeSat



Watching the grass grow: Framework of VedgeSat



Wider transition zone = diffuse vegetation signal = greater physical resilience?



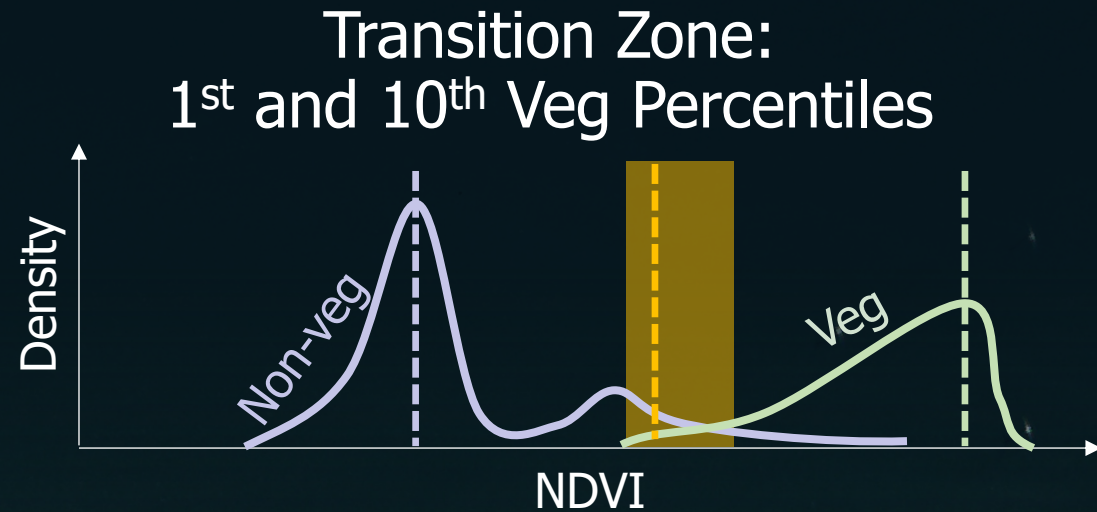
User Requirements &
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Image Pre-processing

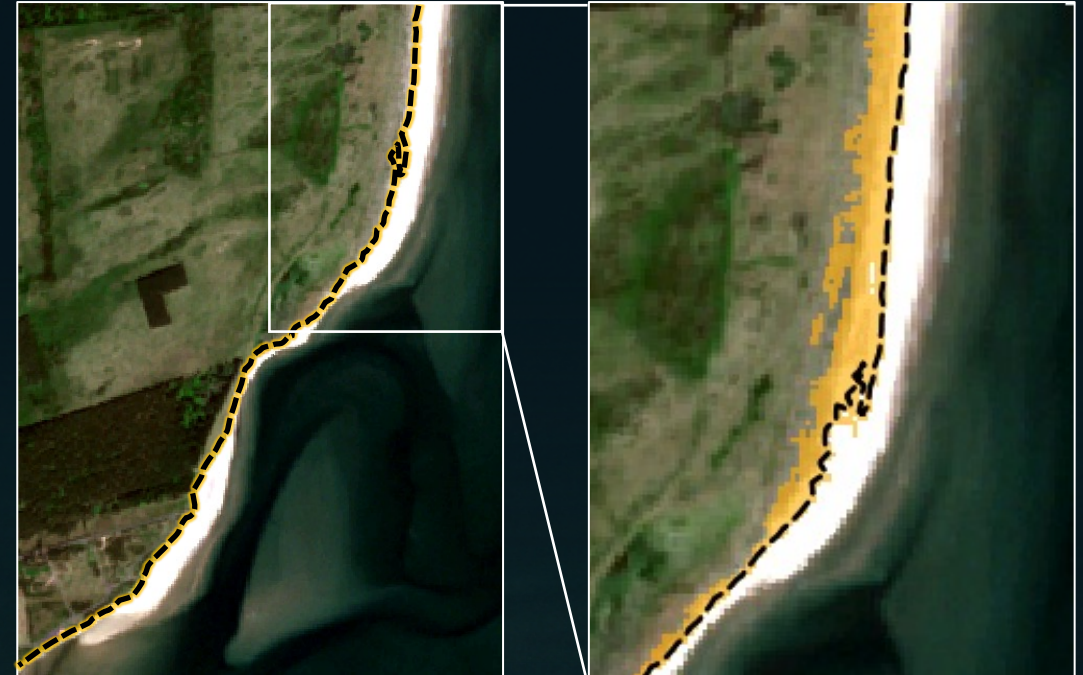
Neural Network
Classification

Sub-pixel Contouring

Watching the grass grow: Framework of VedgeSat



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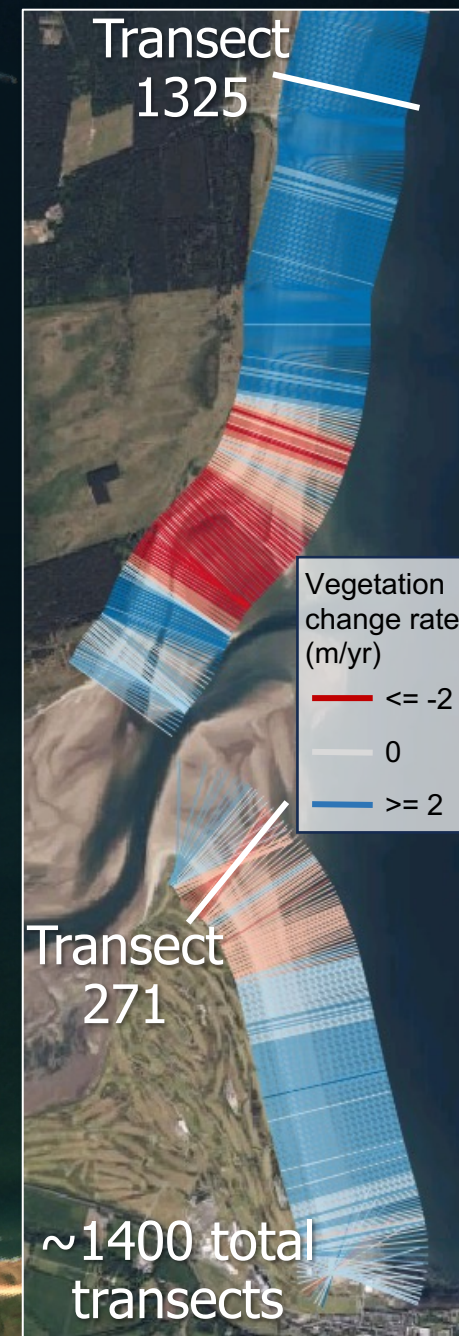
Satellite-derived change indicators



Validation site:
Muir et al., 2023
(in review)

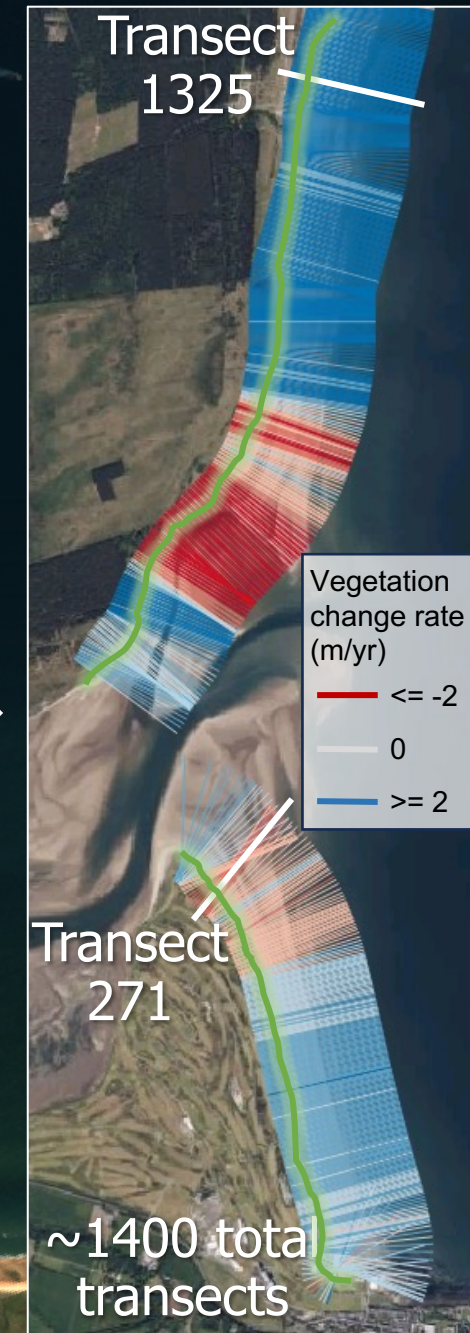
@fme_muir

Satellite-derived change indicators



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Satellite-derived change indicators

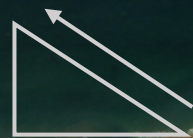
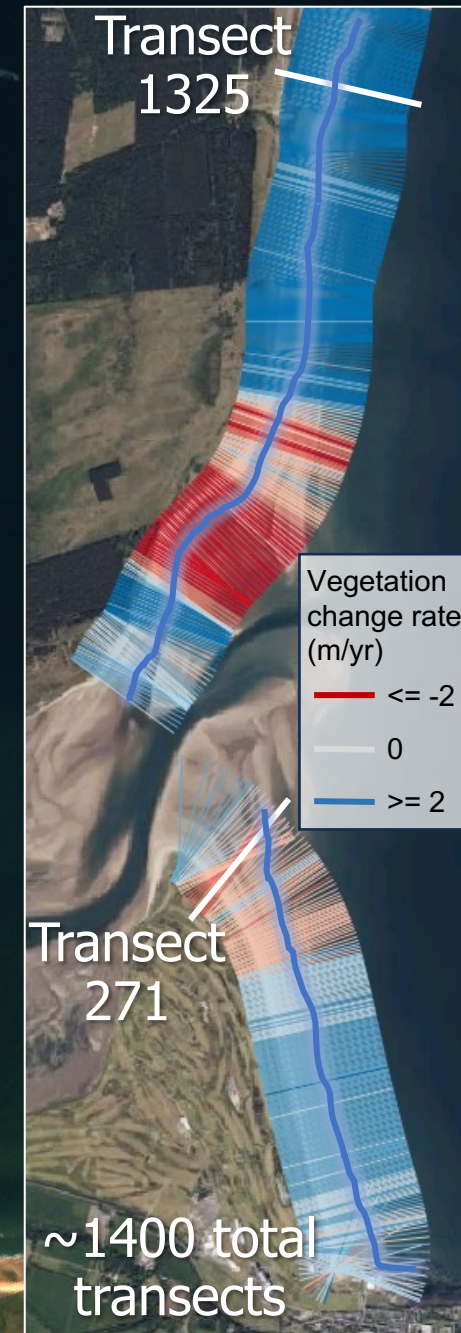


Validation site:
Muir et al., 2023
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2023 Ordnance Survey (100025252)

Satellite-derived change indicators

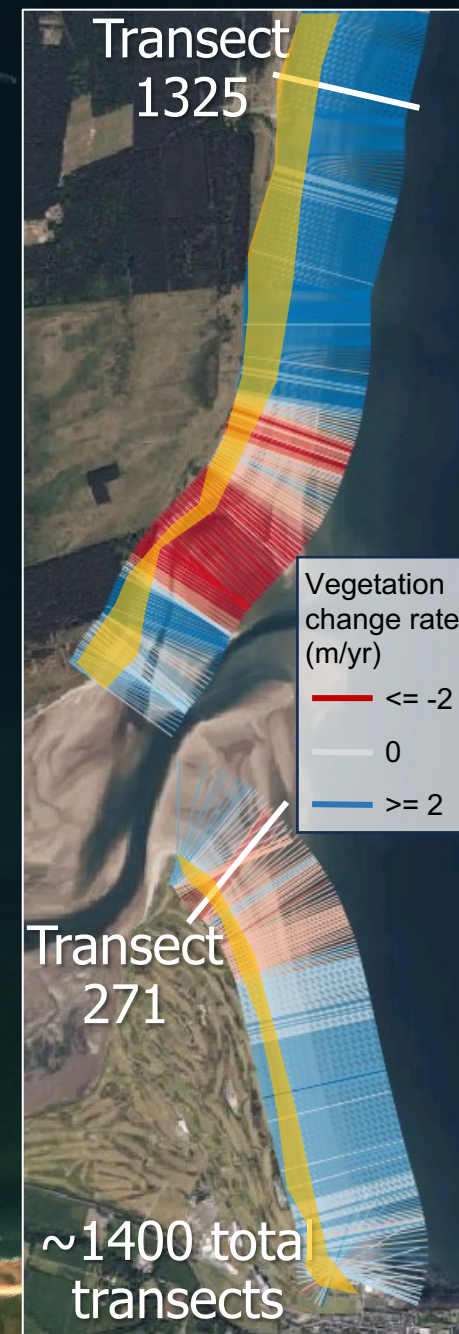


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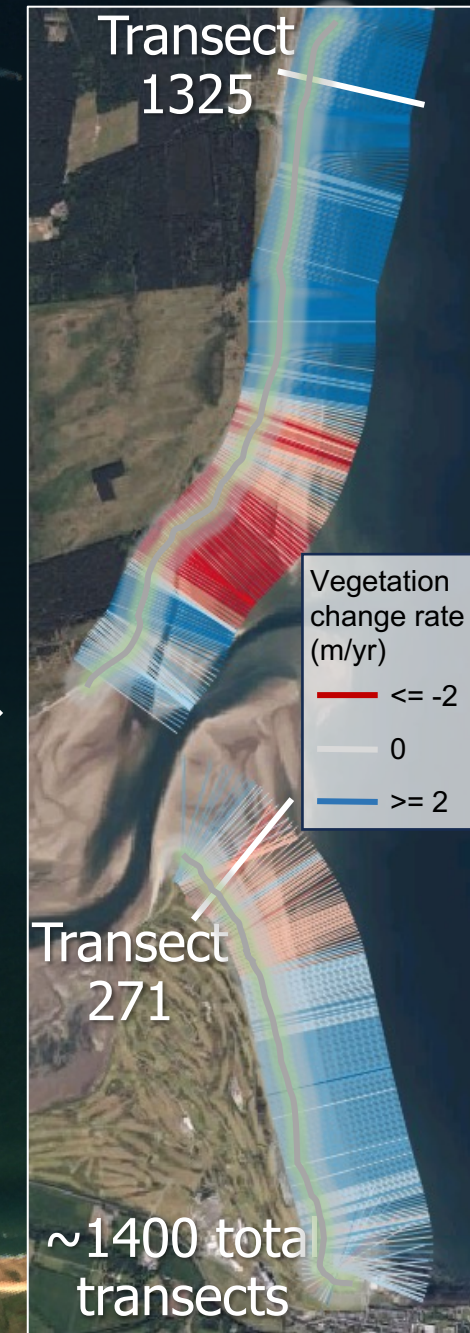
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Satellite-derived change indicators



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Satellite-derived change indicators

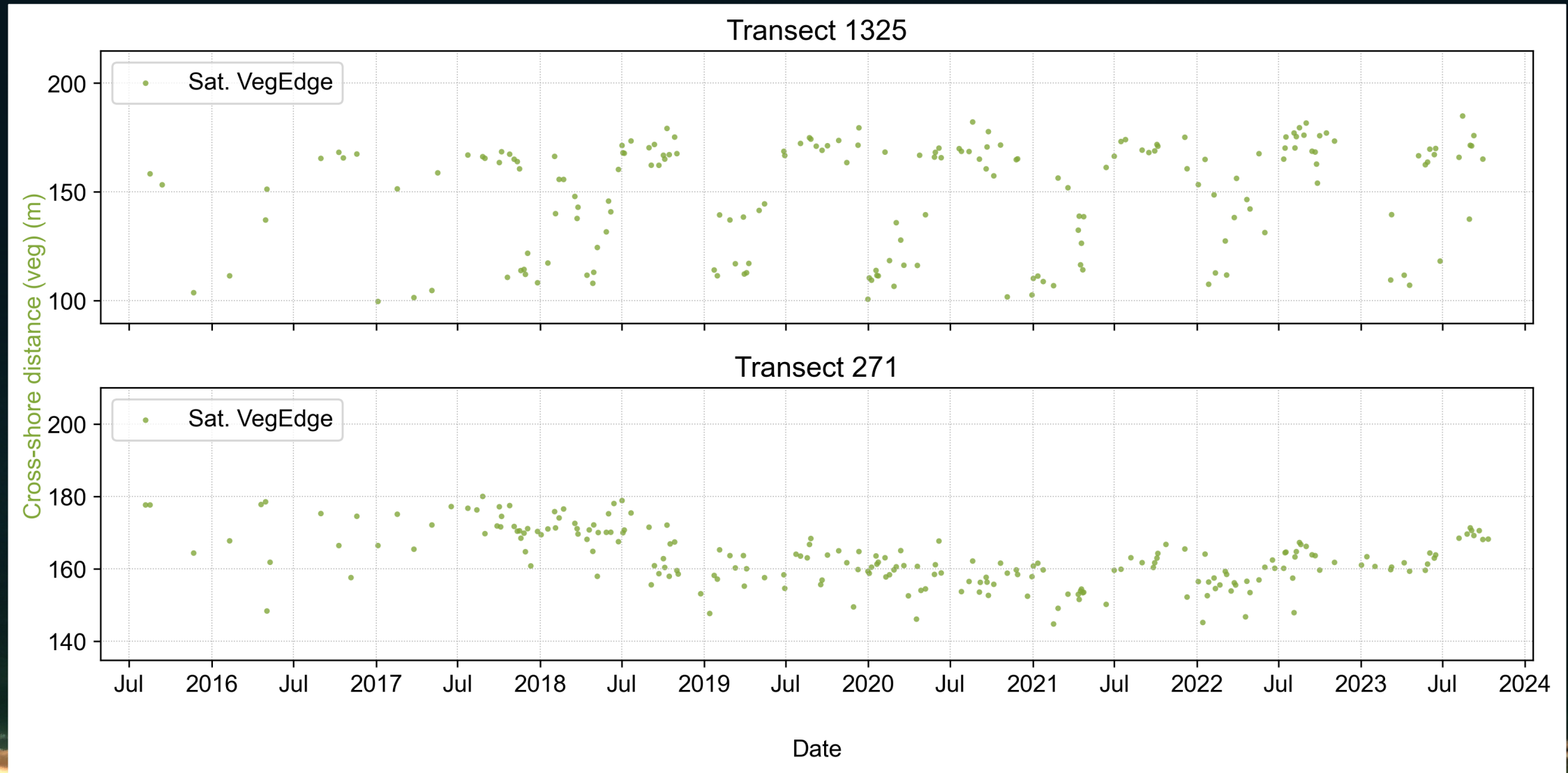


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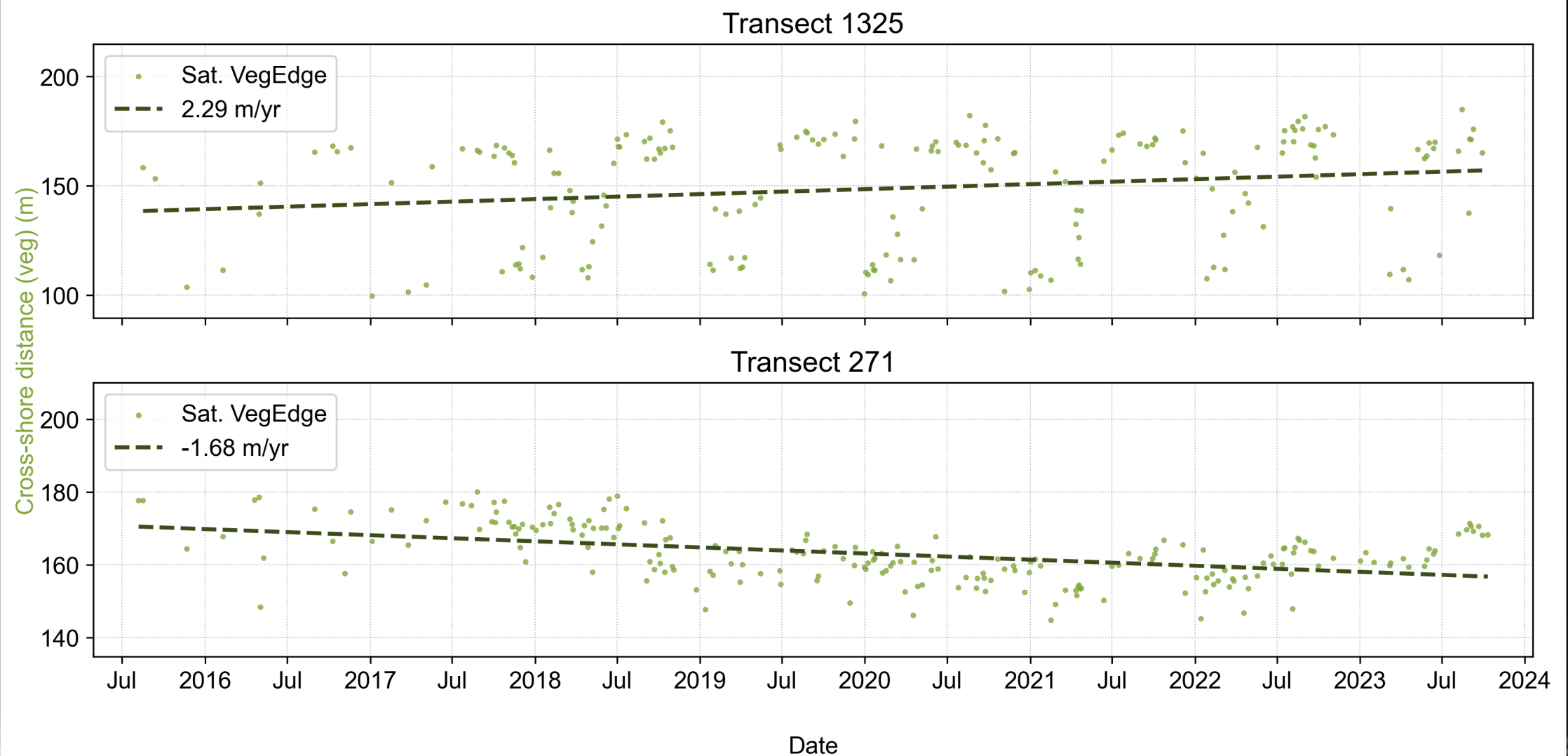
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2023 Ordnance Survey (100025252)

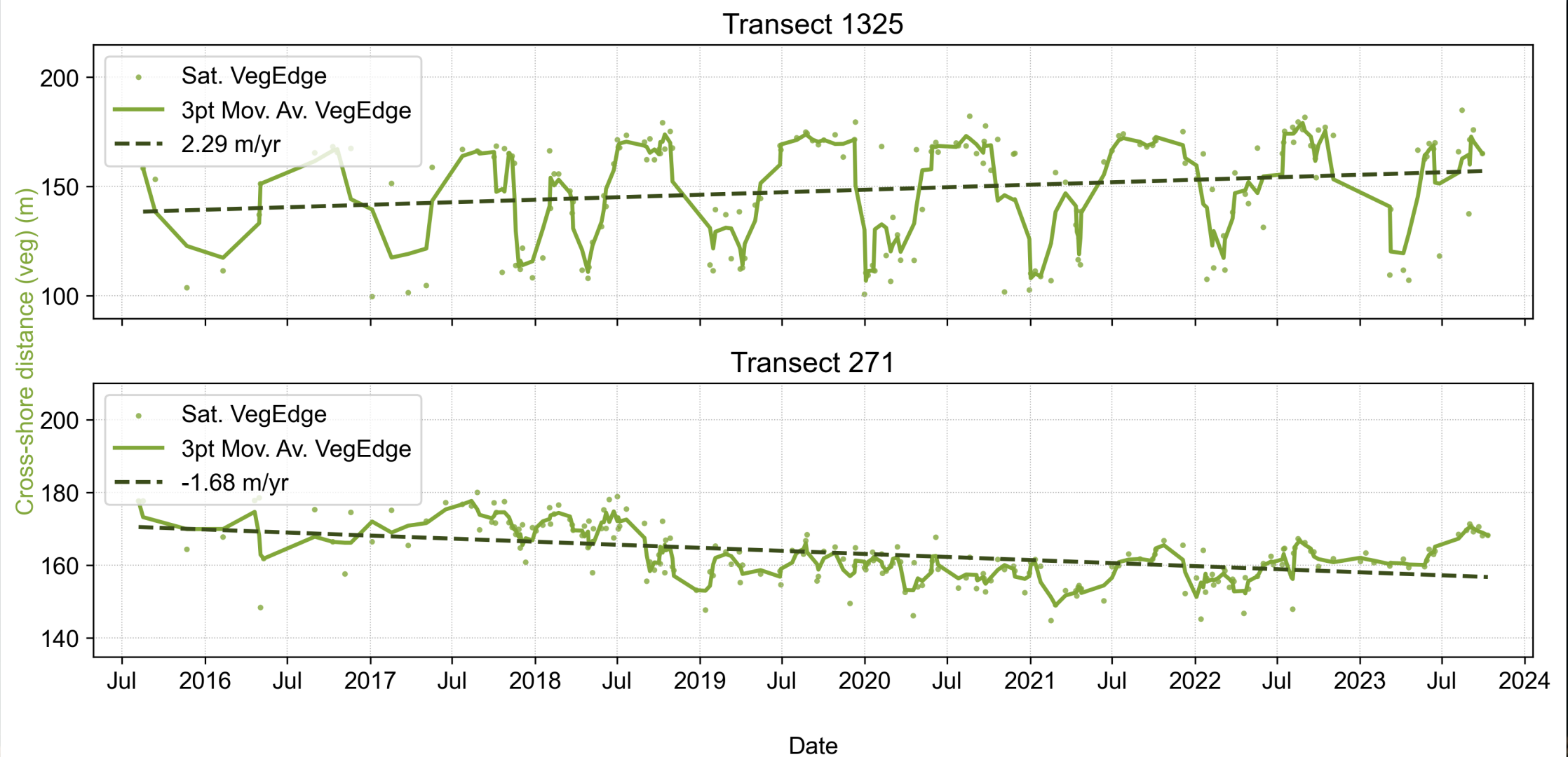
Cross-shore timeseries as a measure of beach health



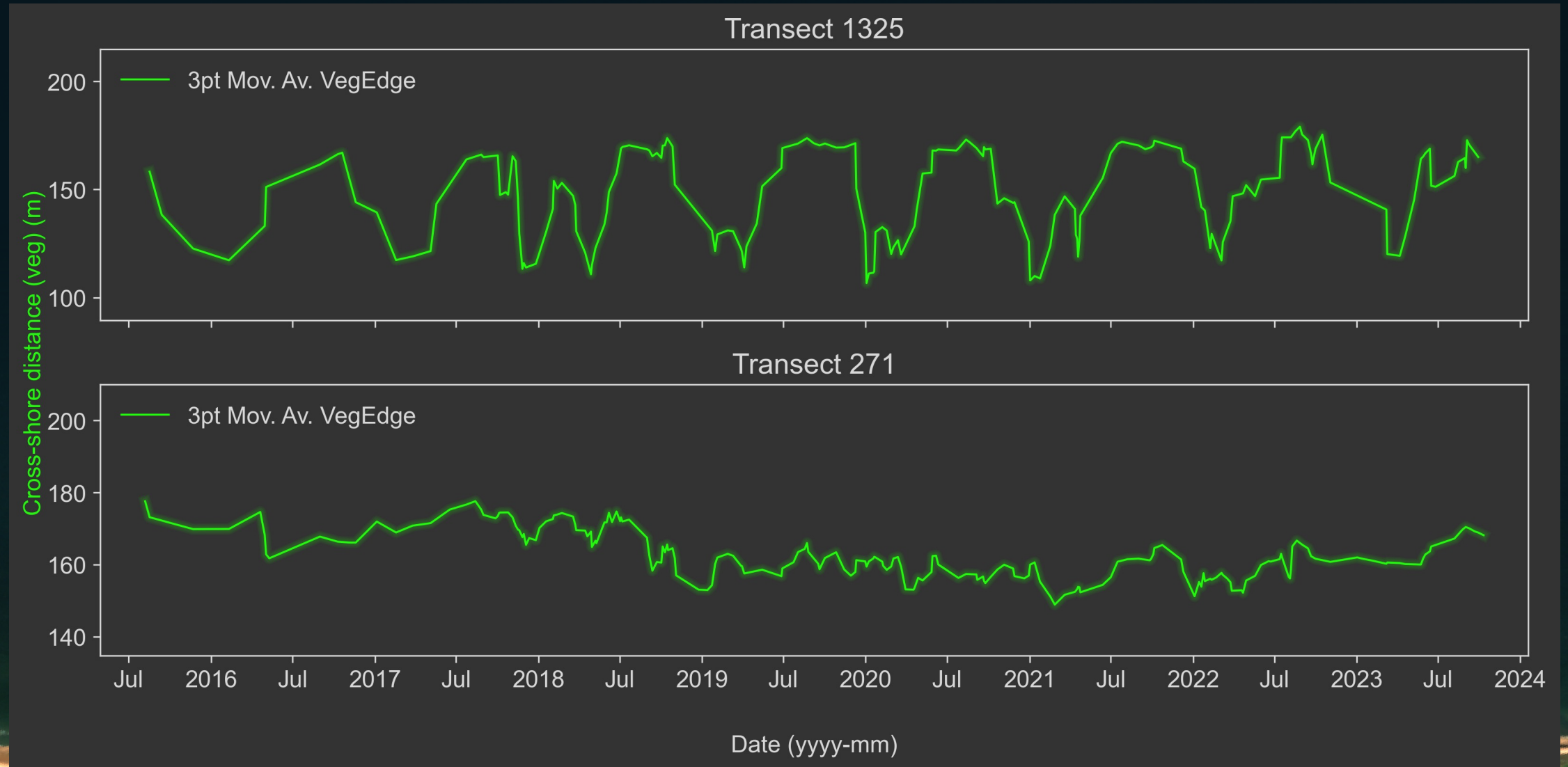
Cross-shore timeseries as a measure of beach health



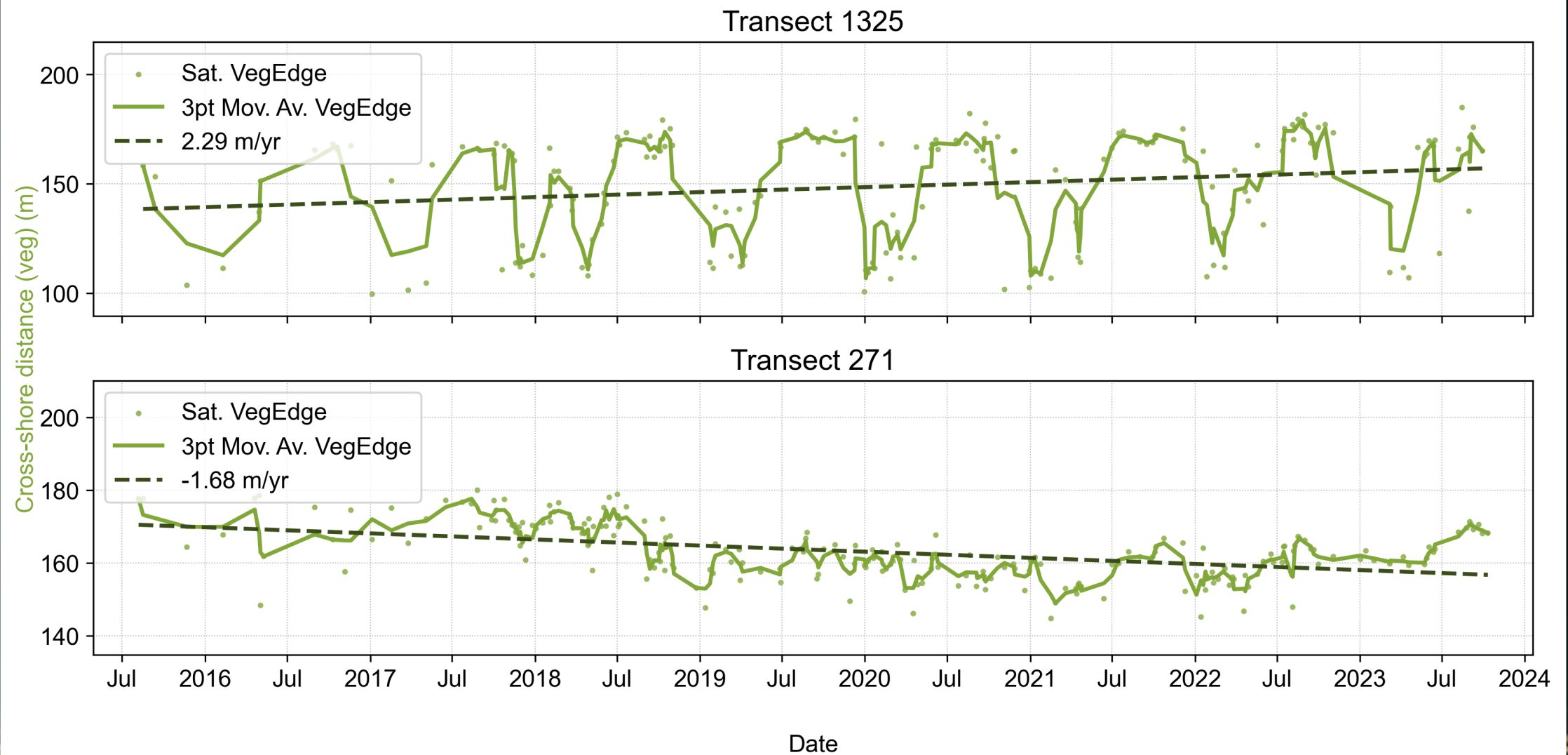
Cross-shore timeseries as a measure of beach health



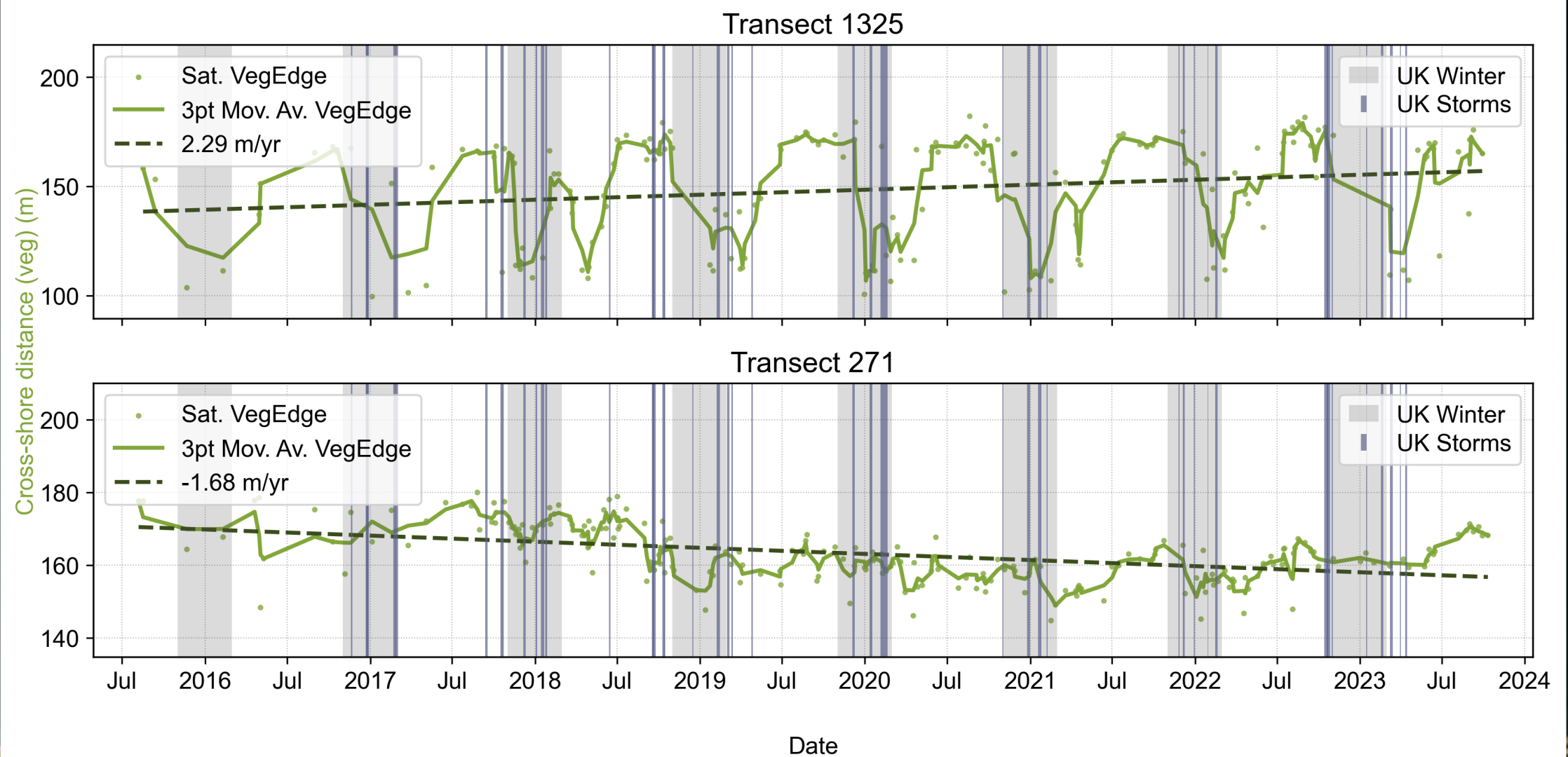
Cross-shore timeseries as a measure of beach health



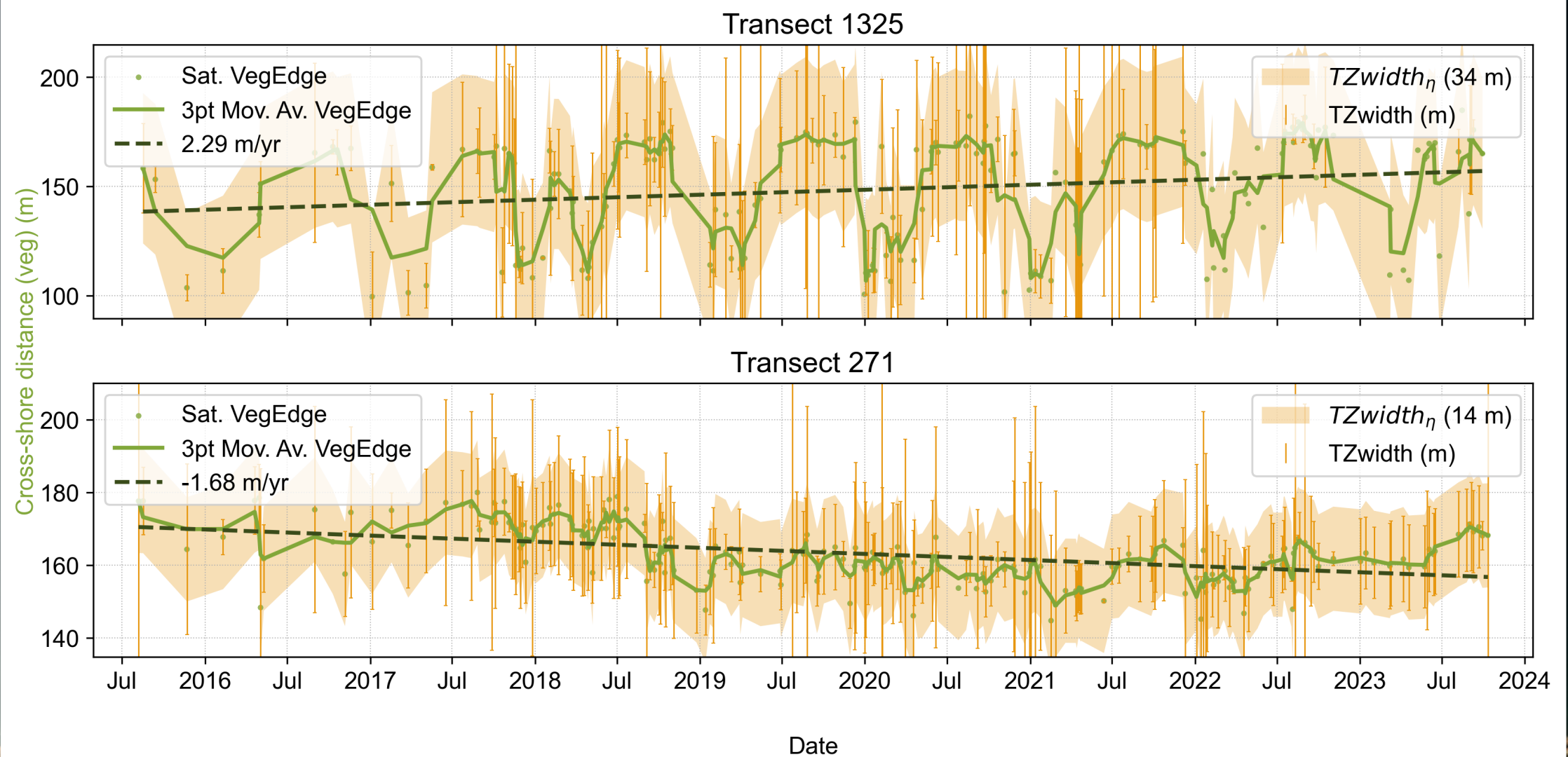
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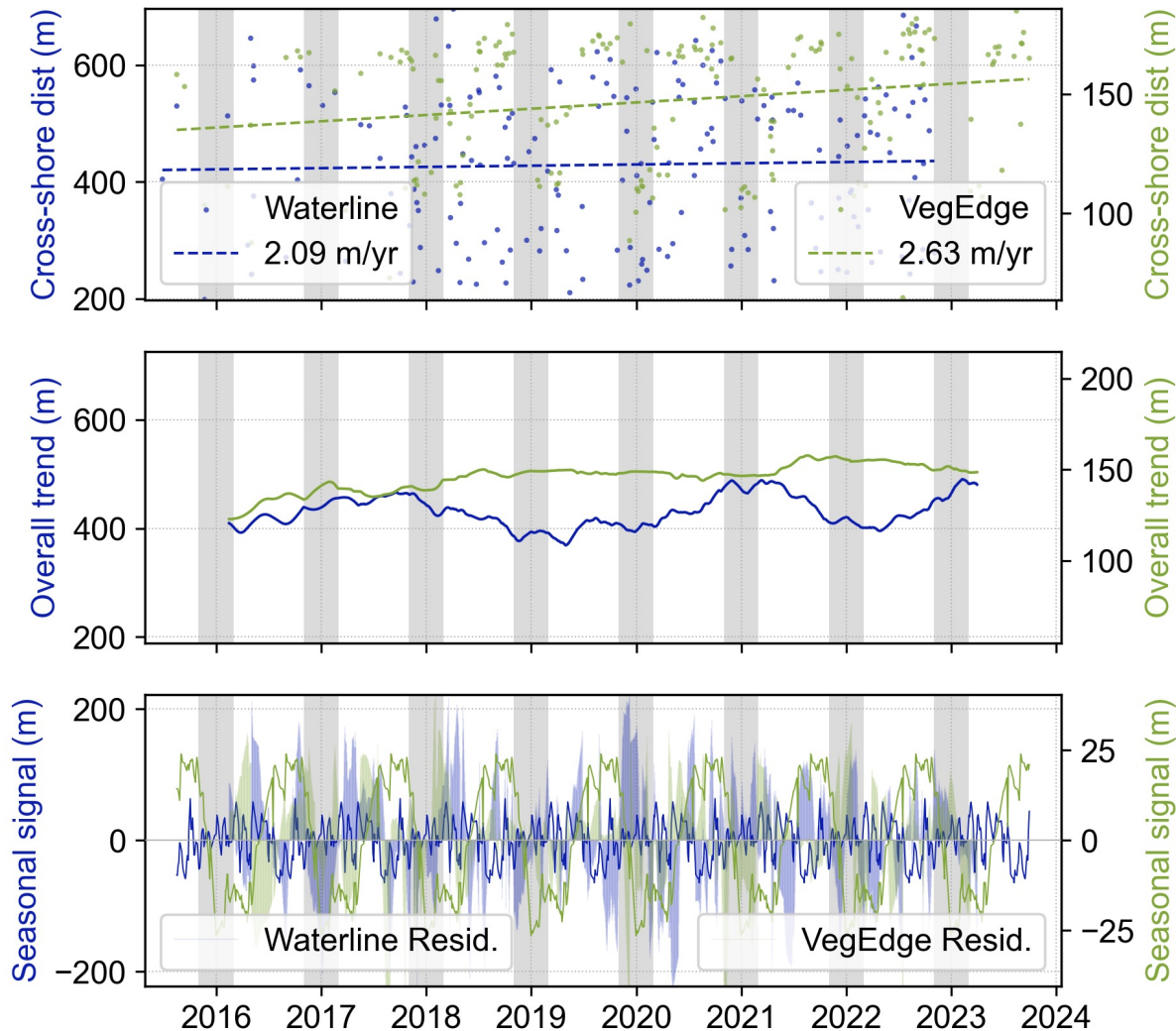


Cross-shore timeseries as a measure of beach health

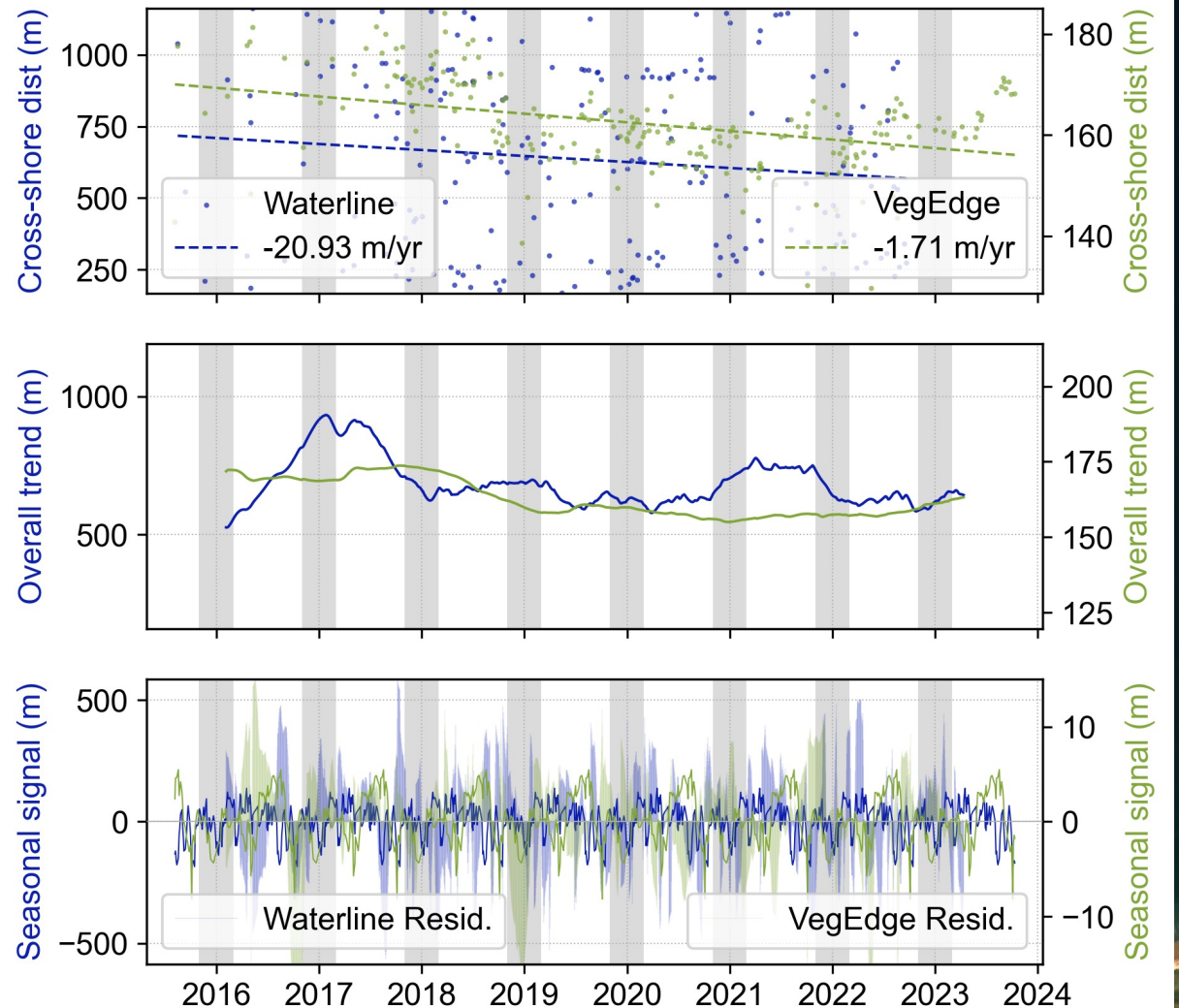


Trend-informed analysis

Transect 1325

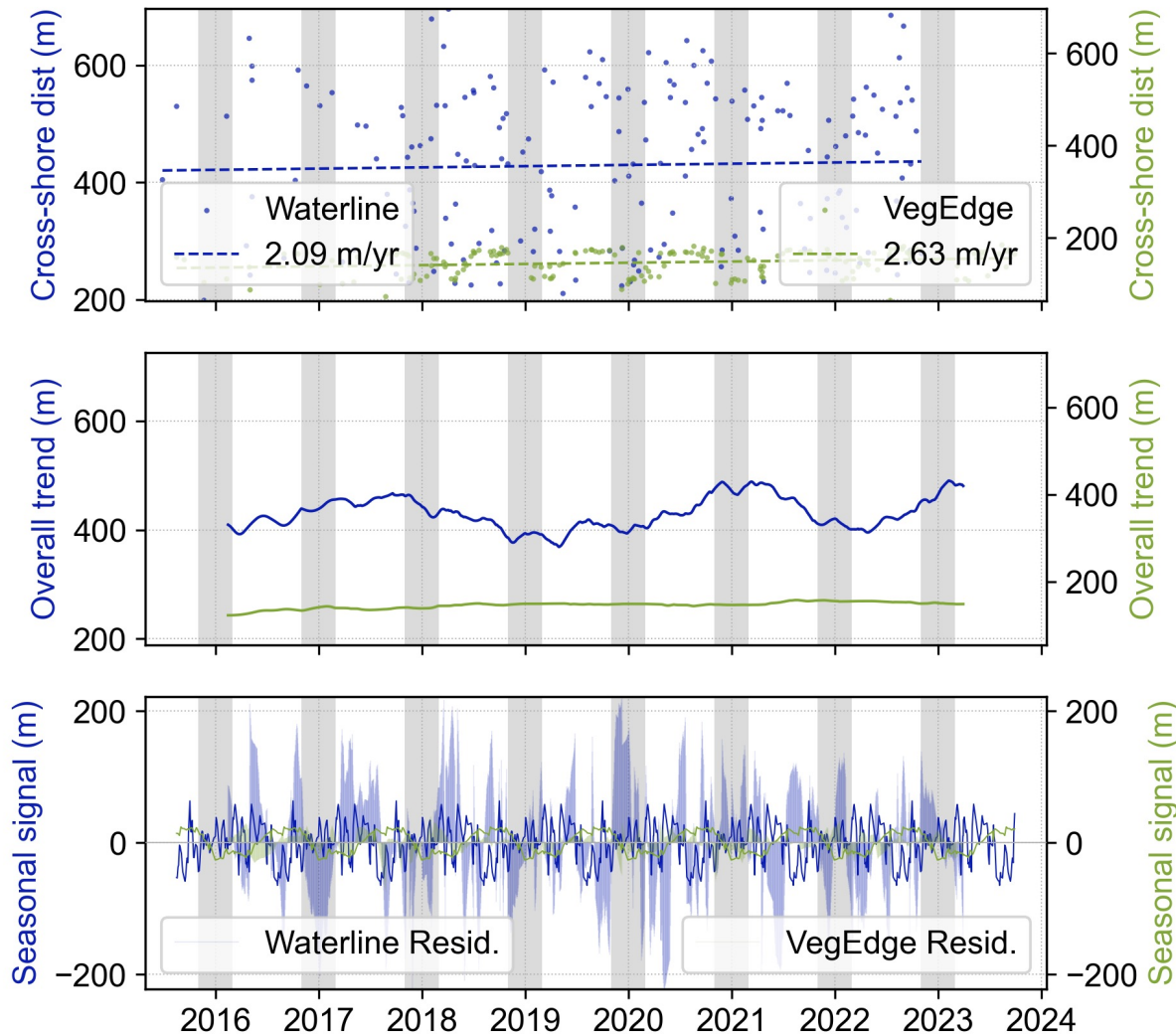


Transect 271

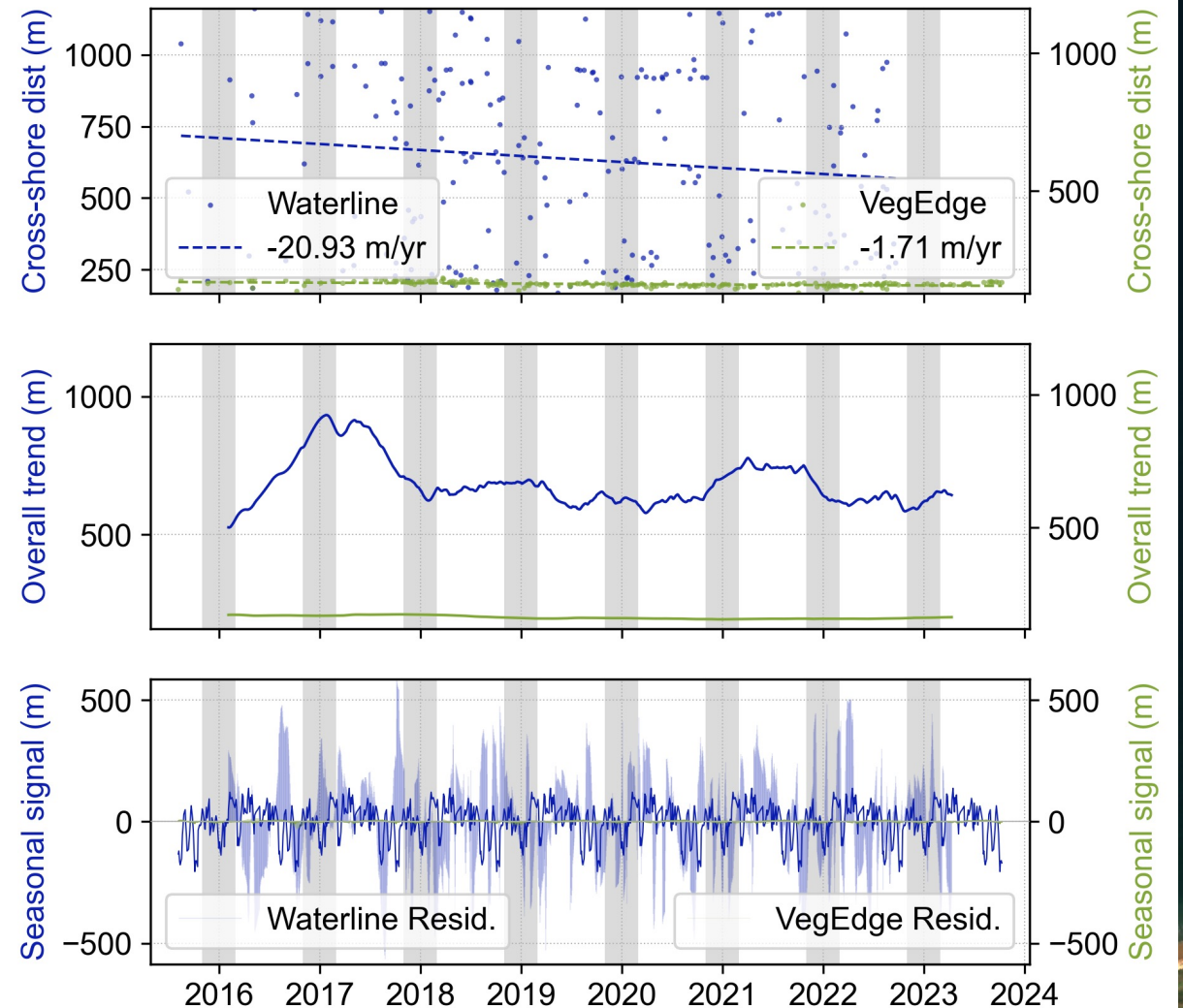


Trend-informed analysis

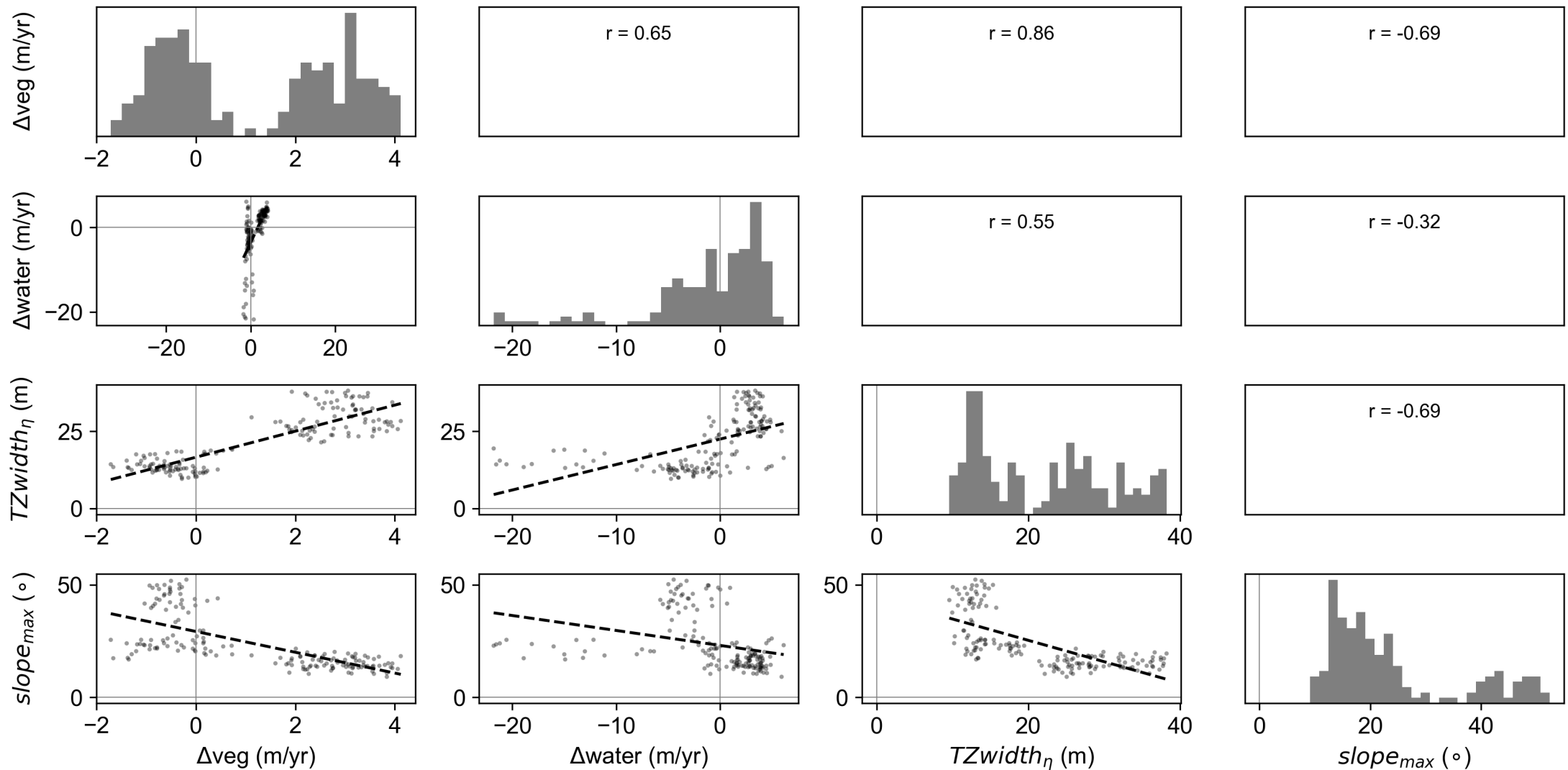
Transect 1325



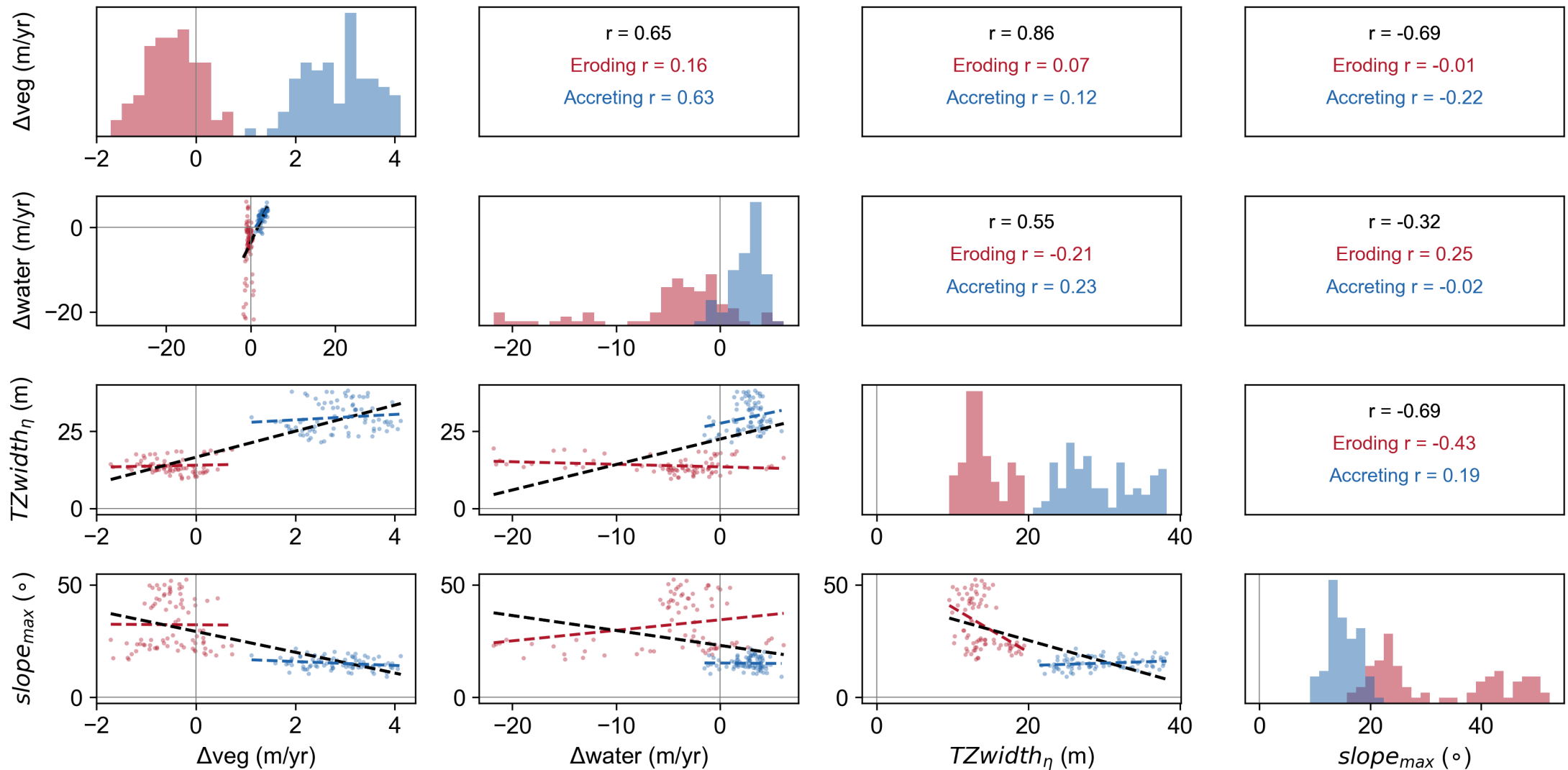
Transect 271



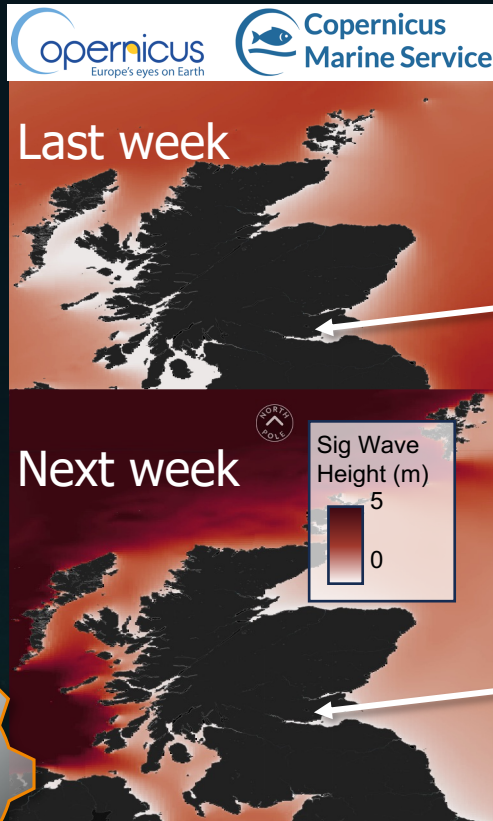
Multivariate Analysis: Fitting the cogs together



Multivariate Analysis: Fitting the cogs together

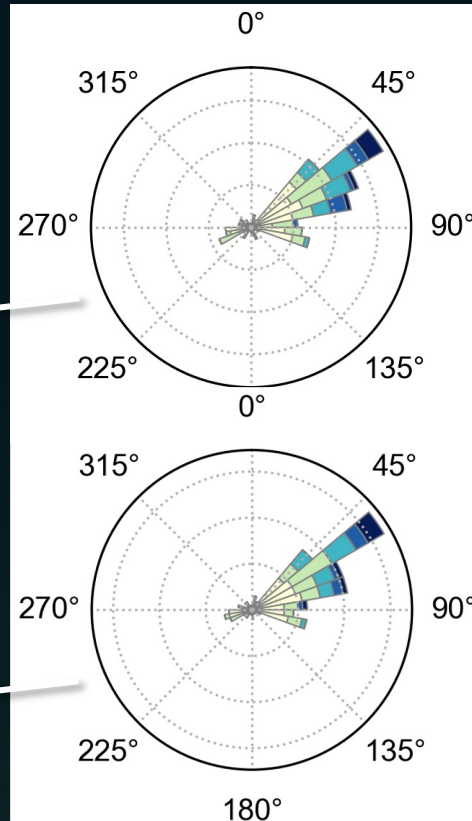


Future directions



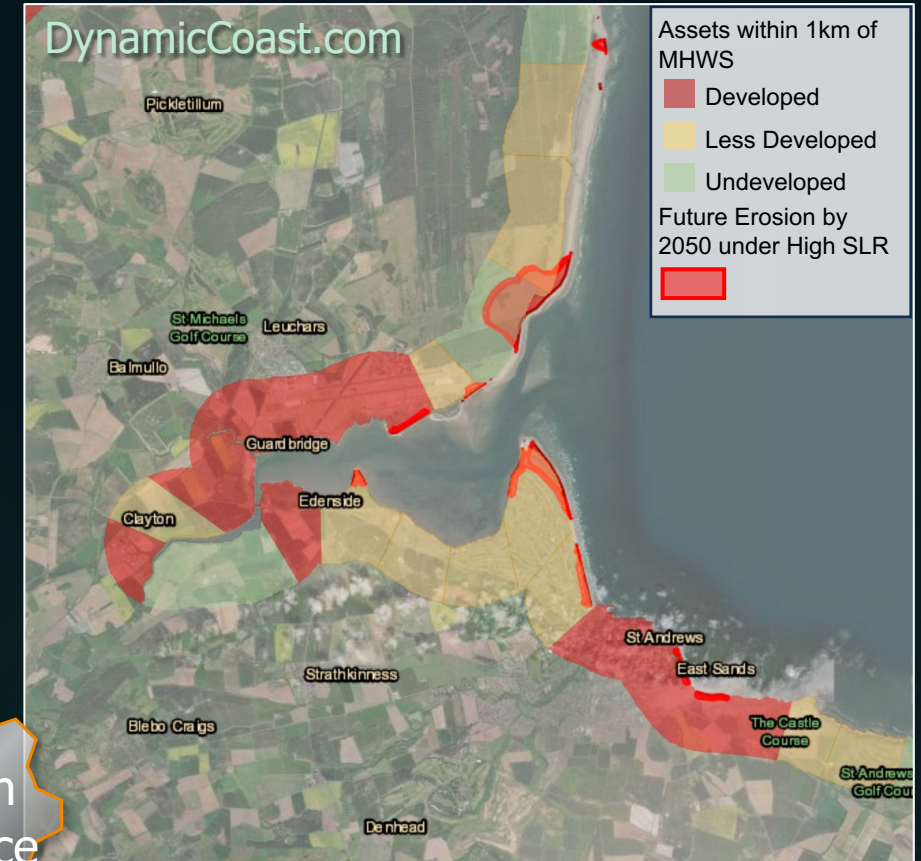
Waves

- Bring in wave data
 - Hindcast analysis of veg vs. wave climate
 - Forecasting of vegetation response using data-driven modelling



Human Influence

- Bring in anthropogenic data
 - Intersecting observed past and modelled future vegetation with coastal assets
 - Natural System Resilience supports Community Resilience



Big coastal datasets offer novel geomorphic insights



Variability of veg edge much less than instantaneous waterline across macrotidal regions
→ better indicator of long-term coastal change



Nuanced metrics like the transition zone width offer a measure of coastal geomorphic resilience
→ helps inform adaptation decisions to improve coastal community resilience



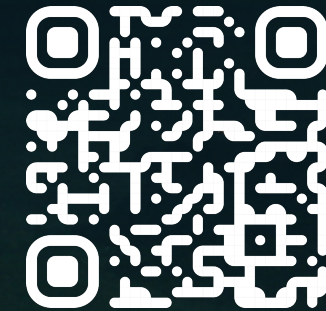
Value of monitoring both veg- and water-based edges; important for practical applications with limits on scope

Thank you!

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VedgeSat tool
(COASTGUARD Github)

References

- Muir, F. M. E., Hurst, M. D., Richardson-Foulger, L., Rennie, A. F. & Naylor, L. A. (2023). Using satellite-derived vegetation edges to quantify coastal change across varied coastal environments. *Earth Surface Processes & Landforms* [in review].
- Vos, K., Splinter, K. D., Harley, M. D., Simmons, J. A., & Turner, I. L. (2019). CoastSat: A Google Earth Engine-enabled Python toolkit to extract shorelines from publicly available satellite imagery. *Environmental Modelling and Software*, 122, 104528. <https://doi.org/10.1016/j.envsoft.2019.104528>