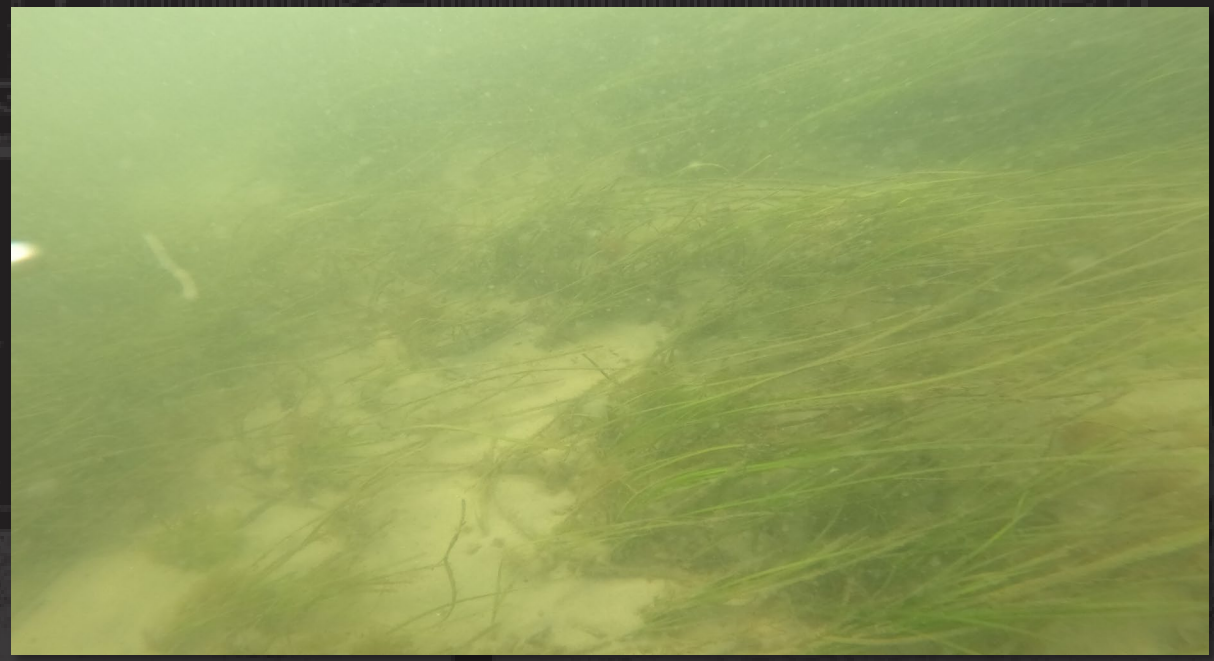
LIGHT AVAILABILITY CALCULATOR: CASE STUDY DEMONSTRATION AND SENSITIVITY ANALYSIS

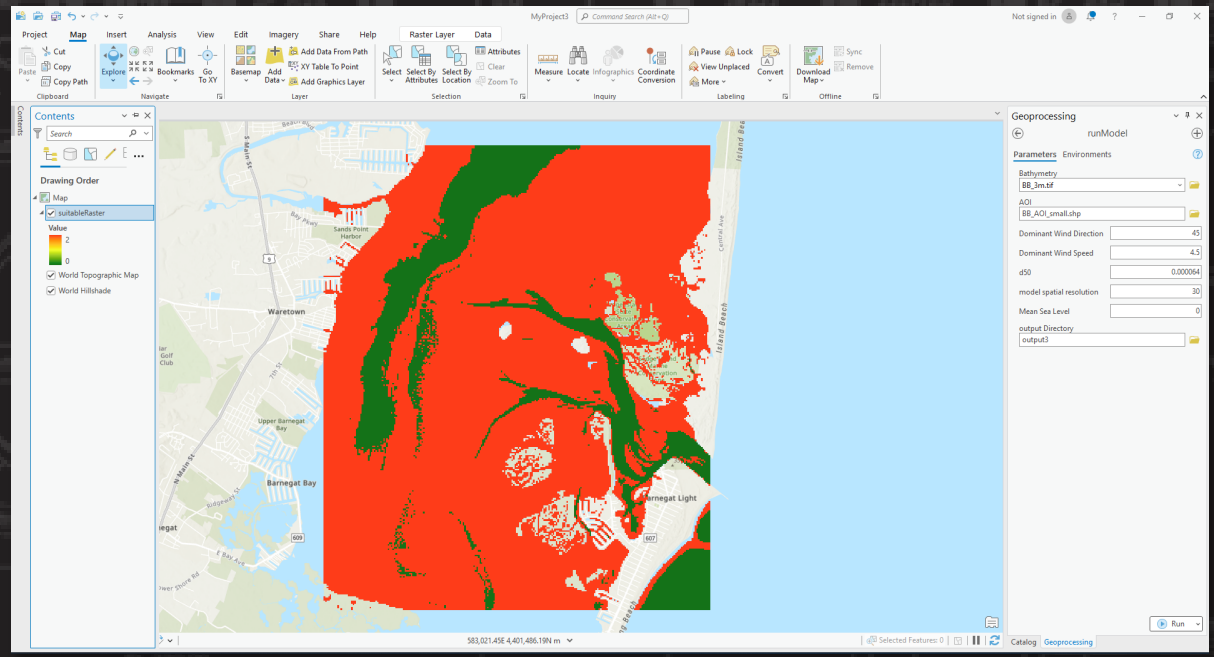


Emily Russ[1], Thomas Huff[1], Liz Holzenthal[2]

[1]Environmental Laboratory
[2]Coastal and Hydraulics Laboratory

30 July 2026

EMRRP Webinar Series



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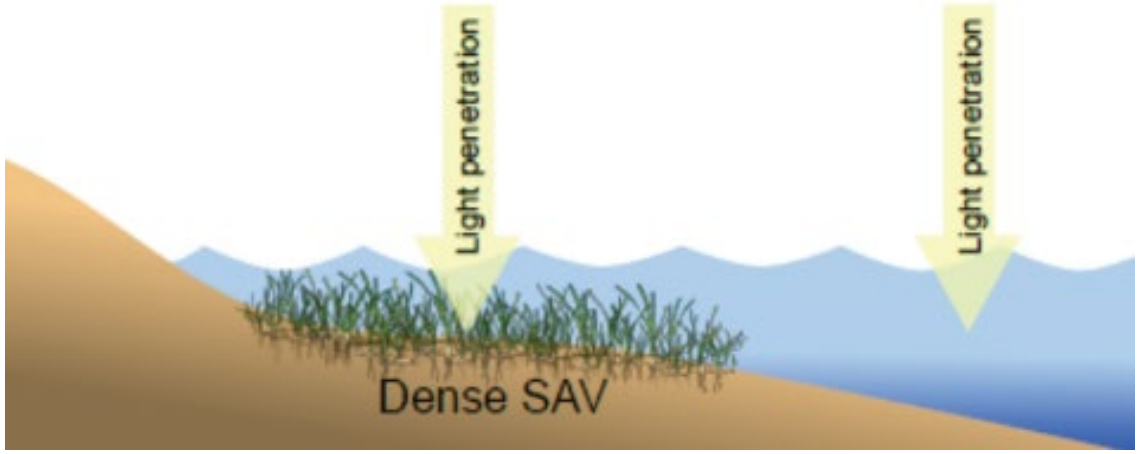
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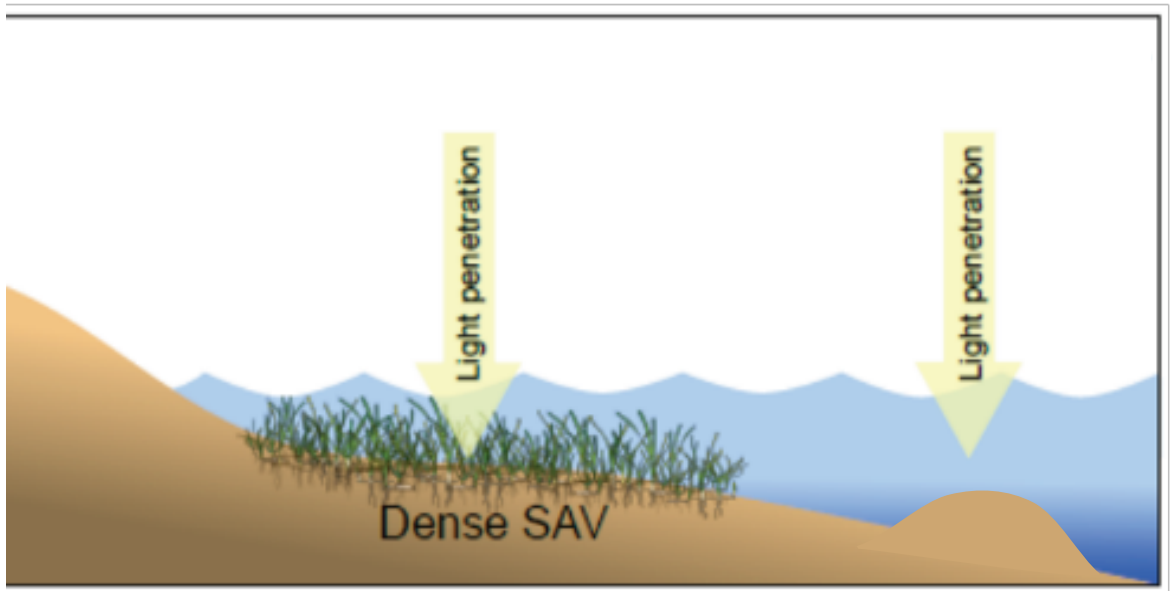
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NEED SAV HABITAT? BUDM FOR SAV

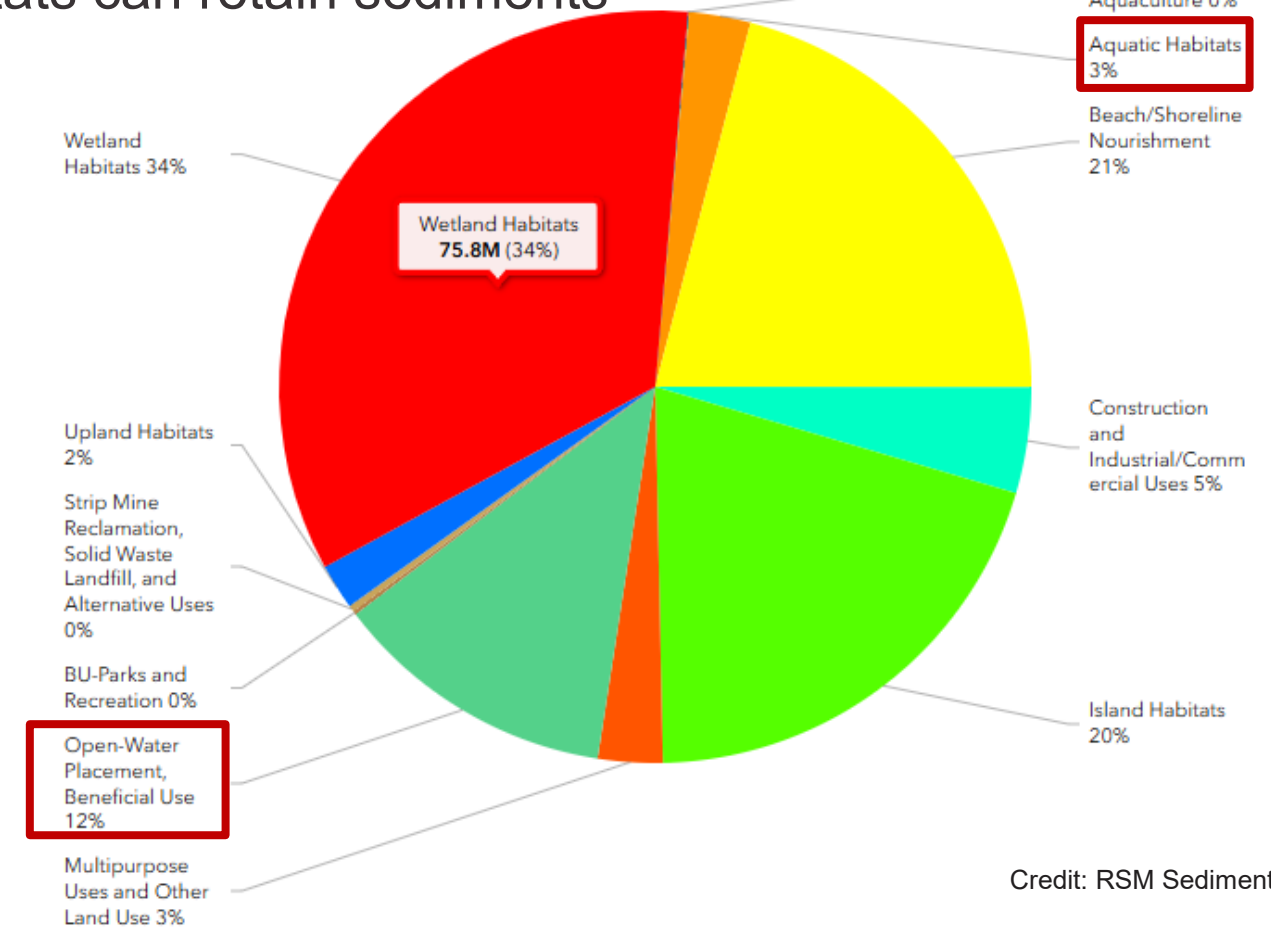
- SAV habitats declining due to environmental and anthropogenic stressors (Waycott et al. 2009)
- Expansion is hindered by developed shorelines (i.e., coastal squeeze)
- Dredged material can elevate light-limited areas to support SAV if other suitability conditions met (Russ et al. 2023)

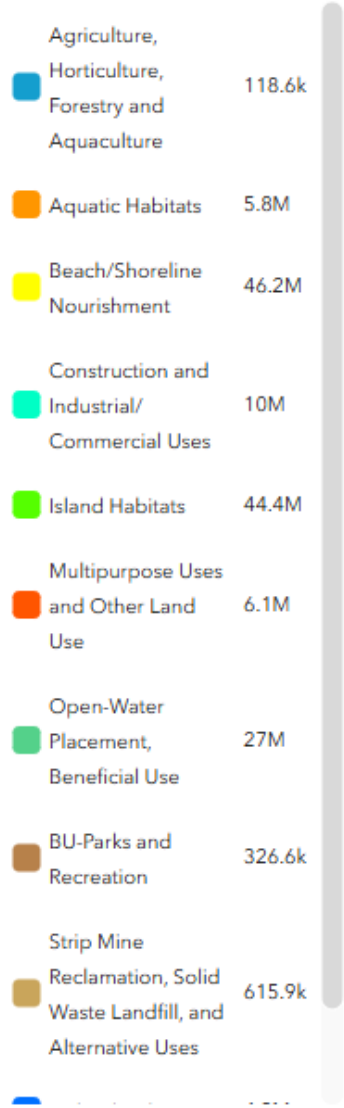




BUDM FOR SAV: BENEFITS

- Open water placement for SAV provides ecological/economic benefits:
  - Creates more suitable habitat for SAV
  - Closer to dredged channels
  - SAV habitats can retain sediments





Credit: RSM Sediment Placement Viewer

BUDM FOR SAV: CONCEPT TO PRACTICE

- Barriers to implementation:
  - Lack of data/documentation (success and failures)
  - Cost (above Federal Standard)
  - Regulatory Hurdles
  - Logistical Challenges

- Site selection can be very subjective
  - Expert opinion (localized)
  - Stakeholders with competing interests

- Need quantitative tools to inform BUDM for SAV

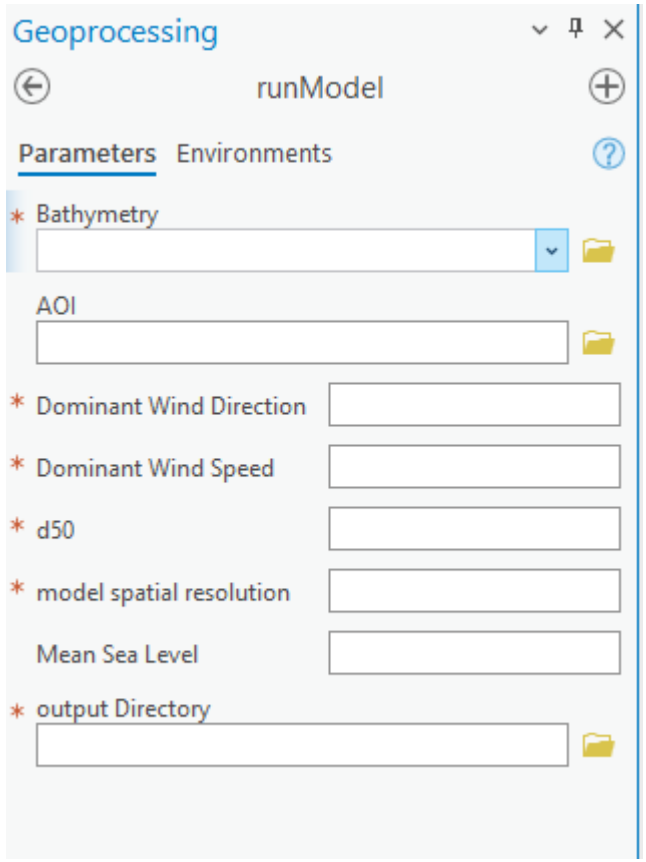
NEED TOOLS FOR BUDM SITE SELECTION

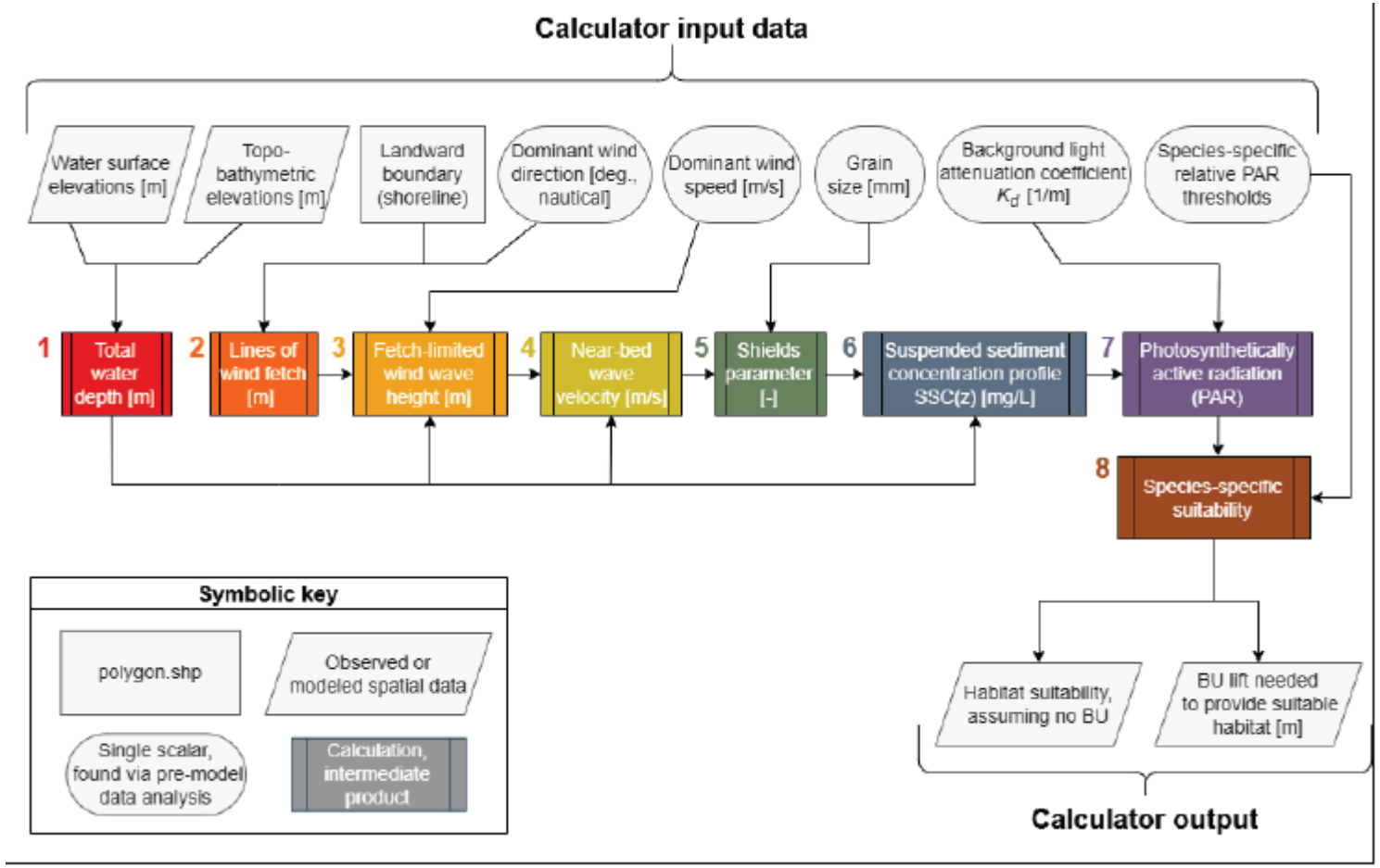
- Light Availability Calculator (LAC) is Habitat-Suitability-Index-type tool
- Developed for estuarine habitats
- Assumes SAV are light-limited



LAC RAPIDLY ASSESSES SAV HABITAT SUITABILITY

- ArcGIS tool to calculate wind-wave-induced turbidity → light environment → SAV suitability:
  - Tool Inputs:
    - Depth (DEM+sea level)
    - Wind speed and direction
    - Grain size





LAC TESTING: BARNEGAT BAY, NJ

- How does LAC-predicted SAV habitat suitability compare with observations?
- How does changing LAC-tool input variables affect SAV habitat suitability area?





LAC TESTING: BARNEGAT BAY, NJ

- How does LAC-predicted SAV habitat suitability compare with observations?
- How does changing LAC-tool input variables affect SAV habitat suitability area?



1122 Site in Blue. Past sites in yellow. Back up locations in red.



BARNEGAT BAY CASE STUDY: DATA INFORMED ANALYSIS

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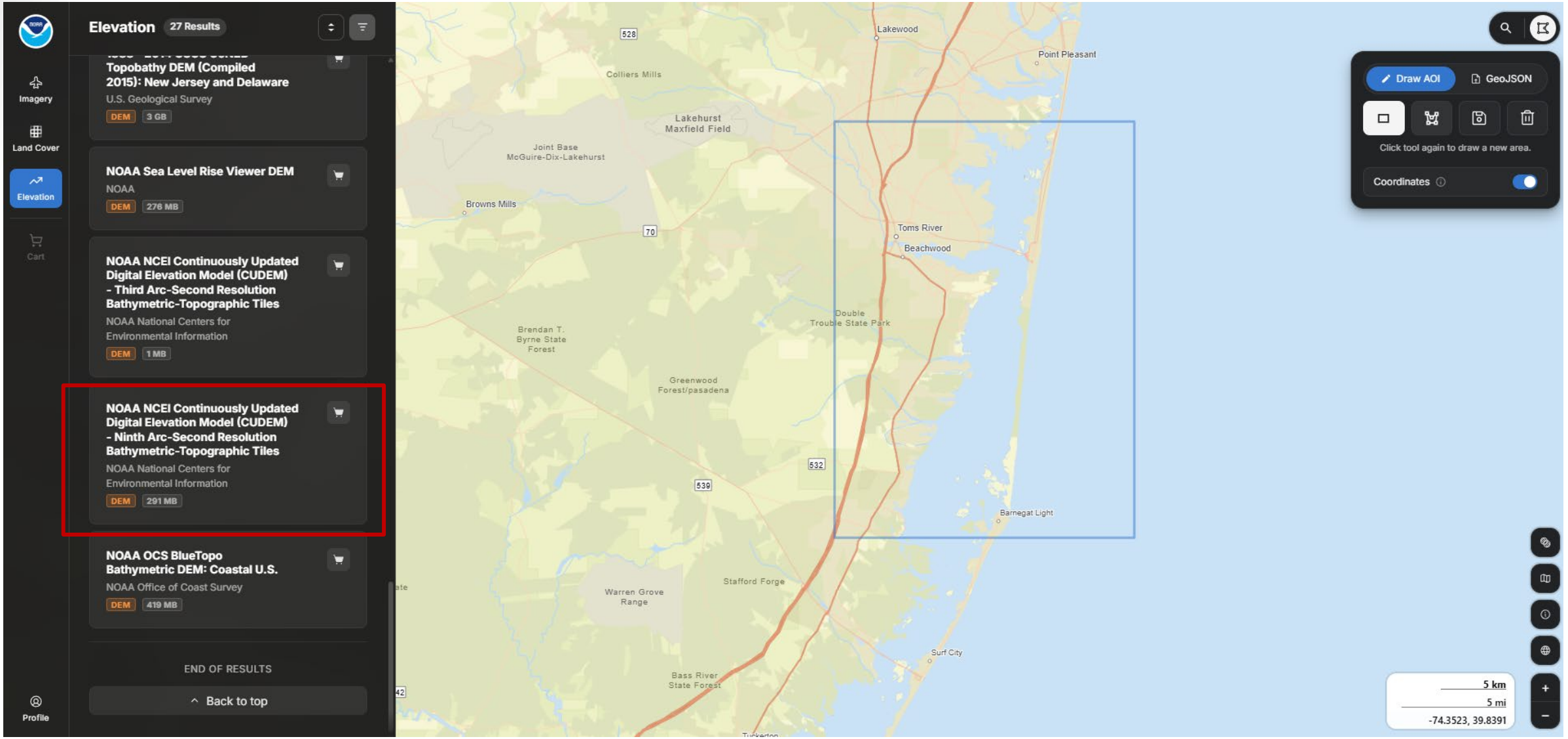
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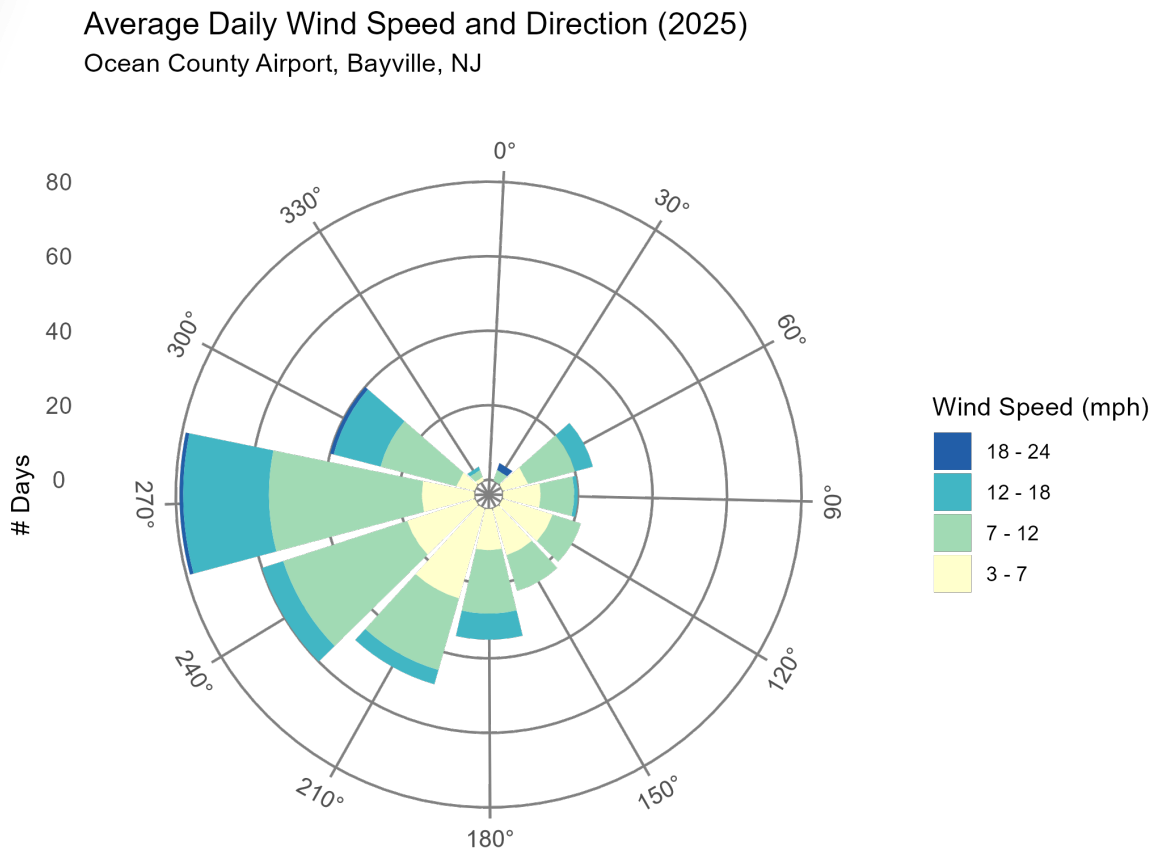
INPUT DATA SOURCES

Input	Data Source used in presented case study
Elevation (Topobathy)	NOAA Digital Coast (https://coast.noaa.gov/digitalcoast/tools/dav.html)
Wind (speed and direction)	NCEI Local Climatology Data (https://www.ncei.noaa.gov/cdo-web/datatools/lcd)
Grain size	Bernier et al., 2016
Background attenuation coefficient (K_d)	*Adams et al., 2016*
Specific attenuation coefficient (alpha)	*Adams et al., 2016*
C(z) equations and ranges	*Soulsby, 1997*

INPUT DATA: BATHYMETRY



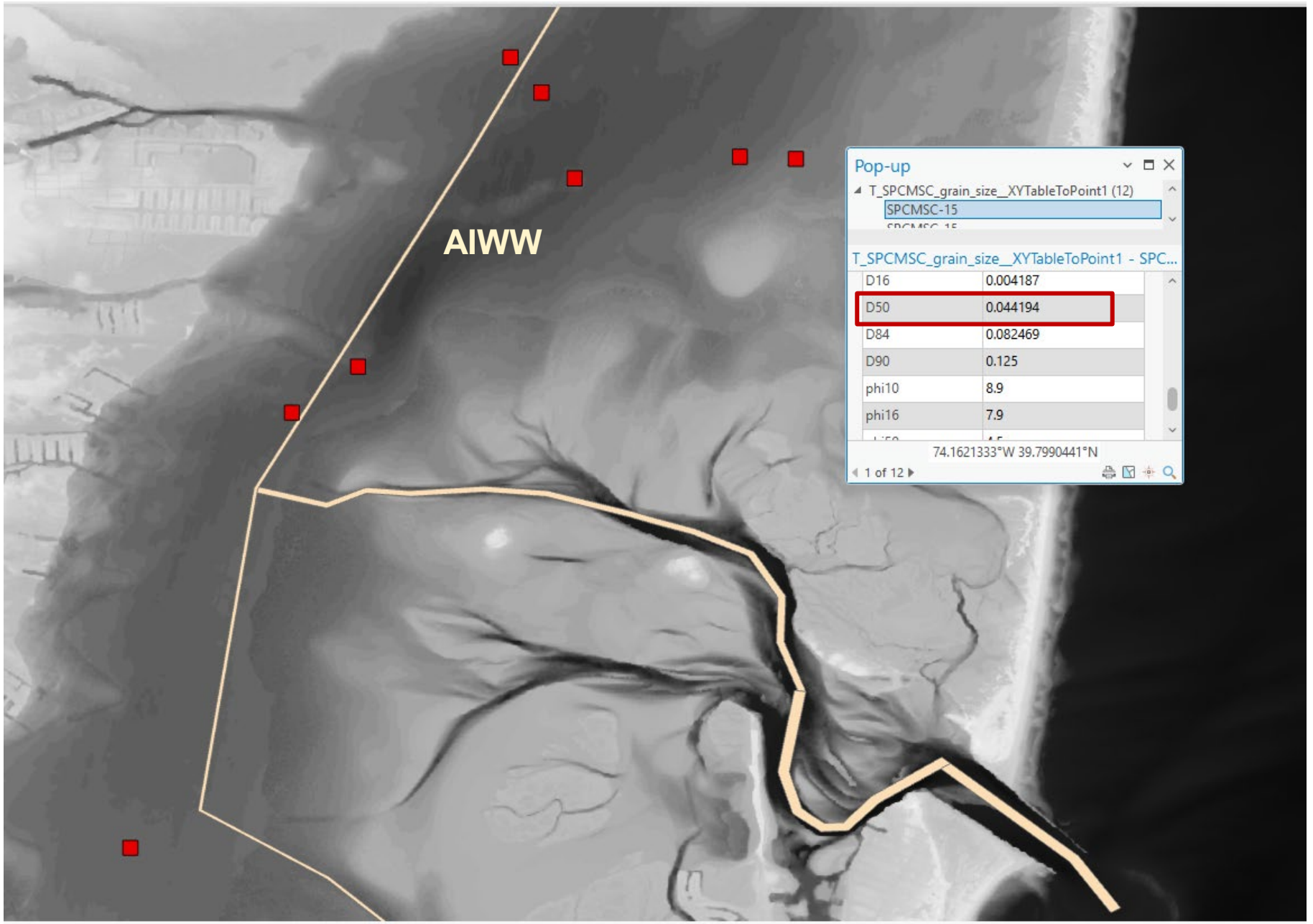
INPUT DATA: WIND SPEED AND DIRECTION



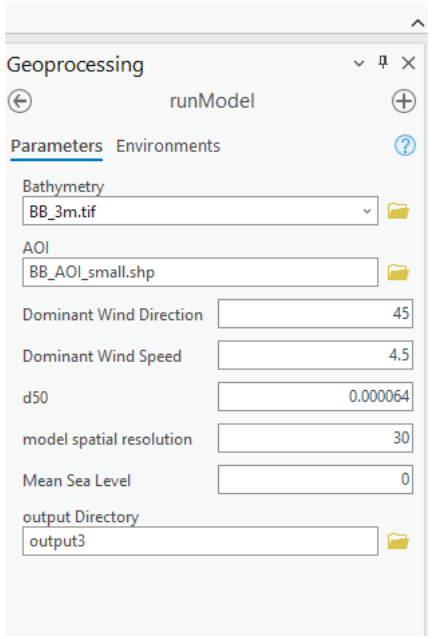
Median wind direction 225°
Median wind speed 10 mph (4.5 m/s)

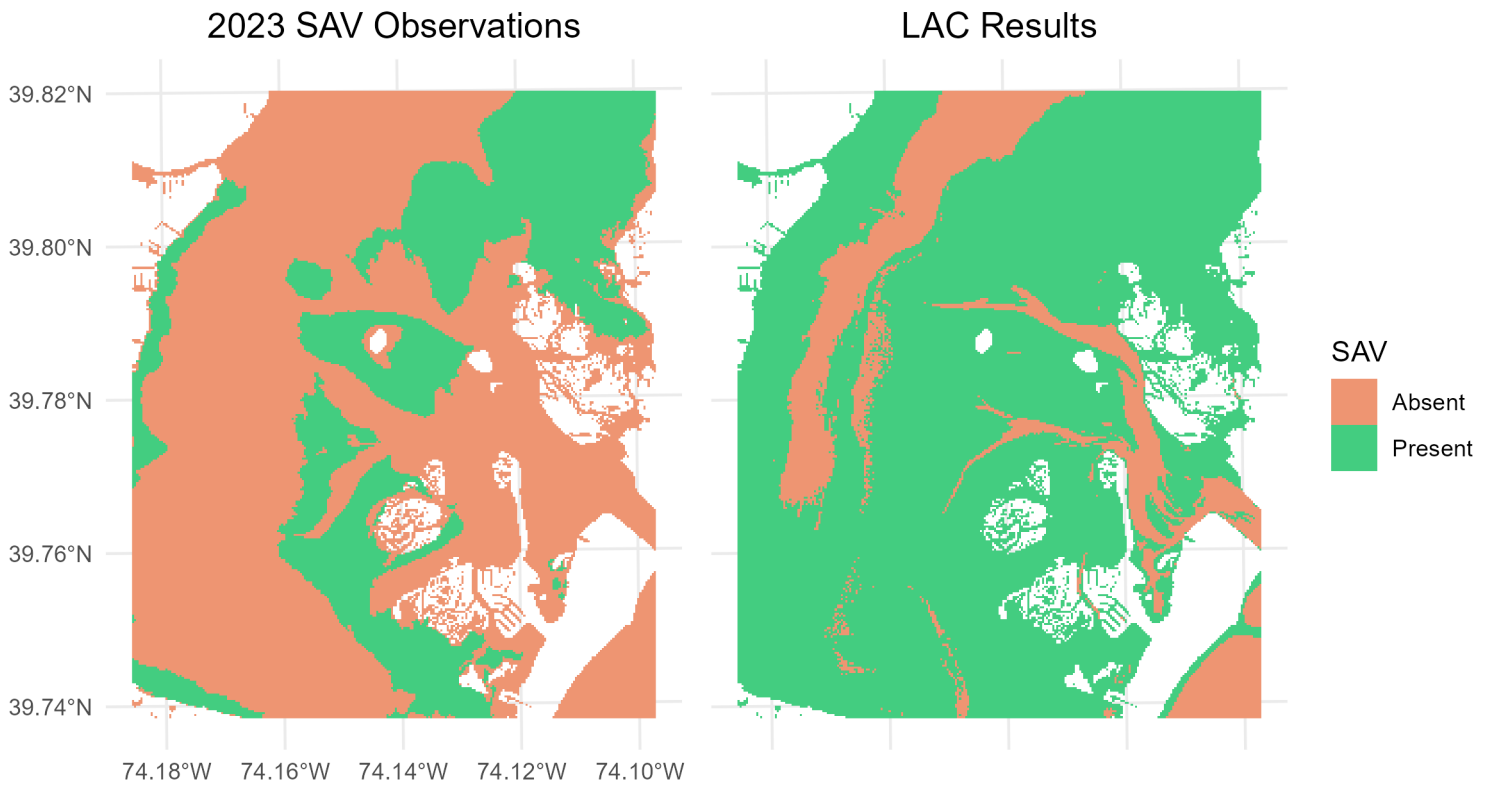
Force	Speed (mph)	Speed (knots)	Description	Specifications for use at sea Specifications for use on land
0	0-1	0-1	Calm	Sea like a mirror. Calm; smoke rises vertically.
1	1-3	1-3	Light Air	Ripples with the appearance of scales are formed, but without foam crests. Direction of wind shown by smoke drift, but not by wind vanes.
2	4-7	4-6	Light Breeze	Small wavelets, still short, but more pronounced. Crests have a glassy appearance and do not break. Wind felt on face; leaves rustle; ordinary vanes moved by wind.
3	8-12	7-10	Gentle Breeze	Large wavelets. Crests begin to break. Foam of glassy appearance. Perhaps scattered white horses. Leaves and small twigs in constant motion; wind extends light flag.
4	13-18	11-16	Moderate Breeze	Small waves, becoming larger; fairly frequent white horses. Raises dust and loose paper; small branches are moved.
5	19-24	17-21	Fresh Breeze	Moderate waves, taking a more pronounced long form; many white horses are formed. Small trees in leaf begin to sway; crested wavelets form on inland waters.
6	25-31	22-27	Strong Breeze	Large waves begin to form; the white foam crests are more extensive everywhere. Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty.
7	32-38	28-33	Near Gale	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind. Whole trees in motion; inconvenience felt when walking against the wind.
8	39-46	34-40	Gale	Moderately high waves of greater length; edges of crests begin to break into spindrift. The foam is blown in well-marked streaks along the direction of the wind. Breaks twigs off trees; generally impedes progress.
9	47-54	41-47	Severe Gale	High waves. Dense streaks of foam along the direction of the wind. Crests of waves begin to topple, tumble and roll over. Spray may affect visibility Slight structural damage occurs (chimney-pots and slates removed)
10	55-63	48-55	Storm	Very high waves with long overhanging crests. The resulting foam, in great patches, is blown in dense white streaks along the direction of the wind. On the whole the surface of the sea takes on a white appearance. The tumbling of the sea becomes heavy and shock-like. Visibility affected. Seldom experienced inland; trees uprooted; considerable structural damage occurs.
11	64-72	56-63	Violent Storm	Exceptionally high waves (small and medium-size ships might be for a time lost to view behind the waves). The sea is completely covered with long white patches of foam lying along the direction of the wind. Everywhere the edges of the wave crests are blown into froth. Visibility affected. Very rarely experienced; accompanied by wide-spread damage.
12	72-83	64-71	Hurricane	The air is filled with foam and spray. Sea completely white with driving spray; visibility very seriously affected. see Saffir-Simpson Hurricane Scale

INPUT DATA: GRAINSIZE

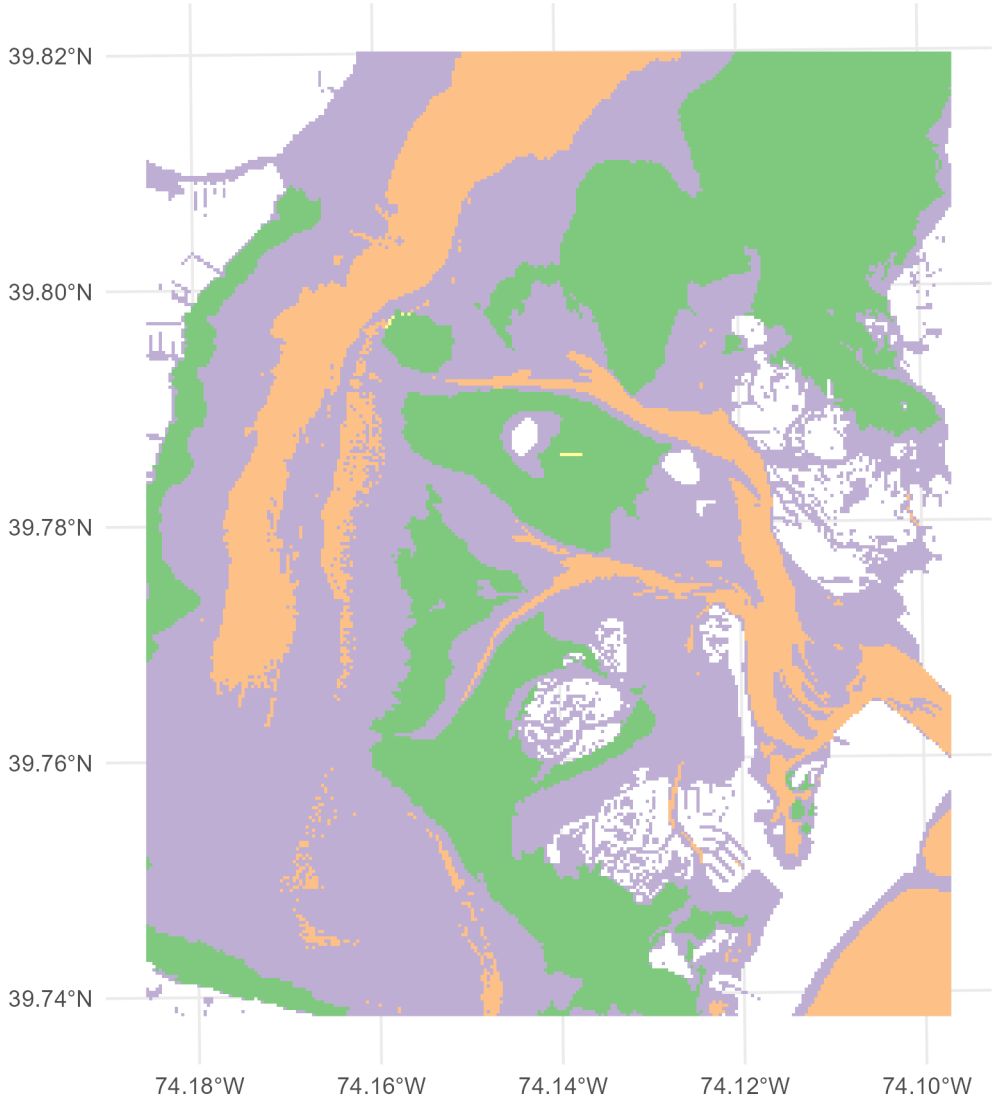


OBSERVATIONS VS SUITABILITY





OBSERVATIONS VS SUITABILITY



- Confusion matrix (table) dominated by False Positives
- Factors beyond light controlling SAV observations

Obs.vs.Suitability	Percent
TN	17.05
FN	0.02
FP	52.61
TP	30.32

BARNEGAT BAY CASE STUDY: SENSITIVITY ANALYSIS

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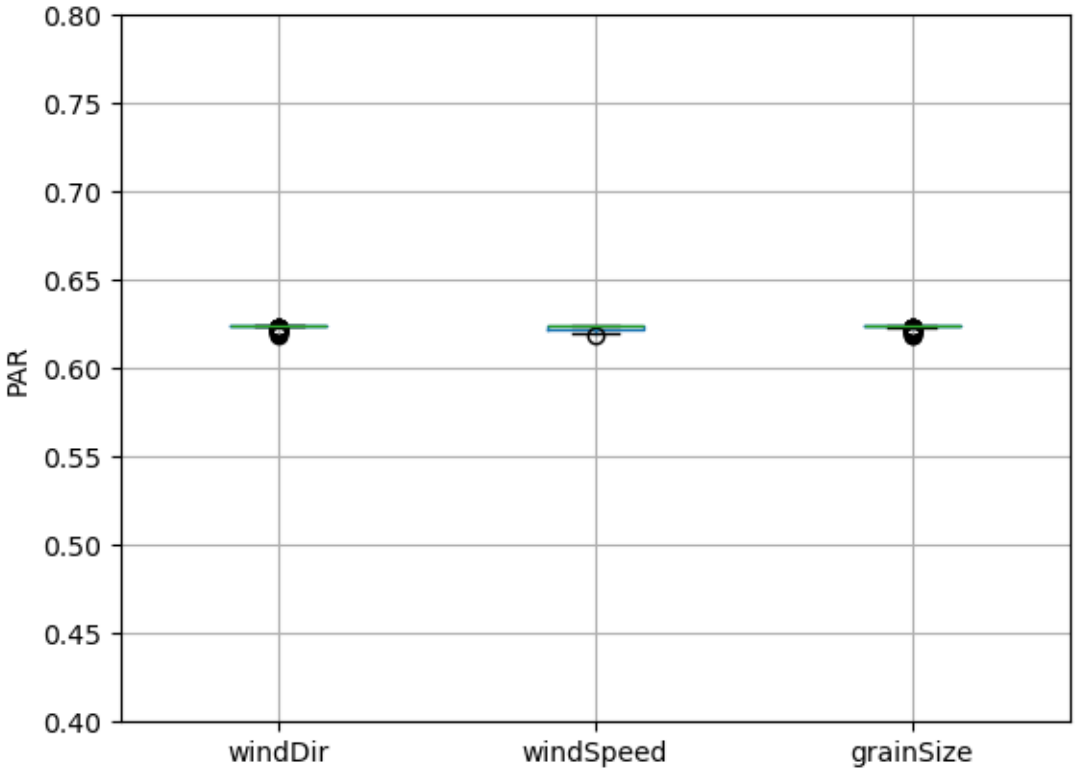
SENSITIVITY ANALYSIS INPUTS

Variable	Minimum value	Maximum value	Default value
Wind Direction (°)	1	360	90° (Southerly wind)
Wind Speed (m/s, [mph])	1 [2]	45 [100]	10 m/s [22.4]
Grain size (m)	0.00004	0.03	0.00015
K_d (m^{-1})	0.18	0.72	0.18
Alpha (m^{-1}/mg L^{-1})	0.013	0.72	0.013
C(z)	x1	x5	2

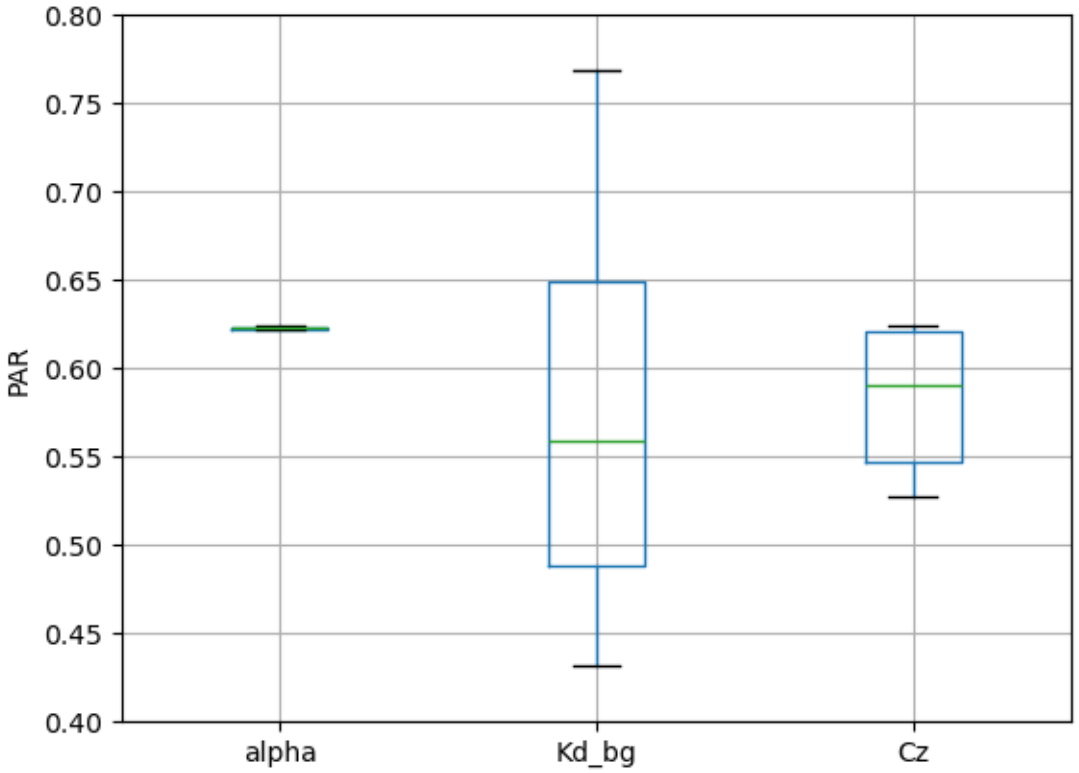
- Ran tool with default inputs and changed one variable at a time:
  - 20 increments between min and max

UNCERTAINTY > ENVIRONMENTAL VARIABILITY

Average PAR across site



User-defined variables



Sediment variables (hard-coded in tool)

NEXT STEPS

- Additional sensitivity testing of tool equations (outside of GIS)
- Testing at 2 USACE Districts
  - SPN
  - NWP
- Results to be submitted in ERDC SR (end of FY26; published in FY27)
- Future work to look at other variables affecting SAV (i.e., geochemistry, water quality, etc.)

CONNECT WITH US

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