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MARINE ENERGY TECHNOLOGY SYMPOSIUM

Implementation of the Spatial Environmental Assessment Tool

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INTRODUCTION

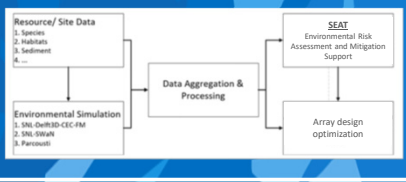
The interaction of marine energy arrays with the environment can be quantified using open-source numerical models such as:

- SNL-Delft3D-CEC-FM hydrodynamic conditions
- SNL-SWAN ocean wave propagation
- Paracousti acoustics propagation

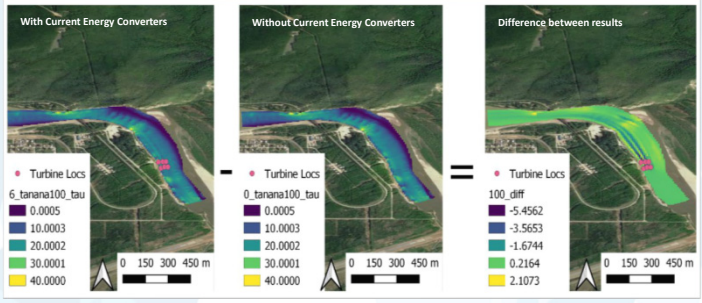
When model results are combined with site-specific information, the risk of environmental change can be determined. The Spatial Environmental Assessment Tool (SEAT) provides a framework and tools to optimize array layouts and limit negative environmental effects.

AIM

The aim of this project is to provide a streamlined approach to identify areas at risk of change due to marine energy developments. To achieve this goal SEAT uses open source models to represent device parameters in the environment. Results are analysed by integrating site-specific data in a GIS platform that produces spatial maps of risk, quantifies and categorizes said risk, and allows for direct comparison between possible array configurations.



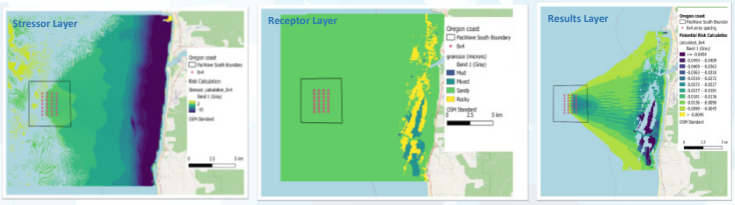
RESULTS

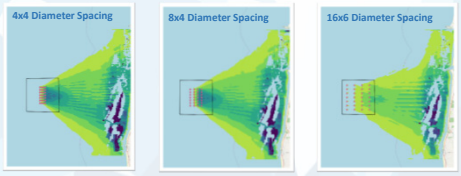


Potential change in environment is computed by comparing the change between conditions with marine energy devices and conditions without.

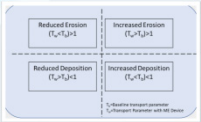
Change in conditions (stressor layer) is paired with site-specific receptors to compute risk. The change is scaled by probability of forcing condition and summed over all conditions considered.

$$Risk = \Sigma(Probability * Change)$$

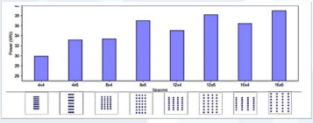




The SEAT produces risk metrics that can be compared between conditions, seasons, and array configuration. Idealized Power produced by the array is also computed. allowing for the optimization of power production while mitigating negative environmental effects.



Threshold matrix for sediment response



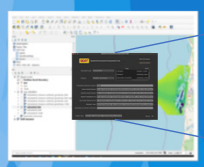
Power output by device array shape

Risk Value	Description	% Coverage	
		4x4	16x6
<-1	Decreased Mobility	0.9	0
-1 to 0	Increased Deposition	54.5	60.1
0	No Change	43.4	38.8
0-1	Decreased Deposition	1.2	1.1
>1	Increased Mobility	0	0

Power output by device array shape

METHOD

The SEAT is a plug-in to the open source spatial analysis software QGIS that computes risk metrics from model outputs, site-specific receptor maps, and user-defined thresholds.



SEAT GUI Interface in QGIS

SEAT Plug-in Menu

CONCLUSIONS

The Spatial Environmental Assessment Tool streamlines the evaluation of marine energy developments. Integration of numerical mode results allows for multiple array and device configurations, and site conditions to guide decision-making by stakeholders, regulators, and developers.

ACKNOWLEDGEMENT

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REFERENCES

SNL-SWAN wave model: https://snl-waterpower.github.io/SNL-SWAN/
Paracousti Acoustic Propogation model: https://snl-waterpower.github.io/Paracousti/
SNL-Delft3D-FM-CEC hydrodynamic model: https://github.com/SNL-WaterPower/SNL-Delft3D-FM-CEC

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