ALEKS SIEMENN – UNIVERSITY AT ALBANY- STATE UNIVERSITY OF NEW YORK

STATEMENT OF PURPOSE:

The energy generation potential of energy systems, especially renewable energy systems, is highly dependent on the spatial location of that system. For example, the amount of energy that a solar panel farm will generate is conditional on the insolation and solar angle of incidence, likewise, wind farm generation potential depends on boundary layer flows and surface friction. This differential distribution of resources, which fuel renewable energy systems, results in some locations clearly being the optimal installation sites. But how do we proceed when the installation location is not obvious? In this study, our goal was to identify and visualize the differential generation potential of thousands of modeled OWC systems along the Northeastern New England coastline to run a Life Cycle Assessment (LCA) on the material consumption of these systems. These same principles of differential resource allocation hold true with ocean energy and in our case, Oscillating Water Column (OWC) systems. Energy generated by OWCs is derived from wave height and wave period resulting in dramatic differences in generation potential with differences in shoreline compositions or barriers restricting fluid flow. OWC system implementation is still in its infancy in comparison to other renewable energy systems so most research is confined to singular model or laboratory tests, therefore, few studies have been conducted on geospatially analyzing the technical feasibility and environmental impacts of these systems. The data sets that we have produced using spline methods of interpolation of Integrated Ocean Observing System buoy data have allowed us to begin looking at OWC generation potential at the large-scale without sacrificing resolution. The significance of this visualization of energy data and environmental impacts is that it can be clearly determined which coastal regions have ideal sites for OWC installations but also which sites will be more material-intensive if the optimally sized OWC systems were to be installed. This data is not only useful as a scientific tool for understanding how the fluid mechanical interactions of the ocean with technology differ dramatically with distance but also as an engineering tool for siting the most profitable OWC systems with the fewest environmental impacts.

DESCRIPTION OF DATA SETS:

The primary data set used in this project was provided by NERACOOS, Integrated Ocean Observing System buoys. These regional coastal observing systems archive historical physical ocean measurements such as wave height and wave period, the two measurement variables used in this project. Accelerometers attached to buoys fixed at their respective locations have all been recording and archiving data from before 2003; this historical data has been used to calculate the energy generation potential of Oscillating Water Column systems. These NERACOOS datasets are authorized for research use with proper citations and acknowledgment. The secondary data set used in this project was provided by NOAA's Coastal Relief Model. This model has generated high geospatial resolution bathymetry data which has been used in the calculation of chamber material consumption. Much like the NERACOOS data sets, the NOAA data sets are authorized for research with a citation.