ATOC-5570 Semester Project

Literature Review: Due Feb 15th

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# Topic: Offshore Wind Energy in California

1. (Krishnamurthy et al., 2021): This report aimed to highlight two potential offshore sites for wind farms off the coast of California. The source of data came from two lidar-equipped buoys: one near Morro Bay (50km off the coast; ocean depth 1100m) and another near Humboldt County (40km off the coast; ocean depth 625m). This study has been the first and only to perform a wind resource assessment at hub height. The data collection period in Morro Bay determined that winds exceeded 3 m/s 85% of the time, and 12 m/s 25% of the time. Combining this distribution with the shore location of grid operations, makes the Morro Bay site an ideal location for providing CA with a reliable electricity. The collection period for Humboldt County only included the winter months (due to technical challenges). Wind speeds experienced at the Humboldt site were above 3 m/s 82% of the time and above 12 m/s 27% of the time. More research is planned to relate sea state conditions and effects to the Marine Boundary Layer.
2. (Optis et al., 2020): This 2020 report wished to provide a wind resource assessment specifically for California that modelled 20 years (CA20) of data through the Weather Research & Forecasting (WRF) numerical weather prediction (NWP). This new dataset claims that there is a potentially of 200GW of offshore wind energy, which is over 30% higher than a 2016 NREL report. Much time is spent explaining the differences; among many are updated software models, excluding environment conflicts, and increased depth limit for floating turbines. The CA20 found higher mean wind speeds than a previous 7-year simulation dataset published in 2013. Moreover, CA20 reported increased windspeeds of 9.7% in Humboldt, 17.4% in Morro Bay, and 19.7% in Diablo Canyon, all promising call areas for floating wind farms.
3. (Sheridan et al., 2021): This report set out to assess large deviations in hub-height (90m) wind speed between observed offshore data and modelled data from reanalysis tools. One lidar-equipped buoys located off the coast of New Jersey collected data from Nov 2015 – Feb 2017, and a second, located off the coast of Virginia collected data from Dec 2014 – May 2016. Further, the report went to evaluate under what sea and atmospheric condition the reanalysis tools best fit the observed data. One note is that nearly all reanalysis products simulated mean wind speeds slower (< 1 m/s) than what was observed by both lidar buoys. Interestingly, biases were found during upwelling and downwelling events for the buoy in New Jersey, but not in Virginia, which has to do with the ocean depth. Since upwelling and downwelling are responsible for sea surface temperature variations near coasts, this implies that reanalysis tools’ grid-resolution is paramount to accurately capturing how the temperature gradients impact offshore wind resources.
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# References:

Krishnamurthy, R., Garcia-Medina, G., Gaudet, B., Mahon, A., Newsom, R., Shaw, W., & Sheridan, L. (2021). Potential of Offshore Wind Energy off the Coast of California.

Optis, M., Rybchuk, O., Bodini, N., Rossol, M., & Musial, W. (2020). *Offshore Wind Resource Assessment for the California Pacific Outer Continental Shelf (2020)* (No. NREL/TP-5000-77642, 1677466, MainId:29568) (p. NREL/TP-5000-77642, 1677466, MainId:29568). https://doi.org/10.2172/1677466

Sheridan, L., Krishnamurthy, R., & Gaudet, B. (2021). *Assessment of Model Hub Height Wind Speed Performance Using DOE Lidar Buoy Data* (No. PNNL--30840, 1779495) (p. PNNL--30840, 1779495). https://doi.org/10.2172/1779495