

NEWS | AUGUST 18 2022

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Scilight 2022, 341106 (2022)

<https://doi.org/10.1063/10.0013780>

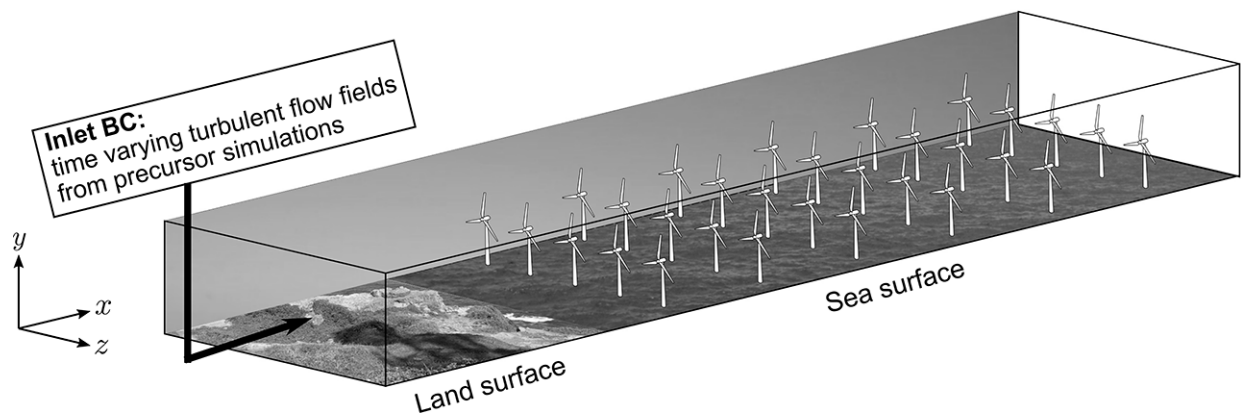


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Large-eddy simulations show need to consider land influence on nearshore offshore wind farms.



Offshore wind farms are typically built nearshore, starting from a few kilometers up to around 20 kilometers, where land influences airflow and thus the performance of turbine arrays when wind blows from land to sea. But little is known about the impact of coastal terrain.

Goit and Önder performed large-eddy simulation (LES) to compare a nearshore wind farm model with a further offshore model unaffected by coastal terrain. They found the terrain induces higher inflow turbulence, which enhances kinetic energy entrainment. This, in turn, improves wake recovery and increases wind farm power output.

“Our objective was to quantify how badly the nearshore wind farm would perform compared to the one further offshore. To our surprise, total power output of the nearshore farm was higher in our land-to-sea airflow model,” author Jay Prakash Goit said. “Our study shows the crucial need to consider terrain effect on wind fields in designing wind farm layouts at coastal sites.”

The researchers attributed the better performance to higher vertical kinetic energy flux, which led to more energy entrainment from the flow above the wind farm. The study could enhance emerging wind energy markets, particularly in Japan and other Asian countries where some coastal sites experience land-to-sea wind direction more than 50% of the time.

Next steps to advance the research include coupling the LES with an optimization scheme to find an optimal turbine array layout and improving the model of sea waves so wind-wave interactions can be more precisely represented. Atmospheric stratification due to difference between surface and air temperature is also important for coastal wind and will be considered in future work.

**Source:** “The effect of coastal terrain on nearshore offshore wind farms: A large-eddy simulation study,” Jay Prakash Goit and Asim Önder, *Journal of Renewable and Sustainable Energy* (2022). The article can be accessed at <https://doi.org/10.1063/5.0094476>.

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