# Article information:

Large-eddy simulation of atmospheric boundary layer flow through wind turbines and wind farms - ScienceDirect
<https://www.sciencedirect.com/science/article/pii/S0167610511000134>

# Article summary:

1. Accurate prediction of atmospheric boundary layer (ABL) flow and its interactions with wind turbines and wind farms is critical for optimizing the design of wind energy projects.

2. Large-eddy simulation (LES) can provide high-resolution spatial and temporal information needed to maximize wind energy production and minimize fatigue loads in wind farms, but accuracy depends on parameterizing subgrid-scale turbulent fluxes and turbine-induced forces.

3. The use of tuning-free Lagrangian scale-dependent dynamic models for SGS fluxes and actuator-disk/line models for turbine-induced forces has shown good agreement with wind-tunnel measurements and can be applied to simulate atmospheric boundary-layer flow through operational wind farms.

# Article rating:

Appears moderately imbalanced: The article provides some useful information, but is missing several important points or pieces of evidence that would be required to present the discussed topics in a balanced and reliable way. You are encouraged to seek a more balanced perspective on the presented issues by exploring the provided research topics and looking at different information sources.

# Article analysis:

The article discusses the use of large-eddy simulation (LES) to accurately predict atmospheric boundary layer (ABL) flow and its interactions with wind turbines and wind farms. The accuracy of LESs of ABL flow with wind turbines depends on our ability to parameterize subgrid-scale (SGS) turbulent fluxes as well as turbine-induced forces. The paper focuses on recent research efforts to develop and validate an LES framework for wind energy applications.

The article provides a detailed description of the LES framework, including the parameterization of SGS fluxes using tuning-free Lagrangian scale-dependent dynamic models and turbine-induced forces using actuator-disk models and actuator-line models. Simulation results are compared to wind-tunnel measurements collected with hot-wire anemometry in the wake of a miniature three-blade wind turbine placed in a boundary layer flow.

While the article provides valuable insights into the potential benefits of using LES for optimizing wind energy production, it is important to note that there may be biases in the reporting. For example, the article does not discuss any potential risks associated with wind energy projects or address any concerns raised by local communities about their impact on wildlife or aesthetics.

Additionally, while the article presents simulation results that are in good agreement with measurements in the far-wake region, it does not provide evidence for claims made about the accuracy of LESs in simulations of ABL flow with wind turbines near the turbine, up to about five rotor diameters downwind. Furthermore, there is no discussion of any potential limitations or uncertainties associated with these simulations.

Overall, while this article provides valuable insights into recent research efforts to develop and validate an LES framework for wind energy applications, readers should be aware of potential biases and limitations in reporting.

# Topics for further research:

* Risks associated with wind energy projects
* Impact of wind turbines on wildlife
* Aesthetics concerns related to wind energy projects
* Accuracy of LESs in simulations of ABL flow with wind turbines near the turbine
* Limitations and uncertainties associated with LES simulations
* Community concerns about wind energy projects

# Report location:

<https://www.fullpicture.app/item/4e9b846e05f6d7136c26b5228fcf5ef5>