Sicheng Wu

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Career & education

Jun 2023 – Present
Postdoctoral Research Associate
Discovery Partners Institute, Chicago, IL, USA
Advisor: Prof. Ashish Sharma

Nov 2021 – Jun 2023
Postdoctoral Associate
Rutgers University, Piscataway, NJ, USA
Advisor: Prof. Ruo-Qian Wang

Jun 2016 – Jul 2021
Ph.D. in Ocean Engineering
University of Delaware, Newark, DE, USA
Thesis title: *Effects of wind turbine wakes on microclimate properties near the ground*
Advisor: Prof. Cristina Archer

Jul 2013 – May 2015
M.S.E. in Mechanical Engineering
Johns Hopkins University, Baltimore, MD, USA

Sep 2009 – Jul 2013
B.Eng. in Energy and Power Engineering
Beihang University, Beijing, China

Research Publications

Journal Articles

1. **Wu**, **S.**, Archer, C. L., & Mirocha, J. D. (2023). New insights on wind turbine wakes from large-eddy simulation: Wake contraction, dual nature, and temperature effects. *Wind Energy*. doi:10.1175/MWR-D-20-0186.1
2. **Wu**, **S.**, & Wang, R.-Q. (2023). Dynamics of real-time forecasting failure and recovery due to data gaps. *Quarterly Journal of the Royal Meteorological Society (under review)*.
3. **Wu**, **S.**, & Archer, C. L. (2021). Near-ground effects of wind turbines: Observations and physical mechanisms. *Monthly Weather Review*. doi:10.1175/MWR-D-20-0186.1
4. Archer, C. L., **Wu**, **S.**, Ma, Y., & Jiménez, P. A. (2020). Two Corrections for Turbulent Kinetic Energy Generated by Wind Farms in the WRF Model. *Monthly Weather Review*, *148*(12), 4823–4835. doi:10.1175/MWR-D-20-0097.1
5. Archer, C. L., **Wu**, **S.**, Vasel-Be-Hagh, A., Brodie, J. F. J., Delgado, R., St. Pé, A., … Semmer, S. (2019). The VERTEX field campaign: observations of near-ground effects of wind turbine wakes. *Journal of Turbulence*, *20*(1), 64–92. doi:10.1080/14685248.2019.1572161
6. Archer, C. L., Vasel-Be-Hagh, A., Yan, C., **Wu**, **S.**, Pan, Y., Brodie, J. F., & Maguire, A. E. (2018). Review and evaluation of wake loss models for wind energy applications. *Applied Energy*, *226*(May 2018), 1187–1207. doi:10.1016/j.apenergy.2018.05.085

7. Ghaisas, N. S., Archer, C. L., Xie, S., **Wu, S.**, & Maguire, E. (2017). Evaluation of layout and atmospheric stability effects in wind farms using large-eddy simulation. *Wind Energy*, *20*(7), 1227–1240. doi:10.1002/we.2091

Conferences

1. **Wu, S.**, & Archer, C. L. (2022). New insights on wind turbine wakes from large-eddy simulation: Wake contraction, dual nature, and temperature effects. *2022 nawea windtech conference*, Newark, DE, USA.
2. **Wu, S.**, & Wang, R.-Q. (2022). Impact of observational data gaps on enkf-based data assimilation. *8th international symposium on data assimilation*, Fort Collins, CO, USA.
3. **Wu, S.**, & Archer, C. L. (2020). Near-ground effects of wind turbines: Observations and physical mechanisms. *American geophysical union fall meeting*, GC125–09.
4. Archer, C. L., & **Wu, S.** (2019). Wind turbines do not enhance vertical mixing near the ground (poster). *American geophysical union fall meeting*, San Francisco, CA, USA, GC31K–1317.
5. **Wu, S.**, Archer, C. L., & Delgado, R. (2019). On the lack of enhanced vertical mixing near the ground under the wake of a wind turbine during the 2016 vertex field campaign. *99th american meteorological society annual meeting*, Phoenix, AZ, USA.

Experience

Research

2022-present

Impact of Offshore Wind Farms on Local Ocanography and Summer Flounder Distribution

Summary: To investigate how the proposed offshore wind farms in NJ offshore wind area impact the underwater structure, the ocean surface wind and fish distribution.

Key responsibility: Developing nested model coupling: 1) the atmospheric field using the WRF model; 2) ocean hydrodynamics using the Delft3D model; 3) wave field using the SWAN model and 4) the FLORIS wind turbine model.

2021-2022

Dynamics of real-time forecasting failure and recovery due to data gaps

Summary: To investigate how observational data gaps impact data assimilation in real-time forecast systems.

Key responsibilities:

- Examining the growth of prediction error inside the observational data gap and the prediction recovery after the gap during the assimilation of the Lorenz model using the ensembled Kalman filter (EnKF).
- Expanding the research to the Weather Research and Forecasting model.

Experience (continued)

2016-2021 **VERtical Enhanced miXing (VERTEX)**

Summary: To examine how wind turbine wakes interact with the lower atmospheric boundary layer and the mechanism behind such interactions.

Key responsibilities:

- Cleaning up and analyzing boundary layer measurement data to investigate how wind turbine wakes change turbulent mixing and local temperature near the ground under different atmospheric stability conditions.
- Proposing a mechanism behind the changes in near-ground temperature in the presence of turbine wakes based on the analysis of measurement data.
- Validating the proposed mechanism with the help of the Weather Research and Forecasting (WRF) model, including Planet Boundary Layer (PBL) scheme with wind farm parameterizations and large-eddy simulations (LES).
- Evaluating wind turbine wakes' behavior including wind speed deficit and added TKE within and around the wind farms under different atmospheric stability conditions using WRF-LES.
- Improving wind farm parameterization to better represent wake turbulence by intercomparison studies between parameterization in PBL schemes and high-fidelity LES studies.

2015-2016 **Geometric Wind Farm Model**

Summary: Participating in development a new wind farm model for wind farm layout optimizations.

Key responsibilities:

- Pre-processing wind resource distribution and wind farm zones using GIS software.
- Assessing model performance using actual and simulated data of wind farm power production.

Key responsibilities: Tutoring students with WindPRO, a commercial wind resource analysis and wind farm planning software, to calculate the power output and optimize layout of wind farms.

Training

2019 **Weather Research and Forecasting (WRF) model Tutorial**
National Center of Atmospheric Research, Boulder, CO, USA

Awards and Achievements

2020 **University of Delaware Dissertation Fellowship**
University of Delaware, Newark, DE, USA

Skills

Research Background Strong background in atmospheric science and meteorology, including both mesoscale and microscale meteorology.

Modeling Systems

- Profound knowledge in atmospheric modeling systems including the Weather Research and Forecasting (WRF) model, including both PBL parameterizations and WRF-LES.
- Experience in data assimilation using the Data Assimilation Research Testbed (DART).

Data

- Well versed in cleanup, analysis and physical interpretation of meteorological measurement (including sonic anemometers, lidars, radars, etc.) and numerical modeling data.
- Familiar with NetCDF data format.

Computational Skills

- Proficient with Linux and high-performance computing (HPC) environments.
- Well experienced in Python (WRF-Python, NumPy, etc.), MATLAB, Fortran and R.

Academic Strong desire and ability in academic presentation and publications, and delivery of scientific messages to diverse audiences.

References

Prof Cristina Archer
Professor
University of Delaware
ISE Lab 371,
221 Academy St., Newark, DE 19716
carcher@udel.edu

Dr Ruben Delgado
Associate Professor
Hampton University
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Prof Ruo-Qian Wang
Assistant Professor
Department of Civil and Environmental Engineering
Rutgers University, New Brunswick
328E Richard Weeks Hall,
500 Bartholomew Rd, Piscataway, NJ 08854
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