Stanford

Catherine Gorle

Associate Professor of Civil and Environmental Engineering and, by courtesy, of Mechanical Engineering

Bio

BIO

Gorlé received her BSc (2002) and MSc (2005) degrees in Aerospace Engineering from the Delft University of Technology, and her PhD (2010) from the von Karman Institute for Fluid Dynamics in cooperation with the University of Antwerp. Afterwards she was a Postdoctoral Fellow at the Center for Turbulence Research at Stanford University and a Research Professor at the von Karman Institute funded by a Pegasus Marie Curie fellowship. Before joining the Civil & Environmental Engineering Department at Stanford she was an Assistant Professor in the Department of Civil Engineering & Engineering Mechanics at Columbia University.

Gorle's research focuses on the development of predictive flow simulations to support the design of sustainable buildings and cities. Specific topics of interest are the coupling of large- and small-scale models and experiments to quantify uncertainties related to the variability of boundary conditions, the development of uncertainty quantification methods for low-fidelity models using high-fidelity data, and the use of field measurements to validate and improve computational predictions.

ACADEMIC APPOINTMENTS

- Associate Professor, Civil and Environmental Engineering
- Associate Professor (By courtesy), Mechanical Engineering
- Member, Institute for Computational and Mathematical Engineering (ICME)

PROFESSIONAL EDUCATION

- BSc, Delft University of Technology , Aerospace Engineering (2002)
- MSc, Delft University of Technology , Aerospace Engineering (2005)
- PhD, Von Karman Institute for Fluid Dynamics , Environmental and Applied Fluid Dynamics (2010)

LINKS

- Wind Engineering Lab website: https://we.stanford.edu

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Gorle's research focuses on the development of predictive flow simulations to support the design of sustainable buildings and cities. Specific topics of interest are the coupling of large- and small-scale models and experiments to quantify uncertainties related to the variability of boundary conditions, the

development of uncertainty quantification methods for low-fidelity models using high-fidelity data, and the use of field measurements to validate and improve computational predictions.

Teaching

COURSES

2025-26

- Seminar in Fluid Mechanics: ENGR 298 (Win)
- Studio 4: Integrated Architecture and Engineering: CEE 133D, CEE 233D (Aut)
- WindWise: CFD for civil engineers and architects: CEE 261C (Aut)

2024-25

- Studio 4: Integrated Architecture and Engineering: CEE 133D, CEE 233D (Win)
- Uncertainty Quantification: CEE 362A (Spr)
- WindWise: CFD for civil engineers and architects: CEE 161C, CEE 261C (Win)

2023-24

- Physics of Wind: CEE 261A (Spr)
- Uncertainty Quantification: CEE 362A, ME 470 (Win)

2022-23

- Environmental Engineering Seminar: CEE 269C (Spr)
- Physics of Wind: CEE 261A (Win)
- Uncertainty Quantification: CEE 362A, ME 470 (Aut)
- Wind Engineering for Sustainable Cities: CEE 261C (Spr)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Theodore MacMillan, Juliet Nwagwu Ume-Ezeoke, Akiri Seki

Postdoctoral Faculty Sponsor

Kopal Nihar

Doctoral Dissertation Advisor (AC)

Nicholas Bachand, Max Beeman

Master's Program Advisor

Anas Alharbi, Josie Amoo, Pierre Boca, Ariana Carmody, Ryan Davies, Xingyi Du, Ziyi Gao, Harry Li, Vivian Liang, Lujia Xue, Liwei Yang, Julie Zhu

Doctoral (Program)

Nicholas Bachand, Jacob Goell, Linqian Zheng

Postdoctoral Research Mentor

Jianyu Wang

Publications

PUBLICATIONS

- **Urban Fluid Mechanics, Resilience, and Sustainability** *ANNUAL REVIEW OF FLUID MECHANICS*
  Gorle, C.
  2026; 58 (1): 193-219

- **Simulating the urban canopy's impact on wind-driven natural ventilation** *FLOW*
  Bachand, N., Salehipour, H., Gorle, C.
  2026; 6

- **Predicting wind-induced interference effects on a low-rise building in a realistic urban area using large-eddy simulations** *JOURNAL OF WIND ENGINEERING AND INDUSTRIAL AERODYNAMICS*
  Vargiemezis, T., Gorle, C.
  2026; 268

- **From large-eddy simulations to deep learning: A U-net model for fast urban canopy flow predictions** *SUSTAINABLE CITIES AND SOCIETY*
  Vargiemezis, T., Gorle, C.
  2025; 135

- **A neural network-based multi-fidelity modeling approach for large-eddy simulations with application to wind loading predictions** *ENGINEERING STRUCTURES*
  Ciarlatani, M., Gorle, C.
  2025; 343

- **A (co-)kriging multi-fidelity framework for wind loading predictions** *JOURNAL OF BUILDING ENGINEERING*
  Ciarlatani, M., Gorle, C.
  2025; 110

- **An open-source simulation platform to support and foster research collaboration in natural hazards engineering** *FRONTIERS IN BUILT ENVIRONMENT*
  Zsarnoczay, A., Deierlein, G. G., McKenna, F., Schoettler, M., Yi, S., Cetiner, B., Satish, A., Zhao, J., Bonus, J., Melaku, A. F., Naeimi, S., Arduino, P., Davidson, et al
  2025; 11

- **Efficient wind farm layout optimization with the FLOWERS AEP model and analytic gradients** *JOURNAL OF RENEWABLE AND SUSTAINABLE ENERGY*
  Locascio, M. J., Bay, C. J., Martinez-Tossas, L. A., Thomas, J. J., Gorle, C.
  2025; 17 (1)

- **Towards Semi-Automated Replication of Floor Plan Layouts for Applications in Building Thermal Performance Evaluation**
  Ume-Ezeoke, J., Gorle, C., Jain, R.
  edited by Jafari, A., Zhu, Y.
  AMER SOC CIVIL ENGINEERS.2025: 904-913

- **Large-eddy simulation of the early jet-vortex interaction phase of contrails from hydrogen aircraft**
  Ferreira, T. S. C., Alonso, J. J., Gorle, C., AIAA
  AMER INST AERONAUTICS & ASTRONAUTICS.2025

- **A predictive large-eddy simulation framework for the analysis of wind loads on a realistic low-rise building geometry** *JOURNAL OF WIND ENGINEERING AND INDUSTRIAL AERODYNAMICS*
  Vargiemezis, T., Gorle, C.
  2025; 256

- **FLOWERS AEP: An Analytical Model for Wind Farm Layout Optimization** *WIND ENERGY*
  Locascio, M. J., Bay, C. J., Martinez-Tossas, L. A., Bastankhah, M., Gorle, C.
  2024

- **Design and demonstration of a sensing network for full-scale wind pressure measurements on buildings** *JOURNAL OF WIND ENGINEERING AND INDUSTRIAL AERODYNAMICS*
  Hochschild, J., Gorle, C.
  2024; 250
- **Comparison of measured and LES-predicted wind pressures on the Space Needle** *JOURNAL OF WIND ENGINEERING AND INDUSTRIAL AERODYNAMICS*
  Hochschild, J., Gorle, C.
  2024; 249
- **Data-driven wake model parameter estimation to analyze effects of wake superposition** *JOURNAL OF RENEWABLE AND SUSTAINABLE ENERGY*
  Locascio, M. J., Gorle, C., Howland, M. F.
  2023; 15 (6)
- **Large-eddy simulations to define building-specific similarity relationships for natural ventilation flow rates** *FLOW*
  Hwang, Y., Gorle, C.
  2023; 3
- **Investigation of peak wind loading on a high-rise building in the atmospheric boundary layer using large-eddy simulations** *JOURNAL OF WIND ENGINEERING AND INDUSTRIAL AERODYNAMICS*
  Ciarlatani, M., Huang, Z., Philips, D., Gorle, C.
  2023; 236
- **Characterizing spatial variability in the temperature field to support thermal model validation in a naturally ventilated building** *JOURNAL OF BUILDING PERFORMANCE SIMULATION*
  Chen, C., Wai Chew, L., Gorle, C.
  2023
- **Full-scale validation of CFD simulations of buoyancy-driven ventilation in a three-story office building** *BUILDING AND ENVIRONMENT*
  Chen, C., Gorle, C.
  2022; 221
- **Improving thermal model predictions for naturally ventilated buildings using large eddy simulations** *BUILDING AND ENVIRONMENT*
  Chew, L., Chen, C., Gorle, C.
  2022; 220
- **Large-Eddy Simulations of Wind-Driven Cross Ventilation, Part 2: Comparison of Ventilation Performance Under Different Ventilation Configurations** *FRONTIERS IN BUILT ENVIRONMENT*
  Hwang, Y., Gorle, C.
  2022; 8
- **Large-Eddy Simulations of Wind-Driven Cross Ventilation, Part1: Validation and Sensitivity Study** *FRONTIERS IN BUILT ENVIRONMENT*
  Hwang, Y., Gorle, C.
  2022; 8
- **Improving the predictive capability of building simulations using uncertainty quantification** *SCIENCE AND TECHNOLOGY FOR THE BUILT ENVIRONMENT*
  Gorle, C.
  2022; 28 (5): 575-576
- **Conceptual model to quantify uncertainty in steady-RANS dissipation closure for turbulence behind bluff bodies** *PHYSICAL REVIEW FLUIDS*
  Hao, Z., Gorle, C.
  2022; 7 (1)
- **Optimal temperature sensor placement in buildings with buoyancy-driven natural ventilation using computational fluid dynamics and uncertainty quantification** *BUILDING AND ENVIRONMENT*
  Chen, C., Gorle, C.
  2022; 207

- **Wind tunnel pressure data analysis for peak cladding load estimation on a high-rise building** *JOURNAL OF WIND ENGINEERING AND INDUSTRIAL AERODYNAMICS*
  Pomaranzi, G., Amerio, L., Schito, P., Lamberti, G., Gorle, C., Zasso, A.
  2022; 220

- **The ICECool Fundamentals Effort on Evaporative Cooling of Microelectronics** *IEEE TRANSACTIONS ON COMPONENTS PACKAGING AND MANUFACTURING TECHNOLOGY*
  Bar-Cohen, A., Asheghi, M., Chainer, T. J., Garimella, S., Goodson, K., Gorle, C., Mandel, R., Maurer, J. J., Ohadi, M., Palko, J. W., Parida, P. R., Peles, Y., Plawsky, et al
  2021; 11 (10): 1546-1564

- **A multi-fidelity machine learning framework to predict wind loads on buildings** *JOURNAL OF WIND ENGINEERING AND INDUSTRIAL AERODYNAMICS*
  Lamberti, G., Gorle, C.
  2021; 214

- **Confronting Grand Challenges in environmental fluid mechanics** *PHYSICAL REVIEW FLUIDS*
  Dauxois, T., Peacock, T., Bauer, P., Caulfield, C. P., Cenedese, C., Gorle, C., Haller, G., Ivey, G. N., Linden, P. F., Meiburg, E., Pinardi, N., Vriend, N. M., Woods, et al
  2021; 6 (2)

- **Sensitivity of LES predictions of wind loading on a high-rise building to the inflow boundary condition** *JOURNAL OF WIND ENGINEERING AND INDUSTRIAL AERODYNAMICS*
  Lamberti, G., Gorle, C.
  2020; 206

- **Quantifying turbulence model uncertainty in Reynolds-averaged Navier-Stokes simulations of a pin-fin array. Part 1: Flow field** *COMPUTERS & FLUIDS*
  Hao, Z., Gorle, C.
  2020; 209

- **Quantifying turbulence model uncertainty in Reynolds-averaged Navier-Stokes simulations of a pin-fin array. Part 2: Scalar transport** *COMPUTERS & FLUIDS*
  Hao, Z., Gorle, C.
  2020; 209

- **Comparison of high resolution pressure measurements on a high-rise building in a closed and open-section wind tunnel** *JOURNAL OF WIND ENGINEERING AND INDUSTRIAL AERODYNAMICS*
  Lamberti, G., Amerio, L., Pomaranzi, G., Zasso, A., Gorle, C.
  2020; 204

- **Pressure scrambling effects and the quantification of turbulent scalar flux model uncertainties** *PHYSICAL REVIEW FLUIDS*
  Hao, Z., Gorle, C.
  2020; 5 (8)

- **Large eddy simulations of forced heat convection in a pin-fin array with a priori examination of an eddy-viscosity turbulence model** *INTERNATIONAL JOURNAL OF HEAT AND FLUID FLOW*
  Hao, Z., Gorle, C.
  2019; 77: 73–83

- **Computational urban flow predictions with Bayesian inference: Validation with field data** *BUILDING AND ENVIRONMENT*
  Sousa, J., Gorle, C.
  2019; 154: 13–22

- **Epistemic uncertainty quantification for Reynolds-averaged Navier-Stokes modeling of separated flows over streamlined surfaces** *PHYSICS OF FLUIDS*
  Gorle, C., Zeoli, S., Emory, M., Larsson, J., Iaccarino, G.
  2019; 31 (3)

- **Improving Predictions of the Urban Wind Environment Using Data** *Technology Architecture and Design*
  Gorlé, C.

2019; 3 (2): 137-141

- **Predictive large eddy simulations for urban flows: Challenges and opportunities** *BUILDING AND ENVIRONMENT*
  Garcia-Sanchez, C., van Beeck, J., Gorle, C.
  2018; 139: 146–56
- **Improving urban flow predictions through data assimilation** *BUILDING AND ENVIRONMENT*
  Sousa, J., Garcia-Sanchez, C., Gorle, C.
  2018; 132: 282–90
- **Uncertainty Quantification for modeling night-time ventilation in Stanford's Y2E2 building.** *Energy and Buildings*
  Lamberti, G., Gorlé, C.
  2018; 168: 319-330
- **Optimizing turbulent inflow conditions for large-eddy simulations of the atmospheric boundary layer.** *Journal of Wind Engineering and Industrial Aerodynamics*
  Lamberti, G., Garcia-Sanchez, C., Sousa, J., Gorle, C.
  2018; 177: 32-44
- **Uncertainty quantification for microscale CFD simulations based on input from mesoscale codes.** *Journal of Wind Engineering and Industrial Aerodynamics*
  Garcia-Sanchez, C., Gorlé, C.
  2018; 176: 87-97
- **RAMS sensitivity to grid spacing and grid aspect ratio in Large-Eddy Simulations of the dry neutral Atmospheric Boundary Layer** *COMPUTERS & FLUIDS*
  Ercolani, G., Gorle, C., Corbari, C., Mancini, M.
  2017; 146: 59-73
- **Quantifying inflow uncertainties in RANS simulations of urban pollutant dispersion** *Atmospheric Environment*
  Garcia-Sanchez, C., Van Tendeloo, G., Gorle, C.
  2017; 161: 263-273
- **Thermal Modeling of Extreme Heat Flux Microchannel Coolers for GaN-on-SiC Semiconductor Devices** *JOURNAL OF ELECTRONIC PACKAGING*
  Lee, H., Agonafer, D. D., Won, Y., Houshmand, F., Gorle, C., Asheghi, M., Goodson, K. E.
  2016; 138 (1)
- **RAMS and WRF sensitivity to grid spacing in large-eddy simulations of the dry convective boundary layer** *COMPUTERS & FLUIDS*
  Ercolani, G., Gorle, C., Garcia-Sanchez, C., Corbari, C., Mancini, M.
  2015; 123: 54-71
- **Quantifying inflow and RANS turbulence model form uncertainties for wind engineering flows** *JOURNAL OF WIND ENGINEERING AND INDUSTRIAL AERODYNAMICS*
  Gorle, C., Garcia-Sanchez, C., Iaccarino, G.
  2015; 144: 202-212
- **Quantifying inflow uncertainties for CFD simulations of the flow in downtown Oklahoma City** *BUILDING AND ENVIRONMENT*
  Garcia-Sanchez, C., Philips, D. A., Gorle, C.
  2014; 78: 118-129
- **The deviation from parallel shear flow as an indicator of linear eddy-viscosity model inaccuracy** *PHYSICS OF FLUIDS*
  Gorle, C., Larsson, J., EMORY, M., Iaccarino, G.
  2014; 26 (5)
- **A framework for epistemic uncertainty quantification of turbulent scalar flux models for Reynolds-averaged Navier-Stokes simulations** *PHYSICS OF FLUIDS*
  Gorle, C., Iaccarino, G.
  2013; 25 (5)
- **A Comprehensive Modelling Approach for the Neutral Atmospheric Boundary Layer: Consistent Inflow Conditions, Wall Function and Turbulence Model** *BOUNDARY-LAYER METEOROLOGY*

Parente, A., Gorle, C., van Beeck, J., Benocci, C.
2011; 140 (3): 411-428

- **Improved kappa-epsilon model and wall function formulation for the RANS simulation of ABL flows** *5th International Symposium on Computational Wind Engineering (CWE2010)*
  Parente, A., Gorle, C., van Beeck, J., Benocci, C.
  ELSEVIER SCIENCE BV.2011: 267–78
- **Dispersion in the Wake of a Rectangular Building: Validation of Two Reynolds-Averaged Navier-Stokes Modelling Approaches** *BOUNDARY-LAYER METEOROLOGY*
  Gorle, C., van Beeck, J., Rambaud, P.
  2010; 137 (1): 115-133
- **Stack gas dispersion measurements with Large Scale-PIV, Aspiration Probes and Light Scattering Techniques and comparison with CFD** *ATMOSPHERIC ENVIRONMENT*
  Nakiboglu, G., Gorle, C., Horvath, I., van Beeck, J., Blocken, B.
  2009; 43 (21): 3396-3406
- **CFD modelling of small particle dispersion: The influence of the turbulence kinetic energy in the atmospheric boundary layer** *ATMOSPHERIC ENVIRONMENT*
  Gorle, C., van Beeck, J., Rarnbaud, P., Van Tendeloo, G.
  2009; 43 (3): 673-681
- **Flow analyses in the lower airways: Patient-specific model and boundary conditions** *MEDICAL ENGINEERING & PHYSICS*
  De Backer, J. W., Vos, W. G., Gorle, C. D., Germonpre, P., Partoens, B., Wuyts, F. L., Parizel, P. M., De Backer, W.
  2008; 30 (7): 872-879