

PhD course offered for the PhD Program in Security, Risk and Vulnerability

The Role of Thunderstorms and Tornadoes in Wind Engineering

Syllabus

Title:

The Role of Thunderstorms and Tornadoes in Wind Engineering

Teacher:

Prof. Franklin Lombardo

Email:

lombaf@illinois.edu

Abstract:

This course will provide a detailed overview on the role of thunderstorms and tornadoes in wind engineering and provide context on why it is important to consider these events in wind engineering and civil engineering more broadly.

PhD Program:

Security, Risk and Vulnerability (<https://sicurezza.unige.net/home>)

Curricula:

RRENIB (<https://sicurezza.unige.net/curricula/rrenib>)

Duration:

12 hours

Credits:

3 credits

**When:**

Feb. 16-20, 2026

- Lecture 1: Mon 16 Feb, 3-6 p.m. CET, Room A13
- Lecture 2: Tue 17 Feb, 3-6 p.m. CET, Room A13
- Lecture 3: Wed 18 Feb, 3-6 p.m. CET, Room A12
- Lecture 4: Thu 19 Feb, 3-6 p.m. CET, Room A13
- Lecture 5: Fri 20 Feb, 3-6 p.m. CET, Room A13

Where:

University of Genoa

All classes will be at the Department of Civil, Chemical, and Environmental Engineering (DICCA), via Montallegro 1, 16145 Genoa (IT).

The course can be attended **online!**

Program:

The program will cover six major topics:

- 1) Storm Basics and History in Wind Engineering
 - a. Historical philosophy
 - b. Physical description of storms (e.g., formation, space and time scales)
- 2) Extreme Wind Prediction and Analytical Models
 - a. Design wind prediction
 - b. Windstorm models and characteristics
 - c. Practical examples (e.g., standardization, time history analysis)
- 3) Wind-Induced Loading
 - a. Loading framework
 - b. Loading differences
- 4) Risk Assessment
 - a. Common damages
 - b. Wind speed estimation techniques
 - c. Damage simulation and practical examples (e.g., fragility curves)
- 5) Codification
 - a. Prescriptions of thunderstorm and tornado loading (e.g., ASCE 7)
 - b. Simulation techniques (e.g., ASCE 49)
- 6) State-of-the Art
 - a. Latest thoughts on thunderstorms and tornadoes
 - b. Experimental facilities

Exam:

Several take-home assignments to test and accumulate knowledge on all topics listed above with actual data and examples



Registration:

Please email to Dr. Massimiliano Burlando massimiliano.burlando@unige.it

References:

- Course notes – references will be provided as topics are discussed in class
- Holmes, J. D., and Oliver, S. E. (2000). An empirical model of a downburst. *Engineering structures*, 22(9), 1167-1172.
- Rhee, D. M., and Lombardo, F. T. (2018). Improved near-surface wind speed characterization using damage patterns. *Journal of Wind Engineering and Industrial Aerodynamics*, 180, 288-297.
- Twisdale, L. A., and Dunn, W. L. (1983). Probabilistic analysis of tornado wind risks. *Journal of Structural Engineering*, 109(2), 468-488.
- Kopp, G. A., and Wu, C. H. (2020). A framework to compare wind loads on low-rise buildings in tornadoes and atmospheric boundary layers. *Journal of Wind Engineering and Industrial Aerodynamics*, 204, 104269.



Bio:

Prof. Frank Lombardo is an Associate Professor in the Department of Civil and Environmental Engineering at the University of Illinois Urbana-Champaign, where he also serves as Co-Director of the Extreme Wind Resilience Center. Prof. Lombardo specializes in wind engineering, where he focuses on characterization of extreme winds such as tornadoes and thunderstorms and the associated loading and damage they cause to the built and natural environment. He also serves on professional committees related to windstorms including the ASCE Wind Load Subcommittee (WLSC). He serves as vice-chair of the tornado task committee of the WLSC, which has developed tornado loading provisions for inclusion in ASCE 7-22.

