

# **International Advanced School on THUNDERSTORM OUTFLOWS AND THEIR IMPACT ON STRUCTURES**

**October 4-8, 2021, Genova, Italy**

## **Organized by:**

Department of Civil, Chemical and Environmental Engineering, University of Genova, Italy

## **Supported by:**

The International Advances School (IAS) is part of the project THUNDERR - Detection, simulation, modelling and loading of thunderstorm outflows to design wind-safer and cost-efficient structures - that has received funding from the European Research Council under the European Union's Horizon 2020 research and innovation program, grant agreement No. 741273.

## **Key Dates**

Early registration (to attend in-person): by August 15, 2021

Late registration (to attend in person): by October 3, 2021

Online registration (to attend remotely only): until the end of the school

## **Venue:**

The IAS will be held in person at the Department of Architecture and Design of the University of Genova  
Aula Benvenuto, Stradone S. Agostino 37, 16123 Genoa

In case the health conditions due to the Covid-19 pandemic situation do not permit to meet in person, the IAS will be held remotely

## **1. The Thunderr project**

The safety and sustainability of built environment with regard to natural actions are primary goals of engineering. Wind is the most destructive natural phenomenon. Evaluating its actions is crucial for society and its economy. Wind climatology is often dominated by cyclones and thunderstorms. The properties of cyclones are known since the 1920s. Their actions on construction are well established since the 1960s and engineering still uses these models. Thunderstorms are complex and devastating phenomena that result in actions often more intense than cyclonic ones. Despite this awareness, there is not yet a model of thunderstorm winds and their actions on structures as that established over half century ago for cyclones. This is a major shortcoming that gives rise to unsafe and/or overly expensive works.

THUNDERR is an acronym of THUNDERstorm that expresses the Roar of the ERC project carried out at the University of Genova. It aims to detect thunderstorms, to create a database of wind records and weather scenarios, to conduct laboratory tests and CFD simulations, to formulate thunderstorm models suitable for atmospheric sciences and structural design, to improve the format of wind actions, engineering practice and codification, to make building safer and more sustainable, to bring about a profound impact on society and its economy.

On November 19, 2020, the PI of THUNDERR Prof. Giovanni Solari passed away. Prof. Maria Pia Repetto took over as scientific responsible of the project.

## **2. Aims and Topics**

The International Advanced School will cover synoptic, mesoscale and thunderstorm meteorology, wind storms and climate changes, wind monitoring and thunderstorm detection, downburst modelling and signal analysis, laboratory and CFD simulation of downbursts, Monte Carlo simulation of wind velocity fields, fundamentals of bluff-body aerodynamics, wind loading and response of structures to thunderstorm outflows, full-scale monitoring of structures, damage induced by local storms, research and codification perspectives.

## 2. Lecturers (in alphabetical order)



**Bert Blocken**  
TU/e Eindhoven, The Netherlands and KU Leuven, Belgium



**Guido Buresti**  
Università di Pisa, Italy



**Massimiliano Burlando**  
Università di Genova, Italy



**Ashraf El Damatty**  
University of Western Ontario, Canada



**Horia Hangan**  
University of Western Ontario, Canada <sup>(1)</sup>



**Ahsan Kareem**  
University of Notre Dame, Indiana, USA



**Frank Lombardo**  
University of Illinois at Urbana-Champaign, USA



**Leigh Orf**  
University of Wisconsin-Madison, USA



**Maria Pia Repetto**  
Università di Genova, Italy



**Ted Stathopoulos**  
Concordia University, Montreal, Canada



**Yukio Tamura**  
Chongqing University, Chongqing, China



**Uwe Ulbrich**  
Freie Universität, Berlin, Germany

<sup>(1)</sup> presently Canada Research Chair Tier 1 with Ontario Tech University

### 3. Schedule\* – “IAS on thunderstorm outflows and their impact on structures”

<b>MONDAY 04/10/2021 – Chair Maria Pia Repetto</b>		
<b>Timetable</b>	<b>Lecturer</b>	<b>Thunderstorm outflows measurement and modelling</b>
9:00-9:50	Maria Pia Repetto	Course Introduction and THUNDERR Project
10:00-10:45	Massimiliano Burlando	Wind monitoring and thunderstorm detection
10:45-11:05	<i>Coffee Break</i>	
11:05-11:50	Massimiliano Burlando	Downburst modelling and signal analysis
12:00-13:00	<i>Lunch</i>	
	<b>Lecturer</b>	<b>Thunderstorm outflows numerical simulation</b>
13:00-13:50	Bert Blocken	Fundamentals of CFD simulations
14:00-14:50		
15:00-15:45	Ahsan Kareem	Monte Carlo simulation of wind velocity fields
15:45-16:05	<i>Coffee Break</i>	
16:05-16:50	Leigh Orf	CFD simulation of downbursts
17:00-17:50		
<b>TUESDAY 05/10/2021 – Chair Giuseppe Piccardo, Luisa Pagnini</b>		
<b>Timetable</b>	<b>Lecturer</b>	<b>Thunderstorm climatology and wind tunnel simulation</b>
9:00-9:50	Uwe Ulbrich	Synoptic and mesoscale meteorology
10:00-10:45		Windstorms and climate changes
10:45-11:00	<i>Coffee Break</i>	
11:00-11:50	Guido Buresti	Fundamentals of bluff-body aerodynamics
12:00-12:50		
13:00-14:00	<i>Lunch</i>	
	<b>Lecturer</b>	<b>Thunderstorm outflow wind loading</b>
14:00-14:50	Horia Hangan	Laboratory simulation of downbursts
15:00-15:45		
15:45-16:05	<i>Coffee Break</i>	
16:05-16:50	Frank Lombardo	Downburst wind loading of structures
17:00-17:50		
<b>WEDNESDAY 06/10/2021 – Chair Federica Tubino, Massimiliano Burlando</b>		
<b>Timetable</b>	<b>Lecturer</b>	<b>Response of structures</b>
9:00-9:50	Yukio Tamura	Damage to buildings and structures by severe local storms and wind speed estimations
10:00-10:45		
10:45-11:05	<i>Coffee Break</i>	
11:05-11:50	Maria Pia Repetto	Thunderstorm response spectrum technique
12:00-13:00	<i>Lunch</i>	
	<b>Lecturer</b>	<b>Future perspectives and new results codification</b>
13:00-13:50	Ahsan Kareem	Gust front factor technique
14:00-14:50	Ashraf El Damatty	Thunderstorms and transmission lines
15:00-15:45		
15:45-16:05	<i>Coffee Break</i>	
16:05-16:50	Ted Stathopoulos	Non-synoptic winds on buildings: wind standards and codes of practice perspectives
17:00-17:50		Perspectives of research on the effects of non-synoptic winds on buildings
20:00	<i>Dinner</i>	

\*Local Italian time (GMT+2)

#### 4. Schedule\*\* – “New frontiers in research of thunderstorm outflows and their impact on structures”

<b>THURSDAY 07/10/2021 (morning)</b>	
<b>Timetable</b>	
9:00-9:10	Opening
Session <b>Modelling of surface winds in severe convective storms</b> <b>Chair Massimiliano Burlando</b>	
9:10-9:30	Classification, generation and synthesis of thunderstorm outflows <i>Teng Wu</i> – University at Buffalo, USA
9:30-9:50	Nonstationary typhoon winds and their impact on long-span bridges <i>You-Lin Xu</i> – The Hong Kong Polytechnic University, Hong Kong
9:50-10:10	Investigations into the role of outflow transience and boundary layer structure on the wind loading of buildings <i>Matthew Mason</i> – The University of Queensland, Australia
10:10-10:30	A complete physical characterization of impinging-jet downburst-like winds at large scale and applicability to full scale <i>Federico Canepa</i> – University of Genoa, Italy
10:30-11:00	Coffee break
<b>Chair Luisa Pagnini</b>	
11:00-11:20	Large eddy simulations of experimentally-produced downburst wind <i>Josip Zuzul</i> – University of Genoa, Italy
11:20-11:40	Downburst wind field analytical modelling through global optimisation techniques <i>Andi Xhelaj</i> – University of Genoa, Italy
11:40-12:00	The physical simulation of non-synoptic wind loading - state of the art and future pathways <i>Mike Jesson</i> – University of Birmingham, UK
12:00-12:20	Modeling and simulation of thunderstorm outflows <i>Massimiliano Gioffrè</i> – University of Perugia, Italy
12:20-12:30	Closing
12:30-14:00	Lunch
<b>THURSDAY 07/10/2021 (afternoon)</b>	
<b>Timetable</b>	
14:00-14:10	Opening
Session <b>Full-scale measurement and damage assessment of severe convective storms</b> <b>Chair Maria Pia Repetto</b>	
14:10-14:30	A study of nocturnal thunderstorm outflow <i>Djordje Romanic</i> – McGill University, Canada
14:30-14:50	Tornadoes in Italy: climatology and numerical simulations <i>Mario Marcello Miglietta</i> – National Research Council, Italy
14:50-15:10	Damage assessments of tornadic winds in Europe: the International Fujita scale <i>Peter Groenemeijer</i> – European Severe Storms Laboratory, Germany
15:10-15:30	Resilience of structural systems damaged by thunderstorm wind hazards <i>Luca Caracoglia</i> – Northeastern University, USA
15:30-16:00	Coffee break
Session <b>Aerodynamics &amp; response of structures to nonstationary winds</b> <b>Chair Federica Tubino</b>	
16:00-16:20	Large-Scale Experimental Simulation of Downburst Flow and Wind Loading on Structures <i>Amal Elawady</i> – Florida International University, USA
16:20-16:40	Nonstationary wind load effects of tall buildings: aeroelastic effect and base isolation <i>Xinzhong Chen</i> – Texas Tech University, USA
16:40-17:00	A simplified impulse load model for assessing structural response from thunderstorm outflows <i>Chris Letchford</i> – Rensselaer Polytechnic Institute, USA
17:00-17:20	Developing Thunderstorm Design Wind Speed Map for Ontario and Applications for Low-Cost Storm Shelters <i>Haitham Aboshosha</i> – Ryerson University, Canada
17:20-17:30	Closing

<b>FRIDAY 08/10/2021 (morning)</b>	
<b>Timetable</b>	
9:00-9:10	Opening
<b>Session Aerodynamics &amp; response of structures to nonstationary winds</b> <b>Chair Giuseppe Piccardo</b>	
9:10-9:30	The introduction of the multiple-fan wind tunnel (at Tamkang University) and its application examples <i>Yuan-Lung Lo</i> – National Taipei University of Technology, Taiwan
9:30-9:50	Wind and Structural Monitoring System for a Telecommunication Lattice Tower - From Setup to Data Analysis <i>Ileana Calotescu</i> – Technical University of Civil Engineering Bucharest, Romania
9:50-10:10	Evolutionary spectral model for thunderstorm outflows and application to the alongwind dynamic response of SDOF systems <i>Luca Roncallo</i> – University of Genoa, Italy
10:10-10:30	On the dynamic response of slender structures subjected to thunderstorm outflows through the strip and quasi-steady theory <i>Stefano Brusco</i> – University of Genoa, Italy
10:30-11:00	<i>Coffee break</i>
<b>Session Wind hazard and codification</b> <b>Chair Luisa Pagnini</b>	
11:00-11:20	Toward the codification of thunderstorm/downburst winds <i>Dae Kun Kwon</i> – University of Notre Dame, USA
11:20-11:40	Nonstationary winds: characterization, simulation and response analysis <i>Guoqing Huang</i> – Chongqing University, China
11:40-12:00	Post-event survey and damage analysis of an intense thunderstorm in Sannicolau Mare, Romania <i>Li Xiao</i> – University of Genoa, Italy
12:20-12:30	Closing
12:30-14:00	<i>Lunch break</i>

**\*\*Local Italian time (GMT+2)**

## 5. Tuition Fees

The tuition fee to attend in person covers the registration to the school, teaching material and lunches on October 4-8, 2021. Please register here <http://www.ias2021.promoest.com/>

Early registration Fee (to attend in person):	€ 175 (by August 15, 2021)
Late registration Fee (to attend in person):	€ 225 (from August 16, 2021)
On-line registration Fee (to attend remotely only):	€ 50 (by October 8, 2021)

## 6. Accommodation

The IAS Secretariat is not responsible for hotel reservations. Please make your own hotel reservation in advance. If you need assistance for hotel choice, please contact the IAS Secretary.

### International advisory board

Prof. Bert Blocken  
Prof. Horia Hangan  
Prof. Ahsan Kareem  
Prof. Ted Stathopoulos  
Prof. Yukio Tamura  
Prof. Uwe Ulbrich

### Local organizing committee

Prof. Massimiliano Burlando (Coordinator)  
Prof. Luisa Carlotta Pagnini  
Prof. Giuseppe Piccardo  
Prof. Maria Pia Repetto (Coordinator)  
Prof. Federica Tubino  
Dr. Xiao Li  
Dr. Josè Benavent  
Dr. Stefano Brusco  
Dr. Federico Canepa  
Dr. Luca Roncallo  
Dr. Andi Xhelaj  
Dr. Josip Zuzul

### Secretary

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