

# Massimiliano Burlando

Associate professor

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## *Education and training*

2004

### **PhD in Geophysics**

Numerical modelling of atmospheric boundary-layer flows over complex terrain

University of Genoa - Genoa - IT

2000

### **M.Sc. in Environmental Sciences**

Wind fields produced by the limited area model LILAM the wind meteorology and climatology of the Liguria Region

University of Genoa - Genoa - IT

## *Academic experience*

2010 - 2018

### **Assistant Professor of Atmospheric Physics**

University of Genoa - Genoa - IT

2018 - ONGOING

### **Associate Professor of Atmospheric Physics**

University of Genoa - Genoa - IT

## *Work experience*

2009 - 2010

### **Wind energy analysis and CFD developer**

German Wind Energy Institute (DEWI) - Wilhelmshaven - DE

## *Language skills*

### **English**

Independent

## *Teaching activity*

Since academic year 2010-2011, I am lecturer of the course in "Atmospheric Physics" (5 credits) of the degree in Civil, Chemical and Environmental

Engineering at the Polytechnic School of the University of Genoa  
Since academic year 2012-2013, I am co-lecturer of the course in  
“Meteorology and Climatology” (6 credits) of the degree in Environmental  
Sciences at the School of Sciences of the University of Genoa

## ***Postgraduate research and teaching activity***

### **Supervision of PhD students, residents and post-doctoral fellows**

I was supervisor of the Ph.D. in Structural and Geotechnical Engineering  
“Wind flow modelling in urban area through experimental and numerical  
techniques” (in English), double doctoral degree of the University of Genoa  
and the University of Technology of Eindhoven (The Netherlands),  
(2012-2017)

Currently, I am host professor supervisor of a Ph.D. student in Mechanical  
Engineering of the Benha University (Egypt) under the research proposal  
“Performance optimization of small scale wind turbines”

Currently, I am supervisor of a Ph.D. student in Civil, Chemical and  
Environmental Engineering (curriculum Wind Sciences and Engineering) of  
the University of Genoa, under the research proposal “Task D of Project  
THUNDERR: Wind tunnel tests”

In 2016, I was supervisor of a postdoc researcher in the Scientific  
Disciplinary Sector GEO/12 "Oceanography and Atmospheric Physics",  
working on "Numerical simulation of strong winds in coastal areas"

In 2017, I was supervisor of a postdoc researcher in the Scientific  
Disciplinary Sector GEO/12 "Oceanography and Atmospheric Physics",  
working on "The wind forecast in port and urban areas"

Currently, I am supervisor of a postdoc researcher in the Scientific  
Disciplinary Sector GEO/12 "Oceanography and Atmospheric Physics",  
working on "Study of thundersotm-induced wind fields"

### **PhD committees membership**

Since 2017, I am member of the Committee of the Ph.D. Program in Civil,  
Chemical and Environmental Engineering

## ***Research interests***

The main research field that I have been working on since my graduation,  
concerns the study of wind flows in the atmospheric boundary layer over  
complex terrain and, more recently, in urban areas through  
experimentation (full-scale anemometric campaigns and wind tunnel tests)  
as well as numerical modelling (by means of mesoscale numerical weather  
prediction NWP models, diagnostic mass-consistent MC models, and  
computational fluid dynamics CFD) for applications concerning meteorology  
and climatology, wind energy, and wind engineering.

In particular, I have been working since then on the subject of numerical-  
statistical downscaling and forecast of wind fields from meso- to micro-  
scale, through the coupling of numerical models or numerical/statistical

models. This mixed approach has been applied to the wind energy sector to downscale numerically the large-scale wind aloft in order to evaluate the high-resolution wind potential at the surface level (Burlando et al. 2009) and to forecast the wind energy production in complex terrain through the downscaling and correction of a NWP model output by means of a Kalman filtering technique (Cassola and Burlando 2012). Besides, in 2007–2009 I developed a methodology based on cluster analysis for automated wind patterns recognition and wind regions identification (Burlando et al. 2008, Burlando 2009), which has been applied for optimisation in the field of wind energy resource assessment (Cassola et al. 2008). Finally, during my participation in 2011–2014 to IEA project “Task 31 WAKEBENCH”, I started collaborating with the University of Perugia and WindSim AS (<https://windsim.com/>) in the field of wind energy resource assessment in complex terrains to test a mixed approach to downscale NWP model outputs by means of a CFD model and neural networks (Castellani et al. 2014, Castellani et al. 2015, Castellani et al. 2016, Mana et al. 2017).

In the field of wind engineering, mixed approaches based on NWP and MC models and statistical models have been applied, for instance, to estimate the design wind speed of the Messina bridge (Burlando et al. 2007a,b), to evaluate the most dangerous wind conditions for railway operations along the Italian high-speed/high-capacity (HS/HC) lines (Burlando et al. 2010), and to forecast the wind fields in port areas for the safety management of operational activities (Solari et al. 2012, Burlando et al. 2013, Burlando et al. 2014, Repetto et al. 2017). The latter activity was developed in the context of two European Projects named “Wind and Ports” (2009–2012) and “Wind, Ports and Sea” (2013–2015). During these projects, an anemometric network made up of almost 30 ultrasonic anemometers and 3 lidar wind profilers, and a medium- to short-term wind forecast system were created, which still operate under my co-supervision and responsibility on behalf of the Italian Port Authorities of the Ligurian and Northern Tyrrhenian Sea (Repetto et al. 2018).

More recently, I concentrated my research activity concerning local-scale wind flow simulation and measurement focusing, in particular, on urban flows. In 2014, I started a collaboration with the Group of Urban Physics of the University of Technology of Eindhoven to study the wind flows in the urban boundary and canopy layers through a joint doctoral program (Ricci et al. 2017a,b). In this context, I also studied the behavior of small-size wind turbines for the wind energy exploitation in urban areas (Burlando et al. 2015, Pagnini et al. 2015). On this topic, I have applied as responsible of Research Unit to the tender of Research Project of National Interest (PRIN 2017) with a project that focuses on urban flow exploitation for energy production through small-size wind turbines.

Thanks to the very high quality wind measurements collected by means of the “Wind and Ports” anemometric network, after the end of this European project I started working on a new research topic that concerns the phenomenological and quantitative analysis of the strongest wind events occurring at the local scale in the coastal areas of Liguria and Tuscany, namely downslope winds (Burlando et al. 2017a) and thunderstorm-induced downbursts (Solari et al. 2015, Burlando et al. 2017b, Zhang et al. 2017). This

activity led to the proposal by Prof. Solari of the European Project THUNDERR “Detection, simulation, modelling and loading of thunderstorm outflows to design wind-safer and cost-efficient structures”, which was funded by an ERC Advanced Grant 2016. The project started in September 2017 and will last till the end of 2022. At present, I am fully involved in the development of WP 1 “Thunderstorm detection”, WP 2 “Thunderstorm analysis”, and WP 3 “Thunderstorm modelling” of such project.

## **Grants**

**2011**

### **Development of an algorithm to forecast the drift of a boat due to the wind forcing for SAR operations in the Mediterranean**

Orizzonte Sistemi Navali SpA - IT  
5.04000 - Pricipal investigator

**2011 - 2014**

### **Task 31 WAKEBENCH Benchmarking of wind farm flow models**

International Energy Agency (IEA)  
Pricipal investigator

Aim of the project was to improve wind farm modeling techniques and provide a forum for industrial, governmental and academic partners to develop, evaluate and improve wind farm models

**2012 - ONGOING**

### **Meteorological webGIS**

Port Authorities of Genoa Savona La Spezia and Livorno - IT  
24.31216 per year from 2012 to 2016 39.32304 per year since 2017 - Pricipal investigator

I am responsible of the operation of the wind-wave forecast system and webGIS developed in the framework of Projects “Wind and Ports” and “Wind, Ports and Sea”, according to a Memorandum Of Understanding between the University of Genoa and the Port Authorities of Genoa, Savona, La Spezia and Livorno

**2012 - 2013**

### **ASTRI extreme wind analysis at Serra La Nave**

Italian Institute for Astrophysics - IT  
43.56000 - Pricipal investigator

The project aimed at the evaluation of the design wind speed for the installation of telescopes in Serra La Nave

**2013**

### **Design numerical optimisation and experimentation in wind tunnel of vertical-axis wind turbines**

Elkrom Srl - IT

45.14000 funded under Program POR-FESR - Participant  
The project aimed to develop an optimised wind turbine based on stators to increase the rotational speed of a Savonius rotor

2013

**Effects of turbulence on small-size wind turbines**

University of Genoa - IT

3.00000 - Pricipal investigator

2013

**Upgrade of the short-term wind forecast and wind climatology offshore the Port of La Spezia**

Port Authority of La Spezia - IT

21.96000 - Pricipal investigator

The project aimed to upgrade the wind forecast system developed in the contest of the European Project "Wind and Ports"

2013 - 2015

**International Projects CTA Project Wind analysis at Aar (Namibia) (2013) CTA Project Wind analysis at Armazones (Chile) (2014) CTA Project Wind analysis at Roques de Los Muchachos (La Palma Canary Islands) (2015)**

CTA Consortium

111.91500 globally - Pricipal investigator

These projects focused on the evaluation of the wind actions in different sites for the installation of a Cherenkov Telescope Array (CTA)

2014

**Full-scale monitoring and simulation of wind flows in the urban boundary layer**

University of Genoa - IT

4.20000 - Pricipal investigator

2015

**CFD analysis of the flow fields inside a oven for the curing of nautical hulls**

Persico Marine - IT

8.50000 - Pricipal investigator

2017

**Base Research Projects funding (FFABR)**

Italian Ministry of University and Research - IT

3.00000 - Pricipal investigator

2017 - ONGOING

**MOORWIND**

Italian Ministry of Infrastructures and Transports - IT

54.90000 - Pricipal investigator

Project “MOORWIND”, developed in the context of Fincantieri’s Program “Technological leadership: base research to analyse performance, safety and comfort of ships” funded by the Italian Ministry of Infrastructures and Transports, aims at evaluating the loading conditions that affect very large ships at berth with respect to wind actions

**2009 - 2012**

### **Wind and Ports**

Interreg Program Italy-France Maritime 2007-2013

1.816.10000 - Participant

The European Project “Wind and Ports”

(<http://www.ventoeporti.net/public/default.asp>) focused on the wind forecast for safety management of port areas

**2013 - 2015**

### **Wind Ports and Sea**

Interreg Program Italy-France Maritime 2007-2013

1.792.27000 - Participant

The European Project “Wind, Ports and Sea”

([http://www.ventoeporti.net/public/SITO\\_VPM/public/](http://www.ventoeporti.net/public/SITO_VPM/public/)) focused on the coupled wind-wave forecast for safety management of operational port activities

**2016 - 2018**

### **Wind monitoring simulation and forecasting for the smart management and safety of port urban and territorial systems**

Compagnia di San Paolo - IT

180.00000 - Participant

The Project “Wind monitoring, simulation and forecasting for the smart management and safety of port, urban and territorial systems” aimed at extending the results of the two European Projects 'Wind and Ports' and 'Wind, Ports and Sea' to urban and anthropic systems

**2017 - ONGOING**

### **Detection simulation modelling and loading of thunderstorm outflows to design wind-safer and cost-efficient structures (THUNDERR)**

ERC Advanced Grant 2016

2.396.73600 - Participant