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## Preface

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**Biographical notes:** Silvia Trini Castelli is a Scientist of the CNR-ISAC and is Adjunct Professor at the University of Torino. She is responsible for the ISAC Torino Branch, leader of the Environmental Physics group and Chair of the Initiative on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes. She graduated in Physics and holds a PhD in Geophysics. Her main research fields are atmospheric physics and boundary layer meteorology, turbulence and dispersion modelling. She led several research projects and co-authored more than 70 publications on ISI-WOS journals and books, more than 60 peer-reviewed publications on international journals, conference proceedings and book chapters.

Silvana Di Sabatino is an Associate Professor at University of Bologna (Italy) where she is the group leader of the Atmospheric Physics Group at the Department of Physics and Astronomy. She holds a PhD and MPhil from the University of Cambridge (UK) and MSc in Physics from the University of Bologna. Her expertise includes environmental fluid dynamics, urban boundary-layer meteorology and air pollutant dispersion. She is an Associate Editor of *Environmental Fluid Mechanics* and editorial board member of *Boundary-Layer Meteorology* journals. She has co-authored more than 100 international scientific publications of which over 80 includes ISI journals and book chapters.

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The series of International Conferences on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes (HARMO conferences) is a main continuous activity of the international initiative on this topic, started in 1991. Extensive scientific, practical and historical information can be found at the website of the Harmo Initiative (<http://www.harmo.org>).

The keyword 'harmonisation' is driven by the idea of employing the best available meteorological and air quality sciences in consensual way to serve the needs of the society and citizens. Originally born as a European initiative, also for regulatory purposes, the Harmo Initiative and its conference series have been developing in an open intercontinental forum. The final goal is the improvement of dispersion models for

regulatory purposes and for real-time applications, addressing the latest scientific findings and meeting specific demands of society and regulators.

Dispersion modelling is a tool to assess the current or future impact of air pollution sources on the environment and human health. Fundamental research is continuously needed for improving the capability and reliability of the models. Studying dispersion requires multi-faceted approaches, namely reliable meteorological forecasting at high resolution able to capture the effects of complex terrain, vegetative canopies, and built environments with their characteristics. It also requires the derivation and proof of robust parametrisations of the atmospheric boundary layer and exchange processes. It involves a reasonable description of a variety of sources, such as those associated with transport, industries, accidental releases, deliberate releases and natural releases. It requires efficient numerical approaches in order to run fast simulations and to deliver multiple scenarios. Ideally, dispersion models used for real applications implement proven parametrisations of a large number of physical and chemical processes in the atmosphere. In addition, real-time data assimilation, the evaluation of model performance and the presentation of results to the public and managers are now disciplines of their own.

It has been proven, through the success of the Harmo conferences, that this forum is needed to allow scientists focused in one or several of these different topics, to work together and come up with improved and harmonised solutions. There is a variety of models of increasing complexity, covering different space and time scales and different areas of applicability. The user needs to select a fit-for-purpose dispersion model that produces reliable results for a given task and also to know the uncertainties and errors associated with the model results.

There are many requirements to models for regulatory purposes. These models should be scientifically sound, validated against observations, and accompanied by clear guidelines and support to ensure proper use. Constant efforts are needed to promote the good practices and eliminate the bad practices, to assure quality with respect to model development, to establish reference problems, and to share experiences.

The Harmo conferences are directed towards scientists, model developers, model users, environmental protection agencies, and environmental legislation experts. This series of conferences has a recognised specificity because it focuses on common tools and methodologies in a broad interdisciplinary field. These conferences are the natural forum for discussing modelling issues related to the European Union air quality directives, at the same time representing the platform for an international discussion beyond the continental borders.

The Harmo conferences have a role as a forum where users and decision makers can bring their requirements to the attention of scientists. Not only the global atmosphere is shared by all, but also the problems related with providing real-time information of accidental and their impacts on economy, society and environment are required by all people and institutions around the world.

The Harmo conference participants are the international scientific community that maintains the Harmo Initiative, forms the committees and organises the conferences on a voluntary basis. In this way, each participant is directly involved in the process of bridging knowledge to a broad public and governing authorities in order to secure sustainable and higher quality of life in Europe and worldwide.

The 18th International Conference on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes (HARMO18) was co-organised by the Institute of Atmospheric Sciences and Climate of the National Research Council and by the

Department of Physics and Astronomy of the Alma Mater Studiorum – University of Bologna, and hosted at CNR Research Area from 9 to 12 October 2017 in Bologna, Italy.

HARMO18 received 212 contributions, covering all main topics in dispersion modelling context:

- Model evaluation and quality assurance: Model validation, model intercomparisons, model uncertainties and model sensitivities.
- Environmental impact assessment: Air pollution management and decision support systems.
- Use of modelling in support of EU air quality directives, including FAIRMODE activities.
- Parametrisation of physical processes in mesoscale meteorology relevant for air quality modelling.
- Urban scale and street canyon modelling: Meteorology and air quality.
- Use of modelling in health and exposure assessments.
- Inverse dispersion modelling and source identification.
- Modelling air dispersion and exposure to accidental releases.
- Modelling of passive control systems (PCS), including nature-based solutions in dispersion studies.
- Mathematical problems in air quality modelling.
- Highlights of past work: A session devoted to reviews and to prominent scientists and ‘golden papers’ of the past, which still have relevance and should not be forgotten.

This special issue is a collection of selected papers carefully revised and extended from research contributions originally presented at HARMO18 and then submitted to the peer-review process according to *IJEP* standards. Some of the papers are published in this volume, and the remainder in *IJEP* 2019, Volume 65, Nos. 1/2/3.

The HARMO conference series will continue its long tradition towards the future, ready to take on new scientific challenges, serving society with the harmonised efforts of researchers and policy makers.

On behalf of the Steering Committee, we would like to conclude by thanking Dr. Helge Rørdam Olesen of Aarhus University in Denmark, for dedicating more than 25 years of his scientific and personal life to the Harmo Initiative. He has been giving an inestimable contribution as Harmo Chair and as a scientist in dispersion modelling, with unique enthusiasm and dedication, leaving a recognisable mark on the Harmo Initiative.