

MAGIC CIRCULAR

Envisaging a world with greener cities

AN UPDATE ON THE
MAGIC PROJECT

ISSUE NO. 03 | SEPTEMBER 2017



MEET THE RESEARCHERS

Who is working on MAGIC?

PROJECT UPDATE

Progress on the project

PARTNERS MEETING

Find out what happened
at the last meeting



INTRODUCTION TO MAGIC

Welcome to this third edition of the MAGIC newsletter, which aims to provide you with an update on the progress of the project so far.

As the summer draws to a close, our research continues at great pace. Over the past six-months, we have begun collecting data from our London test site and from the wind

tunnel in Surrey. We have further developed our computer models and preparation for our laboratory tests is well under way. Furthermore, we welcome two new members to the project team and have enjoyed networking with many of our Partners' at our last Partners' Meeting.



Professor Paul Linden,
Lead Investigator
University of Cambridge

PROGRESS SO FAR...

THE TEST SITE

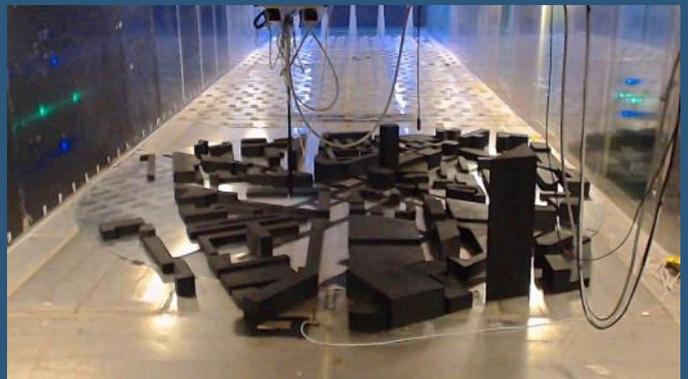


Installing the meteorological station at LSBU

Over the summer we have been busy at our test site in the Elephant and Castle area of London, installing indoor monitors in our test building at London Southbank University (LSBU). The sensors are placed in a naturally ventilated room and have been capturing data on trace gases, temperature, pressure and relative humidity. We have also installed monitors to assess window movement and the number of people in the room. To support these data, a meteorological station has been mounted on top of our test building and outdoor monitors, again assessing trace gases and meteorological data, have been placed on a number of lampposts around the test building. The initial results from the monitors look extremely interesting and we can already see useful data patterns. Further analysis of the data will continue over the coming months.

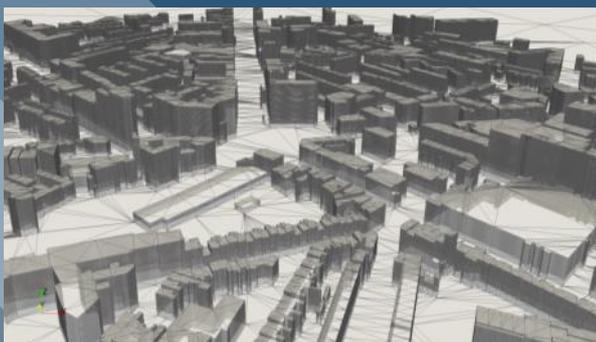
WIND TUNNEL

Our project team at the University of Surrey have been using the wind tunnel to provide some comparative results with the field monitoring and numerical modelling analysis of the test site. More specifically, work has investigated the main flow characteristics from various wind directions around the test site. The wake effect that tall buildings have on typical air flow and the concentration decay of pollutants with distance from their source has also been examined. More work in the wind tunnel will take place over the coming months.



Inside the wind tunnel at Surrey

MODELLING



Computer generated models from ICL

The team at ICL have been generating CFD simulations of the test site and successfully comparing the models with the data from the wind tunnels. Going forward, the modellers will examine traffic models, add thermal effects and develop indoor models. These indoor models will be combined with the EnergyPlus model of the test site, to investigate indoor ventilation flows. The models will also be supported by laboratory data from Cambridge.

RESEARCH PROGRESS



DR MEGAN DAVIES WYKES- UNIVERSITY OF CAMBRIDGE

Building Ventilation

Over the past few months, Megan has been supported, by student intern, Jean-Etienne Debay, from INSA, Lyon- France. Megan and Jean-Etienne have been using simulations to understand the potential heat effects and pollutant variations the laboratory experiments will show.

DR SHIWEI FAN- UNIVERSITY OF CAMBRIDGE

Sensor Development

Shiwei has finished and installed the sensors at the LSBU test site in London. He has also added window opening monitors, people counters and a camera monitoring when windows are used. Shiwei has been calibrating initial data from the site and will continue to analyse data over the coming months.



DR JIYUN SONG- UNIVERSITY OF CAMBRIDGE

Building Energy Performance

Jiyun has been using the EnergyPlus model of the indoor test site to begin to understand ventilation within the building, specifically focusing on understanding cross-ventilation when windows are open different amounts. Going forward, Jiyun will begin to couple her model with the Fluidity and Wind Tunnel models.



DR LAETITIA MOTTET- IMPERIAL COLLEGE LONDON

Building Modelling

Laetitia has been using the Fluidity model to begin to compare the results from the wind tunnel experiments with her numerical computations. Laetitia has also begun comparing the difference between a simple and complex test site geometry. Going forward, Laetitia will couple her models with other indoor and outdoor models and add traffic and thermal effects.



DR DUNHUI XIAO- IMPERIAL COLLEGE LONDON

Reduced Order Modelling

Dunhui has been developing the reduced order models to improve their accuracy and efficiency, through which he has been able to produce a number of journal publications. Going forward Dunhui will spend more time applying his developments in reduced order modelling with the LSBU test site.



DR HUW WOODWARD- IMPERIAL COLLEGE LONDON

Atmospheric Modelling

Huw has been concentrating on understanding the capabilities of ADMS (Advanced Dispersion Model), particularly how the wake effects of tall buildings are presented in the model. Huw will continue his work by considering traffic data local to the test site and begin to combine his work with the Fluidity model.



DR WILL LIN- UNIVERSITY OF SURREY

Wind Tunnel Modelling

Will has been concentrating on understanding the main flow characteristics of various wind directions in the wind tunnel at Surrey. Will has been considering the wake effect of tall buildings and dispersion from ground-level pollutants and will continue and build upon these investigations going forward.



WELCOME:

DR ROSELLA ARCUCCI- IMPERIAL COLLEGE LONDON

Data Assimilation Modelling

Welcome to Rosella- the newest member of the MAGIC team. Rosella's area of expertise lies in numerical analysis, scientific computing and the development of methods, algorithms and software for scientific applications on high performing computer architecture. Rosella received a MSc in Mathematics in 2008 at the University of Naples "Federico II" followed by her PhD in 2012 in Computational and Computer Science. She worked on the main models for DA (Kalman filtering and variational models). She also worked on DA software (namely OceanVAR, DART, ROMS-IS4DVAR). Going forward, Rosella will continue the work of David Fairburn.



LATEST PUBLICATIONS:

D Xiao, F Fang, CC Pain, IM Navon, A parameterized non-intrusive reduced order model and error analysis for general time-dependent nonlinear partial differential equations and its applications, *Computer Methods in Applied Mechanics and Engineering*, 317, 868-889, 2017.

F. Fang, C. C. Pain, I.M. Navon, D. Xiao, An efficient goal based reduced order model approach for targeted adaptive observations, *International Journal for Numerical Methods in Fluids*, 83(3), 263-275, 2017.

D. Xiao, Y. Pan, F. Fang*, J. Xiang, C.C. Pain, I.M. Navon, M. Chen, A non-intrusive reduced-order model for compressible fluid and fractured solid coupling and its application to blasting, *Journal of Computational Physics*, 330, 221-244, 2017

Wang, Z., Xiao, D., Fang, F., Govindan, R., Pain, C.c., Guo, Y., (2017) Model identification of reduced order fluid dynamics systems using deep learning. *International Journal for Numerical Methods in Fluids*. DOI: 10.1002/flid.4416

PARTNERS MEETING

On the 19th of September we held our bi-annual Partner's Meeting at Imperial College London. The meeting was attended by a number of our project partners. The meeting commenced with a project update from Paul Linden and a series of presentations from the post-doctoral researchers about their work over the past six-months.

Following on from these presentations, we were joined by Marko Tainio from the Centre for Diet and Activity Research (CEDAR) who focused his presentation on TIGTHAT- an MRC funded project which examines the health implications of (sustainable) transport policies and scenarios in low and middle income countries. The project aims to create an integrated global transport and health assessment tool, building on research from higher income countries, extending areas of research interest (in the first instance) to South America and India.

The greatest challenge for the project is ensuring accurate and sufficient data collection; the team is relying on, often incomplete, national transport and air pollution records and data from Google Street View. More information about TIGTHAT can be found [online](#).

After lunch, Matthew Johnson from Airlabs presented. Airlabs is a Danish organisation that focuses on air cleaning technologies and would like to visualize a future city which uses existing urban architecture such as building facades and bus shelters to clean our air. The company has installed sensors in the MAGIC test site area to collect data which will support MAGIC.

We were also joined by Espen Åkervik from FFI Norway (Norwegian Defence Research Establishment) who discussed research that has been conducted by the Fluid Dynamics Research Group. The group examines pollutant dispersion in the context of defence and societal-security applications e.g. the environmental impact of a wood chip factory fire. Current work examines how flows in cities are influenced by buildings, much like the MAGIC wind tunnel project work.

In the latter half of the day, the project Steering Group met and were able to provide some feedback about the strategic direction of the MAGIC project. All-in-all the Steering Group were content with the progress of the project.

It is anticipated that the next meeting will be held in March 2018.

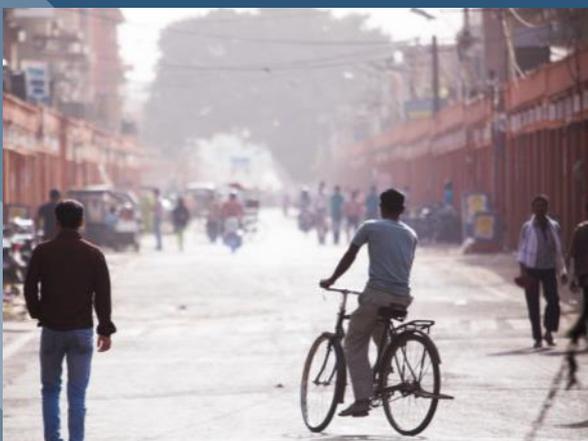


Photo Credit: . By Riccardo Romano [[CC BY-NC-ND 2.0](#)]



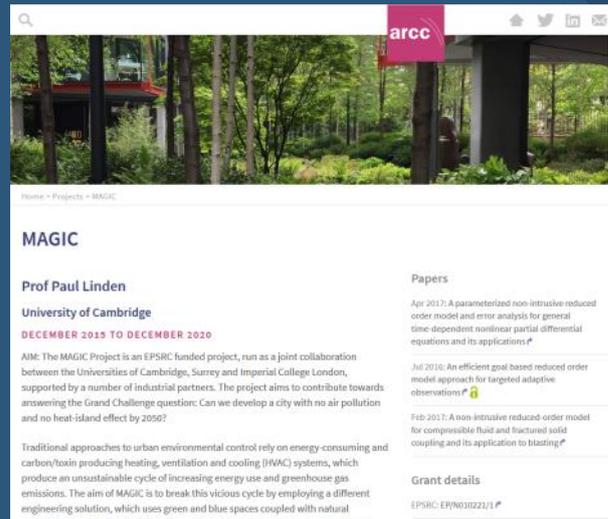
Photo originally found at: <http://www.airlabs.com/effects-of-pollution-on-environment>

EXTENDING OUR RESEARCH

The MAGIC project has already been showcased at the International Refurbishment Symposium and Resilient Cities 2017 conference. Articles about the project have also appeared in write up's by CIBSE (Chartered Institute of Building Engineers) and the ARCC-Network.

MAGIC will be the focus of the Greater London Authority (GLA) annual APRIL meeting, to be held in October 2017. Invitees include members of the GLA and representatives from organisations such as Mott MacDonald, URS Corp, the Mett Office, the Environment Agency, Imperial College London, BRE, University of Cambridge and Public Health England.

MAGIC will also feature in the NewStatesman, in an article introduced by Sadiq Khan (Mayor of London). Any members of CIRIA (the Construction Industry Research and Information Association) will also see the project feature as a briefing over the coming months. As always, further project updates can be found [online](#).



FUTURE STEPS



RESEARCH: Research at our MAGIC test site will continue until the start of the winter. After this point, the researchers will concentrate on analysing the data, developing the models and collecting and analysing further data from the wind tunnel and laboratory studies.

FUTURE TEST SITES: The project expects to spend next spring/summer collecting data from a new, more complex, test site and any suggestions for a suitable naturally ventilated building space we could use would be warmly welcomed.

PHD OPPORTUNITIES: We are actively seeking an industrial sponsor for a PhD project, examining the effect of green infrastructure on air pollution removal in cities. We anticipate that the sponsor will contribute 50% of the funding for the project, equating to £15,000/annum over a three year period.

The project team is extremely interested in discussing any other collaborative industrial or research opportunities.

THE LEAD INVESTIGATORS



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Funded by:

