Dr. Eliott Lumet (he/him)

PhD in Applied Mathematics and Atmospheric Sciences

28 years old

Mail: eliott.lumet@gmail.com
Academic website: https://eliott.lumet.me/
ORCID: 0000-0003-0426-7311
GitHub: https://github.com/eliott-lumet

Summary

After obtaining a prestigious general engineering degree from the École Centrale de Nantes, France, I turned to scientific research in atmospheric sciences and applied mathematics, with a strong focus on the quantification of uncertainty in microscale atmospheric processes.

I defended my PhD thesis, entitled *"Assessing and reducing uncertainty in large-eddy simulation for microscale atmospheric dispersion"*, at the Université Toulouse III, France, on January 12, 2024. During this highly interdisciplinary project involving CERFACS and CNRS-LAAS research institutes, I successfully designed and implemented an ensemble-based data assimilation framework involving high-fidelity simulations and surrogate modeling. By going all the way through the assimilation of real field measurements, I was able to demonstrate my organization and management skills as well as my ability to work with HPC systems. I also developed my communication skills by participating in several international conferences and writing several articles for peer-reviewed scientific journals.

I am now a post-doctoral researcher at CNRM in Toulouse, France, and my research work focuses on the development of machine learning-based models for regional numerical weather prediction. I am open to new collaboration opportunities in connection with my long-term scientific project that combines applied mathematics, machine learning and atmospheric sciences, with a particular focus on the study of the vulnerability of urban environments.

1. Research interests

- Atmosphere and pollutant dispersion modeling
- Uncertainty characterization, quantification and reduction through data assimilation
- Model emulation and acceleration using machine learning techniques
- Environmental risk assessment for urban environments

2. Key skills

Designing and building complex modeling chains that combine large-ensemble of high-fidelity and expensive numerical simulations, surrogate modeling, and ensemble-based data assimilation of observations.

Microscale atmospheric modeling

- Setting up and running CFD models (AVBP, FEniCS, NEK5000, OpenFOAM) to perform large-eddy simulations of new case study on microscale atmospheric flows/pollutant dispersion,
- Handling of datasets of observations from an experimental campaign (MUST).

Applied mathematics

- Quantifying internal variability in simulations using bootstrap techniques,
- Implementing data assimilation algorithms (EnKF, ESMDA), and using them with synthetic and real measurements,
- Analyzing the sensitivity of a model to its main input parameters (Sobol' indices, Saltelli algorithm),
- Implementing machine learning and deep learning methods (PCA, Gaussian processes, Convolutional Autoencoder) for surrogate modeling.

Coding skills

- Strong expertise in Python and bash scripts,
- Mastery of the basics of C++ and Fortran,

- Really familiar with high-performance computing (HPC) systems.

Carbon accounting: quantifying the greenhouse gas emissions associated with research activities.

3. Education

- 2024 – **Doctoral Degree** in Atmospheric Sciences, Université Paul Sabatier Toulouse III, France.
- 2020 – **Engineering diploma** (equivalent to MSc) in Applied Mathematics, École Centrale de Nantes (a highly-selective engineering school), France.

4. Professional experience

Research experience

- April 2025 – present
  Postdoctoral research fellow, Centre National de Recherches Météorologiques (CNRM), Toulouse, France. "*New generation of weather prediction systems, based on hybridization of traditional physical models and state-of-the-art machine learning methods, allowing for increased accuracy and timeliness in a cost-effective way*". Supervisor: Dr. Laure Raynaud.
- January 2024 – January 2025
  Postdoctoral research fellow, European Centre for Research and Advanced Training in Scientific Computation (CERFACS), Toulouse, France. "*Data assimilation for large-eddy simulations of accidental atmospheric pollutant dispersion*". Supervisor: Dr. Mélanie Rochoux.
- October 2020 – January 2024
  PhD, Université Paul Sabatier Toulouse III, France. "*Assessing and reducing uncertainty in large-eddy simulation for microscale atmospheric dispersion*". Supervisors: Dr. Mélanie Rochoux and Dr. Simon Lacroix.
- April 2020 – September 2020
  Master 2, Research Internship, von Karman Institute for Fluid Dynamics (VKI), Belgium. "*Dispersion of pollutants in built environment*". Supervisors: Dr. Delphine Laboureur and Dr. Sophia Buckingham.

Other experience

- April 2019 – August 2019
  Engineer internship, Safran Aircraft Engines, Villaroche, France. *"Impact of uncertainties in thermodynamic cycle predictions"*. Supervisor: Nathan Eckert.
- Summers 2013 to 2018
  Summer jobs at Le Rustick (restaurant), La Tranche-sur-Mer, France, and Laboratoire de l'Environnement et de l'Alimentation de la Vendée (as a sampling agent), La Roche-sur-Yon, France.

5. Publication in peer-reviewed scientific journals

1. **Lumet, E.**, Jaravel, T., Rochoux, M. C., Vermorel, O., and Lacroix, S. (2024). Assessing the internal variability of Large-Eddy Simulations for microscale pollutant dispersion prediction in an idealized urban environment. *Boundary-Layer Meteorology*, 190(2):9. DOI: 10.1007/s10546-023-00853-7
2. **Lumet, E.**, Rochoux, M. C., Jaravel, T., and Lacroix, S. (2025). Uncertainty-Aware Surrogate Modeling for Urban Air Pollutant Dispersion Prediction. *Building and Environment*, 267:112287. DOI: 10.1016/j.buildenv.2024.112287
3. **Lumet, E.**, Jaravel, T., and Rochoux, M. C. (2025). Dataset of microscale atmospheric flow and pollutant concentration large-eddy simulations for varying mesoscale meteorological forcing in an idealized urban environment. *Data in Brief,* 58:111285. DOI: 10.1016/j.dib.2025.111285

6. Other research outputs

Data repository

1. **Lumet, E.**, Jaravel, T., and Rochoux, M. C. (2024). PPMLES – Perturbed-Parameter ensemble of MUST Large-Eddy Simulations. Dataset at Zenodo. DOI: 10.5281/zenodo.11394347

Open-access code

2. **Lumet, E.** (2024). POD–GPR surrogate modeling for microscale pollutant dispersion. Tutorial notebook. URL: https://github.com/eliott-lumet/pod_gpr_ppmles

7. Conferences

International conference

1. **Lumet, E.**, Rochoux, M. C., Jaravel, T., and Lacroix, S. (2024). Reduced-cost EnKF for parameter estimation of microscale atmospheric pollutant dispersion models. International EnKF workshop, *Bergen*, *Norway.* Oral presentation.
2. **Lumet, E.**, Rochoux, M. C., Jaravel, T., and Lacroix, S. (2024). Surrogate-based data assimilation for microscale atmospheric pollutant dispersion. European Geophysical Union (EGU) General Meeting, *Vienna, Austria.* Poster presentation, Abstract EGU24-17987.
3. **Lumet, E.**, Rochoux, M. C., Jaravel, T., Lacroix, S., and Vermorel, O. (2022). Sensitivity analysis of microscale pollutant dispersion large-eddy simulations for observation network design. HARMO conference, *Aveiro*, *Portugal*. Oral presentation.

Invited presentation

4. Rochoux, M.C., **Lumet, E**., Jaravel, T., and Lacroix, S. (2024) Prendre en compte les incertitudes dans les prévisions de dispersion atmosphérique de polluants en milieu urbain, Atelier TERATEC "Risques naturels et technologiques", *Paris*, *France.* Invited talk *(in French).*

8. Projects and fundings

- 2024 – **LEARN4LES** "Learning for large-scale atmospheric dispersion simulations". An ENV'IA funding from the Observatoire Midi-Pyrénées (OMP), for the supervision of a 4-month Master student. Report URL: https://cerfacs.fr/wp-content/uploads/2024/09/Rapport_de_stage_Emmarius_Delar.pdf *(in French).*
- 2024 – **ASSIM4LES** "Data assimilation for large-eddy simulations of accidental atmospheric pollutant dispersion". Selection for internal funding from CERFACS for the funding of his postdoctoral position.
- 2022 – **LES2EMULATE** "From high-fidelity simulations to reduced-order modelling to analyse environmental risk". Project funded by DARI-GENCI 2022, a French national program, that provided access to the HPC resources for Dr. Lumet's PhD project (grant agreement no. A0062A10822).

9. Supervising, teaching, and mentoring activities

Supervising

- May 2024 – August 2024

  Co-supervision of Master Student. "Learning-based dimension reduction methods for statistical emulation of an atmospheric dispersion model". Université Paul Sabatier Toulouse III, *Toulouse, France*

Teaching

- 2021 – 2022

  Tutorials for bachelor students. La Prépa des INP, *Toulouse, France*. Mechanical wave propagation (20 hours/year)
- 2021 – 2024

  Tutorials and practical works for PhD students and scientists. CERFACS, *Toulouse, France*. Data Assimilation (2 hours/year)

Mentoring

- 2023 – present

  Organisation of bi-monthly meetings to improve the well-being and supervision of trainees, PhD students and young researchers. CERFACS, *Toulouse, France*
- November 2017 – June 2018

  Mentoring of undergraduate students. CPGE Lycée Clémenceau, *Nantes, France.* Mathematics and Physics *(56 hours)*

10. Hobbies

- **Running** – intensive training and competition (from 10k to marathon)
- **Bike traveling**