CEREA activity report – 2025

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Published articles in peer-reviewed international journals

[1] **A. Squarcioni**, **Y. Roustan**, M. Valari, **Y. Kim**, **K. Sartelet**, **L. Lugon**, F. Dugay and R. Voitot. 'To what extent is the description of streets important in estimating local air quality: a case study over Paris'. In: *Atmos. Chem. Phys.* 25 (2025), pp. 93–117. DOI: 10.5194/acp-25-93-2025.

[2] K. Nathanael, **S. Cheng**, N. M. Kovalchuk, R. Arcucci and M. J. Simmons. 'Optimisation of microfluidic synthesis of silver nanoparticles via data-driven inverse modelling'. In: *Chemical Engineering Research and Design* 216 (2025), pp. 523–530. DOI: 10.1016/j.cherd.2025.03.014.

[3] H. Fan, **S. Cheng**, A. J. de Nazelle and R. Arcucci. 'ViTAE-SL: A vision transformer-based autoencoder and spatial interpolation learner for field reconstruction'. In: *Computer Physics Communications* 308 (2025), p. 109464. DOI: 10.1016/j.cpc.2024.109464.

[4] Z. Xia and **S. Cheng**. 'PyTorchFire: A GPU-Accelerated Wildfire Simulator with Differentiable Cellular Automata'. In: *Environmental Modelling & Software* 188 (2025), p. 106401. DOI: 10.1016/j.envsoft.2025.106401.

[5] Y. Zhuang, **S. Cheng** and K. Duraisamy. 'Spatially-aware diffusion models with cross-attention for global field reconstruction with sparse observations'. In: *Computer Methods in Applied Mechanics and Engineering* 435 (2025), p. 117623. DOI: 10.1016/j.cma.2024.117623.

[6] **S. Cheng**, **M. Bocquet**, W. Ding, **T. S. Finn**, R. Fu, J. Fu, Y. Guo, E. Johnson, S. Li, C. Liu, E. N. Moro, J. Pan, M. Piggott, C. Quilodran, P. Sharma, K. Wang, D. Xiao, X. Xue, Y. Zeng, M. Zhang, H. Zhou, K. Zhu and R. Arcucci. 'Machine learning for modelling unstructured grid data in computational physics: A review'. In: *Information Fusion* (2025), p. 103255. DOI: 10.1016/j.inffus.2025.00328.

[7] J. Lever, **S. Cheng**, C. Q. Casas, C. Liu, H. Fan, R. Platt, A. Rakotoharisoa, E. Johnson, S. Li, Z. Shang et al. 'Facing & mitigating common challenges when working with real-world data: The Data Learning Paradigm'. In: *J. Comput. Sci.* 85 (2025), p. 102523. DOI: 10.1016/j.jocs.2024.102523.

[8] Y. Zhou, R. Kong, Z. Xu, L. Xu and **S. Cheng**. 'Comparative and interpretative analysis of CNN and transformer models in predicting wildfire spread using remote sensing data'. In: *Journal of Geophysical Research: Machine Learning and Computation* 2 (2025), e2024JH000409. DOI: 10.1029/2024JH000409.

[9] A. Farchi, M. Chrust, **M. Bocquet** and M. Bonavita. 'Development of an offline and online hybrid model for the Integrated Forecasting System'. In: *Q. J. Roy. Meteor. Soc.* 151 (2025), e4934. DOI: 10.1002/qj.4934.

[10] K. Wang, **S. Cheng**, M. D. Piggott, S. L. Dance, Y. Wang and R. Arcucci. 'Latent data assimilation with non-explicit observation operator in hydrology'. In: *Q. J. Roy. Meteor. Soc.* (2025), e5009. DOI: 10.1002/qj.5009.

[11] G. Wang and **S. Cheng**. 'Can foundation language models predict fluid dynamics?' In: *Engineering Applications of Artificial Intelligence* 158 (2025), p. 111427. DOI: 10.1016/j.engappai.2025.111427.

[12] **J. Dumont Le Brazidec**, **P. Vanderbecken**, **A. Farchi**, G. Broquet, G. Kuhlmann and **M. Bocquet**. 'Quantification of CO_2 hotspot emissions from OCO-3 SAM CO_2 satellite images using deep learning methods'. In: *Geosci. Model Dev.* 18 (2025), pp. 3607–3622. DOI: 10.5194/gmd-18-3607-2025.

[13] S. Li, T. Zheng, **A. Farchi**, **M. Bocquet** and P. Gentine. 'Probabilistic Data Assimilation for Ensemble Distribution Projections With Generative Machine Learning: A Lorenz '96 Proof-of-Concept'. In: 52 (2025), e2024GL112523. DOI: 10.1029/2024GL112523.

[14] Z. Xu, J. Li, **S. Cheng**, X. Rui, Y. Zhao, H. He, H. Guan, A. Sharma, M. Erxleben, R. Chang et al. 'Deep learning for wildfire risk prediction: Integrating remote sensing and environmental data'. In: *ISPRS Journal of Photogrammetry and Remote Sensing* 227 (2025), pp. 632–677. DOI: 10.1016j.isprsjprs.2025.06.002.

[15] K. Wang, G. Bertoli, **S. Cheng**, K. Schröter, E. Caporali, M. D. Piggott, Y. Wang and R. Arcucci. 'AI-empowered latent four-dimensional variational data assimilation for river discharge forecasting'. In: *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* (2025). DOI: 10.1109/JSTARS.2025.3611136.

[16] M. Zhu, L. Wu, **M. Bocquet**, J. Cao, L. Kong, S. Zhang, W. Cao, X. Tang, H. Su, J. Zhu and Z. Wang. 'Learning physically interpretable deep networks from reanalysis data for medium-term regional PM2.5 forecasts'. In: *Environ. Res. Lett.* 20 (2025), p. 084032. DOI: 10.1088/1748-9326/ade606.

[17] **J. Jose**, A. Gires, I. Tchiguirinskaia, **Y. Roustan** and D. Schertzer. 'Characterization of atmospheric visibility through extinction coefficient and the influence of lower threshold on assessment of multifractal parameters'. In: *J. Appl. Meteorol. Clim.* 64 (2025), pp. 1063–1075. DOI: 10.1175/JAMC-D-24-0202.1.

[18] A. V. Poecke, **T. S. Finn**, R. Meng, J. V. d. Bergh, G. Smet, J. Demaeyer, P. Termonia, H. Tabari and P. Hellinckx. 'Self-attentive transformer for fast and accurate postprocessing of temperature and wind speed forecasts'. In: *Artificial Intelligence for the Earth Systems* (2025). DOI: 10.1175/AIES-D-24-0127.1.

[19] **N. Bennoura Bouchiba**, **M. Ferrand** and **J.-M. Hérard**. 'A Godunov-type scheme and a relaxation scheme for second-order turbulence-moment models'. In: *ESAIM: Mathematical Modeling and Numerical Analysis* 59 (2025), pp. 2639–2683. DOI: 10.1051/m2an/2025066.

[20] H. Zhou and **S. Cheng**. 'Improving long-term autoregressive spatiotemporal predictions: A proof of concept with fluid dynamics'. In: *Computer Methods in Applied Mechanics and Engineering* 447 (2025), p. 118332. DOI: 10.1016/j.cma.2025.118332.

[21] P. Shao, Y. Jiang, N. M. Kovalchuk, M. J. Simmons, O. Matar, R. Arcucci and **S. Cheng**. 'Explainability of AI predictive models for drop coalescence in microfluidics channels: Experimental validation'. In: *Chemical Engineering Science* (2025), p. 122559. DOI: 10.1016/j.ces.2025.122559.

[22] **G. Balvet**, **Y. Roustan** and **M. Ferrand**. 'Derivation of model-consistent universal functions for second-order turbulence models and their implications on Lagrangian stochastic methods for thermally stratified atmospheric surface boundary layer flows'. In: *Phys. Rev. Fluids* 10 (2025), p. 103801. DOI: 10.1103/r4hc-hwhk.

[23] J. Meuer, M. Witte, **T. S. Finn**, C. Timmreck, T. Ludwig and C. Kadow. 'Latent diffusion and spatio-temporal transformers generate large ensemble climate simulations'. In: *IEEE Transactions on Artificial Intelligence* (2025), pp. 1–14. DOI: 10.1109/TAI.2025.3621121.

[24] **B. Amiot**, R. Le Berre, S. Giroux–Julien and **M. Ferrand**. 'Boundary-layer parameterization for assessing temperature and evaporation in floating photovoltaics at the utility-scale'. In: *Renewable Energy* 258 (2026), p. 124901. ISSN: 0960-1481. DOI: https://doi.org/10.1016/j.renene.2025.124901.

[25] **C. Durand**, **T. S. Finn**, **A. Farchi**, **M. Bocquet**, J. Brajard and L. Bertino. 'Four-dimensional variational data assimilation with a sea-ice thickness emulator'. In: *The Cryosphere* (2025), pp. 5613–5637. DOI: 10.5194/tc-19-5613-2025.

[26] **B. Amiot**, **J. Vernier**, B. Berlioux, **B. Cuilhé**, R. Le Berre, S. Edouard and **M. Ferrand**. 'Co-simulating photovoltaics and environments: a proof-of-concept for solar forecasting operation'. In: *EPJ Photovoltaics* 16 (2025). DOI: 10.1051/epjpv/2025018.

[27] B. Berlioux, **B. Amiot**, **M. Ferrand**, R. Le Berre, O.-L. Rhazi, J. Vidal, H. Pabiou and R. Knikker. 'Numerical analysis of evaporation reduction in floating photovoltaic power plants: influence of design parameters'. In: *EPJ Photovoltaics* 16 (2025). DOI: 10.1051/epjpv/2024047.

[28] F. Couvidat, **L. Lugon**, P. Messina, **K. Sartelet** and A. Colette. 'Optimizing computation time in 3D air quality models by using aerosol superbins within a sectional size distribution approach: Application to the CHIMERE model'. In: *Journal of Aerosol Science* 187 (2025), p. 106572. DOI: 10.1016/j.jaerosci.2025.106572.

[29] M. Farhat, L. Pailler, M. Camredon, **A. Maison**, **K. Sartelet**, L. Patryl, P. Armand, C. Afif, A. Borbon and L. Deguillaume. 'Investigating the role of anthropogenic terpenoids in urban secondary pollution under summer conditions by a box modeling approach'. In: *Environmental Science: Atmospheres* 5.5 (2025), pp. 574–590. DOI: 10.1039/D4EA00112E.

[30] **M. Ferrand**, **R. Pennel** and **E. Dupont**. 'Universal Functions with Ekman Spiral and Monin–Obukhov Surface Layers'. In: *Boundary-Layer Meteorology* 191 (2025). DOI: 10.1007/s10546-025-00938-5.

[31] **O. Jacquot** and **K. Sartelet**. 'Numerical investigations on the modelling of ultrafine particles in SSH-aerosol-v1.3a: Size resolution and redistribution'. In: *Geoscientific Model Development* 18 (2025), pp. 3965–3984. DOI: 10.5194/gmd-18-3965-2025.

[32] A. Lostier, **T. Sarica**, J. Lasne, A. Roose, **K. Sartelet**, M. Jamar, V. Gaudion, S. Dusanter, D. Lesueur, H. Chen, T. Salameh and M. N. Romanias. 'Real-world asphalt pavement emissions: Combining simulation chamber measurements and city-scale modeling to elucidate the impacts on air quality'. In: *ACS ES&T Air* 2.3 (2025), pp. 426–435. DOI: 10.1021/acsestair.4c00323.

[33] **L. Lugon**, C. Kemgne, V. L. Vot, N. Mauchard, B. V. Quang, C. Wang, **S.-J. Park**, **Y. Kim**, J. Vigneron, F. Dugay, O. Sanchez and **K. Sartelet**. 'How far can we improve urban air quality and population exposure by changing mobility? An analysis in Paris'. In: *Science of The Total Environment* 1000 (2025), p. 180266. DOI: 10.1016/j.scitotenv.2025.180266.

[34] **S.-J. Park**, **L. Lugon**, **O. Jacquot**, **Y. Kim**, A. Baudic, B. D'Anna, L. Di Antonio, C. Di Biagio, F. Dugay, O. Favez, V. Ghersi, A. Gratien, J. Kammer, J.-E. Petit, O. Sanchez, M. Valari, J. Vigneron and **K. Sartelet**. 'Population exposure to outdoor NO_2, black carbon, and ultrafine and fine particles over Paris with multi-scale modelling down to the street scale'. In: *Atmospheric Chemistry and Physics* 25.6 (2025), pp. 3363–3387. DOI: 10.5194/acp-25-3363-2025.

[35] **K. Sartelet**, J. Kerckhoffs, E. Athanasopoulou, **L. Lugon**, J. Vasilescu, J. Zhong, G. Hoek, C. Joly, **S.-J. Park**, C. Talianu, S. van den Elshout, F. Dugay, E. Gerasopoulos, A. Ilie, **Y. Kim**, D. Nicolae, R. M. Harrison and T. Petaja. 'Air pollution mapping and variability over five European cities'. In: *Environment International* 199 (2025), p. 109474. DOI: 10.1016/j.envint.2025.109474.

[36] H. Song, H. Zhao, X. Liu, Y. Zhang, Z. Han, **Y. Kim**, **K. Sartelet**, X. Zhang, M. de Fatima Andrade, M. Wang and L. Gao. 'Street-scale traffic emission inventory derived from GeoVideo and coupled WRF/Chem–MUNICH modelling for urban air quality management: A case study in Kaifeng, China'. In: *Urban Climate* 64 (2025), p. 102689. DOI: 10.1016/j.uclim.2025.102689.

[37] **J. Vernier**, B. Berlioux, **B. Amiot**, S. Edouard, **M. Ferrand**, **E. Dupont**, **C. Caruyer**, V. Trotin, D. Combes and **P. Massin**. 'An innovative method based on CFD to simulate the influence of photovoltaic panels on the microclimate in agrivoltaic conditions'. In: *Solar Energy* 297 (2025), p. 113571. ISSN: 0038-092X. DOI: https://doi.org/10.1016/j.solener.2025.113571.

Peer-reviewed chapters and proceedings

[1] E. Launay, V. Hergault, **M. Bocquet**, **J. Brazidec** and **Y. Roustan**. 'Inverse Modelling for the Atmospheric Dispersion of Large-Scale Urban Smoke Plumes'. In: *Air Pollution Modeling and Its Application XXIX*. Mar. 2025. DOI: 10.1007/978-3-031-70424-6_38.

International conference oral presentations

[1] C. Durand, **T. S. Finn**, A. Farchi, **M. Bocquet**, L. Bertino and J. Brajard. *Four-dimensional variational data assimilation with a sea-ice thickness emulator.* Arctic ROOS. online. February 06, 2025.

[2] **S. Cheng**, J. Min, K. Wang, S. Dance, M. Piggot, **M. Bocquet** and R. Arcucci. *Torchda: data assimilation with neural networks.* AICOMAS. Paris. February 19, 2025.

[3] **M. Bocquet**, A. Farchi, **T. S. Finn**, C. Durand, **S. Cheng**, Y. Chen, I. Pasmans and A. Carrassi. *Are ensemble-based data assimilation methods necessary for accurate filtering?* MFO workshop on data assimilation. Oberwolfach, Germany. February 24, 2024. [invited].

[4] **M. Bocquet**, A. Farchi, **T. S. Finn**, C. Durand, **S. Cheng**, Y. Chen, I. Pasmans and A. Carrassi. *Are ensemble-based data assimilation methods really necessary for accurate filtering?* ISDA-online. https://isda-online.univie.ac.at/online-events/march-2025-data-assimilation-methodology/. March 13, 2025. [online].

[5] **S. Cheng**, **M. Bocquet** and R. Arcucci. *Hybrid data assimilation and machine learning algorithms for sparse observational data.* SMASH seminar [invited]. Ljubljana, Slovenia. April 4, 2025.

[6] **M. Bocquet**, A. Farchi, **T. S. Finn**, C. Durand, **S. Cheng**, Y. Chen, I. Pasmans, A. Carrassi, M. Bonavita, P. Laloyaux, M. Chrust, J. Brajard and L. Bertino. *Machine learning for data assimilation.* ECMWF 2025 Annual Seminar. Workshop on data assimilation: initial conditions and beyond. Bonn, Germany. April 10, 2025. [invited].

[7] A. Carrassi, I. Pasmans, G. De Cillis, I. Higgs, **T. Finn**, Y. Chen, **M. Bocquet**, J. Brajard, M. Broccoli, L. Bertino, R. Bannister, S. Ciavatta, J. Skakala and S. Driscoll. *Merging DA and ML at various degrees Examples from applications to Arctic sea ice and ocean biogeochemistry.* ECMWF 2025 Annual Seminar. Workshop on data assimilation: initial conditions and beyond. Bonn, Germany. April 10, 2025. [invited].

[8] A. Farchi, M. Chrust, P. Laloyaux, M. Bonavita and **M. Bocquet**. *Development of an offline and online hybrid model for the Integrated Forecasting System.* ECMWF 2025 Annual Seminar. Workshop on data assimilation: initial conditions and beyond. Bonn, Germany. April 10, 2025. [invited].

[9] **M. Bocquet**, A. Farchi, **T. S. Finn**, C. Durand, **S. Cheng**, Y. Chen, I. Pasmans and A. Carrassi. *Learning data assimilation from artificial intelligence. Are ensemble-based data assimilation methods necessary for accurate filtering?* Mini-Symposium on Data Assimilation For Earth Systems – Femke Vossepoel's inaugural lecture. TU Delft, Delft, The Netherlands. April 16, 2025. [invited].

[10] **M. Lannes**, **Y. Roustan** and N. Coulombel. *Sensitivity analysis of a mobility – emissions – air quality – exposure modelling chain to assess individuals' exposure in metropolitan areas*. EGU General Assembly. Vienna, Austria. April 28 - May 2, 2025.

[11] **S. Cheng**, H. Fan, Y. Zhuang, **T. S. Finn**, **L. Lugon**, **K. Sartelet**, K. Duraisamy, R. Arcucci and **M. Bocquet**. *Hybrid data assimilation and machine learning algorithms for sparse observational data*. EGU [solicited talk]. Vienna, Austria. April 28 - May 2, 2025.

[12] **A. De Villeroché**, V. Le Guen, **R.-S. Mouradi**, **P. Massin**, **M. Bocquet**, **A. Farchi**, **S. Cheng** and P. Armand. *MeshGraphNets for 3D atmospheric flow in urban environment for atmospheric dispersion*. EGU. Vienna, Austria. April 28 - May 2, 2025.

[13] **M. Bocquet**, A. Farchi, **T. S. Finn**, C. Durand, **S. Cheng**, Y. Chen, I. Pasmans, A. Carrassi, M. Bonavita, P. Laloyaux, M. Chrust, J. Brajard and L. Bertino. *Artificial intelligence for data assimilation*. AI and Math for Meteorology and CLimatology. Collège de France, Paris. May 5, 2025. [invited].

[14] **A. De Villeroché**, V. Le Guen, **R.-S. Mouradi**, **P. Massin**, **M. Bocquet**, **A. Farchi**, **S. Cheng** and P. Armand. *MeshGraphNets for 3D atmospheric flow in urban environment for atmospheric dispersion*. AIFLUIDS. Chania, Greece. May 27 - May 30, 2025.

[15] **T. S. Finn**, **M. Bocquet**, P. Rampal, C. Durand, F. Porro, A. Farchi and A. Carrassi. *Going with the flow: towards physically consistent data-driven Earth system models*. ECMWF Seminar. Bonn, Germany. May 19 - May 23, 2025. [invited].

[16] **M. Bocquet**, A. Farchi, **T. S. Finn**, C. Durand, **S. Cheng**, Y. Chen, I. Pasmans and A. Carrassi. *Learning data assimilation from artificial intelligence. Are ensemble-based data assimilation methods necessary for accurate filtering?* The 20th international EnKF workshop 2025. Ullensvang, Norway. June 17, 2025. [invited].

[17] **J. Vernier**, **B. Amiot**, S. Edouard, **E. Dupont**, V. Trotin, D. Combes and **P. Massin**. *Wind and Turbulence Fields Altered by Plants and Photovoltaic Panels. What is the Impact on Plant-Air Convective Exchanges?* 25th Symposium on Boundary Layers and Turbulence. Torino, Italy. 17–20 June 2025.

[18] **S. Cheng**, **W. Yu**, H. Fan, Y. Zhuang, **T. S. Finn**, L. Lugon, K. Sartelet, K. Duraisamy, R. Arcucci and **M. Bocquet**. *Hybrid data assimilation and machine learning algorithms for sparse observational data in geoscience*. IMT-Atlantique & Kyoto University & RIKEN joint Data Assimilation workshop [keynote]. Brest, France. Juin 28, 2025.

[19] **T. S. Finn**, **M. Bocquet**, P. Rampal, C. Durand, F. Porro, A. Farchi and A. Carrassi. *Going with the flow: towards physically consistent data-driven Earth system models*. NSF LEAP: 2025 Summer Lectures in Climate Data Science. New York, United States. June 05, 2025. [invited, online].

[20] Y. Yang, X. Cheng, D. Giles, **S. Cheng**, Y. He, X. Xue, B. Chen and Y. Hu. *Tensor-Var: Variational Data Assimilation in Tensor Product Feature Space*. International Conference on Machine Learning (ICML). Vancouver, Canada. July 13 - July 19, 2025.

[21] **T. S. Finn**, **M. Bocquet**, P. Rampal, C. Durand, F. Porro, A. Farchi and A. Carrassi. *Going with the flow: towards physically consistent data-driven Earth system models*. Third Workshop on Machine Learning for Earth System Modelling. Bonn, Germany. August 25 - August 27, 2025.

[22] A. Carrassi, I. Pasmans, F. Porro, G. De Cillis, I. Higgs, S. Raciti, **T. Finn**, Y. Chen, **M. Bocquet**, J. Brajard, L. Bertino, R. Bannister, S. Ciavatta, J. Skakala, A. Barone, R. S. Pandey, M. Grenzi, A. Ortolani and C. Sgattoni. *Merging DA and ML at various degrees Examples from applications to Arctic sea ice, ocean biogeochemistry and radiative tranfer*. 11th International Symposium on Data Assimilation. Melbourne, Australia. September 29, 2025.

[23] **M. Bocquet**, A. Farchi, **T. S. Finn**, C. Durand, **S. Cheng**, **W. Yu**, Y. Chen, I. Pasmans, A. Carrassi, M. Bonavita, P. Laloyaux, M. Chrust, J. Brajard and L. Bertino. *Machine learning innovations in geophysical data assimilation*. 11th International Symposium on Data Assimilation. Melbourne, Australia. October 2, 2025. [invited, online].

[24] **M. Bocquet**, A. Farchi, **T. S. Finn**, C. Durand, **S. Cheng**, **W. Yu**, W. Chen, I. Pasmans and A. Carrassi. *Learning surrogate models and data assimilation processes for advanced geophysical dynamics forecasting*. Data Assimilation and Inverse Problems for Digital Twins. Chicago, USA. October 6, 2025. [invited].

[25] **S. Cheng**, Z. Xia, S. Abhishek, **W. Yu**, H. Sandy, F. Mouillot, R. Arcucci and **M. Bocquet**. *Towards stochastic differentiable wildfire prediction with physics- and neural-network-based models*. Numerical Wildfire and AI Weather conference 2025 [invited]. Cargèse. November 5, 2025.

[26] **T. S. Finn**, **M. Bocquet**, P. Rampal, C. Durand, F. Porro, A. Farchi and A. Carrassi. *Going with the flow: towards physically consistent data-driven Earth system models*. Seminar at GFDL. Princeton, USA. December 04, 2025. [invited, online].

[27] A. Le Bayon, Z. Wang, V. Lannuque, F. Couvidat, R. Ciuraru and **K. Sartelet**. Molecular representation of benzene SOA for 3D modelling. EGU General Assembly 2025. Vienna, Austria. DOI: 10.5194/egusphere-egu25-17378. URL: https://doi.org/10.5194/egusphere-egu25-17378. April 27–May 2, 2025, EGU25-17378.

[28] Y. Shi, F. Couvidat and **K. Sartelet**. Modeling the role of extremely low-volatile organic compounds in β-caryophyllene secondary organic aerosol formation. EGU General Assembly 2025. Vienna, Austria. DOI: 10.5194/egusphere-egu25-5620. April 27–May 2, 2025, EGU25-5620.

[29] **L. Lugon**, A. Rosso, L. Schmitz, **Y. Kim**, A. Squarcioni, **S.-J. Park**, J. Vigneron and **K. Sartelet**. Representation of anthropogenic heat flux and emissions of residential pollutants as a function of ambient temperature and implications for urban air quality. 2025 CMAS-Asia-Pacific and Regional IUAPPA Conference. Seoul, South Korea. July 3, 2025.

[30] B. D'Anna, B. Marques, B. Temime-Roussel, E. Kostenidou, L. Fine, C. Ferronato, B. Vansevenant, Y. Liu and **K. Sartelet**. Primary and secondary emissions from Euro 6 vehicles. European Aerosol Conference. Lecce, Italy. August 31–September 5, 2025.

[31] **K. Sartelet**, J. Zhong, E. Athanasopoulou, **L. Lugon**, **S.-J. Park** and R. Harrison. Service Tool for Urban Mapping and Deterministic Modelling. RI-URBANS Final Science Meeting. Barcelona, Spain. September 8–9, 2025.

[32] **L. Lugon**, **Y. Kim**, C. Kimmerlin, P. Pousset, J. Achille, F. Joly, M. Redaelli and **K. Sartelet**. Contribution of wood heating to the population exposure to regulated and emerging pollutants with a street-level resolution: An analysis in the Paris region. 23rd International Conference on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes. Hamburg, Germany. September 15–19, 2025.

[33] **K. Sartelet**, J. Kerckhoffs, E. Athanasopoulou, **L. Lugon**, J. Vasilescu, J. Zhong, G. Hoek, C. Joly, **S.-J. Park**, C. Talianu, S. van den Elshout, F. Dugay, E. Gerasopoulos, A. Ilie, Y. Kim, D. Nicolae, R. M. Harrison and T. Petäjä. Air pollution mapping and variability over five European cities. 23rd International Conference on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes. Hamburg, Germany. September 15–19, 2025.

International conference poster presentations

[1] **T. S. Finn**, **M. Bocquet**, P. Rampal et al. *Efficient generative flows unlock physical consistent surrogates*. ECMWF Annual Seminar 2025. Bonn, Germany. April 7 - April 11, 2025.

[2] Z. Xia and **S. Cheng**. *PyTorchFire: A Differentiable Cellular Automata-Based Wildfire Simulator with GPU Acceleration*. EGU. Vienna, Austria. April 28 - May 2, 2025.

[3] **A. De Villeroché**, V. Le Guen, **R.-S. Mouradi**, **P. Massin**, **M. Bocquet**, **A. Farchi**, **S. Cheng** and P. Armand. *MeshGraphNets for 3D atmospheric flow in urban environment for atmospheric dispersion*. Hi Paris summer school. Saclay, France. July 7 - July 10, 2025.

[4] **B. Cuilhé**, **M. Ferrand**, **P. Alam**, **Y. Roustan**, **E. Dupont** and **B. Carissimo**. *An operational CFD-Based approach for (fast) atmospheric dispersion modeling incorporating low-frequency meandering wind effects: validation against Prairie Grass data*. 23rd International Conference on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes, HARMO 23, Hamburg, Germany. 15-19 Sept 2025.

[5] **L. Volle**, **M. Ferrand**, **P. Massin**, A. Barbe and C. Duquennoy. *Stochastic Lagrangian Modeling of Wet Cooling Towers Rain Zones*. 23rd International Conference on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes, HARMO 23, Hamburg, Germany. 15-19 Sept 2025.

[6] **O. Jacquot**, V. Ehrlacher, T. Lelièvre and **K. Sartelet**. A Reduced Order Model for Aerosol Coagulation. EGU General Assembly 2025. Vienna, Austria. DOI: 10.5194/egusphere-egu25-11092. April 27–May 2, 2025, EGU25-11092.

National conference oral presentations

[1] C. Durand, **T. S. Finn**, **A. Farchi**, **M. Bocquet**, L. Bertino and J. Brajard. *Four-dimensional variational data assimilation with a sea-ice thickness emulator.* DRAKKAR Workshop. Grenoble, France. January 27-29, 2025.

[2] **S. Cheng**, **M. Bocquet**, **T. S. Finn**, **L. Lugon**, **A. Farchi**, **Y. Roustan**, **K. Sartelet** and R. Arcucci. *Integrating data assimilation and machine learning algorithms for sparse observational data in geoscience and air pollution.* LSCE seminar [invited]. Saclay. February 7, 2025.

[3] **S. Cheng**, **M. Bocquet**, **T. S. Finn**, **L. Lugon**, **A. Farchi**, **Y. Roustan**, **K. Sartelet** and R. Arcucci. *Combining data assimilation and machine learning for sparse observational data.* CentraleSupélec L2S seminar [invited]. Saclay. February 21, 2025.

[4] **M. Bocquet**, S. Gratton, S. Mallat, V. Chabot, **S. Cheng**, **T. S. Finn** and E. Simon. *DRUIDS: Data-driven learning of uncertainty in dynamical systems.* PEPR Maths-VivES kickoff meeting. Montpellier, France. March 24-25, 2025.

[5] **S. Cheng**, Y. Zhuang, **L. Lugon**, **K. Sartelet**, K. Duraisamy, R. Arcucci and **M. Bocquet**. *Data assimilation and machine learning for dynamical systems.* CERMICS seminaire [invited]. ENPC, France. May 28, 2025.

[6] **S. Cheng**, X. Zeyu, H. Sandy, R. Arcucci and **M. Bocquet**. *Wildfire prediction and simulation.* CentraleSupelec LGI seminaire [invited]. Saclay, France. June 12, 2025.

[7] **T. S. Finn**, **M. Bocquet**, P. Rampal, C. Durand, F. Porro, A. Farchi and A. Carrassi. *Suivre le flot: vers des modèles du système Terre physiquement cohérents basés sur l'IA*. GDR "Défis théoriques pour les sciences du climat". Toulouse, France. June 11 - June 13, 2025. [invited].

[8] **S. Cheng**, **W. Yu**, **A.** de **Villeroché**, H. Fan, Y. Zhuang, **T. S. Finn**, **L. Lugon**, **K. Sartelet**, K. Duraisamy, R. Arcucci and **M. Bocquet**. *Machine learning and data assimilation for reduced order surrogate models*. 4Vlab Seminair. La Rochelle [online], France. July 1, 2025.

[9] **M. Bocquet**, A. Farchi, **T. S. Finn**, C. Durand, **S. Cheng**, Y. Chen, I. Pasmans and A. Carrassi. *Artificial intelligence for geophysical data assimilation*. Journées GIS Lartisste. EdF Lab, Saclay, France. July 8, 2025. [invited].

[10] **M. Bocquet**, A. Farchi, **T. S. Finn**, C. Durand, **S. Cheng**, Y. Chen, I. Pasmans, Carrassi, M. Bonavita, P. Laloyaux, M. Chrust, J. Brajard and L. Bertino. *La révolution de l'IA dans la prévision numérique du temps : modèles de substitution et assimilation de données*. GRETSI'25. Palais de la Musique et des Congrès, Strasbourg, France. August 26, 2025. [invited].

[11] **M. Bocquet**, A. Farchi, **T. S. Finn**, C. Durand, **S. Cheng**, Y. Chen, I. Pasmans and A. Carrassi. *Learning data assimilation from machine learning*. Les journées de géostatistique 2025. Centre de Géosciences MINES Paris PSL, Fontainebleau. September 4, 2025. [invited].

[12] **M. Bocquet**, A. Farchi, **T. S. Finn**, C. Durand, **S. Cheng**, **W. Yu**, Y. Chen, I. Pasmans and Carrassi. *Stochastic surrogate models, data assimilation, and uncertainty quantification*. Workshop on Uncertainty Quantification for Climate Science. IHP, Paris, France. November 13, 2025. [invited].

[13] **M. Bocquet**, A. Farchi, **T. S. Finn**, C. Durand, **S. Cheng**, Y. Chen, I. Pasmans, Carrassi, M. Bonavita, P. Laloyaux, M. Chrust, J. Brajard and L. Bertino. *La révolution de l'IA dans la prévision numérique du temps : modèles de substitution et assimilation de données*. IPP Research Day, Numerical Modeling and Ecological Transition. Télécom Paris, Palaiseau, France. December 1, 2025. [invited].

[14] **S. Cheng**, Z. Xia, A. Sabnis, **W. Yu**, S. Harrison, F. Mouillot, R. Arcucci and **M. Bocquet**. *Toward Stochastic and Differentiable Wildfire Prediction Using Cellular Automata and Generative AI*. Schulmberger AI Lab (Paris) global Webnair. Online, France. December 12, 2025. [invited].

[15] **L. Lugon**, A. Rosso, L. Schmitz, **Y. Kim**, A. Squarcioni, **S.-J. Park**, J. Vigneron and **K. Sartelet**. Représentation du flux de chaleur anthropique et des émissions résidentielles en fonction de la température ambiante et implications sur la qualité de l'air urbaine. Ateliers de Modélisation de l'Atmosphère 2025. Toulouse, France. March 17–21, 2025.

Summer or winter schools

[1] **K. Sartelet**. *Fine-scale modelling*. IPSL-CGS Summer School'25. Jussieu, Paris, France. June 30–July 4, 2025; 40 on-site participants and 50 online participants. [teacher].

Committee activities

Editorial boards

[1] **S. Cheng**. Editor for the special issue *Advances in physics aware machine learning*. Computer Physics Communications.

[2] **K. Sartelet**. Editor for the special issue *Air quality research at street level*. Interjournal 'Atmospheric Chemistry and Physics' and 'Geoscientific Model Developments'.

Conference organisation

[1] **K. Sartelet**. Organisation of the annual General Assembly of the PEPR URB-HEALTH project, including the nine project stakeholders. May 2025.

[2] **K. Sartelet**. Co-organisation of the *IPSL-CGS Summer School'25: Atmospheric Chemistry and Air Quality*; 40 on-site participants and 50 online participants. Jussieu, Paris, France. June 30–July 4, 2025.

[3] R. Arcucci, T. Necker and **S. Cheng**. Co-organisation of the MLDADS workshop in 25th International Conference on Computational Science. Singapore. 24-26, Juin, 2025.

[4] **S. Cheng**. Co-organisation of the CERMICS-CEREA Seminar. France. 9, september, 2025.

Conference session chairing

[1] **K. Sartelet**. Co-chair of the session *Dispersion modelling and exposure to accidental releases*. 23rd International Conference on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes. Hamburg, Germany. September 15-19, 2025.

[2] **M. Bocquet** and M. Bonavita. *Session 2 continued: Hybrid Data Assimilation - Machine Learning*. ECMWF 2025 Annual Seminar. Workshop on data assimilation: initial conditions and beyond. Bonn, Germany. April 10, 2025.

[3] T. Necker, H. Chipilski and **S. Cheng**. *Session ' Machine Learning or Data Assimilation?'* ISDA webinar. online. July 4, 2025.

[4] C. Bishop, T. McNally, G. Hakim, R. Potthast, **M. Bocquet**, X. Wang and A. Carrassi. *Data Assimilation and Machine Learning discussion panel*. 11th International Symposium on Data Assimilation. Melbourne, Australia. October 3, 2025. [invited, online].

Scientific committees

[1] A. Chazottes, Y. Robin and **S. Cheng**. Co-animation of the IPSL SAMA theme on Data Assimilation.

[2] V. Cuesta, V. Gros and **K. Sartelet**. Co-animation of the IPSL theme on Atmospheric Composition and Air Quality.

[3] **K. Sartelet**. Member of the ANSES working group on wood heating.

[4] **K. Sartelet**. Member of the board of OSU-EFLUVE as representative of college A called 'university professors and assimilated personnel'.

[5] **K. Sartelet**. Member of the ICEO steering committee.

[6] **K. Sartelet**. Member of the scientific committee of the IPSL Centre Climat Société. Since 2025.

[7] **K. Sartelet**. Member of the E4H Council of Institut Polytechnique de Paris.

[8] **K. Sartelet**. Member of the scientific committee of the GREC francilien. Since 2025.

Thesis committees

[1] **S. Cheng**. Membre du comité suivi de thèse, Clément Lacrouts, 'Méthodes d'analyse pour la détermination des distributions de variables géophysiques : caractérisation des échanges à l'interface air-mer'. IMT Atlantique. June 3, 2025.

[2] **M. Bocquet**. Membre du comité suivi de thèse, Violette Launeau, 'Prévisions probabilistes et multivariées de variables climatiques à l'horizon décennal par modèle de diffusion et transfert d'apprentissage'. Université Paris Saclay. June 30, 2025.

[3] **Y. Roustan**. Membre du comité suivi de thèse, Kaiwen Liu, 'Source urbaines de méthane : quantification in situ et attribution par secteur'. LSCE. July 8, 2025.

[4] **M. Bocquet**. Membre du comité suivi de thèse, Bharath Shanmugasundaram, 'Application of Data Assimilation Methods to Earthquake Forecasting'. École normale supérieure. July 17, 2025.

[5] **Y. Roustan**. Membre du comité suivi de thèse, Simon Beylat, 'Calibration des paramètres d'un modèle de surface continentale à partir d'observations atmosphériques du CO_2 : méthodes et applications'. LSCE. September 8, 2025.

[6] **M. Bocquet**. Membre du comité suivi de thèse, Adrien Audren, 'Emulating Météo France's AROME Ensemble Forecasting with Machine Learning'. Université de Toulouse / Météo-France and Eviden. October 13, 2025.

[7] **M. Ferrand**. Membre du comité suivi de thèse, Corina Sanz Souhait, 'Industrialisation des modèles RANS avancés avec transferts thermiques pour la convection forcée, mixte et naturelle'. Université de Pau et des Pays de l'Adour. 13/10/2025.

[8] **M. Bocquet**. Membre du comité suivi de thèse, Francesco Fossella, 'Deep-data assimilation and deep-feature-based metric for turbulent flows'. Télécom Paris and Università degli Studi di Roma Tor Vergata. November 4, 2025.

PhD Jury

[1] **E. Dupont** and **Y. Roustan**. PhD advisors, PhD, Hanane Bounouas 'Caractérisation expérimentale et modélisation de la dispersion atmosphérique en vent faible et en milieu bâti'. École nationale des ponts et chaussées. March 14, 2025.

[2] **Y. Roustan**. Examinateur, PhD, Jean Salles-Loustau, 'Approches de modélisation inverse pour un modèle de dispersion atmosphérique lagrangien stochastique : application à la caractérisation de sources en milieu industriel complexe'. École Centrale de Lyon. June 25, 2025.

[3] **M. Bocquet** and **A. Farchi**. PhD advisors, PhD, Pierre Letournel 'Les infrasons océaniques comme traceur de la dynamique de la moyenne atmosphère : évaluation des performances des modèles atmosphériques et assimilation de données pour la prévision numérique du temps'. École nationale des ponts et chaussées. November 25, 2025.

[4] **K. Sartelet**. Rapporteuse, PhD, Meredith Dournaux. Université de Toulouse, France. March 20, 2025.

[5] **K. Sartelet**. Rapporteuse, PhD, Khaled Chekrouba. Université Paris-Saclay, France. April 7, 2025.

[6] **K. Sartelet**. Rapporteuse, PhD, Quenti Gunti. Aix-Marseille Université, France. November 13, 2025.

[7] **K. Sartelet**. Rapporteuse, PhD, Thibaud Legros. Aix-Marseille Université, France. December 17, 2025.

[8] **K. Sartelet**. Rapporteuse, PhD, Marwa Shahin. Aix-Marseille Université, France. December 18, 2025.

[9] **K. Sartelet**. Examinatrice, PhD, Nicolas Dubois. Université Paris-Est Créteil, France. December 19, 2025.

Teaching

École nationale des ponts et chaussées and affiliated masters

[1] **M. Bocquet** and **T. S. Finn**. *Introduction to Data Assimilation.* Master MOCIS and WAPE's Num2.2, and ENPC's ADOMO. (École nationale des ponts et chaussées).

[2] **S. Cheng**. *Graduate project supervision (2024-2025).* IMI Department Senior Project (IMIP2). (École nationale des ponts et chaussées).

[3] **S. Cheng**. *Statistiques numériques et analyse de données (STNUM), graduate level, lecture and pratical sessions.* IMI Department. (École nationale des ponts et chaussées).

[4] **S. Cheng**. *Introduction aux sciences des données (ISDO), undergraduate level, pratical sessions.* IMI Department. (École nationale des ponts et chaussées).

[5] **M. Ferrand**. *Mécanique des fluides incompressibles - 1.* 2nd year ENPC. École nationale des ponts et chaussées. [teacher].

[6] **M. Ferrand**. *Mécanique des fluides incompressibles - 2.* 2nd year ENPC. École nationale des ponts et chaussées. [teacher].

[7] **K. Sartelet**. *TP - modélisation de la pollution atmosphérique.* 2nd year ENPC - POLU1. École des Ponts. [teacher].

[8] **Y. Roustan**. *Externalité des transports.* Master TraDD. École Nationale des Ponts et Chaussées. [teacher].

[9] **Y. Roustan**. *Modélisation numérique.* Master SGE. UPC - UPEC - ENPC. [teacher, coordinator].

[10] **K. Sartelet**. *Atmospheric Environment and Air Quality.* 2nd year ENPC - POLU1. École des Ponts. [teacher, coordinator].

[11] **K. Sartelet**. *Emissions et dépôts des polluants atmosphériques.* 2nd year ENPC - POLU1. École des Ponts. [teacher.

[12] **K. Sartelet**. *Modélisation des aérosols.* Master SGE. UPC - UPEC - ENPC. [teacher, coordinator].

[13] **K. Sartelet**. *Visibilité et ozone stratosphérique.* 2nd year ENPC - POLU1. École des Ponts. [teacher].

[14] **K. Sartelet**. *Qualité de l'air et santé.* 2nd year ENPC - POLU1. École des Ponts. [teacher].

[15] **K. Sartelet**. *Pollution photochimique.* 2nd year ENPC - POLU1. École des Ponts. [teacher].

[16] **K. Sartelet**. *Formation des particules.* 2nd year ENPC - POLU1. École des Ponts. [teacher].

[17] **K. Sartelet**. *Qualité de l'air urbain.* 2nd year ENPC - DSOTV. École des Ponts. [teacher].

[18] **K. Sartelet**. *Conseil de département du département VET.* Ville, environnement, transport. École des Ponts. [participant].

Other schools and masters

[1] **B. Carissimo**. *Air pollutant dispersion modeling.* Master. IMT Atlantique. [teacher].

[2] **M. Ferrand**. *Mécanique des Fluides - 2.* M2FESup Génie civil. École Normale Supérieure Paris Saclay. [teacher].

[3] **Y. Kim** and Y. Zhang. *MUNICH training.* during 2025 CMAS-Asia-Pacific. Konkuk University, Seoul, South Korea. [teacher, coordinator].

[4] **P. Massin**. *Mécanique des milieux continus.* 1ère année cycle ingénieur. ENSTA Paris. [practical sessions].

[5] **P. Massin**. *Elasticité linéaire*. 1ère année cycle ingénieur. ENSTA Paris. [practical sessions].

[6] **Y. Roustan**. *Qualité de l'air et Santé*. 3rd year ENTPE. École Nationale des Travaux Publics de l'État. [teacher, coordinator].

[7] **Y. Roustan**. *Pollutions et risques*. Licence Génie Urbain. Université Gustave Eiffel. [teacher, coordinator].

Outreach

[1] **K. Sartelet**. *Participation in the round table 'Assurer l'avenir face au climat : que dit la recherche ?'* Séminaire PACIFICA–École des Ponts, Champs-sur-Marne, France. October 9–10, 2025.

[2] **K. Sartelet**. *Participation in a round table on sustainable cities*. Journées scientifiques du PEPR Villes Durables, Marseille, France. November 3–4, 2025.

[3] **K. Sartelet**. *Participation in the round table 'Villes, pollutions et changement climatique'*. 30 ans de l'IPSL, Paris, France. December 11–12, 2025.

[4] F. Martín et al. *Best practice guidelines for air quality modelling at microscale for regulatory purposes*. Contribution of **K. Sartelet** to the FAIRMODE guidance document on local-scale air quality modelling. URL: https://knowledge4policy.ec.europa.eu/sites/default/files/WG4_air_quality_modelling_microscale_guidance_document_v1.pdf. , 2025.

Prize, honours, outstanding grants

[1] **S. Cheng**, C. Quilodran-Casas, S. Ouala, **A. Farchi**, C. Liu, P. Tandeo, R. Fablet, D. Lucor, B. Iooss, J. Brajard, D. Xiao, T. Janjic, W. Ding, Y. Guo, A. Carrassi, **M. Bocquet** and R. Arcucci. ESI highly cited paper (top 1%). 2025.

[2] **T. S. Finn**, **C. Durand**, **A. Farchi**, **M. Bocquet**, P. Rampal and A. Carrassi. Selection as highlight paper in Journal of Advances in Modeling Earth Systems. URL: https://eos.org/editor-highlights/fast-adept-sea-ice-forecasts. 2025.

[3] R. Fu, D. Xiao, I. Navon, F. Fang, L. Yang, C. Wang and **S. Cheng**. Wiley top cited paper in International Journal for Numerical Methods in Engineering. 2025.

[4] **M. Bocquet**. Chevalier de l'Ordre des Palmes académiques. 2025.

[5] **L. Lugon**. Best young researcher presentation award at HARMO23 conference - Contribution of wood heating to the population exposure of regulated and emerging pollutants with a street-level resolution : an analysis in Paris region. Hamburg, 15-19/09/2025.

[6] **K. Sartelet**. Chevalier de l'Ordre des Palmes académiques. 2025.

[7] **K. Sartelet**. Appointment as Professor at École des Ponts. 2025.

[8] **L. Volle**. Best poster award at HARMO23 conference - Stochastic Lagrangian Modeling of Wet Cooling Towers Rain Zones. Hamburg, 15-19/09/2025.