

Report of research activities 2013

CEREA



CEREA - Centre d'Enseignement et de Recherche en Environnement Atmosphérique

Atmospheric Environment Center

École des Ponts ParisTech & EDF R&D

6-8 avenue Blaise Pascal – Cité Descartes
Champs-sur-Marne
77455 Marne-la-Vallée cedex 02, France

Tel.: +33 (0) 1 64 15 21 57

<http://cerea.enpc.fr>

Director: Christian Seigneur
Deputy director: Luc Musson-Genon
Deputy director: Marc Bocquet

Staff: 47 (as of 31 December 2013)

OVERVIEW

Introduction

The Atmospheric Environment Center (CEREA) is a joint laboratory of École des Ponts ParisTech and the Research & Development Branch of the French Energy Group (EDF R&D). It also hosts a joint effort with the French National Computer Science Institute (Inria, Institut national de recherche en informatique et en automatique), the Clime project-team.

CEREA has three locations in the Paris region (École des Ponts ParisTech in Champs-sur-Marne, EDF R&D in Chatou, and Inria in Rocquencourt).

Research activities cover three major areas:

- Chemistry and physics of air pollution
- Physical processes in the atmospheric boundary layer
- Data and image assimilation, inverse modeling, and monitoring network design

The overall objective is to develop a better understanding of the physics and chemistry of air pollution and of the physical processes occurring in the atmospheric boundary layer (i.e., the layer extending from the surface to about 1 to 2 km), as well as to develop novel methods for data assimilation, image assimilation, and inverse modeling in the geosciences. The strategy is based on constant interactions between theory and measurements. Information from past measurements (obtained in laboratories or in field experiments) is codified into models, which are subsequently evaluated against other observations. Improvements in our understanding of fundamental processes are then achieved via this iterative process involving measurements and modeling. Furthermore, assimilation of data and images allows one to improve model performance by combining the theoretical framework of models with the practical aspects of measurements, taking into account the uncertainties associated with both models and measurements.

CEREA conducts meteorological and tracer measurements to improve our understanding of the physical processes that govern the atmospheric flow, air pollutant dispersion, and fog formation near the ground. Those measurements are used for model evaluation and for improving parameterizations of atmospheric physical processes. Air pollution measurements are not conducted at CEREA and we collaborate with other groups to have access to such data.

To model atmospheric processes, CEREA uses primarily two numerical modeling platforms: an atmospheric Computational Fluid Dynamics (CFD) model, "Code_Saturne", to simulate physical processes in the atmospheric boundary layer and an air quality modeling system, "Polyphemus", to simulate the transport processes and physico-chemical transformations of air pollutants. The atmospheric version of Code_Saturne is developed at CEREA ; it is used to study local air pollutant dispersion and transformation, wind power estimates, fog formation, and atmosphere/buildings energy transfer. Polyphemus is also developed at CEREA; it includes an array of air quality models (Gaussian plume and puff models, Lagrangian particle model, an Eulerian chemical-transport model, Polair3D, and hybrid "plume-in-grid" models) covering various spatial scales and source types. Both modeling platforms are open source. These models are evaluated by comparison to available measurements (including those collected by CEREA) and are used to improve our understanding of atmospheric processes. They are also used at CEREA and in other organizations to conduct air pollution impact studies, investigate the effect of various emission scenarios on future air quality, and forecast air quality on a daily basis.

Examples of applications of those models to real-world case studies include the assessment of the environmental impacts of the transportation and energy production (both fossil-fuel fired and nuclear power plants) sectors. These activities are related to the programs of EDF R&D and to the activities of the working group for air issues (RST Air) of the Ministry of Ecology, Sustainable Development, and Energy (MEDDE, ministère de l'Écologie, du Développement Durable et de l'Énergie). Long-term relationships have also been developed with CEREMA (the Center for Studies and Expertise on Risk, Environment, Transportation, and Planning) for the air quality impacts of roadways, with IRSN (the French Agency for Radioprotection and Nuclear Safety) for impact studies related to radioactive releases, and with INERIS (the French Agency for the Industrial Environment and Risk Analysis) for air quality impact studies and forecasting.

The research activities devoted to data and image assimilation aim at improving the ability of models to make reliable forecasts and identifying (or refining) emission sources and other model inputs via inverse modeling. They also address other issues such as the design of optimal monitoring networks, the estimation of modeling uncertainties, the calibration of model ensembles, and the development of reduced models for efficient computing. The new data assimilation methods developed at CEREAs are not model-specific and, although they are typically tested with CEREAS models, their operational applications have included other models. Examples of operational applications include projects conducted in partnership with IRSN to characterize the emissions and potential impacts of the Fukushima nuclear power plant accidental releases, with AIRPARIF (the air quality agency of the Paris region) to develop spatial maps of air quality, and with Numtech (an air quality consulting company) to develop air quality modeling capabilities with much faster computing times.

Budget summary

The operating budget of CEREAS (excluding salaries of permanent staff) was about 700 000 € in 2013. It was about 2 500 000 € if one includes salaries of permanent staff.

Key facts

CEREAS is a member of the Environmental Science Observatory EFLUVE (Observatoire des sciences de l'univers, OSU), which includes four other laboratories of Université Paris-Est (LISA, LEESU, CERTES and the Geoscience Department of IEES).

CEREAS is also a member of the "Labex" Urban Futures, which consists of a group of thirteen laboratories conducting research on urban planning architecture, transportation, environment, and resource economics.

The Clime project-team hosts an I-Lab, which is a joint effort between Inria and a private company (Seth). This I-Lab conducts technology transfer of research tools developed at CEREAS toward their operational use in areas such as data assimilation, ensemble forecasting and uncertainty assessment.

CEREAS will become a member of "Institut Pierre-Simon Laplace" (IPSL), a federation of geoscience laboratories in the Paris region.

CEREAS leads or participates in several projects of the French National Agency for Research (ANR). CEREAS has also been awarded projects on sustainable development by the Île-de-France region (R2DS, "Réseau de recherche sur le développement soutenable").

CEREAS is an official partner of the French national air quality forecast system Prev'air (<http://www.prevoir.org>). CEREAS developed the method used to conduct improved air quality forecasts using ensemble modeling and data assimilation. Furthermore, the CEREAS air quality model (Polair3D of Polyphemus) is part of this ensemble modeling system. The Polair3D/Polyphemus forecast is available on the CEREAS web site (<http://cerea.enpc.fr/fr/prevision.html>).

At SIRTA, the experimental site for atmospheric research using remote sensing (<http://sirta.ipsl.polytechnique.fr>), CEREAS is conducting a novel experiment to study turbulence and air pollutant dispersion under stable atmospheric conditions using propene, which is released upwind of an array of fast-response monitors. Twelve sonic anemometers provide very detailed information on turbulent spectra and anisotropy, and turbulent structures transport. Several industrial and government organizations have expressed interest in participating in those experiments with their instruments.

Results

Completed projects

Four Ph.D. theses were completed in 2013. They addressed image assimilation in geoscience, atmospheric fluid dynamics using large-eddy simulation, the effect of climate change on air pollution, and the assimilation of lidar data to improve air quality forecasts.

Under a contract with the Center for Tunnel Studies (CETU), CEREAS applied its atmospheric computational fluid dynamics (CFD) model, Code_Saturne, to the atmospheric dispersion of pollutants near two road tunnel exits. At the first tunnel in Saint-Denis near Paris, the open-source Code_Saturne

model gave similar results as the proprietary CFX model. At the second tunnel in Bobigny near Paris, comparisons of both models with lidar data gave satisfactory results.

Under several programs of ANR and the French Ministry of Ecology (MEDDE), CEREAs is developing new modeling tools to simulate atmospheric dispersion and deposition of pollutants to urban watersheds. This work is conducted in collaboration with IFSTTAR (the French Institute for Science and Technology of Transportation, Planning, and Networks) and LEESU (the water engineering laboratory of École des Ponts ParisTech). Two projects were completed in 2013: the ANR INOGEV project led to the development of a novel method to calculate the deposition of air pollutants in urban settings and its application to three urban watersheds in Nantes, a Paris suburb, and Lyon; the "Ville numérique" project led to the coupling of a dynamic traffic model with various air pollutant emission models and its interfacing with an atmospheric dispersion model and a stormwater runoff model to calculate the contribution of traffic emissions to water contamination, with an application to a Paris suburban watershed.

Under the PREDIT (Research program on transportation) MOCOPO project, CEREAs evaluated its atmospheric dispersion model for traffic emissions using detailed measurements of gaseous and particulate pollutants collected near a freeway in Grenoble. This work resulted in improvements to the model to better handle population exposure upwind of a roadway.

The R2DS project funded by the Paris Region focused on the air quality impacts of biofuels from well to wheels. Its pollutant emission scenario component was completed in 2013. Work is ongoing to simulate the associated air quality impacts.

A new method, the finite-size ensemble Kalman filter (EnKF-N), was recently developed that allows one not to use arbitrary inflation parameters to account for ensemble sampling errors when applying an ensemble Kalman filter (EnKF) for data assimilation. EnKF-N was further combined with the iterative ensemble Kalman filter (IEnKF) to constitute the finite-size iterative ensemble Kalman filter (IEnKF-N), which performs as well as or better than previous EnKF algorithms and much better for strongly non-linear systems without inflation. Current work focuses on the development of a method that combines the advantages of EnKF techniques and variational techniques, but without the need of an adjoint model.

As a partner of the ADEME project CARBOSOR, CEREAs carried out the first inverse modelling study of emissions for 15 volatile organic compounds (VOC) species using ground-based measurements of the EMEP network. Uncertainty of the retrieved emissions was provided.

As one of about ten French laboratories actively working in the field of atmospheric chemistry data assimilation, CEREAs participated in the final meeting of the INSU/LEFE ADOMOCA-2 project, with a contribution to the project of 8 publications on the subject, and several contributions of the publicly available project newsletter ACHILLE.

As an extension of the Iterative ensemble Kalman filter designed for data assimilation with nonlinear models, an Iterative ensemble Kalman smoother (IEnKS) was proposed. It combines several advantages of the ensemble Kalman filter and the four-dimensional variational (4D-Var) approach in a very simple manner. As such it is called an ensemble variational method. It does not require the model adjoint and, for this reason, appears as an ideal tool for parameter estimation. Using toy-models, it was shown to significantly outperform state-of-the-art data assimilation algorithm in all regimes, for both filtering or smoothing.

Data assimilation is at the heart of many projects conducted at CEREAs. To facilitate the applications of methods developed at CEREAs and elsewhere, a generic data assimilation methods library (named "Verdandi") developed at INRIA is now available.

Ongoing projects

Work is ongoing on the use of the CFD model "Code_Saturne" to simulate heat transfer between buildings and the atmosphere. The development of accurate modeling tools to correctly assess energy transfer is essential for managing our energy consumption in buildings as a function of varying atmospheric conditions. A detailed comparison between model simulation results and experimental data was conducted for an area of the southern city of Toulouse and will continue with areas of Marseilles and Paris under a new ANR project EUREQUA, in collaboration with Météo France and other laboratories.

Work is ongoing on the contribution of on-road traffic emissions on atmospheric pollution and stormwater contamination with the ANR TRAFIPOLLU project. This work is being conducted in collaboration with IFSTTAR, LEESU, IGN (the National Geographic Institute), AIRPARIF (the air quality

agency for the Paris Region), and CEREMA. An avenue in a Paris suburb has been equipped to monitor traffic, air pollution, and stormwater contamination. Modeling results will be compared to measurements to assess model performance and, if needed, provide valuable information for model improvement.

A project funded by ADEME, conducted in collaboration with LISA (a laboratory of Université Paris-Est), is assessing the potential impacts for the time horizon of 2030 of an energy scenario, « Vision 2030-2050 », on air quality and emissions of greenhouse gases. Preliminary results were provided to ADEME in 2012 and final results are expected in 2014.

A new KIC-Climate European project was recently initiated to estimate methane (a greenhouse gas) emissions from various industrial facilities. This project is led by the British National Physical Laboratory and CEREIA will provide expertise in atmospheric dispersion modeling.

CEREIA is involved in the development and validation of methodologies for onshore and offshore wind resource assessment including the modelling of wake effect. This work is especially important in the short term for EDF-Énergies Nouvelles, which is in charge of the development of 3 offshore wind farms in France as part of a consortium including Dong and Alstom. New methodologies based on CFD models coupled with mesoscale models should allow one to reduce the uncertainty in the estimation of the annual energy production compared to the current operational tools.

Research activities on photovoltaic energy have been initiated at CEREIA. The objective consists in improving solar radiation forecast by means of ensemble forecasting methods as done for air quality forecasts.

Work is ongoing on aerosol modeling, in particular via two projects funded by ANR (SAFMED project of the Charmex program) and the French Ministry of Ecology and ADEME (NATORGA project of the GMES program). A new secondary organic aerosol model is under development to take into account the viscosity of particles and phase separation. To better represent the dynamics of particles, a new aerosol model that includes detailed representations of size-segregated chemical composition is also being developed. These two models will be integrated into Polair3D and compared to measurements obtained in the Paris region (Megapoli field campaigns) and in Corsica (Charmex field campaigns).

Models for gas and aerosol transformation processes have been incorporated in the CFD model Code_Saturne. Different levels of complexity of the chemical scheme have been compared for different background concentrations, different emission rates, and different meteorological conditions. Thus it is now possible to take into account chemical transformations in Code_Saturne simulations to assess the impact of traffic or industrial emissions on air quality.

A new ANR project (ESTIMAIR) was initiated that will investigate the propagation of uncertainties in the modeling of the impacts of on-road traffic on air quality. This work is led by CEREIA and involves the Numtech consulting company, LVMT (Laboratory for Urban and Transportation Studies) of École des Ponts ParisTech, and LMFA (Fluid Mechanics and Acoustics Laboratory) of École Centrale de Lyon.

In a collaborative effort between an experimentalist (Patrick Chazette, LSCE) and CEREIA, a lidar observation operator was developed to directly assimilate lidar signals into an air quality model to forecast PM₁₀. This approach was successfully evaluated using data from the MEGAPOLI campaign. It is being tested at the Mediterranean scale using several days of continuous lidar monitoring.

A comprehensive review of the scavenging models used in air quality models is ongoing in collaboration with IRSN. This work is based on a comprehensive cross-sensitivity analysis performed on case studies of the Fukushima and Chernobyl accidents. The aim of the study is to improve our understanding of the magnitude of the modeling uncertainties and to identify scavenging models that can be implemented in the IRSN operational modeling system .

LABORATORY STAFF

Permanent research staff and faculty

- **BOCQUET Marc**, École des Ponts ParisTech, Senior research scientist (ICPEF) and Professor, HDR
- **CARISSIMO Bertrand**, EDF R&D, Senior research scientist and Associate professor, HDR
- **DUPONT Éric**, EDF R&D, Research engineer
- **HERLIN Isabelle**, Inria, Senior research scientist (DR2)
- **HUOT Étienne**, Inria, Université de Versailles Saint-Quentin-en-Yvelines , Associate professor
- **MALLET Vivien**, Inria, Research scientist (CR1)
- **MILLIEZ Maya**, EDF R&D, Research engineer
- **MUSSON-GENON Luc**, EDF R&D, Research engineer (IGPEF)
- **ROUSTAN Yelva**, École des Ponts ParisTech, Research scientist (CR1)
- **SARTELET Karine**, École des Ponts ParisTech, Research scientist (CR1), HDR
- **SEIGNEUR Christian**, École des Ponts ParisTech, Director and Professor, HDR

External collaborators

- **BÉRÉZIAT Dominique**, Université Pierre-et-Marie-Curie, Associate professor, HDR
- **ZHUK Sergey**, IBM Research Dublin, Ireland, Research scientist
- **ZHANG Yang**, North Carolina State University, USA, Professor

Post-doctoral scientists

- **BECERRA-BARAUD Giuliana**, École des Ponts ParisTech
- **CHAHINE ALI**, École des Ponts ParisTech
- **COUVIDAT Florian**, École des Ponts ParisTech
- **DUHANYAN Nora**, École des Ponts ParisTech
- **GIRARD Sylvain**, Inria/IRSN
- **GIRAULT Laëtitia**, École des Ponts ParisTech
- **HERGAULT Virginie**, École des Ponts ParisTech
- **QU Yongfeng**, École des Ponts ParisTech
- **QUÉREL Arnaud**, École des Ponts ParisTech
- **YAN Nicolas**, École des Ponts ParisTech

Ph.D. students

- **ABDALLAH Charbel**, École des Ponts ParisTech, ED SIE
- **BAUDIN Paul**, Inria, ED Sciences Mathématiques Paris Centre
- **CHERIN Nicolas**, École des Ponts ParisTech, ED SIE
- **DALL'OZZO Cédric**, EDF R&D, ED SIE
- **DAVIAU-PELLEGRIN Noëlie**, EDF R&D, ED SIE
- **DESCHAMPS Stéphanie**, École des Ponts ParisTech, ED SIE
- **DRIFI Karim**, Inria, ED Sciences Mathématiques Paris Centre
- **DURAISAMY Venkatesh**, EDF R&D, ED SIE
- **FALLAH SHORSHANI Masoud**, IFSTTAR, ED SIE
- **HAUSSAIRE Jean-Matthieu**, École des Ponts ParisTech, ED SIE
- **LECOEUR Ève**, École des Ponts ParisTech, ED SIE
- **LEPOITTEVIN Yann**, Inria, ED Sciences Mathématiques Paris Centre
- **LOIZEAU Vincent**, EDF R&D, ED SIE
- **MAKKÉ Laurent**, École des Ponts ParisTech, ED SIE
- **THOREY Jean**, Inria, ED Sciences Mathématiques Paris Centre
- **THOURON Laëtitia**, École des Ponts ParisTech, ED SIE
- **WANG Yiguo**, CEA, ED École Polytechnique

- **WEI Xiao**, EDF R&D, ED SIE
- **WINIAREK Victor**, École des Ponts ParisTech, ED SIE
- **ZHU Shupeng**, École des Ponts ParisTech, ED SIE

Interns

- **PEROTIN Tristan**, Inria
- **SOUMARÉ Canelle**, EDF R&D
- **WELSCH Thomas**, École des Ponts ParisTech

Engineers, administrative staff, and technicians

Engineers

- **BRESSON Raphaël**, EDF R&D, Engineer
- **DEMENGEL Dominique**, EDF R&D, Engineer
- **DORÉ Sylvain**, École des Ponts ParisTech, Engineer
- **DREVET Jérôme**, École des Ponts ParisTech, Engineer
- **FROGER David**, Inria, Engineer
- **GILBERT Éric**, EDF R&D, Engineer
- **LEFRANC Yannick**, EDF R&D, Engineer
- **PÉRILLAT Raphaël**, Inria, Engineer
- **TILLOY Anne**, Inria, Engineer
- **WENDUM Denis**, EDF R&D, Engineer
- **ZAÏDI Hanane**, École des Ponts ParisTech, Engineer

Administrative staff

- **DEHLINGER Véronique**, École des Ponts ParisTech
- **GAUDECHOUX Nathalie**, Inria

Technicians

- **FAUCHEUX Aurélien**, École des Ponts ParisTech
- **ROZBORSKI Sébastien**, EDF R&D

RESEARCH

Publications

Articles in peer-reviewed international journals

- **Bocquet, M.**, P. Sakov. Joint state and parameter estimation with an iterative ensemble Kalman smoother, *Nonlin. Processes Geophys.*, **20**, 803-818, 2013, doi:10.5194/npg-20-803-2013.
- **Briant, R., C. Seigneur.** Multi-scale modeling of roadway air quality impacts: development and evaluation of a plume-in-grid model, *Atmos. Environ.*, **68**, 162-173, 2013, doi:10.1016/j.atmosenv.2012.11.058.
- **Briant, R., C. Seigneur,** M. Gadrat, C. Bugajny. Evaluation of roadway Gaussian plume models with large-scale measurement campaigns, *Geosci. Model Dev.*, **6**, 445-456, 2013, doi:10.5194/gmd-6-445-2013.
- Chapelle, D., M. Fragu, **V. Mallet,** P. Moireau. Fundamental principles of data assimilation underlying the Verdandi library: applications to biophysical model personalization within euHeart, *Med. Biol. Eng. Comput.*, **51**, 1221-1233, 2013, doi:10.1007/s11517-012-0969-6.
- **Couvidat, F., Y. Kim, K. Sartelet, C. Seigneur,** N. Marchand, J. Sciare. Modeling secondary organic aerosol in an urban area: application to Paris, France, *Atmos. Chem. Phys.*, **13**, 983-996, 2013, doi:10.1021/es3034318.
- **Couvidat, F., K. Sartelet, C. Seigneur.** Investigating the impact of aqueous-phase chemistry and wet deposition on organic aerosol formation using a molecular surrogate modeling approach, *Environ. Sci. Technol.*, **47**, 914-922, 2013, doi:10.1021/es3034318.
- **Dergaoui, H, É. Debry, K. Sartelet, C. Seigneur.** Modeling coagulation of externally mixed particles: sectional approach for both size and chemical composition, *J. Aerosol Sci.*, **58**, 17-32, 2013, doi:10.1016/j.jaerosci.2012.11.007.
- **Devilliers, M., É. Debry, K. Sartelet, C. Seigneur.** A new algorithm to solve condensation/evaporation for ultra fine, fine, and coarse particles, *J. Aerosol Sci.*, **55**, 116-136, 2013, doi: 10.1016/j.jaerosci.2012.08.005,
- **Kim, Y., K. Sartelet,** J.-C. Raut, P. Chazette. Evaluation of the Weather Research and Forecast/urban model over Greater Paris, *Boundary Layer Meteorol.*, **149**, 105-132, 2013, doi:10.1007/s10546-013-9838-6.
- **Koohkan, R.M., M. Bocquet, Y. Roustan, Y. Kim, C. Seigneur.** Estimation of volatile organic compound emissions for Europe using data assimilation, *Atmos. Chem. Phys.*, **13**, 5887-5905, 2013, doi:10.5194/acp-13-5887-2013.
- **Lecoeur, È, C. Seigneur,** Dynamic evaluation of a multi-year model simulation of particulate matter concentrations over Europe, *Atmos. Chem. Phys.*, **13**, 4319-4337, 2013, doi:10.5194/acp-13-4319.
- **Mallet, V.,** A. Nakonechny, **S. Zhuk.** Minimax filtering for sequential aggregation – Application to ensemble forecast of ozone analyses, *J. Geophys. Res. Atmos.*, **118**, 11294-11303, 2013, doi:10.1002/jgrd.50751.
- Saunier, O., A. Mathieu, D. Didier, M. Tombette, D. Quélo, **V. Winiarek, M. Bocquet.** An inverse modeling method to assess the source term of the Fukushima nuclear power plant accident using gamma dose rate observations, *Atmos. Chem. Phys.*, **13**, 11403-11421, 2013, doi:10.5194/acp-13-11403-2013.
- Solazzo, E., R. Bianconi, G. Pirovano, M. D. Moran, R. Vautard, C. Hogrefe, V. Matthias, P. Grossi, K. W. Appel, B. Bessagnet, J. Brandt, C. Chemel, J. H. Christensen, R. Forkel, X. V. Francis, A. Hansen, S. McKeen, U. Nopmongkol, M. Prank, **K. N. Sartelet,** A. Segers, J. D. Silver, G. Yarwood, J. Werhahn, J. Zhang, S. T. Rao, and S. Galmarini. Evaluating the capability of regional scale air quality models to capture the vertical distribution of pollutants, *Geosci. Model Dev.* **6**, 791-818, 2013, doi:10.5194/gmd-6-791-2013.
- **Tilloy, A., V. Mallet,** D. Poulet, C. Pesin, F. Brocheton. BLUE-Based NO₂ data assimilation at urban scale, *J. Geophys. Res.*, **118**, 2013-2040, 2013, doi:10.1002/jgrd.50233.
- **Waked, A., C. Seigneur, F. Couvidat, Y. Kim, K. Sartelet,** C. Afif, A. Borbon, P. Formenti, S. Sauvage. Modeling air pollution in Lebanon: evaluation at a suburban site in Beirut in summer, *Atmos. Chem. Phys.*, **13**, 5873-5886, 2013, doi:10.5194/acp-13-5873-2013.
- **Waked, A.,** C. Afif, J. Brioude, P. Formenti, S. Chevaillier, I. el Haddad, J.-F. Doussin, A. Borbon, **C. Seigneur.** Fine organic aerosols collected at a semi-urban site in Beirut in the winter of 2012, *Aerosol Sci. Technol.*, **47**, 1258-1266, 2013, doi: 10.1080/02786826.2013.831975.

- Wu, L., **M. Bocquet**, F. Chevallier, T. Lauvaux, K. Davis. Hyperparameter estimation for uncertainty quantification in mesoscale carbon dioxide inversions., *Tellus B*, **65**, 20894, 2013, doi.org/10.3402/tellusb.v65i0.20894.
- **Wang, Y., K.N. Sartelet, M. Bocquet**, P. Chazette. Assimilation of ground versus lidar observations for PM10 forecasting, *Atmos. Chem. Phys.*, **13**, 269-283, 2013, doi:10.5194/acp-13-269-2013
- **Zaïdi, H., É. Dupont, M. Milliez, B. Carissimo, L. Musson-Genon**. Numerical simulations of the microscale heterogeneities of turbulence observed on a complex site, *Boundary-Layer Meteorol.*, **147**, 237-259, 2013, doi:10.1007/s10546-012-9783-9.
- Zhang, Y., **K. Sartelet**, S.-Y. Wu, **C. Seigneur**. Application of WRF/Chem-MADRID and WRF/Polyphemus in Europe, Part I: Model description, evaluation of meteorological predictions, and aerosol-meteorology interactions, *Atmos. Chem. Phys.*, **13**, 6807-6843, 2013, doi:10.5194/acp-13-6807-2013.
- Zhang, Y., **K. Sartelet**, S. Zhu, W. Wang, S.-Y. Wu, X. Zhang, K. Wang, **P. Tran, C. Seigneur**, Z.-F. Wang. Application of WRF/Chem-MADRID and WRF/Polyphemus in Europe, Part II: Evaluation of chemical concentrations and sensitivity simulations, *Atmos. Chem. Phys.*, **13**, 6845-6875, 2013, doi:10.5194/acp-13-6845-2013.

Articles in other journals

- Mathieu, A., I. Korsakissok, D. Quélo, O. Saunier, J. Groëll, D. Didier, D. Corbin, J. Denis, M. Tombette, **V. Winiarek, M. Bocquet**, E. Quentric, J.-P. Benoit, État de la modélisation pour simuler l'accident nucléaire de la centrale Fukushima Daiichi, *Pollut. Atmos.*, **217** (2013).
- **Bocquet, M.** Modélisation numérique de la dispersion atmosphérique accidentelle des radionucléides : l'état de l'art de la recherche. Revue du Centre de Défense NBC, **3**, 47-49, 2013, <http://www.cdnbc.terre.defense.gouv.fr>

International conference proceedings

- Baklanov, A., K.H. Schlünzen, P. Suppan, J. Baldasano, D. Brunner, M. Gauss, A. Maurizi, N. Moussiopoulos, **C. Seigneur**, X. Kong, O. Jorba, S. Joffre et al. Online integrated meteorology-chemistry models: needs and benefits for numerical weather prediction, air quality and climate communities (European experience), 33rd International Technical Meeting on Air Pollution and its Application, 26-30 August 2013, Miami, Florida, USA.
- **Huot, E., I. Herlin, G. Papari**, Optimal Orthogonal Basis and Image Assimilation: Motion Modeling, in "ICCV - International Conference on Computer Vision", , IEEE, December 2013, Sydney, Australia
- **Huot, E., I. Herlin, G. Papari, K. Drifi**, Surface Circulation from Satellite Images: Reduced Model of the Black Sea, in "Integrated system of the Black and Azov seas' monitoring international conference", September 2013, National Academy of Science of Ukraine, Kiev, Ukraine.
- **Lepoittevin, Y., D. Bereziat, I. Herlin**, N. Mercier, Continuous tracking of structures from an image sequence, in "VISAPP - 9th International Conference on Computer Vision Theory and Applications", Barcelone, Spain, Springer Verlag, February 2013, pp. 386–389.
- **Lepoittevin, Y., I. Herlin, D. Bereziat**, Object's tracking by advection of a distance map, in "ICIP - IEEE International Conference on Image Processing", Melbourne, Australia, IEEE, September 2013, pp. 3612-3616.
- **Mallet, V., A. Tilloy**, D. Poulet, F. Brocheton, Reduction and emulation of ADMS Urban, in "HARMO 15 - 15th International Conference on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes", , May 2013, Madrid, Spain.

National conference proceedings

- **Deschamps S, Sartelet K.**, Modélisation de la qualité de l'air : nombre de particules, 28^{ème} congrès français sur les aérosols, CFA 2013, 23-24 January 2013, Paris, France.
- **Lecoeur, È., C. Seigneur**, L. Terray, C. Pagé, Sensibilité des concentrations de PM_{2.5} au changement climatique sur l'Europe, 28^{ème} congrès français sur les aérosols, CFA 2013, 23-24 January 2013, Paris, France.
- **Lepoittevin Y., I. Herlin, D. Bereziat**, Assimilation de données pour estimer le mouvement et suivre un objet, in "ORASIS - Journées francophones des jeunes chercheurs en vision par ordinateur", Le2i UMR CNRS 6306, June 2013, Cluny, France.

International conference oral and poster presentations

- **Bocquet M**, P. Sakov, An iterative ensemble Kalman smoother, in "WMO Symposium on Data Assimilation", October 2013, College Park, Maryland, U.S.A.
- Bonhomme, C., **M. Fallahshorshani**, M. André, **C. Seigneur**. A multi-media approach to environmental impacts of road traffic in urban areas, Urban Futures Conference, "Emerging interdisciplinary challenges for understanding, planning and creating the cities of tomorrow", 16-18 January 2013, Université Paris-Est, Champs-sur-Marne, France.
- **Huot E., G. Papari, I. Herlin, K. Drifi**, Motion estimation on ocean satellite images by data assimilation in a wavelets reduced model, in "EGU - European Geosciences Union General Assembly", , April 2013, Vienna, Austria.
- **Lecoeur, È., C. Seigneur**, C. Pagé, L. Terray. A statistical method to estimate PM2.5 concentrations over Europe from meteorology and its application to the effect of climate change, European Geosciences Union General Assembly 2013, 8-12 April 2013, Vienna, Austria.
- **Bocquet, M.**, P. Sakov, New developments in ensemble Kalman filtering and smoothing where a Bayesian approach gives an advantage, Probabilistic Approaches to Data Assimilation for Earth Systems, 17-22 February 2013, Banff, Canada.
- **Bocquet, M.**, P. Sakov, The iterative ensemble Kalman smoother: The best of both worlds, GDRE ConEDP Meeting 2013, 9-11 April 2013, Grenoble, France.
- **Roustan, Y., N. Duhanyan, M. Bocquet, V. Winiarek**, Revisiting the radionuclide atmospheric dispersion event of the Chernobyl disaster - modelling sensitivity and data assimilation, European Geosciences Union General Assembly, 7-12 April 2013, Vienna, Austria.
- Saunier, O., A. Mathieu, D. Didier, M. Tombette, D. Quélo, **V. Winiarek, M. Bocquet**, The Fukushima releases: an inverse modelling approach to assess the source term by using gamma dose rate observations, European Geosciences Union General Assembly, 7-12 April 2013, Vienna.
- **Winiarek, V., M. Bocquet, N. Duhanyan, Y. Roustan**, Estimation of the Cesium-137 Source Term from the Fukushima Daiichi Power Plant Using Air Concentration and Deposition Data, HARMO 15, 15th International Conference on Harmonisation within Atmospheric, Dispersion Modelling for Regulatory Purposes, 6-9 May 2013, Madrid, Spain.
- Saunier, O., A. Mathieu, D. Didier, M. Tombette, D. Quélo, **V. Winiarek, M. Bocquet**, USING Gamma dose rate monitoring with inverse modeling techniques to estimate the atmospheric release of a nuclear power plant accident: application to the Fukushima case, HARMO 15, 15th International Conference on Harmonisation within Atmospheric, Dispersion Modelling for Regulatory Purposes, 6-9 May 2013, Madrid, Spain.
- **Bocquet, M.**, P. Sakov, An iterative ensemble Kalman smoother, 8th EnKF workshop, 27-29 May 2013, Bergen, Norway.

- Sakov, P., **M. Bocquet**, Ensemble redrawing in strongly nonlinear systems, 8th EnKF workshop, 27-29 May 2013, Bergen, Norway.
- **Bocquet, M.**, P. Sakov, An iterative ensemble Kalman smoother, WMO Symposium on Data Assimilation, 7-11 October 2013, College Park, Maryland, USA.
- **Winiarek, V., M. Bocquet, N. Duhanyan, Y. Roustan, O. Saunier, and A. Mathieu**, Estimation of the Cesium-137 Source Term from the Fukushima Daiichi Power Plant Using Air Concentration and Deposition Data, European Geosciences Union General Assembly, 7-12 April 2013, Vienna, Austria.
- **Wang, Y., K.N. Sartelet, M. Bocquet, P. Chazette**, Comparison of aerosol modeling with lidar observations and assimilation for aerosol forecasting, European Geosciences Union General Assembly, 7-12 April 2013, Vienna, Austria.
- **Bocquet, M.**, Ensemble Kalman Filtering Without the Intrinsic Need for Inflation, WMO Symposium on Data Assimilation, 7-11 October 2013, College Park, Maryland, USA.
- **Koohkan, M. R., M. Bocquet**, Accounting for Representativeness Errors in the Inversion of Atmospheric Constituent Emissions, WMO Symposium on Data Assimilation, 7-11 October 2013, College Park, Maryland, USA.
- Gray, M., Petit, C., Rodionov, S., Bertino, L., **Bocquet, M.**, Fusco, T., Local ensemble transform Kalman filter: a non-stationary control law for complex adaptive optics systems on ELTS, AO4ELT3 Conference, 26-31 May 2013, Florence, Italy.
- Dulac, F. et al., Overview of the Project ChArMEx activities on Saharan Dust in the Mediterranean region. 7th International Workshop on Sand/Duststorms and Associated Dustfall, 2-4 December 2013, Frascati, Italy.
- **Deschamps S, Sartelet K.**, Modeling of air quality: number of particles. European Aerosol Conference, 1-6 September 2013, Prague, Czech Republic.
- **Loizeau, V.**, P. Ciffroy, **L. Musson Genon, Y. Roustan**. Identification of sensitive parameters in the modeling of SVOCs reemission processes from soil to atmosphere. European Geosciences Union General Assembly, 7-12 April 2013, Vienna.
- **Quérel, A.**, P. Lemaitre, M. Monier, E. Porcheron, A. Flossmann, **Y. Roustan**, D. Quélo. Study of aerosol particle scavenging by rain at microphysical scale in case of a nuclear contamination of the atmosphere and implementation in a dispersion model. Workshop on Aerosol emission and deposition fluxes from and onto environmental surfaces in urban and rural areas, 31 August 2013, Prague, Czech Republic.
- **Roustan, Y.**. Prospective modelling, what we have and what we dream of, AirMonTech workshop, Current and Future Urban Air Quality Monitoring, 4-6 March 2013, Duisburg, Germany.
- **Duraisamy Jothiprakasham V., E. Dupont, B. Carissimo**, Downscaling wind energy resource from mesoscale to CFD model and data assimilating field measurements into CFD model. European Wind Energy Association Conference, 4-7 February 2013, Vienna, Austria.
- **Wei X., Dupont E., Carissimo B., Gilbert E., Musson-Genon L.**, A preliminary analysis of measurements from a near-field pollutants dispersion campaign in a stratified surface layer. HARMO 15, 15th International Conference on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes, 6-9 May 2013, Madrid, Spain.
- **Qu Y., Milliez M., Musson-Genon L., Carissimo B.**, Numerical simulations of pollutant dispersion in the centre of a European city for different thermal transfer conditions. **HARMO 15**, 15th International Conference on Harmonisation within Atmospheric, Dispersion Modelling for Regulatory Purposes, 6-9 May 2013, Madrid, Spain.

- **Dall'Ozzo C., Carissimo B., Milliez M., Musson-Genon L., Dupont E.,** Large-eddy simulation of the diurnal cycle of the atmospheric boundary layer and influence of the radiative forcing during the Wangara experiment. European Geosciences Union General Assembly, 7-12 April 2013, Vienna, Austria.

National conference oral and poster presentations

- Maro, D., **C. Seigneur, N. Cherin,** D. Herbert, P. Laguionie, B. Letellier, M. Milliet, S. Percot, P. Roupsard, **Y. Roustan,** M. Rozet, V. Ruban, L. Solier. Caractérisation des sources de polluants atmosphériques et de leurs dépôts sur les surfaces : contexte et objectifs, Colloque « Quelles innovations pour la gestion durable des eaux pluviales en milieu urbain ? », 3-5 December 2013, Nantes, France.
- **Roustan, Y., N. Cherin,** S. Percot, V. Ruban, **C. Seigneur.** Source et concentrations des polluants en milieu urbain, Colloque « Quelles innovations pour la gestion durable des eaux pluviales en milieu urbain ? », 3-5 December 2013, Nantes, France.
- **Roustan, Y., N. Cherin,** D. Herbert, P. Laguionie, B. Letellier, D. Maro, S. Percot, P. Roupsard, V. Ruban, **C. Seigneur.** Dépôts des polluants en milieu urbain sous forme particulaire par temps sec, Colloque « Quelles innovations pour la gestion durable des eaux pluviales en milieu urbain ? », 3-5 December 2013, Nantes, France.
- Laguionie, P., **Y. Roustan,** D. Maro, **C. Seigneur, N. Duhanian,** P. Roupsard, S. Percot, D. Herbert, B. Letellier, V. Ruban. Dépôts des polluants en milieu urbain sous forme particulaire par temps de pluie, Colloque « Quelles innovations pour la gestion durable des eaux pluviales en milieu urbain ? », 3-5 December 2013, Nantes, France.
- **Seigneur, C., N. Cherin,** D. Herbert, P. Laguionie, B. Letellier, D. Maro, S. Percot, P. Roupsard, **Y. Roustan,** V. Ruban. Caractérisation des sources de polluants atmosphériques et de leurs dépôts sur les surfaces : synthèse et perspectives, Colloque « Quelles innovations pour la gestion durable des eaux pluviales en milieu urbain ? », 3-5 December 2013, Nantes, France.
- **Bocquet, M,** Inverse modelling of model parameters: Application to atmospheric transport and chemistry, LEFE-MANU workshop, 12 February 2013, INRIA, Paris, France.
- **Wang, Y., K.N. Sartelet, M. Bocquet,** P. Chazette, Assimilation of lidar observations for PM₁₀ forecasting, ADOMOCA-2 meeting, 13-15 May 2013, Les Lecques, France.

Committee activities

Editorial boards

- **Bocquet M.,** Associate Editor, "Quartely Journal of the Royal Meteorological Society"
- **Musson-Genon L.,** Scientific Committee, « Pollution Atmosphérique »

International conference committees

- **Milliez, M.,** Co-organization of the Second International Open Workshop on Local-scale Airborne Hazards Modelling and Emergency Response, COST Action ES-1006, 13 June 2013, Paris, France.
- **Seigneur, C.,** Organization Committee, Urban Futures Conference, 2012-2013, Université Paris-Est.
- Blum, J., Talagrand, O., **Bocquet, M.,** Symposium Open session on Data Assimilation. MCPIT 2013, GDRE ConEDP, 19 November 2013, Institut Henri Poincaré, Paris, France.

National conference committees

- LEFE-MANU workshop, Que peuvent attendre les modélisateurs de l'assimilation de données ? F. Chevallier, J. Verron, M. Bocquet, 12 February 2013, INRIA, Paris, France.

Conference session chairs

- **Seigneur, C.**, Session on Urban environmental modeling, Urban Futures Conference, January 2013, Université Paris-Est.

Scientific committees

- **Bocquet M.** Scientific committee, European Center for Scientific Computing (CERFACS).
- **Bocquet M.** Co-chair: Scientific Committee of the "Mathematical and numerical methods" (MANU) activity of the research program, "Les enveloppes fluides et l'environnement" (LEFE) of the National Institute of Earth and Space Science (INSU)
- **Demengel D., E. Dupont, I. Herlin, Y. Roustan, C. Seigneur.** Council, EFLUVE Observatory (Observatoire des sciences de l'univers ; Enveloppes fluides : de la ville à l'exobiologie).
- **Dupont E., L. Musson-Genon, K. Sartelet L.:** Scientific Committee, "Site instrumental de recherche par télédétection atmosphérique" (SIRTA).
- **Dupont E., Musson-Genon L., Seigneur C. :** Scientific Committee OSU EFLUVE.
- **Herlin I.,** Scientific Council of the High Council for Strategic Education and Research in France (CSFRS)
- **Milliez M.** Management Committee of the Earth System Science and Environmental Management Domain, COST Action ES-10-06, "Evaluation, improvement and guidance for the use of local-scale emergency prediction and response tools for airborne hazards in built environment".
- **Sartelet K.** Scientific Committee of the "Atmospheric Chemistry" (CHAT) activity of the research program "Les enveloppes fluides et l'environnement" (LEFE) of the National Institute of Earth and Space Science (INSU).
- **Seigneur C.** Expert Committee (CES) for the risk assessment of air pollutants, French Agency for Food, Environmental and Occupational Health & Safety (ANSES).
- **Seigneur C.** General Assembly of the Air Quality Agency for the Paris Region (AIRPARIF).
- **Seigneur C.** Management Committee of the Earth System Science and Environmental Management Domain, COST Action ES-10-04, "European framework for online integrated air quality and meteorological modelling".
- **Seigneur C.** National Funding Commission (CNA) for climate, air and energy of the Agency for Environment and Energy Management (ADEME).
- **Seigneur C.** Scientific Advisory Committee of Interagency Research Program for Improved Local Air Quality (PRIMEQUAL).
- **Seigneur C.,** Scientific Committee of the Chronic Risk Division (DRC) of the National Institute of Industrial Environment and Risk (INERIS).

- **Seigneur C.** Scientific Committee of the Global Monitoring for Environment and Security (GMES) program of the Ministry of Ecology, Sustainable Development, and Energy (GMES-MDD).
- **Seigneur C.** Scientific and Steering Committee of the Excellence Laboratory (Labex) “Urban Futures”.

Thesis committees

- **Bocquet, M.**, Ph.D. thesis, Benjamin Gaubert, « Assimilation des observations pour la modélisation de la qualité de l’air », Université Paris Diderot, Créteil, France, 8 July 2013.
- **Bocquet, M.**, Ph.D. thesis, Bertrand Bonan, « Assimilation de données pour l'initialisation et l'estimation de paramètres d'un modèle d'évolution de calotte polaire », Université Joseph Fourier, Grenoble, France, 15 November 2013.
- **Seigneur C.** Ph.D. thesis, Warda Ait-Helal, « Les composés organiques gazeux en périphérie de deux mégapoles, Paris et Los Angeles : Sources, variabilité et impact sur l'aérosol organique secondaire », École des Mines de Douai et Université de Lille 1, 17 June 2013.
- **Seigneur, C.** Ph.D. thesis, Camille Mouchel-Vallon, « La chimie des composés organiques dans les nuages : Modélisation explicite multiphasique », Université Paris-Est, 2 July 2013.
- **Seigneur C.** Ph.D. thesis, Thamara Vieira da Rocha, « Quantification des erreurs associées à l’usage de trajectoires simplifiées, issues de modèles de trafic, pour le calcul de la consommation en carburant », École Nationale des Travaux Publics de l’État, 7 November 2013.
- **Seigneur C.** Ph.D. thesis, Lola Brégonzio, « Formation d’aérosols organiques secondaires au cours de la photooxydation multiphasique de l’isoprène », Université Paris-Est, 19 December 2013.

HDR committees

- **Carissimo B.**, HDR, Lionel Soulhac, “Écoulement et dispersion turbulente dans la couche limite atmosphérique », 19 November 2013, École Centrale de Lyon, France.

EDUCATIONAL ACTIVITIES

Supervision of Ph.D. theses

Completed Ph.D. theses

- **DALL’OZZO Cédric.** Mathematical modeling of complex atmospheric flows with large eddy simulation (Modélisation d’écoulements atmosphériques complexes par la simulation des grandes échelles). Advisor: Bertrand Carissimo; co-advisor: Luc Musson-Genon. ED SIE.
- **DRIFI Karim.** Motion estimation using data assimilation in reduced order models (Estimation du mouvement par assimilation de données dans des modèles dynamiques d’ordre réduit). Advisor: Isabelle Herlin. ED Sciences Mathématiques Paris-Centre.
- **LECOEUR Ève.** Effect of climate change on air quality in Europe (Influence de l’évolution climatique sur la qualité de l’air en Europe). Advisor: Christian Seigneur; co-advisor: Laurent Terray, CERFACS. ED SIE.
- **WANG Yiguo.** A new approach for air quality modeling at the regional scale with lidar data assimilation (Une nouvelle approche de modélisation de la qualité de l’air à l’échelle régionale par

assimilation de mesures lidar). Advisor: Marc Bocquet; co-advisors: Patrick Chazette, LSCE, CEA, Karine Sartelet. ED École Polytechnique.

Ongoing Ph.D. theses

- **ABDALLAH Charbel.** Characterization of aerosol mass and number concentrations in Beirut, Lebanon (Caractérisation des aerosols (masse et nombre) à Beyrouth, Liban). Advisor: Karine Sartelet; co-advisor: Charbel Afif, Université Saint-Joseph, Beirut, Lebanon. ED SIE.
- **BAUDIN Paul.** Sequential aggregation of predictors applied to air quality forecasting (Agrégation séquentielle de prédicteurs appliquée à la prévision de la qualité de l'air). Advisor: Isabelle Herlin; co-advisors: Vivien Mallet, Gilles Stoltz. ED Sciences Mathématiques Paris Centre.
- **CHERIN Nicolas.** Characterization of air pollution sources and pollutant deposition onto urban watersheds (Caractérisation des sources de polluants atmosphériques et de leurs dépôts sur les bassins versants urbains). Advisor: Christian Seigneur; co-advisor: Yelva Roustan. ED SIE.
- **DAVIAU-PELLEGRIN Noëlie.** Fine-scale modeling of heat transfer between buildings and the atmosphere (Étude fine des échanges énergétiques entre les bâtiments et l'atmosphère). Advisor: Bertrand Carissimo; co-advisor: Maya Milliez. ED SIE.
- **DESCHAMPS Stéphanie.** Air quality modeling: particles number concentrations (Modélisation de la qualité de l'air : nombre de particules). Advisor: Karine Sartelet. ED SIE.
- **DURASAMY JOTHIPRAKASAM Venkatesh.** Downscaling the wind energy resource in complex terrain using a coupled mesoscale microscale CDF modeling system including wake effect (Descente d'échelle de l'énergie éolienne en terrain complexe avec un code de mécanique des fluides avec effet de sillage). Advisor: Bertrand Carissimo; co-advisor: Éric Dupont. ED SIE.
- **FALLAH SHORSHANI Masoud.** Modeling air pollution from road traffic in urban areas (Modélisation de la pollution atmosphérique liée à la circulation automobile en zone urbaine). Advisor: Christian Seigneur; co-advisors: Michel André, IFSTTAR, Céline Bonhomme, LEESU. ED SIE.
- **HAUSSAIRE Jean-Mathieu.** Ensemble variational methods for inverse modeling in geoscience: Application to atmospheric transport and chemistry (Méthodes variationnelles d'ensemble pour la modélisation inverse en géosciences. Application au transport et à la chimie atmosphérique). Advisor: Marc Bocquet, ED SIE.
- **LEPOITTEVIN Yann.** Tracking of images structures (Suivi des structures d'images). Advisor: Isabelle Herlin. ED Sciences Mathématiques Paris Centre.
- **LOIZEAU Vincent.** Modeling of soil atmosphere exchange for POPs and mercury (Modélisation des échanges sol-atmosphère pour les polluants organiques et le mercure). Advisor: Marc Bocquet; co-advisors: Philippe Ciffroy, LNHE, EDF R&D, Luc Musson-Genon, Yelva Roustan. ED SIE.
- **MAKKÉ Laurent.** 3D fog modeling (Modélisation 3D des rétroactions microphysiques de l'eau, turbulence, rayonnement dans les nuages bas). Advisor: Bertrand Carissimo; co-advisors: Maya Milliez, Luc Musson-Genon. ED SIE.
- **THOREY Jean.** Ensemble forecasting of solar radiation for the photovoltaic production of EDF (Prévision d'ensemble du rayonnement solaire pour la production photovoltaïque du parc EDF). Advisor: Isabelle Herlin ; co-advisor: Vivien Mallet, ED Sciences Mathématiques Paris-Centre.
- **THOURON Laëtita.** Dynamic modeling of the transfer of pollutants emitted from on-road traffic from the atmosphere to surfaces (Modélisation dynamique du transfert de l'atmosphère vers les sols de polluants issus du trafic routier). Advisor: Christian Seigneur; co-advisor : Yelva Roustan. ED SIE.
- **WEI Xiao.** Experimental and numerical study of atmospheric turbulence and dispersion under stable conditions in near-field (étude expérimentale et numérique de la turbulence et de la dispersion

atmosphériques en conditions stables en champ proche). Advisor: Bertrand Carissimo; co-advisor: Éric Dupont. ED SIE.

- **WINIAREK Victor.** Dispersion en milieu urbain et modélisation inverse de sources. Atmospheric dispersion in an urban area and inverse modeling of sources. Advisor: Marc Bocquet; co-advisor: Bertrand Carissimo. ED SIE.
- **ZHU Shupeng.** Modeling externally-mixed aerosols (Modélisation du mélange externe des aerosols). Advisor: Karine Sartelet. ED SIE.

Completed HDR

- **Sartelet Karine.** Modélisation de la qualité de l'air à l'échelle régionale, 5 April 2013 ED SIE.

Teaching

École des Ponts ParisTech

- **CARISSIMO Bertrand, MILLIEZ Maya,** MECA 1 & 2, Mécanique des fluides (Fluid mechanics).
- **SEIGNEUR Christian, MALLET Vivien, MUSSON-GENON Luc,** POLU1, Environnement atmosphérique et qualité de l'air (Atmospheric environment and air quality).
- **ROUSTAN Yelva, Sartelet Karine,** Pollution atmosphérique (Air pollution), Master Transports et développement durable (TRADD).
- **BOCQUET Marc, MALLET Vivien,** Introduction à l'assimilation de données (Introduction to data assimilation), Master Océan, atmosphère, climat et observations spatiales (OACOS).
- **BOCQUET Marc, MUSSON-GENON Luc, CARISSIMO Bertrand, MALLET Vivien, MILLIEZ Maya, QU Yongfen, ROUSTAN Yelva, WENDUM Denis, WINIAREK Victor,** Environment and Society, Master Nuclear Energy.
- **SEIGNEUR Christian, MALLET Vivien, MILLIEZ Maya,** Modélisation de la pollution atmosphérique (Mathematical modeling of air pollution) Master Science et génie de l'environnement (SGE).
- **SEIGNEUR Christian,** Pollution atmosphérique et aérocontamination (Air pollution and contamination), Master Science et génie de l'environnement (SGE).

Other Masters

- **SEIGNEUR Christian.** "Chemistry of air pollution", Master : Sciences et Techniques de l'Environnement Urbain (STEU), École Centrale de Nantes.

DISSEMINATION ACTIVITIES AND PARTNERSHIPS

Public communications

- **Bocquet, M.,** Témoignages : Métiers du secteur environnement/écologie/planète, 2^{sd} Forum Maths Emploi, CNAM, Conservatoire National des Arts et Métiers, 11 January 2013, Paris.
- **Herlin I., Mallet V.,** « Votre air, votre santé » (Your air, your health), Brief published on 5 December

2013, French blog of *Mathematics of Planet Earth*, <http://www.mpe2013.org>.

- **SEIGNEUR Christian.** Interview, France 5 Télévision, Magazine de la Santé, Particules fines : au cœur de la pollution (Fine particles: in the heart of air pollution).

Research partnerships

Research activities at CEREAs are supported by a myriad of funding sources including several contracts from the National Agency for Research (ANR), the French Agency for Environment and Energy Management (ADEME), the French Ministry for Ecology (MEDDE), the Île-de-France Region program on sustainable development (R2DS), industry (EDF, Total), the Center for Tunnel Studies (CETU), the Interagency Program for Air Quality Research (Primequal), and the National Center for Scientific Research (CNRS). Most of these activities are conducted in partnership with other research laboratories.

New research contracts awarded in 2013 include the following:

- **ESTIMAIR ANR contract:** Uncertainty estimation of air quality simulations at the urban scale, project managed by INRIA/CEREA (Vivien Mallet) with Numtech, LVMT of École des Ponts ParisTech, and LMFA of École Centrale de Lyon as partners, 415 000 euros.
- **FuME KIC-Climate contract:** Characterization of fugitive methane emissions, project managed by National Physical Laboratory with CEREA (Christian Seigneur and Yelva Roustan) as partner, 120 000 euros.
- **EDF contract:** Long-range air pollution modeling, project managed by CEREA (Luc Musson-Genon), funded by the Nuclear Engineering Center (CIDEN), 39 000 euros.