Report of research activities 2011

CEREA

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

Atmospheric Environment Center

École des Ponts ParisTech et EDF R&D

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Director : Christian Seigneur
Deputy director : Luc Musson-Genon
Deputy director 2 : Marc Bocquet

Staff : 56

Qualitative results

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). The main research activities at CEREA focus on modeling the atmospheric environment with particular emphasis on air quality and atmospheric dispersion modeling from short-range to long-range scales, atmospheric dynamics near the Earth's surface (i.e., the so-called atmospheric boundary layer, which extends from the surface to about 1 to 2 km) and the assimilation of data and images into geophysics models.

Applications of research-grade models to real-world case studies include the assessment of the environmental impacts of the transportation and energy production (both thermal and nuclear) sectors. These activities are related to the programs of EDF R&D and to the activities of the research and technical centers of the Ministry of Ecology, Sustainable Development, Transportation and Housing (MEDDTL, Ministère de l'Écologie, du Développement Durable, des Transports et du Logement). Long-term relationships have also been developed with the Technical Center for Transportation Studies of the Nord-Picardie Region (CETE Nord-Picardie) for the air quality impacts of roadways, the French Agency for Radioprotection and Nuclear Safety (IRSN, Institut de Radioprotection et de Sûreté Nucléaire) for impact studies related to radioactive releases and with the French Agency for the Industrial Environment and Risk Analysis (INERIS, Institut National de l'Environnement Industriel et des Risques) for air quality impact studies and forecasting.

Research activities cover three major areas:

- Dynamics of the atmospheric boundary layer

- Air quality modeling at local, regional and continental scales

Meteorological measurements are conducted to better understand the physical processes that govern the atmospheric flow, air pollutant dispersion and fog formation near the ground. Those measurements are used to evaluate the atmospheric dynamic model and help to improve its parameterizations of atmospheric physical processes.

For modeling atmospheric processes, CEREA uses primarily two numerical modeling platforms: an atmospheric Computational Fluid Dynamics (CFD) model, "Code_Saturne", for simulating the dynamics of the atmospheric boundary layer and an air quality modeling system, "Polyphemus". The atmospheric version of "Code_Saturne" was developed at CEREA and it is used to study local pollution, wind power estimates, fog formation, atmosphere/buildings energy transfer. "Polyphemus" includes different air quality chemical transport models ranging from short-range dispersion (Gaussian plume and puff models) to long-range transport at regional and continental scales (the chemical transport model Polair3D). Both modeling platforms are open source.

These models are evaluated by comparison to available measurements (included those collected by CEREA) and used for impact studies or air quality forecasting. The research activities devoted to data assimilation (using measurements to improve model performance) aim at improving the ability of models to make reliable forecasts and identifying emission sources via inverse modeling.

Budget summary

The operating budget of CEREA (excluding salaries of permanent staff and office space rental) was about 700 000 euros in 2011. It was about 2 400 000 euros if one includes salaries of permanent staff.

Key facts

CEREA is one of the founding members of the Environmental Science Observatory EFFLUVE (Observatoire des sciences de l'univers, OSU), which includes three other laboratories of University Paris-Est: Leesu and Certes.

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

The CLIME project-team horsts 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 CEREA toward their operational use in areas such as data assimilation, ensemble forecasting and uncertainty assessment.

CEREA participates in some projects of the French National Agency for Research (ANR), as well as the R2DS network on sustainable development in the Île-de-France region. Partnerships with IRSN (French Agency for Nuclear Safety), INERIS (French Agency for the Industrial Environment and Risk Analysis) the Technical Center for Transportation Studies of the Nord-Picardie region (CETE Nord-Picardie) and the scientific and technical network for air issues of the Ministry of Ecology (MEDDTL) are very active and lead to the use for real-world case studies by these organizations of methods and models developed at CEREA.

The CLIME project-team has been extended for a period of three years. The Polyphemus modeling software registration with the Agency for Software Protection (Agence de Protection des Programmes, APP) was completed and now includes all composents of the air quality modeling platform.

Results and successes

Model simulations of the Fukushima nuclear power plant accidental release of radionuclides to the atmosphere were conducted by CEREA. They were made available on the CEREA Web site and were also provided to another French laboratory where model simulations of potential ocean contamination were conducted. The first estimate of the radioactive release was performed by inverse modeling using available radionuclide concentrations measured all over the world.

A Smart Phone application (votre air) was developed by the I-Lab in collaboration with the Paris air quality agency (Airparif), which provides real-time information on air pollution in Paris.

Two new versions of the main modeling platforms of CEREA, "Code_Saturne" and Polyphemus, are now available online (see Software below). These two models are now used widely by other groups in France and abroad.

For example, the computational fluid dynamics (CFD) model ("Code_Saturne") is used by the Building Science Center (CSTB, Centre Scientifique et Technique du Bâtiment) to study atmospheric flow and energy exchange between buildings and the surrounding atmosphere and by the Architecture School of Nantes to study energy budgets of building. The air quality model of CEREA ("Polyphemus") is used operationally to forecast air quality in France by INERIS (www.prevair.org) and in Chile by the national weather service (Dirección Meteorológica de Chile).

Ongoing work

Dynamics of the Atmospheric Boundary Layer

CEREA scientists study the dynamics of the atmospheric boundary layer (between the ground and about 1 to 2 km altitude) by means of meteorological measurements and numerical simulations. The instrumentation (sodars, surface meteorological stations, instrumented masts, sonic anemometers, UHF radar, wind lidar, diffusiometers, scintillometer) provide reliable and accurate measurements of wind, temperature, solar radiation, relative humidity and atmospheric turbulence. Those instruments are set up in part on the campus of École Polytechnique at Palaiseau, as part of a regional observatory for air quality and meteorology (SIRTA) of the Pierre-Simon Laplace Institute (IPSL). The atmospheric version of the Code_Saturne CFD model, which was developed at CEREA, provides a realistic description of atmospheric flow and heat transfer over spatial scales ranging from a few meters (for example vehicle exhaust) to a few kilometers (urban area or industrial site). This model is in part evaluated with measurements obtained at SIRTA.

Examples of ongoing applications include the dispersion of pollutants among buildings or near a roadway, the estimation of wind and turbulence fields at a wind energy site, and the estimation of heat transfer between buildings and the ambient atmosphere. In that respect, important partnerships have been created with the scientific and technical network for air issues (RST Air) of the Ministry of Ecology (MEEDDM) and EDF Énergies Nouvelles (Renewable Energy Division of the French Energy Group EDF), respectively.

Air Quality Modeling at Urban, Regional and Continental Scales

CEREA develops and applies its own air quality modeling system, "Polyphemus", which is used for both research and applied studies. "Polyphemus" is central to many studies, such as future emission scenarios (for example, the effect of new fuels on air quality), impact studies for industrial emissions and new roadways, regional air quality forecasting, radionuclide dispersion following accidental releases, and transboundary pollution at the continental scale (mercury and other heavy metals, persistent organic pollutants, acid rain). Several partnerships exist with IRSN, INERIS and CETE Nord-Picardie, as well as with the Research and Innovation Division of the Ministry of Ecology and University Saint-Joseph in Lebanon. New developments of the models take place continuously to ensure that the models reflect the state of the art in atmospheric modeling. Current efforts focus on the improvements of atmospheric dispersion of the emissions from roadway traffic and tall stacks to provide better estimates of the potential impacts of those sources on air quality and the comparison of various algorithms to simulate ozone formation, particulate matter formation and horizontal and vertical dispersion of atmospheric pollutants. A large program is also ongoing on the improvement of existing models for simulating atmospheric aerosols, including secondary organic aerosols and ultrafine particulate matter. Other topics of research include improving the representation of dry and wet deposition processes of air pollutants to surfaces and understanding the effect of climate change on air quality.

Data Assimilation and Inverse Modeling

Research activities of the CLIME project-team include the development of data and image assimilation methods that combine numerical models and measurements, inverse modeling, and the application of optimization methods to environmental problems. Typical applications are the improvement of air quality forecasts via satellite data assimilation, optimal combination of model ensembles, and inverse modeling of pollutant emissions (for example, to estimate an accidental release of radionuclides from a nuclear power plant). Other applications address, for example, the optimal design of monitoring networks for radionuclides and photochemical pollutants (for example, ozone).

Concluding projets

The ANR project led by CEREA on the assimilation of data in multi-scale geophysical models has led to innovative techniques to improve data assimilation in geophysics. Implications will be beneficial to various areas of geophysics including climate science and atmospheric pollution. We anticipate that, in addition to academic contributions in the scientific literature, operational tools will be developed and made available to the scientific community over the next few years. This project, which was extended by ANR for six months, will end in September 2012.

One year projects

Several projects initiated in 2010 will be completed and will lead to operational products by 2012.

Four ongoing PhD theses on atmospheric particles focus on nanoparticles, organic aerosols and the identification of emission sources. This work combines modeling and measurements in a constructive and judicious fashion. The results of this research program will lead in 2012 to new and improved models for simulating the formation and fate of atmospheric particles in indoor and outdoor atmospheres.

Work conducted under the Geo-FLUIDS project (sponsored by ANR) intends to develop new mathematical approaches (for example using Independent Component Analysis rather than Principal Component Analysis to obtain a reduced basis of the flow field from images) to implement machine learning algorithms for image assimilation in geophysics.

Research on the propagation dynamics of forest fires and the atmospheric dispersion of their emissions will continue via the ANR-sponsored IDEA project. CEREA is primarily involved in the estimation of uncertainties.

Data assimilation is at the heart of many projects conducted at CEREA. To facilitate the applications of methods developed at CEREA and elsewhere, a generic data assimilation methods library, named "Verdandi", is nearing completion and will become available within the next year. Simulation of wind flow on turbulence with "large eddy simulation" using Code_Saturne nearing completion inverse modeling of volatile organic compounds (VOC) will shed new light on their source attribution.

Three years projects

Work is ongoing on the use of the CFD model "Code_Saturne" to simulate heat exchange 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. Ongoing work focuses on the detailed comparisons between model simulations results and experimental data with a validated software expected to become operational in a couple of years.

Ongoing work on the potential impacts of roadway traffic on air quality includes several components with, in particular, the development of a new modeling tool to link traffic models with air quality models (in collaboration with IFSTTAR, the French Science and Technology Institute for Transportation) and the development of new modeling tools to simulate air quality in the proximity of roadways. Those efforts will lead to operational products in the next few years.

Under two programs of the French Ministry of Ecology (MEDDTL), "Ville numérique" and "Immanent", CEREA is developing new modeling tools to simulate atmospheric deposition of pollutants to urban watersheds. This work is conducted in collaboration with LEESU (the water quality laboratory of École des Ponts ParisTech), IFSTTAR and IRSN.

Work is ongoing on the simulation of wind and turbulence fields at wind farm sites. The objective is to develop efficient modeling techniques to characterize the meteorological fields at various spatial scales to forecast wind resources and analyze potential wake impacts behind wind turbines.

Research is ongoing on data assimilation in air quality models, either to improve the predicting capability of air quality models or to identify the major sources of selected air pollutants.

Research on climate in air quality, which is conducted in collaboration with the European Center for Scientific Computing (Centre Européen de Recherche et de Formation Avancée pour le Calcul Scientifique, CERFACS). Will provide new insights on the meteorological variables that govern high air pollution episodes over Europe.

Other research topics, which have been initiated in 2011, include the modeling of fog formation, multi-media modeling of persistent organic pollutants and mercury and modeling of particle number concentrations in urban areas.

A major project funded of the Agency for the Environment and Energy Management (ADEME) was initiated recently. This project conducted in collaboration with the UPEC laboratory Lisa will assess the potential air quality impact of the atmosphere particulate matter program ("Plan particules"). A research project funded by the Île-de-France region concerns the air quality impacts of biofuels.

Research scholarships

- **COUVIDAT Florian,** Scholarship from ADEME, Thesis support at 40 %
- **DALL'OZZO Cédric,** Scholarship from EDF (CIFRE)
- **KOOHKAN Mohammad Réza,** Scholarship from École des Ponts ParisTech, Thesis support at 100 %
- **WAKED Antoine,** Scholarship from École des Ponts ParisTech (50%) and CNRS Liban (50%), Thesis conducted at CEREA (50%) and at Université Saint Joseph, Lebanon (50%)
- **DEVILLIERS Marion,** Scholarship from INERIS, Thesis conducted at CEREA (33%) and at INERIS (67%)
- **DERGAOUI Hilel,** Scholarship from INERIS, Thesis conducted at CEREA (33%) and at INERIS (67%)
- **WANG Yiguo,** Scholarship from CEA, Thesis support at 50 %
- **LOIZEAU Vincent,** Scholarship from EDF R&D (CIFRE)

Laboratory instrumentation and models

CEREA is an official partner of the French national air quality forecast system Prev'air, http://www.prevair.org/. CEREA developed the method used to conduct improved air quality forecasts using ensemble modeling (i.e., several models rather than a single model). Furthermore, the CEREA air quality model (Polair3D of Polyphemus) is part of this ensemble modeling system.

At SIRTA, http://sirta.ipsl.polytechnique.fr/, the experimental site for atmospheric research using remote sensing, CEREA is setting up a new experiment to study air pollutant dispersion under stable atmospheric conditions using fast-response monitors for propene, which is released upwind of an array of monitors.

Laboratory staff

Permanent research staff

- **SEIGNEUR Christian** École des Ponts ParisTech Director HDR
- **MUSSON-GENON Luc** EDF R&D Research engineer (ICPEF)
- **BOCQUET Marc** École des Ponts ParisTech Research scientist (ICPEF) HDR
- **CARISSIMO Bertrand** EDF R&D Research engineer HDR
- **HERLIN Isabelle** INRIA Research scientist (DR2)
- **DUPONT Éric** EDF R&D Research engineer
- **MALLET Vivien** INRIA Research scientist (CR1)
- **MILLIEZ Maya** EDF R&D Research engineer
- **ROUSTAN Yelva** École des Ponts ParisTech Research scientist (CR2)
- **SARTELET Karine** École des Ponts ParisTech Research scientist (CR2)

Permanent teaching staff

- **HUOT Étienne** INRIA Associate Professor (MDC)

Adjunct research staff

- **BÉRÉZIAT Dominique** Université Pierre et Marie Curie Associate Professor

Research staff on temporary contract (including post-doctoral scientists)

- **BADOSA Jordi** EDF R&D

Post-doctoral Students

- **DREVET Jérôme** École des Ponts ParisTech
- **DUHANYAN Nora** École des Ponts ParisTech
- **GIRAULT Laetitia** École des Ponts ParisTech
- **HERGAULT Virginie** EDF R&D
- **PAPARI Guiseppe** INRIA
- **REAL Elsa** École des Ponts ParisTech
- **TRAN Pierre** École des Ponts ParisTech
- **WU Lin** École des Ponts ParisTech
- **ZAÏDI Hanane** École des Ponts ParisTech
- **ZHUK Sergey** INRIA
-

PhD Students

- **BRIANT Régis** École des Ponts ParisTech ED Ville SIE
- **CHERIN Nicolas** École des Ponts ParisTech ED SIE
- **COUVIDAT Florian** ADEME ED SIE
- **DALL'OZZO Cédric** EDF R&D ED SIE CIFRE
- **DERGAOUI Hilel** INERIS ED SIE
- **DESCHAMPS Stéphanie** École des Ponts ParisTech ED SIE
- **DEVILLIERS Marion** INERIS ED SIE
- **DRIFI Karim** INRIA ED Sciences Mathématiques Paris Centre
- **DURAISAMY Venkatesh** EDF R&D ED SIE
- **FALLAH SHORSHANI Masoud** École des Ponts ParisTech ED SIE
- **GARAUD Damien** EDF R&D ED SIE CIFRE
- **KIM Youngseob** École des Ponts ParisTech ED SIE
- **KOOHKAN Mohammad Reza** École des Ponts ParisTech ED SIE
- **LECOEUR Eve** École des Ponts ParisTech ED SIE
- **LOIZEAU Vincent** École des Ponts ParisTech ED SIE
- **MAKKE Laurent** École des Ponts ParisTech ED SIE
- **QU Yongfen** EDF R&D ED SIE CIFRE
- **SHORSHANI Masoud Fallah** École des Ponts ParisTech INRETS
- **WAKED Antoine** École des Ponts ParisTech ED SIE
- **WANG Yiguo** CEA ED École Polytechnique
- **WINIAREK Victor** École des Ponts ParisTech ED SIE
- **ZYSK Janusz** École des Ponts ParisTech ED SIE

Interns

- **AGOUMI Jalil** EDF R&D
- **AYED Hajer** INRIA
- **BIRMAN Camille** École des Ponts ParisTech
- **CAIVIN Frédéric** EDF R&D
- **FOESSEL Etienne** École des Ponts ParisTech
- **PERILLAT Rafael** INRIA

Administrative staff and Technical staff

Administrative staff

- **DEHLINGER Véronique** École des Ponts ParisTech
- **GAUDECHOUX Nathalie** INRIA

Technical staff

- **BRESSON Raphael** EDF R&D Engineer
- **COULON Fanny** École des Ponts ParisTech Associate Engineer
- **CHARPENTIER Kévin** EDF R&D Associate Engineer
- **DEMENGEL Dominique** EDF R&D Technical supervisor
- **GILBERT Éric** EDF R&D Engineer
- **LEFRANC Yannick** EDF R&D Technical supervisor
- **LHOIR Thomas** École des Ponts ParisTech Technician
- **MERCIER Nicolas** INRIA Associate Engineer
- **ROZBORSKI Sébastien** EDF R&D Technician
- **TILLOY Anne** INRIA Engineer
- **WENDUM Denis** EDF R&D Engineer

Completed theses

- **CHAMBON P.,** « Contribution à l'estimation des précipitations tropicales : préparation aux missions Megha-Tropiques et Global Precipitation Measurement », 2011
- **GARAUD D.,** « Estimation des incertitudes et prévision des risques en qualité de l'air », 2011
- **KIM Y.,** « Air quality modeling : evaluation of chemical and meteorological parameterizations », 2011
- **QU Y.,** « Modélisation tri-dimensionnelle des échanges radiatifs et convectifs dans l'atmosphère urbaine », 2011

Ongoing theses

- **BRIANT Régis,** Modélisation de l'impact du trafic routier sur la qualité de l'air. Mathematical modeling of the air quality impacts of roadway traffic. Advisor: SEIGNEUR Christian. Science, Ingénierie & Environnement (SIE)

- **CHERIN Nicolas,** Caractérisation des sources de polluants atmosphériques et de leurs dépôts sur les bassins versants urbains. Characterization of air pollution sources and pollutant deposition on urban watersheds. Advisor: SEIGNEUR Christian. Science, Ingénierie & Environnement (SIE)

- **COUVIDAT Florian,** Modélisation des particules organiques dans l'atmosphère. Mathematical modeling of atmospheric organic aerosols. Advisor: SEIGNEUR Christian. Co-advisor: SARTELET Karine. Science, Ingénierie & Environnement (SIE)

- **DALL'OZZO Cédric,** Modélisation d'écoulements atmosphériques complexes par la méthode des gros tourbillons. Mathematical modeling of complex atmospheric flows with large eddy simulation. Advisor: CARISSIMO Bertrand. Co-advisor: MUSSON GENON Luc. Science, Ingénierie & Environnement (SIE)

- **DESCHAMPS Stéphanie,** Modélisation de la qualité de l'air : nombre de particules. Air quality modeling: particles number concentrations. Advisor:BOCQUET Marc. Co-advisor: SARTELET Karine. Science, Ingénierie & Environnement (SIE)

- **DERGAOUI Hilel,** Modélisation d'une population d'aérosols multi-sources. Mathematical modeling of a multi-source aerosol population. Advisor: SEIGNEUR Christian. Co-advisor: DEBRY Édouard SARTELET Karine. Science, Ingénierie & Environnement (SIE)

- **DEVILLIERS Marion,** Modélisation des nanoparticules. Mathematical modeling of nanoparticles. Advisor: SEIGNEUR Christian. Co-advisor: DEBRY Édouard SARTELET Karine. Science, Ingénierie & Environnement (SIE)

- **DRIFI Karim,** Apprentissage statistique de modèles pour l'assimilation de données images. Machine learning for image assimilation models. Advisor: HERLIN Isabelle. Co-advisor : Sciences mathématiques de Paris-Centre (SMPC)

- **DURAISAMY JOTHIPRAKASAM Venkatesh,** Descente d'échelle de l'énergie éolienne en terrain complexe avec un code de mécanique des fluides avec effet de sillage. Downscaling the wind energy resource in complex terrain using a coupled mesoscale microscale CDF modeling system including wake effect, Advisor: CARISSIMO Bertrand. Co-advisor: DUPONT Eric. Science, Ingénierie & Environnement (SIE)

- **FALLAH SHORSHANI Masoud,** Modélisation de la pollution atmosphérique liée à la circulation automobile en zone urbaine. Modeling air pollution from road traffic in urban areas. Advisor: SEIGNEUR Christian. Co-advisor: ANDRE Michel, IFSTTAR. Science, Ingénierie & Environnement (SIE)

- **KOOHKAN Reza,** Modélisation inverse et assimilation de données en qualité de l'air. Inverse modeling and data assimilation in air quality. Advisor: BOCQUET Marc. Science, Ingénierie & Environnement (SIE)

- **LECOEUR Eve,** Influence de l'évolution climatique sur la qualité de l'air en Europe. Effect of climate change on air quality in Europe. Advisor: SEIGNEUR Christian. Co-advisor: TERRAY Laurent (CERFACS). Science, Ingénierie & Environnement (SIE)

- **LOIZEAU Vincent,** Modélisation des échanges sol-atmosphère pour les polluants organiques. Modeling and atmosphere exchange for POPs and mercury. Advisor: BOCQUET Marc. Co-advisor: CIFFROY Philippe, MUSSON GENON Luc, ROUSTAN Yelva. Science, Ingénierie & Environnement (SIE)

- **MAKKE Laurent,** Modélisation 3D des rétroactions microphysique de l'eau, turbulence, rayonnement dans les nuages bas. 3D Fog modeling. Advisor: CARISSIMO Bertrand. Co-adviror: MILLIEZ Maya. Science, Ingénierie & Environnement (SIE)

- **WAKED Antoine,** Caractérisation des aérosols organiques à Beyrouth, Liban. Characterization of organic aerosols in Beyrouth, Lebanon. Advisor: BOCQUET Marc. Co-advisor: AFIF Charbel, SEIGNEUR Christian. Science, Ingénierie & Environnement (SIE)

- **WANG Yiguo,** Une nouvelle approche de modélisation de la qualité de l'air à l'échelle régionale par assimilation de mesures lidar. A new approach for air quality modeling at the regional scale with lidar data assimilation. Advisor: BOCQUET Marc. Co-advisor: CHAZETTE Patrick CEA LSCE, SARTELET Karine. École Polytechnique

- **WINIAREK Victor,** Dispersion en milieu urbain et modélisation inverse de source. Atmospheric dispersion in an urban area and inverse modeling of sources. Advisor: BOCQUET Marc. Science, Ingénierie & Environnement (SIE)

- **ZYSK Janusz,** Modélisation de la pollution pour la Pologne. Mathematical modeling of air pollution in Poland. Advisor: SPORTISSE Bruno. Co-advisor : SEIGNEUR Christian ROUSTAN Yelva. Science, Ingénierie & Environnement (SIE)

Teaching at École des Ponts ParisTech (Masters co-sponsored by École des Ponts included)

- **CARISSIMO Bertrand**, **MILLIEZ Maya**, MECA 1 & 2 Mécanique des fluides (Fluid mechanics)

- **SEIGNEUR Christian, MUSSON-GENON Luc,** POLU Environnement atmosphérique et qualité de l'air (Atmospheric environment and air quality)

- **SARTELET Karine, ROUSTAN Yelva,** 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, WENDUM Denis, MILLIEZ Maya, MALLET Vivien, ROUSTAN Yelva, WINIAREK Victor, TAGHAVI Mohammad, KORSAKISSOK Irène, QU Yongfen,** Environment and Society Master Nuclear Energy

- **MILLIEZ Maya, MALLET Vivien, SEIGNEUR Christian,** 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 teaching (Engineering schools)

- **ROUSTAN Yelva,** Qualité de l'air et santé (Air quality and health), École Nationale des Travaux Publics de l'État (ENTPE) à Lyon

Other teaching (Master)

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

Committees - Editorial boards

- **BOCQUET Marc,** Associate Editor, Quartely Journal of the Royal Meteorological Society

- **MUSSON-GENON Luc,** Scientific Committee, « Pollution Atmosphérique »

Scientific committees

- **BOCQUET Marc,** Scientific committee, European Center for Scientific Computing (CERFACS)

- **BOCQUET Marc,** Co-chair: Scientific Committee of the "Data Assimilation" (ASSIM) activity of the research program, "Les enveloppes fluides et l'environnement" (LEFE) of the National Institute of Earth and Space Science (INSU)

- **MILLIEZ Maya,** 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 airbone hazards in built environment".

- **MUSSON GENON Luc,** Chair: Scientitifc Committee, "Site instrumental de recherche par télédétection atmosphérique" (SIRTA)

- **SARTELET Karine,** Scientific committee, SIRTA

- **SARTELET Karine,** 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 Christian,** Chair: Working Group on the selection of air pollutants for risk assessment of roadway projects, ANSES

- **SEIGNEUR Christian,** Expert Committee (CES) for the risk assessment of air pollutants, French Agency for Food, Environmental and Occupational Health Safety (ANSES)

- **SEIGNEUR Christian,** General Assembly of the Air Quality Agency for the Paris Region (AIRPARIF)

- **SEIGNEUR Christian,** 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 Christian,** National Funding Commission (CNA) for climate, air and energy of the Agency for Environment and Energy Management (ADEME)

- **SEIGNEUR Christian,** Scientific Advisory Committee of Interagency Research Program for Improved Local Air Quality (PRIMEQUAL)

- **SEIGNEUR Christian,** Scientific Committee of the Chronic Risk Division (DRC) of the National Institute of Industrial Environment and Risk (INERIS)

- **SEIGNEUR Christian,** Scientific Advisory Committee for the Source apportionment of airborne particles in Ile-de-France

- **SEIGNEUR Christian,** Operational Group N°1 "Energy-Environment", Program for Research and Innovation in Transportation (PREDIT 4)

International conference committees

- **DUCROT A., DUMORTIER Y., HERLIN I., DUCROT V.,** « Real-Time Quasi Dense Two-Frames Depth Map for Autonomous Guided Vehicles »*, 5-9th June 2011*, GERMANY, 2011, p. 497-503

- **HERLIN I., BEREZIAT D., MERCIER N.,** « Recovering missing data on satellite images »*, 23-27th May 2011*, SWEDEN, edsci. Heyden, A. and Kahl, F.

- **HERLIN I., BEREZIAT D., DRIFI K., ZHUK S.,** « Learning reduced models for motion estimation on ocean satellite images »*, 20-24th September 2011*, UKRAINE, 2011

- **HUOT E., HERLIN I., MERCIER N., KOROTAEV G., PLOTNIKOV E.,** « Motion estimation from satellite image sequences: validation »*, 20-24th September 2011*, UKRAINE, 2011

- **MALLET V., ZHUK S.,** « Reduced minimax filtering by means of Differential-Algebraic equations »*, 5-8th September 2011*, SPAIN, 2011

- **PRADELLE F., BROCHETON F., CHABANON B., HONORE C., DUGAY F., LEGER K., DAMBRE F., MALLET V., TILLOY A., OLESEN R., HIGSON H.,** « The "Votre Air" project: development of a modelling tool to assess the real atmospheric exposure in Paris »*, 2-6th Octobrer 2011*, GREECE, 2011, p. 448-451

Articles in-peer-reviewed international journals

- **Béréziat, D., I. Herlin.** Solving ill-posed image processing problems using data assimilation, *Numerical Algorithms*, 56, 219-252 (2011), doi:10.1007/s11075-010-9383-z.

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- **Kim, Y., K. Sartelet, C. Seigneur**. Formation of secondary aerosols over Europe: comparison of two gas-phase chemical mechanisms, *Atmos. Chem. Phys.*, 11, 583-598 (2011), doi:10.5194/acp-11-583-2011.

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- **Garaud, D., V. Mallet**. Automatic calibration of an ensemble for uncertainty estimation and probabilistic forecast: Application to air quality, *J. Geophys. Res.*, 116, D19304 (2011), doi:10.1029/2011JD015780.

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- **Yongfeng Qu, Maya Milliez, Luc Musson-Genon, Bertrand Carissimo**, Modeling of the urban energy balance taking into account fluid mechanics with meteorology in an idealized urban area. EURASAP Newsletter, 72, 19, 42.

International conference proceedings

- **Qu, Y., M. Milliez, L. Musson-Genon, B. Carissimo** : Impacts on airflow of thermal transfers taking into account 3D atmospheric radiation in urban areas. 13th International Conference on Wind Engineering, July 10-15th, 2011

- **Duraisamy Jothiprakasam V., E. Dupont, B. Carissimo** : Downscaling the wind energy resource in complex terrain using coupled mesoscale and microscale CFD modelling. European Wind Energy Association Conference, 14-17th March 2011, Bruxelles

- **Hanane Zaïdi, Eric Dupont, Maya Milliez, Bertrand Carissimo, Luc Musson Genon** : Evaluating the ability of two canopy models to reproduce the forested area effects using Code_Saturne. 13th International Conference on Wind Engineering, July 10-15th, 2011, Netherlands

- **Hanane Zaïdi, Eric Dupont, Maya Milliez, Bertrand Carissimo, Luc Musson Genon** : Numerical simulation of the atmospheric flow over a complex terrain at local scale using Code_Saturne. 14th International conferences on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes, October 2-6th, 2011

- **Yongfeng Qu, Maya Milliez, Luc Musson-Genon, Bertrand Carissimo** : Numerical simulation of the energy exchanges in a real urban area with a 3D building resolving code. The 18th International Seminar on Urban Form and Urban Morphology and the Post-Carbon City (ISUF2011), Montreal, Canada August 26–29th, 2011

- **Yongfeng Qu, Maya Milliez, Luc Musson-Genon, Bertrand Carissimo** : 3D Modeling of urban environment taking into account the energy exchanges between the buildings and the atmosphere. 14th International Conferences on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes, October 2-6th, 2011, Greece

- **Ducrot,** Real-time Quasi Dense Two-Frames Depth Map for Autonomous Guided Vehicles, IV'11 – Intelligent Vehicles Symposium, IEEE, 5-9th June 2011, Baden-Baden, Germany, 497-503, doi:10.1109/ivs.2011.5940507.

- **Herlin, I., D. Béréziat, N. Mercier**, Recovering missing data on satellite images, SCIA 2011 – Scandinavian Conference on Image Analysis, 23-27th May 2011, Ystad Saltsjöbad, Sweden, 697-707, 6688, doi: 10.1007/978-3-642-21227-7_65.

- **Mallet, V., S. Zhuk,** Reduced minimax filtering by means of Differential-Algebraic equations, International Conference on Physics and Control (PhysCon), 5-8th September 2011, León, Spain.

- **Frédéric Pradelle, Fabien Brocheton, Benjamin Chabanon, Cécile Honoré, Fabrice Dugray, Karine Léger, François Dambre, Vivien Mallet, Anne Tilloy** : The"Votre Air" project: development of a modeling tool to assess the real atmospheric exposure in Paris, 14th International Conference on Harmonisation within atmospheric dispersion modeling for regulatory purposes (2011).

- **Dergaoui H, Seigneur C, Sartelet K, Debry E, Bessagnet B, and Rouïl L**, "A new method to simulate coagulation of an externally mixed particle population", *Geophysical Research Abstracts*, Vol. 13, 2011, EGU2011-11583.

- **Devilliers M, Seigneur C, Sartelet K, Debry E, Bessagnet B, and Rouïl L**, "A New Algorithm to Solve Condensation/Evaporation Growth and Coagulation of Nanoparticles", *Geophysical Research Abstracts*, Vol. 13, 2011, EGU2011-10803

- **Briant R., Seigneur C., Gadrat M., Bugajny C.** : A comparaison study beteween near roadway measurements and air pollutant dispersion simulations using an improved line source model. Conference Air Pollution 2011: 19-21st September 2011, Malta

National conference proceedings

- **Drifi, K., I. Herlin**, Assimilation d'images dans un modèle réduit pour l'estimation du mouvement, GRETSI 2011 – Groupe d'Etudes du Traitement du Signal et des Images, 5-8th September 2011, Bordeaux, France.

- **Huot, E., I. Herlin, N. Mercier, G.K. Korotaev, E. Plotnikov**, Validation de la vitesse estimée à partir d'images satellite, GRETSI 2011 – Groupe d'Etudes du Traitement du Signal et des Images, 5-8th September 2011, Bordeaux, France.

International conference invited talks

- **Seigneur, C.**, Overview of secondary organic aerosol (SOA) modeling for atmospheric particulate matter, American Meteorological Society 91st Annual Meeting, 23-27th January 2011, Seattle, Washington, USA.

- **Herlin, I., D. Béréziat, K. Drifi, S. Zhuk,** Learning reduced models for motion estimation on ocean satellite images, Conference "Hydrodynamic modeling of the Black Sea Dynamics, September 2011,Sevastopol, Ukraine.

- **Huot, E., I. Herlin, N. Mercier, G. K. Korotaev, E. Plotnikov,** Motion estimation from satellite image sequences: validation, Conference "Hydrodynamic modeling of the Black Sea Dynamics, September 2011, Sevastopol, Ukraine

- **Vivien Mallet**: Uncertainty Estimation and Ensemble Forecasting in Air Quality Modeling, CLIMAQS "Data Assimilation Workshop" Antwerp, March 2011.

- **Bocquet, M**., Non-Gaussianity and non-linearity in high dimensional ensemble filter, 2nd Summer School on Data Assimilation and its applications, July 2011, Iasi, Romania.

- **Bocquet, M**., Ensemble Kalman filtering without the intrinsic need for inflation, LMS-EPSRC Durham Research Symposium, "Mathemathics of Data Assimilation", 1-11th August 2011, Durham, United-Kingdom.

- **Bocquet, M**., Inverse modelling and data assimilation for atmospheric tracers: Application to Chernobyl and Fukushima, TTM 2011 workshop/summer school, "Tracer and Timescale Methods for Understanding Complex Geophysical and Environmental Processes", 16-19th August 2011, Louvain-La-Neuve, Belgium.

- **Bocquet, M., M. R. Koohkan, Y. Wang, K.Sartelet, and P.Chazette**. Efficient assimilation of ground-based observations in air quality: recent examples, 48th Oholo Conference, 6-10th November 2011, Eilat, Israel.

- **Bocquet, M**., Ensemble filtering and data assimilation for high-dimensional systems. GdR MascotNum, 21st June 2011, Paris, France.

National conference invited talks

- **Bocquet, M.,** Ensemble filtering for high-dimensional data assimilation, JSTAR 2011, 20-21st October 2011, Agrocampus Ouest, Rennes, France.

- **Bocquet, M.,** Assimilation de données pour les sciences de l'atmosphère et de l'océan, "Fouille de données" symposium, 22nd November 2011, Laboratoire Jacques-Louis Lions, Paris, France.

- **Mallet V., Garaud D., Tilloy A.,** Estimation des incertitudes et couplage entre les modèles et les données : Journée Technique Modélisation de la Qualité de l'Air en Milieu Urbain, 20th January 2011, École Centrale de Lyon, Écully, France

International conference oral presentations

- **Devilliers, M., C. Seigneur, É. Debry, K. Sartelet**, A new algorithm to solve condensation/evaporation growth and coagulation of nanoparticles, European Geosciences Union General Assembly 2011, 4-8th April 2011, Vienna, Austria.

- **Dergaoui, H., É. Debry, K. Sartelet, C. Seigneur.** A new method to simulate coagulation of an externally mixed particle population, European Geosciences Union General Assembly 2011, 4-8th April 2011, Vienna, Austria.

- **Zhang, Y., Y. Chen, S.-Y. Wu, S. Zhu, K. Sartelet, P. Tran, C. Seigneur**. Application of WRF/Chem-MADRID in Europe: Model evaluation and aerosol-meteorology interactions, European Geosciences Union General Assembly 2011, 4-8th April 2011, Vienna, Austria.

- **Couvidat, F., K. Sartelet, C. Seigneur**. Modeling secondary organic aerosols in an urban area: Application to Paris, France, 2nd Conference of the Brazilian Association for Aerosol Research, 1-5th August 2011, Rio de Janeiro, Brazil.

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- **Couvidat, F., Y. Kim, K. Sartelet, C. Seigneur.** H^2O: a new model to predict organic aerosol formation, European Aerosol Conference 2011, 4-9th September 2011, Manchester, United Kingdom.

- **Dergaoui, H., K. Sartelet, E. Debry, C. Seigneur**. A new model to simulate coagulation of externally mixed particles, International Aerosol Modeling Algorithms Conference, 30th November- 2nd December 2011, Davis, California, USA.

- **Couvidat, F., K. Sartelet, C. Seigneur**. Organic aerosols modeling over Europe with the molecular approach: Impact of primary organic aerosol volatility, International Aerosol Modeling Algorithms Conference, 30th November- 2nd December 2011, Davis, California, USA

- **Wu, L., M. Bocquet, T. Lauvaux, F. Chevallier, P. Rayner, K. Davis**, Towards optimal representation of sources for mesoscale carbon dioxide inversion with synthetic data, 3rd Workshop for the Mid-Continent Intensive Campaign (MCI) Synthesis, January 11-13th 2011, Fort-Collins, Colorado, USA.

- **Bocquet, M**., Parameter field estimation for atmospheric dispersion: application to the Chernobyl accident using 4D-Var, GLOREAM-EURASAP Workshop 2011, 26-28th January 2011, Copenhagen, Denmark.

- **Winiarek, V., J. Vira, M. Bocquet, M. Sofiev and O. Saunier**, Towards the operational application of inverse modelling for the source identification and plume forecast of an accidental release of radionuclides, GLOREAM-EURASAP Workshop 2011, 26-28th January 2011, Copenhagen, Denmark.

- **Bocquet, M**., Parameter field estimation for atmospheric dispersion: Application to the Chernobyl accident using 4D-Var, European Geosciences Union General Assembly 2011, 3-8th April 2011, Vienna, Austria.

- **Bocquet, M.,** Ensemble Kalman filtering without the intrinsic need for inflation. European Geosciences Union General Assembly 2011, 3-8th April 2011, Vienna, Austria.

- **Mathieu, A., I. Korsakissok, J.-P. Benoit, D. Didier, O. Isnard, J. Groëll, D. Quélo, E. Quentric, M. Tombette, O. Saunier, V. Winiarek, M. Bocquet, V. Mallet, R. Périllat,** Assessment of atmospheric dispersion and radiological consequences for the Fukushima Dai-ichi Nuclear Power Plant accident, HARMO 14, 6-8th October 2011, Kos Island, Greece.

- **Koohkan, M. R., M. Bocquet, L. Wu, M. Krysta,** Potential of the International Monitoring System radionuclide network for inverse modelling, Science and Technology meeting 2011, 8-10th June 2011, Vienna, Austria.

National conference oral presentations

- **Seigneur, C., Y. Roustan, M. Pausader**, Influence du trafic routier sur l'évolution des concentrations de dioxyde d'azote (NO_2) en milieu urbain, Journée Technique Modélisation de la Qualité de l'Air en Milieu Urbain, 20th January 2011, École Centrale de Lyon, Écully, France.

- **Couvidat, F., C. Seigneur, K. Sartelet**, Modélisation de la formation d'aérosols organiques secondaires formés par oxydation de l'isoprène sous différentes conditions, 26ème Congrès Français sur les Aérosols, CFA 2011, 25-26th January 2011, Paris, France.

- **Devilliers, M., C. Seigneur, É. Debry, K. Sartelet, B. Bessagnet, L. Rouïl**, Simulation numérique de la condensation/évaporation et de la coagulation des nanoparticules, 26ème congrès français sur les aérosols, CFA 2011, 25-26th January 2011, Paris, France.

- **Couvidat, F., K. Sartelet, C. Seigneur**. Modeling secondary organics in Paris during the MEGAPOLI campaign, Final Symposium of the EU FP7 Project MEGAPOLI – Megacities: emissions, urban, regional and global atmospheric pollution and climate effects, and integrated tools for assessment and mitigation, 26th-28th September 2011, Paris France.

- **Koohkan, M. R., M. Bocquet, C. Seigneur**, Modélisation inverse et assimilation de données, monoxyde de carbone et les espèces COVs, ADOMOCA-2, 22-23th November 2011, Les Lecques, France.

International conference posters

- **Waked, A., C. Afif, C. Seigneur**. An atmospheric emission inventory of anthropogenic and biogenic sources for Lebanon, American Geophysical Union Fall Meeting, 5-9th December 2011, San Francisco, California, USA.

- **Afif, C., A. Waked, I. El Haddad, P. Formenti, A. Borbon, A.S.H. Prevot, J.-F. Doussin, UY. Baltensperger, C. Seigneur**. Overview of preliminary results on aerosols in ECOCEM - Beirut, American Geophysical Union Fall Meeting, 5-9th December 2011, San Francisco, California, USA.

- **Gilbert E., E. Dupont, B. Carissimo**. Investigation of sonic and lidar measurements for initialisation of atmospheric dispersion models towards a pre-processor for CFD code. 14th international conferences on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes, October 2-6th, 2011, Greece.

- **Wu L., M. Bocquet, F. Chevallier**, Bayesian design of control space in inverse modelling: Application to mesoscale carbon dioxide inversion, European Geosciences Union General Assembly, 3–8th April 2011, Vienna, Austria.

- **Wu L., M. Bocquet**, Network design for ozone monitoring, European Geosciences Union General Assembly 2011, 3–8th April 2011, Vienna, Austria.

- **Chazette, P., M.** Bocquet, **P. Royer, V. Winiarek, J.-C. Raut, P. Labazuy, M. Gouhier, M. Lardier, and J.-P. Cariou,** Lidar and modelling to study the Eyjafjallajökull ash concentrations, European Geosciences Union General Assembly 2011, 3–8th April 2011, Vienna, Austria.

- **Maurau S., P. Ciffroy, L. Marang, Y. Roustan** : Linking multimedia environmental and PBPK models to assess health risks, SETAC Europe 21st Annual Meeting, 15-19th May 2011, Milan, Italy.

National conference posters

- **Roustan Y., M. Pausader, C. Seigneur** : Estimating the effect of on-road vehicle emission controls on future air quality in Paris, France, Colloque du GIS Modélisation Urbaine, 23-24th February 2011 École nationale de ponts et chaussées, Marne-la-Vallée, France.

International seminars

- **Vivien Mallet**: Uncertainty estimation and data assimilation in air quality modelling : CWI, November 2011

- **Royer P, Chazette P, Sartelet K, Zhang Q, Beekmann M, Raut J-C.** Comparison of lidar-derived PM10 with regional modeling and ground-based observations in the frame of MEGAPOLI experiment. Final Symposium of the EU FP7 project MEGAPOLI , 26-28th September 2011, Paris.

- **Couvidat F, Sartelet K, Seigneur C**. Modeling secondary organic in Paris during the MEGAPOLI campaign. Final Symposium of the EU FP7 project MEGAPOLI , 26-28th September 2011, Paris.

- **Bocquet,** Ensemble Kalman filtering without the intrinsic need for inflation, NCAR, 13th January 2011, Boulder, Colorado, USA.

- **Bocquet**, Ensemble Kalman filtering without the intrinsic need for inflation, Weather and Chaos group, University of Maryland, 18th January 2011, College Park, Maryland, USA.

Session Chairs 2011

- **Bocquet M., Roskier-Edelstein D.,** "Model Development and Validation "session, 48th Oholo Conference, 6-10th November 2011, Eilat, Israel.

- **Kata K.,** Participation to the organisation of the international conference IAMA on aerosols, 30th Novembrer -2nd December, 2011, Davis, USA.

- **Carissimo B.,** 14th International Conference on Harmonisation within Atmospheric Dispersion Modelling for Regulatory, Kos Island, Greece, 2-6th October 2011.

Thesis committees

- **Seigneur, C.,** Ph.D. thesis, Yao Liu, « Etudes des impacts de la réactivité en phase aqueuse atmosphérique sur la formation et le vieillissement des aérosols organiques secondaires sous conditions simulées », Université de Provence, 25th February 2011.

- **Seigneur, C.,** Ph.D. thesis, Richard Valorso, « Développement et évaluation d'un modèle explicite de formation d'aérosols organiques secondaires : sensibilité aux paramètres physico-chimiques », Université Paris-Est, 19th December 2011.

- **Carissimo B.,** PhD thesis, Bertrand Sapolin, « Construction d'une méthodologie d'évaluation statistique et d'un modèle d'estimation de l'incertitude pour les logiciels de dispersion atmosphérique utilisés en évaluation de risque NRBC », Université Paris Diderot, 16th December 2011

- **Herlin, I**., Ph.D. thesis, Damien Garaud, « L'estimation des incertitudes et la prevision des risques en qualité de l'air », Université Paris-Est, 14th December 2011.

- **Herlin, I**., Ph.D. thesis, Luigi Nardi « Formalisation et automatisation de YAO, générateur de code pour l'assimilation variationnelle de données », Université Paris VI, 8th March 2011.

- **Mallet, V.,** Ph.D. thesis, Damien Garaud, « L'estimation des incertitudes et la prevision des risques en qualité de l'air », Université Paris-Est, 14th December 2011.

- **Bocquet, M**. Ph.D. Thesis, Émilie Neveu, « Application des méthodes multigrilles à l'assimilation de données en géophysique », Joseph Fourier University, Grenoble, 31st March 2011.

HDR committees

- **Seigneur, C**., HDR, Corinne Galy-Lacaux, « Emissions et dépôts atmosphériques en régions tropicales », Université Paul Sabatier Toulouse III, 13th May 2011.

Software

- Registration of POLYPHEMUS at Agence de Protection des Programmes (APP).