Cerea

Centre d'Enseignement et de Recherche en Environnement Atmosphérique

ACTIVITY REPORT 2006

CEREA

Research and Teaching Center in Atmospheric Environment

Joint Laboratory
Ecole Nationale des Ponts et Chaussées
Electricité de France R&D

ECOLE NATIONALE DES PONTS ET CHAUSSEES

EDF

CEREA

Research and Teaching Center in Atmospheric Environment

Joint LABORATORY ENPC-EDF R&D

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6 Master thesis

CEREA was created in 2003 as a research center at Ecole Nationale des Ponts et Chaussées and has become in 2004 a joint laboratory ENPC-EDF R&D, with two locations (ENPC/Champs sur Marne and EDF R&D/Chatou). Its research activities concern the modeling of the atmospheric environment with a special focus on the assessment of environmental impact of transport and energy production (thermal or nuclear). These activities are coupled with the programs of EDF R&D and strongly related to other organizations of the French Ministry for Transport through its Research Directorate.

Other strong relationships have been developed for specific applications, with IRSN for radionuclides and with INERIS for impact studies or environmental forecast.

CEREA organizes its multidisciplinary activities through five research teams: fluid mechanics at local scale, measurements of the atmospheric boundary layer, dispersion at regional and continental scales, multiphase modeling and data assimilation. The data assimilation team is also part of an INRIA project, the CLIME project.

Research topics

CEREA develops modeling activities with two numerical models: a CFD (Computational Fluid Dynamics) tool, Mercure_Saturne, for small scale dispersion (urban pollution, industrial risk), and a platform, Polyphemus, devoted to atmospheric dispersion from local to continental scales. Some appropriate physical parameterizations and multiphase reactive box models are developed and plugged in these three-dimensional models.
The resulting models are compared to measured data and used for impact studies or environmental forecast. In this framework, the research actions devoted to data assimilation (coupling between model outputs and measurements) aim at improving the ability of models to make good forecasts and/or perform inverse modeling of pollutants.
Moreover, a team is active in the observation of the atmospheric boundary layer.

Key facts 2006

In 2006, more than 18 publications in international peer-reviewed journals with the first author belonging to CEREA have been published or accepted. Two PhD works have been successfully defended by Monika Krysta (Modeling and data assimilation of the atmospheric dispersion of radionuclides) and Maya Milliez (Modeling of urban environment with Mercure_Saturne).

CEREA takes part in two European projects (HEIMTSA and EXIOPOL) devoted to the evaluation of the impact of air pollution, that have been successfully submitted in 2006.

The strategic partnership with IRSN and INERIS for risk assessment has been strengthened, especially through the Polyphemus system, to be used for short-range dispersion by INERIS and long-range dispersion of radionuclides by IRSN (for operational forecast).

Many projects devoted to data assimilation and inverse modeling started with a special attention paid to network design.

CEREA has become a member of an observational network of air quality and meteorology at regional scale over Greater Paris with IPSL and Météo France. A field campaign, ParisFog, devoted to the observation of fogs has just begun in Autumn 2006. Dayly simulation with Mercure_Saturne will be performed in a second phase of the project.

CEREA is involved in the R2D2 network (Research Network of the Region Ile de France), devoted to sustainable development.

The scientific assessment of CEREA has been starting in September 2006 by a one-day seminar with the CEREA Scientific Committee.

Research groups

Local scale and fluid mechanics
(Group leader: Bertrand Carissimo)

The research actions are related to the preoccupations of the French Ministry for Transport (urban pollution) and those of EDF (dispersion at an industrial site). They mainly rely on the development of an integrated numerical model, Mercure_Saturne (EDF).
This code is based on a general purpose CFD tool, Code_Saturne, which has a wide range of applications. In this framework, the team adapts or develops parameterisations suitable for the atmospheric applications (cloud scheme, atmospheric radiative scheme, chemistry, aerosols ...).

General code evolution

This year, two actions have been performed. The first one is the migration of the atmospheric version toward the new version of Code_Saturne (1.2). This includes the re-validation of all test cases which has been partially completed. In addition, part of the (on line) documentation specific of the atmospheric version has been written. The second action is an audit action to prepare the next migration toward the open source version of Code_Saturne (1.3).

Radiative scheme for complex geometries

The numerical scheme suitable to study radiative effects in a urban environment has been completed. This can take into account both the solar and infrared radiations in a complex geometry (buildings and street canyons). This numerical scheme has been derived from numerical techniques used for combustion and adapted to the specific case of solar and infrared atmospheric radiation. The validation of this new scheme has been performed with comparisons to the results of well known simple experiments giving the variation of albedo as a function of solar zenith angle. Similarly, the decrease in temperature in a street canyon (infrared cooling) has been correctly reproduced. The final validation has been performed on a diurnal cycle of temperature observed on different wall surfaces observed during the MUST (Mock Urban Setting Test) experiment and already used for the validation of the dispersion fields. This work is reported in the PhD work of Maya Milliez defended in December 2006.

Dispersion for industrial site

After comparing the Mercure results with models which are classically used for these applications (Gaussian plume models), the work is now focusing on the simulation of two actual industrial site, including buildings and topography, for which the mesh and simulation domain have been designed. The first site, the Bugey nuclear power plant, is located in an area of moderate topography. Detailed comparisons have been performed for the dynamical variables (wind components and turbulence) and for the concentrations (mean values and fluctuations). For the release at the chimney, the low grid resolution near the release point gives an important underestimation of the plume rise which needs to be corrected. Taking this into account we find a globally satisfactory agreement but with an overestimation far from the source that needs further investigation. For the second site, the new nuclear power plant of Flamanville where a high cliff is found just behind the buildings, the results are under analysis and comparison with other detailed measurements obtained in the wind tunnel of the Ecole Centrale de Lyon (PhD work of Emmanuel Demael).

Wind potential estimates

In this area, the goal is first to try to improve the estimates that are currently obtained with very simple models. These models fail in complex terrain and along the coast with local circulations induced by the thermal contrast. In this context, detailed comparison are performed on the Askervein field experiment, well known for wind energy applications. The second objective is to quantify an additional effect of "mask" found in very large wind farms when a large set of wind mills modifies the local flow and can reduce the energy potential. This work has been performed by introducing this masking effect in Mercure by ways of a drag and lift (to force the rotation of the wake) within the

flow. Comparisons have been made with measurement obtained in the wind tunnel for a small wind turbine (as found on sailing ships) on the velocity deficit in the wake. Additional comparisons will be performed with a new measurement database obtained in another wind tunnel with porous disks to simulate the wind mills but this time with additional information on the turbulence level in the wake (PhD work of Laurent Laporte).

Estimation of pollution induced by traffic

In collaboration with LCPC, a database has been used to estimate pollutant emissions during road works. Over-emissions during the road repairing period were computed using kernel averaging methods. It is found that road work engines has a small contribution to air pollution. This is often hidden by the decrease of vehicular fluxes during repairs.
New building materials, containing titanium oxydes, are promoted to reduced air pollution near roads, especially for NO2 concentration. To simulate the physico-chemical properties of these covering material, a deposition model was introduced in Mercure_Saturne. This version was tested on the PICADA experiment. Meteorological simulated variables were compared to field data leading to an acceptable agreement. Pollutant fluxes were computed and bring relevant information for pollutant dispersion in the street canyon. Two methods were used to assess the efficiency of the titanium covered walls.

Local particle formation, dispersion and deposition

A model for large particle (1 to 30 micrometers) dispersion has been introduced into the Mercure_Saturne code. Comparison between the Gaussian approach and Mercure are carried out for PM10 deposition near sources. An eolian erosion model for the ground level is also included to deal with resuspension. The MAM aerosol model was introduced into Mercure_Saturne code in order to study the rapid growth of ultrafine particles near emission sources. The dispersion of exhaust particles are simulated near the exhaust tube. The results show the competition between dilution, cooling and condensation in the few meters after exhausts. The growth of nuclei radicals and soot is very sensitive to some organic compounds that could condense during the cooling phase.

Meteorological Measurements
(Group leader: Eric Dupont)

The observational actions are related to the needs of EDF in the fields of atmospheric dispersion at an industrial or urban site, and wind energy resource assessment, in close link with the "local scale and fluid mechanics" activity. The field campaigns are devoted primarily to the constitution of data base for numerical simulations, and to the tests of instruments, especially wind profilers (sodar, UHF radar).

Collaboration with IPSL (Institut Pierre Simon Laplace)

The main point related to the future of the measurement activity is the partnership with the IPSL Institute which has started in 2006. In the framework of this collaboration, the meteorological instruments of CEREA have been installed at the permanent experimental site of IPSL (SIRTA, located at Ecole Polytechnique, about 25 km south-west of Paris). SIRTA gathers a lot of in-situ and remote sensing instruments (lidars and radars) of several laboratories and is included in international networks of experimental sites devoted to research on aerosols and clouds. During 2006, CEREA has brought instruments for wind and turbulence measurements (UHF radar, sodar, sonic anemometers) and additional measurements of radiative budget, temperature and humidity. Moreover, the installation of sensors (temperature, humidity, radiative budget, wind, turbulence) near some buildings is planned for the beginning of 2007 in order to study the effect of wall surfaces on these physical parameters. A joint project with IPSL has been retained by Ile de France region (SESAME program) to support development and installation of instruments on SIRTA and thus to create on this site an experimental platform for research on meteorology and air quality in this region.

The instruments of SIRTA will provide routine measurements which will be compared during a long time period to Mercure_Saturne simulations, in order to study the ability of this code to simulate correctly the meteorological heterogeneities induced by the land use (buildings, trees …). Moreover, they will be used in the framework of campaigns on specific subjects. Since November, CEREA is involved with IPSL and Météo-France in a joint project (ParisFog) which is dedicated to the observation and numerical simulation of turbulent, radiative, dynamical, and microphysical processes involved in the life cycle of fog. The field campaign takes place at SIRTA up to April 2007. Numerical simulations (1D and 3D) will be performed on the IOPs (Intensive Observation Period) both by CEREA with Mercure_Saturne and by Météo-France with Méso-NH.

Sodars intercomparison

During the winter 2005-2006, the measurements group has performed a field campaign of intercomparison of sodars, in order to evaluate the quality of measurements and the acoustic disturbance of several commercialised sodars. The goals were first to select an instrument for wind and turbulence measurements on the French Nuclear Power Plants, and second to study the ability of these sodars to fulfil the specific needs for wind energy applications. The campaign site was located in Beauce region, on a very flat and opened site, thus well adapted to intercomparisons. Four sodars have been compared during 2 months to a 80 m height mast instrumented with cup and sonic anemometers, and to a reference sodar which has been extensively evaluated in the past. The analysis of the data has shown that two of the sodars perform well, one being more efficient for measurements of strong winds or in rainy situations. This analysis has also allowed to propose a methodology of sodar use to estimate wind at hub height, which leads to a strong decrease of the uncertainty on wind potential compared to a vertical extrapolation with a power law.

Campaign for wind resource assessment in complex terrain

The experimental group is currently involved in the preparation of a 8 months campaign of wind and turbulent measurements, which is planned for April-December 2007 on a future wind energy production site. The objectives are first to bring input and validation data for numerical simulations with Mercure_Saturne code, and second to carry on with the evaluation on a complex site of a new method to improve the estimate of wind at hub height using sodar measurements. The selected site is located in Southern of France and is characterised by strong slopes. The horizontal and vertical heterogeneities of wind and turbulence will be documented by means of 4 instrumented masts and a sodar. These data will allow a comparison between the calculations of wind resource obtained with Mercure_Saturne and with the linearized model WAsP (PhD work of Laurent Laporte).

Tests of a UHF radar and derivation of turbulent parameters

A Degréane UHF radar has been extensively tested for several years in collaboration with the Centre de Recherches Atmosphériques at Lannemezan plateau. It is well known that ground clutter and problem of commutation between emission and reception prevent UHF radar from giving good quality measurements in the first two hundred meters of the atmosphere. During 2005, a campaign has been initiated in order to test some important modifications performed by Degréane on the emitted pulse and on the receiver. The analysis of the data performed during 2006 has shown that the results of comparison between the first level of UHF radar (85 m) and a sonic anemometer are now very similar to those obtained from a comparison between our reference sodar and the same sonic anemometer. Moreover, the use of the spectral width of the meteorological peak allows to determine some turbulent parameters as the dissipation rate of kinetic energy. The comparison of the spectral width on the vertical beam with the standard deviation of vertical velocity measured by a sonic anemometer shows a good agreement during daytime, but large differences during night time.

Modeling at regional and continental scales (Group leader: Vivien Mallet)

The team is focused on air quality modeling from regional to continental scales. The applications are photochemistry (ozone), heavy metals (like mercury or lead) and radionuclides. The activities range from process studies to forecast and impact studies.

These activities now rely on a new modeling system, the Polyphemus platform, which hosts the "pure" dispersion models of CEREA, from local scales (Gaussian and Puff models) to regional and continental scales (Chemistry Transport Models Polair++ and Castor).

Many joint projects with other teams have been initiated with this modeling system, from forecast of radionuclides (with IRSN, France) or photochemistry (INERIS, France) to impact studies (with EDF Polska; with the University of Stuttgart, IER, for Cost-Benefit analysis in the framework of the European project NEEDS).

Development of the Polyphemus platform

Polyphemus has been extended to short-range dispersion with the development of low-level dispersion models (Gaussian and Puff models). Moreover, the Chemistry Transport Model Polair3D has been rewritten in a more advanced language (C++) and a new Chemistry Transport Model (Castor, a clone of Chimère) has been developed.

The new version of Polyphemus (version v1.0) has been released in November 2006 (www.enpc.fr/cerea/polyphemus). The resources (User's Guide) have also been completed.

Air quality ensemble forecast

Due to the wide range of uncertainties, a promising approach for air quality forecast is related to ensemble techniques. A multi-modeling approach has been proposed in order to improve the forecast of chemistry. The method is based on a set of configurations for Polyphemus (typically 50). The resulting spread in the outputs is the basis for the evaluation of uncertainties. Some algorithms, ranging from super-ensemble least square methods to machine learning have been proposed and applied to the forecast of ozone at continental scale for summer 2001 (Vivien Mallet, Christelle Bordas).

Moreover, the coupling to the Prev'air platform of INERIS has been achieved (Denis Quélo, Vivien Mallet, Yelva Roustan). The Polyphemus platform has been delivering air quality forecasts (photochemistry and Particulate Matter) since July 2006 in an operational framework (test for the Prev'air platform).

Impact studies at continental scale

A key application of such works is related to impact studies at European scale. A comprehensive model-to-data comparison has been performed with a focus on aerosols. The observational data were provided by the EMEP and AIRBASE monitoring networks.

CEREA is also implied in the European project NEEDS, devoted to Cost-Benefit Analysis. The computation of transfer matrices to be used for Cost-Benefit analysis has begun. Another goal is to estimate the associated uncertainties. The project is also the opportunity for strengthening the relationship with IER Stuttgart. Two other European projects (HEIMTSA and EXIOPOL) have been successfully submitted in a collaborative work with IER Stuttgart.

Moreover, the joint work with EDF Polska has been strengthened with the visits of Artur Wyrwa and Janusz Zisk (Leonardo de Vinci program) at CEREA. The use of Polyphemus by EDF Polska and by the consortium of associated polish universities has begun.

Dispersion of radionuclides

An important application of Polyphemus is the forecast of the dispersion of radionuclides. This work is done in a joint project with the Emergency Center of IRSN. Polyphemus is the basis of the forecast system of IRSN at regional/continental scales. The operational set-up of Polyphemus has been adapted for this purpose.

An extensive work has been devoted in 2006 for simulating the Chernobyl's accident, the ETEX campaign and the Algeciras release (Denis Quélo, Monika Krysta, Marc Bocquet, Bruno Sportisse).

Multi-media modeling

The assessement of the impact of air pollution for human health requires to take into account different media (air, soil, water). In the PhD work of Solen Quéguiner, the outputs of Polair3D for lead and cadmium (air concentration and ground deposition) have been coupled with the ground transfer model OURSON developed at LNHE (Department of EDF R&D). The OURSON model has been modified and a first test is scheduled over the Seine basin (PIREN/SEINE program). An extent of this work to mercury is planned in future.

The development of a model devoted to Persistent Organic Pollutants (POP), which requires a soil model, has also begun in Polyphemus.

Long-range transport

In order to simulate long-lived species (such as mercury) and to take into account the impact of other anthropogenic sources of emissions in the Northern hemisphere, the development of a prototype hemispheric version of Polair3D has been initiated (Denis Wendum). This is based on particularly simple modifications of the limited area model.

Multiphase modeling
(Group leader: Karine Kata-Sartelet)

During 2006, the activity of the group focused on the development and the validation of two multiphase models that differ mostly in the discretization of the size distribution of aerosols: lognormal distribution for MAM (Modal Aerosol Model) and size-resolved distribution for SIREAM (Size Resolved Aerosol Model).

PAM project

The works devoted to multiphase modeling (water/gas/aerosols) have been completed in the framework of the PAM project (Multiphase Air Pollution), funded by the French research program Primequal/Predit.

New parameterizations have been developed in 2006 (sea-salt emissions, heterogeneous reactions, etc). New numerical algorithms have also been proposed and tested (for condensation/evaporation, for redistribution from a moving grid to a fixed grid, etc).

The application to the data of the LISAIR campaign held in April 2005 over Paris has just begun (Marilyne Tombette) in a joint project with LSCE (IPSL/CEA).

Modeling of Secondary Organic Aerosols

The modeling of Secondary Organic Aerosols (SOA) is a challenging issue of aerosol modeling. The development of a new SOA model has been initiated (Edouard Debry) in a joint project with Christian Seigneur (AER & associate researcher at CEREA). The objective is to have a better description of the hydrophilic/hygrophobic behavior of aerosols.

Model-to-data comparison at regional and continental scales

The main part of the activities have been related to model-to-data comparisons: at continental scale over Europe (Karine Sartelet, Yelva Roustan, Edouard Debry, Bruno Sportisse), over Asia (Karine Sartelet), at regional scale over Greater Paris (Marilyne Tombette, Bruno Sportisse), over Marseille in the framework of the ESCOMPTE campaign (Karine Sartelet) and over Tokyo (Karine Sartelet).

Many sensitivity analysis have also been performed in order to evaluate the uncertainties in the model outputs.

The MICS project

CEREA participated, through a collaboration with CRIEPI (Central Research Institute of Electric Power Industry), to the phase II of MICS (Model InterComparison Study) Asia. Eight teams participated to MICS Asia phase II, which aimed at having a common understanding of model performance and uncertainties in Asia. The study focused on transport and deposition of sulfur, nitrogen compounds, ozone and aerosols in East Asia for March, July, December 2001 and March 2002. In 2006, the work has been completed and many articles have been submitted.

Local scale

At local scale, the local model MAM is used to reproduce the quick growth of ultrafine particles at the vicinity of roads (Bastien Albriet, Stéphanie Lacour). MAM has been coupled to Mercure_Saturne and process studies have been performed in order to evaluate the competition among nucleation, coagulation and condensation/evaporation. A crucial point is to follow the number distribution, a focus of the future reglementation. Current models only describe the mass distribution.

Extension to other applications

For "aircraft" particles, a project coordinated by ONERA, has been just starting for the modeling of soot (Stéphanie Lacour). This project is funded by Primequal/Predit.

A comprehensive review of dry deposition and wet scavenging models for radionuclides has been completed (Bruno Sportisse). This work will be the basis for a joint project with CEA. The extension to radionuclides of the current aerosol models of CEREA is one of the leading points of the next joint agreement between CEREA and IRSN.

Inverse modeling / Data assimilation
(Group leader: Marc Bocquet)

In 2006, the works in data assimilation and inverse modeling have been strengthened with a special attention paid to the dispersion of radionuclides. Monika Krysta PhD's defence was held successfully on the 14th September 2006: "Modélisation numérique et assimilation de données de la dispersion de radionucléides en champ proche et à l'échelle continentale". The activity "network design" had its kick-off at the beginning of the year, with the start of Rachid Abida's thesis, and the stay of Nikki Vercauteren for 8 months. She has worked on a project promoted by IRSN (see below) and due to the end of February 2007.

The Action de Recherche Concertée (ARC) ADOQUA (Data Assimilation for Air Quality), a Joint project with other INRIA teams, has taken part in the ARCs meeting at Grenoble (October 2006). Jean-Paul Berroir and Lin Wu made a clear presentation of ADOQUA progresses in front of the ARCs assembly.

A "young researchers" project has been submitted to the Research National Agency (ANR). Our project mainly involved Marc Bocquet (PI), and Vivien Mallet, but also support from INERIS and IRSN. The two lead topics that have been proposed are "advanced inverse modeling" and "ensemble forecast in air quality". The project has eventually been rejected. The argument invoked was that the team was not enough known in the field. The previous version of this project was rejected last year because we were already known to be experts in the field!

IRSN future remote monitoring network for radioactive particles in atmosphere

The aim of this study is to give an objective response concerning the setting up of an optimal monitoring network over France. For this, Polair3D model forced by ECMWF

analysis was used to generate a database representing all probable scenarios accident over one year. Spatial interpolation methods and simulated annealing algorithm were used to assess monitoring networks capacity to detect and reproduce the accident situations. One month of database was used to perform the first tests on the inference chain. Several computing tools (parallel distributed) were designed to alleviate the task (Vercauteren, Abida, Bocquet).

Development of the data assimilation system within the Polyphemus platform

Thanks to object-oriented techniques, the developments of three components of the data assimilation system, namely data (observation), model (physics), and assimilation algorithms, are independent from one another. Classical sequential assimilation methods, such as OI, EnKF, RRSQRT, are implemented. Adjoint model (obtained by automatic differentiation tool Odyssee) for 4D-Var is ready. Preliminary results are obtained by perturbing model field data, such as surface emissions, boundary conditions, etc. Future work will focus on the validations of the data assimilation system, for which model and background error modeling are needed (Wu, Mallet, Bocquet, Sportisse, Benoir).

Adjoint modeling and sensitivities computations for the Chernobyl accident

This work has been carried out as a research training period (IMI department of ENPC) for three of the ENPC students (advisor: Marc Bocquet). This work aimed at building and validating several tools dedicated to sensitivity analysis of activity measurements with respect to many forcing fields, but especially sources. A similar work had been carried out in 2004-2005 on the dispersion of mercury (Roustan, Bocquet). The goal is to demonstrate that such an approach could also be applied on a radionuclide dispersion episode. Most of the work has focused on the computation of adjoint solutions related to wet deposition (the wet scavenging using a Belot or relative humidity parametrisation). In addition to the results obtained for the sensitivity analysis of the Chernobyl accident, this work can be understood as a prelude to inverse modeling of deposited activity (Anantharaman, Roehrig, Ghoul, Bocquet, Roustan).

Inverse modeling-based reconstruction of the Chernobyl source term available for long-range transport

The reconstruction of the Chernobyl accident source term has been previously carried out using core inventories, but also back and forth confrontations between model simulations and activity concentration or deposited activity measurements. The approach developped in this work is based on inverse modeling techniques. It relies both on the activity concentration measurements and on the adjoint of a chemistry-transport model. The location of the release is assumed to be known, and one is looking for a source term available for long-range transport that depends both on time and altitude. The method relies on the maximum entropy on the mean principle and exploits source positivity. The inversion results are mainly sensitive to two tuning parameters, a mass scale and the scale of the prior errors in the inversion. To overcome this hardship, we resort to the statistical L-curve method to estimate balanced values for these two parameters. Once this is done, many of the retrieved features of the source are robust within a reasonable range of parameter values. Our results favour the acknowledged three-step scenario, with a strong initial release (26 to 27 April), followed by a weak emission period of four days (28 April - 1 May) and again a release, longer but less intense than the initial one (2 May - 6 May). The retrieved quantities of iodine-131, caesium-134 and caesium-137 that have been released are in good agreement with the latest reported estimations. Yet, a stronger apportionment of the total released activity is ascribed to the first period and less to the third one. Finer chronological details are obtained, such as a sequence of eruptive episodes in the first two days, likely related to the modulation of the boundary layer diurnal cycle. In addition, the first two-day release surges are found to have effectively reached an altitude up to the top of the domain (5000 metres) (Davoine, Bocquet).

High resolution reconstruction of a tracer dispersion event

In a previous QJRMS two-part paper (see CEREA activity report 2005), new methods to reconstruct the source for an atmospheric tracer at regional scale have been developed. Specifically the maximum entropy on the mean method was extended to large (although linear) data assimilation problem. Tests using twin experiments and a limited subset of the data from the European Tracer Experiment [ETEX] were performed. Although temporal reconstruction knowing the location of the source was satisfying, a full 3D reconstruction was still out of reach with real data. In this work, using the MEM method and some of its refinements, a reconstruction using all ETEX-I measurements at a resolution of 1.125° x 1.125° x 1 hour is shown to be possible. This allows for a

reconstruction of the full dispersion event. The MEM retrieval of the tracer plume using what is believed to be a good prior is then compared to other priors including Gaussian priors. Eventually, a reconstruction using all data sequentially in time (not all together) is obtained. This helps define what a maximum entropy filter applied to sequential data assimilation of a linear tracer should be able to do, with a view to an efficient emergency response in case of an accidental release of pollutant (Bocquet).

Source reconstruction of an accidental radionuclide release at European scale

Source retrieval is one of the problems that are currently being addressed within a framework of data assimilation for dispersion of radionuclides. Firstly, a series of hypothetical releases have been designed. The accidents have been imagined to take place at one of the European nuclear facilities at a time. The aim of a retrieval is to tell the position of the source and the shape of its temporal profile. The solution is given by a procedure based on the maximum of entropy principle. A couple of new, problem-adapted cost functions have been put forward and their performance tested. The tests have been undertaken with perfect and noisy synthetic measurements, and have been assessed with an objective indicator. In perfect measurement configurations, perfect reconstructions have been obtained for a number of measurements significantly lower than the number of unknowns. Secondly, temporal profile of an accidental release of caesium-137 in Algeciras steel mill has been inverted. The total reconstructed activity falls within an interval given by the official estimations. The profile is narrow which remains in accordance with the information disclosed after the release but is slightly shifted towards the earlier times (Krysta, Bocquet).

Data assimilation of satellite ozone data in a chemistry transport model

Hervé Boisgontier and Jean-Paul Berroir have performed a series of tests and experiments towards data assimilation of an ozone column (from 0 to 6 kilometres high) into Polyphemus. Optimal interpolation was used but it offers a reliable assessment on these data performance. This column data are characteristic of the IASI instrument on board the METOP platform, successfully launched on 19th October 2006. Their results confirm the difficulty of such an endeavour (more than for nitrogen dioxide column assimilation) but it does not rule it out (Boisgontier, Berroir, Mallet, Bocquet, Herlin, Sportisse)

Teaching activities

CEREA is involved in the teaching activities at Ecole Nationale des Ponts et Chaussées. This includes courses devoted not only to applications (Air Pollution) but also to academic fields (Applied Mathematics and Fluid Mechanics). CEREA is also active in teaching activities at ENSTA with two courses: one devoted to Computational Physics for geophysics, one devoted to data assimilation. These courses are now also proposed for ENPC students.

CEREA is involved in the teaching program of Mastère TRADD with a course devoted to Air Pollution and Transport. Some courses (Atmospheric Modeling) have been given in Research Master SGE.

A first key fact in 2006 is the start of a new course devoted to Air Pollution at ENTPE (Ecole Nationale des Travaux Publics de l'Etat). This gives to CEREA a central position for teaching these topics inside the Scientific Network of the French Ministry for transport.

A second key fact is related to the use of Polyphemus as a tool for courses at ENPC and ENSTA (air pollution, computer science for environment and data assimilation). Polyphemus is then used both for research (academic and operational applications) and teaching.

International collaborations

Christian Seigneur (AER, USA), one of the leading experts in aerosol modeling, has been joining CEREA as associate researcher from October 2006. He will contribute to projects devoted to aerosol modeling and plume-in-grid modeling. This is also the opportunity for CEREA to develop relationships with the CMAQ community.

CEREA has begun a participation in the European project NEEDS devoted to Impact studies and Cost-Benefit Analysis of Air Pollution Externalities. This project will promote collaborative works with EMEP/West and IER Stuttgart. Two other European projects (HEIMTSA and EXIOPOL) have been successfully submitted.

CEREA has developed relations with the CMM of Santiago de Chile and Meteo Chile, with topics devoted to inverse modeling of pollutants and Air Quality forecast (mission of Ricardo Alcafuz, Meteo Chile at CEREA). This work is supported by CONYCIT/INRIA and STIC/AmSud and is part of the CLIME project.

CEREA has welcome Artur Wyrwa and Janusz Zisk from the University of Cracow in the framework of the Leonardo de Vinci program. This visit will strengthen the joint project with EDF Polska and the related consortium of the Polish Universities.

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ALBRIET Bastien		ENPC
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DEMAEL Emmanuel		EDF
KORSAKISSOK Irène		ENPC
KRYSTA Monika	#	ENPC
LAGACHE Rémy		METL
LAPORTE Damien		EDF
MALAKOOTI Hossein		ENPC
MILLIEZ Maya	#	ENPC
QUEGUINER Solen		EDF
TOMBETTE Marilyne		ENPC
ZHANG Xiaojing		ENPC

(#) Not a member of CEREA at 31/12/2006

Master thesis

BORDAS Christelle (ENSTA)
CHALLET Johan (ENSTA)
DAVOINE Xavier (ENSTA)
EL ATTAR Abdel (Univ. Pierre & Marie Curie)
GIRAULT Laëtitia (Univ. Pierre & Marie Curie)
SAMBA Céline (Centrale Lyon)

Technical staff

DEMENGEL Dominique	EDF
LEFRANC Yannick	EDF

Administrative Staff

BARRES Karine	ENPC

Teaching activities

Air Pollution, ENPC.
Bruno SPORTISSE.

TRADD Mastère (Air Pollution and Transport), ENPC.
Stéphanie LACOUR, Bruno SPORTISSE.

Applied Mathematics, ENPC (1st year).
Bruno SPORTISSE.

Fluid Mechanics, ENPC (2nd year)
Bertrand CARISSIMO.

Data assimilation and inverse modeling, ENSTA & ENPC.
Marc BOCQUET, Vivien MALLET, Bruno SPORTISSE.

Computational Physics for Environment, ENSTA & ENPC.
Bruno SPORTISSE, Vivien MALLET, Lin Wu.

Atmospheric Modeling, Master SGE/AQA.
Bertrand CARISSIMO, Edouard DEBRY, Vivien MALLET.

Air Pollution, ENTPE.
Stéphanie LACOUR.

Summer school CEA/EDF/INRIA "Data assimilation". July 2006. Paris.
Vivien MALLET (teaching assistant).

Publications

Articles accepted or published in international peer-reviewed journals

E. Bouzereau, L. Musson-Genon, and B. Carissimo.
On the definition of the cloud water content fluctuations and its effects on the computation of a second-order liquid water correlation. *Accepted for publication in Journal of Atmospheric Sciences*.

E. Debry, K. Fahey, K. Sartelet, B. Sportisse and M. Tombette.
A new SIze REsolved Aerosol Model: SIREAM. *Accepted for publication in Atmos.Chem.Phys.Discus. (ACPD), 2006.*

E. Debry and B. Sportisse.
Reduction of the condensation/evaporation dynamics for atmospheric aerosols: theoretical and numerical investigation of hybrid methods. *Journal Aerosol Science, 2006, 378, pages 950-966.*

E. Debry and B. Sportisse.
Solving aerosol coagulation with size-binning methods. *Accepted for publication in Appl.Num.Math.*

E. Debry and B. Sportisse.
Numerical simulation of the General Dynamics Equation (GDE) for aerosols with two collocation methods. *Accepted for publication in Appl.Num.Math.*

E. Demaël and B. Carissimo.
A comparison between Eulerian CFD and Gaussian Plume models on Prairie Grass Dispersion Experiment. *Accepted for publication in Journal of Applied Meteorology.*

M. Krysta and M. Bocquet.
Source reconstruction of an accidental radionuclide release at European scale 2006. *Accepted for publication in QJRMS.*

M. Krysta, M. Bocquet, B. Sportisse, O. Isnard.
Data assimilation for short-range dispersion of radionuclides: an application to wind tunnel data. *Atmospheric Environment, 2006, 40(38), 7267-7279.*

V. Mallet and B. Sportisse.
Uncertainty in a chemistry-transport model due to physical parameterizations and numerical approximations: an ensemble approach applied to ozone modeling. *JGR, 2006, 111,D01302.*

V. Mallet and B. Sportisse.
Air Quality Modeling: from deterministic to stochastic modeling. *Accepted for publication in Journal of Computers and Mathematics with Application.*

V. Mallet and B. Sportisse.
Ensemble-based air quality forecasts: a multi-model approach applied to ozone. *JGR, 2006, 111, D18.*

M. Milliez and B. Carissimo.
Numerical simulations of flow and pollutant dispersion in an idealized urban area, for different meteorological conditions. *Accepted for publication in Boundary-Layer Meteorology.*

Y. Roustan and M. Bocquet.
Sensitivity analysis for mercury over Europe. *JGR, 2006, 111, D14304.*

Y. Roustan and M. Bocquet.
Inverse modeling for mercury over Europe. *ACP, 2006, Vol. 6, 3085-3098.*

B. Sportisse.
A review of parameterizations for modeling dry deposition and wet scavenging of radionuclides. *Accepted for publication in Atmospheric Environment.*

B. Sportisse.
A review of current issues in air pollution modeling and simulation. *Accepted for publication in Journal of Computational Geosciences.*

B. Sportisse and R. Djouad.
Use of Proper Orthogonal Decompositions for the reduction of atmospheric chemistry. *Accepted for publication in JGR.*

M. Tombette and B. Sportisse.
Aerosol modeling at regional scale: Model-to-data comparison and sensitivity analysis over Great Paris. *Accepted for publication in Atmospheric Environment.*

Submitted articles

M. Bocquet.
High resolution reconstruction of a tracer dispersion event: application to ETEX 2006. *Submitted to QJRMS.*

E. Bouzereau, L. Musson-Genon, and B. Carissimo.
Application of a semi-spectral cloud water parameterization to cooling tower plumes simulations. *Submitted to Journal of Applied Meteorology.*

Carmichael et al. (including K. Sartelet).
Overview of the Second Model Intercomparison Study for Asia (MICS-Asia Phase II). *Submitted to Atmospheric Environment (MICS Special Issue*).

X. Davoine and M. Bocquet.
Inverse modeling-based reconstruction of the Chernobyl source term available for long-range transport. *Submitted to Atmospheric Chemistry and Physics.*

Han et al. (including K. Sartelet).
Model Intercomparison and Evaluation of Ozone and Relevant Species. *Submitted to Atmospheric Environment (MICS Special Issue*).

Hayami et al. (including K. Sartelet).
Model Intercomparison Study of Chemical Transport Models for East Asia (MICS-Asia): Particulate Sulfate, Nitrate and Ammonium. *Submitted to Atmospheric Environment (MICS Special Issue*).

S. Lacour and B. Sportisse.
Estimation of indoor deposition velocity for ozone with a simplified reactive box model. *Submitted to Atmospheric Environment.*

S. Lacour, H. Schmitt-Foudhil and B. Carissimo.
Detailed modeling of NOx and NO2 dispersion in a street canyon. *Submitted to Atmospheric Environment*.

V. Mallet, D. Quélo, B. Sportisse, E. Debry, I. Korsakissok, Y. Roustan, K. Sartelet, L. Wu, M. Tombette and H. Schmitt-Foudhil.
A new air quality modeling system: Polyphemus. *Submitted to ACPD.*

M. Milliez and B. Carissimo.
CFD modeling of concentration fluctuations in an idealized urban area. *Submitted to Boundary-Layer Meteorology*.

L. Musson Genon, E. Dupont and D. Wendum.
Reconstruction of the surface boundary layer vertical structure of wind temperature and humidity at two levels. *Submitted to Boundary-Layer Meteorology.*

A. Pourchet, V. Mallet, D. Quélo and B. Sportisse.
A review of some numerical issues in Chemistry-Transport models. *Submitted to JGR.*

D. Quélo, M. Krysta, M. Bocquet, O. Isnard, Y. Minier and B. Sportisse.
Validation of the Polyphemus system: the ETEX, Chernobyl and Algeciras cases. *Submitted to Atmospheric Environment.*

K. Sartelet, E. Debry, K. Fahey, M. Tombette, Y. Roustan and B. Sportisse.
Simulation of aerosols and related species over Europe with the Polyphemus system. Part I: model-to-data comparison for year 2001. *Submitted to JGR.*

K. Sartelet, H. Hayami and B. Sportisse.
MICS Asia Phase II - Sensitivity to the aerosol module. *Submitted to Atmospheric Environment (MICS Special Issue*).

K. Sartelet, H. Hayami and B. Sportisse.
Dominant aerosol processes during high-pollution episodes over Greater Tokyo. *Submitted to JGR.*

B. Sportisse and D. Quélo.
Impact of mass consistency errors for atmospheric dispersion. *Submitted to Atmospheric Environment, 2006.*

Wang et al. (including K. Sartelet).
Modeling deposition in East Asia: a model intercomparison study. *Submitted to Atmospheric Environment (MICS Special Issue*).

Articles in French

M. Bocquet and B. Sportisse.
Modélisation inverse pour la qualité de l'air : éléments de méthodologie et exemples. *Submitted to Pollution Atmosphérique, 2006.*

V. Mallet, I. Korssakissok, D. Quélo and B. Sportisse.
Polyphemus : un système modulaire de modélisation pour la dispersion atmosphérique et l'évaluation des risques. *Submitted to Pollution Atmosphérique, 2006.*

Y. Roustan, M. Bocquet, L. Musson Genon et B. Sportisse.
Modélisation du mercure, du plomb et du cadmium à l'échelle européenne. *Accepted in Pollution Atmosphérique.*

Proceedings

R. Joumard, J. Laurikko, S. Geivanidis, Z. Samaras, Z. Oláh, M. Weilenmann, J-M. André, E. Cornelis, M. Gribe, S. Lacour, M.V. Prati, R. Vermeulen and M. Zallinger.
Accuracy of exhaust emissions measurements on vehicle bench, FISITA 2006, World Automotive Congress, 22-27 October 2006,

Yokohama, Japan - Paper reference: F2006P409

S. Lacour, A. Ventura, N. Rangod, B. Carissimo, A.Jullien.
How to estimate roadworks emissions factors from traffic and air quality monitoring measurements - A methodological approach.
In Proceedings of the 15th Workshop "Transport and Air Pollution", Reims, France, 12-14 June 2006.

R. Lagache, C.Declercq, B. Sportisse, D. Quélo, P. Palmier, B. Quetelard & F. Haziak.
Évaluation de l'impact du plan de déplacements urbains de Lille-Métropole sur le trafic, les concentrations de polluants atmosphériques et la mortalité.
In Proceedings of the 15th Workshop "Transport and Air Pollution", Reims, France, 12-14 June 2006.

V. Mallet, B. Sportisse.
Peut-on modéliser la qualité de l'air de manière déterministe ?
In Proceedings of "38e Journées de Statistique". SMS. Paris, June 2006.

M. Milliez, L. Musson-Genon, and B. Carissimo.
Validation of a radiative scheme for CFD modeling of heat transfers between buildings and flowin urban canopies.
In Preprints of the 6th International Conference on Urban Climate, Goteborg, Sweden, June 12-16.

M. Milliez, L. Musson-Genon, and B. Carissimo.
Radiative transfers in CFD modeling of the urban canopy.
In Proceedings of the 28th NATO International Technical Meeting on Air Pollution Modeling and its Applications, Leipzig, Germany, May 15-19.

Reports

Report 2006-1: Rapport du Projet PAM. B. Sportisse, K. Kata, E. Debry, K. Fahey, Y. Roustan, M. Tombette, B. Albriet et H. Schmitt. P.171

Report 2006-2: Modélisation de l'impact du CPT de Porcheville. Résultats préliminaires. M. Tombette, L. Musson-Genon et B. Sportisse. P.12

Report 2006-3: Le projet PAM - Actes primequal. B. Sportisse. P.4

Report 2006-4: Inverse modeling for mercury over Europe. Y. Roustan, M. Bocquet. P.14

Report 2006-5: Etude de l'évolution en zone aéroportuaire des suies émises par les avions. Rapport d'avancement ONERA. S. Lacour, K. Kata. P.22

Report 2006-6: Data assimilation for short-range dispersion of radionuclides: an application to wind tunnel data. M. Krysta, M. Bocquet, B. Sportisse &O. Isnard. P.23

Report 2006-7: Peut-on modéliser la qualité de l'air de manière déterministe ? V. Mallet, B. Sportisse. P.6

Report 2006-8: The Size REsolved Aerosol Model (SIREAM) and the Modal Aerosol Model (MAM). Technical documentation. B. Sportisse, K. Kata, E. Debry, K. Fahey, Y. Roustan and M. Tombette. P.115

Report 2006-9: Aerosol modeling at a regional scale: Model-to-data comparison and sensitivity analysis over Greater Paris. M. Tombette, B. Sportisse. P.26

Report 2006-10: Rapport de contrat ONERA. Description du modèle de panache réactif. S. Lacour. P.20

Report 2006-11: Source reconstruction of an accidental radionuclide release at European scale. M. Krysta, M. Bocquet. P.26

Report 2006-12: Generation of sea-salt aerosols in Polyphemus. K. Kata. P.6

Report 2006-13: Modélisation inverse pour la qualité de l'air: éléments de méthodologie et exemples. M. Bocquet, B. Sportisse. P.13

Report 2006-14: Modélisation adjointe et calcul de sensibilités pour l'accident de Tchernobyl. Projet du Département Ingénierie Mathématique et Informatique. A. Anantharaman, T-E. Ghoul, R. Roehrig. P.50

Report 2006-15: Validation of the Polyphemus platform: the ETEX, Chernobyl and Algeciras cases. D. Quélo, M. Krysta, M. Bocquet, O. Isnard, Y. Minier and B. Sportisse. Tcherno. P.31

Report 2006-16: Air quality modeling: from deterministic to stochastic approaches. V. Mallet, B. Sportisse.

Report 2006-17: Polyphemus: un système modulaire multi-modèles pour la dispersion atmosphérique et l'évaluation des risques. V. Mallet, I. Korsakissok, D. Quélo et B. Sportisse. P.11

Report 2006-18: Définition des scénarios de calcul pour l'évaluation des réseaux de mesure aux échelles locale et régionale. I. Korsakissok. P.34

Report 2006-19: Evaluation des performances du radar UHF Degréane : Résultats de la campagne de l'été 2005 et ses conclusions. E. Dupont. P.44

Report 2006-20: Dominant aerosol processes during hig-pollution episodes over Greater Tokyo. K. Kata. P.39

Report 2006-21: MICS Asia Phase II - Sensitivity to the aerosol module. K. Kata, H. Hayami and B. Sportisse. P.18

Report 2006-22: Use of Proper Orthogonal Decomposition for the Reduction of Atmospheric Chemical Kinetics. B. Sportisse, R. Djouad. P.33

Report 2006-23: Impact of mass consistency errors for atmospheric dispersion. B. Sportisse, D. Quélo. P.16

Report 2006-24: A review of parameterizations for modeling dry deposition and scavenging of radionuclides. B.Sportisse. P.27

Report 2006-25: A review of current issues in air pollution modeling and simulation. B. Sportisse. P.44

Report 2006-26: Solving aerosol coagulation with size-binning methods. E.Debry, B. Sportisse. P.18

Report 2006-27: Numerical simulation of the General Dynamic Equation (GDE) for aerosols with collocation methods. E.Debry, B. Sportisse. P.21

Report 2006-28: CFD modeling of concentration fluctuations in an idealized urban aera. M. Milliez, B. Carissimo. P.40

Report 2006-29: Simulation of aerosol and related species over Europe with the Poyphemus system. Part I: model-to-data comparison for 2001. K. Kata, E. Debry; K. Fahey, Y. Roustan. P.30

Report 2006-30: Modeling of dispersion and scavenging in the Polyphemus platform. Applications to passive tracers. I. Korsakissok, B. Sportisse, V. Mallet and D. Quélo. P.28

Report 2006-31: Polyphemus user's guide. V. Mallet et I. Korsakissok. P.46

Report 2006-32: Rapport de projet de fin d'études - Modélisation du brouillard à l'aide du modèle météorologique méso-échelle MERCURE. C. Samba. P.59

Report 2006-33: Passage du code Polair3D en mode global ou hémisphérique: Note de Principe. D. Wendum. P.33

Report 2006-34: Etude de l'impact du CPT Martigues sur la pollution particulaire dans la région de Marseille-Berre. K. Kata, M. Taghavi, L. Musson-Genon. P.36

Report 2006-35: Finalisation d'une note sur les méthodes d'apprentissage et d'ensemble pour la modélisation de la qualité de l'air. C. Bordas. P.15

Report 2006-36: Evaluation des performances du radar UHF Degréane : résultats de la campagne de l'été 2005 et conclusions. E. Dupont. P.44

Report 2006-37: Technical Note: A new SIze REsolved Aerosol Model (SIREAM). E. Debry, K. Kata, B. Sportisse and M. Tombette. P.11

Report 2006-38: Partenariat recherche publique/entreprise : l'exemple du CEREA, Laboratoire Commun ENPC/EDF R&D. B. Sportisse. P.13

Report 2006-39: Rapport de stage ISUP CS2 : Propagation d'incertitudes dans le modèle "panache" Gaussien de dispersion atmosphérique par la méthode de Monte Carlo. A. El Attar. P.64

Report 2006-40: Rapport de stage de Master2. Evaluation de l'efficacité de murs catalytiques sur les teneurs en NOx dans une rue à fort trafic. L. Girault. P.83

Report 2006-41: Projet de développement d'un réseau automatisé de télésurveillance des particules radioactives dans l'air- Etude pour l'optimisation du réseau. N. Vercauterren, M. Bocquet.

Report 2006-42: Rapport d'avancement convention cadre IRSN/CEREA:insertion de Polyphemus au sein du système krX. D. Quélo.

Report 2006-43: Matrices de transfert pour la dispersion atmosphérique et l'étude d'impact multi-polluant. Y. Roustan.

Report 2006-44: Projet de fin d'étude : Modélisation inverse de rejets accidentels dans l'atmosphère, application au cas de Tchernobyl. X. Davoine. P.73

Report 2006-45: Rapport de stage : Evaluation d'un modèle de chimie-transport et de méthodes d'ensemble pour la prévision de la qualité de l'air. C. Bordas. P.78

Report 2006-46: Rapport du contrat DGA. Simulations et évaluation des réseaux à l'échelle locale. I. Korsakissok. P.62

Report 2006-47: Inverse modeling-based reconstruction of the Chernobyl source term available for long-range transport. X.Davoine, M. Bocquet.

Report 2006-48: Modélisation du veillissement des suies d'avions, rapport d'avancement du projet CAAT, activité 2.5. S. Lacour, K. Kata-Sartelet.

Report 2006-49: Estimation of indoor deposition velocity for ozone with a simplified reactive box model. S. Lacour, B. Sportisse. P.23

Report 2006-50: User's guide Polyphemus. Version V1.0. V.Mallet et al.

Report 2006-51: Synthèse de la convention cadre IRSN/CEREA 2003-2006. O. Isnard and B. Sportisse.

Report 2006-52: How to estimate roadworks emissions factors from traffic and airquality monitoring measurements - A methodological approach. S. Lacour, A. Ventura, N. Rangod, B. Carissimo, A. Jullien.

Report 2006-53: Modélisation de la pollution atmosphérique et des impacts à l'échelle locale en interaction avec le RST, rapport d'activité 2005. S. Lacour.

Report 2006-54: Modélisation de la pollution atmosphérique et des impacts à l'échelle locale en interaction avec le RST, rapport d'activité 2006. S. Lacour.

Report 2006-55: Rapport intermédiaire de contrat 2006 : Evaluation des impacts du CPT Porcheville. Marilyne, Bruno. P. 7

Report 2006-56: Rapport final de contrat 2006: Evaluation des impacts du CPT Porcheville. Denis Quélo, Bruno Sportisse. P46

Report 2006-57: Modèle de dépot et de resuspension de particules pour le code Mercure_Saturne". Stéphanie Lacour.

Report 2006-58: Aerosol modelling at the local scale. B. Albriet, S. Lacour, K. Sartelet, B. Carissimo.

Report 2006-59: Cours ingénieur TPE, "Qualité de l'air et santé", Volet 1 - Introduction à la pollution atmosphérique. S. Lacour. P.48

Report 2006-60: Cours ingénieur TPE, "Qualité de l air et santé", Volet 2 - Emissions de polluants atmosphériques. S. Lacour. P. 78

Textbooks for teaching activities

(Available at www.enpc.fr/cerea as ParisTech courseware)

Air Pollution Modeling (ENPC)
B. Sportisse

Air Pollution and Transport: emission inventories (ENPC)
S. Lacour

Data Assimilation and inverse modeling (ENSTA)
B. Sportisse and D. Quélo (part 1)
M. Bocquet (part 2)

Computational Physics for Environmental Problems (ENSTA)
B. Sportisse and V. Mallet

Theses in progress

R. ABIDA
Construction optimale de réseaux de mesure pour la pollution atmosphérique. ENPC.

B. ALBRIET
Modélisation des aérosols à l'échelle locale et régionale. ENPC.

E. DEMAEL
Modélisation de la dispersion sur un site nucléaire. ENPC.

I. KORSAKISSOK
Changements d'échelles en modélisation de la qualité de l'air et estimation des incertitudes associées. ENPC.

R. LAGACHE
Couplage de modèles pour l'estimation des impacts de la pollution atmosphérique liée aux transports à l'échelle locale. ENPC.

D. LAPORTE
Amélioration de l'estimation du productible éolien en terrain complexe. ENPC.

H. MALAKOOTI
Modélisation de la qualité de l'air dans une "Megacity". Application à Téhéran. ENPC.

S. QUEGUINER
Modélisation multi-milieux de la pollution atmosphérique. ENPC.

M. TOMBETTE
Modélisation des aérosols à l'échelle régionale. ENPC.

X. ZHANG
Modélisation du brouillard à l'aide du code Mercure_Saturne. ENPC.

Theses defended

M. KRYSTA 14/09/06
Modélisation inverse de la dispersion des radionucléides dans l'atmosphère. Paris 12.

M. MILLIEZ 14/12/06
Modélisation thermique au sein du modèle Mercure_Saturne. Application à la modélisation de l'environnement urbain. ENPC.

Contracts

Agreement 2006 EDF R&D
EDF R&D - 284 k€

Agreement 2006 DRAST
S. Lacour.
MTETM – 35 k€

Agreement 2006 IRSN
B. Sportisse, M. Bocquet, M. Krysta, D. Quélo.
IRSN – 130 k€

PAM project (Primequal-Predit)
B. Sportisse, K. Fahey, K. Sartelet, E. Debry and M. Tombette.
MEDD – 100 k€

Etude du comportement et optimisation de l'utilisation d'un réseau de capteurs
B. Sportisse, I. Korsakissok.
DGA - 80 K€

Etude de l'évolution en zone aéroportuaire des suies émises par les avions.
S. Lacour.
ADEME – 40 k€

Etude d'impact à l'échelle régionale pour les rejets atmosphériques des CTP à fioul et à charbon : application aux CPT Ile de France.
L. Musson-Genon, D. Quélo, B. Sportisse.
EDF R&D – 70 k€

Agreement INERIS
B. Sportisse and V. Mallet.
INERIS – 48 K€

Etude de l'impact des émissions d'avions sur la composition de l'atmosphère.
S. Lacour
ONERA – 20 k€

Conferences, seminars, missions

Conferences (with presentations)

EGU, European Geophysical Conference. 2006, 2-6 April, Vienna, Austria.
M. Krysta and M. Bocquet.

ITM06, May 2006, Leipzig, Germany.
M. Milliez

GLOREAM (Global and Regional Atmospheric Modeling)/ACCENT Meeting, 11-13 October 2006, Paris.
M. Bocquet, E. Debry, B. Sportisse.

The 6th Conference on Urban Air Quality, Gothenburg, Sweden, 11-16 June 2006.
M. Milliez, B. Carrissimo, R. Lagache.

2nd Conference Environment & Transport/including 15th Conference Transport and Air Pollution Reims, France, 12-14 June 2006.
S. Lacour, B. Albriet, R. Lagache.

Conference "journée statistique de la SMS", May 2006, Paris.
V. Mallet.

Workshop Primequal, February 2006, Strasbourg, France.
B.Sportisse.

Main missions

V. Mallet. CWI, Amsterdam. August – November 2006.

E. Debry. Workshop Needs RS1b- Stuttgart, Germany. November 2006.

S. Lacour. Workshop « Particles » Primequal, Avignon, France. March 2006.

L. Wu, Y. Roustan, M. Bocquet, M. Krysta. Workshop "Assimilation de données" (LEFE/CNRS), Toulouse, France. May 2006.

M. Bocquet. Workshop Accent/WMO, Genève, Switzerland. April 2006

H. Malakooti. Field campaign for aerosols over Tehran (Iran). July and November 2006.

R. Abida. Summer school: STATGIS06. Klagenfurt, Austria. September 2006.
M. Bocquet, L. Wu. Meeting ARCs (INRIA), Grenoble, France. October 2006.

M. Tombette. Summer school (Turbulence in the Atmospheric Boundary Layer). Barcelona, Spain. November 2006.

Seminars

B. Sportisse. "Uncertainties in Chemistry-Transport Models". Presentation for the Scientific Committee of Institut Français du Pétrole (18 January 2006). Paris, France.

B. Sportisse. "Air pollution modeling". 8th Workshop Transport/Energy/Environment. 22 May 2006. Paris.

B. Sportisse. "Atmospheric dispersion of radionuclides: some modeling approaches". EMRAS Tritium Meeting, IAEA/EDF, June 2006. Chatou, France.

V. Mallet. "Uncertainties in Air Quality Modeling". CWI Seminar. October 2006.

M. Bocquet. "Advanced Inverse Modeling of radionuclides". LMD, Paris. December 2006.

M. Bocquet. "Modélisation inverse en chimie atmosphérique". Summer school "Data Assimilation" CEA/INRIA/EDF. July 2006.

Invited Fellows

Janusz Zisk (University of Science and Technology, Krakow, Polska). Impact studies with Polyphemus/Polair3D. September-December 2006.

Seminars at CEREA

February 9, 2006: Jean-Paul Chilès, Serge Séguret et Hans Wackernagel. Centre de Géosciences - Ecole des Mines de Paris. Les problèmes géostatistiques de l'assimilation de données. Analyse géostatistique de données de validation d'un modèle de prévision de la pollution atmosphérique.

March 8, 2006: Jean-Michel Rosant. DAH/LMF - Ecole Centrale de Nantes. Mesures micro-météorologiques dans une rue canyon : l'expérience JAPEx.

March 10, 2006: Faouad Badran, Charles Sorror, Sylvia Thiria. LOCEAN - Université de Paris VI. YAO : une méthodologie logicielle pour l'implémentation de modèles numériques (schéma direct, adjoint et assimilation variationnelle).
March 17, 2006: Thierry Bergot. Centre National de Recherches Météorologies. Recherche sur le brouillard au CNRM.
April 28, 2006: Alberto Carrassi. ISAC-CNR, Bologna – Italy. Adaptive observations and assimilation in the unstable subspace (AUS).

May 5, 2006: Remus Hanea. Department of Applied Mathematics Analysis, Delft University of Technology. Kalman filter algorithms for large scale atmospheric chemistry applications

May 23, 2006: Benoît Noetinger. Institut Français du Pétrole. Les techniques de changement d'échelle des écoulements, une approche physique : applications aux problèmes de l'industrie pétrolière et à la gestion des incertitudes.

June 15, 2006: Gérald Nicolas, Electricité de France R&D – Département SINETICS. Adaptation de maillages avec le logiciel HOMARD.

June 27, 2006: Sylvain Dupont. INRIA-EPHYSE. Modélisation des écoulements atmosphériques en zones urbaines et rurales à fine résolution spatiale.

July 12, 2006: Patrick Chazette. Laboratoire des Sciences du Climat et de l'Environnement – CEA & CNRS. Un lidar compact pour l'étude de la troposphère.

October 19, 2006: Alain Clappier. Laboratoire de Pollution de l'Air et des Sols – Ecole Polytechnique Fédérale de Lausanne. Modélisation méso-échelle de la qualité de l'air en milieu urbain.

Editorial Boards

B. Sportisse: Computational Geosciences

L. Musson-Genon: Pollution atmosphérique

Members of scientific Committees

L. Musson-Genon: Scientific Committee for Primequal/Predit ; Conseil Supérieur de la Météorologie/Environmental Committee ; Cost Action 728 (Atmospheric Dispersion).

B. Sportisse: Comité National des Aides de l'ADEME/Qualité de l'Air ; Scientific committee of "Pôle de compétivité ville et mobilité durable ".

M. Bocquet: Action Thématique Assimilation (ATA) of the French Research Program LEFE.

B. Carissimo: Cost Action 732 (Quality Insurance and Improvement of Microscale Meteorological models); Dynamique de l'Atmosphère et de l'Océan (IDAO) of the French Research Program LEFE; Scientific Committee of the HARMO conference (Harmonization within atmospheric dispersion modeling for regulatory purposes).

Softwares

AtmoPy
AtmoPy, statistical and graphical python library for analysing Chemistry Transport model output concentrations: model-to-data and model-to-model comparisons.
V. Mallet.
ENPC.

AtmoData
Library for data processing and parameterizations in atmospheric chemistry and physics.
V. Mallet, D. Quélo.
ENPC.

Mam
Modal Aerosol Model.
K. Sartelet, B. Albriet, B. Sportisse.
ENPC.

Siream
Size Resolved Aerosol Model.
E. Debry, K. Fahey, K. Sartelet, B. Sportisse, M. Tombette.
ENPC.

Polyphemus
Modeling system for atmospheric modeling (www.enpc.fr/cerea/polyphemus).
V. Mallet, D. Quélo, I. Korsakissok, A. Meyed de Biasi, B. Sportisse.
ENPC.

Polair3D: Chemistry transport model.
D. Quélo, K. Sartelet, B. Sportisse, M. Tombette.
ENPC.

Mercure_Code Saturne
CFD model for the Atmospheric Boundary Layer.
B. Carissimo, E. Dupont, H. Foudhil, S. Lacour, M. Milliez, L. Musson-Genon.
EDF R&D

List of initials used

ADEME	Agence pour le Défense de l'Environnement et la Maîtrise de l'Energie
ARC	Action de Recherche Concertée (INRIA)
CEA	Commissariat à l'Energie Atomique
CEREA	Centre d'Enseignement et de Recherche sur l'Environnement Atmosphérique
CETE	Centre d'Etudes Techniques de l'Equipement
CMAQ	Community Model for Air Quality
CNRS	Centre National de Recherche Scientifique
CONICYT	Comision National de Investigacion Cientifica y Tecnologica de Chile
CRIEPI	Central Research Institute for Electric Power Industry (Japon)
DRAST	Direction de la Recherche et des Affaires Scientifiques et Techniques du METMLT
ECL	Ecole Centrale de Lyon
EDF R&D	Electricité de France Recherche et Développement
ENPC	Ecole Nationale des Ponts et Chaussées
ENSTA	Ecole Nationale Supérieure des Techniques Avancées
ESA	European Spatial Agency
ENTPE	Ecole Nationale des Travaux Publics de l'Etat
IAEA	International Atomic Energy Agency
INRIA	Institut National de Recherche en Informatique et Automatique
INERIS	Institut National sur l'Environnement et les Risques Industriels et Sanitaires
INRETS	Institut National de Recherche et d'Etude sur les Transports et la Sécurité
IPSL	Institut Pierre-Simon Laplace
IRSN	Institut de Radioprotection et de Sûreté Nucléaire
LCPC	Laboratoire Central des Ponts et Chaussées
LEFE	Les Enveloppes Fluides et l'Environnement (CNRS Program)
LMD	Laboratoire de Météorologie Dynamique (X-ENS-CNRS)
LSCE	Laboratoire Surveillance du Climat et de l'Environnement (CEA/CNRS)
MEDD	Ministère de l'Ecologie et du Développement Durable
MTETM	Ministère des Transports de l'Equipement du Tourisme et de la Mer
ONERA	Office National d'Etudes et de Recherches Aérospatiales
PREDIT	Programme pour la Recherche, le Développement et l'Innovation dans les transports terrestres
PRIMEQUAL	Programme Interministériel d'Etude de la Qualité de l'Air
R2D2	Réseau de Recherche sur le Développement Durable (Research Network of region Ile de France)
SIRTA	Site Instrumental de Recherche par Télédétection Atmosphérique