Agència de Gestió d'Ajuts Universitaris i de Recerca

AGAUR

DOCUMENT ANNEX DE LA SOL·LICITUD DE LA CONVOCATÒRIA DE BEQUES PER A ESTADES DE RECERCA A L'ESTRANGER (BE-DGR 2012)

Aquest document només és vàlid per a annexar-lo, en format PDF, al formulari de sol·licitud de la convocatòria de **beques per a estades de recerca a l'estranger (BE-DGR 2012).**

Beques per a estades de recerca a l'estranger (BE-DGR 2012)

Dades de la persona sol·licitant

Nom		Primer cognom	Segon cognom
Maria Teresa		Pay	Pérez
Tipus identificador		Número identificador	
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1. Currículum de la persona candidata (màxim 8 fulls)

1.1 Formació acadèmica
1.2 Experiència professional, incloses les beques i altres ajuts rebuts
1.3 Participació en projectes, convenis i contractes de recerca
1.4 Publicacions i resultats científics (per a revistes, si escau, indiqueu índex d'impacte, quartil i àrea)
1.5 Estades a l'estranger
1.6 Participació en congressos i conferències
1.7 Patents, premis i altres mèrits acadèmics i/o científics rellevants

1.1 Education

2011 **PhD in Environmental Engineering (Degree of European Doctor**)
Technical University of Catalonia, Spain.
Directors: Dr. José María Baldasano and Dr. Pedro Jiménez.
Dissertation title: *Regional and urban evaluation of an air quality model in the European and Spanish domains*. Qualification: Excelent, Cum Laude, November 2011.

2008 **Diploma of Advanced Studies (DEA) in Environmental Engineering**
Technical University of Catalonia, Spain.
Thesis title: *Regional and urban evaluation of an air quality model in the European and Iberian Peninsula domains*. July, 2008.

2006 **B.S. in Chemical Engineering**
University of Murcia, Spain. Qualification: 2.3. July, 2006.

1.2 Professional experience

2012-present **Postdoctoral Researcher**
Earth Science Department, Barcelona Supercomputing Center-Centro Nacional de Supercomputación (BSC-CNS).
- Tasks:
  - Evaluation methodologies to air quality models: intercomparison exercises.
  - Dynamical assessment of air pollution in Spain.
  - Analysis of secondary aerosol formation.
  - Application of model to forecast air quality.
  - Application of models to assess about plans and measures to control air quality exceedances in Europe and Spain.

2006-2011 **Graduate Research Assistant**
Earth Science Department, Barcelona Supercomputing Center-Centro Nacional de Supercomputación.
- Scholarships of the Spanish Ministry of Science and Innovation for the Formation of Researchers (FPI) (2007-2011).
- Scholarship of the BSC-CNS for pre-doctoral studies (2006/2007).
- Tasks:
  - Evaluation methodologies to air quality models.
  - Evaluation and improvement of an air quality system for Europe and Spain.
  - Developing a numerical model to simulate particulate matter in the Iberian Peninsula at high spatial and temporal resolution.

1.3 Participation in projects, contracts and research agreements

1.3.1. Participation in projects

Títol del projecte: Ensamblaje y puesta en operación del sistema de pronóstico de la calidad del aire para la Península Ibérica

Entitat finançadora: Ministerio de Innovación y Ciencia. Gobierno de España (Spain-Portugal Integrated Actions Subprogram)

Referència de la concessió: PT2009-0029

Durada: des de/d' 2009 **fins a** 2011

Investigador/a principal: Dr. José Mª Baldasano/Dr. Carlos Borrego

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Títol del projecte: CALIOPE: Sistema de calidad del aire operativo para España; convocatoria 2008

Entitat finançadora: Ministerio de Medio Ambiente y Medio Rural y Marino. Gobierno de España (Plan Nacional I+D+i)

Referència de la concessió: 157/PC08/3-12.0.

Durada: des de/d' 2008 **fins a** 2010

Investigador/a principal: Dr. José Mª Baldasano

Títol del projecte: Supercomputación y e-Ciencia, convocatoria CONSOLIDER 2007

Entitat finançadora: MEC-CICYT

Referència de la concessió: CSD-REFERENCIA 2007 – 00050

Durada: des de/d' 2007 **fins a** 2011

Investigador/a principal: Dr. Mateo Valero

Títol del projecte: Sistema de calidad del aire operativo para España; convocatoria 2007

Entitat finançadora: Ministerio de Medio Ambiente y Medio Rural y Marino. Gobierno de España (Plan Nacional I+D+i)

Referència de la concessió: 357/2007/2-12.1.

Durada: des de/d' 2007 **fins a** 2008

Investigador/a principal: Dr. José Mª Baldasano

Títol del projecte: Modelización de alta resolución de la contaminación atmosfèrica por material particulado antropogénico y natural en la Péninsula Ibérica; convocatoria 2005

Entitat finançadora: Ministerio de Educación. Gobierno de España, (CICYT)

Referència de la concessió: CGL2006-08903

Durada: des de/d' 2006 **fins a** 2008

Investigador/a principal: Dr. Pedro Jiménez Guerrero

Títol del projecte: Sistema de calidad del aire operativo para España; convocatoria 2006

Entitat finançadora: Ministerio de Medio Ambiente y Medio Rural y Marino. Gobierno de España

Referència de la concessió: 441/2006/3-12.1.

Durada: des de/d' 2006 **fins a** 2007

Investigador/a principal: Dr. José Mª Baldasano

Títol del projecte: Field campaign for the determination of the sources of atmospheric aerosols in urban and rural environments (DAURE)

Entitat finançadora: University of Colorado, Boulder (USA)

Referència de la concessió:

Durada: des de/d' 2009 **fins a** 2012

Investigador/a principal: Dr. José Luis Jiménez

Títol del projecte: Integrated assessment of air pollution supporting the revision of EU air quality legislation

Entitat finançadora: European Commission

Referència de la concessió: FP7-ENV.2012.6.5-4

Durada: des de/d' 2012 **fins a** 2015

Investigador/a principal: Dr. Maria Luisa Volta, University of Bescia, Italy.

Títol del projecte: European Consortium for Modelling Air Pollution and Climate Strategies (EC4MAS)

Entitat finançadora: EU LIFE program

Referència de la concessió:

Durada: des de/d' 2006 **fins a** 2012

Investigador/a principal: Markus Amman, International Institute for Applied System Analysis (IIASA)

1.3.2. Participation in contracts

Títol del contracte: Plan Estratégico de reducción de NO_x y Partículas del Área Metropolitana de Barcelona

Empresa/administració finançadora: Barcelona Ecología

País: España

Durada: des de/d' 01/09/2005 **fins a** 01/07/2006

Investigador responsable: Dr. José Mª Baldasano

Títol del contracte: Modelización de alta resolución de la contaminación atmosfèrica por material particulado antropogénico y natural en la Península Ibérica (CGL2006-08903)

Empresa/administració finançadora: Ministerio de Ciencia e Innovación. Gobierno de España, (CICYT)

País: España

Durada: des de/d' 01/07/2007 **fins a** 01/07/2011

Investigador responsable: Dr. Pedro Jiménez Guerrero

Títol del contracte: 401- Para la realización de un proyecto de investigación / Consolider SysEC

Empresa/administració finançadora: Barcelona Supercomputing Center – Centro Nacional de Supercomputación (BSC-CNS) y Ministerio de Ciencia e Innovación (MICINN)

País: España

Durada: des de/d' 01/07/2011 **fins a** 31/01/2012

Investigador responsable: Dr. Mateo Valero

Títol del contracte: 420- Para la incorporación de investigadores en el sistema español de la ciencia / Consolider SysEC

Empresa/administració finançadora: Barcelona Supercomputing Center – Centro Nacional de Supercomputación (BSC-CNS) y Ministerio de Ciencia e Innovación (MICINN)

País: España

Durada: des de/d' 01/02/2012 **fins a** 31/12/2012

Investigador responsable: Dr. Mateo Valero

1.4 Publications and scientific results (impact factor, area and quartile)

1. Pay MT, Piot M, Jorba O, Basart S, Gassó S, Jiménez-Guerrero P, Gonçalves M, Dabdub D, Baldasano JM, 2010. **A full year evaluation of the CALIOPE-EU air quality system in Europe for 2004: a model study**. *Atmos Environ*, **44**, 3322-3342. *doi:10.1016/j.atmosenv.2010.050140*. Impact Factor (2010 JCR Science Edition): 3.226/Quartil: Q1/Area: Environmental Sciences.
2. Pay MT, Jiménez-Guerrero P, Baldasano JM, 2011. **Implementation of resuspension from paved roads for the improvement of CALIOPE air quality system in Spain**. *Atmos Environ*, **45**, 802-807. *doi:10.1016/j.atmosenv.2010.10.032*. Impact Factor (2010 JCR Science Edition): 3.226/Quartil:Q1/Area: Environmental Sciences.
3. Baldasano JM, Pay MT, Jorba O, Gassó S, Jiménez-Guerrero P, 2011. **An annual assessment of air quality with the CALIOPE modeling system over Spain**. *Sci Total Environ*, **409**, 2163-2178. *doi:10.1016/j.scitotenv.2011.01.041*. Impact Factor (2010 JCR Science Edition): 3.190/Quartil:Q/Area: Environmental Sciences.
4. Jiménez-Guerrero P., Jorba O, Pay MT, Montávez JP, Jerez S, Gomez-Navarro JJ, Baldasano JM, 2011. **Comparison of two different sea-salt aerosol schemes as implemented in air quality models applied to the Mediterranean basin**. *Atmos Chem Phys*, **11**, 4833-4850. *doi:10.5194/acp-11-4833-2011*. Impact Factor (2010 JCR Science Edition): 5.309/Quartil:Q1/Area: Environmental Sciences.
5. Sicardi V, Ortiz J, Rincón A, Jorba O, Pay MT, Gassó S, Baldasano JM, 2011. **Assessment of Kalman filter bias-adjustment technique to improve the simulation of ground-level ozone over Spain**. *Sci Total Environ*, **416**, 329-342. *doi: 10.1016/j.scitotenv.2011.11.050*. Impact Factor (2010 JCR Science Edition): 3.190/Quartil: Q1/Area: Environmental Sciences.
6. Borrego C, Monteiro A, Pay MT, Ribeiro I, Miranda AI, Basart S, Baldasano JM, 2011**. How bias-correction can improve air quality forecast over Portugal**. *Atmos Environ,* **45**, 6629-6664. *doi: 10.1016/j.atmosenv.2011.09.006*. Impact Factor (2010 JCR Science Edition): 3.190/Quartil: Q1/Area: Environmental Sciences.
7. Basart S, Pay MT, Jorba O, Pérez C, Jiménez-Guerrero P, Schulz M, Baldasano JM, 2011. **Aerosol in the CALIOPE air quality modelling system: validation and analysis of PM levels, optical depths and chemical composition over Europe**. *Atmos Chem Phys*, **12**, 3363-3392. *doi: 10.5194/acp-12-3363-2012*. Impact Factor (2010 JCR Science Edition): 5.309/Quartil: Q1/Area: Meteorology and Atmospheric Sciences.
8. Pay MT, Jiménez-Guerrero P, Jorba O, Basart S, Pandolfi M, Querol X, Baldasano JM, 2012. **Spatio-temporal variability of levels and speciation of particulate matter across Spain in the CALIOPE modeling system**. *Atmos Environ*, **46**, 376-396. *doi: 10.1016/j.atmosenv.2011.09.049*. Impact Factor (2010 JCR Science Edition): 3.226/Quartil:Q1/Area: Environmental Sciences.
9. Pay MT, Jiménez-Guerrero P, Baldasano JM, 2012. **Assessing sensitivity regimes of secondary inorganic aerosol formation in Europe with the CALIOPE-EU modeling system**. *Atmos Environ,* **51**, 146-164. *doi:10.1016/j.atmosenv.2012.01.027*. Impact Factor (2010 JCR Science Edition): 3.226/Quartil: Q1/Area: Environmental Sciences.
10. Monteiro A, Carvalho A, Ribeiro I, Scotto M, Barbosa S, Alonso A, Baldasano JM, Pay MT, Miranda, AI, Borrego C, 2012. **Trends in ozone concentrations in the Iberian Peninsula by quantile regression and clustering**. *Atmos Environ*, **56**, 184-193. *doi: 10.1016/j.atmosenv.2012.03.069*. Impact Factor (2010 JCR Science Edition): 3.226/Quartil: Q1/Area: Environmental Sciences.

Chapter in books

1. Piot, M., Pay, M.T., Jorba, O., Jiménez-Guerrero, P., López, E., Gassó, S., Baldasano, J.M., 2010. **Annual Dynamics and Statistical Evaluation of an Air Quality Forecasting System (CALIOPE) with High Resolution for Europe**. Air Pollution Modeling and its Application XX. Ed. Down G. Steyn and S.T. Rao. Springer: 241-245. ISBN: 978-90-481-3810-4, January 2010, 737 pp.

1.5 Research stays abroad

February-May 2011 (3 months)	**Graduate Research Assistant. Department of Environment. University of Aveiro, Portugal.** • Studying of bias-correction techniques for improving air quality forecast models. • Evaluation of Chemical transport models: CHIMERE, CMAQ and EURAD. • Advisor: Dr. Carlos Borrego
September-December 2009 (3 months)	**Graduate Research Assistant. Department of mechanical and Aerospace Engineering. University of California, Irvine, USA**. • Evaluation of regional air quality modelling system. • Computer tools applied to air quality modelling. • Advisor: Dr. Donald Dabdub

1.6 Attendance to congresses and conferences

1. Pay MT, Jiménez-Guerrero P, Jorba O, Pérez C. Gassó S., Baldasano JM, 2008. A long-term evaluation study of the atmospheric dynamics of aerosols and gaseous species over Europe using an integrated air quality modelling system with high resolution. In: European Geoscience Union (EGU) General Assembly (EGU2008-A-09968). Vienna, Austria. April 13-18.
2. Jiménez-Guerrero P, Pay MT, Jorba O, Piot M, Baldasano JM, 2008. Inclusion of Saharan dust in an integrated air quality forecasting system for Europe. In: European Geoscience Union (EGU) General Assembly. Vienna, Austria. April 13-18.
3. Jiménez-Guerrero, P., Pay, M.T., Jorba, O., Piot, M., Baldasano, J.M., 2008. Evaluating the annual performance of an air quality forecasting system (Caliope) with high resolution for Europe and Spain. In: ACCENT/GLOREAM workshop Antwerp, Belgium. October 29-31.
4. Jiménez-Guerrero, P., Pay, M.T., Baldasano, J.M., Jorba, O., Gómez-Navarro, J.J., Jerez, S., Montávez, J.P., 2008. Comparison of two different sea salt aerosol schemes as implemented in air quality models applied to the Mediterranean. In: ACCENT/GLOREAM workshop. Antwerp, Belgium. October 29-31.
5. Pay, M.T., Jiménez-Guerrero, P., Jorba, O., Pérez, C., Baldasano, J.M., Querol, X., Pandolfi, M., 2009. An assessment of the ability of an integrated air quality forecasting system to simulate chemically speciated PM2.5. In: 7th International Conference on Air Quality - Science and Application (Air Quality 2009). Istanbul, Turkey. March 24-27.
6. Pay, M.T., Piot, M., Jiménez-Guerrero, P., Jorba, O., Pérez, C., Baldasano, J.M., 2009. Evaluation of the chemically speciated particulate matter from a high-resolution air quality modelling system over the Iberian Peninsula. European Geoscience Union (EGU) General Assembly. Vienna, Austria. April 19-24.
7. Piot, M., Pay, M.T., Jorba, O., Baldasano, J.M., Jiménez-Guerrero, P., López, E., Pérez, E., Gassó, S. 2009. Evaluating the CALIOPE air quality modelling system: dynamics and chemistry over Europe and the Iberian Peninsula for 2004 at high horizontal resolution. European Geoscience Union (EGU) General Assembly. Vienna, Austria. April 19-24.
8. Piot, M., Pay, M.T., Jorba, O., Jiménez-Guerrero, P., López, E., Gassó, S., Baldasano, J.M., 2009. Annual dynamics and statistical evaluation of an air quality forecasting system (Caliope) with high resolution for Europe. In: 30th NATO/SPS International Technical Meeting on Air Pollution Modeling and Its Application. San Francisco, USA. May 18-22.
9. Gonçalves, M., Piot, M., Jorba, O., Pay, M.T., López, E., Gassó, S., Baldasano, J.M., 2009. Near real time of the Spanish air quality forecast system: CALIOPE. In: HARMO 13 Paris, France. June1-4.
10. Jorba, O., Piot, M., Pay, M.T., Jiménez-Guerrero, P., López, E., Pérez, C., Gassó, S., Baldasano, J.M., 2009. Air quality over Europe and Iberian Peninsula for 2004 at high horizontal resolution: evaluation of the CALIOPE modelling

system. In: 9th Annual Meeting of the European Meteorological Society (EMS). Toulouse, France. September 28-October 2.

11. Baldasano, J.M., Piot, M., Jorba, O., Gonçalves, M., Pay, M.T., Lopez, E., Pérez, C., Gassó, S., 2009. The CALIOPE high-resolution air quality forecasting system: development and evaluation for Spain and Europe. In: 8th Annual CMAS Conference. Chapel Hill, NC, USA. October 19-21.
12. Baldasano, J.M., López, E., Gonçalves, M., Pay, M.T., Güereca, P., Jiménez-Guerrero, P., Gassó, S., 2009. The HERMES high-resolution emission system: simulating anthropogenic and biogenic emissions for the Iberian Peninsula, Canary Islands and Europe. In: GEIA ACCENT 2009. Oslo, Norway. October 26-28.
13. Pay, M.T., Piot, M., Jiménez-Guerrero, P., Jorba, O., Pérez, C., Baldasasano, J.M., Querol, X., Pandolfi, M., Alastuey, A., Dabdub, D., 2009. In: American Association for Aerosol Research 28th Annual Conference. Minneapolis, Minnesota. October 26-30.
14. Gonçalves, M., Piot, M., Jorba, O., Pay, M.T., López, E., Gassó, S., Baldasano, J.M., 2009. Operational evaluation system of the Spanish air quality forecasting model CALIOPE. In: ACCENT/GLOREAM workshop. Brescia, Italy. November 27-29.
15. Piot, M., Pay, M.T., Jorba, O., Climent, N., Lopez, E., Pérez, C., Gassó, S., Baldasano, J.M., 2009. The evaluation of the Spanish air quality modeling system: CALIOPE. Dynamics and chemistry over Europe and Iberian Peninsula for 2004 at high horizontal resolution. American Geoscience Union (AGU) Fall meeting. San Francisco, USA. December 14-18.
16. Baldasano, J.M., Piot, M., Jorba, O., Gonçalves, M., Pay, M.T., Pérez, C., López, E., Gassó, S., Martín, F., García-Vivanco, M., Palomino, I., Querol, X., Pandolfi, M., Diéguez, J.J., Padilla, L., 2009. Operational air quality forecasting system for Spain: CALIOPE. American Geoscience Union (AGU) Fall meeting. San Francisco, USA. December 14-18.
17. Baldasano J.M., Piot, M., Jorba, O., Gonçalves, M., Pay, M.T., Basart, S., Jiménez, P., Gassó, S., 2010. CALIOPE: an Operational Air Quality Forecasting System for Europe and Spain. In: Mesoscale Modelling For Air Pollution Applications: Achievements And Challenges (COST 728 Final Workshop), Organisers: COST 728, WMO/GURME and MEGAPOLI. Geneva, Switzerland. February 25-26.
18. Piot, M., Pay, M.T., Jorba, O., Basart, S., Gassó, S., Querol, X., Pandolfi, M., Baldasano, J.M., et al., 2010. Preliminary modelling results of the chemical composition of particulate matter in NE Spain for the DAURE campaign. European Geoscience Union (EGU) General Assembly. Vienna, Austria. May 2-7.
19. Basart, S., Pay, M.T., Pérez, C., Cuevas, E., Jorba, O., Piot, M., Baldasano, J.M., 2010. Aerosol Optical Depth over Europe: evaluation of the CALIOPE air quality modelling system with direct-sun AERONET observations. European Geoscience Union (EGU) General Assembly. Vienna, Austria. May 2-7.
20. Pay, M.T., Piot, M., Jorba, O., Basart, S., Gassó, S., Dabdub, D., Jiménez-Guerrero, P., Baldasano, J.M., 2010. Chemical composition of particulate matter in Spain: modelling evaluation of the CALIOPE system for 2004. European Geoscience Union (EGU) General Assembly. Vienna, Austria. May 2-7.
21. Gonçalves, M., Piot, M., Jorba, O., Pay, M.T., Gassó, S., Baldasano, J.M., 2010. Near real time evaluation system of the Spanish air quality forecasting system CALIOPE. European Geoscience Union (EGU) General Assembly. Vienna, Austria. May 2-7.
22. Baldasano, J.M., Pay, M.T., Jorba, O., Ortiz, J., Gonçalves, M., Basart, S., Gassó, S., Jiménez-Guerrero, P., 2010. Evaluation of the Spanish operational air quality forecasting system: diagnostic and near real time. In: International workshop on air quality forecasting research. Quebec, Canada. November 16-18.
23. Basart, S., Pay, M.T., Jorba, O., Pérez, C., Baldasano, J.M., 2011. Aerosol in the CALIOPE air quality modeling system: validation and analysis of PM levels, optical depths and chemical composition over Europe. European Geoscience Union (EGU) General Assembly. Vienna, Austria. April 4-8.
24. Borrego, C., Monteiro, A., Ribeiro, I., Miranda, A.I., Pay, M.T., Basart, S., Baldasano, J.M., 2011. How different air quality forecasting systems operate over Portugal. In: HARMO 14 Kos Island, Greece. October 2-6.
25. Baldasano, J.M., Pay, M.T., Gassó, S., 2012. Assessment of two typical pollution episodes in 2011 over Barcelona and Madrid greater areas (Spain). In: 8th International Conference on Air Quality - Science and Application (Air Quality 2012). Athens, Greece. March 19-23.

26. Pay, M.T., Jiménez-Guerrero, Baldasano, J.M., 2012. Assessing sensitivity regimes of secondary inorganic aerosol formation in Europe with the CALIOPE-EU modelling system. In: 32nd NATO/SPS International Technical Meeting on Air Pollution Modeling and Its Application. Utrecht, The Netherlands. May 7-11.

27. Baldasano, J.M., Jorba, O., Gassó, S., Pay, M.T., Arévalo, G., 2012. CALIOPE: sistema de pronóstico operacional de calidad del aire para Europa y España. In: XXXII Jornadas Científicas de la Asociación Meteorológica Española. Madrid, Spain. May 28-30.

2. Historial científic del grup d'acollida del centre receptor (màxim 5 fulls)

2.1 Breu descripció del departament o grup d'acollida del centre receptor
2.2 Breu descripció de la idoneïtat del departament o grup d'acollida en relació al projecte de recerca que es vol desenvolupar
2.2 Principals publicacions i resultats científics obtinguts en els darrers cinc anys

2.1 Brief description of the host research group.

Members of the Interfaces and Troposphere (InTro) group (http://www.lmd.polytechnique.fr/~intro/) study the physical and chemical properties of the troposphere and its interfaces. The InTro group is part of the Laboratoire de Météorologie Dynamique, located on the Ecole Polytechnique campus in Palaiseau.

Their primary scientific interests include:

- Analysing observations of water clouds and ice clouds (http://www.lmd.polytechnique.fr/~intro/static/ice_clouds.html).
- Evaluation of Clouds in models.
- Polar Stratospheric Clouds.
- Upper Troposphere/Lower Stratosphere (UTLS) dynamics.
- Boundary layer dynamics.
- Physical and chemical modeling of the troposphere, especially on CHIMERE chemistry-transport model (http://www.lmd.polytechnique.fr/chimere/).
- Fluid dynamics and turbulence.
- Observing the radiative and dynamic properties of the troposphere.

The InTro research group has been involved in many European and national projects:

European projects

- CIRCE RL4 (http://aesgard.gva.es/circe_rl4/)
- The **CITY-DELTA** modelling experiment (european project)
- AMMA (http://amma.mediasfrance.org/), GEMS (http://gems.ecmwf.int/index.jsp), PROMOTE (http://www.gse-promote.org/)

French projects

- ANR Project TRANSTEK (http://www.lmd.polytechnique.fr/~dubos/ANR/index.html)
- GIS project PREMAPOL about impact of pollution on health,
- GIS project MORCE-MED about regional modelling over the Mediterranean region,
- GIS project PAC about the modelling of pollen in France

Members of the InTro group work closely with:

- The Site Instrumental de Recherche par Télédétection Atmosphérique (SIRTA, http://sirta.ipsl.fr/), which hosts several active and passive remote sensing instruments as well as in-situ observations.

- The ClimServ data center (http://climserv.ipsl.polytechnique.fr/), which provides access to several large public datasets (ECMWF, NCEP, CALIPSO, CloudSAT, MODIS, etc), and important computing resources.

Members of the InTro group are **model developments**:

- **CHIMERE**, a chemistry-transport model (http://www.lmd.polytechnique.fr/chimere/)
- **CHIMERE-DUST**, a mineral dust transport model (http://www.lmd.polytechnique.fr/dust/chimdust.php)
- Local EXPERIMENTAL daily forecast: **COSY** (http://www.lmd.polytechnique.fr/cosy/cosy.php).

2.2 Brief description of the suitability of the host research group related to the research project to develop.

The InTro group, part of the Laboratoire de Météorologie Dynamique, located on the Ecole Polytechnique campus in Palaiseau, has as primary scientific interest the physical and chemical modelling of the troposphere by means of the CHIMERE chemical transport model in order to analyse the impact of air pollution on health. The group, leader by Laurent Menut (http://www.lmd.polytechnique.fr/~menut/) among others, demonstrates high experience on modelling the atmospheric pollution in urbanized areas, long-range transport of mineral dust, and impact of air pollution in health.

The group has developed the CHIMERE multi-scale model which is primarily designed to produce daily forecasts of ozone, aerosols and other pollutants and make long-term simulations for emission control scenarios. CHIMERE runs over a range of spatial scales from the regional scale (several thousand kilometers) to the urban scale (100-200 km) with resolutions from 1-2 km to 100 km. On CHIMERE server, documentation and source codes are proposed for the complete multi-scale model. However most data are valid only for Europe and should be revisited for applications on other continents. CHIMERE proposes many different options for simulations which make it also a powerful research tool for testing parameterizations, hypotheses. Its use is relatively simple so long as input data is correctly provided. It can run with several vertical resolutions, and with a wide range of complexity. It can run with several chemical mechanisms, simplified or more complete, with or without aerosols.

The InTro group present high experience and background about the modelling of air pollution dynamic in the Mediterranean region. The group takes part some European research projects such as GEMS project, a comprehensive data analysis and modelling system for monitoring the global distribution of atmospheric constituents important for climate, air quality and UV radiation, with a focus on Europe.

The high experience of the host group in terms of air quality modelling (emissions, meteorology, and physical and chemical processes) and atmospheric dynamics contribute to guide the development of the present project.

2.3 Main publications and scientific results obtained during the last five years.

1. Menut L., Goussebaile, A., Bessagnet, B., Khvorostiyanov, D., Ung, A., 2012. **Impact of realistic hourly emissions profiles on modelled air pollutants concentrations**. Atmos. Environ., 49, 233-244.
2. Wilson, R. C., Fleming, Z. L., Monks, P. S., Clain, G., Henne, S., Konovalov, I. B., Szopa, S., Menut, L., 2012. **Have primary emission reduction measures reduced ozone across Europe? An analysis of European rural background ozone trends 1996-2005**. Atmos. Chem. Phys., 12, 437-454.
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3. Activitat de recerca que es vol desenvolupar durant l'estada de recerca (màxim 10 fulls)

3.1 Breu descripció de l'activitat de recerca que es vol desenvolupar durant l'estada de recerca i dels seus antecedents (en el cas de la Modalitat A, els antecedents s'han de posar en relació a la tesi doctoral que s'està duent a terme)
3.2 Objectius, metodologia, pla de treball i bibliografia/referències de l'activitat de recerca
3.3 Impacte previst dels resultats de l'activitat de recerca (en el cas de la Modalitat A, l'impacte previst dels resultats s'ha de posar en relació a la tesi doctoral que s'està duent a terme)

3.1 Brief description of the research project.

Air pollution is the largest environmental factor affecting human health in Europe. As a result, air quality management is a priority issue in European environmental policies. Modeling techniques have become very useful tools to study the dynamics and transport of air pollutants and to forecast air quality concentration for short term mitigation and public information and warnings, both applications for regulatory and scientific purposes (European Commission, 2008; EEA, 2011).

Several operational air quality forecasting systems already exists for Europe (see http://gems.ecmwf.int or http://www.chemicalweather.eu; Menut and Bessagnet, 2010). In the Spanish context, **the CALIOPE system** consists in a set of models that will take into account both anthropogenic and natural pollution. These models are the WRF-ARW meteorological model (Skamarock and Klemp, 2008); the HERMES emission model (Baldasano et al., 2008a), the BSC-DREAM8b natural dust model (Nickovic et al., 2001; Perez et al. 2006) and the **CMAQ** Chemical Transport Model (CTM).

Emission models play a key role within both the performance of emission sensibility analysis in a given region and the development of high-resolution air quality models. To minimize the uncertainty given by the emissions inventory, it is especially important to accurately characterize the variety of emission sources, as well as to use up-to-date information and emission estimation methodologies compiling the state-of-the-art in the pollutant activities considered. During 2005 and 2006, the BSC-CNS developed the High-Elective Resolution Modeling Emissions System (**HERMES**) to generate an emission inventory for Spain with a temporal resolution of 1 h and a spatial resolution of 1 km x 1 km, taking 2004 as the reference period (Baldasano et al., 2008a). Due to both the age of the activity data on which the model is based and the appearance of new versions of some remarkable emission inventory guidebooks (i.e. EMEP/EEA 2009), it has become necessary to update and improve the whole system itself. Hence, a new high emission model for Spain (HERMES v.2.0) has been developed (Guevara et al., 2012). Some of the main features of HERMES v.2.0 are: (1) introduction of new pollutant activities which allow the generation of results for both anthropogenic (SNAP01 to SNAP10) and biogenic (SNAP11 using the MEGAN v.2.0 model) emission sources, using *Bottom-Up* approaches for the most relevant sectors (i.e. road traffic, public power); (2) updating of the activity data of each emission source according to its availability (raging from 2008 to 2010); (3) improvement and updating of the emissions estimation methodologies (i.e. COPERT IV); (4) inclusion of the chemical mechanism Carbon Bond-05 (CB-05) besides Carbon Bond-IV (CB-IV).

The **CALIOPE system** has been widely evaluated during its development over northeastern Spain (Jiménez *et al.*, 2005a,b, 2006a,b, 2007), the Iberian Peninsula (Jiménez-Guerrero *et al.*, 2008; Baldasano *et al.*, 2008b, 2011; Pay *et al.*, 2010, 2011) and Europe (Basart *et al.*, 2012; Pay *et al.*, 2012a, b) Furthermore, it has been used for assessing on the contribution of atmospheric processing affecting the dynamic of air pollution (Gonçalves *et al.*, 2009a) and as management tool to study air quality impact of urban management strategies (Gonçalves *et al.*, 2008; 2009b; Soret *et al.*, 2011). The complexity of the Iberian Peninsula forces to consider high spatial (4km x 4km) and vertical resolution (15 layers) to be able to simulate the layering of meteorology

and pollutants. The CALIOPE system is advancing our understanding about atmospheric pollution dynamics in Spain with several evaluation and near-real time evaluation (NRT) that support the confidence on the system.

Both **CMAQ** and **CHIMERE** CTMs represent the state of the art in air quality modelling in EEUU and Europe, respectively. The Models-3 Community Multiscale Air Quality Modeling System (Models-3/**CMAQ**, Byun and Schere, 2006) is used to study the behaviour of air pollutants from regional to local scales due to its generalized coordinate system and its advanced nesting grid capability. CMAQ version 4.5 has been extensively evaluated under various conditions and locations (Appel et al., 2008; Solazzo et al., 2012). Parallel to CMAQ CTM (integrated in the CALIOPE system), **CHIMERE** is a widely used European CTM which has been extensively documented in the scientific literature (Schmidt et al. 2001; Bessagnet et al. 2004; 2008; Menut et al., 2012) and online (http://euler.lmd.polytechnique.fr/chimere/) and it has been evaluated and intercompared with other models for in several studies (Vautard et al. 2007; van Loon et al. 2007).

In the context of CALIOPE project, both CMAQ and CHIMERE CTMs were intercompared in terms of air quality (Baldasano et al., 2008b) at coarse resolution (18 km x 18 km) using disaggregated emissions from EMEP inventory (2004 as reference year). Also, both Models were intercompared in terms of sea salt aerosol by Jiménez-Guerrero et al. (2011). Both CTMs have been recently updated with the new state-of-the-art on atmospheric modelling, containing substantial scientific improvements especially devoted to improve secondary organic aerosol formation and dynamic interactions of fine and coarse aerosol. The intercomparison between these widely used CTMs, CMAQ and CHIMERE, are essential because the differences between results reveal the strengths and weaknesses of particular models and parameterizations schemes and could help to characterize conceptual uncertainties arising from the choice and implementation of the physical models applied to forecast air quality.

The present project plans to intercompare the last version of the CMAQ and CHIMERE CMTs which include the last scientific state of the art on atmospheric modelling using a spatial and temporal resolution (4 km x 4 km, 1h) over the Iberian Peninsula. Furthermore this exercise includes a dynamical assessment of atmospheric pollution using the highly disaggregated emission model HERMESv2.0 based on a bottom-up approach which includes latest emission estimation methodologies and updated emissions database to the year 2009.

This model exercise would constitute an important scientific and technical improvement in the performance of air quality models and emission inventories in the Iberian Peninsula, which would help increasing the spatial and temporal resolution of the simulations. Thanks to this fine resolution of the CALIOPE system (4 km x 4 km), we would be able to determine the dynamic patterns of pollutants, and also to discriminate between anthropogenic and natural episodes of air pollution.

3.2 Objectives, methodology, work plan and bibliography/references.

3.2.1 Objectives

The main objective of the present research project is **to intercompare two state-of-the-art chemical transport models to assess the dynamics of atmospheric gaseous and particulate pollutants (transport, diffusion, deposition and chemical transformations) in the Iberian Peninsula.**

With this milestone, this research project is structured to achieve the following objectives:

1. Model intercomparison of the last versions of **CMAQ (version 5.0)** and **CHIMERE (version 2011a+)** CTMs in terms of air quality concentration and deposition during a summer and winter season in 2009.
2. Characterization of the summer and winter air pollution dynamics over the Iberian Peninsula.

Summarising, the objective is improving the scientifically sounding knowledge of atmospheric pollutants dynamics over the Iberian Peninsula with a degree of detail that contributes to understanding the air pollutant dispersion with high spatial resolution and to accomplishing the air quality thresholds set by legislation.

3.2.2 Methodology

Activity 1. Model intercomparison of CMAQ and CHIMERE Chemical Transport Models over the Iberian Peninsula.

Milestone: to analyse and quantify the strengths and weaknesses of both CTMs and their parameterizations schemes and to characterize conceptual uncertainties arising from the choice and implementation of the physical models applied. It constitutes an important scientific and technical improvement in the performance of air quality models applied over Spain.

Task 1.1 Compilation and treatment of available air quality data for the studied period

- Compilation of air quality registers in the Iberian Peninsula during summer and winter 2009 form public available data, such as AIRBASE air quality network (http://www.eea.europa.eu/themes/air/airbase), Spanish air quality monitoring network, background levels from EMEP (www.emet.int, Torseth et al., 2012), and AERONET network photometer data.
- Compilation of particulate matter measured concentrations for PM10, PM2.5 and chemical aerosol speciation from the IDAEA-CSIC research group which has published several studies outlining the particular behaviour of tropospheric aerosol dynamics and physics based on measurements analysis (Querol et al., 2001a,b; Viana et al., 2005, 2006; Pey et al., 2008; Pérez et al., 2008a,b).
- Compilation of experimental data from DAURE field campaign (Jorba et al., 2011). The experimental campaign named DAURE took place in northeastern Spain in both an urban and rural sites Barcelona city and Montseny Natural Park) with the main objective of studying the formation 5 and transport processes of particulate matter in the region. Several groups collaborated in an extensive measurement campaign with aerosol monitoring, meteorological measurements, atmospheric vertical structure retrievals from LIDAR and supported by numerical simulations of the meteorological and air quality conditions over the region. There DAURE field campaign covers the winter (from end of February until March 2009) and summer (July 2009) seasons.
- The recent DAURE field campaign performed over the western Mediterranean provides intensive measurements of aerosols (with particular attention to carbonaceous aerosols) and gas precursors; and could be a useful framework to evaluate the CMAQ and CHIMERE CTMs and indirectly the HERMES emission model.
- Compilation of deposition flux measurement from the EMEP network (Torseth et al., 2012). The EMEP monitoring network provides measurement of wet deposition of base cations: NH_4^+, non-marine SO_4^{2-} and NO_3^-. Sulphur and nitrogen deposition causing acidification and eutrophication of ecosystems, rivers and lakes (Slootweg et al., 2010; Lorenz and Granke, 2009). Therefore it is important to analyse model capability to reproduce observed levels for areas where measurements are available.

Task 1.2 Air quality simulations with CMAQ and CHIMERE CTMs

- Meteorological simulation with the WRF-ARW model. The WRF-ARW meteorological fields are required as input for air quality simulations (summer and winter 2009).

- To compile the emission from the HERMES model new version. To perform air quality simulation (both with CMAQ and CHIMERE CTMs) we will use hourly emissions fields estimated by the HERMES model specifically development for Spain. The Earth Science department form the BSC-CNS will provide the emission data to feed the CTMs. Note that the emissions estimations required previously simulated meteorological fields to estimated emissions which are function of temperature and solar radiation as VOC.
- To speciate the HERMES emissions to MELCHIOR chemical mechanism. The HERMES model, integrated in the CALIOPE system estimates internally the hourly emissions in terms of CB-IV and CB-V chemical mechanism, which after is used by the CMAQ CTM to simulate air quality. In the case of CHIMERE, HERMES emissions (VOC, NO_x, SO_2, PM10, CO) have to be speciated into MELCHIOR2 mechanism (Derognat et al., 2003) before run the CTM.
- Compilation and treatment of the last version of the CHIMERE model (chimere2011a+, http://www.lmd.polytechnique.fr/chimere/).
- Compilation and treatment of the last version of the CMAQ model (CMAQv5.0, http://www.cmascenter.org/).
- Simulations the air quality fields with the CMAQ and CHIMERE for the summer and winter season 2009 with high spatial and temporal resolution (4 km x 4 km, 1h) for photochemical pollutants in gas-phase (mainly O_3, NO_2, and SO_2) and particulate phase (nitrate, ammonium, sulphate, organic carbon, elemental carbon, crustal aerosol, desert dust and sea salt). In order to study the dynamic of the air pollutants we will take into account air quality fields in the 3 dimension (surface and column) with a spatial resolution of 4km x 4km covering the Iberian Peninsula.

Task 1.3 Evaluation of the models in terms of air quality

- Modelled (CMAQ and CHIMERE) O_3, NO_2, SO_2, PM10, PM2.5 and aerosol components (SO_4^{2-}, NO_3^-, NH_4^+, organic carbon, elemental carbon, desert dust, sea salt) concentrations at surface level are compared to observations provided by the aforementioned source of data (Task 1.1) across the Iberian Peninsula. The main statistical parameters (i.e. Bias, Root Mean Square Error, correlation coefficient, standard deviation) as well as different types of diagrams (scatter plots, time series plots, Taylor and Target plots) will be produced.
- Application of the last version (2.0) of the DELTA evaluation Tool (Thunis et al., 2012). This software, designed in the frame of the FAIRMODE activity (Forum for Air Quality Modelling in Europe, http://fairmode.ew.eea.europa.eu/), is currently used for supporting modelling groups across Europe in the diagnostics and assessment of air quality model performances under the EU Air Quality Directive 2008 (AQD).
- Intercompare gas-phase chemical mechanism, CB-05 (Yarwood et al., 2005) vs. MELCHIOR2 (Derognat et al., 2003) to better understand the differences observed between both models in the target area in terms of O_3 and NO_2.
- Intercompare aerosols module implemented in both CTM to better understand the differences observed between both models in the target area in terms of particulate matter and their chemical compositions.

Task 1.4 Evaluation of the models in terms of deposition

- Modelled (CMAQ and CHIMERE) wet deposition fluxes for NO_3^-, SO_4^{-2} and NH_4^+ at surface level are compared to observations provided by the EMEP data as described in Task 1.1) across the Iberian Peninsula. Measurements at EMEP stations are exclusively used because they all have the same sampling strategy, they are well documented and quality controlled and they represent background conditions of a larger area.
- Intercompare dry and wet deposition schemes to better understand the differences observed between both models in the target area.

Activity 2. Characterization of the summer and winter air pollution dynamics over the Iberian Peninsula by means of air quality modelling.

Milestone: Dynamic assessment of atmospheric air pollution (gas-phase and particulate matter) under the summer and winter season 2009 over Spain using the CMAQ and CHIMERE Chemical Transport Models.

Task 2.1 Characterizing the sources of air pollution in the study domains

- Study the main topographic features which determine the wind flows which transport of air pollutants in the studies cities (e.g. coastal vs. continental domains, mountains, valley, etc.).
- Compile and quantify of the main anthropogenic emission sources and pollutants in **urban areas** which contribute to air pollution by means of the HERMES emission model. Obviously, the major sources of pollutant emission in big cities are the urban area where population is usually concentrated. Namely, traffic emissions are usually the most important sources in big cities. In this sense, especial focus will be done in analyse the road network, traffic volume and float park.
- Compile and quantify of the main industrial emission sources and pollutants in the **industrial areas** which contribute to air pollution by means of the HERMES emission model. Usually the major sources of pollutant emission in important industrial areas are related with power plant and refineries. In this sense, an important task will be the review of the temporal and vertical disaggregation of pollutant emissions in stacks.

Task 2.2 Integrated analysis and synthesis of the obtained simulations

- Analysing the chemical regime of O_3 formation in the Iberian Peninsula in terms of NO_x-VOC sensitivity by means the two studies CTMs (CMAQ and CHIMERE) during the winter and summer season in 2009. It is generally known that under some condition, O_3 concentration increase with NO_x increasing and is relatively insensitive to changes in VOC (NO_x-sensitive), while for other conditions the rate of formation will increase with increasing VOC and will be unchanged or decrease with increasing NO_x (VOC-sensitive).
- Integrated analysis of the primary and secondary (inorganic and organic) aerosols by means the two studies CTMs (CMAQ and CHIMERE) during the winter and summer season in 2009. Identifying and quantifying the anthropogenic contribution under each season. Assessing sensitivity regimes of secondary inorganic aerosol formation in Spain. Understanding (and controlling) the formation regimes for these components is important for the achievement of the reduction objectives established in the European legislation for PM2.5 (20% of PM2.5 triennial for the mean of urban background levels

between 2018 and 2020). Discrimination of the particulate matter episodes with an anthropogenic and natural cause.

- Integrated analysis of the deposition fluxes of pollutants in the Iberian Peninsula by means the two studies CTMs (CMAQ and CHIMERE) during the winter and summer season in 2009.

3.2.3 Work plan

The following table summarizes the tasks and the chronogram to succed with the objectives proposed in Section 3.2.2. The project is expected to be completelly done in for months.

Activities and Tasks	Month 1*				Month 2				Month 3				Month 4			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Activity 1.Model intercomparison of CMAQ and CHIMERE Chemical Transport Models over the Iberian Peninsula																
Task 1.1. Compilation and treatment of available air quality data for the studied period																
Task 1.2. Air quality simulations with CMAQ and CHIMERE CTMs																
Task 1.3. Evaluation of the models in terms of air quality																
Task 1.4. Evaluation of the models in terms of deposition																
Activity 2. Characterization of the summer and winter air pollution dynamics over the Iberian Peninsula by means of air quality modelling.																
Task 2.1. Characterizing the sources of air pollution in the study domains																
Task 2.2. Integrated analysis and synthesis of the obtained simulations																

*Each month is split on 7.5 days, aprox. 1 week

3.2.4 References

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3.3 Planned impact of the project results.

The justification of the Project has a bearing on the improvement of life quality, health and protection of ecosystems through a more precise scientific knowledge of the physico-chemical processes in the atmosphere. At the same time, this will help to a better administration of the air quality networks. The current European directive (2008/50/EC) on ambient air quality and cleaner air for Europe and their transposition to the Spanish legislation (RD 102/2011) highlight the necessity of having modelling tools, which provides an estimation of the geographical scope of the episode and to establish restrictive measurements. Air pollution is the environmental factors with the greatest impact on health in Europe and is responsible for the largest burden of environment-related disease.

The CALIOPE modelling system correctly addresses the air pollution behaviour in Europe (configuration CALIOPE-EU; 12 km x 12 km, 1 h), and Spain (configuration CALIOPE-IP; 4 km x 4 km, 1 h) over (1) background levels across Europe, (2) urban/industrial areas with a pervasive influence of anthropogenic emissions on a local scale, (3) areas with very complex terrains and meteorology like southern Europe; and (4) Iberian Peninsula and South Europe highly affected by frequent Saharan dust outbreaks. The intercomparison between the widely used CTMs, CMAQ and CHIMERE, in the context of the CALIOPE system is essential because the differences between results reveal the strengths and weaknesses of particular models and parameterizations schemes and could help to characterize conceptual uncertainties arising from the choice and implementation of the physical models applied to forecast air quality. Therefore, the main benefits derived from the Project are:

1. Important scientific and technical improvement in the performance of air quality models, CMAQ and CHIMERE, in the Iberian Peninsula.
2. Optimization in the design of air quality networks for specific conditions in the Iberian Peninsula. This will be based in a solid knowledge of the cycle of gaseous and aerosol pollutions, and their annual pattern.
3. Contribution in the development of emergency plans, decision-making, and reduction programs when the thresholds set by legislation are exceeded.

4. Establishment of complementary information which is needed for the assessment of atmospheric pollution (gaseous and particulate matter) related to damage to human health, vegetation and ecosystems.
5. Increase in the knowledge of relevant processes in critical situations in the south of Europe and specifically the Iberian Peninsula.