

# Curriculum Vitae of Ronan PAUGAM

## Overview

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I am currently working at the Universitat Politècnica de Catalunya in Barcelona (UPC) where I am now a post-doctoral researcher after having completed a MSCA fellowship.

I have 13 years of experience in fire science on both active fire monitoring and fire-plume modelling. I have been working as a postdoctoral researcher at the University of Corte in Corsica for a short 4 months contract in 2020 with Dr Jean-Baptiste Filippi, and at CERFACS in Toulouse with Dr Melanie Rochoux for a year between 2018 and 2019. Previously I was a visiting scholar at the University of Washington for 2 years working with Dr William MELL from the US Forest Service, and a postdoctoral researcher for 8 years in the Department of Geography of Kings College London (KCL) with Prof. Martin WOOSTER.

My main scientific products so far are:

- the development of a parameterization for fire plume injection height (PRMv2) which is now running operationally in the IFS model of ECMWF. (see [here](#) for a presentation of PRMv2)
- an orthorectification algorithm ([GeoRefIRCam](#)) designed for IR observation (both Long Wave and Middle Infra Ref) from experimental fire collected without Inertial-Measurement-Unit.

Over the last couples of years, I worked on the development of a simulation strategy for the modelling of radiative transfer in large-scale fire plume. The end objective of this work supported by my MSCA Fellowship is to help improving Earth Observation fire remote sensing product by creating a virtual fire laboratory.

## Personal Data

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Nationality: French

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## Professional Background

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Oct 2022 to present

**Post Doctoral Researcher, University Polytechnica of Catalonia (UPC, Barcelona, Spain) at CERTEC.** Supervisor Dr Eulalia Planas.

- Support to several national and international project
- Finalization of previous MSCA fellowship development
- Master student co-supervision

Oct 2020 to Oct 2022

**MSCA Fellowship at University Polytechnica of Catalonia (UPC, Barcelona, Spain) at CERTEC.** Collaboration with Dr Elsa Pastor and Dr Eulalia Planas (CERTEC) Prof Jean-Philippe Gastellu-Etchegorry (Cesbio, Toulouse), Dr Melanie Rochoux and Corentin Lapere (CERFACS, Toulouse)

- Radiative Transfer simulation with the DART model using small scale Fire scene simulated with the FDS model.
- Development of a data acquisition system for recording thermal IR image from UAV
- Application of PI's orthorectification algorithm GerefIRCam to experimental fire of the CERTEC data base

Mars – July 2020

- To come: extension of DART fire simulation to landscape scale fire scene simulated with the MesoNH model.

**Post Doctoral Researcher, Universite of Corte, SPE Lab (Corsica, France).**

Supervisor Dr Jean-Baptiste Filippi.

- Support to the FireCaster ANR project
- Implementation of the Fire Weather Index calculation for Corsica
- Participation at a Fire Fighter training exercise. Simulation of the dummy fire with MesoNH.

June 2018 – May 2019  
& Sep 2019

**Post Doctoral Researcher, CERFACS (Toulouse, France).** Supervisor Dr Melanie Rochoux.

- Work in the continuity of the collaboration with Dr. William Mell when at Seattle (See below).
- Large Eddy simulation of Fire Plume with the coupled fire-atmosphere model MesoNH-ForeFire
- Airborne Image processing for Fire behaviour metrics, in particular Rate of Spread and flaming residence time calculation
- Deep Learning application to segmentation of fire front in Infra Red fire observation.
- Master student co-supervision

Mars 2016 – Feb 2018

**Visiting Scholar, US Forest Service / University of Washington, Seattle USA.** Collaboration with Dr William Mell.

- Large Eddy simulation of Fire Plume with the coupled fire-atmosphere model MesoNH-ForeFire
- Airborne Image processing for Fire behaviour metrics, in particular Rate of Spread and flaming residence time calculation
- Airborne Image georeferencing in collaboration with the Canadian Forest Service.
- Development of a methodology for Fire Intensity estimation from small scale fire monitored with low cost UAV.

Oct 2008 - Dec 2015

**Post Doctoral Research Associate, Dept Geography Kings College London (KCL, London,UK).** Supervisor: Prof. Martin Wooster

- Development of a parameterization for wildfire emission injection height estimation in large scale transport model for ECMWF.
- Implementation of mapping methodology to airborne thermal data for derivation of the Fire Radiative Power product.
- Development of a fire scene simulation algorithm and coupling with the Radiative transfer model DART (Cesbio, France) for the simulation of the Fire Radiative Power product.
- Multiple Fieldwork participations with organisation position in several of them.

Jan 2005 - May 2008	<ul style="list-style-type: none"> <li>- Successful Grant application as Co-PI for 3 NERC, 1 ESA and 2 internal KCL projects.</li> <li>- Master student co-supervision</li> <li>- Published in refereed journal and presented in international conferences.</li> </ul> <p><b>PhD Student, Ecole Centrale Paris (Chatenay-Malabry, France) and team Aviation Environment of CERFACS (Toulouse, France).</b> Advisor: Dr. Daniel Cariolle</p> <p>Thesis title: Numerical study of a contrail evolution and its interaction with the atmospheric turbulence.</p> <ul style="list-style-type: none"> <li>- Large-Eddy simulation of aircraft wake instabilities and atmospheric-contrail interaction.</li> <li>- Published in refereed journal and presented in international conferences.</li> </ul>
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## Studies

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Jan 2005 - May 2008	<p><b>PhD in Computational Fluid Mechanics</b> Ecole Centrale Paris and CERFACS.</p>
Sep 2002 - Dec 2004	<p><b>Engineering School</b> Ecole Centrale Paris option Applied Mathematics</p>
Sep 2003 - Sep 2004	<p><b>MSc in numerical methods</b> Ecole Normale Supérieure de Cachan</p>
Sep 1998 - June 2002	<p><b>BSc, and a Magistère degree in Fundamental Physics</b> Paris-South University, Centre of Orsay.</p>

## Early Research Experiences (internships)

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Jun-Oct 2004	<p>research project in oceanography physics, Department of Meteorology, University of Reading (U.K.) Supervisor: Prof David Marshall subject: Study of the Upper Limb of a Closed Ocean Basin in the hypothesis of Basin Modes and Geostrophic Turbulence</p>
Apr-Jul 2002	<p>research project in atmospheric dynamic, Department of Applied Mathematics and Theoretical Physics - University of Cambridge (U.K.) Supervisor: Prof Micheal McIntyre subject: Interaction wave – vortex</p>
Jun-Jul 2001	<p>research project in Fundamental Physics, Laboratoire de l'Accélérateur Linéaire, Paris-South University, Centre of Orsay (France) Supervisor: Pr. Francois Couchot subject: Short-Range Gravitation Forces</p>

## Research Projects

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### *Participation as PI:*

MSCA Fellowship                      “3DFireLab”, H2020-MSCA-IF-2019-892463, XXk €

### *Participation as Co-PI:*

NERC small grant                      “Determining convective/radiative energy partitioning in large scale open fire”, NE/J014060/1, £58k

NERC knowledge exchange                      “Improving representation of the effects of Biomass Burning Smoke Emissions in a Key UK/European Operational Atmospheric Monitoring and forecasting scheme”, NE/I022116/1, £99.5k

ESA                      “3D Fire Radiative Power Approach Modelling Approach”, ESA ITT 1-6811/11/NL/AF, 249keuro

Canadian Forest Service                      “geo-correct thermal Infrared imagery collected from a fixed wing aircraft”, 65k Canadian dollars. Collaboration set-up as a Contract Agreement.

US Forest Service                      “Open Fire Plume Simulation Comparison Exercise”, 54k US dollars. Collaboration set-up as a Contract Agreement.

### *Participation in Consortium project:*

FASMEE                      Fire and Smoke Model Evaluation Experiment. Joint Fire Science Program grant. Jan 2016-Apr 2017

SAMBBA                      South American Biomass Burning Analysis. NERC consortium grant. Sep 12 – Aug 16

MACC-III                      Monitoring Atmospheric Composition and Climate- Interim Implementation. EU H2020, Aug 2014 - Jun 2015

MACC-II                      Monitoring Atmospheric Composition and Climate - Interim Implementation. D-Fire sub-project. EU FP7, 2011-2014

QUANTIFY                      Quantifying the Climate Impact of Global and European Transport System, EU FP6, 2005-2009

## Teaching

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2013-2015: ‘Fire Carbon Cycle’ course and practical for the MSc Remote Sensing and Environmental Mapping delivered jointly by University College London (UCL) and KCL (6h).

## Invited Presentations

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Oct 2021:    Numerical WildFire 2021 workshop. Cargese, France

Sep 2015:    Meteorology and Climate - Modeling for Air Quality (MAC-MAQ) workshop. Sacramento, US

Oct 2011:    National Institute for Space Research (INPE), visiting researcher, Sao Jose dos Campos, Brazil.

## Research Interest and Expertise

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- Physical processes of Wildfire, in particular radiation
- Developing coarse/empirically based Radiative Transfer model for large fire.
- Fire Radiation Measurement – Remote Sensing techniques for prescribed burn.
- Meso Scale Atmospheric Dynamics
- Coupling of physical processes and turbulent atmospheric dynamics

## Languages

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- French: mother tongue
- English: fluent speaking, reading and writing

## Computer skills

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- Scientific programming: Python (opencv, gdal libraries), IDL, Fortran90
- System: Linux (server installation and maintenance)
- Software: Latex, Office package, visualisation tools (tecplot, paraview, ENVI, QGIS)

## List of Publications

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### *Peer-reviewed publications:*

#### **2021**

1. **Paugam, R.**; Wooster, M.J.; Mell, W.E.; Rochoux, M.C.; Filippi, J.-B.; Rücker, G.; Frauenberger, O.; Lorenz, E.; Schroeder, W.; Main, B.; Govender, N. Orthorectification of Helicopter-Borne High Resolution Experimental Burn Observation from Infra Red Handheld Imagers. Remote Sens. 2021, 13, 4913.

#### **2019**

2. Evangeliou, N., Kylling, A., Eckhardt, S., Myroniuk, V., Stebel, K., **Paugam, R.**, Zibtsev, S., and Stohl, A.: Open fires in Greenland in summer 2017: transport, deposition and radiative effects of BC, OC and BrC emissions, Atmos. Chem. Phys., 19, 1393-1411, 2019.
3. Andela, N., Morton, D. C., Giglio, L., **Paugam, R.**, Chen, Y., Hantson, S., van der Werf, G. R., and Randerson, J. T.: The Global Fire Atlas of individual fire size, duration, speed, and direction, Earth System Science Data 11 (2), 529-552, 2019
4. Liu Y., Kochanski A., Baker K. R., Mell W., Linn R., **Paugam R.**, Mandel J., Fournier A., Jenkins M. A., Goodrick S., Achtemeier G., Zhao F., Ottmar R., French N. H. F., Larkin N., Brown T., Hudak A., Dickinson M., Potter B., Clements C., Urbanski S., Prichard S., Watts A., McNamara D. Fire behaviour and smoke modelling: model improvement and measurement needs for next-generation smoke research and forecasting systems. International Journal of Wildland Fire 28, 570-588, 2019.

#### **2018**

5. Johnston J.M., Wheatley M.J., Wooster M.J., **Paugam R.**, Davies G.M., DeBoer K.A.: Flame-Front Rate of Spread Estimates for Moderate Scale Experimental Fires Are Strongly Influenced by Measurement Approach. *Fire*, 1, 16., 2018

## 2017

6. Sauvage, B., Fontaine, A., Eckhardt, S., Auby, A., Boulanger, D., Petetin, H., **Paugam, R.**, Athier, G., Cousin, J.-M., Darras, S., Nédélec, P., Stohl, A., Turquety, S., Cammas, J.-P., and Thouret, V.: Source attribution using FLEXPART and carbon monoxide emission inventories: SOFT-IO version 1.0, *Atmos. Chem. Phys.*, 17, 15271-15292, <https://doi.org/10.5194/acp-17-15271-2017>, 2017.
7. Johnston J. M., Wooster M. J., **Paugam R.**, Wang X., Lynham T. J., Johnston L. M.: Direct estimation of Byram's fire intensity from infrared remote sensing imagery. *International Journal of Wildland Fire* 26, 668-684, 2017.
8. Rémy, S., Veira, A., **Paugam, R.**, Sofiev, M., Kaiser, J. W., Marenco, F., Burton, S. P., Benedetti, A., Engelen, R. J., Ferrare, R., and Hair, J. W.: Two global data sets of daily fire emission injection heights since 2003, *Atmos. Chem. Phys.*, 17, 2921-2942, doi:10.5194/acp-17-2921-2017, 2017.

## 2016

9. Evangeliou, Nikolaos; Zibtsev, S.; Myroniuk, V.; Zhurba, M.; Hamburger, Thomas; Stohl, Andreas; Balkanski, Y.; **Paugam, R.**; Mousseau, T.A.; Møller, A.P.; Kireev, S.I.: Resuspension and atmospheric transport of radionuclides due to wildfires near the Chernobyl Nuclear Power Plant in 2015: An impact assessment. *Scientific Reports, Nature*, doi:10.1038/srep26062, 2016.
10. **Paugam, R.**, Wooster, M., Freitas, S., and Val Martin, M.: A review of approaches to estimate wildfire plume injection height within large-scale atmospheric chemical transport models, *Atmos. Chem. Phys.*, 16, 907-925, doi:10.5194/acp-16-907-2016, 2016.

## 2015

11. **Paugam, R.**, Wooster, M., Atherton, J., Freitas, S. R., Schultz, M. G., and Kaiser, J. W.: Development and optimization of a wildfire plume rise model based on remote sensing data inputs -Part 2, *Atmos. Chem. Phys. Discuss.*, 15, 9815-9895, doi:10.5194/acpd-15-9815-2015, 2015. [kept in review for acp]
12. Gonzi, S., Palmer, P. I., **Paugam, R.**, Wooster, M., and Deeter, M. N.: Quantifying pyroconvective injection heights using observations of fire energy: sensitivity of spaceborne observations of carbon monoxide, *Atmos. Chem. Phys.*, 15, 4339-4355, doi:10.5194/acp-15-4339-2015, 2015.
13. N. Evangeliou, Y. Balkanski, A. Cozic, W. M. Hao, F. Mouillot, K. Thonicke, **R. Paugam**, S. Zibtsev, T. A. Mousseau, R. Wang, B. Poulter, A. Petkov, C. Yue, P. Cadule, B. Koffi, J. W. Kaiser, and A. P. Møller. Fire evolution in the radioactive forests of Ukraine and Belarus: future risks for the population and the environment. *Ecological Monographs* 85:49-72. 2015
14. **Paugam R.**, Wooster, M. J. and Roberts, G, 2013: Use of Handheld Thermal Imager Data for Airborne Mapping of Fire Radiative Power and Energy and Flame Front Rate of Spread, *Geoscience and Remote Sensing, IEEE Transactions on* , vol.51, no.6, pp.3385,3399

## 2014 and before

15. Rochoux, M. C., Cuenot, B., Ricci, S., Trouve, A., Delmotte, B., Massart, S., Paoli, R. & **Paugam, R.**: Data assimilation applied to combustion, *COMPTES RENDUS MECANIQUE*. 341, 1-2, p. 266-276 11 p., DOI: 10.1016/j.crme.2012.10.011 , Jan 2013
16. Val Martin, M., R. A. Kahn, J. A. Logan, **R. Paugam**, M. Wooster, and C. Ichoku, 2012: Space-based observational constraints for 1-D fire smoke plume-rise models, *J. Geophys. Res.*, 117, D22204
17. **Paugam R.** , R. Paoli, and D. Cariolle, 2010: Influence of vortex dynamics and atmospheric turbulence on the early evolution of a contrail, *Atmospheric Chemistry and Physics*, Vol. 10, pp. 3933-3952.
18. D. Cariolle, D. Caro, R. Paoli, D. Hauglustaine, B. Cuenot, A. Cozic, and **R. Paugam**, 2009: Introduction of non-linear plume chemistry into large scale atmospheric models: application to aircraft emissions, *Journal of Geophysical Research*, Vol. 114, D19302.

#### ***Book chapters:***

- Schiks T., Cantin A.S., Johnston J.M., **Paugam R.**, Whitman E. (2019) Satellite-Based Fire Detection. In: Manzello S. (eds) *Encyclopedia of Wildfires and Wildland-Urban Interface (WUI) Fires*. Springer, Cham
- Whitman E., Johnston J.M., Schiks T., **Paugam R.**, Cantin A.S. (2019) Imaging Postfire Environments. In: Manzello S. (eds) *Encyclopedia of Wildfires and Wildland-Urban Interface (WUI) Fires*. Springer, Cham
- Johnston J.M., **Paugam R.**, Whitman E., Schiks T., Cantin A.S. (2019) Remote Sensing of Fire Behavior. In: Manzello S. (eds) *Encyclopedia of Wildfires and Wildland-Urban Interface (WUI) Fires*. Springer, Cham

#### ***In preparation:***

- **Paugam R**, Nicolas Cazard, Mélanie C. Rochoux, Corentin J Lapeyre, William E. Mell, Niels Andela, Martin J. Wooster, “Processing high resolution airborne thermal infra red observation of experimental fire: (part 1) fire front segmentation using deep learning”, in preparation for submission to *International Journal of Wildland Fire*.
- **Paugam R**, Nicolas Cazard, Mélanie C. Rochoux, Corentin J Lapeyre, William E. Mell, Niels Andela, Martin J. Wooster, “Processing high resolution airborne thermal infra red observation of experimental fire: (part 2) fire front rate of spread computation”, in preparation for submission to *International Journal of Wildland Fire*.

#### ***Referenced conference publications:***

- **Paugam R.**, W. Mell, J.-B. Filippi, M. Rochoux, M. Wooster, High Resolution Fire Behavior Monitoring and Plume Simulation in the context of Experimental Fire. In *Proc. of the IX International Congress on Forest Fire Research (ICFFR) 2022* edited by Viegas, D. X., Coimbra, Portugal. <http://dx.doi.org/10.14195/978-989-26-2298-9>
- Liu, Yongqiang; Kochanski, A; Baker, K; Mell, W; Linn, R; **Paugam, R**; Mandel, J; Fournier, A; Jenkins, M A; Goodrick, S; Achtemeier, G; Hudak, A; Dickson, M; Potter, B; Clements, C; Urbanski, S; Ottmar, R; Larkin, N; Brown, T; French, N; Prichard, S; Watts, A; McNamara, D. 2017. Fire and Smoke Model Evaluation Experiment (FASMEE): Modeling gaps and data needs.

In: Proceedings for the 2nd International Smoke Symposium November; 14-17, 2016, Long Beach, California, USA. Missoula, MT: International Association of Wildland Fire. 13 p.

- Dold John, Tsitsopoulos V, Khan I, Scott K, McMorrow J, Lowe E, Danson F M, Ramirez A, Doerr S, Bryant R, Harris M, Tollitt T, Allen K, **Paugam R**, Freeborn P, Smith T, Davies H, Wooster M, Legg C, Gibson S, Elliott A, Yearsley S, 2010. Report on field experiments in Northumberland, March 2010 a multidisciplinary approach to assess fire behaviour and effects in a temperate climate. Proc. 6th Int. Conf. Forest Fire, Res.
- **R. Paugam**, M. Wooster, G. Papadakis, and M. Schultz: Estimation of the Injection Height of Biomass Burning Emission, Proceeding for the ESA-iLEAPS-EGU joint conference, Frascati, Italy, November 2010
- **R. Paugam**, R. Paoli, D. Cariolle and B. Cuenot: Numerical simulation of aircraft plume evolution using a mesoscale code, Proceedings of the International Conference on Transport, Atmosphere and Climate, Oxford, UK, June 2006.

### ***Main Conference Abstracts***

- **Paugam R.**, M. Rochoux, N. Cazard, C. Lapeyre, J.-B. Vincentelli, J.-B. Filippi, W. Mell, J. Johnston, M. Wooster. High Resolution Fire Behavior Monitoring & Plume Simulation in the context of Prescribed Burns. Numerical WildFire 2021, IESC Cargese France, 15-19 November 2021.
- **Paugam R.**, N. Lauret, J.-P. Gastellu-Etchegorry, E. Pastor, E. Planas. 3DFireLab: a Virtual Fire Scene Simulator for the Simulation of Infra Red Fire Observation. 13th IAFSS Symposium, Waterloo CA, 26-30 April 2021.
- **R. Paugam**, JP Gastellu-Etchegorry, W Mell, J Johnston, JB Filippi: Prescribed Burn, Helicopterborne Infrared Imagery, and 3D Plume Model for Synthetic FRP Product Simulation. Earth Observation Submit, Montreal 2017.
- **R. Paugam**, JP Gastellu-Etchegorry, W Mell, J Johnston, JB Filippi: Modelling Middle Infrared Thermal Imagery from Observed or Simulated Active Fire, AGU Fall Meeting Abstracts, 2016
- **R. Paugam**, M. Wooster, J. Johnston, J.P. Gastellu-Etchegorry: FRP product simulation tools. Numerical Wildfire workshop, Cargese France 2013
- **R Paugam**, M Wooster, J Atherton, S Beevers, N Kitwiroon, JW Kaiser, S Remy, SR Freitas: Wildfire Emission, injection height: Development, Optimization, and Large Scale Impact - AGU Fall Meeting Abstracts, 2013
- **R Paugam**, M Wooster, J Atherton, JW Kaiser, S Freitas: On the parameterization of Injection Height and the use of the MISR plume height project data - Vol. 15, EGU2013-13779, 2013
- **R Paugam**, M Wooster, S Freitas, S Gonzi, P Palmer: Parameterization of Fire Injection Height in Large Scale Transport Model - Vol. 14, EGU2012-8366, 2012
- **R Paugam**, M Wooster, G Papadakis, M Schultz: Estimation of the Injection Height of Biomass Burning Emission - Vol. 13, EGU2011-1097, 2011