Curriculum Vitae of Ronan PAUGAM

Overview

Since 2008, I have been active in fire science on both active fire monitoring and fire-plume modelling. I am currently a postdoctoral researcher at CERFACS in Toulouse (France) with Dr Mélanie ROCHOUX where I started working in 2018 after an experience of 10 years abroad. Before coming back to France, I was a visiting scholar of the University of Washington for 2 years (2016-2018) working with Dr William MELL at the US Forest Service Pacific Wildland Fire Sciences Lab (PWSL) in Seattle (USA), and a postdoctoral researcher for 8 years (2008-2015) in the Department of Geography of Kings College London (KCL, UK) with Prof. Martin WOOSTER. Prior to that time abroad, I performed my PhD at CERFACS from 2005 to 2008 on the subject of contrail interaction with atmospheric turbulence with the supervision of Dr Daniel CARIOLLE.

My main scientific product achievement so far is the development of a parameterization for fire plume injection height which is now running operationally in the IFS model of ECMWF and was delivered in 2015 in the framework of the MACC project.

In 2015 while still at KCL I initiated the development of a simulation strategy for the modelling of energy transfer in large-scale fire plume within a project supported by the European Space Agency (ESA). The end objective of this work that I have been continuing since then, during my time at PWSL and CERFACS, is to help improving Earth Observation active fire remote sensing products by creating a simulation tool (i.e. a virtual fire laboratory) capable to study energy transfer (in particular radiative transfer) in large-scale fire scene. In this work, I am particularly interested in designing and conducting fieldwork campaign, integrating fire radiation measurement from prescribed burn into atmospheric meso-scale model, and in fine generating realistic fire scene for radiative transfer model.

Personal Data

Name:	Ronan Gabriel Michel Paugam
Date of Birth:	13-07-1980
Country of citizenship:	French
email:	ronan.paugam@pm.me
website:	https://ronanpaugam.github.io/

Professional Background

June 2018 – May 2019 & Sep 2019 – Present	**Postdoctoral Researcher at Centre Européen de Recherche et de Formation Avancée en Calcul Scientifique (CERFACS, Toulouse, France),** in the team of Dr Mélanie ROCHOUX. Airborne Image processing to compute Fire behaviour metrics for application in Machine Learning tools and Data Assimilation scheme. Master Student supervision.
March 2016 – March 2018	**Visiting Scholar at the University of Washington, based at the US Forest Service Pacific Wildland Fire Sciences Lab (PWSL, Seattle, USA),** in the team of 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	**Postdoctoral 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. Successful Grant application as Co-PI for 3 NERC, 1 ESA and 2 internal KCL projects. Master student co-supervision Published in refereed journal and presented in international conferences.
Jan 2005 - May 2008	**PhD Student, Ecole Centrale Paris (Chatenay-Malabry, France) and Aviation Environment group of CERFACS (Toulouse, France)**, advisor: Dr Daniel CARIOLLE. Thesis title: Numerical study of a contrail evolution and its interaction with the atmospheric turbulence. Large-Eddy simulation of aircraft wake instabilities and atmospheric-contrail interaction. Published in refereed journal and presented in international conferences.

Studies

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

Early Research Experiences (internships)

Jun-Oct 2004	**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
Apr-Jul 2002	**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
Jun-Jul 2001	**research project in Fundamental Physics**, Laboratoire de l'Accelerateur Lineaire, Paris-South University, Centre of Orsay (France) Supervisor: Pr. Francois Couchot subject: Short-Range Gravitation Forces

Research Projects

Participation as a Co-PI:

NERC small grant	"Determining convective/radiative energy portioning 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
NERC consortium grant	"South American Biomass Burning Analysis" (SAMBBA). NE/J010073/1, £703,031
ESA	"3D Fire Radiative Power Approach Modelling Approach", ESA ITT 1-6811/11/NL/AF, 249keuro

Participation in Consortium project:

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

Invited Presentations

Sep 2015:   Meteorology and Climate - Modelling for Air Quality (MAC-MAQ) workshop. Sacramento, USA
Oct 2011:   National Institute for Space Research (INPE), visiting researcher, Sao Jose dos Campos, Brazil.

Teaching

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).

Research Interest and Expertise

- 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

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

Computer skills

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

List of Publications

Peer-reviewed publications:
For each publication R. Paugam participation is quickly summarized in between brackets.

2019

1. 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. [satellite products extraction and plume height parameterization runs]

2. 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 [discussion on Methodology]

3. 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. [experiment planning discussion and coupled fire-atmosphere ForeFire-MesoNH runs]

2018

4. 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 [ROS algorithm developement]

2017

5. 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. [satellite products extraction and plume height parameterization runs]

6. 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. [fieldwork campaign planning, data post-processing, and discussion on methodology]

7. 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. [development of the plume height parameterization included in the Copernicus model]

2016

8. 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. [satellite products extraction and plume height parameterization runs]

9. **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. [bibliography and writing up]

10. **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. Manuscript was kept in review. [methodology; model development; satellite product postprocessing; help from Dr J. Atherton on the optimization algorithm implementation; writing up]

2015

11. 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. [development of the plume height parameterization]

12. 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. MÃ¸ller. Fire evolution in the radioactive forests of Ukraine and Belarus: future risks for the population and the environment. Ecological Monographs 85:49-72. 2015. [satellite products extraction and plume height parameterization runs]

2014 and before

13. **Paugam R.**, Wooster, M. J. and Roberts, G: 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, 2013. [fieldwork organization and deployment. Algorithm development. Writing up.]

14. Rochoux, M. C., Cuenot, B., Ricci, S., Trouve, A., Delmotte, B., Massart, S., Paoli, R. & **Paugam, R.**: Data assimilation applied to combustion, Compte Rendus Mecanique. 341, 1-2, p. 266-276 11 p., 2013. [providing fire observation and postprocessing.]

15. Val Martin, M., R. A. Kahn, J. A. Logan, **R. Paugam**, M. Wooster, and C. Ichoku,: Space-based observational constraints for 1-D fire smoke plume-rise models, J. Geophys. Res., 117, D22204, 2012. [methodology discussion and plume height parameterization]

16. **Paugam R.** , R. Paoli, and D. Cariolle: Influence of vortex dynamics and atmospheric turbulence on the early evolution of a contrail, Atmospheric Chemistry and Physics, Vol. 10, pp. 3933-3952, 2010. [Phd Final publication. Model development and writing up]

17. D. Cariolle, D. Caro, R. Paoli, D. Hauglustaine, B. Cuenot, A. Cozic, and **R. Paugam**: Introduction of non-linear plume chemistry into large scale atmospheric models: application to aircraft emissions, Journal of Geophysical Research, Vol. 114, D19302, 2009. [Participation at the conception of the parameterization formulation].

In preparation

- **Paugam R.**, Mell W., Rochoux M., Wooster M., Main B., Govender N.: High Resolution Fire Behaviour Metrics from Prescribed Burn. Part 1: Automatic georeferencing of helicopter-borne imagery, in preparation for submission to International Journal of Wildland Fire.

- **Paugam R.**, Rochoux, M., Cazard N., Lapeyre C., Wooster, M., Govender, N.: High Resolution Fire Behaviour Metrics from Prescribed Burn. Part 2: Fire Front Extraction using Deep Learning, in preparation for submission to International Journal of Wildland Fire.

Book chapters:
1. 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
2. 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
3. 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

Referenced conference publications:
1. Liu, Yongqiang Kochanski, A Baker, K Mell, W Linn, R **Paugam, R** et al.: 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.
2. **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
3. **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
1. **R. Paugam**, Rochoux M., Cazard N., Lapeyre C., Mell W, and Wooster M: Computing High Resolution Fire Behavior Metrics from Prescribed Burnusing Handheld Airborne Thermal Camera Observations, vol. 21, EGU2019-13804, 2019
2. **R. Paugam**, Rochoux M., Cazard N., Lapeyre C., Mell W, Johnston J. and Wooster M: Computing High Resolution Fire Behavior Metrics from Prescribed Burnusing Handheld Airborne Thermal Camera Observations, the 6th Fire Behavior and Fuels Conference, Marseille, 2019
3. **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.
4. **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
5. **R. Paugam**, M. Wooster, J. Johnston, J.P. Gastellu-Etchegorry: FRP product simulation tools. Numerical Wildfire workshop, Cargese France 2013