Duncan Watson-Parris

Atmospheric, Oceanic and Planetary Physics, Clarendon Laboratory, University of Oxford, Oxford, UK
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Research Experience

2020 – Present	**Senior Research Associate and Course Director**, University of Oxford My research focuses on better understanding aerosol-cloud interactions and improving their representation in global climate models through the use of machine learning
2015 – 2020	**Post-doctoral Research Associate**, University of Oxford Research on the understanding and improvement of aerosol processes in climate models

Professional Experience

2020– 2021	**Independent Consultant**, Oxford University Innovation, Oxford European Space Agency 'Digital Twin Earth Precursor' project (worth >£500k total)
2011- 2015	**Data Analytics Consultant**, Tessella Ltd., Abingdon I completed various projects for national and multi-national R&D organisations, obtaining certifications in software engineering, business analysis and project management.

Education

2007- 2011	**PhD Theoretical Physics,** University of Manchester **Title:** Carrier localization in InGaN/GaN quantum wells
2003- 2007	**First Class BSc. (Hons.) Theoretical and Computational Physics,** Cardiff University **Project:** Computer simulation studies of spin-glass systems

Awards, Fellowships, and Grants

2021	*Named Researcher:* "ML4CLOUDS", Natural Environment Research Council: ~£800k total
2020	Amazon Web Services (AWS) Machine Learning Research Awards: **$40,0000**
2019	NeurIPS 2019 Climate Change AI workshop – Best Paper and **$10,000** in Microsoft Azure cloud computing credits
2019	ICML 2019 Climate Change AI workshop – Best Paper
2018	*Co-wrote:* "iMIRACLI on AWS", AWS Grant: **$150,000**
2018	NVIDIA GPU Grant: ca. **£2000**
2017	*Researcher Co-I: "*access to EnVironmental Analytics for Developing countriEs (EVADE)", UK Science and Technology Facilities Council: **£50,399**
2015	Alan Taylor visiting lecturer award, University of Oxford
2009	ICNS-8 Conference paper selected for cover-page of journal special issue
2009	Institute of Physics "Research Student Conference Fund" for ICNS-8
2009	UKNC Travel Bursary for ICNS-8

Teaching Experience

Machine Learning for Climate Physics, Virtual, May 2021

- An invited extra-curricular lecture for Oxford Physics Undergraduate students.

1st iMIRACLI summer school, Virtual, September 2020

- I designed, organized and managed a two-week summer school for the 15 PhD students enrolled on the iMIRACLI Marie Curie ITN across Europe, as well as 8 other invited students.

Big data analysis, Environmental Research DTP (Oxford University), September 2015 – Present
CIS user-workshop, International, 2015 - 2017:
Python for climate scientists, Oxford University, December 2016
Physics of the Atmosphere and Oceans October 2016 – May 2017

Invited Presentations

2022 UN AI for Good 'Accelerating Climate Science with AI', Virtual
2021 International Aerosol Modeling Algorithms Conference, Virtual
2021 AGU Fall Meeting, Virtual (declined)
2021 Machine Learning for Climate, UC Santa Barbra
2021 ISC High Performance, Virtual
2021 US CLIVAR Data Science Webinar, Virtual
2021 ETH Zurich Institute for Atmospheric and Climate Science ML Seminar, Virtual
2021 Department of Atmospheric, Oceanic and Planetary Physics, University of Oxford
2020 Hebrew University Climate, Atmosphere and Oceanography, Virtual
2020 University of Wyoming Department of Atmospheric Science, Virtual
2020 ECMWF-ESA Workshop on ML for Earth System Observation and Prediction, Virtual
2020 University of Bath Department of Computer Science, Virtual
2020 NCAS@Reading Science Meeting, Reading (cancelled due to COVID19)
2018 Telluride Science Research Center Workshop, Colorado (declined)
2018 World Climate Research Programme workshop, Ringberg
2017 Swedish Meteorological and Hydrological Institute
2008 Rank Prize Funds symposium

Publications

*Co-advised ORCID: 0000-0002-5312-4950; Google Scholar
Published peer-reviewed papers: 37; First author: 9. Currently > 1100 citations; h-index 17.

Submitted and Under Review

(2022) Che, H., Stier, P., **Watson-Parris, D.**, Gordon, H., and Deaconu, L. *Source attribution of cloud condensation nuclei and their impact on stratocumulus clouds and radiation in the south-eastern Atlantic.* Submitted to Atmospheric Chemistry and Physics

(2022) **Watson-Parris, D.**, Rao, Y., Olivié, D., Seland, Ø., … *ClimateBench: A benchmark dataset for data-driven climate projections.* Submitted to Journal of Advances in Modeling Earth Systems: 10.1002/essoar.10509765.1

(2022) *Williams, A., Stier, P., Dagan. G., **Watson-Parris, D.** *Strong control of effective radiative forcing by the spatial pattern of absorbing aerosol.* Under review at Nature Climate Change: 10.21203/rs.3.rs-1015938/v1

(2022) Myhre, G., Samset, B. H., …, **Watson-Parris, D.** *Observational constraints reduce estimates of the global mean climate relevance of black carbon*. Under review at Nature Climate Change

(2022) Salzmann, M., …, **Watson-Parris, D.**, …, Tegen, I. *The global atmosphere-aerosol model ICON-A-HAM2.3*. Submitted to Journal of Advances in Modeling Earth Systems

(2022) Whaley, C. H., ..., **Watson-Parris, D.**, Weiss-Gibbons, T. *Model evaluation of short-lived climate forcers for the Arctic Monitoring and Assessment Programme: a multi-species, multi-model study*. Submitted to Atmospheric Chemistry and Physics: 10.5194/acp-2021-975

(2022) Kramer, R.J., Soden, B.J., Smith, C.J., Myhre, G., Forster, P.M., Andrews, T., Boucher, O., Faluvegi, G., Fläschner, D., Hodnebrog, Ø., …, **Watson-Parris, D.** *Inter-model spread in instantaneous radiative forcing across multiple climate drivers*. Under review at Nature Geoscience

Accepted / published

2022 Christensen, M., Gettelman, A., …., **Watson-Parris, D**., ... *Opportunistic Experiments to Constrain Aerosol Effective Radiative Forcing.* Atmospheric Chemistry and Physics, 22: 10.5194/acp-22-641-2022

2021b **Watson-Parris, D**., Williams, A., Deaconu, L., Stier, P. *Model calibration using ESEm v1.1.0 – an open, scalable Earth System Emulator.* Geoscientific Model Development, 14: 10.5194/gmd-14-7659-2021

2021 Kasim, M. F., **Watson-Parris, D**., Deaconu, L., Topp-Mugglestone, …, Vinko S. M. *Building high accuracy emulators for scientific simulations with deep neural architecture search*. Machine Learning: Science and Technology, 3: 10.1088/2632-2153/ac3ffa

Highlight: *From models of galaxies to atoms, simple AI shortcuts speed up simulations by billions of times*. Science 10.1126/science.abb2769

2021 Sand, M., Samset, B. H., Myhre, G., Gliß, J., …, and **Watson-Parris, D.** *Aerosol absorption in global models from AeroCom Phase III*. Atmospheric Chemistry and Physics, 21: 10.5194/acp-21-15929-2021

2021 *Zhang, S., Stier, P., **Watson-Parris, D.** *On the Contribution of Fast and Slow Responses to Precipitation Changes Caused by Aerosol Perturbations*. Atmospheric Chemistry and Physics, 21: 10.5194/acp-21-10179-2021

2021 *Langton, T., Stier, P., **Watson-Parris, D.**, Mulcahy, J. *Decomposing Indirect Aerosol Forcing by Global Cloud Regimes*. Geophysical Research Letters, 48: 10.1029/2021GL093833

2021 **Watson-Parris, D.** *Machine learning for climate and weather are worlds apart*. Philosophical Transactions of the Royal Society A, 379: 10.1098/rsta.2020.0098

2021 Dagan, G., Stier, P. & **Watson-Parris, D.** *An energetic view on the geographical dependence of the fast aerosol radiative effects on precipitation*. Journal of Geophysical Research: Atmospheres, 126: 10.1029/2020JD033045

2021a **Watson-Parris, D.**, Sutherland, S. A., Christensen, M. W. & Stier, P. *A large-scale analysis of pockets of open cells and their radiative impact*. Geophysical Research Letters, 48: 10.1029/2020GL092213

2020 Gettelman, A., ..., **Watson-Parris, D.** *Climate Impacts of COVID-19 Induced Emission Changes*. Geophysical Research Letters, 48: 10.1029/2020GL091805
Highlight: *COVID-19 lockdowns temporarily raised global temperatures* https://bit.ly/3p20zc8

2020 Haywood, J. M., Abel, S., …, **Watson-Parris, D.**, … Zuidema, P. *Overview: The CLoud-Aerosol-Radiation Interaction and Forcing: Year-2017 (CLARIFY-2017) measurement campaign*. Atmospheric Chemistry and Physics: 21: 10.5194/acp-21-1049-2021

2020 Dagan, G., Stier, P. & **Watson-Parris, D.** *Aerosol forcing masks and delays the formation of the North-Atlantic warming hole by three decades*. Geophysical Research Letters, 47, e2020GL090778: 10.1029/2020GL090778

2020 Brown, H, Liu, X., …, **Watson-Paris, D.**, …, Chand, D. *Biomass burning aerosols in most climate models are too absorbing*. Nature Communications: 10.1038/s41467-020-20482-9

2020 Che, H., Stier, P., Gordon, H., **Watson-Parris, D.**, and Deaconu, L. *The significant role of biomass burning aerosols in clouds and radiation in the South-eastern Atlantic Ocean*, Atmospheric Chemistry and Physics, 21: 10.5194/acp-21-17-2021

2020 McCoy, I. L., McCoy, D. T., Wood, R., Regayre, L., **Watson- Parris, D**., Grosvenor, D. P., Mulcahy, J., Hu, Y., Bender, F. A. M., Field, P. R., Carslaw, K., Gordon, H. *The hemispheric contrast in cloud microphysical properties constrains aerosol forcing*. Proceedings of the National Academy of Sciences 117 (32): 10.1073/pnas.1922502117

2020 Allen, R. J., Lamarque, J. F., **Watson-Parris, D.** & Olivie, D. *Assessing California wintertime precipitation responses to various climate drivers*. Journal of Geophysical Research: Atmospheres, 125: 10.1029/2019JD031736

2020 **Watson-Parris, D.,** Bellouin, N., Deaconu, L., Schutgens, N., Yoshioka, M., Regayre, L. A., Pringle, K. J., Johnson, J. S., Carslaw, K. S. & Stier, P. *Constraining uncertainty in aerosol direct forcing*. Geophysical Research Letters, 47: 10.1029/2020GL087141

2020 Wood, T., Maycock, A. C., Forster, P. M., Richardson T. B., …. **Watson-Parris, D.** *The Southern hemisphere midlatitude circulation response to rapid adjustments and sea surface temperature driven feedbacks* Journal of Climate 1-53: 10.1175/JCLI-D-19-1015.1

2019 Richardson, T. B., Forster, P. M., Smith, C. J., Maycock, A. C., Wood, T., Andrews, T., Boucher, ..., **Watson-Parris, D.** *Efficacy of Climate Forcings in PDRMIP Models*. Journal of Geophysical Research: Atmospheres, 124: 10.1029/2019JD030581
Editors' Highlight: *How Does Climate Respond to Different Forcings?* https://eos.org/editor-highlights/how-does-climate-respond-to-different-forcings

2019 Hodnebrog, O., Myhre, G., Samset, B. H., Alterskjær, K., Andrews, T., Boucher, O., Faluvegi, G., Fläschner, D., M Forster, P., …, **Watson-Parris, D.** *Water vapour adjustments and responses differ between climate drivers*. Atmospheric Chemistry and Physics, 19(20): 10.5194/acp-19-12887-2019

2019 Tegen, I., Neubauer, D., Ferrachat, S., Drian, C. S.-L., Bey, I., Schutgens, N., Stier, P., **Watson-Parris, D.**, Stanelle, T., ..., Heinold, B., & Lohmann, U. *The global aerosol-climate model ECHAM6.3–HAM2.3 Part 1: Aerosol evaluation*. Geoscientific Model Development, 12(4): 10.5194/gmd-12-3609-2019

2019b **Watson-Parris, D.**, Schutgens, N., Reddington, C., Pringle, K. J., Liu, D., Allan, J. D., Coe, H., Carslaw, K. S., & Stier, P. *In situ constraints on the vertical distribution of global aerosol*. Atmospheric Chemistry and Physics, 19(18): 10.5194/acp-19-11765-2019

2019 Dagan, G., Stier, P., & **Watson-Parris, D.** *Contrasting Response of Precipitation to Aerosol Perturbation in the Tropics and Extratropics Explained by Energy Budget Considerations*. Geophysical Research Letters, 46(13): 10.1029/2019GL083479

2019 Dagan, G., Stier, P., & **Watson-Parris, D.** *Analysis of the Atmospheric Water Budget for Elucidating the Spatial Scale of Precipitation Changes Under Climate Change*. Geophysical Research Letters, 46(17–18): 10.1029/2019GL084173

2019 Bellouin, N., Quaas, J., Gryspeerdt, E., Kinne, S., Stier, P., **Watson-Parris, D.**, …, Stevens, B. *Bounding global aerosol radiative forcing of climate change*. Reviews of Geophysics, 2019RG000660: 10.1029/2019RG000660
Editors' Highlight: *Effects of Particles on Climate Remain Unsettled*
https://eos.org/editor-highlights/effects-of-particles-on-climate-remain-unsettled
Clarivate ESI 'Highly Cited' and 'Hot' paper: Top 0.1% of Geosciences papers 2020

2019 Heikenfeld, M., Marinescu, P. J., Christensen, M., **Watson-Parris, D.,** Senf, F., Van Den Heever, S. C., & Stier, P. (2019). *Tobac 1.2: Towards a flexible framework for tracking and analysis of clouds in diverse datasets*. Geoscientific Model Development, 12(11): 10.5194/gmd-12-4551-2019

2019 Fanourgakis, G. S., Kanakidou, M., Nenes, A., Bauer, S. E., Bergman, T., Carslaw, K. S., Grini, A., Hamilton, D. S., Johnson, J. S., Karydis, V. A., Kirkeväg, A., …, **Watson-Parris, D.**, …, Yu, F. *Evaluation of global simulations of aerosol particle and cloud condensation nuclei number, with implications for cloud droplet formation*. Atmospheric Chemistry and Physics, 19(13): 10.5194/acp-19-8591-2019

2018 Myhre, G., Kramer, R. J., Smith, C. J., Hodnebrog, Ø., Forster, P., Soden, B. J., Samset, B. H., Stjern, C. W., Andrews, T., Boucher, O., Faluvegi, G., Fläschner, D., Kasoar, M., Kirkevåg, A., Lamarque, J.-F., Olivié, D., … **Watson-Parris, D.** *Quantifying the Importance of Rapid Adjustments for Global Precipitation Changes*. Geophysical Research Letters, 45(20): 10.1029/2018GL079474

2018 **Watson-Parris, D.**, Schutgens, N., Winker, D., Burton, S. P., Ferrare, R. A., & Stier, P. *On the Limits of CALIOP for Constraining Modeled Free Tropospheric Aerosol*. Geophysical Research Letters, 45(17): 10.1029/2018GL078195

2018 Smith, C. J., Kramer, R. J., Myhre, G., Forster, P. M., Soden, B. J., Andrews, T., Boucher, O., Faluvegi, G., Fläschner, D., Hodnebrog, Ø., Kasoar, M., Kharin, V., Kirkevåg, A., Lamarque, J.-F., Mülmenstädt, J., Olivié, D., Richardson, T., Samset, D., … **Watson-Parris, D.** *Understanding Rapid Adjustments to Diverse Forcing Agents*. Geophysical Research Letters, 45(21): 10.1029/2018GL079826

2018 Lund, M. T., Samset, B. H., Skeie, R. B., **Watson-Parris, D.**, Katich, J. M., Schwarz, J. P., & Weinzierl, B. *Short Black Carbon lifetime inferred from a global set of aircraft observations*. Npj Climate and Atmospheric Science, 1(1), 31: 10.1038/s41612-018-0040-x

2016 **Watson-Parris, D.,** Schutgens, N., Cook, N., Kipling, Z., Kershaw, P., Gryspeerdt, E., Lawrence, B., & Stier, P. *Community Intercomparison Suite (CIS) v1.4.0: A tool for intercomparing models and observations*. Geoscientific Model Development, 9(9): 10.5194/gmd-9-3093-2016

2011-2015 **(Working in Industry)**

2013 Badcock, T. J., Hammersley, S., **Watson-Parris, D.,** ..., Humphreys, C. J. (2013). *Carrier density dependent localization and consequences for efficiency droop in InGaN/GaN quantum well structures*. Japanese Journal of Applied Physics, 52(8 PART 2): 10.7567/JJAP.52.08JK10

2012 Hammersley, S., **Watson-Parris, D.,** Dawson, P, ..., Humphreys, C. J. (2012). *The consequences of high injected carrier densities on carrier localization and efficiency droop in InGaN/GaN quantum well structures*. Journal of Applied Physics, 111(8): 10.1063/1.3703062

2011 **Watson-Parris, D.**, Godfrey, M. J., Dawson, P., Oliver, R. A., Galtrey, M. J., Kappers, M. J., & Humphreys, C. J. (2011). *Carrier localization mechanisms in InxGa1-xN/GaN quantum wells*. Physical Review B, 83(11): 10.1103/PhysRevB.83.115321

2011 Hammersley, S., Badcock, T. J., **Watson-Parris, D.**, Godfrey, M. J., Dawson, P., Kappers, M. J., & Humphreys, C. J. (2011). *Study of efficiency droop and carrier localisation in an InGaN/GaN quantum well structure*. Physica Status Solidi (C), 8, 2194-2196: 10.1002/pssc.201001001

2010 **Watson-Parris, D.,** Godfrey, M. J., Oliver, R. A., Dawson, P., Galtrey, M. J., Kappers, M. J., & Humphreys, C. J. (2010). *Energy landscape and carrier wave-functions in InGaN/GaN quantum wells*. Physica Status Solidi (C), 7, 2255–2258: 10.1002/pssc.200983516
Highlight: Chosen for the cover page of special issue

Conference Papers

2021 *Jesson, A., Manshausen, P., Douglas, A., **Watson-Parris, D.**, Gal, Y., Stier, P. *Using Non-Linear Causal Models to Study Aerosol-Cloud Interactions in the Southeast Pacific*. Climate Change AI workshop at NeurIPS 2021: arxiv:2110.15084

2021 *Harder, P., **Watson-Parris, D.**, Strassel, D., Gauger, N., Stier, P., Keuper, J. *Emulating Aerosol Microphysics with Machine Learning.* Tackling Climate Change with Machine Learning Workshop at ICML 2021

2021 *Schroeder de Witt, C., Tong, C., Zantedeschi, V., Martini D., Kalaitzis, A., Chantry, M., **Watson-Parris, D.**, Bilinski, P. *RainBench: Towards Data-Driven Global Precipitation Forecasting from Satellite Imagery.* Thirty-Fifth AAAI Conference on Artificial Intelligence

2020 *Tong, C., Schroeder de Witt, C. A., Zantedeschi, V., Martini, D., Kalaitzis, A., Chantry, M., **Watson-Parris, D.**, Bilinski, P. *RainBench: Enabling Data-Driven Precipitation Forecasting on a Global Scale.* Tackling Climate Change with Machine Learning workshop at NeurIPS 2020
Highlight: Spotlight talk

2020 *Zantedeschi, V., Martini, D., Tong, C., Schroeder de Witt, C. A., Bilinski, P., Kalaitzis, A., Chantry, M., **Watson-Parris, D.** *Towards Data-Driven Physics-Informed Global Precipitation Forecasting From Satellite Imagery.* AI for Earth Sciences workshop at NeurIPS 2020
Highlight: Spotlight talk

2020 *Harder, P., Jones, W., Lguensat, R., Bouabid, S., Fulton, J., Quesada-Chacón, D., Marcolongo, A., Stefanović, S., Rao, Y., Manshausen, P. & **Watson-Parris, D.** *NightVision: Generating Nighttime Satellite Imagery from Infra-Red Observations.* Tackling Climate Change with Machine Learning workshop at NeurIPS 2020: arxiv:2011.07017

2019 *Zantedeschi, V., Falasca, F., Douglas, A., Strange, R., Kusner, M. J., **Watson-Parris, D.** *Cumulo: A Dataset for Learning Cloud Classes.* Climate Change AI workshop at NeurIPS 2019: arxiv:1911.04227
Highlight: Chosen for 'best paper' award

2019a **Watson-Parris, D.**, Sutherland, S., Christensen, M., Caterini, A., Sejdinovic, D., Stier, P. "Detecting anthropogenic cloud perturbations with deep learning" Climate Change: How Can AI Help? workshop at the ICML 2019: arxiv:1911.13061
Highlight: Chosen for 'best paper' award

Book contributions

(2022) Allan, J. and **Watson-Parris, D.** *Measurements of Ambient Aerosol Properties.* In "Aerosols and Climate", Edited by Ken Carslaw. Elsevier (in press)

(2022) Contributed to *Modelling of short-lived climate forcers.* In "AMAP 2021 Assessment: Arctic climate, air quality, and health impacts from short-lived climate forcers" (in press)

Mentoring

- Climate Change Faculty for Stanford AI for Climate Change Bootcamp (2020-present)
- Super Mentor for Frontier Development Lab (FDL) summer projects (2019-present)
- 5 Phd Students: Peter Manshausen (2020-present); Sofija Stefanović (2020-2021); Andrew Williams. (2019-present); Tom Langton (2018-present); Shipeng Zhang (2018-2020).
- 3 MPhys projects: Thomas Matthews (2019); Robin Gan (2019); Sam Sutherland (2018).

Contributed Presentations

>26 oral presentations and 5 posters

Service and Outreach

Conference and workshop organisation

- Lead Convener of "Machine Learning for Climate Science" session at EGU 2022
- Co-chair of the UN AI for Good - Accelerating Climate Science with AI series (2021-2022)
- Meta-reviewer for Climate Change AI workshop at ICML 2021
- Chair of "Machine Learning" session at UK Atmospheric Science Conference 2021
- Program committee member for Climate Change AI workshop at NeurIPS 2020
- Program committee member for AI for Earth Sciences workshop at NeurIPS 2020
- Co-chair of 10th "Climate Informatics" international conference (2020)
- Organising Committee member for "Machine Learning for Nowcasting" workshop (2020)
- Co-host of the 1st "Oxford Machine Learning in Climate Science" workshop (2018)
- Co-convener of the machine learning in climate forum of the Oxford Climate Research Network

Editorial

Guest Editor for 'Environmental Informatics' special issue in Environmental Data Science

Peer review

Proceedings of the National Academy of Sciences; Geophysical Research Letters; Journal of Geophysical Research – Atmospheres; Nature Communications; Atmospheric Chemistry and Physics (Letters); Geoscientific Model Development; Journal of Advances in Modelling Earth Systems; Atmospheric Environment; International Journal of Climatology; AGU Books

Proposal review

Swiss Data Science Center (SDSC) Collaborative Data Science Projects; Research Council of Norway for Chinese-Norwegian Collaboration Projects within Climate Systems; Climate Change AI Innovation Grants (meta-reviewer).

Open-source projects

- Lead developer and maintainer of the Earth System Emulator (ESEm) which enables easy emulation and calibration of Earth System Models and data, such as ClimateBench
- Lead developer and maintainer of CIS, a climate data fusion tool (>100,000 downloads)
- Also developed CALIOPy and CMORize
- Contributor to many other popular libraries such as iris, cartopy and xarray

Outreach

- AGU News article "COVID-19 lockdowns temporarily raised global temperatures": https://bit.ly/3p20zc8 (2021)
- Contributed material and instructional video to "ESA AI for Earth Monitoring" MOOC (2021)
- Featured in "Climate Researchers Enlist Big Cloud Providers for Big Data Challenges" Wall Street Journal: https://www.wsj.com/articles/climate-researchers-enlist-big-cloud-providers-for-big-data-challenges-11606300202 (2020)
- Interviewed in Amazon Web Services for the "Fix This" podcast (https://bit.ly/37ZhGWL) and a blog post by the CTO of Amazon: https://www.allthingsdistributed.com/2020/11/science-of-climate-change.html (2020)
- "Climate change: difficult choices" Science Week at Europa School, Culham (2020)
- "Stargazing+" open day for children with additional support needs (2019)
- "Stargazing+" open day for children with additional support needs (2018)
- "Climate change: what is it all about?" Science Week at Europa School, Culham (2017)
- "Stargazing live" departmental public day (2017)

Committee memberships

- Steering committee member of the AeroCom international modelling consortium
- Steering committee member of the HAMMOZ aerosol model community

Other

- Co-organised a departmental Equality, Diversity and Inclusion (EDI) session (2021)
- AGU Outstanding Student Presentation Award (OSPA) judge (2019)

Professional Memberships

American Geosciences Union; European Geosciences Union; Institute of Physics; British Computer Society (2012 - 2015)

Professional development

- *ECRs: Managing researchers - an introduction for postdocs* (2019)
- *Udacity Deep Learning* – Covers deep convolutional neural networks and inception (2018)
- *NVIDIA Deep Learning Institution Ambassador* (2018)
- *Software/Data Carpentry instructor training* (2017)
- *Stanford University (Coursera) Machine Learning* – Covers modern machine learning algorithms including back propagation and stochastic gradient descent (2016)
- *Open University module in Project Management (M865; 2014)*
- *BCS Professional Graduate Diploma module in Software Engineering (2013)*

Referees

Prof. Philip Stier Head of Atmospheric, Oceanic and Planetary Physics	**Prof. Ken Carslaw** Atmospheric Scientist	**Dr. Andrew Gettelman** Senior Scientist
Department of Physics, University of Oxford, Oxford, UK	School of Earth and Environment, University of Leeds, Leeds, UK	National Center for Atmospheric Research, Boulder, Colorado, USA
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