Dr Natalie Jane Harvey

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Employment History

2019 – present	**Research Scientist (R4Ash project)**
	Department of Meteorology, University of Reading
2016 – 2019	**Research Scientist (IMPALA project)**
	NCAS-Climate, Department of Meteorology, University of Reading
2013 – 2016	**Research associate in statistics for volcanic ash hazards**
	Department of Meteorology, University of Reading

Education

2009 – 2013	PhD in Atmosphere, Oceans and Climate, University of Reading
2006 – 2007	PGCE Secondary Science, University of Nottingham
2003 – 2006	BSc in Physics (First Class Honours), University of Nottingham

RESEARCH

Research interests

Understanding atmospheric transport processes; idealised modelling of convection; atmospheric dispersion; boundary layer processes; forecast verification; quantification of uncertainty; communication of uncertainty

Research highlights

Currently I work on the NERC-funded Highlight Topic project Radar-supported Next-Generation Forecasting of Volcanic Ash Hazard (R4AsH). I am responsible for the delivery of a work package on utilising satellite observations to inverse model information about the plume source parameters. This work is in close collaboration with the UK Met Office and the Universities of Cambridge, Oxford and Lancaster. I will design and perform a suite of experiments to assess the sensitivity to input parameters and ensemble meteorology to the UK Met Office volcanic ash inversion model, InTEM. I will also provide expertise on ensemble modelling to enable the extension of InTEM to include the assimilation of effective radius data generated from satellite retrievals and use novel techniques to determine the value added by including this new data.

My previous post was focussed on improving the representation of atmospheric deep convection in the Met Office NWP and Climate configurations as part of the IMPALA and ParaCon projects. I contributed significantly to the development of the new Met Office-NERC cloud resolving model (MONC) and designed and performed simulations to better understand the impact of surface heterogeneity on the diurnal cycle of deep convection. These new high-resolution simulations of the diurnal cycle of deep convection, a phenomenon that has well known timing and magnitude errors in climate and numerical weather prediction models, show that the introduction of surface heterogeneity can modify the onset of precipitation and modify its spatial distribution.

My work on the Robust Assessment and Communication of Environmental Risk (RACER) project developed a framework for the robust assessment of volcanic ash uncertainty following a volcanic eruption. This framework uses a Bayesian linear emulation approach to better understand the influence of source and internal model parameters on the output of the NAME atmospheric dispersion model. This framework enabled the production of probabilistic ash forecast maps using state-of-the-art operational dispersion model. In addition to this, novel techniques for evaluating ash forecasts were developed and applied.

My PhD thesis addresses whether the parameterizations used for turbulent mixing implemented in NWP and climate models are representative of the real world. The highlight of this work was the development of a flexible algorithm that can be used to diagnose boundary-layer type using Doppler lidar observations. This is now being used by several international universities.

Academic publications

In preparation:

Capponi, A., **Harvey, N. J.**, Dacre, H. F., Bevan, K., Saint, C., Wells, C., and James, M., *Refining an ensemble of volcanic ash forecasts using satellite retrievals: Raikoke 2019.*

Harvey, N. J., Dacre, H. F., Webster, H. N., Saint, C. and Prata, A., *Quantifying the impact of ensemble meteorology on emission estimates and volcanic ash forecasts of Raikoke 2019 eruption*

Harvey, N. J., Western, L., Dacre, H. F. and Capponi, A., *A decision theoretical approach to ensemble volcanic ash forecasting*

Submitted:

Harvey, N. J., Woolnough, S. J., Plant, R. S., Daleu, C. L.., *The impact of surface heterogeneity on the diurnal cycle of deep convection.*

Published:

Harvey, N.J., Dacre, H.F., Webster, H.N., Taylor, I.A., Khanal, S., Grainger, R.G., Cooke, M.C. (2020) T*he Impact of Ensemble Meteorology on Inverse Modeling Estimates of Volcano Emissions and Ash Dispersion Forecasts: Grímsvötn 2011*. Atmosphere, *11*(10), 1022; https://doi.org/10.3390/atmos11101022

Daleu, C. L., Plant, R. S., Woolnough, S. J., Stirling, A. J., & **Harvey, N. J**. (2020). Memory properties in cloud-resolving simulations of the diurnal cycle of deep convection. *Journal of Advances in Modeling Earth Systems*, 12, e2019MS001897. https://doi.org/10.1029/2019MS001897

Dacre, H. F. and **Harvey, N. J.** (2018) *Characterising the atmospheric conditions leading to large error growth in volcanic ash cloud forecasts.* Journal of Applied Meteorology and Climatology, 57 (4). pp. 1011-1019. ISSN 1558-8432 doi: https://doi.org/10.1175/jamc-d-17-0298.1

Harvey, N. J., Huntley, N., Dacre, H. F., Goldstein, M., Thomson, D. and Webster, H. (2018) *Multi-level emulation of a volcanic ash transport and dispersion model to quantify sensitivity to uncertain parameters.* Natural Hazards and Earth System Science, 18 (1). pp. 41-63. ISSN 1684-9981 doi: https://doi.org/10.5194/nhess-18-41-2018

Mulder, K. J., Lickiss, M., **Harvey, N.**, Black, A., Charlton-Perez, A., Dacre, H. and McCloy, R. (2017) *Visualizing volcanic ash forecasts: scientist and stakeholder decisions using different graphical representations and conflicting forecasts.* Weather, Climate and Society, 9 (3). pp. 333-348. ISSN 1948-8327 doi: https://doi.org/10.1175/WCAS-D-16-0062.1

Dacre, H. F., **Harvey, N. J.,** Webley, P. W. and Morton, D. (2016) *How accurate are volcanic ash simulations of the 2010 Eyjafjallajökull eruption?* Journal of Geophysical Research: Atmospheres, 121 (7). pp. 3534-3547. ISSN 2169-8996 doi: https://doi.org/10.1002/2015JD024265

Harvey, N. and Dacre, H. (2016) *Spatial evaluation of volcanic ash forecasts using satellite observations.* Atmospheric Chemistry and Physics, 16 (2). pp. 861-872. ISSN 1680-7316 doi: https://doi.org/10.5194/acp-16-861-2016

Harvey, N.J., Hogan, R.J. and Dacre, H.F. (2015) *Evaluation of boundary-layer type in a weather forecast model utilising long-term Doppler lidar observations.* Quarterly Journal of the Royal Meteorological Society, 141 (689). pp. 1345-1353. ISSN 1477-870X doi: https://doi.org/10.1002/qj.2444 (Part B)

Dacre, H., Grant, A., **Harvey, N.**, Thomson, D., Webster, H. and Marenco, F. (2015) *Volcanic ash layer depth: processes and mechanisms.* Geophysical Research Letters, 42 (2). pp. 637-645. ISSN 0094-8276 doi: https://doi.org/10.1002/2014GL062454

Harvey, N. J., Hogan, R. J. and Dacre, H. F. (2013) *A method to diagnose boundary-layer type using Doppler lidar.* Quarterly Journal of the Royal Meteorological Society, 139 (676). pp. 1681-1693. ISSN 1477-870X doi: https://doi.org/10.1002/qj.2068

Other publications

Natural Environment Research Council (2016) *PURE: Probability, Uncertainty & Risk in the Environment* https://nerc.ukri.org/research/funded/programmes/pure/pure-brochure/

SCIENCE COMMUNITY AND COMMITTEE ACTIVITIES

Member of the European Geosciences Union (2019 – present)

Member of the Institute of Physics Environmental Physics Group Committee (2016 – present)

Member of the Institute of Physics (2016-present)

Member of the Royal Meteorological Society Meetings Committee (2012-present)

Fellow of the Royal Meteorological Society (2009-present)

Member of the organising committee for the University of Reading Environmental Risks to the Aviation Industry Event at the Science Museum (2013)

Coordinator of the Departmental PhD seminar series (2010-2012)

AWARDS

Weather Research Division Early Career Research Output Prize 2020 for *Multi-level emulation of a volcanic ash transport and dispersion model to quantify sensitivity to uncertain parameters.*

University Research Travel Grant - £120 to attend NAME user workshop and present results from the RACER Project (June 2015)

Royal Meteorological Society (RMetS) Legacies Fund - £500 to attend Cabot Institute/CREDIBLE summer school (July 2013)

Outstanding poster presentation prize at the Royal Meteorological Society Conference (July 2011)

INVITED TALKS

University of Cambridge - Centre for Atmospheric Science seminar series (February 2020)

TEACHING EXPERIENCE

Lead supervisor for an MSc student: “To fly or not to fly: Improving volcanic ash forecasts for aviation” (Summer 2021).

Lead supervisor for UROP student placement: “Using Doppler lidar to understand mixing processes in the atmospheric boundary layer” (Summer 2020). This student won the overall project prize.

Guest lecture for MSc Hazardous Weather Analysis module: “Volcanic Ash forecasting” (March 2020 and March 2021)

Co-supervisor for an MSc student: “Modelling the diurnal cycle of shallow convection over land with the new Met Office NERC cloud Model” (Summer 2019). This student won the overall dissertation award.

Co-supervisor for an MSc student: “Evaluation of subseasonal prediction of extreme rainfall events and their relationship with the Madden Julian Oscillation over the Solomon Islands.” (Summer 2017).

Co-supervisor for an EPSRC Undergraduate Research Bursary: “Testing the structural uncertainties in volcanic ash cloud predictions and their impact on aviation” (Summer 2015).

Co-supervisor for a NERC Research Experience Placement project: “Modelling the vertical structure of volcanic ash clouds” (Summer 2013).

Co-lead the additional MSc Atmospheric Physics tutorials which provides support to MSc students who have very diverse mathematical backgrounds. (Autumn 2018 - current).

Teaching assistant for BSc and MSc modules: “Introduction to Weather Systems”, “Atmospheric Physics”, “Surface Energy Exchange”, “Boundary Layer Meteorology and Micrometeorology” and “Engineering Mathematics” (2009-present).