# Curriculum Vitae: Robin J. Hogan

## A. PERSONAL INFORMATION


***Address*** Department of Meteorology, Earley Gate, PO Box 243, Reading, RG6 6BB, UK
***Nationality*** British
***Date of Birth*** 27 July 1974
***Telephone*** +44 118 3786416
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***Present employment***

2010–present Professor of Atmospheric Physics, Dept of Meteorology, University of Reading, UK
2011–present Head of Department for Research, Dept of Meteorology, University of Reading, UK

***Previous employment***

2007–2010 Reader in Atmospheric Physics, Dept of Meteorology, University of Reading, UK
2003–2007 Lecturer, Department of Meteorology, University of Reading, UK
1998–2002 Postdoctoral research scientist, Department of Meteorology, University of Reading, UK

***Qualifications***

1998 PhD in Meteorology, University of Reading, UK
1995 BSc in Physics with Astrophysics (First Class Honours), University of Leicester, UK

## B. RESEARCH

My research is concerned with clouds and radiation, and is motivated by the need to improve the accuracy of weather and climate forecasts. Most of my recent work falls into three categories: (1) development of novel radar and lidar techniques to retrieve cloud properties remotely, (2) application of these techniques to improve understanding of cloud processes and to evaluate numerical weather forecast and climate models, and (3) development of efficient numerical methods for atmospheric radiative transfer. Research highlights are described in Section E.

***Research grants awarded***

2011 Dynamical and Microphysical Evolution of Convective Storms (DYMECS)
*NERC Standard Grant, **£547k** (Principal Investigator)*
2010 Aerosols, Clouds and Trace-Gas Observing Network (ACTRIS)
*EU FP7 proposal, Reading share **£278k** (Co-Investigator)*
2010 Synergy algorithms for EarthCARE
*NCEO Mission Support call, Reading share **£250k** (Principal Investigator)*
2009 More Operational Radiosonde Sensors (MORSE)
*NERC Technologies Proof of Concept, Reading share **£168k** (Co-Investigator)*
2009 Radiative Transfer for EarthCARE (RATEC)
*European Space Agency, Reading share **£189k** (Subcontractor; lead Reading investigator)*
2009 FASTER: Development of a Numerical Weather Prediction Testbed
*US Department of Energy Climate Change Prediction Program, **$96k** in year 1 of 5, **$104k** in year 2 (Co-Investigator, lead Reading investigator)*
2009 The effect of 3D radiative transfer on climate
*NERC Standard Grant, **£254k** (Principal Investigator)*
2008 National Centre for Earth Observation
*NERC Centre of Excellence, Reading share around **£7m** (Co-Investigator)*
*Dr Hogan is involved in both the Climate Theme and the Hazardous Weather Theme*
2007 Cloud and aerosol synergetic products from EarthCARE retrievals (CASPER)
*European Space Agency, Reading share **£60k** (Subcontractor, lead Reading investigator)*
2007 Representing cloud inhomogeneity and overlap in a General Circulation Model
*NERC Small grant, **£53k** (Principal Investigator)*
2007 Aerosol interactions in mixed-phase clouds

*NERC Consortium proposal, Reading share **£254k** (Co-Investigator)*

2006 Cascade: Cloud-system resolving modelling of the tropical atmosphere
*NERC Consortium proposal, Reading share **£1.6m** (Co-Investigator)*

2005 Evaluation of clouds in climate and forecasting models using CloudSat and Calipso data
*NERC Standard Grant, **£198k** (Principal Investigator)*

2005 Improvement of stratocumulus representation in models by the use of high-resolution observations
*NERC Standard Grant, **£245k** (Co-Investigator)*

2005 Balloon-carried instrument for measurement of atmospheric turbulence
*Royal Society Paul Instrument Fund, **£77k** (Co-Investigator)*

2004 All weather Doppler lidar for clouds and boundary layer
*NERC Standard Grant, **£149k** (Co-Investigator)*

2003 The properties of ice clouds and supercooled liquid water layer clouds derived from ground based polarimetric radar and lidar observations
*NERC New Observing Techniques Grant, Reading share **£215** (Co-Investigator)*

***Postgraduate and postdoctoral supervision***

- The PI for five current postdocs: Nicola Pounder, Ewan O'Connor, Jonathan Shonk, Thorwald Stein and Chris Westbrook. Former postdocs supervised as PI: Julien Delanoë, Kevin Pearson and Debbie Clifford.
- The primary supervisor for three successfully completed PhD students: Jonathan Wilkinson (2007), Jonathan Shonk (2008) and Nicky Chalmers (2011)
- The primary supervisor of one current PhD student (Andrew Barrett) and the co-supervisor of four others (Peter Hill, Natalie Harvey, Julian Mann and Mark Fielding)
- On the Monitoring Committee for around six other Higher Degree/PhD students at any one time
- Supervised 14 masters dissertations, 7 of whom were awarded distinctions, 7 of whom went on to study PhDs and 6 of whom co-authored papers on their dissertation work

***Awards***

2007 School award for outstanding contributions to teaching and learning support, University of Reading

2005 L F Richardson Prize, Royal Meteorological Society, for meritorious papers published under the age of 35

2004 Best poster award at 14th International Conference on Clouds and Precipitation, Bologna, Italy

2000 Highly commended poster prize at Royal Meteorological Society 150th Anniversary Conference, Cambridge, UK

1994 Raymond Hide prize for undergraduate work at the University of Leicester

***International invited talks***

2011 Gordon Research Conference on Radiation and Climate, Waterville, Maine (14 Jul)
2009 NASA Goddard Institute for Space Studies, New York (13 Feb)
2009 Climate and Radiation Branch, NASA Goddard Space Flight Center, Greenbelt (4 Feb)
2009 Atmospheric Sciences Division, Brookhaven National Laboratory, Long Island (30 Jan)
2008 CPTEC, INPE, Cachoeira Paulista, Brazil (14 Aug)
2008 Keynote talk at the International Radiation Symposium, Foz do Iguassu, Brazil (7 Aug)
2008 Keynote talk at the ARM Science Team meeting, Norfolk, Virginia (13 Mar)
2007 Keynote talk at 33rd AMS Conference on Radar Meteorology, Cairns, Australia (7 Aug)
2006 EOL/RAL Seminar, National Center for Atmospheric Research (NCAR), Boulder (18 July)
2006 Session on "Scale, scaling and non-linear variability", EGU General Assembly, Vienna (5 Apr)
2003 Department of Atmospheric Sciences, University of Washington, Seattle (17 Nov)
2003 GEWEX Workshop on "3D Clouds and Radiative Transfer", Victoria, BC, Canada (14 Nov)

***UK invited talks***

2011 Space Research Centre Seminar, University of Leicester (18 Mar)
2010 Keynote talk at National Centre for Atmospheric Science Conference, Manchester (5 July)

2010 ECMWF Workshop on "Assimilating satellite observations of clouds and precipitation into NWP models", Reading (15 June)
2010 Workshop of COST Action ES0702: Integrated Ground-Based Observations of Essential Variables for Climate and Operational Meteorology EG-CLIMET, Reading (24 Mar)
2010 Atmospheric, Oceanic and Planetary Physics, University of Oxford (4 Feb)
2009 ECMWF Formal Seminar, Reading (27 Oct)
2008 ECMWF Seminar "Parametrization of subgrid physical processes", Reading (1 Sept)
2008 Royal Meteorology Society meeting on "Ice in the atmosphere", Manchester (23 Apr)
2007 Workshop on High Resolution Modelling, Reading (30 Oct)
2007 Chilbolton 40th Anniversary Celebration, Chilbolton Observatory (11 Apr)
2006 ECMWF Workshop on "Parametrization of clouds in large-scale models", Reading (14 Nov)
2005 Department of Physics, Imperial College London (8 Nov)
2004 School of the Environment, University of Leeds (28 Oct)
2004 ECMWF Formal Seminar, Reading (14 Oct)
2004 Met Office NWP Seminar, Exeter (4 June)
2003 Royal Meteorological Society Physical Processes group meeting, UMIST (4 June)
2002 Royal Meteorological Society Scottish Centre, Edinburgh (13 Dec)

***Professional activities***

- Fellow of the Royal Meteorological Society and entitled to use the appellation "FRMetS" (elected in 2007 following nomination by two existing fellows)
- PhD external examiner twice at Manchester University: in December 2006 and November 2011
- PhD internal examiner in Reading in December 2006, September 2007 and August 2010
- MPhil internal examiner in Reading in November 2009
- Chaired sessions at the 1999 International Union of Geodesy and Geophysics, 2005 Royal Meteorological Society and 2007 American Meteorological Society radar conferences
- Reviewer for many international scientific journals including *Nature*
- Member of the NERC Atmospheric Radar Facilities Steering Committee (NARFSC), 2006 and from 2009
- Member of the NERC Service Review Group (SRG), 2009
- Member of the Programme Committee for the 2007 American Meteorological Society Conference on Radar Meteorology, Cairns, Australia
- Member of the Walker Institute Development Group, University of Reading
- Former member of the Management Committee of the UK Universities Weather Research Network (UWERN)
- Routinely invited to meetings of the EarthCARE Mission Advisory Group, EarthCARE being a joint ESA/Japanese satellite due for launch in 2015
- Wrote most of the science case for renewal of funding for the Chilbolton Facility for Atmospheric and Radio Research (CFARR) to the 2008 NERC Service Review Group; the proposal was awarded the highest possible grade and funding was secured for 5 years at around £0.5M per year

***Publications in peer-reviewed journals***

Updated November 2011; download PDFs from *www.met.reading.ac.uk/clouds/publications.html*

*Publications in review and in press*

78. Hill, P. G., **R. J. Hogan,** J. Manners and J. C. Petch, 2011: Parametrising the horizontal inhomogeneity of ice water content using CloudSat observations. *Submitted to Q. J. R. Meteorol. Soc.*
77. **Hogan, R. J.,** L. Tian, P. R. A. Brown, C. D. Westbrook, A. J. Heymsfield and J. D. Eastment, 2011: Radar scattering from ice aggreates using the horizontally aligned oblate spheroid approximation. *J. Appl. Meteorol. Climatology,* in press.
76. Marenco, F., and **R. J. Hogan,** 2011: Determining the contribution of volcanic ash and boundary layer aerosol in backscatter lidar returns: a three-component atmosphere approach. *J. Geophys. Res.,* in press.

75. Pounder, N. L., **R. J. Hogan,** T. Varnai, A. Battaglia and R. F. Cahalan, 2011: A variational method to retrieve the extinction profile in liquid clouds using multiple field-of-view lidar. *J. Appl. Meteorol. Climatology,* in press.
74. Stein, T. H. M., D. J. Parker, J. Delanoe, N. S. Dixon, **R. J. Hogan,** P. Knippertz, R. I. Maidment and J. H. Marsham, 2011: The vertical cloud structure of the West African monsoon: A four-year climatology using CloudSat and CALIPSO. *J. Geophys. Res.,* in press.
73. Zhao, C., S. Xie, S. A. Klein, A. Protat, M. D. Shupe, S. A. McFarlane, J. M. Comstock, J. Delanoë, M. Deng, M. Dunn, **R. J. Hogan,** D. Huang, M. P. Jensen, G. G. Mace, R. McCoy, E. J. O'Connor, D. D. Turner and Z. Wang, 2011: Toward understanding of differences in current cloud retrievals of ARM ground-based measurements. *Submitted to J. Geophys. Res.*

*2011 (up to November 2011)*

72. Barker, H. W., M. P. Jerg, T. Wehr, S. Kato, D. P. Donovan and **R. J. Hogan,** 2011: A 3D cloud construction algorithm for the EarthCARE satellite mission. *Q. J. R. Meteorol. Soc.,* **137,** 1042-1058.
71. Dacre, H. F., A. L. M. Grant, **R. J. Hogan, S**. E. Belcher, D. Thomson, B. Devenish, F. Marenco, J. Haywood, A. Ansmann, I. Mattis and L. Clarisse, 2011: Evaluating the structure and magnitude of the ash plume during the initial phase of the 2010 Eyjafjallajokull eruption using lidar observations and NAME simulations. *J. Geophys. Res.,* **116,** D00U03, doi:10.1029/2011JD015608.
70. Delanoe, J., **R. J. Hogan,** R. M. Forbes, A. Bodas-Salcedo and T. H. M. Stein. 2011: Evaluation of ice cloud representation in the ECMWF and UK Met Office models using CloudSat and CALIPSO data. *Q. J. R. Meteorol. Soc.,* doi: 10.1002/qj.882.
69. Shonk, J. K. P., **R. J. Hogan** and J. Manners, 2011: Impact of improved representation of horizontal and vertical cloud structure in a climate model. *Clim. Dyn.,* doi: 10.1007/s00382-011-1174-2.
68. Stein, T. H. M., J. Delanoe and **R. J. Hogan,** 2011: A comparison between four different retrieval methods for ice-cloud properties using data from the CloudSat, CALIPSO, and MODIS satellites. *J. Appl. Meteorol. Climatology*, **50,** 1952-1969.

*2010*

67. Battaglia, A., S. Tanelli, S. Kobayashi, D. Zrnic, **R. J. Hogan** and C. Simmer, 2010: Multiple-scattering in radar systems: a review. *J. Quant. Spectroscopy,* **111,** 917-947.
66. Bouniol, D., A. Protat, J. Delanoe, J. Pelon, D. P. Donovan, J.-M. Piriou, F. Bouyssel, A. M. Tompkins, D. R. Wilson, Y. Morille, M. Haeffelin, E. J. O'Connor, **R. J. Hogan,** A. J. Illingworth, 2010: Using continuous ground-based radar and lidar measurements for evaluating the representation of clouds in four operational models. *J. Appl. Meteorol. Climatology.,* **88,** 883-898.
65. Delanoë, J., and **R. J. Hogan,** 2010: Combined CloudSat-CALIPSO-MODIS retrievals of the properties of ice clouds. *J. Geophys. Res.,* **115,** D00H29, doi:10.1029/2009JD012346.
64. **Hogan, R. J.,** 2010: The full-spectrum correlated *k* method for longwave atmospheric radiative transfer using an effective Planck function. *J. Atmos. Sci.*, **67,** 2086-2100.
63. **Hogan, R. J.,** C. A. T. Ferro, I. T. Jolliffe and D. B. Stephenson, 2010: Equitability revisited: Why the 'equitable threat score' is not equitable. *Weath. Forecasting.,* **25,** 710-726.
62. O'Connor, E. J., A. J. Illingworth, I. M. Brooks, C. D. Westbrook, **R. J. Hogan,** F. Davies and B. J. Brooks, 2010: A method for estimating the turbulent kinetic energy dissipation rate from a vertically-pointing Doppler lidar, and independent evaluation from balloon-borne in-situ measurements. *J. Atmos. Oceanic Technol.,* **27,** 1652-1664.
61. Pearson, K. J., **R. J. Hogan,** R. P. Allan, G. M. S. Lister and C. E. Holloway. Evaluation of model representation of the evolution of convective systems using satellite observations of outgoing longwave radiation. *J. Geophys. Res.,* **115,** D20206, doi:10.1029/2010JD014265.
60. Shonk, J. K. P., **R. J. Hogan,** J. M. Edwards and G. G. Mace, 2010: Effect of improving representation of horizontal and vertical cloud structure on the Earth's radiation budget—1. Review and parameterisation. *Quart. J. Roy. Meteorol. Soc.,* **136,** 1191-1204.
59. Shonk, J. K. P. and **R. J. Hogan,** 2010: Effect of improving representation of horizontal and vertical cloud structure on the Earth's radiation budget—2. The global effects. *Quart. J. Roy. Meteorol. Soc.*, **136,** 1205-1215.

58. Westbrook, C. D., A. J. Illingworth, E. J. O'Connor and **R. J. Hogan,** 2010: Doppler lidar measurements of oriented planar ice crystals falling from supercooled and glaciated layer clouds. *Quart. J. Roy. Meteorol. Soc.,* **136,** 260-276.
57. Westbrook, C. D., **R. J. Hogan,** E. J. O'Connor and A. J. Illingworth, 2010: Estimates of drizzle drop size and precipitation rate using two-colour lidar measurements. *Atmos. Meas. Technol.,* **3,** 671-781.
56. Wilkinson, J. M., **R. J. Hogan** and A. J. Illingworth, 2010: Using Doppler radar and a simple explicit microphysics model to diagnose problems with ice sublimation depth scales in forecast models. *Q. J. R. Meteorol. Soc.,* **136,** 2094-2108.

*2009*

55. Barrett, A. I., **R. J. Hogan** and E. J. O'Connor, 2009: Evaluating forecasts of the evolution of the cloudy boundary layer using diurnal composites of radar and lidar observations. *Geophys. Res. Lett.,* **36,** L17811, doi:10.1029/2009GL038919.
54. Harrison, R. G., A. M. Heath, **R. J. Hogan** and G. W. Rogers, 2009: Comparison of balloon-carried atmospheric motion sensors with Doppler lidar measurements. *Rev. Sci. Inst.,* **80,** 026108.
53. **Hogan, R. J.,** A. L. M. Grant, A. J. Illingworth, G. N. Pearson and E. J. O'Connor, 2009: Vertical velocity variance and skewness in clear and cloud-topped boundary layers as revealed by Doppler lidar. *Quart. J. Roy. Meteorol. Soc.* **135,** 635-643.
52. **Hogan, R. J.,** E. J. O'Connor and A. J. Illingworth, 2009: Verification of cloud fraction forecasts. *Quart. J. Roy. Meteorol. Soc.,* **135,** 1494-1511.

*2008*

51. Delanoë, J., and **R. J. Hogan,** 2008: A variational scheme for retrieving ice cloud properties from combined radar, lidar and infrared radiometer. *J. Geophys. Res.,* **113,** D07204, doi:10.1029/2007JD009000.
50. Dunbar, T. M., E. Hanert and **R. J. Hogan,** A one-dimensional finite-element boundary layer model with a vertically adaptive grid. *Bound. Layer Meteorol.,* **128,** 459-472.
49. Harrison, R. G., N. Chalmers and **R. J. Hogan**, 2008: Cloud determinations from surface solar radiation measurements. *Atmos. Res.,* **90,** 54-62.
48. Heymsfield, A. J., A. Protat, R. Austin, D. Bouniol, **R. J. Hogan,** H. Okamoto, K. Sato, G.-J. van Zadelhoff, D. Donovan and Z. Wang, 2008: Testing and evaluation of ice water content retrieval methods using radar and ancillary measurements. *J. Atmos. Sci.,* **47,** 135-163.
47. **Hogan, R. J.,** 2008: Fast lidar and radar multiple-scattering models—1. Small-angle scattering using the photon variance-covariance method. *J. Atmos. Sci.,* **65,** 3621-3635.
46. **Hogan, R. J.,** and A. Battaglia., 2008: Fast lidar and radar multiple-scattering models—2. Wide-angle scattering using the time-dependent two-stream approximation. *J. Atmos. Sci.,* **65,** 3636-3651.
45. **Hogan, R. J.,** A. J. Illingworth and K. Halladay, Estimating mass and momentum fluxes in a line of cumulonimbus observed by a single high-resolution Doppler radar. *Quart. J. Roy. Meteorol. Soc.,* **134,** 1127-1141.
44. Shonk, J. K. P., and **R. J. Hogan,** 2008: Tripleclouds: an efficient method for representing cloud inhomogeneity in 1D radiation schemes by using three regions at each height. *J. Climate,* **21,** 2352-2370.
43. Westbrook, C. D., **R. J. Hogan** and A. J. Illingworth, 2008: The capacitance of pristine ice crystals and aggregate snowflakes. *J. Atmos. Sci.,* **65,** 209-219.
42. Wilkinson, J. M., **R. J. Hogan** and A. J. Illingworth, 2008: Use of a lidar forward model for global comparisons of cloud fraction between the ICESat lidar and the ECMWF model. *Mon. Weath. Rev.,* **136,** 3742-3759.
41. Zhong, W., **R. J. Hogan** and J. D. Haigh, 2008: Three-dimensional radiative transfer in mid-latitude cirrus clouds. *Quart. J. Roy. Meteorol. Soc.,* **134,** 199-215.

*2007*

40. Gaussiat, N., **R. J. Hogan** and A. J. Illingworth, 2007: Accurate liquid water path retrieval from low-cost microwave radiometers using additional information from lidar and operational forecast models. *J. Atmos. Oceanic Technol.,* **24,** 1562-1575.

39. Gounou, A., and **R. J. Hogan,** 2007: The effect of horizontal photon transport on the radiative forcing of contrails. *J. Atmos. Sci.,* **64,** 1706-1716.
38. Harrison, R. G., and **R. J. Hogan,** 2007: Response to comment on "In-situ atmospheric turbulence measurement using the terrestrial magnetic field - a compass for a radiosonde" by Ralph D. Lorenz. *J. Atmos. Oceanic Technol.,* **24,** 1521-1522.
37. Harrison, R. G., G. W. Rogers and **R. J. Hogan,** 2007: A three-dimensional magnetometer for motion sensing of a balloon-carried atmospheric measurement package. *Rev. Sci. Inst.,* **78,** 124501.
36. Heymsfield, A. J., G.-J. van Zadelhoff, D. P. Donovan, F. Fabry, **R. J. Hogan** and A. J. Illingworth, 2007: Refinements to ice particle mass dimensional and terminal velocity relationships for ice clouds—2. Evaluation and parameterizations of ensemble ice particle sedimentation velocities. *J. Atmos. Sci.,* **64,** 1068-1088.
35. **Hogan, R. J.,** 2007: A variational scheme for retrieving rainfall rate and hail intensity from polarization radar. *J. Appl. Meteorol. Climatology,* **46,** 1544-1564.
34. Illingworth, A. J., **R. J. Hogan,** E. J. O'Connor, D. Bouniol, M. E. Brooks, J. Delanoë, D. P. Donovan, J. D. Eastment, N. Gaussiat, J. W. F. Goddard, M. Haeffelin, H. Klein Baltink, O. A. Krasnov, J. Pelon, J.-M. Piriou, A. Protat, H. W. J. Russchenberg, A. Seifert, A. M. Tompkins, G.-J. van Zadelhoff, F. Vinit, U. Willen, D. R. Wilson and C. L. Wrench, 2007: Cloudnet—continuous evaluation of cloud profiles in seven operational models using ground-based observations. *Bull. Am. Meteorol. Soc.,* **88,** 883-898.
33. Naud, C., K. L. Mitchell, J.-P. Muller, E. E. Clothiaux, P. Albert, R. Preusker, J. Fischer and **R. J. Hogan,** 2007: Comparison between ATSR2 stereo, MOS $O_2$ A-band and ground-based derived cloud top heights. *Int. J. Remote Sens.,* **28,** 1969-1987.
32. Westbrook, C. D., **R. J. Hogan,** A. J. Illingworth and E. J. O'Connor, 2007: Theory and observations of ice particle evolution in cirrus using Doppler radar: evidence for aggregation. *Geophys. Res. Lett.,* **34,** L02824, doi: 10.1029/2006GL027863.

*2006*

31. Forbes, R. M., and **R. J. Hogan,** 2006: Ice sublimation depth scales in frontal cloud. *Quart. J. Roy. Meteorol. Soc.,* **132,** 865–884.
30. Harrison, R. G., and **R. J. Hogan,** 2006: In-situ atmospheric turbulence measurement using the terrestrial magnetic field—a compass for a radiosonde. *J. Atmos. Oceanic Technol.,* **23,** 517–523.
29. **Hogan, R. J.,** 2006: Fast approximate calculation of multiply scattered lidar returns. *Appl. Optics,* **45,** 5984–5992.
28. **Hogan, R. J.,** D. P. Donovan, C. Tinel, M. A. Brooks, A. J. Illingworth and J. P. V. Poiares Baptista, 2006a: Independent evaluation of the ability of spaceborne radar and lidar to retrieve the microphysical and radiative properties of ice clouds. *J. Atmos. Oceanic Technol.,* **23,** 211–227.
27. **Hogan, R. J.,** M. P. Mittermaier and A. J. Illingworth, 2006b: The retrieval of ice water content from radar reflectivity factor and temperature and its use in the evaluation of a mesoscale model. *J. Appl. Meteorol. Climatology,* **45,** 301–317.
26. Marsham, J., S. Dobbie and **R. J. Hogan,** 2006: Evaluation of a large eddy model simulation of a mixed-phase altocumulus cloud using microwave radiometer, lidar and Doppler radar data. *Quart. J. Roy. Meteorol. Soc.,* **132,** 1693–1715.
25. Mittermaier, M. P., A. J. Illingworth and **R. J. Hogan,** 2006: Assessing vertical resolution requirements for operational weather radar data quality. *Atmos. Sci. Lett.,* **7,** 9–14.

*2005*

24. Brooks, M. E., **R. J. Hogan** and A. J. Illingworth, 2005: Parameterizing the difference in cloud fraction defined by area and volume as observed with radar and lidar. *J. Atmos. Sci.,* **62,** 2248–2260.
23. Clark, P. D., T. W. Choularton, P. R. A. Brown, P. R. Field, A. J. Illingworth and **R. J. Hogan,** 2005: Numerical modelling of mixed-phase frontal clouds observed during the CWVC project. *Quart. J. Roy. Meteorol. Soc.,* **131,** 1677–1694.
22. Field, P. R., **R. J. Hogan,** P. R. A. Brown, A. J. Illingworth, T. W. Choularton and R. J. Cotton, 2005: Parameterization of ice particle size distributions for mid-latitude stratiform cloud. *Quart. J. Roy. Meteorol. Soc.,* **131,** 1997–2017.

21. **Hogan, R. J.,** and S. F. Kew, 2005: A 3D stochastic cloud model for investigating the radiative properties of inhomogeneous cirrus clouds. *Quart. J. Roy. Meteorol. Soc.,* **131,** 2585–2608.
20. **Hogan, R. J.,** N. Gaussiat and A. J. Illingworth, 2005: Stratocumulus liquid water content from dual-wavelength radar. *J. Atmos. Oceanic Technol.,* **22,** 1207–1278.
19. O'Connor, E. J., **R. J. Hogan** and A. J. Illingworth, 2005: Retrieving stratocumulus drizzle parameters using Doppler radar and lidar. *J. Appl. Meteorol.,* **44,** 14–27.
18. Tinel, C., J. Testud, **R. J. Hogan,** A. Protat, J. Delanoë and D. Bouniol, 2005: The retrieval of ice cloud properties from cloud radar and lidar synergy. *J. Appl. Meteorol.,* **44,** 860–875.

*2004*

17. Field, P. R., **R. J. Hogan,** P. R. A. Brown, A. J. Illingworth, T. W. Choularton, P. H. Kaye, E. Hirst and R. Greenaway, 2004: Simultaneous radar and aircraft observations of mixed-phase cloud at the 100-m-scale. *Quart. J. Roy. Meteorol. Soc.,* **130,** 1877–1904. [Contribution: Analysis of the radar data; production of four of the figures; contribution to the scientific interpretation.]
16. **Hogan, R. J.,** M. D. Behera, E. J. O'Connor and A. J. Illingworth, 2004: Estimating the global distribution of supercooled liquid water clouds using spaceborne lidar. *Geophys. Res. Lett.,* **32,** L05106, doi:10.1029/2003GL018977.
15. Mittermaier, M. P., **R. J. Hogan** and A. J. Illingworth, 2004: Using mesoscale model winds for correcting wind-drift errors in radar estimates of surface rainfall. *Quart. J. Roy. Meteorol. Soc.,* **130,** 2105–2123.
14. O'Connor, E. J., A. J. Illingworth and **R. J. Hogan,** 2004: A technique for auto-calibration of cloud lidar. *J. Atmos. Oceanic Technol.,* **21,** 777–786.

*2003*

13. **Hogan, R. J.,** and A. J. Illingworth, 2003: Parameterizing ice cloud inhomogeneity and the overlap of inhomogeneities using cloud radar data. *J. Atmos. Sci.,* **60,** 756–767.
12. **Hogan, R. J.,** D. Bouniol, D. N. Ladd, E. J. O'Connor and A. J. Illingworth, 2003a: Absolute calibration of 94/95-GHz radars using rain. *J. Atmos. Oceanic Technol.,* **20,** 572–580.
11. **Hogan, R. J.,** P. N. Francis, H. Flentje, A. J. Illingworth, M. Quante and J. Pelon, 2003b: Characteristics of mixed-phase clouds—1. Lidar, radar and aircraft observations from CLARE'98. *Quart. J. Roy. Meteorol. Soc.,* **129,** 2089–2116.
10. **Hogan, R. J.,** A. J. Illingworth, E. J. O'Connor and J. P. V. Poiares Baptista, 2003c: Characteristics of mixed-phase clouds—2. A climatology from ground-based lidar. *Quart. J. Roy. Meteorol. Soc.,* **129,** 2117–2134.
9. Phillips, V. T. J., T. W. Choularton, A. J. Illingworth, **R. J. Hogan** and P. R. Field, 2003: Simulations of the glaciation of a frontal mixed-phase cloud with the Explicit Microphysics Model. *Quart. J. Roy. Meteorol. Soc.,* **129,** 1351–1371.

*2002 and earlier*

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## C. TEACHING AND ADMINISTRATION

I have engaged in a very wide range of teaching methods including lectures, problem classes, computer classes, laboratory practicals, field-site practicals, field trips, small-group tutorials, team projects, undergraduate and postgraduate project supervision, oral presentations and leading the Department-wide "Weather and Climate Discussion". The feedback from the modules I teach is consistently good. In the most recent questionnaire-based evaluation of my postgraduate "Boundary Layer Meteorology" module, 93% of the responses to the 8 questions (assessing the quality of the teaching and the module in terms of interest, clarity, good structure, enthusiasm, encouragement of student participation etc.) were in the top two categories out of five. Comments included "Excellent, very clear lecture notes, very clearly explained". In terms of learner support, I introduced an undergraduate mentoring scheme in the Department, in which first year students are each introduced to two "buddies" from higher years, to whom they can then go for work-related advice and other issues. In 2007 I received the "School award for outstanding contributions to teaching and learning support" from the School of Mathematics, Meteorology and Physics at the University of Reading.

***Teaching experience***

| | |
|---|---|
| 2011 | Speaker at the NCAS Climate Modelling Summer School |
| 2011 | Numerical Methods (postgraduate: MSc and PhD)<br>*24 contact hours: computer classes and lectures* |
| 2010 | Remote Sensing (undergraduate)<br>*9 contact hours* |
| 2008, 2011 | Boundary Layer Meteorology (undergraduate):<br>*2008: 28 contact hours: lectures and field-site practicals*<br>*2011: 20 contact hours: lectures and computer practical* |
| 2007–2008 | Convener of BSc Projects |
| 2007 | Convener of MSc Dissertations |
| 2005–present | Weather and Climate Discussion (undergraduate and postgraduate):<br>*5 contact hours per year* |
| 2004–2010 | Academic tutor for 3–4 MSc students each year |
| 2004–2008 | Boundary Layer Meteorology (postgraduate: MSc and PhD):<br>*25 contact hours per year: lectures and practicals (computer, laboratory and field-site)* |
| 2004 | Weather Systems Analysis (undergraduate):<br>*30 contact hours: lectures and practical workshops* |
| 2003–present | Supervised eight undergraduate projects |
| 2003–2007, 2010 | Surface Energy Exchange (undergraduate): *19 contact hours per year: field-site practicals* |
| 2003, 2007, 2010 | Team project (postgraduate): *8 contact hours* |
| 2003, 2006 | Dorset field trip (undergraduate and postgraduate): *16 contact hours* |

***Administrative activities and faculty responsibilities***

My management skills and rapport with the students are well recognised within the Department. I have managed the full range of taught degrees within the Department, first as Director of Undergraduate Studies and then as Director of MSc Programmes. Before that I was Chair of the Staff-Student Liaison Committee of the newly formed School of Mathematics, Meteorology and Physics, the first committee to be merged in the School. It was very effective at acting on the students' comments; one of the representatives wrote to thank me personally when she graduated, saying "I feel that the staff student committee was very useful in creating a relaxed and approachable way to raise our concerns". I have also managed the Meteorology Laboratories and organized PhD recruitment. Several years ago I led a detailed proposal to bolster the core physics content of the undergraduate Meteorology degrees, important for those going on to research careers; this was enthusiastically welcomed by other members of staff. I am now one of the three Heads of Department, with responsibility for research.

***Administrative responsibilities***

| | |
|---|---|
| 2011–present | Head of Department for Research |
| 2011–present | Member of the School of Mathematical and Physical Sciences Steering Committee |
| 2011–present | Chair of the Meteorology/ESSC Strategy Group |
| 2010–2011 | Director of Research, Department of Meteorology |
| 2009–2010 | PhD admissions tutor |
| 2009–present | Member of the School of Mathematics, Meteorology and Physics Higher Degree by Research Board of Studies |
| 2007–2008 | Manager of the Meteorology Laboratories |
| 2006–2007 | Director of MSc Programmes, Meteorology |
| 2006 | Director of Undergraduate Studies, Meteorology (sabbatical cover, Jan–Sept) |
| 2006–2007 | Member of the School of Mathematics, Meteorology and Physics Teaching and Learning Committee and Board of Studies |
| 2003–2005 | Chair of the School of Mathematics, Meteorology and Physics Staff-Student Liaison Committee |
| 2003–2005 | Member of the Faculty of Science Staff-Student Committee |
| 2003–2006 | Coordinator of module evaluation questionnaires, including designing a new School-wide system |
| 2004 | Designer of the Departmental Research Brochure |
| 2003–present | Personal tutor for 15 undergraduate students (past and present) |
| 2008–present | Mentor for two new members of academic staff |

# D. ENTERPRISE AND OUTREACH

*My many fruitful collaborations with the Met Office are included in "research highlights" at the end of section E.*

- In the last four years I have led the Reading component of two successful proposals to the European Space Agency to develop cloud retrieval algorithms for the forthcoming EarthCARE satellite, "CASPER" and "RATEC". I now lead the European effort to combine the instruments on EarthCARE to derive cloud and precipitation properties
- I have collaborated with a new company *HALO Photonics* in the evaluation of a 1.5-μm Doppler cloud lidar. This is a pioneering new technology in lidar design, allowing continuous, unmanned measurements of wind at a far lower cost than ever before. It is now operating continuously at Chilbolton, I have published a paper (Hogan et al. 2009) with the Director of the company (Dr Guy Pearson) using the instrument, and the company has had many subsequent orders for these instruments.
- I am an active commentator on high profile scientific issues; for example, I was quoted in the 7 November 2009 issue of *New Scientist* in an article entitled "Tomorrow's weather: cloudy, with a chance of fractals".
- I created a web-site (*www.met.reading.ac.uk/radar/realtime*) displaying high resolution imagery from the cloud observing instruments at Chilbolton in real time, as well as storing an archive of previous images. This is very useful for understanding the properties of the atmosphere immediately above our heads and is used frequently in the Department's weekly "Weather and Climate Discussion". The site now gets around 1000 hits per month.
- I created a web-site (*www.met.reading.ac.uk/clouds/maxwell*) containing many animations of electromagnetic waves that illustrate the physics behind a wide range of optical phenomena and the workings of optical and microwave instruments. This site is an excellent educational resource and receives over 500 hits per month, as well as being used within the Department in our radiative transfer and remote sensing lecture courses. A visitor to the web site told me "The animations on your Maxwell2D page are fantastic. Despite a PhD in optics I'd only read about many of the effects you have demonstrated; you have really brought them to life."
- In the final work-package of the EU Cloudnet project we collaborated with lidar manufacturer *Vaisala* and radar manufacturers *Gematronik* and *Degreanne* in proposing the specification of a European network of cloud observing stations.

# E. RESEARCH HIGHLIGHTS

My published papers have attracted over 900 citations and I have an h-index of 18 (Web of Knowledge Author="Hogan RJ", Address= "Univ Reading").

*1. Cloud structure and radiative transfer in weather forecast and climate models*

The distribution of clouds in climate models is very important for the way in which they modulate solar and terrestrial radiation, and hence for forecasting surface temperature. Hogan and Illingworth (2000) introduced the concept of an "overlap parameter" to describe how clouds are overlapped vertically, extended to describe the overlap of cloud inhomogeneities (Hogan and Illingworth 2003). These papers have 77 and 35 citations respectively, and the ideas in these papers have been implemented in several climate models used by the Intergovernmental Panel on Climate Change (e.g. the US GFDL and NCAR models, the German ECHAM5 model and the UK Met Office model), as well as the European Centre for Medium-Range Weather Forecasts (ECMWF) model. I have developed a novel stochastic model to generate realistic 3D cirrus clouds and determine their radiative properties (Hogan and Kew 2005). I have quantified the role of 3D radiative transfer on the radiative forcing of both aircraft contrails (Gounou and Hogan 2007) and natural cirrus (Zhong et al. 2008). With a PhD student I developed a new way to represent cloud horizontal structure efficiently in the radiation schemes of models (Shonk and Hogan 2008, 2010) and have implemented this in the Met Office climate model (Shonk et al. 2011). Other radiative transfer work includes an innovative way to improve the efficiency of the treatment of gaseous absorption (Hogan 2010) and breakthroughs in the rapid modelling of radar and lidar multiple scattering (Hogan 2006, 2008; Hogan and Battaglia 2008; a total of 32 citations), including the use of the time-dependent form of the two-stream radiative transfer equations for the first time. Via a NERC standard grant I am currently developing a scheme to represent 3D radiative transfer in a climate model.

*2. Mixed-phase clouds*

A series of papers has uncovered the importance of mixed-phase clouds (those that contain a mixture of liquid water and ice), particularly the role of embedded convection and ice multiplication (Hogan et al. 2002), their radiative importance (Hogan et al. 2003b), their poor representation in current forecast models (Hogan et al. 2003c), their global distribution (Hogan et al. 2004) and their spatial structure (Field, Hogan et al. 2004). These papers have a total of 126 citations, and the findings of the first three were highlighted in NERC's 2001–2002 Annual Report (page 9) as "a key scientific advance", and led to my being awarded the L F Richardson prize of the Royal Meteorological Society. This work has spawned a number of modelling studies co-authored by myself (e.g. Phillips et al. 2003, Clark et al. 2005, Marsham et al. 2006).

*3. Evaluation of clouds in forecast models*

I have pioneered methods to evaluate objectively the representation of clouds in forecast models using data from the Chilbolton Observatory in Hampshire. This has included the development of retrieval algorithms (such as the dual-wavelength radar technique of Hogan and Illingworth 1999 and Hogan et al. 2000; a total of 55 citations), and the first evaluation of model cloud fraction and ice water content (Hogan et al. 2001, 2006; a total of 93 citations). This work was taken to a new level in the EU Cloudnet project (*www.cloud-net.org*; Illingworth, Hogan et al. 2007; 80 citations), in which 7 operational models are being evaluated over 4 European sites. The Cloudnet data archive hosted at Reading now has over 40 users from around the world. I have secured funding from the US Department of Energy to further develop and apply the Cloudnet algorithms (many of which were written by myself) to decade-long datasets from the various US "Atmospheric Radiation Measurement" sites worldwide, providing an even tighter constraint on forecast models.

*4. Development of synergy algorithms for CloudSat, Calipso and EarthCARE*

I am recognised as a world expert in combining active and passive satellite instruments for retrieving the properties of clouds. With NERC funding, a postdoc and I have developed and applied a method for combining data from the CloudSat radar, the Calipso lidar and the MODIS radiometer to retrieve ice cloud properties (Delanoë and Hogan 2008, 2010). It is based on the rigorous mathematical approach of optimal estimation theory (similar to data assimilation). As part of the National Centre for Earth Observation Climate Theme, we have used it to reveal significant discrepancies in the ECMWF and Met Office forecast models, and Dr Richard Forbes of ECMWF is currently using these results to guide the development of their new cloud scheme (Delanoë et al. 2011). Our retrievals are available for several years of CloudSat and Calipso data from *http://www.icare.univ-lille1.fr/projects/dardar/*. Our algorithm has inspired the recent development of the "official" CloudSat-Calipso ice-cloud algorithm in the US.

My work in evaluating the potential for a proposed satellite (EarthCARE), in which the UK has a strong interest, was instrumental in its being selected by the European Space Agency (ESA) for deployment. I am now centrally involved in developing algorithms for EarthCARE, to carry a cloud radar and lidar on the same platform, and have been awarded two ESA grants in the last three years. The second will pioneer the development of the first "unified" synergetic retrieval scheme, in which the properties of clouds, aerosols and precipitation are retrieved simultaneously by combining EarthCARE's radar, lidar and radiometer.

*5. Retrievals of rain and hail from polarimetric radar*

I have developed a new method for retrieving rain rate and hail intensity from polarization radar, again utilizing the rigorous mathematical framework of optimal estimation theory (Hogan 2007). This work unifies aspects of many previous algorithms and includes correction for attenuation, which has been a major problem for radars in the most intense rainfall events. The UK Met Office has implemented my method on their prototype polarization radars, and Météo-France are currently implementing it on the French radar network. If successful it will be used to improve short-term flood forecasts. I am also working with a scientist at Colorado State University who is applying the method to radars from the US "CASA" network. As with a number of my computer codes, it is freely available for download (*www.met.reading.ac.uk/clouds/var_rain_hail*).