Richard Wilkinson

Education

2010 – 2013 Postgraduate Certificate in Higher Education **(PGCHE)**, University of Nottingham.

2004 – 2008 **PhD**, Department of Applied Mathematics and Theoretical Physics, University of Cambridge. Supervised by Simon Tavaré. *Bayesian inference of primate divergence times.*

2002 – 2003 Part III Mathematics - **Distinction**, University of Cambridge.

1999 – 2002 **BA** Mathematics – **First Class** (Honours), Downing College, University of Cambridge.

Appointments

- Senior Lecturer, School of Mathematics and Statistics, University of Sheffield, September 2015 - present.
- Assistant Professor, School of Mathematical Sciences, University of Nottingham, September 2009 - August 2015.
- Research Associate, Department of Probability and Statistics, University of Sheffield, October 2007 - September 2009. RCUK funded post-doctoral researcher on the Managing Uncertainty in Complex Models (MUCM) project. I worked on emulation, calibration and data assimilation for complex computer models.

Publications

2016

24. Wilkinson, a discussion of *The impact of structural error on parameter constraint in a climate model*, by D McNeall, J. Williams, B. Booth, R. Betts, P. Challenor, A. Wiltshire, and D. Sexton. Earth System Dynamics.

23. D. Crevillén-García, R. D. Wilkinson, A. A. Shah, H. Power, *Gaussian Process Modelling for Uncertainty Quantification in Groundwater flow and Convectively-Enhanced Dissolution Processes in Porous Media.* In submission, Advances in Water Resources.

22. E. Uteva, R. Graham, Wilkinson, R. Wheatley, *Interpolation of intermolecular potentials using Gaussian processes.* In submission, Physical Review Letters.

21. Wilkinson, A. Kapranas, I. C. W. Hardy, *Statistical methods for detecting non-binomial sex allocation when developmental mortality operates.* Journal of Theoretical Biology, 408, 167-178.

20. J. Carson, M. Crucifix, S. Preston, Wilkinson. *Bayesian model selection for the glacial-interglacial cycle.* Under revision, Journal of the Royal Statistical Society, Series C.

19. L. Tian, Wilkinson, Z. Yang, H. Power, F. Fargerlund, A. Niemi. *Gaussian Process Emulators for Quantifying Uncertainty in CO2 Spreading Predictions in Heterogeneous Media.* In submission, Computers and Geosciences.

18. A. J. Cresswell, R. J. Wheatley, Wilkinson, R. S. Graham, *FDCCS16 Molecular simulation of the thermophysical properties and phase behaviour of impure CO2 relevant to CCS*. To appear, Faraday Discussions, The Royal Society Of Chemistry.

2015

17. P. B. Holden, N. R. Edwards, P. H. Garthwaite, Wilkinson, *Emulation and interpretation of high-dimensional climate model outputs*. Journal of Applied Statistics, 42(9) 2038-2055.
16. N. Bounceur, M. Crucifix, Wilkinson, *Global sensitivity analysis of the climate vegetation system to astronomical forcing: an emulator-based approach.* Earth Syst. Dynam. Discuss, 6, 205-224.
15. P. Holden, N. Edwards, Wilkinson, *ABC for climate: dealing with expensive simulators*. To appear in the *Handbook of ABC*.

2014

14. Wilkinson, *Accelerating ABC methods using Gaussian processes*. JMLR Workshop and Conference Proceedings 33, 1015-1023: Proceedings of the Seventeenth International Conference on Artificial Intelligence and Statistics.
13. Bracken-Grissom, H.D., Ahyong, S. T., Wilkinson, R. D., Feldmann, R., Schweitzer, C., Brienholdt, J., Bendall, M., Palero, F., Chan, T-Y., Felder, D.L., Robles, R., Chu, K.H., Tsang, M., Kim, D., Martin, J., Crandall, K.A. *The Emergence of the Lobsters: Phylogenetic Relationships, Morphological Evolution and Divergence Time Comparisons of an Ancient Group (Decapoda: Achelata, Astacidea, Glypheidea, Polychelida)* Systematic biology, 63(4): 457-479, 2014.
12. Wilkinson, a discussion of *PLASIM-ENTSem: a spatio-temporal emulator of future climate change for impacts assessment*, by P.B. Holden, N. R. Edwards, P. H. Garthwaite, K. Fraedrich, F. Lunkeit, E. Kirk, M. Labriet, A. Kanudia, and F. Babonneau. Geoscientific Model Development, 7, 433-451, 2014.

2013

11. Wilkinson, *Approximate Bayesian computation (ABC) gives exact results under the assumption of model error*, Statistical Applications in Genetics and Molecular Biology, 12(2), 129-142, 2013.

2012

10. Wilkinson, a short contribution to the discussion of *Constructing summary statistics for approximate Bayesian computation: semi-automatic approximate Bayesian computation*, by Fearnhead and Prangle. Journal of the Royal Statistical Society, Series B, 2012.

2011

9. Wilkinson, M. Steiper, C. Soligo, R.D. Martin, Z. Yang, and S. Tavaré, *Dating primate divergences through an integrated analysis of palaeontological and molecular data*, Systematic Biology, 60(1): 16-31, 2011.
8. Wilkinson, M. Vrettas, D. Cornford, J. E. Oakley, *Quantifying simulator discrepancy in discrete-time dynamical simulators.* Journal of Agricultural, Biological, and Environmental Statistics: Special issue on *Computer models and spatial statistics for environmental science*, 16(4), 554-570, 2011.

2010

7. P.B. Holden, N.R. Edwards, K.I.C. Oliver, T.M. Lenton and Wilkinson, *A probabilistic calibration of climate sensitivity and terrestial carbon change in GENIE-1*, Climate Dynamics, 35(5), 785-806, 2010.

6. Wilkinson, a short contribution to the discussion of *Geostatistical inference under preferential sampling*, by Diggle, Menezes and Su. Journal of the Royal Statistical Society, Series C, 59(2), 191-232, 2010.
5. Wilkinson, *Bayesian calibration of expensive multivariate computer experiments.* In 'Large-scale inverse problems and quantification of uncertainty', 2010, John Wiley and Sons. Edited by L. T. Biegler.
4. Bastos, L. and Wilkinson, *Statistical Analysis of Computer Experiments (Análise Estatística de Simuladores)*, Simpsio Nacional de Probabilidade e Estatstica (SINAPE), pages 1–93, 2010.

2009

3. Wilkinson and S. Tavaré, *Estimating the primate divergence time using conditioned birth-and-death processes*, Theoretical Population Biology 75, pp. 278-285.
2. D.M. Ricciuto, R. Tonkonojenkov, N. Urban, Wilkinson, D. Matthews, K.J. Davis, and K. Keller, *Assimilation of global carbon cycle observations into an Earth system model to estimate uncertain terrestrial carbon cycle parameters.*

2008

1. Wilkinson, *Bayesian inference of primate divergence times*, PhD thesis, Department of Applied Mathematics and Theoretical Physics, University of Cambridge.

Grants Held and Awards

- *A novel statistical approach for palaeoclimate spatial model-data comparison*, Past Earth Network feasibility study, funded by EPSRC, (£24,742 total), PI.
- Exceptional Performance Bonus 2012/13 and 2013/14, University of Nottingham.
- *Tractable equations of state for carbon dioxide mixtures in carbon capture, transport and storage: algorithms for automated generation and optimisation, tailored to end-users* (UKCCSRC-C1-22), funded by *EPSRC* via the *UK Carbon Capture and Storage Research Centre (UKCCSRC)* to fund a PDRA for 12 months (£93,000 total), CI.
- *PANACEA: Predicting and monitoring the long term behaviour of CO_2 injected in deep geological formations*, EU FP7 project (`panacea-co2.org`), €3.6 million (2012-2014), CI.
- *Improving the efficiency of Monte Carlo inference using Gaussian process regression*, EPSRC studentship (£1440 total).
- *Sequential learning of model error in rainfall-runoff models*, Early Career Research and Knowledge Transfer Award from the University of Nottingham (£16,000), July 2010 to funding a PDRA for six months.
- *Royal Society International Travel Grant* for travel to a conference and to meet collaborators in Brazil (£970), July 2010.
- *Visiting Fellowship* at the Isaac Newton Institute (£1260 subsistence costs), August-September 2010.
- *CRiSM Young Academic Awards* , University of Warwick, conference expenses and travel (approximately £300), December 2009.
- Subsistence costs for a six week period as Visiting Fellow at the Institute of Advanced Studies, University of Durham, March-April 2008.
- *Early Career Researcher Award*, International Society for Bayesian Analysis, ($600), January 2008.
- *Rayleigh–Knight and Smith-Knight Essay Prize* (£250), Cambridge, March 2006.

Academic service

- Area chair (scientific programme committee) for NIPS 2014 conference.
- Meetings secretary of the Environmental Statistics Section of the Royal Statistical Society, 2009-2012.
- Leader of the 'model-data comparison' working group of the Past Earth Network (with Louise Sime and Manfred Mudelsee).
- Chair of the Environmental Statistics Section of the Royal Statistical Society, 2016–.

Invited talks since 2010

A full list of talks with slides is available at `www.maths.nottingham.ac.uk/personal/pmzrdw/`

- Uncertainty quantification for complex simulators using emulation, British Antarctic Survey, Cambridge, October 2016.
- Gaussian process accelerated ABC, Gatsby Computational Neuroscience Unit, UCL, London, September 2016.
- Introduction to ABC, GP and UQ summer school, University of Sheffield, September 2016.
- Surrogate modelling and ABC, invited talk, ABC in Helsinki meeting, middle of the Baltic Sea, May 2016.
- Design for Calibration and History Matching for Complex Simulators, invited talk, minisymposium on Sequential Design of Computer Experiments, SIAM UQ, Lausanne, April 2016.
- Using surrogate models to accelerate parameter estimation for complex simulators, Laboratoire de Recherche en informatique (LRI), Paris, March 2016.
- *Design for ABC and history matching with Gaussian processes*, Biostatistics Unit, MRC, Cambridge, March 2016.
- *Using surrogate models to accelerate parameter estimation for complex simulators*, departmental seminar, Maths Dept, University of Manchester, February 2016.
- *Approximate Bayesian computation: inference for intractable computer models*, invited speaker, Data science @LHC workshop, CERN, Switzerland, November 2015.
- *ABC and history matching with GPs*, invited speaker, Gaussian process summer school, Sheffield, 2015.
- *Modern Computational Statistics*, invited speaker, Statistics for Climate PIs, Royal Statistical Society, London, September 2015.
- *What drives the glacial-interglacial cycle? A Bayesian approach*, invited speaker, Royal Statistical Society conference, Exeter, September 2015.
- *How far can fancy Monte Carlo methods take us?*, contributed talk, Past Earth Network conference, Crewe, September 2015.
- *Efficient history matching and calibration of complex simulators using Bayesian optimization*, invited speaker, International Congress on Industrial and Applied Mathematics (ICIAM), Beijing, August 2015.
- *GP-ABC: accelerating inference for intractable stochastic computer models*, plenary speaker, MascotNum2015, St Etienne, France, April 2015.
- *What drives the glacial-interglacial cycle? A Bayesian approach to a long-standing model selection problem*, University of Glasgow, School of Maths seminar, November 2014.
- *Approximate Bayesian computation (ABC) and the challenge of big simulation*, keynote lecture, NeuroStats2014: Statistical Challenges in Neuroscience. University of Warwick, September 2014.
- *What drives the glacial-interglacial cycle? A Bayesian approach to a long-standing model*

selection problem, Advances in Climate Theory Workshop, Royal Institute of Meteorology, Brussels, Belgium, August 2014.
- *What drives the glacial-interglacial cycle? A Bayesian approach to a long-standing model selection problem*, ISBA, Cancun, July 2014.
- *Statistical challenges and solutions in Equation of State modelling*, Nottingham NEST workshop, Nottingham, May 2014.
- *Emulating computer simulators with high dimensional input and output*, Statoil, Trondheim, Norway, March 2014.
- *Statistical applications of Gaussian processes*, invited seminar, Gaussian process winter school, Sheffield Institute of Translational Neuroscience, January 2014.
- *Approximate Bayesian computation*, 2 hour invited tutorial, NIPS, Lake Tahoe, USA 2014.
- *Probabilistic ABC: accelerating ABC using Gaussian processes*, invited seminar, Robotics Research Group, Department of Engineering Science, University of Oxford, August 2013.
- *Gaussian processes for uncertainty quantification in computer experiments*, invited lecture, Summer School on Gaussian Processes, Sheffield Institute for Translational Neuroscience, June 2013.
- *Accelerating ABC using emulation and history-matching*, invited seminar, Statistical Sciences Research Institute (S3RI), University of Southampton, April 2013.
- *ABC, history matching, and emulation*, invited seminar, School of Mathematics, University of Durham, November 2012.
- *A modelling approach to ABC*, invited seminar, School of Mathematics, University of Leeds, September 2012.
- *Alternative approaches to approximate Bayesian computation (ABC): what and why*, invited seminar, Dept. of Statistics, University of Oxford, January 2012.
- *Calibrating computer simulators using ABC: An example from evolutionary biology*, invited seminar, Maths Department, Exeter University, March 2011.
- *Calibrating the UVic climate model using global carbon cycle observation*, invited seminar, Field Sciences Department, Open University, January 2011.
- *Calibrating and emulating multivariate computer models*, invited seminar, Centre de recherche sur la Terre et le climat, Université catholique de Louvain, January 2011.
- *Exploring the Error in ABC algorithms*,invited seminar, University of Warwick, November 2010.
- *ABC and the challenge of model calibration*, invited seminar, Isaac Newton Institute, September 2010.
- *Análise Estatística de Simuladores*, 18^o SINAPE - Simpósio Nacional de Probabilidade e Estatística, Brazilian national statistics conference, Sao Pedro, invited short course on computer experiments, July 2010.
- *Análise Estatística de Simuladores: Learning from computer experiments*, Universidade de Brasília, Brazil, invited seminar, July 2010.
- *Learning model error in dynamical systems*, Royal Meteorological Society Workshop on Model Error, invited talk, Met Office, Exeter April 2010.

PhD Students

- Dr Jake Carson (Department of Statistics, University of Warwick) - Calibration and model-selection in palaeo-climate (2010-2014)
- Dr Kamonrat Suphawan (Department of Statistics, Chaing Mai University) - Identifying model error in dynamical systems (2011 - 2014)
- Dr David Crevillen Garcia (School of Engineering, University of Warwick) - Uncertainty

quantification for flow and transport in porous media (2012 - 2015)
- Michael Thompson - Gaussian process models for equations of state (second supervisor, started Sept 2013)
- Elena Uteva - Speeding up molecular simulations using Gaussian processes (second supervisor, started Sept 2013).
- Fiona Turner - Reconstructing the past and predicting the future: what can ice?cores tell us about climate? (started Sept 2016), funded by the Grantham Centre for Sustainable Futures.
- Jonathan Sykes - Characterising Uncertainty in Complex Environmental Simulations for Public Engagement with Climate Change Conscious Sustainable Planning and Design (second supervisor, start Sept 2016), funded by the Grantham Centre for Sustainable Futures.

Post-Docs

- Dr Ed Knock (1/9/2014 - 1/1/2015), employed by ERC grant *PANACEA* - an investigation of carbon capture and storage technology.
- Dr Jo Dunster, University of Warwick, (20/1/2014 - 30/4/2014), employed by EPSRC grant *Tractable equations of state for carbon dioxide mixtures in carbon capture, transport and storage: algorithms for automated generation and optimisation, tailored to end-users*
- Dr Martin Nelson, Nottingham Trent University, (1/4/2013 - 31/3/2014), employed by EPSRC grant *Tractable equations of state for carbon dioxide mixtures in carbon capture, transport and storage: algorithms for automated generation and optimisation, tailored to end-users*
- Dr Michail Vrettas, U.C. Berkeley, (1/2011 - 6/2011), employed by the grant *Sequential learning of model error in rainfall-runoff models.*

Teaching Experience

Spring 2011 -	**Module Convenor** (Lecturer and Examiner) for the level four module Topics in Biomedical Statistics. A 20 credit (30 lecture) module for fourth year mathematics students and Master in Statistics Students at the University of Nottingham. The module was new and had to be written from scratch
Spring 2011 -	**Module Lecturer** (Lecturer and Examiner) for the level two module Statistical Methods and Models (Linear Models). A 20 credit (20 lecture) module for second year mathematics students at the University of Nottingham.
Autumn 2009	**Module Convenor** (Lecturer and Examiner) for the level four module Computational Statistics. A 20 credit (30 lecture) module for fourth year mathematics students at the University of Nottingham.
Nov - Dec 2008	**Lectured** the course Statistics in Society, giving a block of four lectures on 'Statistics and the Law', a second year undergraduate course, University of Sheffield.
Oct 2007 – May 2009	**Staff tutor** for statistics courses PAS201 and PAS174 at the University of Sheffield.
Oct – Dec 2004 and 2005	Stood in for the **Director of Studies of Mathematics** at Downing College while the permanent Director was on sabbatical leave for two terms. Involved arranging supervisions for the undergraduate students, monitoring their progress and providing support, and interviewing sixth form applicants to the college.
Oct 2003 – Sept 2007	**Small group tutorials** (approximately 280 hours) given at the University of Cambridge in a wide range of statistics and probability courses including 1st year — Probability, Optimization 2nd year — Markov Chains, Statistics 3rd year — Probability and Measure, Applied Probability
Sept 2003 – July 2004	**A-Level Physics and Maths Teacher** Cambridge Centre for Sixth Form Studies, Cambridge, UK. Taught three AS Physics classes and one AS Further Maths class to primarily overseas students.

Consultancy

- Network Rail, the UK rail operator. We conducted a major review and development of the uncertainty quantification methods used within Network Rail. We focussed on their Whole Life Costs and Asset Life Cycle profiles, and developed methods to account for uncertainties in the models of various asset disciplines, focusing on track, signalling and earthworks. The project was conducted with John Paul Gosling, via our company UQuant Consulting Limited, and involved 70 days work.
- Sealevel Research, a start-up company in Liverpool. I advised on building and fitting models to predict sea-level in the Port of Liverpool. Funded by a Technology and Strategy Board (TSB) voucher.
- Garrad Hassan and Partners Ltd - engineering (renewable energy) consultants, Bristol, UK. Delivered day-long training workshops on dealing with uncertainty to their engineering consultants in 2010 and 2012.

Meeting organisation

- Co-organiser (with Christian Robert, Luke Bornn, Jukka Corander, Gael Martin and Dennis Prangle) of the Banff International Research Station program on *Validating and Expanding Approximate Bayesian Computation Methods*. This will be a 5 day program to take place between 19-24 February 2017.
- Organiser (with Louise Sime and Manfred Mudelsee) of the Data-model comparison workshop, Cambridge, 24-27 August 2016.
- Organiser (with Javier Gonzalez) of the Gaussian Process and Uncertainty Quantification summer school, Sheffield, 12-15 September 2016.
- Organiser (with Caitlin Buck) of the special topic session *Uncertainty quantification for climate simulation*, ISBA 2016, Sardinia, Italy.
- Organiser (with Alex Diaz de la O) of the mini-symposium *Learning Parameters from Data: Calibration, Inverse Problems, and Model Updating* at SIAM UQ2016, Lausanne, Switzerland.
- I am the group leader of the Model-Data Comparison group of the Past Earth Network.
- *Equation of State Modelling* - a workshop for $\sim$ 20 people (mixture of energy company delegates and academics) on fitting equations of state to data. Nottingham University, May 2014. Organised with Richard Graham and Simon Preston
- *Bayes in the environment* - a celebration of the 250th anniversary of the publication of Bayes theorem. Royal Statistical Society, London 2013. Organised with Adam Butler.
- *Subjective inference and uncertainty quantification*, Leeds 2013, and Durham 2014. Organised with JP Gosling and Danny Williamson.
- *ABC in Montreal*, NIPS workshop, Montreal 2014. Organised with Ted Meads, Max Welling, Christian Robert and Neil Lawrence.
- *Uncertainty Quantification for Climate Simulation*, special topic session, ISBA 2016.