Award: ESRC Centre for Climate Change Economics and Policy, Phase II
Project: Climate change, non-linear systems and economic decisions
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Overview of project aims

Producing climate information and managing climate risk both require a conceptual understanding of the transient behaviour of nonlinear systems under time-dependent forcing, of the implications of nonlinearity for the interpretation of imperfect models, and of the consequences of nonlinearity for economic and policy decisions. This project was an end-to-end study of the implications of nonlinearities in climate change, through an inter-disciplinary collaboration between scholars in philosophy, nonlinear systems theory, climate modelling and economics.

Overview of data

- Much of the research in this project has been based on theoretical models and has therefore not produced any data to be archived.
- Some papers have applied integrated assessment models. The DICE model has been used in several papers (1, 3, 5, 6, 7, 9, 10 and 11). This model is available to download at https://sites.google.com/site/williamdnordhaus/dice-rice. Papers 3 and 5 have developed additional code that can be used to run extended versions of the DICE model. The model code has been archived with ReShare.
- Paper 6 also applied the FUND and PAGE integrated assessment models. FUND is available to download at https://github.com/fund-model/fund. The PAGE model is not publicly available, but is described in full detail in: Chris Hope, 2006, "The marginal impact of CO_2 from PAGE 2002", *Integrated Assessment Journal*, **6(1)**, 9-56.
- Paper 12 was based on analysis of the E-Obs dataset, which is available to download from https://www.ecad.eu/download/ensembles/download.php.
- Paper 14 involved analysis of a new ensemble of simulations with the FAMOUS GCM. These were carried out at Reading University. The data used in the paper are available in three collections of files gathered together in a tarball and compressed with gzip. Each file is a netCDF file containing timeseries of seasonal means of 2D surface temperature and precipitation from one simulation. The collections are:
    - MACRO-ens.tar.gz – containing the MACRO ensemble.
    - MICRO-ens.tar.gz – containing the MICRO ensemble.
    - MINI-ens.tar.gz – containing the two MINI-MICRO ensembles.

CCCEP publications

1. "Cumulative carbon emissions and economic policy: in search of general principles", Simon Dietz and Frank Venmans, Centre for Climate Change Economics and Policy Working Paper 317, 2017
2. "The economics of 1.5°C climate change", Simon Dietz, Alex Bowen, Baran Doda, Ajay Gambhir and Rachel Warren, *Annual Review of Environment and Resources*, **43**, 18.1-18.26, 2018
3. "The climate beta", Simon Dietz, Christian Gollier and Louise Kessler, *Journal of Environmental Economics and Management*, **87**, 258-274, 2018
4. "The risk of climate ruin", Simon Dietz, Oliver Bettis and Nick Silver, *Climatic Change*, **140(2)**, 109-118, 2017

5. “Estimating the economic impact of the permafrost carbon feedback”, Louise Kessler, *Climate Change Economics*, **8(2)**, 1750008, 2017
6. “On the physics of three integrated assessment models”, Raphael Calel and David Stainforth, *Bulletin of the American Meteorological Society*, **June 2017**
7. “‘Climate Value at Risk’ of global financial assets”, Simon Dietz, Alex Bowen, Philip Gradwell and Charlie Dixon, *Nature Climate Change*, **6**, 676-679, 2016
8. “Weighing the costs and benefits of climate change to our children”, Simon Dietz, Ben Groom and Billy Pizer, *The Future of Children*, **26(1)**, 133-155, 2016
9. “Spaces for agreement: a theory of Time-Stochastic Dominance and an application to climate change”, Simon Dietz and Nicoleta Anca Matei, *Journal of the Association of Environmental and Resource Economists*, **3(1)**, 85-130, 2016
10. “Tall tales and fat tails: the science and economics of extreme warming”, Raphael Calel, David Stainforth and Simon Dietz, *Climatic Change*, **132(1)**, 127-141, 2015
11. “Endogenous growth, convexity of damages and climate risk: how Nordhaus’ framework supports deep cuts in carbon emissions”, Simon Dietz and Nicholas Stern, *Economic Journal*, **125(583)**, 574-602, 2015
12. “Limits to the quantification of local climate change”, Sandra Chapman, David Stainforth and Nicholas Watkins, *Environmental Research Letters*, **10**, 094018, 2015
13. “An assessment of the foundational assumptions in high-resolution climate projections: the case of UKCP09”, Roman Frigg, Leonard Smith and David Stainforth, *Synthese*, **192(12)**, 3979-4008, 2015
14. “Irreducible uncertainty in near-term climate projections”, Ed Hawkins, Robin Smith, Jonathan Gregory and David Stainforth, *Climate Dynamics*, **46(11-12)**, 3807-3819, 2015
15. “Tales of future weather”, W. Hazeleger, B. J. J. M. Van den Hurk, E. Min, G. J. Van Oldenborgh, A. C. Petersen, D. A. Stainforth, E. Vasileiadou, and L. A. Smith, *Nature Climate Change*, **5**, 107–113, 2015
16. “Climate change mitigation as catastrophic risk management”, Simon Dietz, *Environment: Science and Policy for Sustainable Development*, **56(6)**, 28-36, 2014