

## **Surface water flood risk management and flood insurance under future climate change - Insights from an Agent-Based Model**

Katie Jenkins, Environmental Change Institute, University of Oxford

Swenja Surminski, Grantham Research Institute on Climate Change and the Environment, The London School of Economics and Political Science

Igor Nikolic, Faculty of Technology, Policy and Management, Delft University of Technology

Seminar at DEFRA, Rm 808, Nobel House, 17 Smith Square, SW1P 3JR  
5.30 (for 6.00) - 9.00 p.m., Tuesday 1<sup>st</sup> November 2016

Climate change and increasing urbanisation are both projected to result in an increase in surface water flooding and consequential damages in the future. In this seminar we begin by looking at the role of Agent Based Modelling for policy and discuss the role of insurance and Flood Re for flood risk reduction. We then present insights from the application of an Agent Based Model (ABM), applied to a London case study of surface water flood risk, to designed to assess the interplay between different adaptation options; how risk reduction could be achieved by homeowners and government; and the role of flood insurance and the new flood insurance pool, Flood Re, in the context of climate change.

### **Part One – Introduction to ABM and application for policy, Igor Nikolic**

Igor will provide an introduction to Agent Based Modeling and their usefulness for policy makers. The talk will start with introducing the notions of complex adaptive systems and generative science. Then, the basic structure and mechanisms of ABM will be discussed, as will be the discussion on (un)suitable problem types for ABMs. The talk will close with a discussion on the strengths and weaknesses of ABM and pointers for recognizing a poorly done model. A policy relevant example will be used to illustrate these points.

### **Part Two – Insurance and Flood Re, Swenja Surminski**

Swenja will provide an introduction to insurance and the new Flood Re scheme, drawing on qualitative analysis undertaken to highlight the challenges that future flood risks presents and to identify how better to harness insurance for flood risk reduction. The presentation will highlight key aspects relevant for an ABM analysis, and show how this work has influenced the recent UKCCRA2 analysis for business and industry sector and the Prudential Regulation Authority's climate change report.

### **Part Three – Insights from the ABM, Katie Jenkins**

Katie will introduce the ABM developed, providing an overview of its design and content, and application to a case study of surface water flood risk in the London Borough of Camden. Building on the insights presented by Igor and Swenja the model is used to analyse different combinations of flood risk management options and insurance in a dynamic manner. The model demonstrates how investment in flood risk management options can reduce flood risk, however, benefits can be outweighed by continued development in high risk areas and the effects of climate change. Findings highlight the

role of Flood Re as a mechanism to provide affordable insurance, even under climate change, and potential missed opportunities in terms of its role to support future flood risk reduction.

## Speakers

### Chair:

#### **Jim Hall, Director of the Environmental Change Institute, University of Oxford**

Professor Jim Hall FREng is Director of the Environmental Change Institute, Professor of Climate and Environmental Risks in the School of Geography and the Environment, a Senior Research Fellow in the Department of Engineering Science and fellow of Linacre College. His research focuses upon management of climate-related risks in infrastructure systems, in particular relating to various dimensions of water security, including flooding and water scarcity.

Jim Hall is a member of the UK independent Committee on Climate Change Adaptation. In 2010 Jim was elected as a Fellow of the Royal Academy of Engineering "for his contribution to the development of methods for flood risk analysis, which underpin approaches for flood risk management in the UK and internationally." He is now a member of the Engineering Policy Committee of the Royal Academy of Engineering and the Public Voice Committee of the Institution of Civil Engineers. He was is a member of the panel conducting the Institution of Civil Engineer's 2014 State of the Nation Infrastructure assessment.

### Presenters:

#### **Igor Nikolic, Associate Professor, Delft University of Technology**

Dr. ir. Igor Nikolic is an Associate Professor at the Energy and Industry group, Faculty of Technology, Policy and Management faculty, Delft University of Technology. Trained as a chemical and bio-process engineer at the Delft University of Technology, he received his Cum Laude MSc degree, with an additional sustainable technology certificate in 2001. After a number of years of working as an environmental scientist at the Centre of Environmental Science (CML) in Leiden, he has joined the Energy and Industry group at the faculty of Technology, Policy and Management at the TUD as a PhD candidate. He has received his PhD degree in 2009, with thesis work focused on the design of a co-evolutionary method for constructing Agent Based Models of the evolution of Large Scale Socio-Technical systems. He has spent time as a senior visiting research associate at the Environmental Change Institute at the University of Oxford. He can be characterized as a creative, multidisciplinary and out-of-the-box system thinker, applying Complex Adaptive Systems theory, Universal Darwinism and Agent Based Modeling to understanding and shaping the co-evolution of socio-technical systems across a wide range of domains. He focuses on the impacts of policies on the technical and social constituents of systems, always aiming at improving the sustainability of these systems. Currently he is involved in a wide array of research topics through industry and EU funded projects, ranging from smart-grids, regional industrial networks, e-waste markets, servicing systems, flood protection and development aid. To these fields he brings a complex adaptive systems view and socio-technical ABM perspective, as well as a strong methodological focus on model development.

#### **Swenja Surminski, Senior Research Fellow at the Grantham Research Institute on Climate Change and the Environment, LSE**

Swenja is Programme Leader for the 'climate risk, insurance and private sector' work-stream at the institute, overseeing research projects from a multi-disciplinary field. Her research focuses on climate adaptation and disaster risk reduction with a special interest in the role of the private sector. The geographic scope of her works spans from the United Kingdom across the European Union to developing countries. As a Principal Investigator for the FP7-project ENHANCE she is currently conducting an analysis of disaster risk management partnerships across Europe and an investigation of the UK's new Flood Re insurance arrangement. Swenja is the LSE-lead in the Costing Climate Change Impacts and Adaptation in Ireland project, in collaboration with University College Cork and funded by the Environmental Protection Agency in Ireland. Swenja

is also part of the Uncertainty reduction in models for understanding development (UMFULA) project, exploring insurance decision making in a developing country context. She was appointed Visiting Academic at the Bank of England in 2015, selected lead author for the business and industry chapter of the UK Climate Change Risk Assessment in 2014, and worked from 2014 - 2016 as the lead academic for a World Bank project on the benefits of Disaster Risk Management (DRM), working with the Overseas Development Institute to explore how the co-benefits of DRM measures can strengthen the economic case for investment.

**Katie Jenkins, Postdoctoral research associate at the Environmental Change Institute, University of Oxford**

Katie is a research associate at the Environmental Change Institute, where she has worked on various multidisciplinary projects with a focus on integrated assessment of climate impacts and adaptation strategies. Her main research interests include modelling direct and indirect social and economic impacts of climate change, with particular regard to extreme weather such as drought, extreme temperatures and surface water flooding, and assessing consequences for adaptation strategies from an interdisciplinary perspective. Before joining ECI in April 2011, Katie was a PhD student at the University of Cambridge modelling the economic and social impacts of drought events under future projections of climate change. Prior to this Katie worked at the University of Cambridge at 4CMR (The Cambridge Centre for Climate Change Mitigation Research) where she was involved in numerous research projects focused around the core theme of modelling economic, environmental and energy systems to assess climate policy. Katie has an MSc in Climate Change and degree in Physical Geography.

Followed by discussion and refreshments

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To register, please email your name, title and organisation to [info@neweconomicthinking.org](mailto:info@neweconomicthinking.org)

Further information on the ABM and related publications are available at:

<https://www.openabm.org/model/4647/version/3/view>

<http://www.lse.ac.uk/GranthamInstitute/publication/reflections-on-the-current-debate-on-how-to-link-flood-insurance-and-disaster-risk-reduction-in-the-european-union/>

[http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2014/11/Surminski\\_and\\_Eldridge\\_2014.pdf](http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2014/11/Surminski_and_Eldridge_2014.pdf)

<http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2016/02/Working-Paper-223-Jenkins-et-al.pdf>

<https://www.theccc.org.uk/wp-content/uploads/2016/07/UK-CCRA-2017-Chapter-6-Business-and-industry.pdf>

<http://www.bankofengland.co.uk/prd/Documents/supervision/activities/pradefra0915.pdf>