City-scale integrated assessment of climate impacts, adaptation and mitigation

Newcastle University: Jim Hall, Stuart Barr, Richard Dawson, Alistair Ford, Claire Walsh
University of Manchester: Sebastian Carney
Cambridge University: Terry Barker, Athanasios Dagoumas
University of Easy Anglia: Colin Harpham
University College London: Mike Batty, Steve Evans
University of Leeds: Miles Tight, Helen Harwatt
Loughborough University: Abigail Bristow, Alberto Zanni

Objectives

• To provide new integrated system-scale understanding of long term change in urban areas by analysing processes of change in:
  – Demography
  – Economy
  – Land use
  – Infrastructure
  – and their interactions

• To develop a quantified integrated assessment model to simulate their processes of change under a wide range of future scenarios.

• To use these new insights and technologies to inform decision making.
Energy Efficient Cities Initiative: Tools & Assessments
5th Urban Research Symposium – Cities and Climate Change
June 28-30, 2009, Marseille, France

Approach for development

1. Integrated framework
2. Module adaptation
3. Module linking
4. Testing and application

- Economic and demographic scenarios
- Climate scenarios
- MDM regional economics model
- Impacts assessment:
  - Flooding
  - Water resources
  - Heat

- Emissions accounting:
  - Energy (GRIP)
  - Personal travel
  - Freight transport

- Employment, population and land use model

- Testing of policy options

Overview of assessment system

Climate impacts assessment and adaptation planning

Interface for testing of policy options

Working with key London stakeholders:

- Environment Agency
- Mayor of London
- Thames Water
- Transport for London
Regional economic modelling

Employment projections for London, comparing outputs from the MDM model (labelled “Tyndall”) and figures used by the GLA. Industrial activity has been aggregated into 5 sectors.

Land use change

Two scenarios of future residential development (blue grid boxes) in 2020. Red boxes denote existing residential land. Projected population change at a ward scale under unconstrained economic growth (left) and constrained development (right).
Energy Efficient Cities Initiative: Tools & Assessments
5th Urban Research Symposium – Cities and Climate Change
June 28-30, 2009, Marseille, France

---

**Climate impacts and adaptation analysis**

Daily maximum temperature for London averaged over the summer season (June, July, August): 1961-1990 (left) and 2050s (right)

---

**Climate impacts and adaptation analysis**

Population at risk from tidal flood risk in London for different scenarios of land use change
Projections of GHG emissions for London based upon a baseline economic growth scenario with no new mitigation policies.

<table>
<thead>
<tr>
<th>Policy 1</th>
<th>CO₂ emissions 2025 2</th>
<th>% change from baseline</th>
<th>% change from 2005</th>
<th>CO₂ emissions 2050 2</th>
<th>% change from baseline</th>
<th>% change from 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>2572156</td>
<td>32.2</td>
<td></td>
<td>4073101</td>
<td>109.4</td>
<td></td>
</tr>
<tr>
<td>Promotion of Low Emissions Vehicles</td>
<td>2147451</td>
<td>-16.5</td>
<td>10.4</td>
<td>2235125</td>
<td>-45.1</td>
<td>14.9</td>
</tr>
<tr>
<td>Drivers’ Training and Performance Measures</td>
<td>2324237</td>
<td>-9.6</td>
<td>19.5</td>
<td>3524500</td>
<td>-13.5</td>
<td>81.2</td>
</tr>
<tr>
<td>Construction Consolidation Centres</td>
<td>2433212</td>
<td>-5.4</td>
<td>25.1</td>
<td>3491394</td>
<td>-14.3</td>
<td>79.5</td>
</tr>
<tr>
<td>Urban Distribution Centres</td>
<td>2478955</td>
<td>-3.6</td>
<td>27.5</td>
<td>3660207</td>
<td>-10.1</td>
<td>88.2</td>
</tr>
<tr>
<td>Vehicle Reception Points (out of hours)</td>
<td>2546320</td>
<td>-1.0</td>
<td>30.9</td>
<td>3929435</td>
<td>-3.5</td>
<td>102.0</td>
</tr>
<tr>
<td>Relaxing Delivery Times</td>
<td>2514282</td>
<td>-2.3</td>
<td>29.3</td>
<td>3802290</td>
<td>-6.6</td>
<td>95.5</td>
</tr>
</tbody>
</table>
What makes this ‘different’

- Systems analysis at city-scale
  - Address emissions, impacts, adaptation and mitigation
  - Works on the timescales of major planning and infrastructure decisions
  - Is based upon coherent national and regional economic, demographic and climate scenarios
  - Is coupled with spatially explicit simulations of land use in order to understand key vulnerabilities (e.g. flood risk) and the effects of spatial planning decisions
  - Includes the functioning of engineering infrastructure systems in a physically realistic way
  - Allows portfolios of adaptation/mitigation strategies to be explored – likely to be more effective than unilateral action
Some remaining questions

1. How far is far enough in tracking down consistency, interactions and feedbacks?
2. How can we estimate and communicate uncertainties?
3. How transferable are our insights and methods to other cities worldwide?
4. How can we build a global coalition of researchers and practitioners equipped to address these problems?
5. How can we best engage stakeholders and inform decision making?


Urban Integrated Assessment Framework –
- Demography, economy, land use, climate impacts and GHG emissions
- Urban systems scale
- Informing decision making

Future research –
- Feedback of climate impacts into the economy and land use
- Application to other cities worldwide
City-scale integrated assessment of climate impacts, adaptation and mitigation

Claire.Walsh@newcastle.ac.uk
School of Civil Engineering and Geosciences
Newcastle University

Co-authors
Newcastle University: Jim Hall (Programme Leader), Stuart Barr, Richard Dawson, Alistair Ford, Claire Walsh
University of Manchester: Sebastien Carney
Cambridge University: Terry Barker, Athanasios Dagoumas
University of East Anglia: Colin Harpham
University College London: Mike Batty, Steve Evans
University of Leeds: Miles Tight, Helen Harwatt
Loughborough University: Abigail Bristow, Alberto Zanni