The Comparative Genetics of Cities

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Extending the Focus of Urban Modelling Tools

Michael Batty
University College London

m.batty@ucl.ac.uk
http://www.casa.ucl.ac.uk/

Outline

- Not One Model but Many
- Better Urban Science Through Models
- Communicating Models to Scientists and Stakeholders: Visualisation
- Towards a Theory of Cities based on Energetics
- Models of Urban Infrastructure
- Building Scenarios: Predict to Inform and Engage the Debate about the Future: Climate Change In London

Not One Model but Many

There are quite well developed urban models based on the interaction between land use and transport that have been developed over the last 50 years

There has been a tendency for these models to expand to embrace more and more sectors of the city system now being referred to as ‘large scale models’

These models take a long time to ‘run’. E.G. The London traffic model LTS, The ILUTE model of Toronto

This is not the future: the future in my view is of many partial models, some coupled perhaps

There are many other reasons for smaller, sharper models

Manageability and communicability, immediacy

The fact that cities cannot be modelled ‘all in one piece’

The fact that we do not have and probably never will have comprehensive theory – physical systems in the city, for example, have very different functions from social and economic

Last but not least, what Greenberger, Crenson and Crissey 40 years ago called ***‘Counter Modelling’***

Better Urban Science Through Models

We need much better urban science. Currently in land use transport models, we have a very rudimentary science based on economic location and spatial interaction

There are alternative approaches which reflect physical form and urban self-organisation based on complexity theory with hints about energy

Models of physical systems in cities, energy, climate and so on tend to be quite divorced from the dominant social and economic models, and operate at very different spatial scales

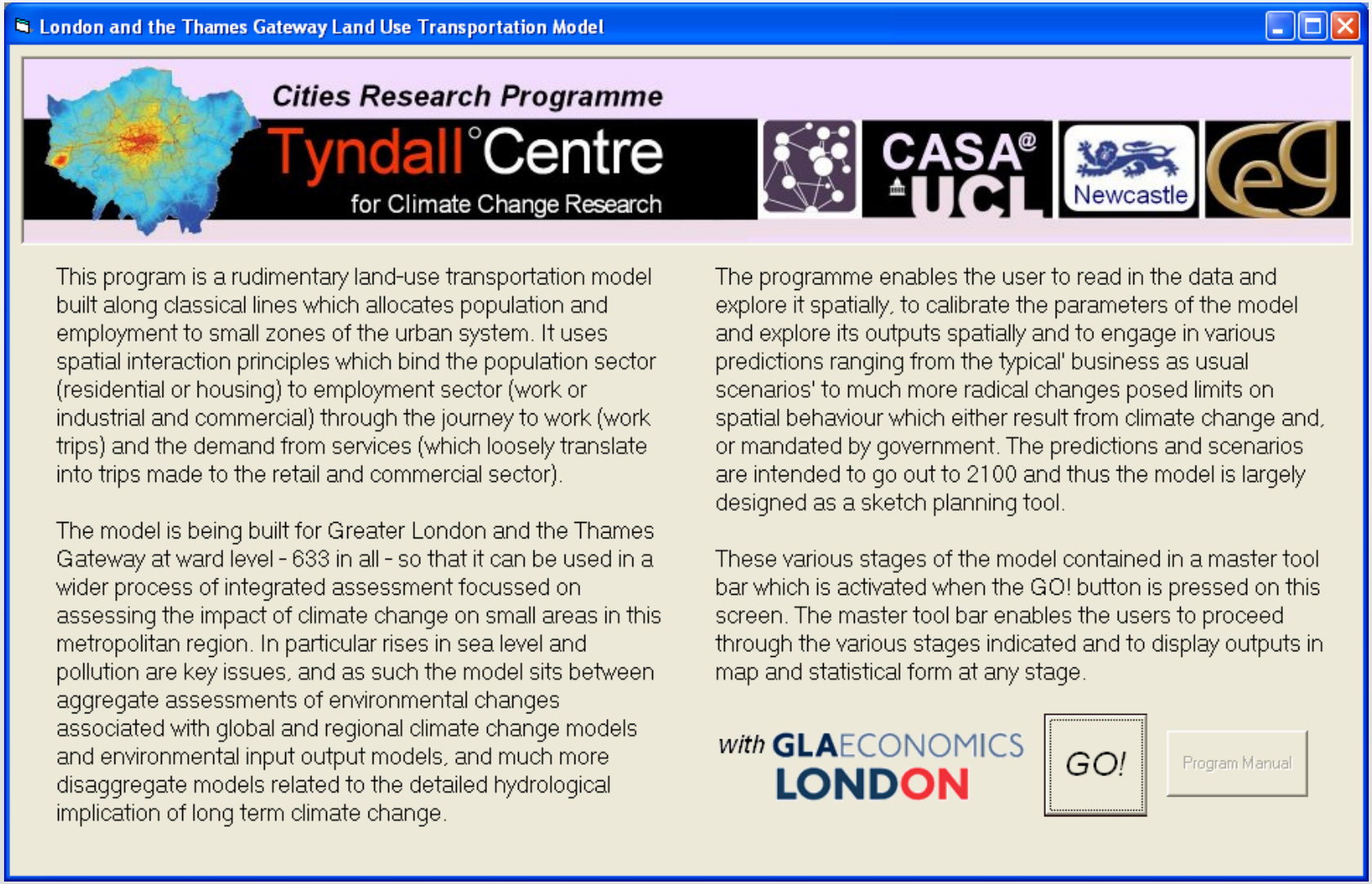
Communicating Models to Scientists and Stakeholders: Visualisation

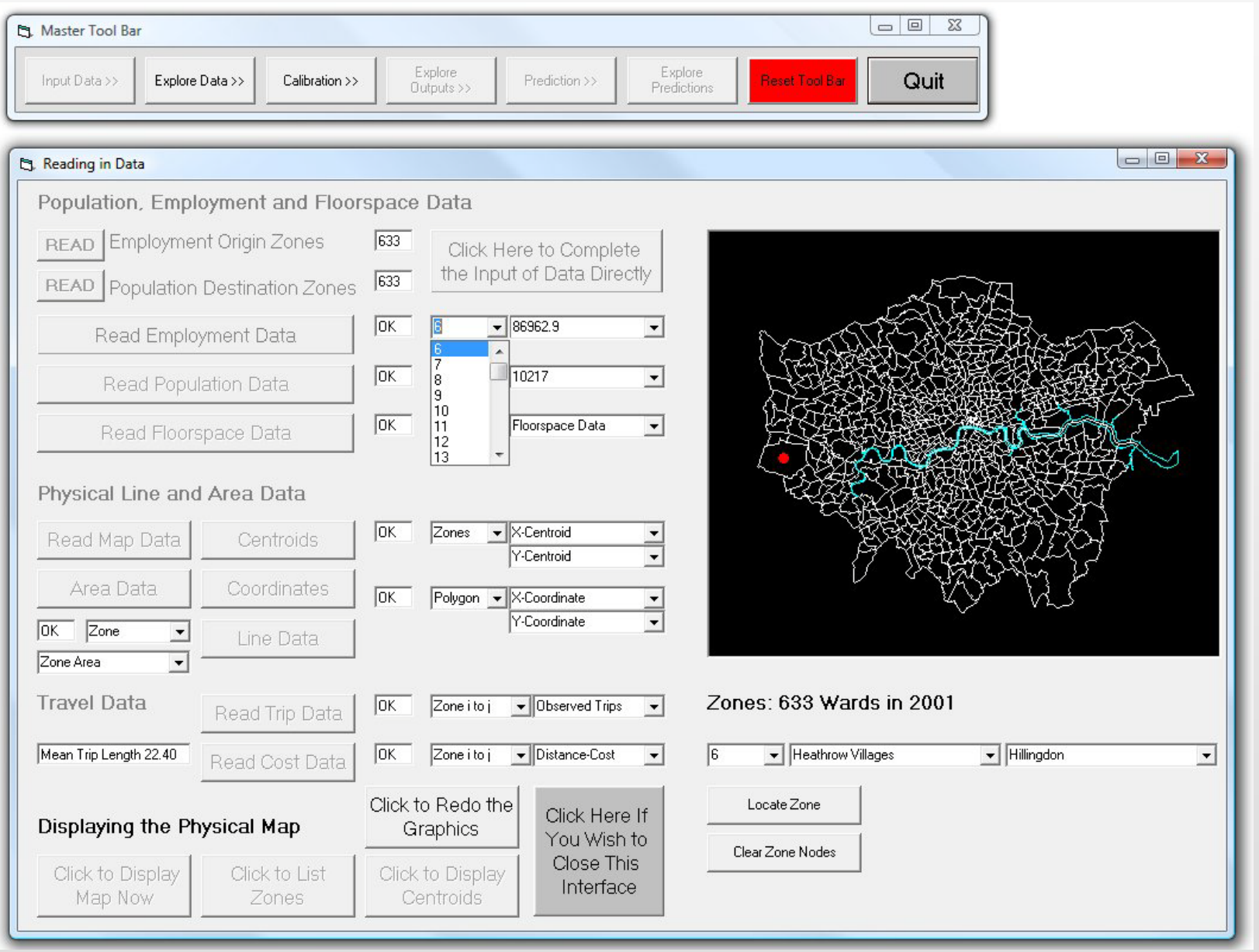
We need to progress our science to stakeholders who range from other scientists to informed decision-makers

We have made very good progress in this area with visualising helping us to communicate between spatial scales

Let me show you what we can do with our Tyndall land use transport model which is highly visual and enables integration across scales

Visual Analytics and Modelling Processes

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Click to List Zones
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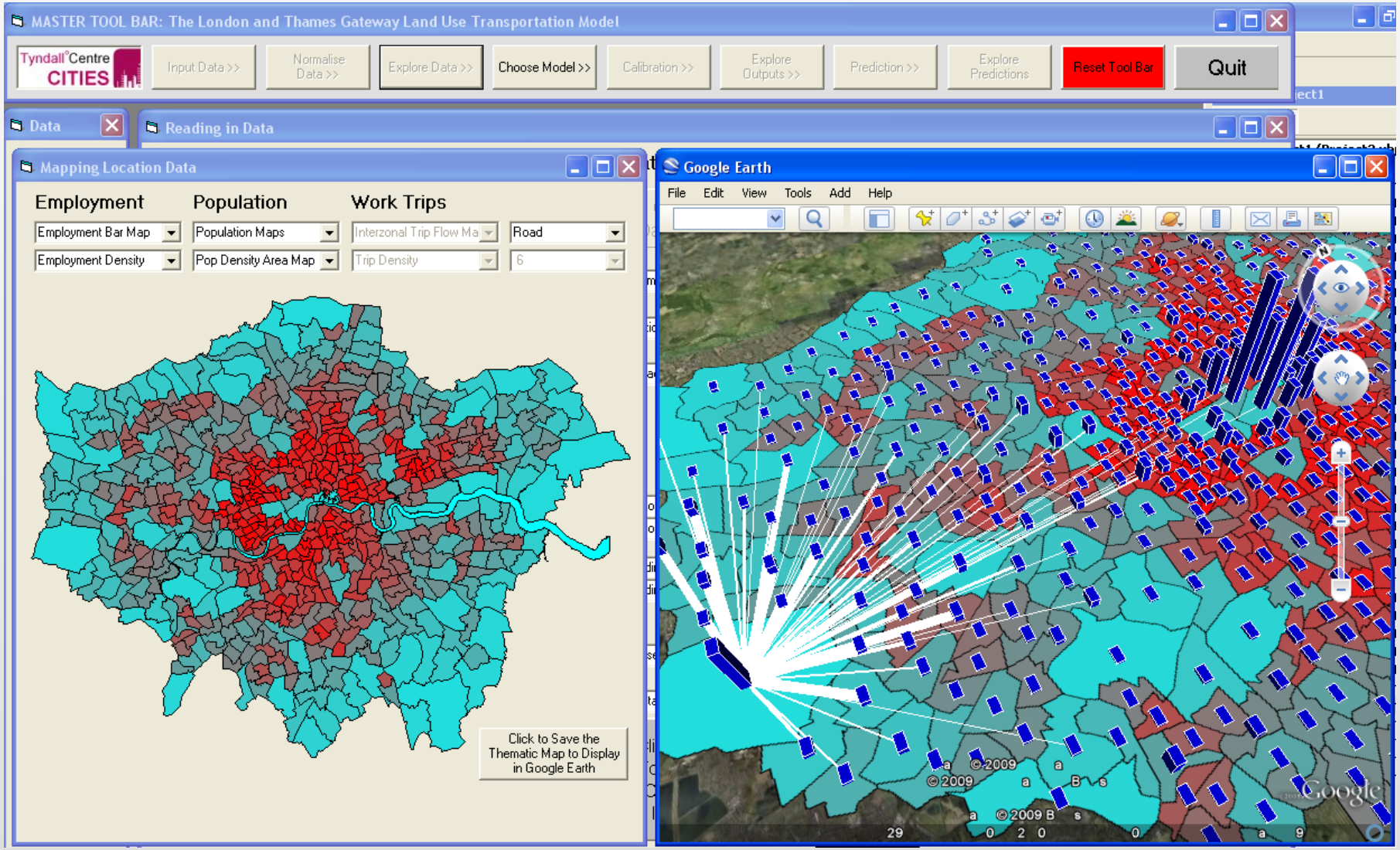
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6
Click to Save the Thematic Map to Display in Google Earth
Google Earth
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© 2009
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I will show you a piece of movie from the demo we did before this afternoon session to give you an idea of the power of this medium

CLICK HERE

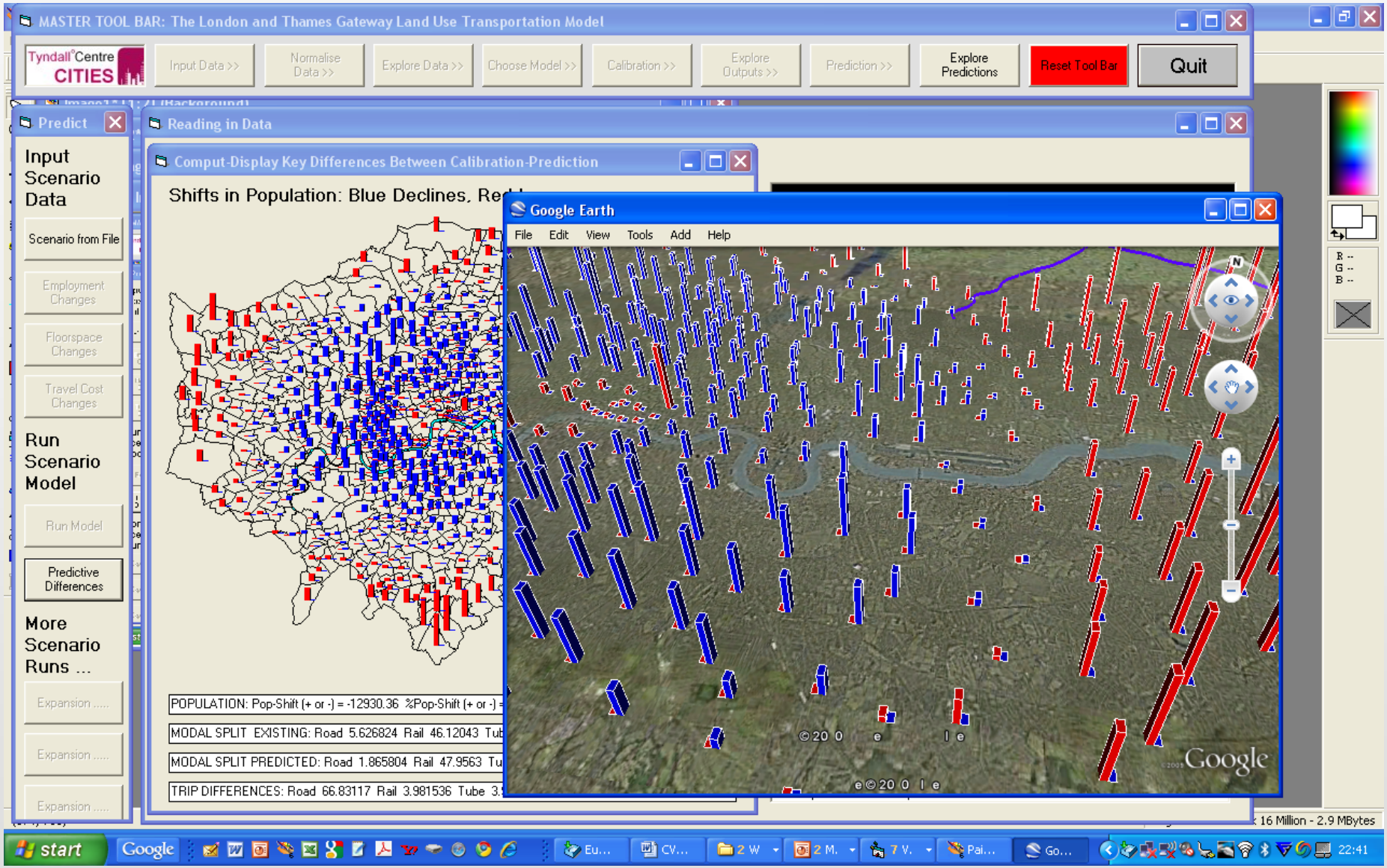
Towards a Theory of Cities based on Energetics

To face the current problems which are beginning to dominate such as energy and climate we do not have good models

We are only just beginning to have integrated modes of assessment e.g. Tyndall

We need much better models of how people use energy and how energy gets used and renewed as cities change over time

We have some hints in ideas about entropy and exergy as I can illustrate as follows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Predict
Input Scenario Data
Scenario from File
Employment Changes
Floorspace Changes
Travel Cost Changes
Run Scenario Model
Run Model
Predictive Differences
More Scenario Runs ...
Expansion .....
Expansion .....
Expansion .....
Reading in Data
Comput-Display Key Differences Between Calibration-Prediction
Shifts in Population: Blue Declines, Red
POPULATION: Pop-Shift (+ or -) = -12930.36 %Pop-Shift (+ or -)
MODAL SPLIT EXISTING: Road 5.626824 Rail 46.12043
MODAL SPLIT PREDICTED: Road 1.865804 Rail 47.9563
TRIP DIFFERENCES: Road 66.83117 Rail 3.981536 Tube
Google Earth
File Edit View Tools Add Help
Google
start
22:41

Models of Urban Infrastructure

We need much better models of urban infrastructure and how these can be integrated and coupling in strong and loose ways with land use transport

We need much better models of how infrastructure is supplied in cities and how demand & supply interact

This echoes a more general point about how our models deal with markets

By coupling energy, infrastructure and land use transport we are likely to discover many counter intuitive effects

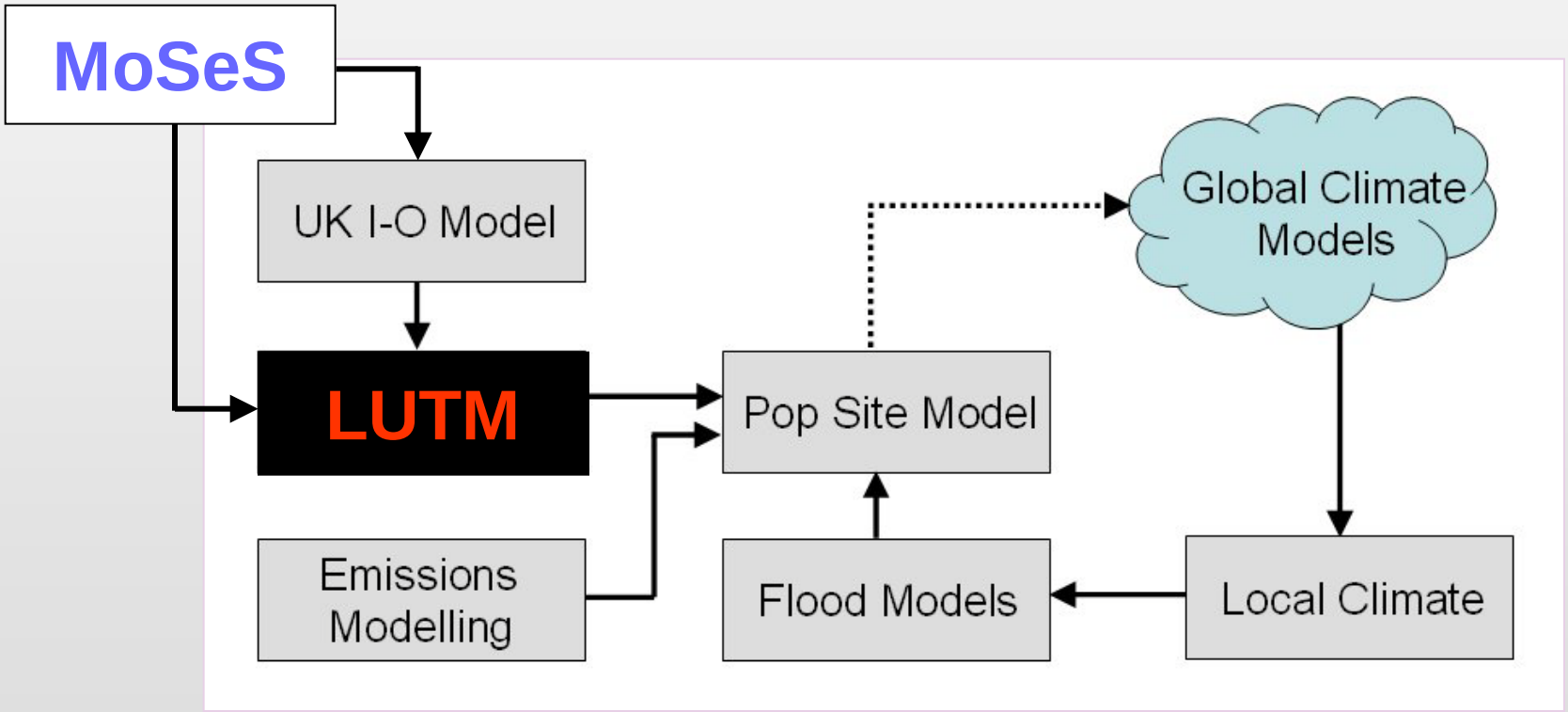
Building Scenarios: Predict to Inform and Engage the Debate: Climate Change In London

In our Tyndall models that Rich Dawson talked about this morning, we are integrating relatively simple models across scales

This is because the problem demands very different kinds of models from the national (even global) to the local site specific scale

From economic to urban to physical models all quite different – we need good visualization even to communicate these ideas to ourselves. Here is the current structure

The various models are chained or coupled together as follows and we need to consider adding other sectors such as demography



Conclusions

Models should be simpler than we tend to make them

There should be a range of models with more being simple than complex, and more being smaller scale than larger

There should be many of them

Models should compete with one another, we should rejoice in counter modeling

I will not steal Carl's thunder for he will quote good precedent about simple models in his talk now ….

You can see an early movie of the Tyndall LUTM model on our web site if you search from 'transport' at

www.casa.ucl.ac.uk

http://www.casa.ucl.ac.uk/transportmodel/transportmodel.asp