From the Auvergne commuting network to every commuting network

Maxime Lenormand, F. Garguilo, Sylvie Huet

From the Auvergne commuting network to every commuting network

M. Lenormand[1], F. Gargiulo[1], S. Huet[1]
[1]LISC, Cemagref, Clermont-Ferrand, France

The municipalities of the Auvergne Region, France

NODES = 1310 MUNICIPALITIES
A **LINK** exits between 2 municipalities if someone commutes between them.
Number of un-oriented links = 31.722; number of reciprocal links =6451
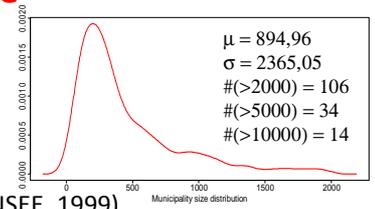
Data: French Census, 1999; delivered by the Maurice Halbwachs Center (INSEE, 1999).

$\mu = 894,96$
$\sigma = 2365,05$
#(>2000) = 106
#(>5000) = 34
#(>10000) = 14

Municipality size distribution

To each node are associated:
1- the number of workers looking for a job outside the municipality (out-commuters)
2- the number of available jobs (in-commuters)

s_{OUT}
s_{IN}
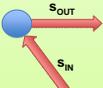
At each time step:
1- one municipality is selected
2- one of the out-commuters is selected
3- the selected commuter chooses the working destination between the municipalities where some jobs are available according to:

$$P_{i \in I \to J} = \frac{\left(\frac{\langle d \rangle}{d_{IJ}}\right)^{\beta}}{\sum_{J \mid S_{IN} \neq 0} \left(\frac{\langle d \rangle}{d_{IJ}}\right)^{\beta}}$$

$d = distance$
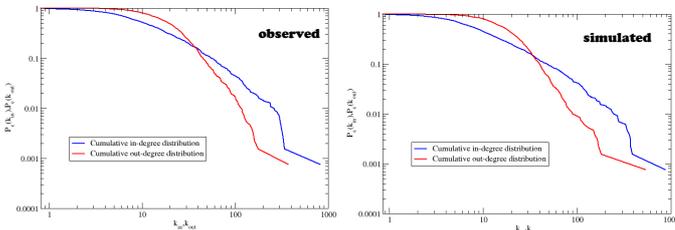
Model description and calibration
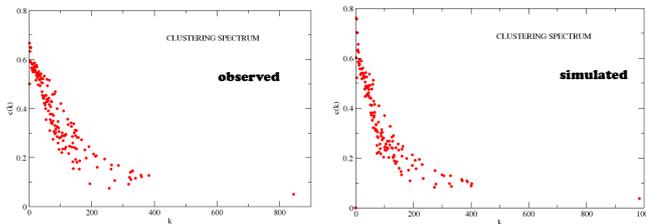
MODEL CALIBRATION using the distance distribution

Observed
Simulated

$\beta = 3.18$
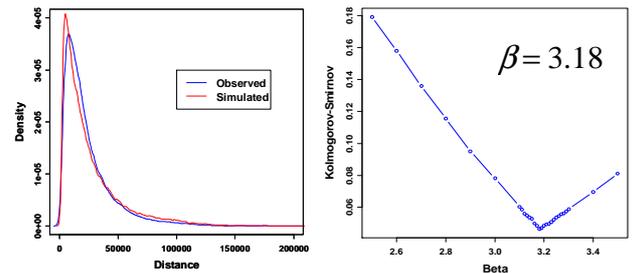
Observed versus simulated network

A well globally simulated network

In and out degree distributions

observed

Cumulative in-degree distribution
Cumulative out-degree distribution

simulated

Cumulative in-degree distribution
Cumulative out-degree distribution

Clustering coefficient as a function of the degree

CLUSTERING SPECTRUM

observed

CLUSTERING SPECTRUM

simulated

67,94±0,33% of individuals commute in the right place.

	Observed	Simulated
Link created		
Link not found		

Percentage of individuals who commute in the right place
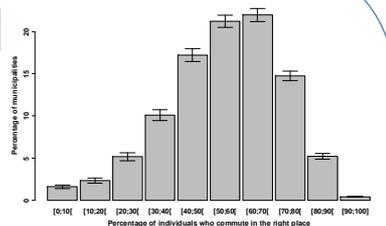
A well locally simulated network

Created
Not found

Minimum size of flows

Created
Not found

Percentage of links

Created
Not found

Percentage of links (flows>3)

Mean ± standard deviation for 100 replicats

A high percentage of individuals who commute in the right place

A weak percentage of created and not found links

But the created and not found links have **mostly** a weight equal to 1
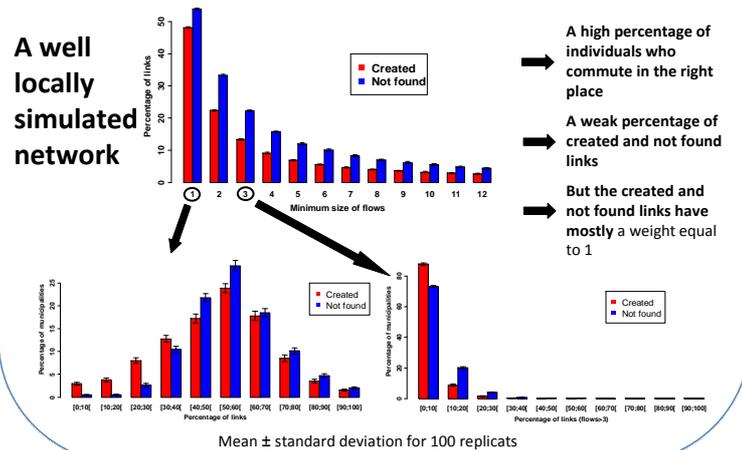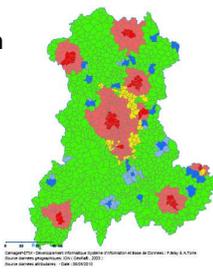
The ZAUER Typology respected

1. Urban area (≥ 5000 jobs)
2. Peri-urban area (≥40% pop. employed in urban area)
3. Multipolarised municipality (≥ 40% pop. employed in several urban areas)
4. Rural employment area (≥ 1500 jobs)
5. Rural employment area outer (≥40% pop. employed in rural area)
6. Rural municipalities

1. Urban area
2. Peri-urban area
3. Multipolarised municipality
4. Employment area
5. Employment area outer
6. Rural municipality

Observed

Simulated

average clustering coefficient
clustering coefficient for a single commune

Average in-degree
Average out-degree

Laboratory of Engineering for Complex Systems

wwwlisc.clermont.cemagref.fr

Cemagref
Science, water & land management