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Cities and regions in Britain through hierarchical percolation

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Review timeline

Original submission:	14 December 2015
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Note: Reports are unedited and appear as submitted by the referee. The review history appears in chronological order.

Review History

RSOS-150691.R0 (Original submission)

Review form: Reviewer 1

Is the manuscript scientifically sound in its present form?
Yes

Are the interpretations and conclusions justified by the results?
Yes

Is the language acceptable?
Yes

Is it clear how to access all supporting data?
I do not know, I could not find explicit mention in the paper about how to access the supporting data

Do you have any ethical concerns with this paper?
No

Have you any concerns about statistical analyses in this paper?
No

Recommendation?
Accept with minor revision (please list in comments)

Comments to the Author(s)
This paper is a multi-scale analysis of spatial discontinuities in Britain through examining the street pattern conceived as a footprint of repeated geographical connections on the long run and matching the level of wealth and urban development. The authors first briefly review different approaches that were used for revealing the hierarchical structure of circulation networks and population nodes. The method they choose here stems from percolation theory and is applied first on street intersections and second to the entire street network. Clusters of highly connected nodes are defined according to successive distance thresholds and connectivity levels in the network. Discontinuities are thus revealed at different scales. They conform mostly to the urban hierarchy and regional differentiations in Britain. A complementary fractal analysis is however necessary for identifying more accurately the transition between urban and rural settlements and this methodology is validated by comparing results with satellite images of built up areas.
This is a remarkable paper well constructed and well explained. The conclusions are sound, and if some were already part of geographical knowledge ("road intersections serve as a good proxy for urbanization", W. Garrison could be quoted?) the major one is really original and convincing: "the percolation process on the point patterns recovers the hierarchical organisation of the system". I also appreciate the cautiousness of the authors when they repeatedly warn against the temptation of considering as universal the values they estimate, that on the contrary result of specific regional and historical processes. The methodology they propose has many advantages and will probably fruitfully be applied to other cases. This could contribute to provide an explanation to another of their interesting findings about the coincidence between the distance thresholds for which the maximum fractal dimension of the system of clusters is observed and the delineation of urban built-up areas.
To me only a few minor revisions could be useful for improving again the legibility of this excellent paper:
Details
On figures 1 and 2 the largest cluster size is said to be "normalized", but how this normalization has been made is not explained in the text
On figure 4 the unit used for measuring the size of clusters should be provided in the legend (number of nodes (intersections)? Of cells?). There is a misspelling in the name of Newcastle at the bottom of the figure.
Page 5 line 58: I do not understand why Liverpool, Manchester, Leeds and Sheffield are described as "post-industrial cities" (they are cities of the first industrial revolution) and line 60 why they could be considered as an "agglomeration" according to the Northern Powerhouse proposal (is that an official denomination? Otherwise the expression does not coincide with the usual acceptation of an "urban agglomeration" in geographical literature).
Page 8 line 27-28 perhaps briefly recall the definition of the three fractal dimensions D0, D1 and D2
Page 8 about the correspondence between fractal measurements and the Corine dataset, the paper could mention the reference of a paper that explored this for a set of European cities (Guérois M., Pumain D. 2008, Built-up encroachment and the urban field: a comparison of forty European cities, Environment and Planning A, 40, 2186-2203).
Page 11 the caption of figure 7 is a little elliptic and could be made more explicit

Review form: Reviewer 2

Is the manuscript scientifically sound in its present form?
Yes

Are the interpretations and conclusions justified by the results?
Yes

Is the language acceptable?
Yes

Is it clear how to access all supporting data?
It is clear from reading the paper how to access data.

Do you have any ethical concerns with this paper?
No

Have you any concerns about statistical analyses in this paper?
No

Recommendation?
Accept with minor revision (please list in comments)

Comments to the Author(s)
This manuscript focuses on a hierarchical structure of cities and regions in Britain. To unveil a hierarchical structure of connections, the author studied connected components of percolations on the intersection points and the street network as the distance threshold varies. Their results show a multiplicity of percolation transitions, where the transitions for small scales occur with forming the core of cities and those with large scales occur with merging several regions. The authors also studied the fractal dimension of connected components with varying distance threshold. The authors found that the observed network are in good correspondence with real boundaries of cities when the fractal dimension is maximized.

This manuscript is well written. The results seem to be reasonable. I think that this manuscript will get reader's interest, and therefore I recommend this manuscript for the publication.

I have a few minor points and comments.

minor points:

1) The authors should explain the color-coding in the caption of Fig.2, because readers cannot find what each color means unless they go on to Fig.4 or Appendix [lines 54-57, page 14].

2) The authors probably should mention the number of sites and average degree of networks. Such information will be helpful for specialists.

3) d at the line 20 of page 14 should be italic.

comment:

The authors considered percolation on the intersections and the street network. But, they only calculated the fraction of the largest component. It is possible to consider other quantities, such as

the correlation length and the average cluster size. I hope that the authors will investigate the distribution function of cluster sizes n_s in the revised manuscript or in future works, because I have a following question. At which distance does n_s obey a power-law in the present case? It is well known that for percolation on lattices or networks n_s obeys a power-law at the critical threshold (that is, a power-law of n_s means a criticality of a system). But, the above question is not trivial because the present model shows a multiplicity of transitions. A power-law may be observed in several points or a finite region of distance. Multiplicity of transitions may suggest that the formation of cities is something like a self organized criticality.

Decision letter (RSOS-150691)

20-Jan-2016

Dear Dr Arcaute

On behalf of the Editors, I am pleased to inform you that your Manuscript RSOS-150691 entitled "Cities and Regions in Britain through hierarchical percolation" has been accepted for publication in Royal Society Open Science subject to minor revision in accordance with the referee suggestions. Please find the referees' comments at the end of this email.

The reviewers and handling editors have recommended publication, but also suggest some minor revisions to your manuscript. Therefore, I invite you to respond to the comments and revise your manuscript.

• Ethics statement
If your study uses humans or animals please include details of the ethical approval received, including the name of the committee that granted approval. For human studies please also detail whether informed consent was obtained. For field studies on animals please include details of all permissions, licences and/or approvals granted to carry out the fieldwork.

• Data accessibility
It is a condition of publication that all supporting data are made available either as supplementary information or preferably in a suitable permanent repository. The data accessibility section should state where the article's supporting data can be accessed. This section should also include details, where possible of where to access other relevant research materials such as statistical tools, protocols, software etc can be accessed. If the data has been deposited in an external repository this section should list the database, accession number and link to the DOI for all data from the article that has been made publicly available. Data sets that have been deposited in an external repository and have a DOI should also be appropriately cited in the manuscript and included in the reference list.

If you wish to submit your supporting data or code to Dryad (http://datadryad.org/), or modify your current submission to dryad, please use the following link:
http://datadryad.org/submit?journalID=RSOS&manu=RSOS-150691

• Competing interests
Please declare any financial or non-financial competing interests, or state that you have no competing interests.

• Authors' contributions
All submissions, other than those with a single author, must include an Authors' Contributions section which individually lists the specific contribution of each author. The list of Authors should meet all of the following criteria; 1) substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; 2) drafting the article or revising it critically for important intellectual content; and 3) final approval of the version to be published.

All contributors who do not meet all of these criteria should be included in the acknowledgements.

We suggest the following format:
AB carried out the molecular lab work, participated in data analysis, carried out sequence alignments, participated in the design of the study and drafted the manuscript; CD carried out the statistical analyses; EF collected field data; GH conceived of the study, designed the study, coordinated the study and helped draft the manuscript. All authors gave final approval for publication.

• Acknowledgements
Please acknowledge anyone who contributed to the study but did not meet the authorship criteria.

• Funding statement
Please list the source of funding for each author.

Because the schedule for publication is very tight, it is a condition of publication that you submit the revised version of your manuscript within 7 days (i.e. by the 29-Jan-2016). If you do not think you will be able to meet this date please let me know immediately.

To revise your manuscript, log into https://mc.manuscriptcentral.com/rsos and enter your Author Centre, where you will find your manuscript title listed under "Manuscripts with Decisions". Under "Actions," click on "Create a Revision." You will be unable to make your revisions on the originally submitted version of the manuscript. Instead, revise your manuscript and upload a new version through your Author Centre.

When submitting your revised manuscript, you will be able to respond to the comments made by the referees and upload a file "Response to Referees" in "Section 6 - File Upload". You can use this to document any changes you make to the original manuscript. In order to expedite the processing of the revised manuscript, please be as specific as possible in your response to the referees.

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5) Included your supplementary files in a format you are happy with (no line numbers, vancouver referencing, track changes removed etc) as these files will NOT be edited in production

Once again, thank you for submitting your manuscript to Royal Society Open Science and I look forward to receiving your revision. If you have any questions at all, please do not hesitate to get in touch.

Best wishes

Andrew Dunn
Senior Publishing Editor, Royal Society Open Science

on behalf of Des Higham
Subject Editor, Royal Society Open Science
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