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2 PhD opportunities in urban remote sensing & population modelling

The successful candidates will be part of the 4-years research project “Modelling and forecasting African Urban Population Patterns for vulnerability and health assessments” (MAUPP).

Project description

The population of Africa is predicted to double over the next 40 years, driving exceptionally high urban expansion rates. Urbanization has profound social, environmental and epidemiological implications and makes spatial and quantitative estimations of urban change, population density and socio-economic characteristics valuable information for epidemiology and vulnerability assessment. The performance of urban expansion models largely depends on the quality and type of data available, which have so far been limited, and reduced the confidence and the applications of models for Africa. Satellite remote sensing offers an effective solution for mapping settlements and monitoring urbanization at different spatial and temporal scales and allows to link empirical observations with urban theory. Moreover, remote sensing data have a great potential to map and predict intra-urban variations in population density because they provide information on the morphology of different residential patterns that can be linked to different population densities and socio-economic parameters.

The general objective of the project is to improve our spatial understanding, prediction and forecast of urbanization and urban population in sub-Saharan Africa through the use of remote sensing and spatial modelling. The project addresses two specific objectives using HRRS (high resolution remote sensing) and VHRRS (very high resolution remote sensing), both with optical and radar sensors:

- Produce an urban expansion model at high spatial resolution for sub-Saharan African cities.
- Understand and predict intra-urban variations in human population density in sub-Saharan Africa.

The project involves four research teams:

- LUBIES, ULB (HRRS, human population mapping, urban models): Catherine Linard & Marius Gilbert
- ANAGEO/IGEAT, ULB (VHRRS, urban mapping, geography of urbanization): Eléonore Wolff
- Signal Image Centre, Royal Military Academy of Belgium (SAR processing, data & image fusion): Michal Shimoni
- Department of Geography and Environment, University of Southampton, UK (human population mapping, leaders of the WorldPop consortium): Andy Tatem

PhD opportunity at LUBIES

Research description

The candidate will first contribute to the development of an automated method to delineate the urban extent of 30 to 50 African cities over the last 30 years using combined high resolution (HR ~30 m) archived SAR and optical data (in collaboration with the Signal Image Centre/Royal Military Academy).

Spatial statistical modelling methods will then be used to (i) simulate urban expansion of large African cities and (ii) map and predict intra-urban variations in population density at a high resolution. The database of land cover change to urban over the last 30 years across 50 cities will be used to calibrate and validate the urban expansion model. The detailed population densities identified using VHRRS data (second PhD opportunity) will be used to calibrate and validate models predicting intra-urban variations in population density using HRRS data. The two models developed at a high resolution will be automated in order to be applied to every large city in Africa. Outputs will be integrated to multi-temporal human population distribution datasets and made freely available on the WorldPop website (www.worldpop.org.uk).

Profile

We are looking for an enthusiastic candidate holding an MSc in geography, bioengineering or in related disciplines. The candidate should have previous experience in the use of GIS and statistical analysis and modelling. An experience in remote sensing is an asset, but not essential. The candidate is expected to be fluent in English or French.

Salary and duration:

4 years, presumably starting on the 1st of October 2014.

Grant's estimated net salary/month: 1850 EUR.

Application

Please submit your application as PDF including a motivation letter, a detailed CV mentioning grades for each academic year, any publication and the details of two referees.

Application must be addressed by email to clinard@ulb.ac.be (Dr. Catherine Linard) before 30 of August 2014.

PhD opportunity at ANAGEO/IGEAT

Research description

The research will focus at the scale of the city on the analysis of the urban morphology and its relations with population density in Sub-Saharan Africa.

For 3 African cities, the first objective is to develop a generic method of land-use mapping using VHRRS data complemented by publicly available datasets such as Google Earth (GE) and OpenStreetMap (OSM).

Using the resulting land use map and available census data, the second objective is to identify, characterize and predict intra-urban variations in population density. The results will be compared to those of the HRRS analysis (see first PhD opportunity) in order not only to validate the HR model and to optimize its use, but also to identify what physical factors controlling human population density can be detected with VHRRS data but not with HRRS data only.

The third objective is to improve our understanding of the drivers behind the changes in human population density within cities using VHRRS data. Factors related to the socio-economic level of residential populations and to the historical evolution of cities will be explored in order to evaluate their impact on the past, present and future population density of city neighbourhoods.

Required skills

The candidate will hold an MSc in geography (or in a related discipline). He/she should be skilled in remote sensing and GIS analysis. Previous experience in these domains is an asset (VHRRS data processing, spatial analysis and modelling, eCognition, PCI Geomatica and ArcGIS). He/she should be interested in urban development in Africa. He/she should be fluent in English.

Salary and duration

4 years, presumably starting on the 1st of October 2014.

Grant's estimated net salary/month: 1850 EUR.

Application

Please submit your application in the form of one PDF file including a motivation letter, a detailed CV mentioning grades for each academic year and publications, copies of certificates and the details of two referees.

Application must be addressed by email to ewolff@ulb.ac.be (Prof. Eléonore Wolff) before the 30th of August 2014.