Mobile Data for Humanitarian Action

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I. Context

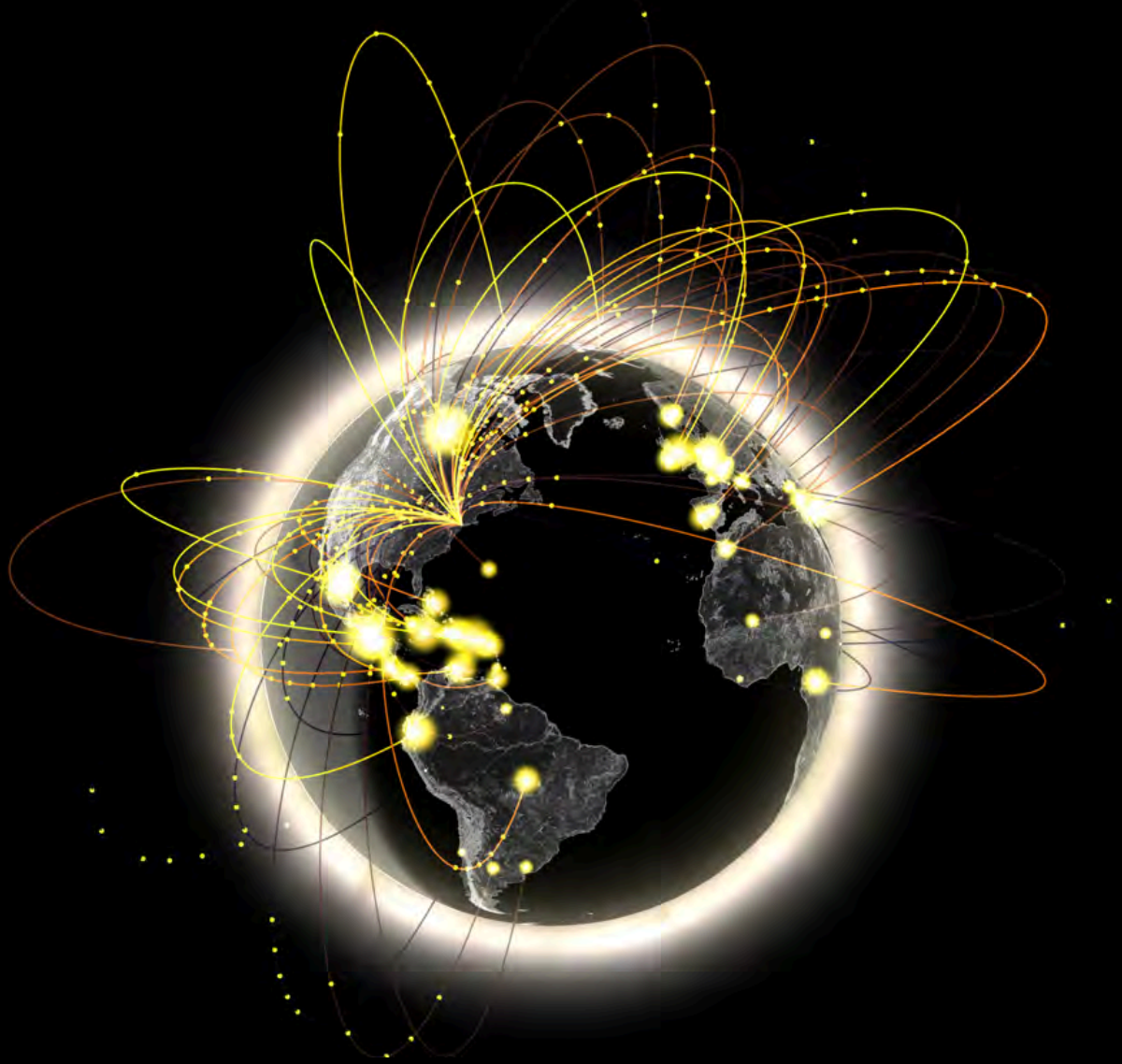


Image credit: Aaron Koblin

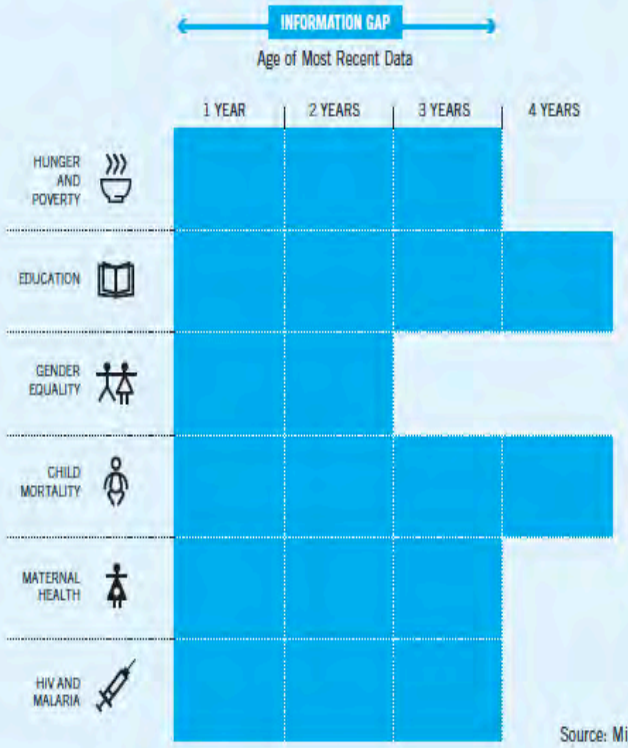
24 hours of global phone calls and Internet traffic flowing through New York City





The Information Gap

Household-level data is so hard to collect that the information being used to track development progress is frequently out of date. We know what happened in the past but not what's happening in the present. Real-time data could strengthen progress indicators by closing the information gap.



Source: Millennium Development Goals Report 2011


If only I had some data…



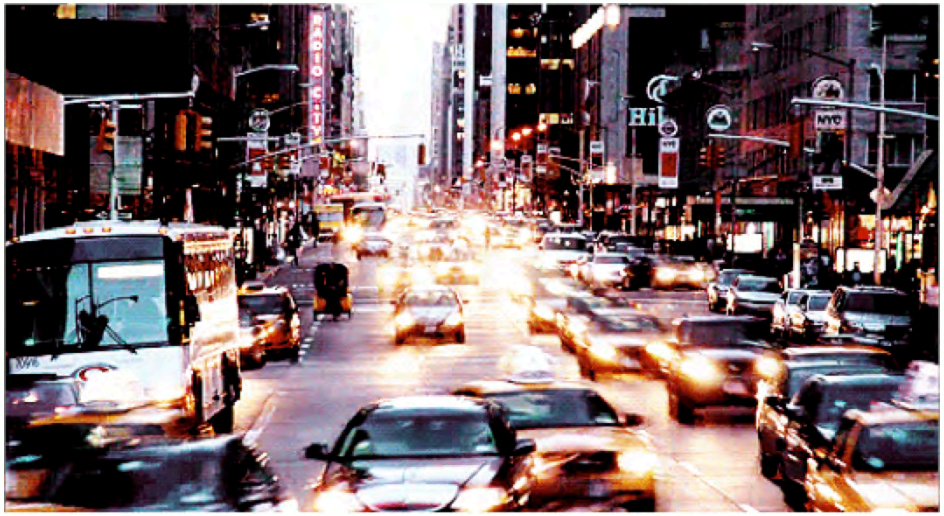
Kamal Muara
Tanjung Priuk
Koja
Kapuk Muara
Pegadungan
Jurumudi
Kapuk
Cengkareng Timur
Duri Kepa
Kayu Putih
Gondrong
Jatinegara Kaum
Grogol Utara
Kunciran Indah
Parung Serab
Pondok Betung
Rempoa
Lengkong Wetan
Jombang
Jatikrama
Tanjung Barat


07:07
JEU
VEN
SAM
DIM
LUN
MAR
MER

How private sector sees the world…



Would you cross the street based on information that was five minutes old?





Global Pulse

Vision

A real-time understanding of human well-being

Mission

Harness big data for sustainable development and humanitarian action





Pulse Lab NYC
Est. 2010

Pulse Lab Jakarta
Est. 2012

Pulse Lab Kampala
Est. 2013





Big Data for Development: 3 Opportunities

1. Enhanced Early Warning: Earlier detection of anomalies and events allows rapid response to crises.

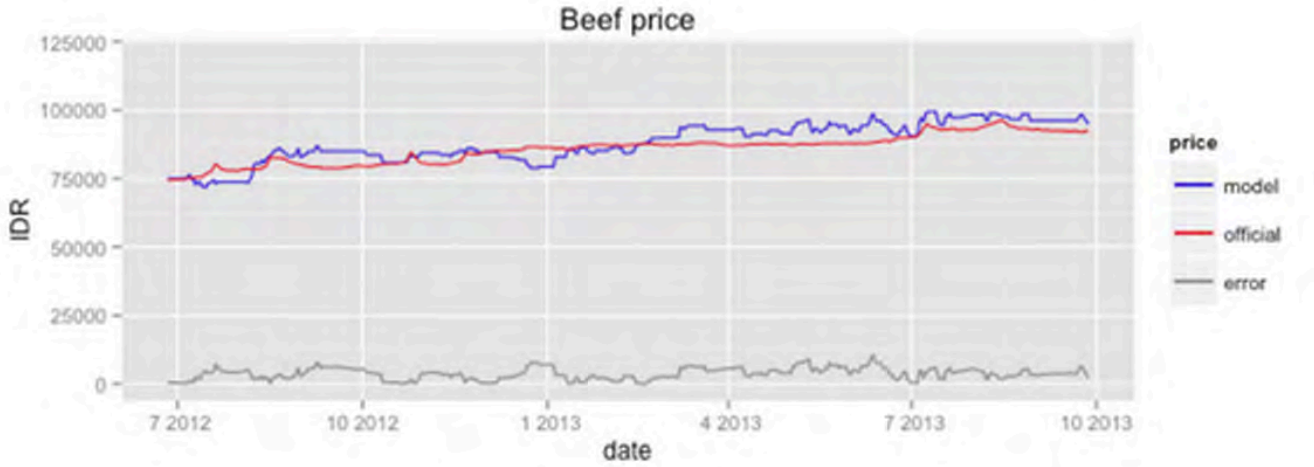
2. Real-Time Awareness: Real-time trend analysis of population activities and dynamics can inform the design and targeting of programmes and policies.

3. Real-time Evaluation: Real-time feedback from citizens, and measurement of behavior change, allows for adaptive course corrections.

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PROJECT: Nowcasting Food Prices in Indonesian Twitter

PARTNERS: WFP, Ministry of Planning, KAIST





What is done by telecom companies

Population Movement

Spending Patterns

Communication Patterns

Demographic Segmentation



How it can serve development

Health

Food Security

Migration

Infrastructure

Safety & Security

Employment

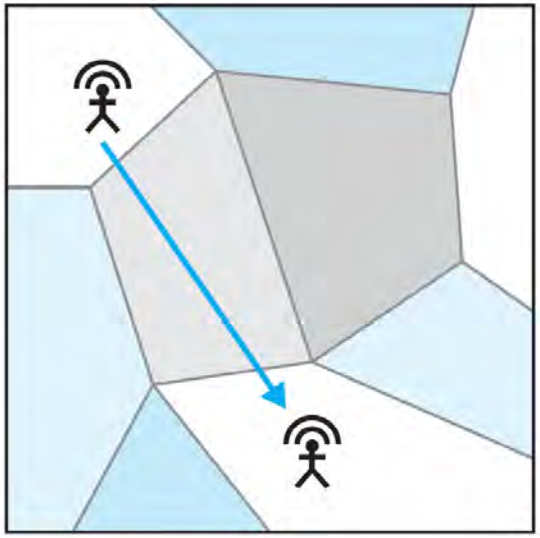
Water

Call Detail Records

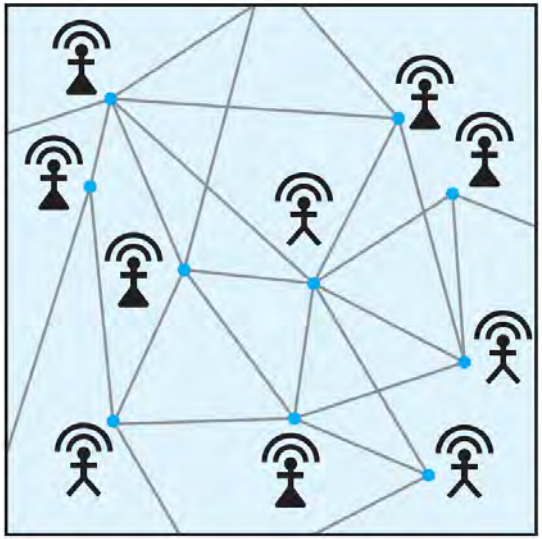
CDR Format:

CALLER ID	CALLER CELL TOWER LOCATION	RECIPIENT PHONE NUMBER	RECIPIENT CELL TOWER LOCATION	CALL TIME	CALL DURATION
X76VG588RLPQ	2°24' 22.14", 35°49' 56.54"	A81UTC93KK52	3°26' 30.47", 31°12' 18.01"	2013-11-07T15:15:00	01:12:02

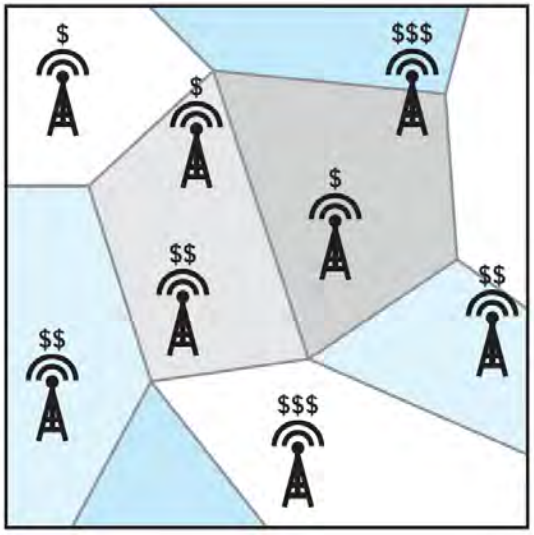
Mobility



Social Interaction

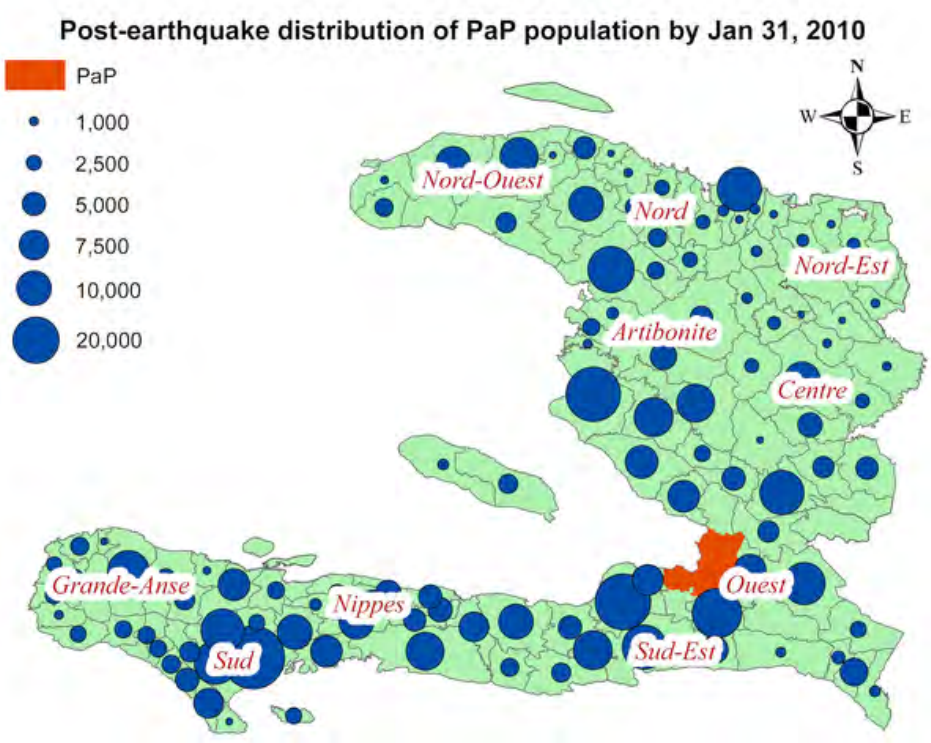


Economic Activity



II. Examples

CDRs to study population migrations after Haiti's Earthquake



BBC News Sport Weather Travel Future Autos

NEWS TECHNOLOGY

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2 September 2011 Last updated at 16:22 GMT

Share

Mobile phones help to target disaster aid, says study

Mobile phones of people fleeing natural disasters can be used to target emergency aid according to a new study.

The report reveals how scientists mapped population movements following the Haiti earthquake based on location data from two million handsets.

That information allowed aid organisations to channel relief supplies to those areas most in need.

Researchers are now setting up a non-profit organisation to provide location analysis for future disasters.

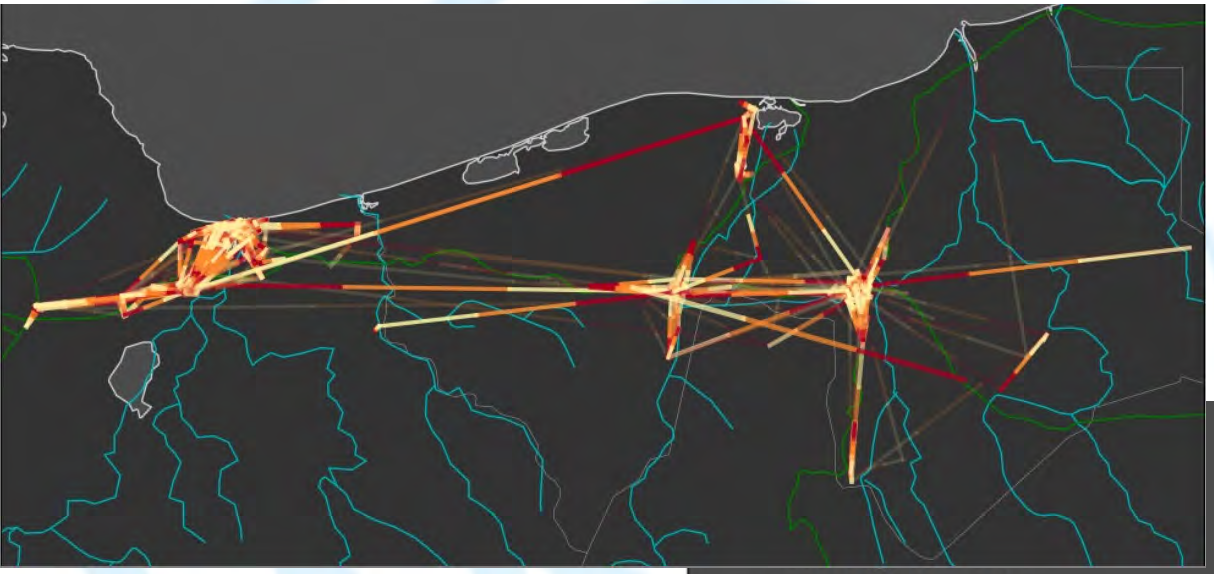


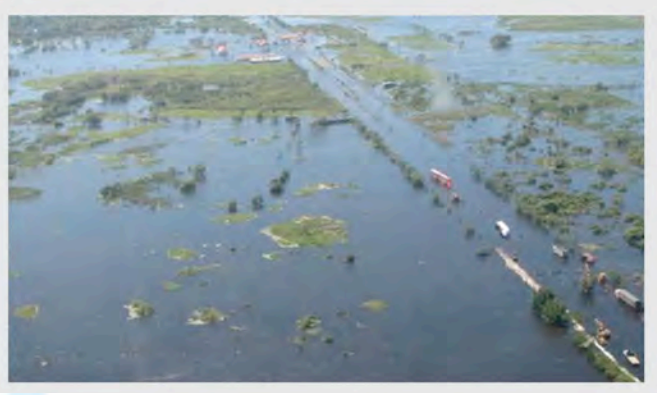
Data from the Digicel network in Haiti was used to estimate population movement

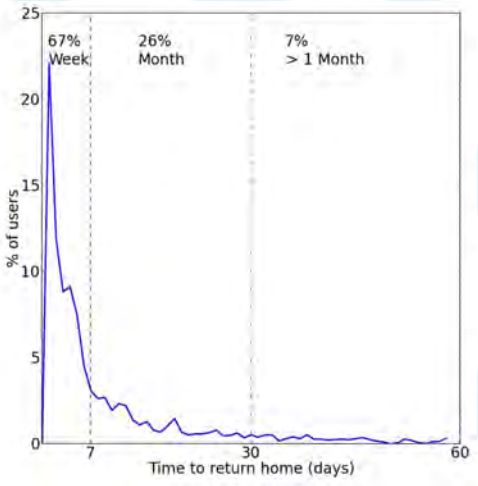
Research between Digicel Haiti and the Karolinska Institute in Stockholm, Sweden

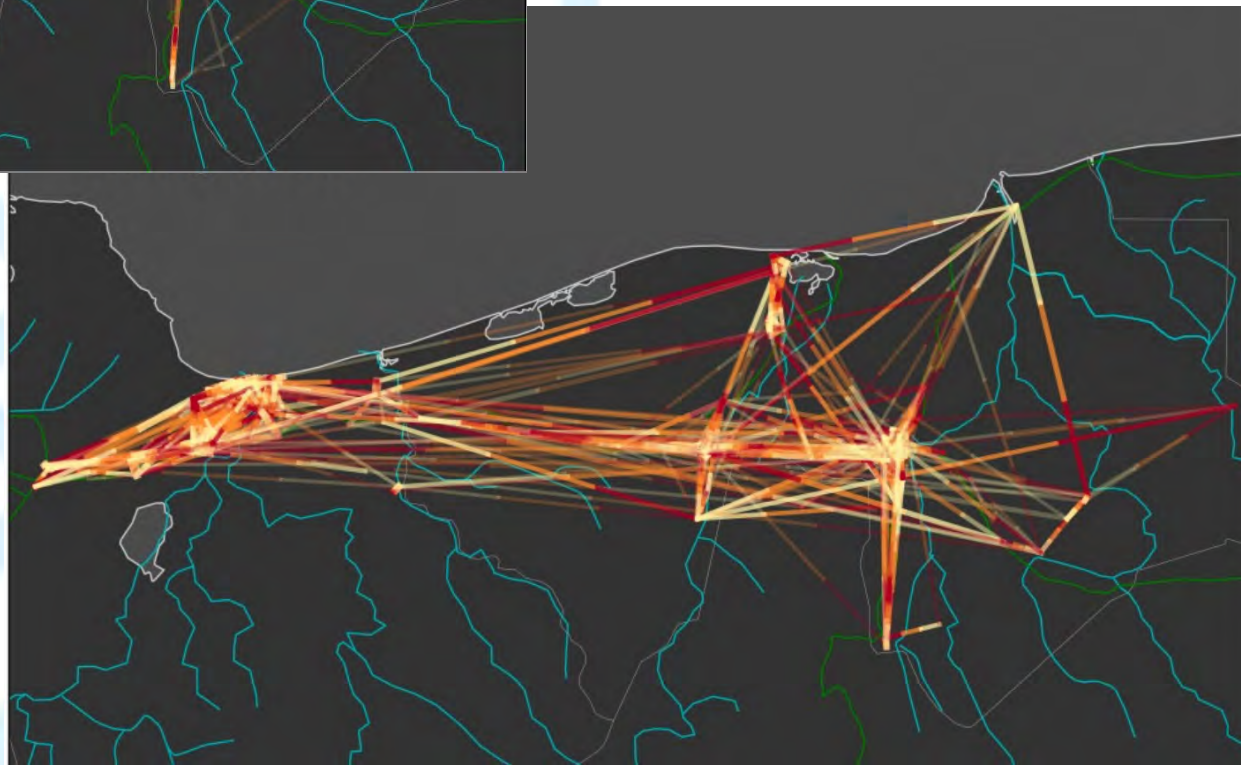
Improved Response to Disasters and Outbreaks by Tracking Population Movements with Mobile Phone Network Data: A Post-Earthquake Geospatial Study in Haiti. Bengtsson L, et al. (2011) PLoS Med 8(8): e1001083

Quantifying Displacement during Natural Disasters

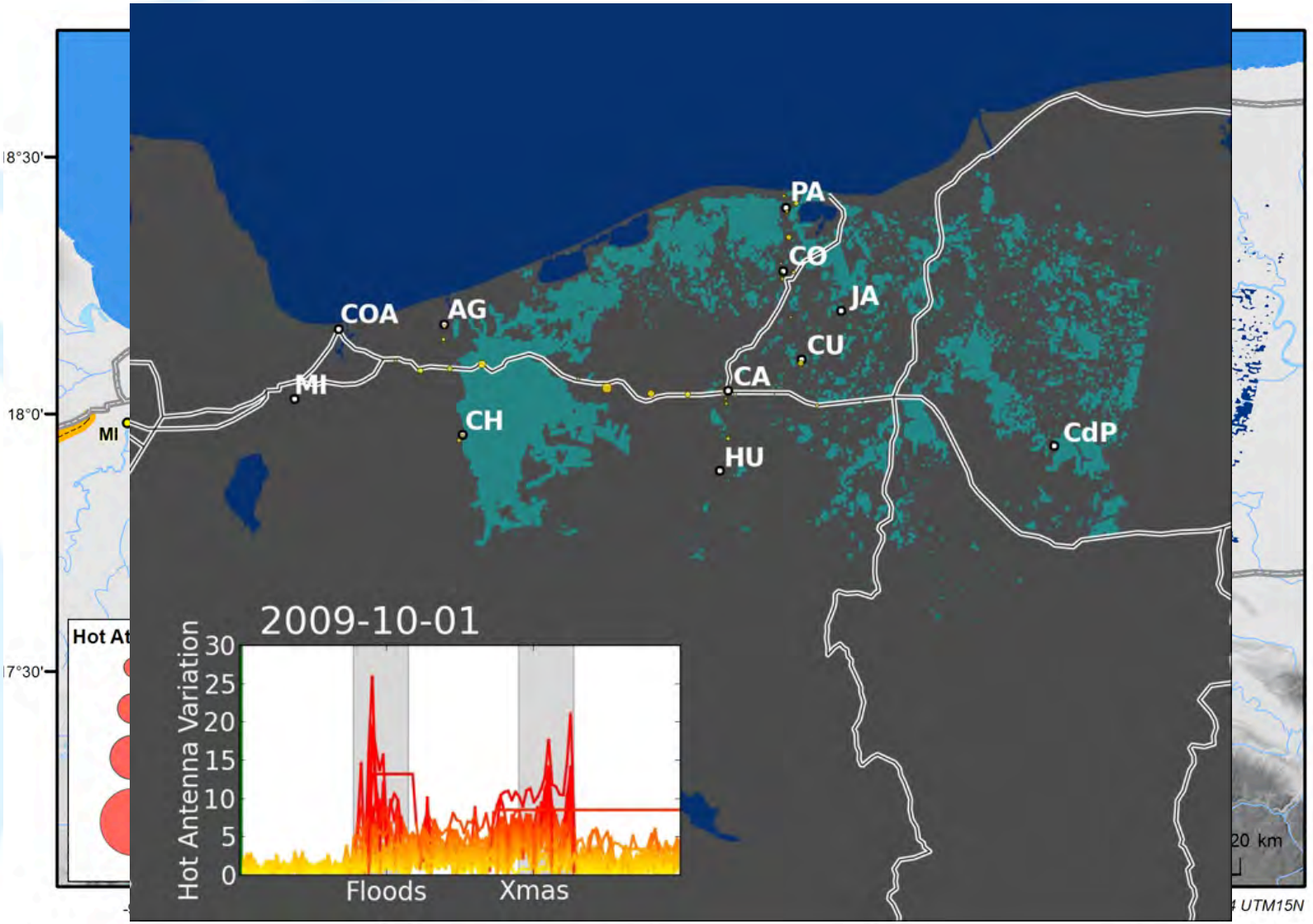








Estimating Awareness during Natural Disasters



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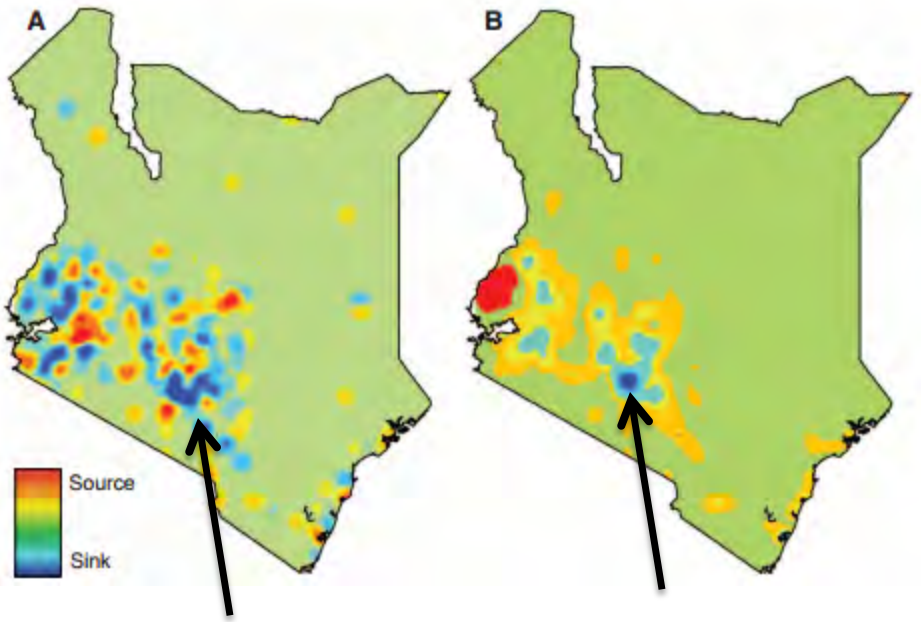
Modeling the spread of disease

Quantifying the Impact of Human Mobility on Malaria

Amy Wesolowski,[1,2] Nathan Eagle,[3,4] Andrew J. Tatem,[5,6,7] David L. Smith,[6,8] Abdisalan M. Noor,[9,10] Robert W. Snow,[9,10] Caroline O. Buckee[4,11]*



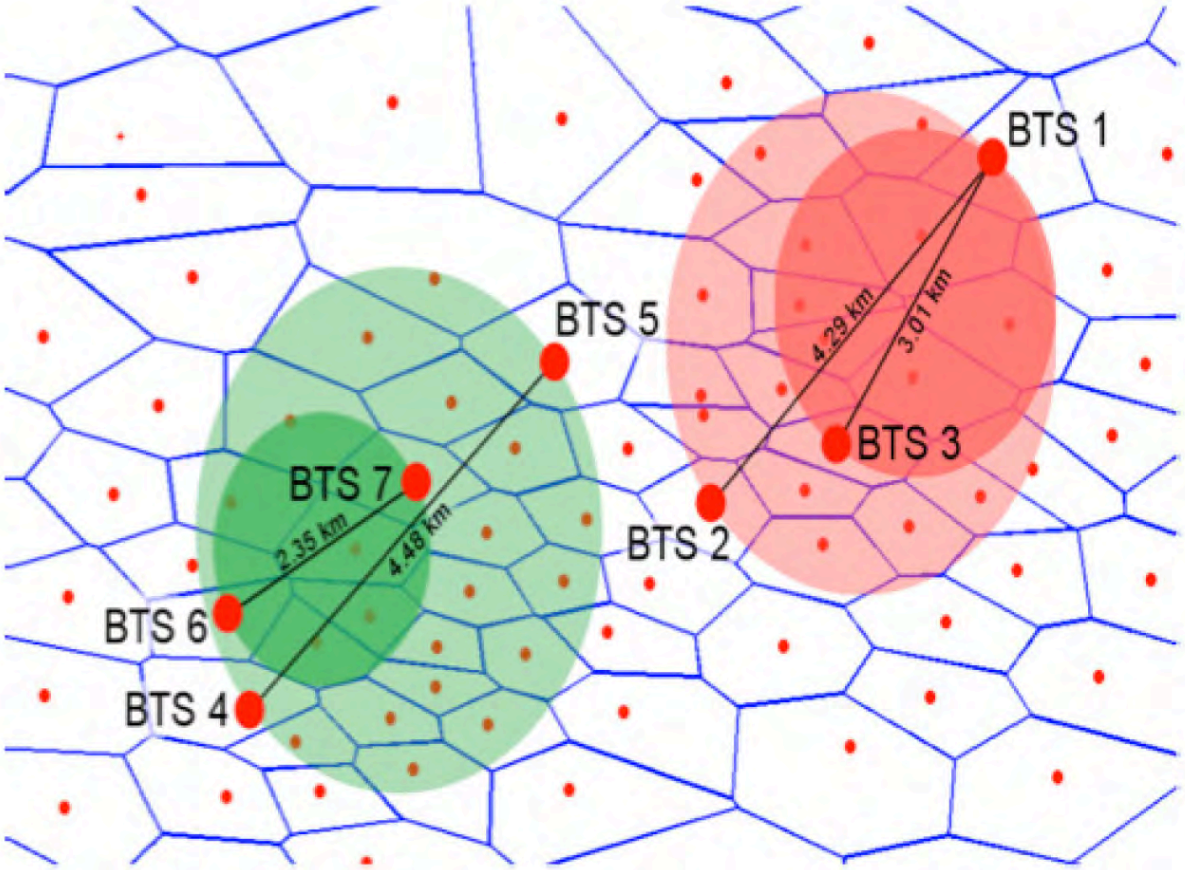
People movements Malaria parasites



KENYA

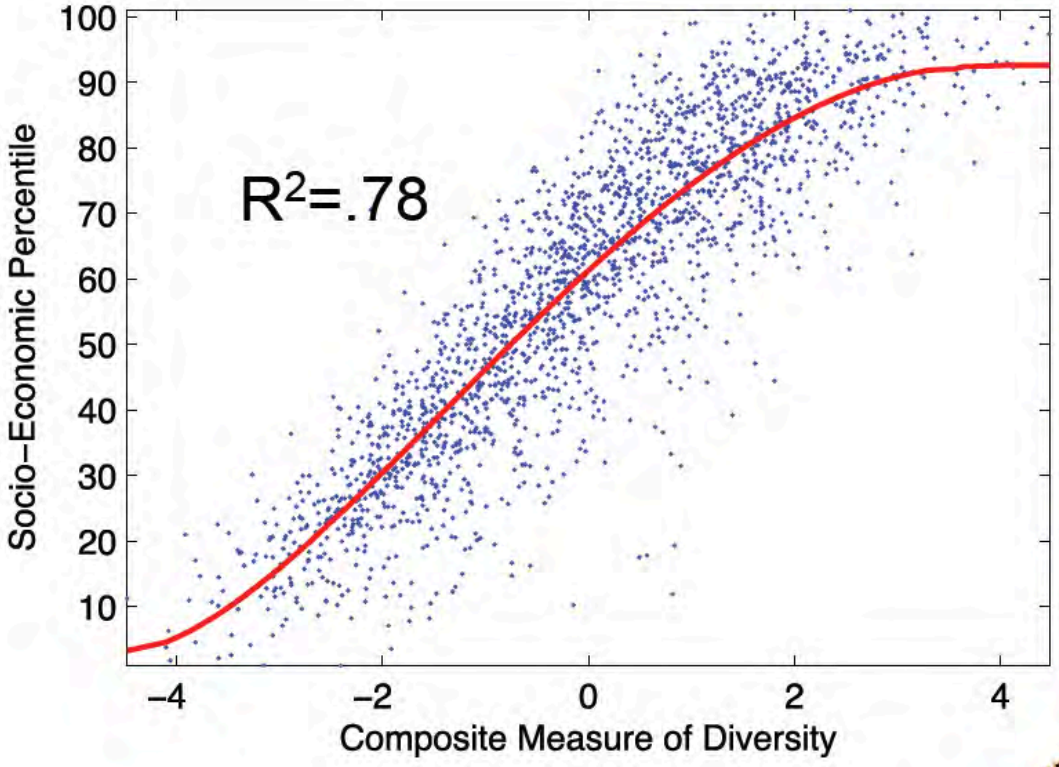
Wesolowski A, Eagle N , Tatem A, Smith D, Noor A, Snow R, Buckee C (2012) Quantifying the impact of human mobility on Malaria, *Science* 338(6104) 267-270.

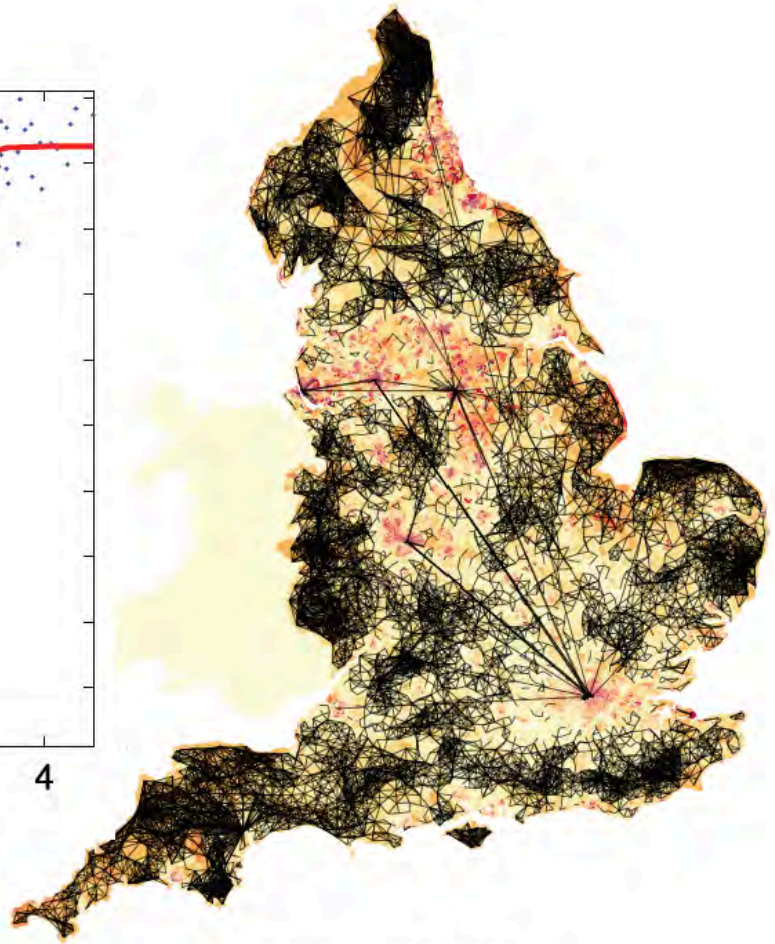
Combating H1N1 in Mexico



Enrique Frias-Martinez, Graham Williamson and Vanessa Frias-Martinez (2011) An Agent-Based Model Of Epidemic Spread Using Human Mobility and Social Network Information, *3rd International Conference on Social Computing, SocialCom '11, Boston.*

Network Diversity and Economic Opportunity

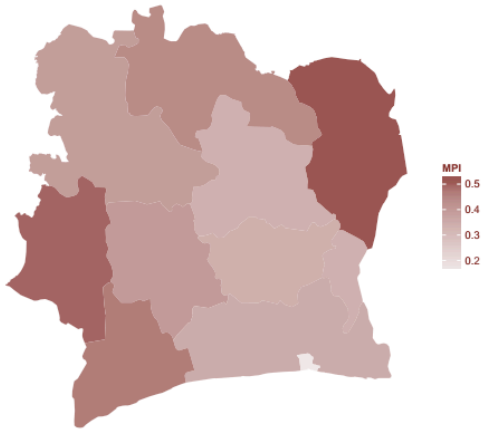




N. Eagle, M. Macy, R. Claxton. (2010). 'Network Diversity and Economic Development', *Science,* 328(5981), pp. 1029-1031.

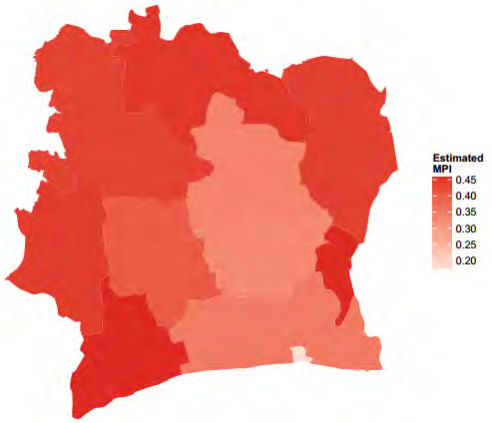
MAPPING SOCIOECONOMIC LEVELS OF POPULATIONS

Ground-Truth Data (Official)

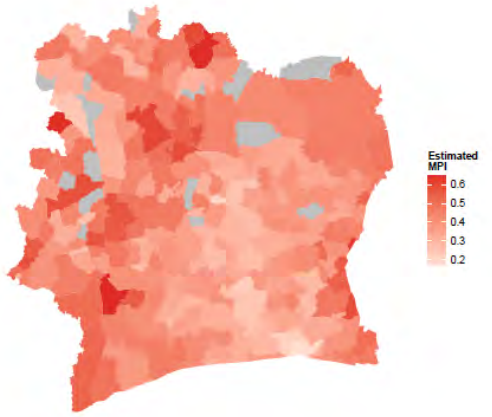


Map of 11 regions showing Multidimensional Poverty Index

CDR-based Model



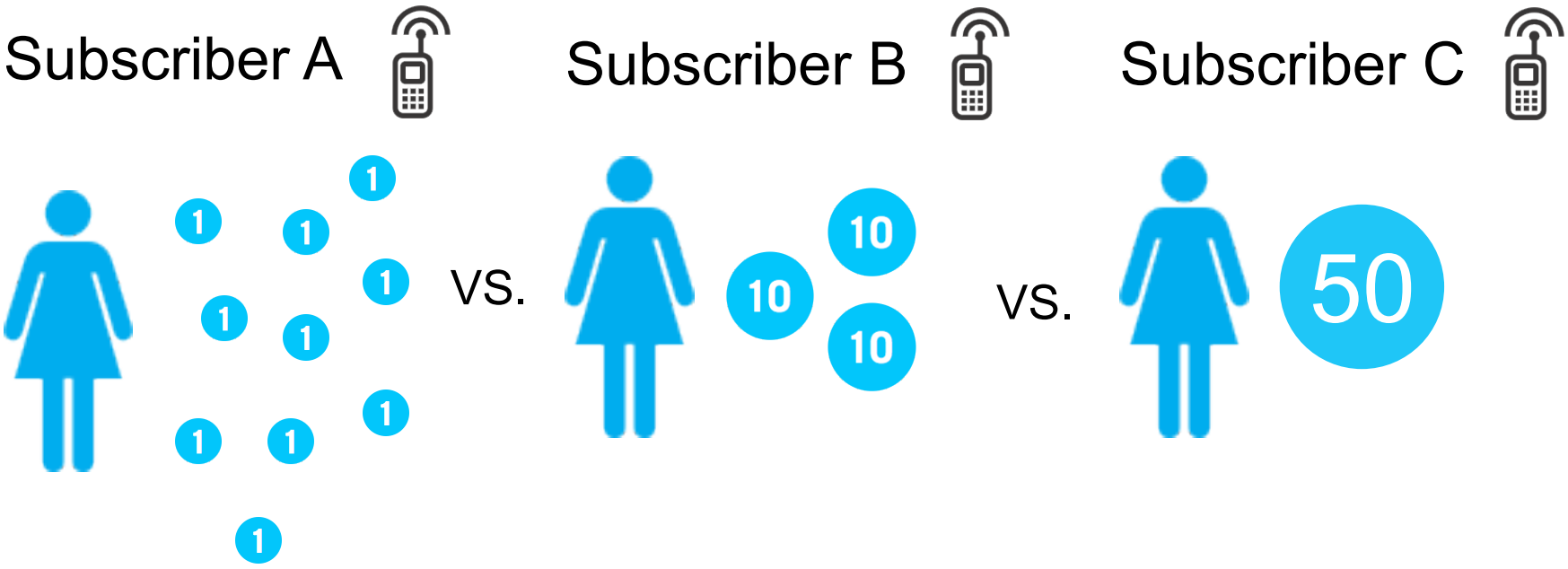
Poverty map estimated based on the link diversity between antennas



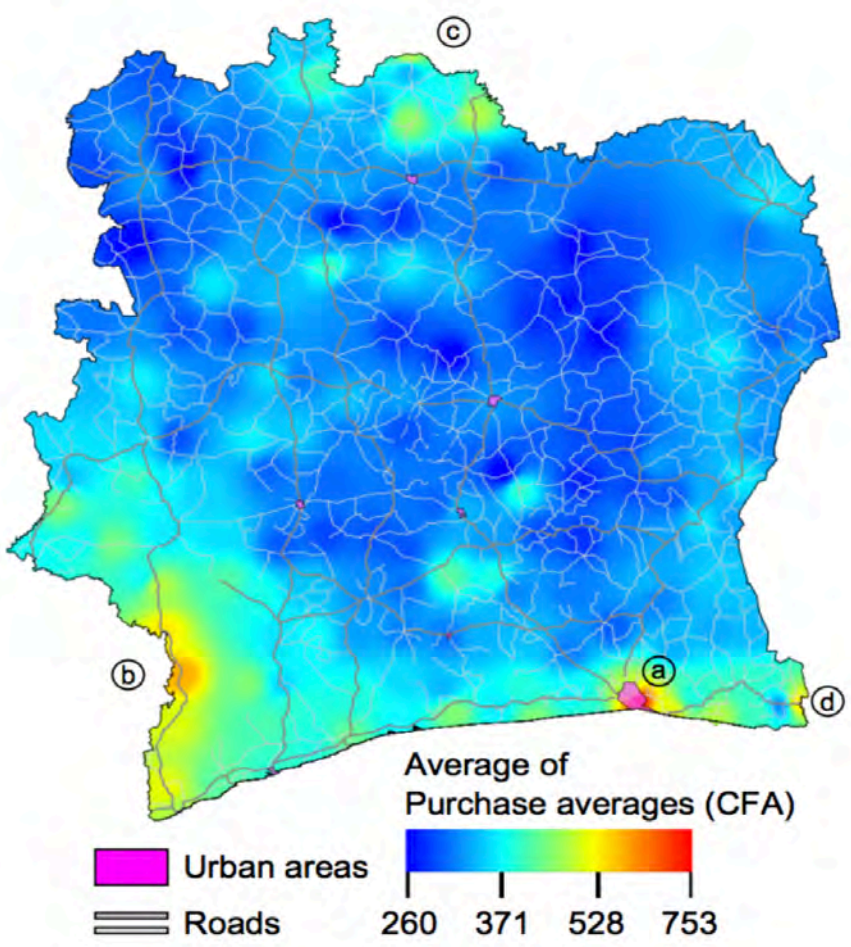
Finer granularity estimate

Smith C, Mashadi A, Capra L (2013) Ubiquitous sensing for mapping poverty in developing countries, *Proceedings of the Third Conference on the Analysis of Mobile Phone Datasets.*

Airtime Expenses



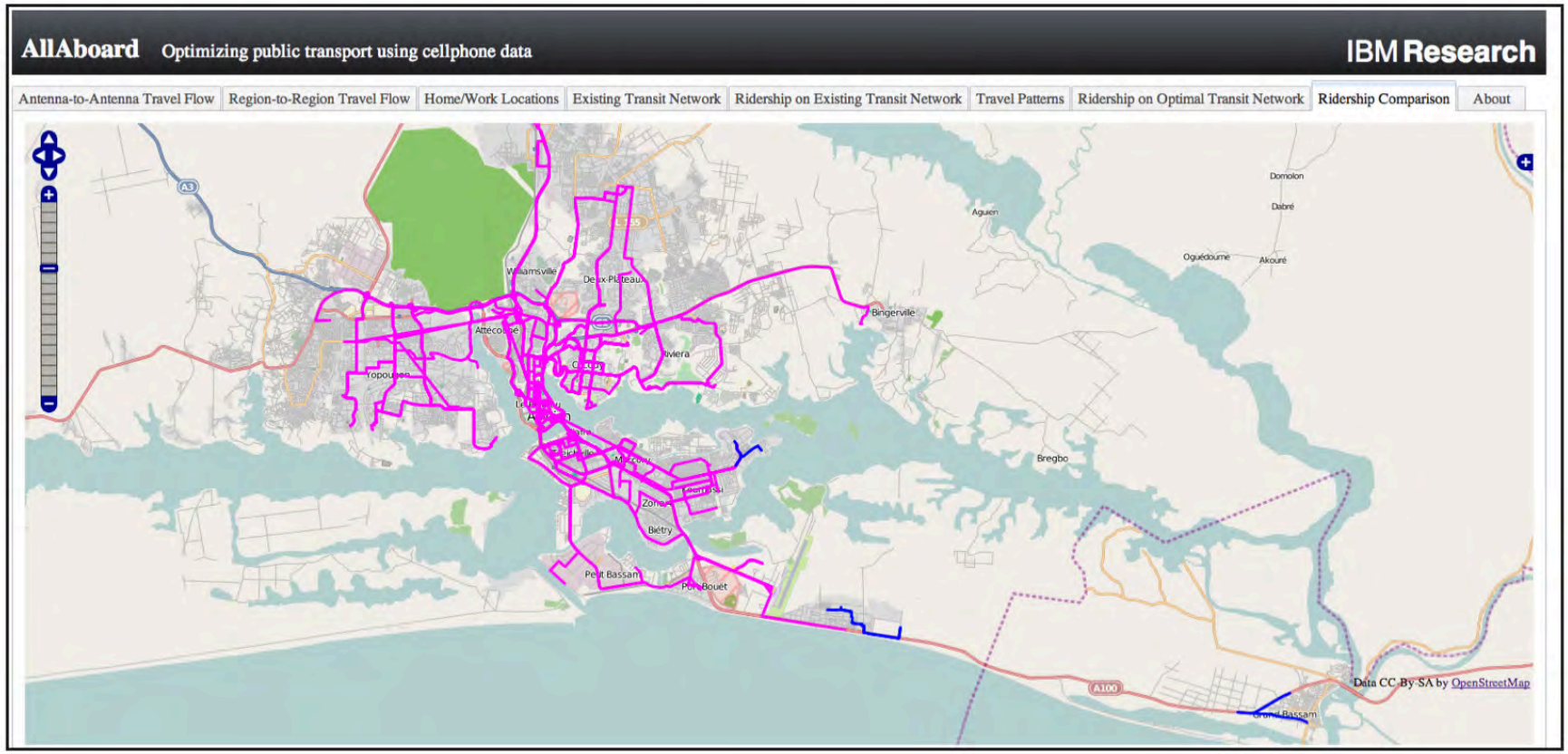
A real-time map of poverty in Cote d'Ivoire?



a) Abidjan
b) Liberian border
c) Roads to Mali and Burkina Faso
d) Road to Ghana

Ref: arxiv.org/abs/1309.4496: Evaluating Socio-Economic State Of A Country Analyzing Airtime Credit And Mobile Phone Datasets

CDRs for optimizing public transport network in Abidjan



"AllAboard: a system for exploring urban mobility and optimizing public transport using cellphone data"
M. Berlingerio et al.

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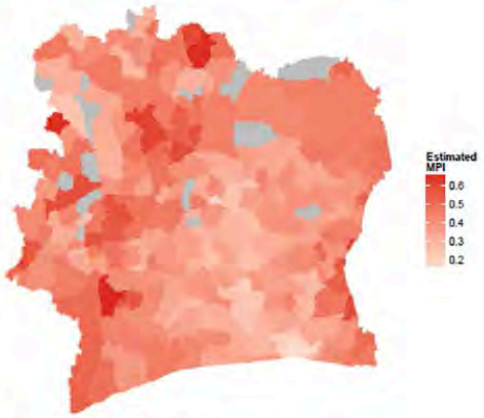
III. Recent developments

orange™

Data for Development D4D Challenge

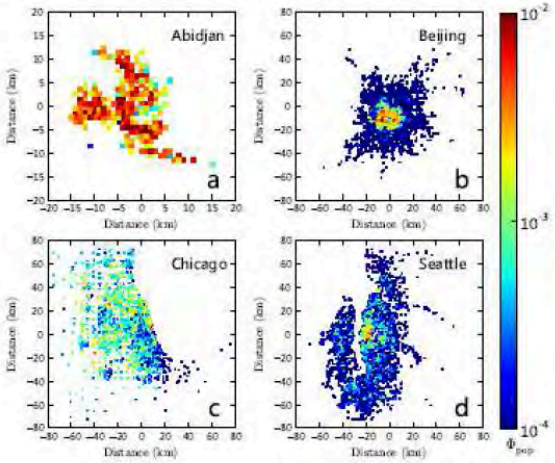


Fine granularity of poverty index (by prefecture)

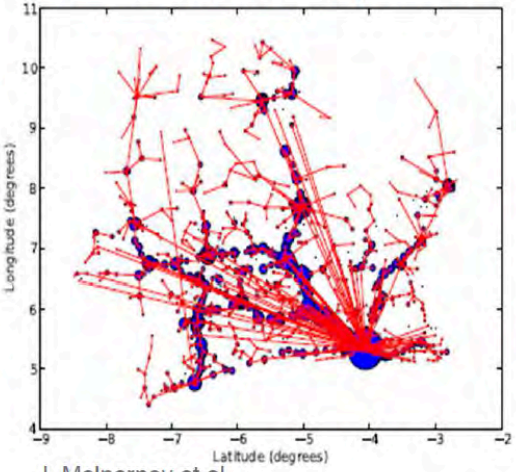


Christopher Smith et . al.

Cities comparison, and urbanization index potential



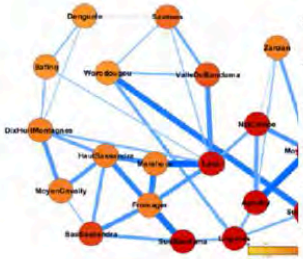
Transports Crowdsourcing for low cost delivery of aid



J. McInerney et al.

Modeling and prevention campaigns against diseases

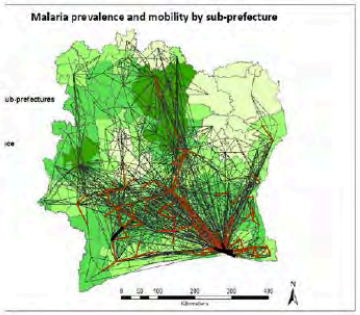
AIDS Cholera, Malaria,…



Katarina Gavric et. al.



Andrew S. Azman et al.



Eva Enns et. al.

Modeling to improve transport and urbanism

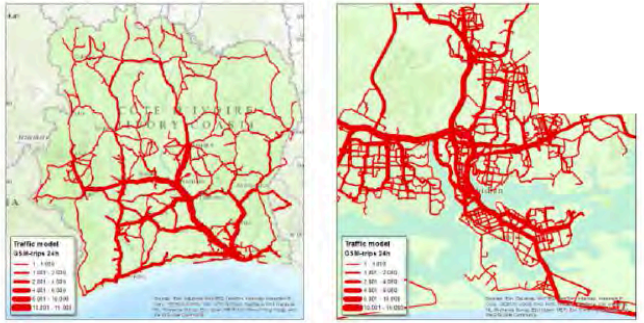
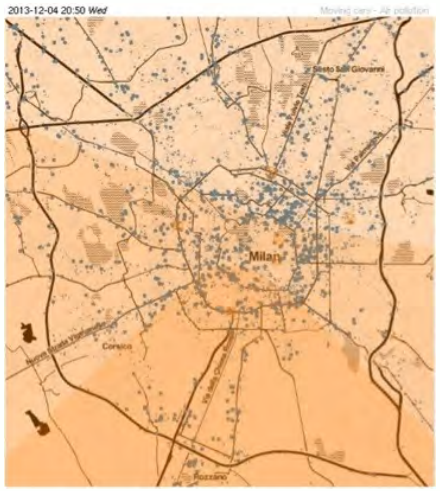
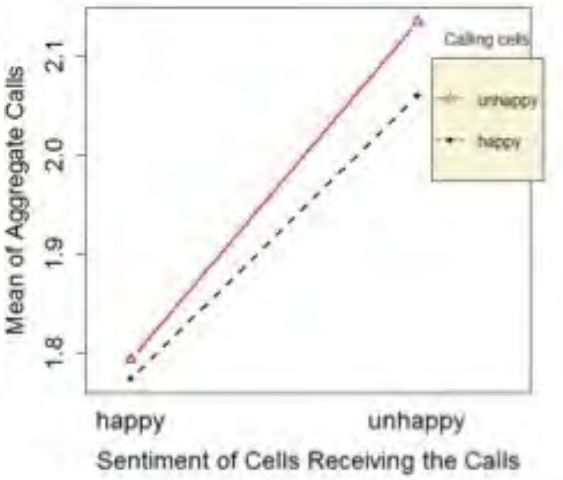


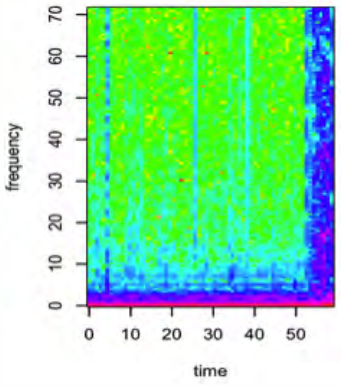
Figure 13: Traffic model for 24 hour period for Ivory Coast (left) and Abidjan Area (right)

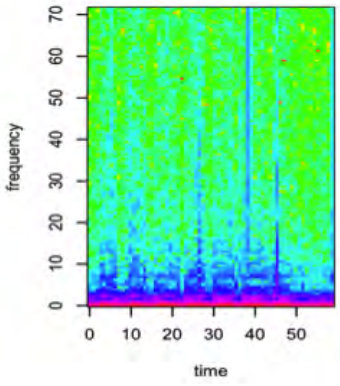
TELECOM ITALIA BigDataCHALLENGE

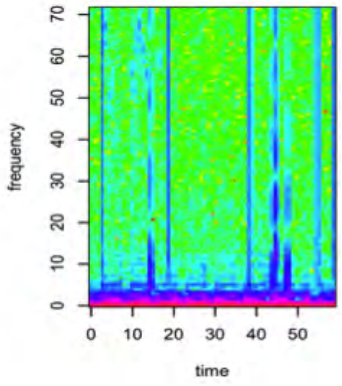




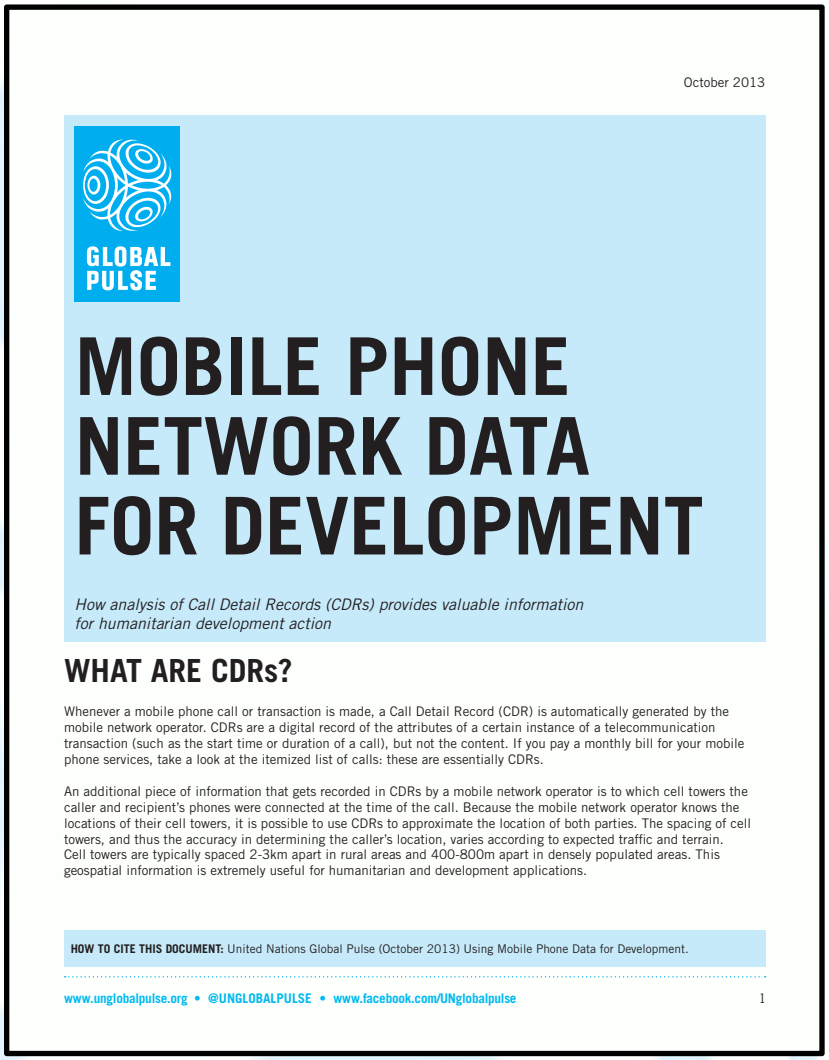








Primer On Mobile Phone Network Data for Development



October 2013

GLOBAL PULSE

MOBILE PHONE NETWORK DATA FOR DEVELOPMENT

How analysis of Call Detail Records (CDRs) provides valuable information for humanitarian development action

WHAT ARE CDRs?

Whenever a mobile phone call or transaction is made, a Call Detail Record (CDR) is automatically generated by the mobile network operator. CDRs are a digital record of the attributes of a certain instance of a telecommunication transaction (such as the start time or duration of a call), but not the content. If you pay a monthly bill for your mobile phone services, take a look at the itemized list of calls: these are essentially CDRs.

An additional piece of information that gets recorded in CDRs by a mobile network operator is to which cell towers the caller and recipient's phones were connected at the time of the call. Because the mobile network operator knows the locations of their cell towers, it is possible to use CDRs to approximate the location of both parties. The spacing of cell towers, and thus the accuracy in determining the caller's location, varies according to expected traffic and terrain. Cell towers are typically spaced 2-3km apart in rural areas and 400-800m apart in densely populated areas. This geospatial information is extremely useful for humanitarian and development applications.

HOW TO CITE THIS DOCUMENT: United Nations Global Pulse (October 2013) Using Mobile Phone Data for Development.

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http://www.unglobalpulse.org/Mobile_Phone_Network_Data-for-Dev

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IV. Concept notes

Brainstorming

- What if you were allowed much money to solve a problem you're facing?
- What looks like your daily life regarding humanitarian tasks?

- What data do you have and could you describe it?
- What kinds of information would you like to have? (just imagine ☺)

- Can you imagine some achievable from mobile data?
  - For instance, timely information (e.g., location, movement, communication, etc.) and new insights (e.g., population, mobility, etc.)

- Please make your solution with pens and papers with your words?



Mobile apps



Dashboard

.....

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PULSE LAB JAKARTA



