Reviewer's report

Title: Mobile phone tracking: in support of modelling traffic-related air pollution contribution to individual exposure and its implications for public health impact assessment

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Reviewer: Ilan Levy

Reviewer's report:

Review to manuscript: “Mobile phone tracking: in support of modelling traffic-related air pollution contribution to individual exposure and its implications for public health impact assessment”

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Overview:

The manuscript presents a concept for using mobile phone tracking technology for assessing human exposure to traffic related air pollution. The authors propose a system that will collect individual mobile phone data and estimate both individual trajectory and vehicle trajectory. The vehicle trajectory will be used for modeling air pollution levels after accounting for estimated vehicle type and emission rates. Juxtaposing the modeled air pollution and individual trajectories can then be used for estimating individual exposure levels.

The concept proposed by the authors is based on mobile phone technologies, and derivative applications, such as tracking human mobility, traffic planning (e.g., Waze - www.waze.com) and real-time demographics (www.trendit.net). This is an interesting approach with relevance to exposure estimates. Although some of the main components of the proposed concept have already been implemented in other studies, there is yet some novelty in using population based mobile phone tracking for modeling air pollution. The authors should recognize the components that were already addressed in other studies and highlight their contribution. More details are given in the major and minor comments below.

Major Compulsory Revisions

1. The ideas presented by the authors are not all new. Similar concepts were presented in earlier studies by several independent research groups, and some have even applied them and published results. PEIR, the Personal Environmental Impact Report (http://peir.cens.ucla.edu/), was presented already in 2009 (Mun et al, 2009). PEIR uses mobile phone tracking to estimate exposure levels. The authors also proposed a method for identifying individual transportation mode (Reddy et al., 2010), one of the components described in the manuscript. Another such project is the CitiSense (https://sosa.ucsd.edu/confluence/display/CitiSensePublic/CitiSense) described
The main differences between these three projects and the concept presented in the manuscript are that 1) all three are using air pollution sensors onboard a (relatively) small number of vehicles through which the estimated pollution levels will be derived, while in the proposed study pollution levels are calculated by an air pollution model based on the acquired distribution of vehicle fleet composition on the road and estimated emissions for each vehicle. 2) the above mentioned studies are based on a participatory network, i.e., only individuals that are interested and actively choose to participate are part of the study population, whereas in the proposed study the population is the entire network of mobile phone users. Nevertheless, the authors should describe these (and possibly other) initiatives in their introduction and explain in greater detail how their proposed concept is different.

2. It is not clear why the authors chose to describe in great detail the air pollution dispersion modeling component. How does this information add to the readers’ understanding of the concept presented in the manuscript? I suggest removing this part and maybe just give some modeling approaches that can be used, such as dispersion models (e.g., CALPUFF, AERMOD), numerical models (CAMx) and others (see Jerrett et al., 2005 for a detailed review of models used in exposure studies)

3. Although the authors address the privacy concerns related to tracking of individual trajectories, they are wrong in saying “very little work that addresses directly the privacy issues in a spatiotemporal data mining context has been published.” (P19 top). For example see Mun (2009) and references therein. The ideas presented in the latter paper are highly relevant and the authors should build on them. The authors could also consider the alternative to a population-wide data collection in the form of willing participants data collection, such as being done by Waze or PEIR mentioned above, where only individuals that are motivated will install an application on their smartphone and take part in the data collection.

Minor Essential Revisions

1. Methods, first bullet: what exactly do the authors mean by “ordinary air quality monitoring.”? How is this different from the stationary network mentioned in the previous sentence?

2. Methods, first bullet: How can remote sensing from satellites improve the spatial resolution of air pollutants in urban areas if they currently have a resolution of about 10km? Can the authors give more specific examples of such satellites?

3. Methods, first bullet, last sentence: it is not clear how stationary AQ monitoring network “density and resolution can be increased by integrating monitoring sites in a traffic surveillance network or a mobile phone base station network”. How will this be done? Can the authors give references to such technology?

4. Methods, bullet starting “Pollution field modeling”: “Traffic pollution is a product of vehicle exhaust.” Vehicle exhaust is not the only source for air pollution from
vehicles. There are additional sources such as tire wear, brakes and oil leaks.

5. Methods, bullet starting “Pollution field modeling”: Modeling of air pollution levels on a street canyon for an entire city is not a trivial task. While dispersion models (e.g., CALPUUF) do not account for the three dimensional urban structure (i.e., street canyons), numerical models (e.g., CAMx) also cannot resolve such fine details. CFD (computational fluid dynamics) models are able to account for the urban structure down to the street canyon level, yet modeling an entire city would be challenging in terms of computational power needed for the task, especially if the model is run over long time periods of weeks and even months.

6. Methods, paragraph starting with “Trough mobile phone…”: A clear distinction should be made between acute and chronic exposures. Estimating exposures from residence postal codes is completely different from using personal monitors and would yield different results.

7. Methods, bullet starting with “Identify other group travelers…”: it is not clear what the authors mean by “other group travelers”. Are these subway commuters? Pedestrians? Motorcycles? Bicycles riders?

8. Methods, bullet starting with “The rest of the trajectories are…”: it is not clear how this group differs from the second group of “private car commuters”.

Minor issues not for publication
P3 first paragraph: sentence starting with “Road traffic…” is very long. Consider rephrasing.
P3 1st Par.: change “evident” to “evidence”
P3 2nd par.: use subscript in NOx
P4: change “Different methods are being used” to “Different methods have been used”
P4: change “dispersion modal” to dispersion model”
P4: change “by taking account indicators” to “by accounting for indicators”
P4: change “can not apply to” to “cannot be applied to”
P4: change “However, both two approaches” to However, both approaches”
P5: add “and” before “the techniques of traffic”
P7 1st par.: change “combing” to combining”
P7 1st par: change “makes it” to “make it”
P9 1st sentence: change “trajectories that can” to “trajectories can”
P9 sentence starting with “Trough mobile phone…” is very long. Consider rephrasing.
P9 5th line from the bottom: change “postal code inadequate” to “postal code are inadequate”
P10 3rd line: change polices to policemen
P10 3rd line: change constructors to “construction workers”
For simplicity… change “each individual person” to “each individual”

It is not clear what the authors mean by “other group travelers”. Can they give examples?

Can they give examples?

what do the authors mean by “net enhancement”?

However, there are other aspects in favour

References:


Level of interest: An article whose findings are important to those with closely related research interests

Quality of written English: Needs some language corrections before being published

Declaration of competing interests:

I declare that I have no competing interests