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Interactive comment on "Status Update: Is smoke on your mind? Using social media to determine smoke exposure" *by* Bonne Ford et al.

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I really don't understand the process of review for this journal. I'm not sure whether my review is going to be posted as a comment on the manuscript, and whether that should influence the way I write the review? Regardless, I am going to use the same type of format I always use. Please see supplemental PDF for formatted version

Summary:

The exposure of interest is smoke from landscape fires. The authors have compared data from social media (Facebook) and online searches (Google) with data from more conventional methods used to assess smoke exposures: PM2.5 measurements from two sources (AQS and IMPROVE), AOD measurements from MODIS, integrated satellite plume footprints from HMS, and PM2.5 estimates from WRF-Chem. They have

also compared the AOD, HMS and WRF-Chem method with the PM2.5 measurements which are the de-facto gold standard. They report that that Facebook posts are useful for assessing population exposure, especially when the data are population-weighted. Their correlation with measured PM2.5 is comparable with correlations observed for the other metrics. When combined with the other metrics they can improve models fitted to the PM2.5 measurements. The Google search data were largely used to compare the utility of different keywords when assessing smoke exposures.

First and foremost, I am impressed by this work. I think it is a very nice and thorough contribution to the literature. My concerns are not about the quality of the science, but about the clarity of its presentation. There are A LOT of ideas in this manuscript, and I think that more careful consideration of its structure would improve its accessibility to readers. Major and minor concerns are listed below.

Major concerns:

- More information about the Facebook data is needed. My interpretation is that the study team provided a list of search terms to Facebook, and was provided with a daily percentage value for each community. The team never saw the posts (this is made clear) and the results for all search terms were lumped together (this is less clear), making it impossible to disaggregate "smoke" from "haze", for example. More specific detail is needed. It was also not clear whether the values reflected the proportional of posts or the proportion of individuals posting. If one noisy person was posting about smoke in a small community, this could make a difference. Either is acceptable, just be clear about what is measured and its limitations.

- If my interpretation is correct, the primary utility of the Google analyses is the ability to disaggregate results for different keywords and to evaluate which are most strongly correlated with smoke. I recommend reframing methods section on the Google data to address this one clear objective.

- On a related note, the authors used a limited number of keywords in their search,

and I think this deserves comment in the discussion – especially with respect for the potential of machine learning to help refine keywords in future work. In our more limited work on this topic we found many posts that make statements such as "Smells like a campfire out here!" and "Where's the fire?" which would not be captured by the methods described.

- The value of presenting the raw and weighted Facebook posts is not clear given that the weighting seems necessary. Would highly recommend removing this one complexity from the other many complexities. Simply state that the data were weighted and describe the methods used to weight them.

- Suggest the authors focus more specifically on smoke rather than more generally on air quality, as smoke is really the thing they are trying to capture. A statement in the introduction about the fact that air quality can degrade for other reasons would be useful, especially if analysis on the Google searches is reframed, but then they could stick to the idea of smoke throughout. Rather than saying "exposure to degraded air quality" just say "smoke". It's a lot simpler, and it's what the manuscript is about.

- Similarly, they could simply define "landscape fire smoke" (currently wildland fire smoke, which omits the agricultural category – often important in the US) in the introduction and then use LFS throughout

- One of the most challenging things about the current manuscript is that different phrases often get used for the same concepts. I encourage the authors to give each smoke exposure metric a single name and to rigorously use that name consistently throughout. For example: Facebook posts; Google searches; PM2.5 measurements (specifying AQS or IMPROVE where necessary); MODIS AOD; HMS plumes; and WRF-Chem PM2.5. Further, suggest that all of these metrics go under single Smoke Exposure Metrics subheading in the Methods section, and that each gets its own paragraph with its name in bold at the beginning. This will more easily help readers to refer back to the methods while they are pondering the results. Also, be clear up front that

analyses were done at the 24-hour time scale.

- Methods section currently gives no information about how Facebook posts were compared with other metrics (temporal correlations, spatial correlations, etc). Much of this information is erroneously included in the Results. Suggest two subheadings be added to Methods: (1) Comparison of Facebook Posts with Conventional Metrics, and (2) Comparison of Other Metrics with PM2.5 Measurements. Main conclusions are that (1) Facebook Posts are correlated with conventional metrics, and (2) they are as correlated with the gold standard as other metrics. As such, suggest they clearly frame the Methods so that the conclusions naturally follow.

- Overall, suggest the following subheadings for Methods: Smoke Exposure Metrics; Comparison of Facebook Posts with Conventional Metrics; Comparison of Other Metrics with PM2.5 Measurements; Assessing the Effects of Cloudy Days; Regression Case Study in Washington State; and Using Google Searches to Evaluate Keyword Utility.

- As such, suggest the following subheadings for Results and Discussion: Facebook Posts Compared with Conventional Metrics; Other Metrics compared with PM2.5 Measurements; Cloudy Day Modification; Regression Case Study; and Keyword Utility for Smoke Detection. It seems like there should be at least one table allowing readers to compare correlations between the main metrics (Google searches omitted).

- Were cloudy days controlled for in the regression analysis? Sounds like they should be, given the findings of that sub analysis.

- Finally (and I know this is long – I'm sorry!), a good paper should stand alone without its figures and tables just as the figures and tables should stand alone without the paper. The authors most often use statements such as "Agreement between MODIS AOD and Facebook posts are shown in Figure 3" where they should use "Agreement between MODIS AOD and Facebook posts was moderate (Figure 3)". Similarly, "In Figure 2 we also show example time series of Facebook posts" should be "An example

of the time series of Facebook posts and other metrics shows that...(Figure 2)".

Minor concerns:

- The statement about cloud cover in the abstract is not put in enough context to make sense. For example, one would assume that Facebook compares poorly with AOD on cloudy days because AOD performs poorly on cloudy days – not because Facebook users (who have noses) perform poorly on cloudy days. The authors do present intriguing evidence to the contrary in the results, but this statement in the abstract shakes their credibility.

- There's a lot of weird and insistent use of hyphens in the text. For example air-quality is not conventionally hyphenated. Please review carefully and correct for common usage.

- Paragraph numbed 15-25 on Page 3 has some really long and complex sentences. Please break up for more clarity.

- Referencing still using numbers rather than names in some places (line 23 on Page 3 and others).

- There's a lot of use of the word "determine" which is quite strong. Its definition implies exactitude. Suggest words like "assess" and "evaluate" are more appropriate. Recommond title be changed to "... : Using social media to assess population smoke exposure".

- AOD and MODIS used before their definitions.

- Page 4: what are "air quality exposure" and "risk exposure assessment"? Do they mean "air pollution exposure" and "exposure assessment"?

- Social media = plural, treated as singular

- Data = plural, treated as singular

- Methods for population weighting / gridded estimates on Page 5 not very clearly described and nor is the rationale. Suggest statement about why this needs to be done and then described as a weighted spatial interpolation (which I think it is).

- US or U.S. – choose one.

- Page 12 brings up the question of visibility, for which the US has good data. Do not suggest that the authors do further analyses, but do suggest that they give thought to what such analyses could help to elucidate.

- Pages 12 and 13, both line 15: because, not since

- Figure 1: Suggest showing HMS plumes and PM2.5 Measurements in separate plots, just to make it really clear that we are dealing with five exposure metrics.

- Figure 2 is...er...a lot. Reducing to population-weighted only Facebook posts would help. Do you really need cloudy days on here? Can you do it with something other than dogs, if so? Why these four locations? Should be described in Methods.

- Time series is two words

- Things that are alike are compared with each other, not to each other

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/acp-2017-26/acp-2017-26-RC1-supplement.pdf

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