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Atmospheric Chemistry and Physics
Discussions

Interactive comment on "Air Quality Impact of the Northern California Camp Fire of November 2018" *by* Brigitte Rooney et al.

Anonymous Referee #2

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A comprehensive study on surface-level air quality impacts of the 2018 Camp Fire is conducted using a combination of WRF-Chem numerical simulations, ground-based monitoring station observations of PM2.5, black carbon ,carbon monoxide and meteorology, and a suite of space-borne satellite measurements for three separate regions, including (i) close proximity to the fire, (ii) the Sacramento Metropolitan Area and (iii) the San Francisco Bay Area. Evaluation of model simulations against ground-based observations showed good agreement for surface-level wind fields, ambient temperatures, and temporal trends in downwind PM2.5 and black carbon concentrations. Comparison to satellite products demonstrated the ability of model simulations to replicate the general spatiotemporal structure and evolution of the wildfire plumes. Sensitivity analyses were performed to investigate the influence of key parameter perturbations

on the accuracy of model predictions relative to the baseline control simulation, including (i) aerosol radiative feedback, (ii) boundary layer dynamics, (iii) plume rise and entrainment, (iv) fire inventory data, (v) emission rates and (vi) flaming versus smoldering partitioning. Results indicate greatest sensitivity to fire emission and boundary layer parameterizations. The main objective of these efforts is to assist improvement in air quality forecasting of wildfire events to ultimately protect human health and reduce economic impact.

Major Comments: The authors do a commendable job in the scale and scope of their simulations and analyses. There is little doubt these efforts will be of interest to the broader community and promote forward movement of this field. The reviewer recommends publication upon consideration of a few key points and minor revisions.

1. Perhaps the most striking feature of these wildland-urban interface firestorms is the scale of destruction of the built environment, including Santa Rosa during the 2017 Napa/Sonoma wildfires, Redding during the 2018 Carr Fire, and Paradise during the 2018 Camp Fire studied here. Although wildfires have been studied for decades and there is vast literature characterizing biomass combustion emissions, there are large knowledge gaps in the composition and toxicity of these emissions when a nontrivial fraction of the burnt area includes built environment comprising a vast array of non-biomass related materials. There is clearly a paucity of the types of land cover and fire emissions data required to incorporate these considerations into model simulations, but the reviewer feels it is a key point of sufficient significance to merit inclusion in the manuscript, if only from a speculative perspective. This discussion could easily be incorporated into section 4.2 – Fire Emission Inventory – or as a standalone subsection. Is it possible to calculate what fraction of the burned area can be attributed to the built environment relative to the other landcover vegetation types for the days that Paradise burned? If so, then these data could be included in Figure 3. Presumably, a large fraction of the non-biomass related materials do not sustain flaming combustion but rather are subjected to high temperature pyrolysis analogous to smoldering, which

impacts gas-particle partitioning, particle size and composition, and injection heights, and thus downwind simulated surface-level PM2.5 concentrations. A brief synopsis of these complexities and their impact on model performance would be beneficial.

2. There is a surplus of figures in the manuscript (14 total), many of which are large multi-panel figures, and some effort should be made to condense these to a critical mass necessary for effective visual dissemination of results and conclusions. For example, Figures 1 and 2, although well crafted, are nonessential to reader comprehension and can easily be described in text. Similarly, Figures 4 and 5 do not elucidate additional clarification to what is already discussed in the manuscript and well summarized in Table 2. Furthermore, Figures 10-12 all support the same underlying fundamental conclusion: deviation of simulated wind fields from observation explains underprediction of downwind surface-level PM2.5 mass concentrations in the Bay Area for the period Nov. 14-16. Only one figure (10 or 11) is necessary to make the point.

Minor Revisions: 1. Consider not abbreviating LSM (land surface model) in Table 1; 2. Figures 6, 7, 10, 11, and 14: change y-axis and color scales from ug/mˆ2 to ug/mˆ3; 3. In Table 3, Bay Area normalized mean bias is missing percentage symbol (%); 4. Figures should be numbered in the order in which they are discussed within the text, but Figures 10-12 are discussed prior to Figure 9; please renumber figures.

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