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Interactive comment on "Evaluating a fire smoke simulation algorithm in the National Air Quality Forecast Capability (NAQFC) by using multiple observation data sets during the Southeast Nexus (SENEX) field campaign" *by* Li Pan et al.

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First of all, I'd like to thank the reviewer for the time and effort spent on this manuscript to strengthen it immensely.

I abundantly agree with your comment on this manuscript "the manuscript, at present, is overly long and laborious". The fire forecasting system presented in this manuscript includes HMS (Hazard Mapping System to detect active fire hot-spots by satellite and modulation by human analyst), BlueSky (fire emission calculation system developed

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by the US Forest Service), SMOKE (the system mapping BlueSky emission to CMAQ-ready emission formats) and CMAQ (a chemistry transport model to calculate fire plume transport, transformation and deposition). The whole system is so complicated that I tried to be thorough and yet as concise as possible to readers by presenting them all the critical aspects. I endeavored to elaborate some empirical methods when dealing with the HMS dataset used in the study binding to the modeling outcome. For an example “a size of 1 km2 and 10% of its area” on line 113 etc. The only purpose is to guide the readers to understand the simulation results presented in this manuscript are dependent on these assumptions. This makes this manuscript rather lengthy.

In my opinion, a single observation dataset can only tell me one side of the story. By using multiple and relatively independent observations, an objective view of the problem would be drawn. Therefore, I used as many as possible available observations to support my arguments in this manuscript. By the same token of thoroughness in guiding an acquisitive reader we explained those dataset and procedures they were handled. This makes this manuscript seemed laborious.

The reviewer’s comments on “it uses “qualitative evaluation” not “quantitative”, aimed primarily at timing. This is a real shortcoming.” raised a very good question about what was a proper way to evaluate fire results simulated by models — one of the main focuses of this manuscript. At present we restrict quantitatively fire simulation evaluation to near fire burning areas during a big fire using ground observed PM2.5 enhancements, such as those reported by the U.S. EPA Air Quality System monitors. On the other hand, more and more case studies found that local air quality could be impacted by fire smoke plumes originated thousands miles away. The long range transport of a fire plume impacting air quality on downwind areas was demonstratively equally important as those originated from near sources. The model performance capturing fire plumes from long range transport is also needed for comprehensive evaluations. However, it is usually very difficult. The interplay of long-range versus near-source impact is a huge challenge for this manuscript. It is also one of the science areas we want to ad-

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dress in this work. Depending on the comprehensiveness of the campaign data (e.g., SENEX) and the observation availability, qualitative evaluation may be a first step before quantitative evaluation. I think the reviewer agreed on this basing on the comment that: “There should be more quantitative evaluation, if only to show the direction of the necessary steps toward”. We absolutely agree with your comment. In the manuscript, we have discussed reasons for qualitative evaluation in the section of “Evaluations”: lines 160-188.

As far as the HMS fire-detection is concerned, it may miss small fires such as agriculture burning and prescribed fire. We used the July 03 2013 case as an example for an in-depth discussion. Actually, the fire hot-spots used in CMAQ were much less than those detected by the HMS (please see methodology section HMS, Figure 1 and Figure 11). HMS counts the detected fire hot-spot data conservatively by removing fire hot-spots that are not associated with smokes. Such conservativeness is very necessary for the NOAA daily air quality forecasting because it reduces the false alarm rate at the possible expense in underestimating or missing actual fire emissions.

We beware that there are much uncertainty in the current fire simulations and observations. We tried to avoid over interpreting the model results – in precise alignment with the reviewer’s comment: “be more focused and concise”.

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