Review of the proposal entitled “A novel method for improving fine particulate matter air quality forecasts during wildfires” with ID of 2777771 by Rajesh Kumar (PI), Stefano Alessandrini (co-PI), and Gabriele Pfister (co-I)

General comments: This project is aimed at developing a novel method to improve the NAQFC PM2.5 predictions by improving initial conditions of chemical species through AOD assimilation and by generating a more accurate long-term training dataset for better analog search for improving bias correction forecast. The applicants propose to improve the chemical data assimilation by assimilating the AOD retrievals from the NOAA GEOS measurements which has much higher frequency data than the MODIS AOD retrievals (30 minutes versus 24 hours). I am not sure that the 2nd task is meaningful for improving the NAQFC predictions or not since the Karman Filter Analog Ensemble (KFAN) Post-processing system has been implemented into the operational NAQFC. The current KFAN usually does better performance than Analog Ensemble (AnEn) that this proposal suggests. The limitation on capturing PM2.5 predictions with KFAN during heavy wildfire events cannot be improved with the AnEn. Therefore, I don’t think the 2nd task that the project proposes will be able to solve the issue that the current KFAN has for heavy wildfire events.

Specific comments for each scoring item are provided below.

1. Importance/Relevance and Applicability of Proposed Project to Program Goals: 23 points

Comments: Providing accurate PM2.5 predictions during wildfire especially heavy wildfire events is a big challenge to the National Air Quality Forecasting Capability (NAQFC) at NOAA. There are two major issues with PM2.5 predictions by the NAQFC: significant under-predictions by both model raw forecast and bias correction approach during heavy wildfire events, opposite seasonal performance with under-predictions in summer and over-predictions in winter. The bias correction KFAN has improved the NAQFC PM2.5 predictions largely by reducing the seasonal biases. In this project, the applicants propose to improve the NAQFC PM2.5 predictions through improving the initial conditions of chemical species by assimilating the aerosol optical depth (AOD) from the NOAA GOES along with MODIS measurements, and to improve bias-corrected PM2.5 predictions by generating more accurate long-term training data for better historical analog search. The work proposed by this project is expected to contribute to the NOAA Science Priorities AQRF-3 and AQRF-4.

1. Technical/Scientific Merits: 22 points

In this project, the applicants propose to develop a novel method for improving the NAQFC PM2.5 predictions during wildfire events by assimilating the aerosol optical depth (AOD) retrievals from NOAA Geostationary Operational Environmental Satellite (GOES) measurements along with the AOD retrieval from MODIS for generating more realistic initial conditions of chemical species, and by generating more accurate long-term training data for better historical analog search which eventually benefits the bias-corrected PM2.5 predictions. However, the proposal is limited to the WRF-driven CMAQ (see Pages 6-7 in the proposal) rather than NMMB-driven CMAQ, the current operational NAQFC or FV3-driven CMAQ, the next updated version of NAQFC for operational implementation. The FV3GFS-driven CMAQ in offline mode will become NOAA operational AQ forecasting model in 2020. Regarding the 2nd task of the proposal, the AnEn post-processing method for bias correction has been implemented into the NAQFC in 2016 and has been replaced by the KFAN bias correction during the 2018 NAQFC operational implementation. The KFAN with current configuration still fails to capture high PM2.5 concentrations during heavy wildfire events. I don’t think that the AnEn work prosed by this project will be able to solve the problem that the KFAN fails to correct underpredictions of PM2.5 by NAQFC during heavy wildfire events.

The proposal has a clear schedule for milestones, deliverable, and advancing Readiness Levels from RL 5-7 to 8. The proposal lists a series statistical metrics for evaluating the success, and provides a good Data Management Plan as required by the program.

1. Overall Quantifications of Application: 17 points

All the applicants have necessary education, experience, facilities, and resources to complete the project. They have demonstrated an ability to conduct successful research and support R2O transition work.

1. Project Costs: 7.5 points

The requested costs are realistic, reasonable, allowable. and commensurate with the project benefits, but the deliverable needs further detailed information.

1. Outreach and Education: 4 points

The proposal includes a reasonable plan for sharing the data, presenting the results at the AGU meeting, and submitting two peer-reviewed papers. The proposal does not promote the education and field experience of undergraduate and graduate students, and does not develop opportunities to share with K-12 educators.