Geoscientific
Model Development
Discussions

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.

Li Pan et al.

li.pan@noaa.gov

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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.

General comments "The authors utilize a variety of physical & chemical data to evaluate their fire emissions and air quality modeling system, with a particular effort to utilize the SENEX campaign observations. Their motivation is apparently to provide guidance

on use or further development of the very similar NAQFC system, as cited in lines 44-45 in the introduction:': : :National Air Quality Forecasting Capability (NAQFC) daily PM2.5 operational forecast (Lee et al., 2017).' The authors describe numerous analyses they completed to compare the 'fire signals' to be found in the CMAQ model results: deltaCO from CMAQ, PM2.5 CO and EC, acetonitrile, AOD, satellite fire hotspot detects and plume extents. Since the NAQFC is explicitly cited as being for the purpose of predicting PM2.5, and since this paper seeks to evaluate a NAQFC analogue, it seems quite odd that there was no effort to compare the SENEX EC and OC PM2.5 with model results, except in terms of ratios. While the paper shows considerable and diverse efforts to utilize appropriate data to evaluate the simulation results, poor writing obscures the value and meaning of this work to an unacceptable extent. The paper is authored by a respectable set of scientists; it is hard to believe that most of these authors actually read the paper as reviewed, so rife was it with grammatical errors, confusing word choices, contorted syntax."

Response: First of all, we'd like to thank reviewer efforts in reviewing this manuscript and valuable comments. For two major concerns raised by reviewer, we will address them in the following response.

Specific comments "I saw no effort to directly compare CMAQ PM2.5 with SENEX PM2.5 EC and OC."

Response: The main focus of this manuscript was to evaluate fire smoke algorithm used in NAQFC. The SENEX campaign observed PM2.5 concentration was one of the data sets this study used in validation. The philosophy being that NAQFC pays more attention to surface PM2.5 as it afflicts human health significantly (Brauer et al., 2015). We customarily use surface PM2.5 observation instead of flight measurement PM2.5 in NAQFC evaluation (Chai et al., 2013; Lee et al., 2017; Pan et al., 2014).

"Figures 7a, b, d and e are all missing color bar legends for AOD." Response: Graphs have been redrawn.

"In Figures 8a and b and 9e, the square symbols for observations are so densely packed that their outlines (in black) obscure the symbol colors over much of the flight path. Perhaps the density of observation points could be reduced in some areas and/or the symbols made larger to address this."

Response: Figures 8a, 8b and 9e have been modified.

"Line 29, comma after campaign" Response: It has been modified.

"Line 33 change 'helped identified' to showed or identified" Response: It has been modified.

"Line 36 , change 'filter out' to retrieve or to 'focus on' " Response: It has been changed to retrieve.

"Line 77 change 'comprised' to consists to make this a sentence. Change Satellite to Satellites" Response: It has been modified.

"Line 82 and following: itemization of the file names could maybe be best isolated in supplemental material. It isn't clear that using file names in this discussion adds much." Response: Figure 1 uses these file names, which represents the order of steps in the process of HMS. Simulation results are significantly affected by the files used in model, for example, in SENEX case #0703.

" Line 94: is hmx.txt meant to read hms.txt as used above. " Response: No, it means that detected wildfire information included in hmx.txt.

"Line 97: HMS imagery is " Response: It has been modified.

"Line 109 and elsewhere: In remote sensing a 12-km grid does not reliably 'resolve' features of size of 12 km, so I object to this casual misuse of 'resolution', even though it is common. Say '12- km grid' or otherwise describe. Use 12-km as adjective for grid. Be consistent. " Response: It has been changed to "12-km CMAQ model grid".

"Line 121-125:Confusing" Response: The actual situation is such.

"Line 128: emission rates " Response: It has been modified.

"Line 132: gridded emission" Response: It has been modified.

"Line 143: If that's a crude estimate what is a better approach and why wasn't that tested?" Response: HMS doesn't provide such information. Constant profile is the assumption at the time.

"Line 166-168: confusing. Reword. " Response: Rewrote it into "The analytical run is a 24-hour retrospective simulation using yesterday's meteorology and fire emissions to provide initial conditions for today's forecast. The forecasting run is a 48-hour predictive simulation using yesterday's fire emissions, assuming fires with duration of more than 24 hours are projected as continued fires."

"Line 171: is emitted by biomass burning " Response: It has been modified.

"Line 181-183 Not sure, but this sounds like you intend to tell us which processes contribute how much error." Response: Rewrote it into "In this study, we realized that it is almost impossible to assess the uncertainty of each specific smoke physical process"

"Line 188-190: But apparently not..." Response: It has been modified.

"Line 190: the purpose is to focus on fire/smoke signal timing? " Response: It has been modified "to capture fire signals".

"Line 205: Table 1 only gives AGL, not ASL. " Response: Table 1 shows CMAQ simulated results, which is based on AGL.

"Lines 210 and 214: change exhibits to shows" Response: It has been modified.

"Line 219 – 222: Unclear" Response: This means above average ΔCO concentration.

"Line 222-225: Not a sentence, even. " Response: It has been modified to "For an example, a clear fire signal between 500 m and 1000 m AGL was indicated by ΔCO across those altitudes and when the concentration of ΔCO was above 2.0 ppb – based

on the campaign duration averaged CO concentrations of about 150 ppb as well as on within the SENEX domain and outside of SENEX domain fire contributions to CO (150*(0.007+0.0067) =2.0).”

“Line 227: 'not negligible perspective' is unclear” Response: It has been modified.

“Line 246: change 'below' to 'above' and change 'was' to 'were' “ Response: It has been modified.

“Line 252: Change Tab. to Table” Response: It has been modified.

“Line 269: Change 'for' to 'to'” Response: It has been modified.

“Line 284 – 292: Could you say something clarifying about the significance of interference from clouds in making informative FMS comparisons? “ Response: June 17th case as an example was discussed in line 293-300.

“Line 290: CMAQ didn't underestimate it, the HMS BlueSky SMOKE emissions system did. “ Response: It has been changed to “HMS-BlueSky-Smoke emission system”.

“Line 294-5. No,your system used a climatological LBC and was thus blind to whether there was more or less actual influence from external fires. “ Response: At that time, NAQFC used climatological LBC. Now, dynamic boundary condition from NGAC is used in NAQFC (Wang et al., 2018).

“Line 303: 'a similar analysis' or 'similar analyses'.” Response: It has been modified.

“Line 302: 'is accessed' Response: It has been modified.

Line 309: 'Other reasons: : : are discussed: : :'” Response: It has been modified.

“ Line 331: change sparingly to occasionally or rarely.” Response: It has been modified.

“Line 334: change that to those or change that to were.” Response: It has been modified.

“Line 338: change 'are subject' to tend” Response: It has been modified.

“Line 387: So CH3CN decreased along with AGL, as AGL decreased? Or was inversely related to AGL? An ambiguously statement as written.” Response: “the decrease with AGL” has been deleted.

“Line 398: change 'was' to 'were'” Response: It has been modified.

“ Line 403-5: The single isolated CH3CN value of 3000+ strongly affects the slopes in Figures 9c and 9d.” Response: The enhancements of CO and OC were also measured at same moment.

“Line 444: 'rely on predicted delta CO, the difference: : :.' “ Response: It has been modified.

“Line 449: delete 'similar', change 'compared with' to 'comparable to' “ Response: It has been modified.

“Line 450: change 'shapefile analysis' to 'shapefiles'” Response: It has been modified.

“Line 452: end sentence as 'from elsewhere in the CONUS domain.' “ Response: It has been modified.

“Line 457: change 'outside'to 'bounding' “ Response: It has been modified.

“Line 461 – 471: For a structure like this with a colon leading to a list of independent clauses (1-4) (that may or may not contain commas), begin each clause in lower case and terminate all the clauses with a semicolon. Except for the last one, which gets a period.” Response: It has been modified.

“ Line 463-4: 'to avoid impasse arose by uncertainties' is unclear” Response: It has been changed to “a holistic evaluation approach was adopted so that the fire smoke algorithm was interpreted as a single entity to avoid deadlock due to over-interpretation of uncertainty of the single component in the system;”

“468-9: we were intentionally conservative: : : “ Response: It has been modified.

"Line 470: 'outliers' and delete 'sparse' " Response: It has been modified.

"Format used in text for citation is inconsistent." Response: It has been modified.

References:

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