Comments to "Constraint of non-methane volatile organic compound emissions with TROPOMI HCHO observations and its impact on summertime surface ozone simulation over China" by Feng et al.

As the key precursors of Ozone (O_3), Non-methane volatile organic compounds (NMVOC) have an important influence on the formation of photochemical, secondary organic aerosols and organic acids, harming human health. It is important and challenge to accurate estimate the spatiotemporal distribution of NMVOC emissions. This study presents the NMVOC emissions over China based on EnKF method by assimilating TROPOMI HCHO retrievals. Authors also optimize NOx emissions to reduce the influence of VOC-NOx-O_3 chemical feedback. The results showed that the forecast experiment with posterior NMVOC emissions reduced the uncertainty of HCHO and concentrations simulation. And the impact on surface O_3 simulation with prior and posterior NMVOC emissions was analyzed. The results will help to improve model forecasts of HCHO, NOx, and O_3 concentrations and contribute to design suitable emission reduction policies.

However, the structure of the article should be revised. Authors conducted four set of DA experiments and five set of forecast experiments. They discuss the influence of background error and observation error on the effect of optimizing HCHO emissions. And They also analyzed the impact on surface O_3 simulation with prior and posterior NMVOC emissions. Thus, there are too many goals in the study, and it is difficult for readers to remember the setting of these nine experiments. I suggested to delete the discussion about the influence of background error (**B**) and observation error (**R**) on the effect of optimizing HCHO emissions in the section 4.4. It would be nice to discuss the influence of the **B** and **R** when introducing the EnKF method and explain why authors design the **B** and **R** to optimize NMVOC emissions in this study.

There are several issues that need to be addressed.

specific comments：

1. Line 40: It should be "Compared with the forecast experiment with prior emission, the forecast with posterior ...". The statement should be revised.

2. Line 42: "Moreover" should be deleted. And the statement also should be revised

3. Line 176: What did you consider about the boundary condition of NMVOC and NOx?

4. Line 204~207: Did author consider about the correction of NOx and NMVOCs in the DA system?

5. Line 209~210: As NO_2 is a kind of short lifetime gas, the concentration of surface NO_2 measurements not only present NO_2, but also may include NOx. What did you consider about the influence of NO_2 observation uncertain on optimizing NOx emissions?

6. Line 265: It would be better to use mosaic diagram to present the data amount of TROPOMI HCHO.

7. Line 299: Please added the year of the study period.

8. Line 307~314: The background error covariance is implicitly expressed in the EnKF method. How did author implement EMS1 experiment in the DA system? And it would be better to introduce EMS1-3 experiment follow the EMDA, making the text description consistent with the Table1.

9. Line 324 and 351: "prior and posterior emissions" should be "prior and posterior NMVOC emissions", and "EMGAN" should be "MEGAN".

10. Line 440-441, Figure 5: It is difficult for readers to remember the setting of experiments. And I think that "CEP3" should be "CEP1" in the Fig. 5a?

11. Line 515-518: The background errors and observation errors play an important role in the DA system. It would be better to give a detailed explanation of why the difference in two posterior NMVOC emissions was small by using 'two-step' inversion strategy in the DA system.