

Comment to acp-2019-485:

This manuscript titled “Quantifying the impact of synoptic circulations on ozone variations in North China from April–October 2013–2017” tried to find out the impacts of synoptic circulations and build a potential forecast model. I found several major problems needed to be addressed before publication in ACP.

Major comments:

1. Now that the grid of Era-interim is fine, thus why only 16-point grid were selected to classify the circulation. Furthermore, if there are some scientific considerations, the authors should clearly illustrate and connected to the O<sub>3</sub> pollution.
2. Closely to comment 1, the synoptic circulation classification must be connected to the features of MDA8 O<sub>3</sub>. In the manuscript, firstly 26 types were separated, and then 5 weather categories were summarized. I think better solution is to consider the MDA8 O<sub>3</sub> in the first step. In other words, in the authors’ scheme, the 26 types might be already diagnosed by many previous studies, even not related to the surface O<sub>3</sub> pollution.
3. Only the sea level pressure was considered when synoptic circulation classification, it is better to add some variables in the mid-high troposphere. As you know, the atmospheric circulations in the mid-high

troposphere were more representativeness.

4. The authors illustrated that “39.2% of the inter-annual domain-averaged O<sub>3</sub> increase from 2013 to 2017 was attributed to synoptic changes”.

I wonder how to discuss the interannual variations only using 5 years data.

5. To provide the potential of O<sub>3</sub> forecast, several models were built for each city and the results were shown in Section 3.4.

- (1) How can we pre-determine the type of the synoptic circulations?

One possible way is to use the output of numerical weather model.

- (2) The selected predictors in the models were the simultaneous variables, thus the question is how to obtain the predictors? If the answer is the output of NWP, the models should be trained from the achieved NWP output data instead of the observation or reanalysis.

- (3) TCC is not a routine observed variable, and also not a reliable NWP output.

6. The English were intensively suggested to be improved by the native speaker.

#### Mini comments

1. Line 24: what is the S-W-N stand for? cyclone type (C)....

The use of abbreviations should be modified throughout the manuscript,

particularly in the Abstract.

2. What is the mean of QHD, ZZ?
3. Line 101-113: the type set is different.
4. Line 164: Why mentioned Figure 7a before Figure 2? Similar problems can be find in the manuscript.
5. Line 182: the definition of “exceedance ratio”?
6. Line 188: the reason for these 14 cities? That is, why the authors choose these 14 cities?
7. Line 219: “ and and and” is not a good section title.
8. Figure 4 & 6: the panels are too small to read.
9. Figure 3: the color bae cannot show the 26 types.