The manuscript entitled by "AOD data fusion with Geostationary Korea Multi-Purpose Satellite (Geo-KOMPSAT) instruments GEMS, AMI, and GOCI-2: Statistical and deep neural network methods" are shown to the data fusion for various AOD retrieval products to enhance accuracy and stability of datasets. This manuscript showed details of statistical fusion methods and pre-processing before data fusion.

For the readability of manuscript, it needs to be checked the English correction. In addition, chapters of the manuscript must be re-constructed. In particular, some words and phrases are unclear. Although this manuscript is highly useful for the application of air quality and climate, the manuscript will be improved before publication. I summarized the details of comments.

Major comments

1) Title: This work used the AOD retrieval from GEMS, AMI, and GOCI-2, which are GK2 mission, not GK mission. I suggested that the title will change 'Geo-KOMPSAT-2 (GK2)'. In addition, the author should check and correct this word in all manuscript.

2) Introduction: This manuscript is purposed on showing the result of AOD data fusion. Although the manuscript explained several previous AOD retrieval algorithms, other product algorithms (such as aerosol index, SSA, ALH) are not essential to explain. Please simplify the introduction session more focusing on the AOD retrieval algorithm only.

3) L92~100: For the AOD algorithms in GK-2 sensors, the manuscript will introduce details of algorithm description including advantage and disadvantage. So, please reinforcement the purpose of this research.

4) Section 2: The manuscript explained the respective GK-2 sensors and applicable algorithm in the same sections. However, I suggest that the section will separate the instruments and algorithms.

5) L166: Please specify the uncertainty of AERONET AOD. "Uncertainty" means bias? Or precision?

6) Section 2.2: Most of AERONET sites are located on land surface. For the fusion, spatio-temporal homogeneity is important. However, the AERONET AOD, for the

reference dataset of training, is not spatially homogeneous. This inhomogeneity will affect the accuracy of fusion. In addition, please list-up or make a figure for AERONET sites.

7) Section 3.1: Why did the dataset re-gridding? Why don't you use the original pixel datasets for training?

8) L205: For cloud pixel identification, -28 K were used. Is that threshold also used in this study? As changing the instrument, the threshold value is also changed.

9) Section 4.1: I suggest that this section will move the method section.

10) Section 4.3.1: Why does the author separate the regions, AOD-EA and AOD-KO?

11) L390~L405: To write the AERONET site name, please write the location information.

12) Section 4.3.3: Author showed the diurnal variation of fusion AOD. However, this diurnal variation is not perfectly showed the diurnal variation. The data includes the arbitral signals during the fusion. How to be classified the real and arbitral diurnal variation from data?

13) Conclusion: Please add the further study of this research to improve the fusion results.

Minor comments

1) L15: "Geostationary Korea Multi-Purpose Satellite (GEO-KOMPSAT, GK)" → "second generation of Geostationary Korea Multi-Purpose Satellite (GEO-KOMPSAT-2, GK-2)"

2) Abstract (L22-L25): "The statistical and DNN-based ~~" is difficult to read. Please rephrase this sentence.

3) L35: Difference of definition between 'spectrometer' and 'radiometer' is different. However, in this manuscript, the author confused to use these words.

4) L134: In version 2 of the GEMS AOD at 550 nm, how to retrieve the AOD at 550 nm from GEMS? GEMS does not have 550 nm observation data.

5) L155: Please include the reference for GEMS algorithm.

6) L195: It is confused. Please re-describe.

7) L208: BTD10.3-13.3 is "BTD of the 10.3 and 13.3 um".

8) L209: "atmospheric window": 13.3 um is not an atmospheric window.

9) L288: "0.05+0.15AOD"

10) L303: Kim, M. et al. -> Kim et al.

11) L306: Please specify the wavelength of AOD. In addition, please clarify the wavelength of AOD in all description.

12) L349-L360: Please add the table of statistical AOD results before and after fusion.

13) L379: What is 'EE gradient'? Is that frequently used?