Anonymous Referee #1:

This study is too simple and may be well-suited as a measurement report. Undoubtedly, the aerosols in that location are very important to study, but the paper lacks enough depth to it.

However, I have some minor comments

Respond:

Thanks for your comments, we have changed the type of this manuscript to "measurement report". This manuscript does not analyze the AOD in detail, part of the reason is lacking of comprehensive observation. However, the CE318-T can provide unique information in the coastal Antarctic.

1. "The increase in AOD during spring and winter correlates with a reduction in the fine mode fraction, whereas the increase observed in summer and autumn may be attributed to the growth and aging of fine particles." How can both increase? Please correct

Respond:

What we meant is, "In winter and spring, high AOD values are related to the increase of coarse mode particles, while in summer and autumn, high AOD values may be related to the growth of fine mode particles." Detailed speaking, in Section 3.2, we use the aerosol classification method proposed by Gobbi to obtain the contribution of fine mode particles to AOD and the size of fine mode particles, and can also separate whether the increase of AOD is caused by the hygroscopicity growth of fine mode particles or by the increase of coarse mode particles. In Fig. 4, we discussed the different seasons. For example, in spring (Fig.4a), when AOD<0.03, the aerosol is mainly composed of fine mode particles ($\alpha_{440-870\,nm} > 1.0$), the contribution of fine mode particles to AOD is less than 70% ($\eta < 70\%$); when AOD>0.03, the aerosol is dominated by coarse mode particles ($\alpha_{440-870\,nm} < 1.0$), and the contribution of fine mode particles to AOD is less than 30% ($\eta < 30\%$). Moreover, since the particles during spring are mainly concentrated in the $\delta\alpha > 0$, this indicates that the increase of coarse mode particles is the main reason for the

increase of AOD in spring. In summer (Fig.4b), when AOD>0.03, aerosols mainly concentrated in the region of fine mode particle growth ($\delta\alpha < 0$), and the contribution of fine mode particles to AOD is 50% to 99% ($50\% < \eta < 99\%$), indicating a significant influence of fine mode particle growth on AOD increase. Therefore, we believe that the main reason for the higher AOD values is different during different seasons.

The former statement was unclear, which may lead to confusion for readers.

2. "Increases in AOD during spring and winter correlated with decreases in fine mode fraction, while increases during summer and winter related to fine mode particle growth and aging." This line is very confusing with the usage of 'increase''

Respond:

It has been modified into:

"The high AOD values during winter and spring were associated with increased contribution of coarse mode particles, while high AOD values during summer and autumn are associated with the growth of fine mode particles."

3. The last line in abstract only talks about the origins of particles in the summer. Why specifically summer? Why not other seasons?

Respond:

Agree with you. In the discussion part, we used the air mass backward trajectory to analyze the sources of aerosol on high AOD days and low AOD days respectively. Although most of the high AOD days occur in summer, it is inaccurate to mention only summer in the abstract. Thus, it has been modified into:

"Backward trajectory analysis revealed that coarse particles from the ocean predominantly contributed to high AOD daily mean values, while fine particles on low AOD days originated mainly from the air mass over the Antarctic Plateau."

4. The abstract is incomplete. I suggest you to add a conclusion line to your abstract as to why this study is important or how it can help others?

Respond:

Agree. The abstract has been extended, such as the following is what we added in abstract:

This study enhances the understanding of the optical properties and seasonal behaviors of aerosols in the coastal Antarctic. Specifically, AOD measurements during the polar night address the lack of validation data for winter AOD simulations. Additionally, we revealed that lower wind speeds, higher temperatures, and lower relative humidity contribute to increased AOD at Zhongshan Station, and air masses from the ocean significantly impact local AOD levels. These findings help us infer AOD variation patterns in the coastal Antarctic based on meteorological changes, providing valuable insights for climate modeling in the context of global climate change.

5. How is DMS found in the plateau? Does it come from transportation from ocean? But you have mentioned about katabatic winds that drive from interior to coastal

Respond:

Thank you for your comments. In fact, we did not observe DMS particles in the Antarctic plateau. In Section 3.2, the seasonal variation in the proportion of fine particles aligns with the seasonal variation in DMS concentrations in previous studies, and the growth in fine mode particles observed during summer and autumn corresponds with the typical coastal process of DMS oxidation to MSA, nucleation, and growth. Therefore, we believe that the particles observed at Zhongshan Station may be related to DMS. In the discussion section, some air masses on low AOD days originated from the Antarctic plateau and may be associated with katabatic winds. Given the small particle sizes observed and referencing other literature on aerosol components from the Antarctic plateau, we infer that these particles may be non-sea-salt sulfates, primarily originating from DMS oxidation. Additionally, during summer, the enhanced efficiency of meridional long-range transport and the weakened inversion layer on the Antarctic Plateau likely facilitate the transport of these particles from the ocean to the Antarctic Plateau.

6. "AOD675 nm is associated with the declining η"….. introduce η before using it

Respond:

The explanation of η has been added in line 197-198:

"The solid black line represents the size of fine mode particles (R_{eff}), and the dashed blue line represents the proportion of the contribution of fine mode particles to AOD (η)."