Point to Point corrections in the paper.

Section changes:

1. All three reviewers want more retrieved data from FTS, therefore, in section 4.3, we add long time period observation.

2. Cloud-only case is deleted. We want to prove Lidar information is important in distinguishing aerosol or cloud, which is already proved in the aerosol case.

3. The results of artificial spectra used as measured spectra are moved into section 4.1, which is in section 3.2.3 in the former version of the manuscript.

Details changes according to three reviewers:

Turner (2008) and Rathke et. al. (2002) are added.
(R1 If there are any previous studies regarding to the remote sensing of aerosols using the FTS, you should mention them.)

The main reason for setting the upper limit of the Reff to 1 \unit{\mu m} is that aerosols in the Arctic region are often below 1μm, according to the measurements of aerosol size distribution in the Arctic area ((Asmi et al., 2016; Park et al., 2020; Boyer et al., 2022)). In addition, if the such constraint is not set to 1 \μm, occasionally, the retrieval of fine particles, such as sulfate and BC, will be mathematically increased for a better fit of the spectrum, which is artificial. Because sea salt can be larger than 1μm, when the retrieved Reff of sea salt is close to 1μm and sea salt is the dominant aerosol, the database of sea salt is extended to 2.5μm and the retrieval is run again.
(R1 Sea salt and dust particles can have a larger radius than 1.0 μm. Why is the maximum radius 1.0 μm?)

Other aerosol types with larger sizes are presented in Fig. A1. As a result, the radiance from sea salt with the same size as other aerosols is significantly lower; only when sea salt has a large particle size, whereas other particles are smaller, are both radiances comparable.
(R1 The result of sea salt in Fig. 4a is calculated using the same effective radius as the other particles. When the effective radius of the other particles is 0.70, and 1.25 μm, does the sea salt have comparable radiances with those of the other particles?)

Section 3.3 AOD in AERONET and MERRA-2 are added.
(R3: Appendix A may be included in Section 3)

In order to show the reliable range of the retrieval AOD, using similar artificial spectra but for several settings of AOD from 0.001 to 0.1 at 900 cm^{-1}, the relative uncertainties of AOD in original cases with several preset values are given in In Fig. 5b. It shows that when the AOD of the aerosol is low, less than 0.003, the retrieval result is distorted. However, as the AOD of aerosol

gradually increases, the aerosol signals in the infrared waveband become more recognizable, the retrieval result of aerosol gradually approaches the true value, becoming more reliable. Therefore, we propose that when the AOD is greater than 0.003, the retrieval results are reliable.
(R1 Can you show the reliable range of the retrieval AOD from the results in Fig. 5?)

Organic carbon (OC) is one of the major components in the tropospheric aerosols. It is not considered because there are no data in the complex refractive index at infrared waveband of OC. There are many types of OC, each of them may have a different spectral signature. However if there are spectral features which are not fitted, e.g. due to the presence of aerosol types not accounted for in the scattering database, the error margin on the retrieved aerosol types will be increased.
(R1 Organic carbon (OC) is one of the major components in tropospheric aerosols. The authors do not consider OC in the retrieval method, but actually, OC would affect the retrieval results. What is the influence of OC?)

The averaging kernels belong to the retrieved result, because they include much information about the retrieval results, e.g. how much influence is exerted by the a priori and how independent the retrieved quantities are from each other. On the diagonal elements one finds the derivatives of each element in the retrieved state vector with respect to its corresponding element in the true state vector. From the averaging kernel, the AOD of sulfate is the parameter least dependent on a priori information, followed by the AOD of dust and sea salt. Except for dust, all other aerosol size information is difficult to be retrieved.
(*R1 Does AVK used in this study?*)