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Comparison of aerosol parameters obtained from ground-based CE318 observations under different wavelength combinations

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Aerosol is an important part of earth-atmosphere system. As the world's largest ground-based aerosol observation network, AERONET provides multi-parameters of aerosol to support climate change research and satellite inversion studies. AERONET currently uses four-bands (1020/870/675/440 nm) observations as inputs for inversion of aerosol parameters. While the 1020 nm band is more susceptible to temperature, and its temperature correction coefficient is more difficult to obtain, thus there may be big uncertainty in retrieval results from instruments without well temperature-effect correction.

In this paper, Dubovik et al. 2002, 2006 inversion method was used to study the differences among aerosol size distribution, single scattering albedo and refractive index at three band-combinations: 1) four normal bands (1020/870/675/440 nm); 2) three bands without 1020 nm; 3) using of 1640 nm band instead of 1020 nm band, under heavy pollution (AOD(440 nm)=1.05), light pollution (AOD(440 nm)=0.41) and clean (AOD(440 nm)=0.25) weather conditions. As can be seen from table 1, in case of low AOD, the inversion errors of the four normal bands are largest among the three band-combinations inversions, while the errors of the inversion results from three bands are close to the results of the band-combination with 1640 nm band. In the case of heavy pollution, the inversions of the three band-combination are not very good, and the inversion errors of the four band-combinations are the same. This is because the input information increases with the observation bands increase, and thus the inversion result is much more reliable. However, under the low AOD condition, the temperature effect has a great influence on the inversion result of the 1020 nm band. Under the high AOD condition, the relative temperature effect of 1020 band is much more less, so its inversion results are almost the same as four band-combination with 1640 nm. From Fig. 1, 2 and 3, it can be found that the change of the band combination has little effect on the particle size distributions. However, after adding 1640 nm band, the inversion information of the coarse mode particle size distribution is much richer, and the size distribution nearly presents three peaks. However, under the condition of heavy pollution, there are big differences in the distribution of fine particles obtained from four normal bands inversion. One can see from the inversion results of SSA, results from the four band-combination with 1640 nm band are close to those of three bands, but different from four band-combination with 1020 nm band inversions. Under heavy pollution, the results of refractive indexes obtained by the inversion of the four band-combinations are consistent, and there is a big difference with the inversion of the three bands. Under lightly polluted weather, the imaginary parts of refractive index obtained by the four-band-combinations inversion are consistent, but the real part results are quite different, the difference is about 0.02. Under the condition of clean weather, the refractive indexes are even worse after adding 1640 nm observations, that is mainly due to the lower signal values observed at 1640 nm band under clean weather.