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Airborne measurements for validating satellite-based above-cloud aerosol optical depth

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Satellite-based retrieval algorithms such as the "color ratio" method, which utilizes measurements at a shorter (470 nm) and a longer (860 nm) wavelength, have demonstrated the simultaneous derivation of aerosol optical depth (AOD) and cloud optical depth (COD) for scenes in which absorbing aerosols are found to overlay low-level cloud. Here [1, 2,3], the color ratio method was adapted for airborne measurements, where the above cloud aerosol optical depth (ACAOD) and aerosol-corrected cloud optical depth (COD) were simultaneously retrieved. The ACAOD was then partitioned between the AOD below-aircraft (AOD_cloudtop) and above-aircraft AOD (AOD_sky). The influence of 3D radiative effects on the retrievals was examined, and it was found that the color ratio method had little sensitivity to 3D effects at overcast stratocumulus cloud decks. The results further indicated that the 3D effects increase retrieved ACAOD by about 3 %–11% and retrieved COD by about 25 % in cloud shadows. This study advances the retrieval and validating of aerosol optical properties in the presence of clouds, a longstanding problem of distinguishing the contributions from aerosols and clouds in top-of-atmosphere (TOA) reflectance measurements.

Keywords: airborne measurements, retrieval algorithm, aerosol, clouds

References

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