



Optical properties of aerosol contaminated cloud derived from MODIS instrument

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The presence of absorbing aerosols above/within cloud can reduce the amount of up-welling radiation in visible (VIS) and short-wave infrared and darken the spectral reflectance when compared with a spectrum of a clean cloud observed by satellite instruments (Jethva et al., 2013). Cloud properties retrieval for aerosol contaminated cases is a great challenge. Even small additional injection of aerosol particles into clouds in the cleanest regions of Earth's atmosphere will cause significant effect on those clouds and on climate forcing (Koren et al., 2014; Rosenfeld et al., 2014) because the micro-physical cloud process are non-linear with respect to the aerosol loading.

The current cloud products like Moderate Resolution Imaging Spectroradiometer (MODIS) ignoring the aerosol effect for the retrieval, which may cause significant error in the satellite-derived cloud properties. In this paper, a new cloud properties retrieval method, considering aerosol effect, based on the weighting-function (WF) method, is presented. The retrieval results shows that the WF retrieved cloud properties (e.g COT) agrees quite well with MODIS COT product for relative clear atmosphere ($AOT \leq 0.4$) while there is a large difference for large aerosol loading. The MODIS COT product is underestimated for at least 2 – 3 times for $AOT > 0.4$, and this underestimation increases with the increase of AOT.