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Comment on "Do aerosols impact ground observation of total cloud cover over the North China Plain?"

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Abstract

We further test the hypothesis suggested by Sun et al. (Sun et al., 2014). Recognizing the problems caused by the area-averaging calculation method, we focus on the analysis of individual observations over North China Plain (NCP) and a larger area where aerosol loading acts as the main contributor to the difference between satellite and ground observations of total cloud cover (ΔTCC). We show that as aerosol loading increases, the occurrence frequencies of $\Delta TCC > 12.5\%$ increase at first and then decrease at heavy aerosol loading conditions. There is a significant linear relationship between the cumulative frequency of $\Delta TCC > 12.5\%$ and aerosol loading for both the increasing and decreasing trends. Therefore, a two-phase relationship between $\Delta TCCs$ and aerosol loading is confirmed.

Key words: total cloud cover, ground-based observation, MODIS, aerosol loading, AOD, visibility

1. Introduction

An important dataset for the long-term trend study of total cloud cover (TCC) is surface observation. Based on this dataset, significant decreasing trend in TCC has been found over China in the second 50 years of the 20th century (Kaiser, 1998; Qian et al., 2006). It seems that the changes in TCC cannot support the decreasing trend in solar radiation over the same period. Therefore, much attention has been paid to the data quality of the surface-observed TCC, for example, inhomogeneous issue (Jovanovic et al., 2011) and aerosol obscuring issue (Sun et al., 2014; Warren et al., 2007).

Sun et al. (Sun et al., 2014) focused on the aerosol obscuring issue and investigated the influence of aerosols on surface observation of TCC over the North China Plain (NCP). The rationale behind their analysis was that if the obscuring effect of aerosols did exist, ground observation of TCC (TCC_{grd}) would decrease as aerosol loading increases, contrarily, satellite observation of TCC (TCC_{sat}) would increase due to misclassification of aerosol to cloud. Therefore, the