



## **Diurnal variations of aerosol optical properties in the North China Plain and their influences on the estimates of direct aerosol radiative effect**

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In this paper, the diurnal variations of aerosol optical properties and their influences on the estimation of daily average direct aerosol radiative effect (DARE) in the North China Plain (NCP) are investigated based on in situ measurements from Haze in China campaign. For ambient aerosol, the diurnal patterns of single scattering albedo (SSA) and asymmetry factor ( $g$ ) in the NCP are both highest at dawn and lowest in the late afternoon, and quite different from those of dry-state aerosol. The relative humidity is the dominant factor which determines the diurnal patterns of SSA and  $g$  for ambient aerosol. Basing on the calculated SSA and  $g$ , several cases are designed to investigate the impacts of the diurnal changes of aerosol optical properties on DARE. The results demonstrate that the diurnal changes of SSA and  $g$  in the NCP have significant influences on the estimation of DARE at the top of the atmosphere (TOA). If the full temporal coverage of aerosol optical depth (AOD), SSA and  $g$  are available, an accurate estimation of daily average DARE can be achieved by using the daily averages of AOD, SSA and  $g$ . However, due to the lack of full temporal coverage datasets of SSA and  $g$ , their daily averages are usually not available. Basing on the results of designed cases, if the RH plays a dominant role in the diurnal variations of SSA and  $g$ , we suggest that using both SSA and  $g$  averaged over early morning and late afternoon as inputs for radiative transfer model to improve the accurate estimation of DARE. If the temporal samplings of SSA or  $g$  are too few to adopt this method, either averaged over early morning or late afternoon of both SSA and  $g$  can be used to improve the estimation of DARF at TOA.