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Estimate of direct and indirect aerosol radiative forcings from satellite data

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Aerosol radiative effects, in particular their indirect effects (their ability to enhance cloud albedo), continue to constitute the main uncertainty regarding anthropogenic forcings of global climate change. Here we present an estimate of the radiative forcing by anthropogenic aerosols due to both their direct and indirect (cloud albedo effect, and cloud lifetime effect as far as it changes cloud albedo) effects from satellite data. We combine retrievals of aerosol optical thickness by the MODerate Resolution Imaging Spectroradiometer (MODIS) and of broadband short-wave planetary albedo by the Clouds and the Earth's Radiant Energy System (CERES) instruments on board the same Terra spacecraft, and find statistically significantly positive relationships for virtually all seasons and regions investigated, in four different cloud scenes (from clear to overcast skies). From these relationships in combination with a recently established dataset of the anthropogenic fraction of MODIS aerosol optical thickness, we are able to quantify the radiative forcings for both the aerosol direct and indirect effects, which in the global annual mean are -0.8 and -0.3 Wm^{-2}, respectively.