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Cirrus Cloud Radiative Forcing Estimation over China

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Midlatitude cirrus cloud radiative forcing (CRF) values at the tropopause over China are estimated using a radiative transfer model initialized by Earth-orbiting Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) and Moderate Resolution Imaging Spectroradiometer (MODIS) measurements. A derived diurnal mean CRF, solved as a function of solar zenith angle (*SZA*), though varied over the solar day, is used to evaluate the sensitivity and influence of *SZA* on CRF calculations. Although a total mean net (NET) CRF of 36.5 $\pm$ 48.4 W m^{-2}, estimated using direct observation data, is approximately equal to the value of 36.8 $\pm$ 50.4 W m^{-2} from the diurnal mean simulations, monthly differences illustrate a seasonality function dictating the influence of *SZA* on CRF. A significant positive NET effect exceeding 80 W m^{-2}over the Qinghai-Tibet Plateau is found, which is in contrast to a NET CRF found to be closer to 20 W m^{-2} for most parts of China. This finding is attributable to a more prominent warming effect of cirrus clouds observed over higher terrain. Furthermore, a warmer and more humid thermal profile over the high terrain in summer induces decreases in longwave (LW) and NET CRF over the plateau. The seasonal spatial variability of cirrus cloud visible optical depths also contributes to the corresponding spatial variability of shortwave (SW), LW, and NET CRF solved.