MINERAL DUST RADIATIVE FORCING AND EFFICIENCY AT THE BSRN IZAÑA STATION.

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Izaña Atmospheric Observatory (IZA) is a subtropical high-mountain observatory, located in Tenerife Island (Canary Islands, Spain) at 28.3°N, 16.5°W, 2.367 m a.s.l., and only 350 km far away from the African continent coast. IZA is managed by the Izaña Atmospheric Research Center (IARC) and belongs to the Meteorological State Agency of Spain (AEMET). Since 1987 IZA is part of the Global Atmospheric Watch (GAW) programme and since 2009 is part of the Baseline Surface Radiation Network (BSRN). IZA is above a quasi-permanent inversion layer, hence avoiding vertical transports and possible mixture processes with local pollution. Consequently, it offers excellent conditions for in situ and remote sensing atmospheric observations of trace gases and aerosols under free troposphere conditions. These conditions are only modified during episodes of African desert mineral dust measured at IZA during summer. Hence, IZA offers excellent conditions for evaluating the effect of Saharan non-perturbated mineral dust on the solar radiative balance.

In this work, we calculate the diurnally aerosol radiative forcing (ΔDF) and the diurnally aerosol radiative forcing efficiency (ΔDF^{eff}) using BSRN measurements for clear-sky days with aerosol optical dept (AOD) at 550 nm higher than 0.1 and Ångström parameter (α) smaller 0.75, which correspond to mineral dust conditions at IZA. The ΔDF and ΔDF^{eff} have been evaluated for global, direct and diffuse shortwave downward radiation (SDR). It is very interesting to distinguish ΔDF and ΔDF^{eff} for each solar component (direct and diffuse SDR), since atmospheric aerosols interact in a different way with the solar radiation, depending on their aerosol properties (size distribution, chemical composition, etc). On average, the ΔDF found for African non-perturbated mineral dust at IZA are -9±5, -106±31 and 50±16 Wm^{-2} (AOD=0.17±0.06) for global, direct and diffuse SDR, respectively, while the ΔDF^{eff} is -73±8, -546±19 and 271±8 Wm^{-2} per unit of AOD at 550 nm for global, direct and diffuse SDR, respectively. These ΔDF values represent mean changes about 0.02% for global, 0.2% for direct and 2.5% for diffuse SDR with regard to the corresponding SDR without aerosols (F^C) at surface ($\Delta DF/F^C$). These results show the significant potential of mineral dust particles to cool the Earth-atmosphere system.