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The impact of Dust Storms on both Solar Radiation and Sky temperature in Tabouk Saudi Arabia, theoretical Investigations

Abdullrahman Maghrabi

King Abdulaziz City For Science and Technology, National Center For Applied Physics, Riydah, Saudi Arabia (amaghrabi@kacst.edu.sa)

Dust particles affect both solar and terrestrial radiation by scattering and absorption and are therefore considered to be a significant climate-forcing factor. Dust storms are a very frequent phenomenon in Saudi Arabia. Several dust storm events occurred in Tabouk, northern region of Saudi Arabia, during the period between 2014-2015. In this study, simulations using the SMART model were conducted to investigate how the dusty conditions affected the solar irradiances during these events. Additionally, theoretical simulations were carried out using MODTRAN program to examine the changes in the infrared sky temperature during dusty conditions. The Atmospheric Optical Depth (AOD) measurements at (500 nm) were used as an input into both programs. The analysis showed that the dusty conditions significantly decrease the global and direct irradiances and increase the diffuse component compared with clear sky days. Also it was found that the dust storms increase the sky temperature in the atmospheric window (8-14 μm) such that the window emissions resembled those of a blackbody and the atmospheric window was almost closed.