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Future Enhanced Tropical Surface UV-B Due to a Continuous-cooling Stratosphere

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To investigate the changes in surface solar ultraviolet (UV) radiation due to climate change under cloud free conditions in tropical regions (30S-30N), we have analyzed the simulations of 10 coupled Chemistry-Climate Models (CCMs). The total ozone columns and vertical profiles of ozone and temperature projected from the simulated outputs were used as input to a line-by-line radiative transfer model in order to get the corresponding erythemal spectral transmittance. The total column ozone changes little in the tropical region, depleting for less than 9 DU from 1960 to 2000 and then about a recovery of $\sim$6 DU in the 21st century while there's a depletion of $\sim$15 DU and a recovery of $\sim$30 DU in the northern midlatitudes (30N-60N). Compared to the total column ozone change, the tropical stratospheric temperature change is intense. The temperature decrease will be amplified with the height above 100 hPa and reach about 4 K at 50 hPa and 13 K at 0.5 hPa in 2090 refer to 1965 in the tropics while the change will be 2 K at 50 hPa and 12 K at 0.5 hPa over the northern midlatitudes. Surface erythemal irradiance transmittance due to stratospheric cooling will increase continuously. Between 1965 and 2090 eythemal irradiance transmittance will increase by 1.0%, 2.9% and 10% in 300 nm, 290 nm and 280 nm due to temperature change, while it is 2.4%, 16% and 55% due to ozone change in the tropics. The surface UV-B change induced by temperature change is about 20% of that induced by ozone change in the tropical regions. Because of the uncertainties of tropical ozone changes and the high surface UV-B in the tropics, the increasing surface UV-B due to a continuous-cooling stratosphere should be paid more attention in the 21st century.