

# **A numerical simulation study on the climate response to ultraviolet irradiation forcing**

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Based on the numerical simulation experiment, the climate responses to the ultraviolet irradiation forcing are studied. In the experiment, the Whole Atmosphere Community Climate Model (WACCM) is employed. Via setting sensitive experiments, the impact of UV variability on middle atmosphere can be detected and analyzed. The analysis of model simulation results shows that the ozone distribution in atmosphere is sensitive to UV irradiation variability. While UV irradiation is enhanced, the ozone content increases at altitude from 10 to 30 km and decreases at altitude above 30km over low-middle latitudes. And the atmospheric temperature below mesosphere is increased. The warm anomalous temperature appears above 35 km and achieved max temperature increasing at stratopause, which is accorded with the zone concentration location in atmosphere. It means that the ozone heating mechanism take an important role in the process. The ozone and temperature response fields are on the contrary when the UV irradiation is reduced. Furthermore analysis reveal that the stronger UV forcing results in the temperature gradient increasing between the equator and polar by ozone heating mechanism , and then modules the zonal wind specially in stratosphere and upper troposphere over middle high latitudes. With the position of the zonal wind poleward and downwards, Arctic Oscillation pattern appears in the northern hemisphere winter which brings about the temperature increasing over Asian middle latitudes. At last, the features coming from the reanalysis data of the European Centre for Medium-Range Weather Forecasts is compared with the experiment results.

Key words: Ultraviolet, ozone, numerical simulation, climate