

Effects of the solar activity on the terrestrial upper atmospheres

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The upper atmospheres of the terrestrial planets (Venus, Earth, and Mars) are strongly affected by the solar energy inputs. For example, changes in the X-ray and extreme ultraviolet (EUV) radiation cause the temperature, wind, and composition variations during a solar cycle. In addition, geomagnetic activity effects are also significant in the Earth's upper atmosphere. The amounts of these energy inputs have been changed since the terrestrial planets were formed. The X-ray and EUV radiation was extremely stronger 3.5 Gyr ago than the present. In order to understand the atmospheric environments and atmospheric evolutions of the terrestrial planets, we should investigate effects of the solar activity on the atmospheres. In particular, the upper atmosphere would be closely related to the atmospheric evolutions because the region is the boundary between the atmosphere and space. We have developed atmospheric models for studies of the aeronomy in the terrestrial planets. Some simulation results for Venus, Earth, and Mars will be shown: e.g., responses of the Venusian and Martian upper atmospheres to changes in the X-ray and EUV radiation, and variations of the Earth's upper atmosphere during geomagnetically quiet and disturbed periods.

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