THE STRATOSPHERIC OZONE IN SAA ZONE CAN BE AFFECTED BY ENERGETIC PARTICLE PRECIPITATION. THE QBO SIGN

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Abstract:

The low magnetic field in the South Atlantic Anomaly (SAA) zone facilitates the entrance of high-energy particles from the magnetosphere. Pitch-angle scattering and storm-time magnetic disturbances, between other magnetospheric mechanisms, can cause an enhancement of the particle precipitation on the SAA zone; moreover, the wave-particle interaction can lead to an increase of the drifting particles loss cone and with other processes, produce the inner radiation belt particles enter into the SAA zone. The quasi-biennial oscillation, QBO, with a period varying from about 26 to 30 months, is the main variation of the mean zonal wind in the equatorial stratosphere and also a feature of many processes in the Earth's atmosphere. In this study, we analyze the effects of the precipitation of energetic protons in the SAA region during and after the occurrence of six intense geomagnetic storms occurred in 2001, 2003, 2004 and 2015; three of them during QBO westerly phase, and the other three during QBO easterly phase. Furthermore we consider three stations located in the SAA area (5 - 40 degrees South and between -45 and -60 degrees East). Data of total column ozone and ozone profiles registered by TOMS and SBUV Merged Ozone Data are used. The effects on the stations during and after the occurrence of geomagnetic storms in QBO easterly phase, first show increases (values between 2.0 % and 4.0 %) in total column ozone (TCO) between day one and day five after the minimum value of Dst geomagnetic index. The following days the effects show significant decreases in TCO with values between -3.4% and -6.0 %, 7 to 10 days after the day of the minimum value of the Dst index. In the case of geomagnetic storms during QBO westerly phase, the TCO on stations located in SAA zone shows increases, in some cases statistically significant, between the day one and 6 to 10 days after the minimum value of the Dst index. The following days show no significant decreases in TCO that reaches -4.0% in the case of November 6, 2001 storm. In the case of ozone profiles from SBUV data, between 0.639 hPa (~53.3 km) and 101.3 hPa (~15.8 km), a significant increase (decrease) at middle stratospheric heights during QBO easterly (westerly) phase storms is detected. . The effects observed after the occurrence of intense geomagnetic storms analyzed in this paper could be due to the increase in proton precipitation in the SAA region,

coming from the inner Van Allen radiation ring. The chemical transport mechanisms widely studied for high latitudes perhaps could also be applied to the SAA region. The sign of the QBO in TCO registered in the stations during the periods analyzed, would also affect the results observed.

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