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同步轨道磁场和地面磁场对太阳风动压变化事件的响应

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Response of geosynchronous magnetic field z component and geomagnetic field to solar wind dynamic pressure change

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摘要

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摘要 本文对磁宁静时的123个动压变化事件(不包含激波事件)进行了统计研究. 研究表明, 在白天侧(9~15MLT)同步轨道磁场z分量对太阳风动压增大、减小事件具有较强的正响应, 而在夜侧(21~3MLT)响应明显减弱, 响应幅度具有明显的磁地方时分布. 对动压增大事件的平均响应幅度在午前最大, 而对动压减小事件的平均响应幅度在午后达到最大. 在白天侧, 同步轨道磁场z分量响应幅度与太阳风动压上下游均方差有较好的线性正相关, 两者比值随磁地方时具有明显的分布变化; 对于同样的动压变化白天侧响应明显强于夜侧. 地磁指数SYM-H响应幅度对太阳风动压上下游均方差具有明显的依赖关系, 统计结果显示磁层压缩较强时, 两者相关性较好. 在白天侧, 地磁指数响应幅度与同步轨道磁场z分量响应幅度具有明显的线性相关, 晨昏侧相关性减弱, 夜侧无明显相关.

关键词: 太阳风动压 地球同步轨道 地磁指数SYM-H 磁场响应 磁层顶电流

Abstract: In this paper, we study 123 solar wind dynamic pressure change events, not including interplanetary shocks, with statistical methods. The results indicate that the geosynchronous magnetic field z component presents strong positive response to solar wind dynamic pressure changes near the noon meridian. The amplitude of geosynchronous magnetic field response shows an obvious magnetic local time distribution in our analysis. The largest amplitude of geosynchronous magnetic field z component response to solar wind dynamic pressure increase events is found at the pre-noon region, and that to decrease events is found at post noon region. On the dayside, the amplitude of geosynchronous magnetic field z component has the best correlation with the square root of the solar wind dynamic pressure, especially near the sunspot region. To the same solar wind dynamic pressure changes, the response on the dayside is significantly stronger than that on the night-side, with distinguished magnetic local time distribution. The dependence between geomagnetic indices SYM-H response amplitude and the square root of the solar wind dynamic pressure is very distinct, especially when magnetosphere is strongly compressed. The amplitude of sudden impulses (dSYM-H) correlates better with the amplitude of magnetic field at geosynchronous orbit near the sub-solar region, which declines in the region of dawn and dusk, especially weakens near the midnight region.

Keywords: Solar wind dynamic pressure Geosynchronous orbit Geomagnetic indices SYM-H Response of magnetic field Magnetopause current system

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