地球物理学报 » 2012, Vol. 55 » Issue (3) :960-969 doi:10.6038/j.issn.0001-5733.2012.03.026

引用本文(Citation):
袁亚红, 杨冬梅, 陈化然, 何宇飞, 陈传华.地磁活动指数Vr的时空分布特征分析. 地球物理学报, 2012,55(3): 960-969,doi: 10.6038/j.issn.0001-5733.2012.03.026

YUAN Ya-Hong, YANG Dong-Mei, CHEN Hua-Ran, HE Yu-Fei, CHEN Chuan-Hua.Analysis of the temporal-spatial distribution characteristics of geomagnetic activity index Vr.Chinese J.Geophys. (in Chinese),2012,55(3): 960-969,doi: 10.6038/j.issn.0001-5733.2012.03.026

地磁活动指数Vr的时空分布特征分析

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Analysis of the temporal-spatial distribution characteristics of geomagnetic activity index Vr

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摘要 本文使用2008—2010年三年内的国内41个地磁台站和国外4个地磁台站的地磁水平分量*H*和磁偏角*D*的分钟值数据,研究了*H*和*D*的Vr指数(以下简称Vr*H*和Vr*D*)与*Kp*指数的关系及其时空分布特征,发现在时间变化上,Vr*H*和Vr*D*均具有27天太阳自转周变化;Vr*D*呈现出显著的季节变化,而Vr*H*却无,但与太阳风速度(SWS, Solar Wind Speed)变化密切相关,其三年的相关系数分别是0.97、0.70、0.88;去除季节变化后的Vr*D*也表现出与SWS的相关,相关系数分别是0.96、0.77、0.5(2010年相关系数低主要受3月份Vr指数不明原因异常变化影响).在空间变化上,在我国大陆范围内,Vr*H*和Vr*D*均随纬度的增高而增大,并且具有地方时效应和显著的晨-昏不对称性,这种地方时效应和晨昏不对称性可能与部分环电流和场向电流有关系.研究认为Vr指数可以反映地磁场的快速变化,并可以间接反映SWS、部分环电流和场向电流对地磁场变化的影响和控制作用.

关键词 Vr指数, 时空分布, 地方时效应, 晨-昏不对称性, 部分环电流, 场向电流

Abstract: Based on the analysis of Vr index of *H* and *D* (Vr*H* and Vr*D*) from data of 41 geomagnetic observatories in China and 4 geomagnetic observatories abroad in 2008—2010, both temporal and spatial variation characteristics of Vr*H* and Vr*D* were observed. For temporal variations, the Vr*H* and Vr*D* showed 27-day solar rotation recurrences, and the Vr*D* showed significant seasonal variation while the Vr*H* did not, Vr*H* was related to solar wind speed (SWS), and their correlation coefficients were 0.97, 0.70 and 0.88. Vr*D* with seasonal variation removed was also related to SWS, and their correlation coefficients were 0.96, 0.77, and 0.5 (The low relative coefficient in 2010 was affected by unexplained anomaly change of Vr in March). For spatial variations, within mainland China, Vr*H* and Vr*D* also increased with latitude. Meanwhile both local-time dependences and an obvious dusk-dawn asymmetry existed, which might be related to the asymmetric ring current, the partial ring current and the field-aligned current. The studies suggested that Vr index could be used for illustrating fast variation of geomagnetic field, and revealing the impact of SWS, partial ring current and field-aligned current on geomagnetic field.

Keywords Vr index, Temporal and spatial distribution, Local time effect, Dusk-dawn asymmetry, Partial ring current, Field-aligned current

Received 2011-05-18;

Fund:

中国地震局地球物理研究所基本科研业务院所长基金课题"华北地区电磁场动态演化特征研究"(DQJB09B01)资助.

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http://118.145.16.227/geophy/CN/10.6038/j.issn.0001-5733.2012.03.026 或 http://118.145.16.227/geophy/CN/Y2012/V55/I3/960