

## オーロラ帯高緯度境界領域近傍における磁場変動データと PC index の比較研究

#立石 晃希<sup>1)</sup>, 吉川 顕正<sup>2)</sup>

<sup>(1)</sup> 九大, <sup>(2)</sup> 九大/理学研究院

### Comparative study of magnetic field data and PC index in the boundary region of the auroral belt

#Koki Tateishi<sup>1)</sup>, Akimasa Yoshikawa<sup>2)</sup>

<sup>(1)</sup>Department of Earth and Planetary Sciences, Graduate School of Science, Kyushu University, <sup>(2)</sup>Department of Earth and Planetary Sciences, Kyushu University

The polar regions are the source of space weather phenomena such as auroras due to the inflow of energy from the sun. In particular, the polar cap is directly connected to the solar wind, and the understanding of various magnetospheric-ionospheric coupling phenomena that occur there is very important for understanding space weather as a system.

The Polar Cap index (PC index) is an important index to monitor the magnetospheric-ionospheric coupling in the polar cap, which is derived from the magnetic field variation in the polar cap and solar wind data. It is derived from polar magnetic field variations and solar wind data and is used as an indicator of the behavior of geomagnetic activity and ionospheric currents in the polar cap [Toroshichev et.al, 1988]. However, geomagnetic fluctuations in the polar cap are expected to be superimposed by complex factors that cannot be captured by the PC index alone, such as convective interactions with the auroral zone and magnetic field effects due to field line currents along the magnetic field. In this study, in order to examine such complex effects closely, in addition to the PC index, we also analyzed ground-based magnetic field data from the Davis station (DVS) of the MAGDAS (Magnetic Data Acquisition System), which is located near the polar cap boundary, ground-based magnetic field data from SuperMAG. The objective of this study is to contribute to the understanding of space weather phenomena through the elucidation of phenomenology in the polar regions by performing a comprehensive analysis of magnetic field data and solar wind data from the Davis station (DVS) of MAGDAS (Magnetic Data Acquisition System), which is located in the polar region.

As part of this study, we first compared the seasonal dependence of the solar wind electric field and PC index to investigate the effect of ionospheric currents on PC index, which is considered to strongly reflect solar irradiation conditions. As a result, a higher correlation was confirmed for the vernal and autumnal equinoxes than for the summer solstice, when the ionospheric current is considered to be more strongly and longer excited due to solar irradiation and higher electrical conductivity. This result may reflect the influence of the Russell-McPherson effect, in which magnetic reconnection occurs more frequently due to the relationship between the rotation axis and the Earth's orbital plane.

In order to remove the influence of the Russell-McPherson effect, the time when reconnection is predominant and the solar wind turns to the south was selected, and the correlation between the DVS magnetic field change data and the solar wind electric field in the frequency band where the ionospheric current contribution appears was investigated under conditions where the ionospheric current is expected to be generated. This is expected to properly capture the seasonality of space weather phenomena due to sunlight conditions. In this presentation, we will discuss the analytical results obtained at the present stage and future prospects.

極域は太陽からのエネルギー流入により、オーロラなどの宇宙天気現象の発生源となる領域であり、特に Polar cap は直接太陽風に繋がった領域であり、そこで生じる様々な磁気圏電離圏結合現象の解明は、宇宙天気をシステムとして理解する為、非常に重要である。

Polar cap における磁気圏電離圏結合をモニターする重要なインデックスとして、Polar Cap index(PC index) が挙げられる。PC index は極域における太陽風エネルギーの流入強度を示す指標であり、極域の磁場変動と太陽風データから導かれ、極冠の地磁気活動や電離層電流の振る舞いを表す指標として用いられている [Toroshichev et.al, 1988]。しかし、Polar cap での地磁気変動にはオーロラ帯との対流相互作用や、沿磁力線電流による磁場効果など、PC index だけでは捉えきれない複合的な要因も重畳していることが予想される。本研究では、このような複合効果を精査するために、PC index に加えて、Polar cap boundary 付近に位置する MAGDAS(Magnetic Data Acquisition System) の Davis 観測点 (DVS) の地上磁場データ、SuperMAG の地上磁場データや太陽風データの総合解析を行い、極域における現象論の解明を通じて、宇宙天気現象の理解に貢献することを目的としている。

その一環として、本研究ではまず最初に日照条件を強く反映すると考えられる電離層電流の PC index への影響を調べるために、太陽風電場と PC index の季節依存性の比較を行った。その結果、日照のため、電気伝導度が高く、電離層電流がより強く長く励起されると考えられる夏至よりも、春分や秋分の時期においてより高い相関関係が確認された。この結果は、自転軸と地球の公転面の関係により、磁気リコネクションが生じる頻度が高くなる Russell-McPherson 効果の影響を反映していると考えられる。

そこで、Russell-McPherson 効果の影響を取り除くために、リコネクションが卓越し、太陽風が南向きになる時間を選定し、電離層電流の発生が予想される条件下で電離層電流の寄与が現れる周波数帯の DVS の磁場変化データと太陽風電場の相関関係を調べた。これにより、宇宙天気現象の日照条件による季節性を適切に捉えることが期待される。本発表では、現段階で得られた解析結果と今後の展望について議論する予定である。