

Relationship between the polar ionospheric currents and the ground magnetic disturbances

Y.-S. Kwak¹ and B.-H. Ahn²

¹Department of Astronomy and Atmospheric Science, Kyungpook National University

²Department of Earth Science, Kyungpook National University

The climatological characteristics of the polar ionospheric currents obtained from the simultaneous observations of the ionospheric electric field and conductivity are examined. For this purpose, 43 and 109 days of measurements from the Chatanika and Sondrestrom incoherent scatter radars, respectively, are utilized. The ionospheric current density is compared with the corresponding ground magnetic disturbance. Also examined is the effect of the field-aligned current on the ground magnetic disturbance, particularly on the D component. Several interesting characteristics about the polar ionosphere are apparent from this study: (1) The E-W ionospheric current over Chatanika flows dominantly in the night hemisphere, 1800-0000-0600 MLT, while it flows in the sunlit hemisphere, 0600-1200-1800 MLT over Sondrestrom. The N-S current over Chatanika flows prominently in the dawn and dusk sectors, while a strong southward current flows over Sondrestrom in the prenoon sector. (2) The assumption of infinite sheet current approximation is far from realistic, underestimating the current density by a factor of 2 or more. It is particularly serious for higher latitude region. (3) The correlation between H and J_E is higher than the one between D and J_N , indicating that field-aligned current affects significantly D. (4) Total upward or downward FAC are quite comparable and they are approximately 5.9×10^5 A and 2.2×10^5 A over Chatanika and Sondrestrom, respectively. With enhancement of magnetic activity, FAC increases drastically over Chatanika by a factor of 4 or 5 but the increment is insignificant over Sondrestrom.