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Annual Variations of the Geomagnetic Field in the Earth's Polar Regions

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The annual variations of the geomagnetic field play an important role in the coupling processes between the solar wind, magnetosphere and ionosphere. The annual variation is a well-established feature of the geomagnetic field, and usually is applied for modeling the conductivity of the lower mantle [Parkinson, 1983], and for long-term space weather forecasting [Bartels, 1932; Malin and Mete Isikara, 1976; Gonzalez et al., 1994]. Considerable effort has been devoted toward understanding the causes of the geomagnetic field variations, but the suggested physical mechanisms differ widely.

The annual variation is relatively weak in many magnetic indices, but it has a distinct signature in the geomagnetic components. Thus, we use the components for this analysis. The components have a positive peak in northern summer and a negative dip in winter [Vestine, 1954]. Vestine [1954] suggested that the annual variation is caused by an ionospheric dynamo in which electric currents in the ionosphere are generated by meridional winds. The winds blow from north-to-south during northern summer, and south-to-north in northern winter. Malin and Mete Isikara [1976], using near-midnight geomagnetic data, concluded that the annual variation results from a latitudinal movement of the auroral electrojet or the ring current. Stauning [2011] derived of the seasonal variation of the quiet daily variations and examined the influence of the sector structure of the interplanetary magnetic field. Ziegger and Mursula [1998] have suggested a third mechanism: that the cause is related to an asymmetric solar wind speed distribution across the heliographic equator.

In this paper, we study the annual variation problem using long-term magnetic observation and ionospheric conductivity. The sunlight incident on the ionosphere will be calculated. Although a global analysis is done, particular focus will be placed on the polar regions. This study covers the interval 1990-2010, and the cause of the well-known fundamental north-south and seasonal anti-correlations is discussed.

Reference
1. Malin, S. R. C., A. Mete Isikaka (1976), Annual variation of the geomagnetic field, J. R. Astron. Soc., 47, 445–457, doi: 10.1111/j.1365-246X.1976.tb07096.x.
2. Stauning, P. (2011), Determination of the quiet daily geomagnetic variations for polar regions, J. Atmos. Sol-Terr. Phy., 73, 2314-2330, doi:10.1016/j.jastp.2011.07.004.