Comparative Responses of the Polar Cap and Auroral Electrojet Indices

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We present research aimed at developing an improved understanding of the relationship between solar wind conditions and ground magnetic field variations measured at auroral latitudes and in the polar caps during magnetospheric substorms and storms. The polar cap *PC* index is often used as a proxy for several measures related to the magnetosphere's response to solar wind coupling including: the solar wind electric field imposed on the magnetosphere, the magnetospheric convection rate, and the polar cap potential. *PC* is important role in this capacity because, in contrast to the quantities that it substitutes for, the ground magnetic field data on which *PC* is based provide a continuous set of observations.

Two types of analyses have been carried out: correlation and linear filtering analyses. These techniques have been applied to study the connection between geomagnetic index variations, specifically those of *PC*, *AL*, and *AU*, with respect to solar wind input time series. A least two factors allow one to probe the responses of these indices with greater fidelity than previously available. One is the compilation of solar wind observations from WIND and ACE that are nearly continuous for several years. Another is an improvement in the accuracy of accounting for solar wind propagation from the solar wind monitor to the Earth's magnetopause.

Given that impulse response function may be calculated for selected data subsets (i.e. by season, time of day, solar wind input level, etc.), the analyses performed can be tailored to address how the various current systems present within the magnetosphere vary by comparing and contrasting the responses of the different geomagnetic activity indices. Among the topics that will be addressed are the seasonal variations of index responses. For instance, linear filtering analysis has shown that the AU index response varies strongly with season. The response magnitude at short time lags of 0 to 30-min. of the AU index, a measure of the eastward auroral electrojet current density that is especially sensitive to the strength of polar cap convection, is nearly nonexistent during the winter but is clearly evident in summer. In contrast, the polar cap index shows a more even response with respect to season at the shorter response time lags. Longer-term variations are seen in the impulse response magnitude of the *PC* and *AE* indices over the course of the last solar cycle. Issues related to the saturation of the cross polar cap potential drop will also be addressed.