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AMPERE-Derived Electrodynamic Parameters of the High Latitude Ionosphere (ADELPHI)

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A statistical relationship between high-latitude field-aligned currents and auroral ionospheric conductances was derived from simultaneous and coincident measurements made by the Active Magnetosphere and Planetary Electrodynamics Response Experiment (AMPERE) and the Poker Flat Incoherent Scatter Radar (PFISR). This relationship allows for global specification of electrodynamic properties, including electric fields, currents, precipitating particle energy flux, and Joule heating over both northern and southern high latitude regions, all based on field-aligned currents alone. Global maps of these parameters at two-minute intervals provide large-scale context for many important high-latitude processes, such as the spatial and temporal evolution of electrojets during storms and substorms, the distortion of ionization patches due to convection electric fields, and the localization and impulsivity of Joule heating intensifications. The spatial and temporal structure of auroral parameters have been validated using ground-based magnetometer data and far ultraviolet imaging observations, as well as by comparison with results from prior event studies and empirical models. In general, the large-scale properties of the auroral regions are accurately captured by the model. As expected, discrepancies are typically observed during substorms, when small-scale and rapidly varying auroral conditions are present. Derived values for global parameters, such as the AE index, the hemispheric power index, and the polar cap potential also agree well with actual values. Overall, AMPERE-derived electrodynamic parameters of the high latitude ionosphere, referred to as ADELPHI, have proven extremely useful for studies of auroral processes and the generation of important space weather products.