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Seasonal dependency of polar cap patches in the high-latitude nightside ionosphere

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Observations and a computer simulation were used to investigate the seasonal dependency of the occurrence of polar cap patches in the high-latitude nightside ionosphere together with the relative importance of the driving processes. Measurements were conducted above northern Scandinavia around solar maximum (1999 – 2001) under conditions predicted to be favourable for observing patches with the EISCAT Svalbard Radar (ESR). The requirements were that the ESR was poleward of the convection reversal boundary, in antisunward cross polar cap flow and that IMF Bz was predominantly negative. The high latitude convection pattern was inferred from the Super Dual Auroral Radar Network (SuperDARN) and the IMF was taken from the Advanced Composition Explorer (ACE) spacecraft. In each study the patch-to-background ratio was calculated and, in most of the winter cases, this ratio was greater than two consistent with a polar cap patch. In summer clear electron density enhancements were seen in the nightside ionosphere, but the patch-to-background ratio was less than two. While these enhancements could not formally be called patches, it was clear that the high-latitude convection pattern was responsible for electron density enhancements. Using a computer simulation the relative importance of the physical processes driving the variation in the patch-to-background ratio was investigated. The dominant factor was changes in the thermospheric composition influencing plasma production and recombination rates.