EGU22-2360
https://doi.org/10.5194/egusphere-egu22-2360
EGU General Assembly 2022

Statistics of transpolar arcs identified by an automated detection algorithm

Gemma Bower[1], Steve Milan[1,2], Larry Paxton[3], and Suzie Imber[1]
[1]University of Leicester , School of Physics and astronomy , UK
[2]Birkeland Centre for Space Science, Bergen, Norway
[3]Johns Hopkins University Applied Physics Laboratory, USA

Transpolar arcs (TPAs) are auroral features that occur polewards of the main auroral oval, at latitudes where auroras are less common, suggesting that the magnetosphere has acquired a complicated magnetic topology. They are primarily a northward interplanetary magnetic field auroral phenomenon, and their formation and evolution have no single explanation that is unanimously agreed upon. An automated detection algorithm has been developed to detect the occurrence of TPAs in UV images captured by the Special Sensor Ultraviolet Spectrographic Imager (SSUSI) instrument onboard the Defense Meteorological Satellite Program (DMSP) spacecraft, in order to further study their occurrence. Via this detection algorithm TPAs are identified as a peak in the average radiance intensity above 12.5° colatitude, in two or more of the wavelengths/bands sensed by SSUSI.

Using the detection algorithm on observations from the years 2010 to 2016, over 5000 images containing TPAs are identified. The occurrence of these TPA images suggest a seasonal dependence, with more TPAs observed in the winter hemisphere. The orbital plane of DMSP has been investigated as a possible explanation of the dependences in the results of the detection algorithm. It has been found that each DMSP spacecraft has a different bias due to its orbit. For the spacecraft of interest (F16, F17 and F18) this leads to a preferential observation of the northern hemisphere, with the detection algorithm missing TPAs in the southern hemisphere around 01 - 06 UT. No seasonal bias has been found for these spacecraft.

We also discover that the majority of TPAs occur in the dawn sector of the polar cap, which is unexpected in current TPA models. Comparing with previous statistical surveys, we note that the dawn-dusk asymmetry has been present but has not gained significant attention. We suggest that field-aligned current polarity may play a role in the observed asymmetry.

We discuss the ramifications of these findings in terms of proposed TPA generation mechanisms and suggest reasons for the seasonal dependence including it being a reflection of probability of seeing TPAs due to visibility.