This public repository contains the Monte-Carlo simulation results based on Fang et al (2004; 2005) proton transport model and used in this work, as well as the FAST satellite and Gillam MSP data used in the event study. In each Monte-Carlo run, protons with a Maxwellian flux distribution are injected from the upper boundary over a unit incidence area. The folder name indicates whether the corresponding run is for the central plasma sheet (CPS) proton auroral band or for the isolated proton aurora (IPA), as well as the characteristic energy (e.g., ‘\_10k’ denotes 10 keV) of the incident proton distribution. The total precipitation energy flux is fixed at 1 erg/cm2/s for all runs. In each folder,

**Flux3D.dat**: 3D distribution of proton and hydrogen atom fluxes. The fluxes are distributed over altitudes along a field line and over horizontal circular meshes centered around the field line. See Figure 1 and text in Section 2.1 for details.

**Exciation3D.dat**: 3D distribution of excitation rates of interest in this study.

**Ionization3D.dat**: 3D distribution of N2/O2/O ionization rates led by proton and hydrogen impact. Ionization rates led by secondary electrons are calculated by TREx-ATM.

**psec4D.sav**. An IDL save file containing the 4D structure (3D space plus energy grid) of the differential number flux of secondary electrons.

In the above files, the first three are in ASCII format and self-explanatory. The ‘psec4D.sav’ is an IDL SAV file that needs the IDL program to read. The core data array embedded in the SAV file is psec4D [NumE, NumP, NumR, NumZ]:

NumE denotes the index of the energy grid (given by the Egrid array):

NumZ denotes the index of the altitude grid (given by the Alt\_bin array)

NumR denotes the index of the horizontal radius grid (given by the Rbin array)

NumP denotes the azimuthal angle array (range from 5 to 355 deg gaped by 10 deg)