An altitude and distance correction to the source fluence distribution of TGFs

R. S. Nisi[1,2], N. Østgaard[1,2], T. Gjesteland[1,2]

[1] *Birkeland Centre of Space Science*
[2] *Department of physics and technology, University of Bergen*

The initial fluence distribution of Terrestrial Gamma-ray flashes (TGFs) has been extensively discussed in recent years, but few have considered how the TGF fluence distribution at the source, as estimated from satellite measurements, depends on the distance from the satellite footprint and assumed production altitude. As the absorption of the TGF photons increases significantly with lower altitude and larger distances between the source and the observation these might be important factors. We have addressed the issue by using the tropopause pressure as an upper limit of the TGF production altitude and WWLLN sferic measurements to determine the distance. The study is made possible by the increased number of RHESSI TGFs found in the second catalog of the RHESSI data. One result is that the TGF/lightning ratio for the tropics probably has an annual variability due to an annual variability in the Dobson-Brewer circulation. The main result is an indication that the altitude distribution and distance should be considered when investigating the source fluence distribution of TGFs.

1. Aim

We aim to look at the fluence distribution of TGFs at the source. This is an important parameter to establish the production of TGFs. The TGFs are produced inside thunderstorms that have an upper limit at the tropopause.

2. Method

We use the tropopause pressure provided by the NCEP/NCAR 40-year reanalysis, which is a model using meteorological data as input. To find the distance we use sferic measurements from the World Wide Lightning Location Network (WWLLN). Out of the 2500 TGFs between 2002 and 2011 in the second RHESSI catalog, around 300 TGFs have a connected sferic detected by WWLLN. For these 300 TGFs, we multiply the number of true photons at the detector (number of photons adjusted for the dead time of RHESSI) with the distance between the source and the satellite squared and the relative absorption of the atmosphere.

3. Result

Figure 1 shows the main result. In red is the number of photons in RHESSI only adjusted for the dead time, in black is the fluence of photons after the distance and altitude are adjusted for. The figure shows that the power law index change from -2.6 for the not pressure adjusted to -3.2 for the pressure adjusted. Other results regarding the tropopause pressure and TGFs will be presented at the summer school.

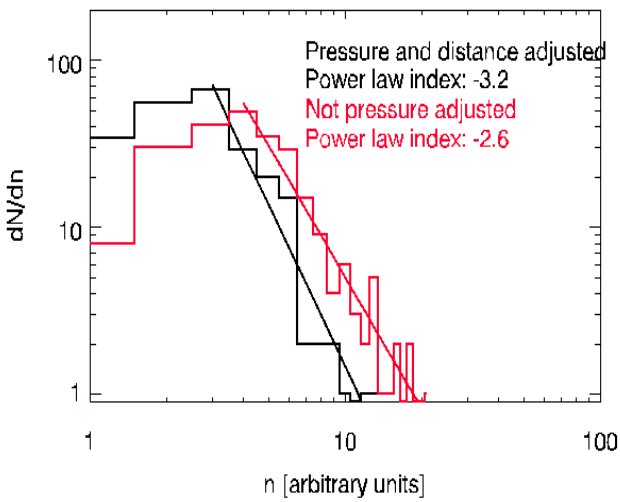

Figure 1: The uncorrected fluence distribution (red) and the distance and altitude corrected fluence distribution (black) with best fit power law indices. The power law index goes from -2.6 to -3.2 when the distribution is corrected.