Second comment on the paper submitted to Geoscientific Model Development (GMD) "Evaluation of Monte Carlo tools for high energy atmospheric physics" by Casper Rutjes, David Sarria, Alexander B. Skeltved, Alejandro Luque, Gabriel Diniz, Nikolai Østgaard, and Ute Ebert (gmd-2016-147).

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I want to comment following statement from the answer of Casper Rutjes et al. "Furthermore, long TGE events are supposed to be associated with cosmic ray induced extensive air showers (EAS), but for x-ray glows such an association has not been stated".
As we can see in Figure 1 (Figure 4, Chilingarian, 2014) there are different channels of generation of so-called secondary cosmic rays (SCR) measured my particles detectors located on the earth's surface or by balloons or aircraft in the terrestrial atmosphere.

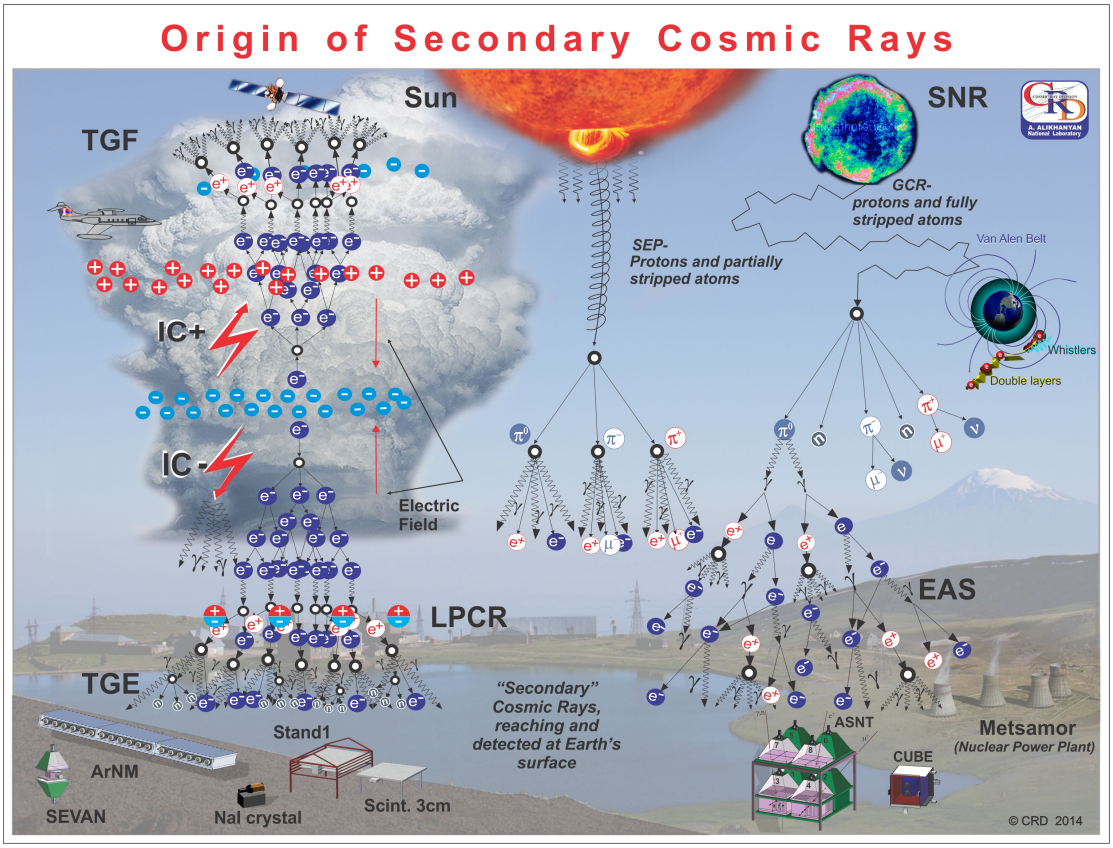

Figure 1. Sources of the secondary cosmic rays detected on the Earth's surface.

High-energy protons and fully stripped nuclei accelerated in numerous sources in our Galaxy entering the terrestrial atmosphere and colliding with nitrogen and oxygen atoms generate extensive air showers— cascades of particles developing in atmosphere comprising secondary cosmic rays, see right side of Fig. 1.

Alternative flux of secondary cosmic rays seen on rather stable background of SCR initiated by EAS are Thunderstorm Ground Enhancements initiated by the Relativistic runaway electron avalanches (RREA) in the thunderstorm atmospheres (bottom left part of Figure 1).

Note also symmetry of TGEs and Terrestrial Gamma Flashes (TGFs), possibly initiated by the same RREA process in upper part of the thundercloud.

SCR initiated by EAS and RREA are systematically different can be distinguished by their spatial and density distributions (Chilingarian et al., 2011, Figures 3-6).

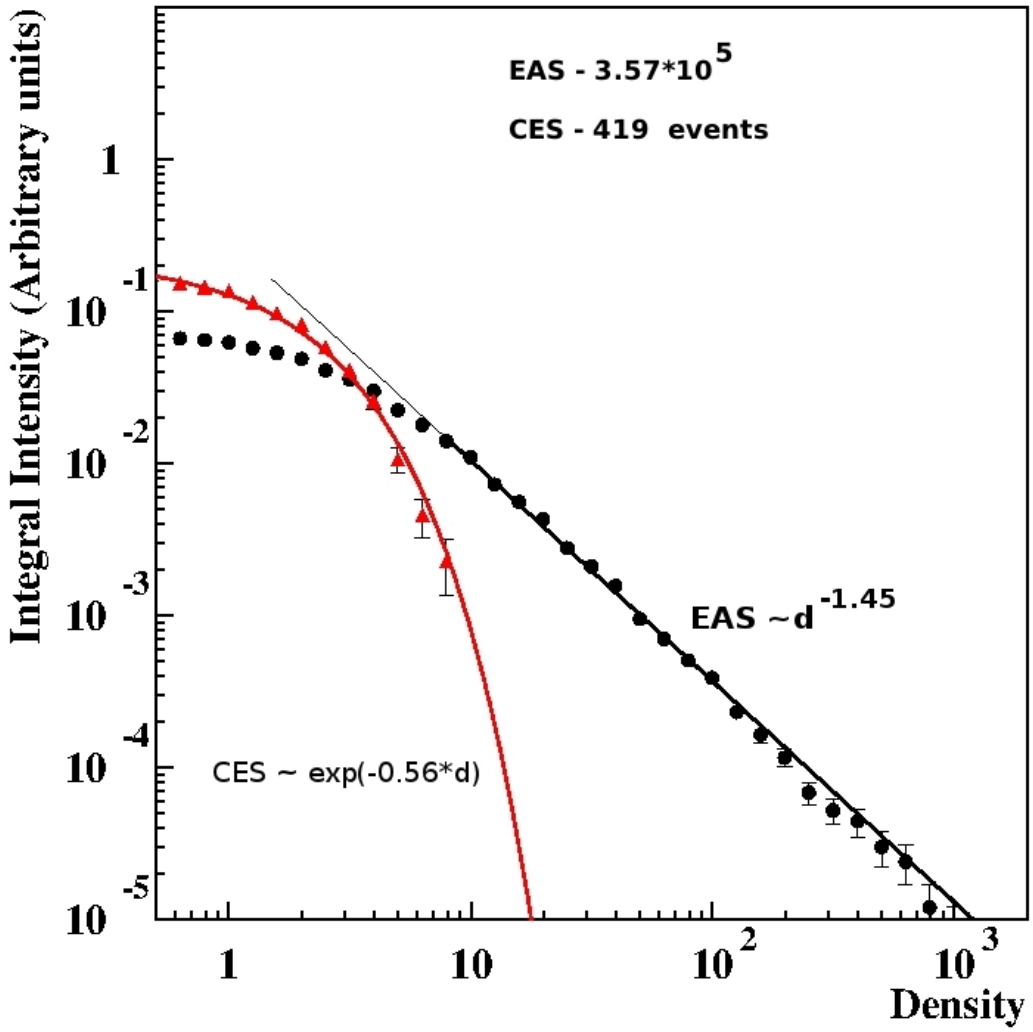

Figure 2. Integral particle density distribution of the RREA showers from the joint and pure EAS cascades.

In Figure 2 particle density distribution of EAS events follows a power law as many other distributions generically connected with the galactic cosmic rays falling on the atmosphere. In contrast, the density distribution of the TGE events follows an exponential curve, as expected from an avalanche process.

References

Chilingarian, A., Hovsepyan, G., Hovhannisyan, A, 2011. Particle bursts from thunderclouds: natural particle accelerators above our heads. Phys. Rev. D: Part. Fields 83 (6), 062001.

A.Chilingarian, Thunderstorm Ground Enhancements - model and relation to lightning flashes, Journal of Atmospheric and Solar-Terrestrial Physics 107 (2014) 68–76.