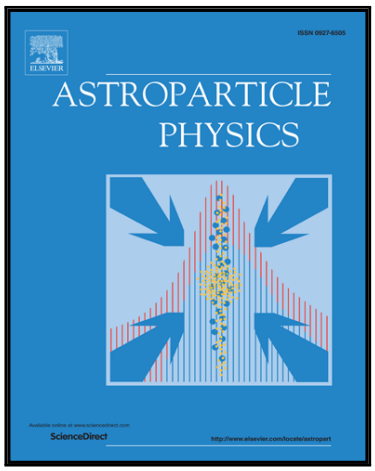


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# Extensive Air Showers, Lightning, and Thunderstorm Ground Enhancements

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***Abstract***

For lightning research, we monitor particle fluxes from thunderclouds, the so-called thunderstorm ground enhancements (TGEs) initiated by runaway electrons, and extensive air showers (EASs) originating from high-energy protons or fully stripped nuclei that enter the Earth's atmosphere. We also monitor the near-surface electric field and atmospheric discharges using a network of electric field mills.

The Aragats "electron accelerator" produced several TGEs and lightning events in the spring of 2015. Using 1-s time series, we investigated the relationship between lightning and particle fluxes. Lightning flashes often terminated the particle flux; in particular, during some TGEs, lightning events would terminate the particle flux thrice after successive recovery. It was postulated that a lightning terminates a particle flux mostly in the beginning of a TGE or in its decay phase; however, we observed two events (19 October 2013 and 20 April 2015) when the huge particle flux was terminated just at the peak of its development. We discuss the possibility of a huge EAS facilitating lightning leader to find its path to the ground.

## 1. Introduction

Considered the highest peak in the South Caucasus, Mount Aragats is a dormant volcano with a 400-m deep crater that has become an ice basin. Its central highlands cover an area of >820 km$^2$ and generate huge summer storms that flow down its slopes into the surrounding valleys. The four crests that top Mt Aragats once reached heights >10, 000 m 1.5 million years ago, before a massive eruption lowered them to its current 4095 m.