Geophysical Research Abstracts
Vol. 15, EGU2013-3129, 2013
EGU General Assembly 2013

Thunderstorm Ground Enhancements (TGEs) with intense fluxes of high-energy electrons

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The high elevation ($\sim$3200m) of Mount Aragats provides a good opportunity to detect thunderstorm-correlated particles, which attenuate rapidly in the atmosphere. We measure fluxes of the TGE electrons and gamma rays with intensities $\sim$10 times above the cosmic ray background, thus, proving the existence of the runaway mechanism in thunderstorm atmospheres. Both electron spectra measured on September 19, 2009 and October 4, 2010 are exponential. The gamma ray spectrum in the energy range 5–10 MeV (4 October 2010 TGE) also is better fitted to the exponential function, in agreement with our model of TGE. The estimated mean energies of the electron integral spectra are equal to $\sim$2.3 and 3.3 MeV for October 4, 2010 and September 19, 2009 TGEs. The mean energy of the gamma ray differential energy spectrum in the energy range of 5–10 MeV is estimated to be 3.8 MeV. In 2011 a new particle detectors with lower energy threshold were installed. Measured energy spectra of the several TGEs reveal significant electron fluxes extended from 2 MeV till 30-40 MeV. Measured in the one and the same event gamma ray and electron fluxes allow to estimate the height of the thundercloud above the detector. Proceeding from the integral energy spectra and the height of the cloud we estimate the electron spectra on the exit from the electric field of the thundercloud, number of electrons in the cloud and avalanche multiplication rates. Correlations of TGE particle increase with lightning activity, near surface electric field, atmospheric pressure and rain rate are presented as well.