Geophysical Research Abstracts
Vol. 18, EGU2016-8285, 2016
EGU General Assembly 2016

Interactions of cosmic rays with the venusian atmosphere during different periods of solar activity

Christina Plainaki (1), Pavlos Paschalis (2), Davide Grassi (1), Helen Mavromichalaki (2), and Maria Andriopoulou (3)

(1) INAF-IAPS, Rome, Italy (christina.plainaki@iaps.inaf.it), (2) Physics Dpt., National and Kapodistrian University of Athens, Greece, (3) Space Science Institute, Austrian Academy of Science, Graz, Austria

Interactions of the galactic and solar cosmic ray particles with the atmosphere of Venus result in extensive nuclear and electromagnetic cascades that can affect cloud formation and chemistry in deep atmospheric layers. Variability in the energy spectrum of the cosmic ray particles and in their integrated flux and direction would have possible effects in the local neutral densities, particle ionization and escape. It is therefore of significant importance to understand and quantify such space weather phenomena at Venus, in the context of future mission preparation and also data interpretations of previous missions (e.g. Venus Express). In this paper, we perform a calculation of the atmosphere ionization and ion production rates caused by cosmic rays, as a function of depth in the Venusian atmosphere. We examine the interactions of the planet's atmosphere with galactic and solar cosmic rays (during solar energetic particle events). The latter scenario was studied for two paradigm cases: the very energetic solar event in October 1989 and the recent, less energetic, solar event in May 2012, assuming that the directional and energy properties of the solar particles allowed their arrival and penetration to the Venusian atmosphere. For the event in 2012, we considered the solar particle properties (integrated flux and spectrum) obtained by the NMBANGLE PPOLA model (Plainaki et al., 2010; 2014) applied previously for the Earth case, scaled to the distance of Venus (i.e. 0.72 AU from the Sun). In order to simulate the actual cascade in the atmosphere initiated by the incoming cosmic ray fluxes we use a Monte Carlo modeling technique based on the Geant4 software, previously applied for the Earth case (Paschalis et al., 2014), namely DYASTIMA. Our predictions are afterwards compared to other estimations derived from previous studies. The current method is furthermore proposed as a paradigm for studying cosmic ray-atmosphere interactions in the terrestrial planets possessing atmospheres.