Possible persistent ionization caused by giant blue jets

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We consider the possible production of persistent ionization at low altitudes ($h \leq$ 70 km) by giant blue jets, using a new five constituent model of stratospheric and lower-ionospheric chemistry. Results indicate substantial ionization at $h < 50$ km, which exhibits an initially rapid (few seconds) recovery due to electron attachment, followed by a long enduring recovery (>10 minutes) determined by the time scale of mutual neutralization of negative and positive ions. Such recovery signatures may be observable in subionospheric VLF data in the form of Early/fast events with long lasting recoveries. Analysis also indicates that electrons may sometimes be quickly ($\lesssim$1 ms) removed by the dissociative attachment mechanism in the presence of a high electric field, while the negative and positive ions remain and persist for extended periods of time. In such cases, the initial rapid recovery may not be observable in VLF data due to its typical time resolution of ∼10 to 20 ms. In stratosphere ($h \lesssim 50$ km) the ionization recovery is found to not be accurately described by a four-constituent model proposed by [*Glukhov, Pasko and Inan*, 1992, hereafter referred to as GPI], necessitating a fifth constituent, namely the heavy negative ions with high electron affinity (N_x^-).