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GLOBAL THUNDERSTORM ACTIVITY AND ITS EFFECTS ON THE LOWER IONOSPHERE AND THE RADIATION BELTS

U. S. Inan

Stanford University, Stanford, California, United States

The Antarctic peninsula is uniquely suited for the observation of the ionospheric and radiation belt effects of lightning discharges, both in terms of geographic/geomagnetic location and in terms of its unusually quiet electromagnetic environment. Electrodynamic coupling of thunderstorms and lightning discharges to the overlying higher altitude regions of near-Earth space is manifested in the form of lightning-induced electron precipitation, terrestrial gamma-ray flashes, and luminous glows such as sprites, elves, and gigantic jets. ELF/VLF observations at Palmer Station, carried out in coordination with those at Rothera (UK) and Commandate Ferraz (Brazil) allow (i) geo-location of lightning discharges that lead to high-altitude electrodynamic effects, (ii) comprehensive measurement and imaging of ionospheric signatures of lightning-induced electron precipitation, and (iii) measurements of magnetospheric ELF/VLF waves (e.g., chorus) during extreme geomagnetic disturbance events. In this paper, we present results results of ELF/VLF studies carried out with data acquired at Palmer Station, in coordination with similar measurements at Rothera and Commandante Ferraz, as well as in the geomagnetically conjugate regions (continental United States, the Caribbean and northwest Atlantic ocean).