LIGHTNING INDUCED SFERICS CORRELATED WITH WHISTLER PROPAGATION

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Lightning discharges generate broadband electromagnetic pulses, known as sferics, that efficiently propagate through the Earth-ionosphere waveguide over long distances. Some sferic energy can escape the Earth-ionosphere waveguide and propagate in a whistler mode, enabled by Earth's magnetic field, through the ionosphere. Because a sferic is an impulse, the whistler it generates can be viewed as the impulse response of the ionosphere. In this presentation, we correlate lightning discharge location, time, and peak current data from the National Lightning Detection Network (NLDN) in the United States with burst mode electric field measurements from the DEMETER spacecraft in Low Earth Orbit to quantify and model whistler propagation through the ionosphere. By pairing each whistler with its parent lightning strike, we can tease out and compare the effects on the signal due to propagation through a known distance in the Earth-ionosphere waveguide and the effects due to propagation through the ionosphere itself. Because the ionosphere has different properties depending on whether or not it is illuminated by the sun, we look at both daytime and nighttime conditions. Using the International Reference Ionosphere (IRI) model for ionosphere electron density and the International Geomagnetic Reference Field (IGRF) model for magnetic field, we also compare the measured propagated signal with the Full Wave Method (FWM) finite element numerical code developed by N. G. Lehtinen and U. S. Inan. While a few studies have analyzed whistler propagation through the ionosphere using spacecraft measurements, spacecraft data have yet to be compared with the FWM as we have done here.