University of Colorado at Boulder

AEROSPACE ENGINEERING SCIENCES

Seminar

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Lightning Effects in Space

A typical lightning discharge involves a pulse of current, known as the “return stroke”, with a peak as high as hundreds of kiloAmperes. The return stroke acts as a powerful antenna, radiating an electromagnetic pulse (EMP). The lighting EMP can propagate many thousands of kilometers in the Earth-ionosphere waveguide and be detected by remote receivers. The EMP also propagates upwards through the atmosphere and interacts with the ionosphere, producing heating, new ionization, and optical emissions known as “Elves”. Furthermore, some energy leaks through the ionosphere and into the magnetosphere, propagates as whistler-mode waves in the magnetized plasma environment, and interacts with radiation belt electrons. As such, lightning is an important factor in the dynamics of radiation belt electron populations. This talk will provide an overview of lightning, Elves, and related phenomena, and then introduce observations and modeling of the lightning EMP and the production of Elves. We will then present the design of a new CubeSat known as the VLF Wave and Particle Precipitation Mapper (VPM) that will make measurements of electromagnetic waves and energetic electrons from low Earth orbit. The VPM CubeSat, which involves two wave instruments and two energetic electron detectors, will help to quantify the effects of lightning on the lower ionosphere and on radiation belt electron populations.

Monday, February 23, 2015
12:00 – 1:00 pm
Onizuka Conference Room

Biography:

Dr. Robert A. Marshall completed his Ph.D in 2009 in Electrical Engineering at Stanford University. After a postdoctoral position at the Center for Space Physics at Boston University, he returned to Stanford in 2011. He is currently a Research Associate in the Department of Aeronautics and Astronautics. Dr. Marshall’s research background primarily covers lightning and the effects on lightning on the near-Earth space environment, including the ionosphere and radiation belts. His other research interests include other dynamic inputs to the upper atmosphere including meteors and gravity waves, as well as instrument and sensor development, spacecraft development, and numerical modeling of electromagnetic waves in plasmas.