

Ocean-Troposphere-Ionosphere Coupling via Lightning and Transient Luminous Phenomena

Alfred Bing-Chih Chen[1]; Cheng-Ling Kuo[2]; Yi-Jen Lee[3]; Rue-Ron Hsu[4]; Han-Tzong Su[4]; Jyh-Long Chern[5]; H.U. Frey[6]; S.B. Mende[6]; Yukihiro Takahashi[7]; Tie-Yue Liu[8]; Yeou-Shin Chang[8]; Lou-Chuang Lee[9]

[1] Department of Physics, National Cheng Kung University; [2] Space science, Natl. Central Univ., Taiwan; [3] Department of Physics, National Cheng-Kung University; [4] Cheng Kung Univ.; [5] Department of Photonics, National Chiao-Tung University; [6] U.C.Berkeley; [7] Dept. of Geophysics, Tohoku Univ.; [8] National Space Organization; [9] NSPO

Thunderstorms are known to be capable of initiating spectacular transient luminous events (TLEs), such as sprites, halos, elves, and jets; however their global distributions and occurrence rates have not been well assessed until recently. ISUAL experiment onboard FORMOSAT-2 satellite recorded thousands of TLEs and lightning flashes in a 3.5-year global survey. Correlations between TLEs, lightning, vertical atmospheric flow and ocean surface temperature indicate there is a strong coupling among ocean, troposphere, stratosphere, and ionosphere, covering an altitudinal range of nearly 100 km. Lightning was known to be an important modulator of the chemical composition in the troposphere and stratosphere. Here we demonstrate that lightning also play an important role in driving the chemistry of the ionosphere D-region by elevating the electron density through the occurrence of elves. In this talk, we present the evidences for the global scale interactions between different layers of Earth atmosphere. Assessments of the impacts of TLEs on the upper atmospheric total electron content and on the electric global circuit will also be discussed.