Utilizing GNSS Radio Occultation Sensors on Space Weather CubeSat Missions

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CubeSats and similar scale satellites offer new opportunities to both explore and monitor the near-earth environment. Their relatively low cost promotes equally low-cost payloads that is achieved by miniaturization of already developed receivers or utilizing Commercial-Off-The-Shelf (COTS) components. GNSS radio occultation (often referred to GPSRO) sensors are one of the most popular types of space weather sensors that provide ionospheric density in the form of Total Electron Content (TEC) and scintillation measurements. In addition to ionospheric observations, GPSRO provides water vapor, temperature, and pressure in the troposphere. Another technique that utilizes GPS signals is reflectometry that can provide observations of the sea surface roughness, ice coverage, and soil moisture. Thus, LEO GNSS receivers are an invaluable tool for near Earth investigations.

While GNSS receivers have successfully flown on a number of small satellites (e.g. CYGNSS), GNSS receivers flown on CubeSats have had varying levels of success. This talk will outline the general requirements for a CubeSat GPSRO sensor, an overview of commercially available receivers, a summary of GPSRO receivers flown on CubeSats and recent small satellites along with their success and science contributions, and the future potential of GPSRO sensors. The talk will then focus on upcoming missions hosting GPSRO sensors by The Aerospace Corporations including the Scintillation Prediction Observations Research Task (SPORT) and the Low-Latitude Ionosphere/Thermosphere Enhancements in Density (LLITED) missions. These two missions utilize different strategies for the receiver. SPORT will use a COTS receiver while LLITED will utilize an in-house developed receiver. Thus, advantages and disadvantages of each strategy will be highlighted.