Observations and Simulations of Whistler Waves in Earth Radiation Belts

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In October of 2014, a cluster of whistler waves localized within prominent density enhancements in the magnetosphere was observed by the Van Allen Probe A's EMFISIS instrument. This event was recorded around 13:00 GMT, when the satellite was near apogee. The most powerful wave lasted approximately five minutes, and was accompanied by a 60 cm^{-3} increase in density and elevated particle acceleration throughout the region. These whistler waves also brought relatively intense magnetic and electric fields, measuring 0.4 nT and 0.0035 V/m, respectively. The accurate computer-replication of whistler waves will lead to a better understanding of how they are created and how they propagate. While simulated models of these electron MHD waves have been engineered, they are not perfect and have not been thoroughly tested. Thus, we will use the most current data and technology to validate the models and ensure their precision.

In order to properly simulate the whistler waves we first establish their characteristics using the data we collected from the Van Allen Probes, primarily from the EMFISIS instrument. While only the data from the probe passing through the event will be analyzed, the other satellite's observations will help re-create the surrounding magnetospheric activity. Next, we incorporate the conditions and location in which the waves occurred into a pre-existing mathematical model, that in turn is used to provide an accurate simulation. Such simulations will allow a closer and more analytical study of how whistler waves become trapped in density ducts. This research will also advance our understanding of how we can use these waves to remove energetic particles from Earth's radiation belts.