URSI AP-RASC, Sydney, Australia, 17-22 August 2025

Analysis of DC Electric Field over the Arctic Region by SS-520-3 Sounding Rocket

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The SS-520-3 sounding rocket was successfully launched from Ny-Ålesund, Spitsbergen, Norway, in November 2021. The objective of the SS-520-3 rocket experiment is to observe the heating and acceleration of ions resulting from the interaction of atmospheric particles and waves over the Arctic region. The SS-520-3 sounding rocket payload is equipped with the Low-Frequency Wave Analysis System (LFAS), which contains two sets of orthogonal double probes. These probes are used to measure both DC and AC electric fields in the spin plane. The Electric Field Detector (EFD) is one of the instruments that comprise the LFAS. The EFD measures the DC electric field and the extremely low frequency components up to 400 Hz of the AC electric field. The EFD is also responsible for the measurement of the potential difference between the electrode of the sensor top and the rocket body, which is called to as the single probe data.

During the flight, EFD electronics was normally operating, however two of the four sensors were not fully extended. Only one of the two sensors measuring the X and Y components was successfully extended. Therefore, the X and Y components in the rocket spin plane of the electric field could not be obtained. However, it was determined that the DC electric field can be derived from the single probe data that the sensor, which extended normally, observed. As a result, the DC electric field vector was able to derive using the attitude data of the rocket during the flight. Consequently, it will be able to expect that the effect of the electric field on particles in the ionospheric plasma can be investigated by comparing the electric field data with observations made by other scientific instruments on board the sounding rocket.

The presentation will demonstrate the method for calculating direct current electric field vectors using a single probe data and will provide a detailed discussion of the accuracy of the derived electric field vectors. The presentation will conclude with an examination of the influence of the derived electric field vectors on the ionospheric plasma in the arctic region.