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Expanding the Topside Sounder Digital Data Collection

Abstract:

The International Satellites for Ionospheric Studies (ISIS) program included four Canadian-built swept-frequency topside sounder satellites: Alouette 1 and 2, and ISIS 1 and 2. These satellites were launched between 1962 and 1971 and, together with other topside sounders, provided the first truly global maps of ionospheric density because they obtained observations over regions that were not readily accessible to ground-based instruments.

An effort has been underway to preserve data from these satellites for modern analysis. A NASA effort has already transferred thousands of the original magnetic tapes to digital form. A pilot project is now underway to digitally preserve data stored on 35mm film using compatible file formats. This effort focusses on the ISIS 2 satellite, particularly on topside soundings made over Resolute Bay (74.4°N, 265.1°E). ISIS 2 had a polar circular 1400 km altitude orbit, providing good coverage of the polar cap. Resolute Bay hosted both a ground station for acquiring ISIS 2 data, and a ground-based ionosonde, allowing complementary soundings to be performed.

Periods of interest have been identified in which both topside and ground-based sounding data films exist. Software has already been developed to analyze film ionograms from ground-based sounders. New software is being developed to convert the topside film into digital ionograms with range and frequency information. Position information from the satellite ephemeris will also be added. Existing software such as TOPIST will be used to produce electron density profiles (EDPs) from the topside soundings for comparison with the ground-based EDPs. The storm-time behavior of the polar cap will be examined. Ultimately, the goal will be to compare polar cap profiles from this early 1970s data set with modern Resolute Bay observations.