

SeaSonde Signals Used for Coronal Mass Ejection Studies

A Coronal Mass Ejection (CME) is a burst of charged particles from the upper atmosphere of the Sun that can disrupt radio transmissions, cause damage to satellites and electrical power grids and produce incredibly beautiful aurorae as seen at right.

SeaSonde transmit signals were recently used to look at the effect on the Earth's ionosphere from the January 22 CME. What was interesting about this study, though, was that it was not done in a research lab with specialized SeaSondes and expensive scientific equipment. The SeaSondes that provided the transmit signals were the same ones that monitor the United States coastal oceans for US IOOS Program and the receive equipment was a commercially available software defined radio (SDR) manufactured by RFSpace Corp. of Atlanta, GA.

Radio engineer and president of RFSpace Corp., Pieter Ibelings, was able to "listen" to SeaSonde signals from all over the U.S. and empirically determine the waveform parameters. Using this and the station information published on the Scripps Institute National HF Radar page, Mr. Ibelings was able to map the heights of ionosphere layers over time as shown in the figure at left.

As long range HF radar users and amateur radio listeners are aware, signals in the lower part of the HF band can propagate over very long distances by bouncing off the ionosphere and Earth surface. The FMCW chirp that the SeaSonde uses allows it to be easily identified and synced. According to Mr. Ibelings, "The signals are almost perfect for ionospheric sounding since they are linear chirps. I capture the chirp with a receiver locked to GPS both in frequency and time. I then de-chirp the waveform so I can extract the time of arrival information at my location." However, in order to most effectively use the signals around the U.S. that are operating on the same frequency, knowledge of each station's GPS timing alignment values is needed.

For more information on Mr. Ibelings' ionospheric studies using SeaSonde signals & SDRs, please visit www.rfspace.com and click on "BLOG".

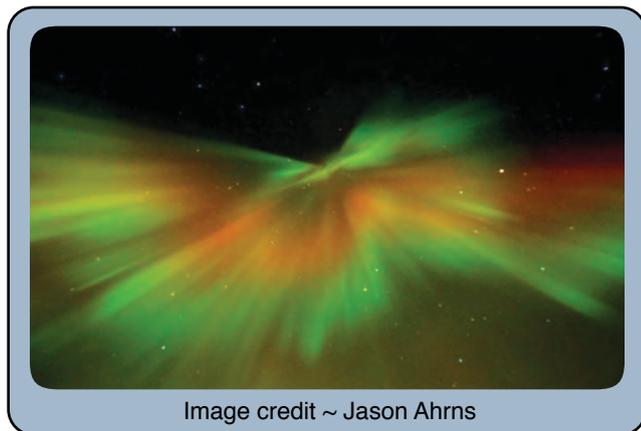


Image credit ~ Jason Ahrns

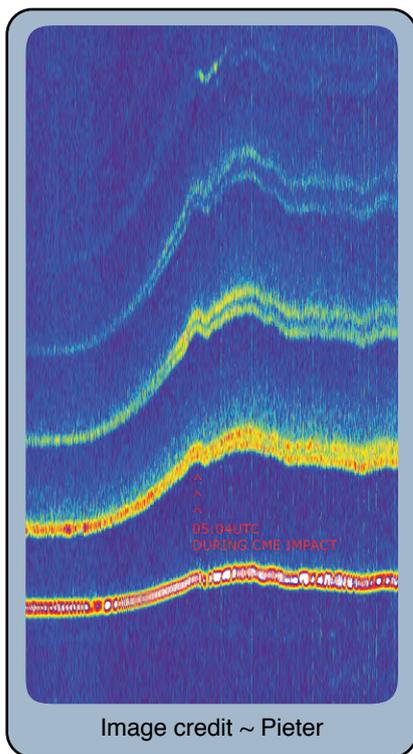


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