Monitoring Shortwave Fadeout (SWF) based on Daytime SuperDARN Ground-Scatter Observations

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1 Introduction

One of the most significant impacts of sudden ionospheric disturbance on HF radio wave is shortwave fadeout (SWF). This sudden disruption of HF communication affects flight communication, OTH radar tracking and many other HF communication systems such as NVIS and HAM radio systems. This motivates a tool to monitor SWF in real-time that can provide the event impact location and intensity of HF radio wave absorption.

2 Extended Abstract

Shortwave fadeout (SWF) is one of the well-known radio wave anomaly occurs in the upper atmosphere. Increase in plasma density in D-layer causes the increase in HF radio wave absorption, which also affects HF OTH radars like SuperDARN. SuperDARN observations of daytime ground-scatter are known to be strongly affected; the number of ground-scatter echoes drops suddenly (∼1 min) and sharply, often to near zero (dependent on intensity of solar flare, zenith angle, radio wave frequency etc). We can exploit this property of SuperDARN observations to monitor SWF on real-time. SWF impacts ground-scatter echoes twice during the event; the first one is absorption in ground scatter and second one is sudden apparent increase in ground-scatter velocity. We use some basic statistics and curve fitting techniques to determine the phases and to identify the velocity flash in the ground scatter that precedes the dropout in ground scatter number. We describe the development of a Python-based tool that can monitor real-time observations and detect the onset of SWF. We discuss the pattern recognition technique and the development of an effective space weather capability for detecting this source of disruption to HF communication channels.

Figure 1. Different color showing different states detected by SuperDARN radar, GOES satellites and Sun during an SWF event. Red stands for SWF event in progress and green stands for normal ground-scatter.

References
