

SOME EFFECTS OF THE HALLOWEEN IONOSPHERIC  
STORM ON MIDLATITUDE HF SYSTEMS

R. D. Hunsucker<sup>2</sup>, D. Rice<sup>13</sup>, J. J. Sojka<sup>1</sup> , J. V. Eccles<sup>1</sup>

<sup>1</sup>Space Environment Corporation, 221 N Spring Creek Parkway,  
Suite A, Providence, UT 84332 USA

<sup>2</sup>RP Consultants, 7917 Gearhart, Klamath Falls, OR 97601 USA

<sup>3</sup>Dept. of Electrical and Computer Engineering, Utah State Uni-  
versity, Logan, UT 84322-4120 USA

The HF spectrum (nominally 3-30 MHz) supports a variety of legacy analog long-distance communications, as well as modern digital point-to-point services used by military, government, and civilian agencies for backup and sometimes primary communications. In addition, the HF spectrum is used for ground-based ionospheric diagnostics such as sounding and riometry. The Halloween Storm of 2004 produced long duration, large magnitude disruptions of midlatitude HF systems.

HF paths from WWV (Fort Collins, CO) and WWVH (Kauai, HI) have been monitored for the HF Investigation of D-Region Ionospheric Variation Experiment (HIDIVE) since December 2002 (Eccles et al., *Space Weather*, in press, 2004). These results, together with observations from the Utah State University (USU) Bear Lake Observatory (BLO), demonstrate the impact of the storm on the midlatitude ionosphere and on HF communications based on the 1400 km path between WWV and the RP Consultants monitoring site in Klamath Falls, OR. BLO is near the midpoint of the WWV-to-Klamath Falls path.

In addition to deep HF signal fades due to x-ray flare absorption, WWV signal levels were severely disturbed for much of November, and the low-power CADI sounder at BLO revealed periods of strong absorption (trace dropouts), sporadic-E, and spread-F. Other intense short-term effects were also observed, including substantial GPS scintillations and four-hour position errors at BLO associated with CME impacts on 29 and 30 October 2003.

Taken together, these results provide insight into the response of the ionosphere above northern Utah to certain space weather events during a major geomagnetic storm. We describe these storm responses and impacts on HF and GPS systems; modeling results for this period are presented in a companion paper. A more extensive observational network would be needed to infer the spatial development of the storm response on a continental scale.

Abstract Submission Form

2004 National Radio Science  
Meeting

Abstract: rice14939

Date Received: September 24, 2004

1. (a) Donald Rice  
Space Environment Corporation  
221 N Spring Creek Parkway, Su  
Providence, UT  
84332 USA  
Don.Rice@usu.edu
- (b) 435-752-6567
- (c) 435-752-6687
2. G - Ionospheric Radio and  
Propagation
3. (a) Impacts of the Ionosphere  
on Terrestrial Systems
4. C - Contributed Paper,  
Program chair: Coster and  
Dougherty
5. Companion abstract to  
abstract rice1998; prefer to  
present this one first.