



Canadian Association
of Physicists

Association canadienne
des physiciens et physiciennes

Contribution ID: 190

Type: Oral (Non-Student) / Orale (non-étudiant(e))

April 2024 Solar Eclipse Effects on Ionospheric Density and Radio Propagation

Monday 9 June 2025 11:00 (15 minutes)

This study examines effects of the April 2024 total solar eclipse on ionospheric electron density and HF radio propagation, using multi-instrument observations and the physics-based SAMI3 model (SAMI3: A Model of the Ionosphere). We compare ground-based ionosonde measurements from across North America, including a newly installed station at Wright-Patterson Air Force Base, which was located under the path of totality, to SAMI3's predictions of altitude profiles of plasma density at these ionosonde locations. We also use data from the HamSCI Solar Eclipse QSO Party (SEQP), which includes radio communications reported by ham radio operators and global automated receiving networks (e.g., WSPRNet, the Reverse Beacon Network, and PSKReporter). Ham radio datasets, along with PHaRLAP raytrace modeling, are utilized to infer the ionospheric and HF radio responses to the solar eclipse. Our findings suggest that the eclipse driven ionospheric electron density changes are symmetric in the E-region but asymmetric and delayed in the F-region. The eclipse increased the range of radio communications in the lower HF bands (3.5, 7, 10 MHz) but decreased long-range communications in the higher HF bands (21, 24, 28 MHz). Ham radio datasets show an earlier opening of radio links between the US and Europe on the day of the eclipse, suggesting a combined effect of the sunset terminator and the eclipse shadow during the later phase of the eclipse.

Keyword-1

Ionosphere

Keyword-2

Solar Eclipse

Keyword-3

Radio Propagation

Author: PANDEY, Kuldeep (New Jersey Institute of Technology)

Co-authors: CHARTIER, Alex (Applied Physics Laboratory, Johns Hopkins University, Laurel, MD, USA); KUNDURI, Bharat (Virginia Polytechnic Institute and State University, Blacksburg, VA, USA); EMMONS, Daniel (Air Force Institute of Technology, Department of Engineering Physics, WPAFB, USA); THEMENS, David (University of New Brunswick); PERRY, Gareth (New Jersey Institute of Technology); HUBA, J. D. (Syntek Technologies, Fairfax, DC, USA); FRISSELL, Nathaniel A. (The University of Scranton, Scranton, PA, USA); THE HAMSCI COMMUNITY (HamSCI Community Volunteer, Scranton, PA USA)

Presenters: PERRY, Gareth (New Jersey Institute of Technology); PANDEY, Kuldeep (New Jersey Institute of Technology)

Session Classification: (DASP) M1-2 Magnetosphere and Magnetospheric Dynamics | Magnétosphère et dynamique magnétosphérique (DPAE)

Track Classification: Technical Sessions / Sessions techniques: Atmospheric and Space Physics / Physique atmosphérique et spatiale (DASP/DPAE)