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GPS phase scintillation and auroral electrojet currents during geomagnetic storms

Paul Prikryl (1,2), Reza Ghoddousi-Fard (3), Knut S. Jacobsen (4), Ari Viljanen (5), James M. Weygand (6), Donald W. Danskin (2), P. Thayyil Jayachandran (1), Bharat S. R. Kunduri (7), Yngvild L. Andalsvik (4), Martin Connors (8), and Tibor Durgonics (9)

(1) University of New Brunswick, Physics Department, Fredericton, NB, Canada, (2) Geomagnetic Laboratory, Natural Resources Canada, Ottawa, ON, Canada, (3) Canadian Geodetic Survey, Natural Resources Canada, Ottawa, ON, Canada, (4) Norwegian Mapping Authority, Hønefoss, Norway, (5) Finnish Meteorological Institute, Helsinki, Finland, (6) Dept. of Earth, Planetary and Space Sciences, University of California, Los Angeles, CA, USA, (7) Bradley Dept. of Electrical and Computer Engineering, Virginia Tech, Blacksburg, VA, USA, (8) Athabasca University, Edmonton, AB, Canada, (9) Technical University of Denmark, National Space Institute, Kongens Lyngby, Denmark

GPS phase scintillation during geomagnetic storms in July 16-17 and September 7-8, 2017 is studied in the context of solar wind coupling to the magnetosphere-ionosphere system using arrays of GNSS receivers and ground-based instruments including magnetometers, HF radars, ionosondes and riometers. The phase scintillation index is computed for signals sampled at a rate of 50 Hz by specialized GPS scintillation receivers from the Canadian High Arctic Ionospheric Network (CHAIN) and the Norwegian Mapping Authority (NMA) network. The scintillation occurrence maps combine the phase scintillation index with a proxy index obtained from dual frequency measurements of geodetic-quality GPS receivers sampling at 1 Hz that include globally distributed receivers of RT-IGS network that are being estimated and monitored by the Canadian Geodetic Survey in near-real-time, the NMA array, and the Greenland GNSS Network (GNET). As proxy scintillation indices, the standard deviation of delta phase rate (sDPR) and the rate-of-TEC index (ROTI) are used. We examine the relation between the scintillation and auroral electrojet currents observed by arrays of ground-based magnetometers as well as energetic particle precipitation observed by the DMSP satellites. Equivalent ionospheric currents are obtained from ground magnetometer data using the spherical elementary currents systems technique [1] that has been applied over the ground magnetometer networks in North America and northern Europe. Preliminary results indicate that the GPS phase scintillation is often mapped to a strong westward electrojet and to the poleward edge of the eastward electrojet, as previously observed during another geomagnetic storm [2], but they also reveal a more complex relationship.

References

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