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Comparison of geomagnetic storms of March 17, 2013 and 2015: GPS phase scintillation and auroral electrojet currents

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Interplanetary coronal mass ejections compounded by high-speed plasma streams from coronal holes caused two intense geomagnetic storms on March 17-18, 2013 and 2015 during the current solar cycle. Using arrays of ground-based instruments including GPS receivers, HF radars, ionosondes, riometers, all-sky imagers and magnetometers, GPS phase scintillation is studied in the context of solar wind coupling to the magnetosphere-ionosphere system comparing the two storms. The phase scintillation index is computed for signals sampled at a rate of 50 Hz by specialized GPS scintillation receivers. It is supplemented by the phase scintillation proxy index obtained from geodetic-quality GPS data sampled at 1 Hz. 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 that has been applied over the ground magnetometer networks in North America and northern Europe. For both storms, preliminary results indicate that the GPS phase scintillation is mapped to strong westward electrojet and to the poleward edge of the eastward electrojet. It is mostly absent or low in the auroral zone when the electrojets are weak.