Multi-Instrument Observations of a Geomagnetic Storm and its Effects on the Arctic Ionosphere: A Case Study of the 19 February 2014 Storm - DTU Orbit (16/12/2018)

We present a multi-instrumented approach for the analysis of the Arctic ionosphere during the 19 February 2014 highly complex, multiphase geomagnetic storm, which had the largest impact on the disturbance storm-time (Dst) index that year. The geomagnetic storm was the result of two powerful Earth-directed coronal mass ejections (CMEs). It produced a strong long lasting negative storm phase over Greenland with a dominant energy input in the polar-cap. We employed GNSS networks, geomagnetic observatories, and a specific ionosonde station in Greenland. We complemented the approach with spaceborne measurements in order to map the state and variability of the Arctic ionosphere. In situ observations from the Canadian CASSIOPE (CAScade, Smallsat and Ionospheric Polar Explorer) satellite's ion mass spectrometer were used to derive ion flow data from the polar cap topside ionosphere during the event. Our research specifically found that, (1) Thermospheric O/N2 measurements demonstrated significantly lower values over the Greenland sector than prior to the storm-time. (2) An increased ion flow in the topside ionosphere was observed during the negative storm phase. (3) Negative storm phase was a direct consequence of energy input into the polar cap. (4) Polar patch formation was significantly decreased during the negative storm phase. This paper analyzes the physical processes that can be responsible for this ionospheric storm development in the northern high-latitudes. We conclude that ionospheric heating due to the CME's energy input caused changes in the polar atmosphere resulting in Ne upwelling, which was the major factor in high-latitude ionosphere dynamics for this storm.