Motion of the cusp and pulsed ion upflow: Simultaneous observations from IMAGE spacecraft, EISCAT and SuperDARN radars

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The Low Energy Neutral Atom (LENA) imager on the IMAGE spacecraft in the dayside magnetosphere can detect neutral particles coming in the general direction of the high altitude cusp. Recent studies have shown that the dominant source of this signal is the cusp ion injection along reconnected field lines. The direction of the cusp LENA signal clearly shifts equatorward/poleward responding to the increase/decrease of the southward IMF component, as is expected. In this study we focus on an event (28 March 2001) in which this kind of signal was identified by IMAGE/LENA in the magnetosphere and the EISCAT Svalbard radar (ESR) and the SuperDARN/CUTLASS radars observed the ionospheric cusp simultaneously. IMAGE/LENA observations for this event show that the high-altitude cusp moved poleward and then returned equatorward several times. In the ionosphere the ion upflow was observed by the ESR radar throughout this event, and the upflow was enhanced concurrently with the motion of the cusp which was identified with LENA. The observation from the CUTLASS HF radar indicates that the convection pattern, which is typical for positive IMF By, is slightly modified whenever the enhancement of the ion upflow occurs, suggesting that the 'pulsed' ion upflow, at least in this event, can be triggered by this kind of moderate convection change, and the resultant ion frictional heating. Detailed characteristics of the pulsed ion upflow and the concurrent change of the convection are presented, and how the ion frictional heating can account for the enhancement of the ion upflow of is discussed.