

Heater-induced artificial ionospheric ion upflow

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We have investigated force balance associated with ion upflow, by using the EISCAT UHF radar and heating facility in Tromsø, northern Norway (69.6 deg N, 19.2 deg E). The heating facility enables us to induce not only enhanced electron temperature but also upward flowing ions in the F-region/topside ionosphere. The heater-induced artificial ion upflow is one of the most suitable events to estimate force balance of ionospheric ions quantitatively and also understand generation mechanisms of ion upflow. Furthermore, the heater-induced ionospheric data are potentially usable to estimate height profiles of ion-neutral collision frequency, neutral density, and horizontal neutral wind in the F-region/topside ionosphere.

We conducted the heater and radar observations as an EISCAT special program by UK and Japan between 17 and 20 November, 2011, and successfully obtained data including artificial ionospheric ion upflow. The UHF radar and heater beams were both pointed into the magnetic zenith, and pump cycle of the heater was 16 min on, and 12 min off. During heater on period electron temperature sometimes increased up to about 4000 K and upward ion velocity reached about 500 m/s at an altitude of 500 km.

In this paper, we show the detailed results of the heating experiment, and discuss quantitative force balance associated with ion upflow.

Keywords: polar ionosphere, ion upflow, ion outflow, EISCAT