

# Occurrence of ion upflow associated with ion/electron heating in the polar cap and cusp regions

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In this study, we investigate the occurrence frequency of ion upflow associated with ion/electron heating in the polar cap and cusp regions, using the data obtained from the European Incoherent Scatter Svalbard radar (ESR) between 2000 and 2010. We classify the upflow events by four cases: driven by ion heating (case 1), electron heating (case 2), both ion and electron heatings (case 3), and without any heating (case 4). The statistical analysis of the data shows that the upflow normally starts at around 350 km altitude and the occurrence seems to peak at 11 MLT. Among the four cases, the occurrence frequency of the upflow is maximized for the case 2 and then followed by case 4, case 1 and case 3. At around 500 km altitude, however, the occurrence frequency is maximized when there is no heating (case 4). We also investigate the dependence of the occurrence frequency of the upflow on  $K_p$  and F10.7 indices. The moderate geomagnetic condition ( $2 \leq K_p < 5$ ) seems to show maximum occurrence frequency. As for the solar activity, the occurrence frequency is higher for low solar activity than for high solar activity. The results of this study suggest that the ion upflow occurring in the polar cap/cusp region is mostly driven by electron heating associated with soft particle precipitation.