Energetic particle precipitations stimulated by the ionosphere heating

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During EISCAT-Heating experiment at Tromso on November 19, 1998 imagine riometer IRIS has recorded a strong absorption of radio noise. Imaging riometer at Kilpisjärvi operates at 38.2 MHz and produces 49 narrow beams. During the experiment strong ionospheric inhomogeneities in the vicinity of the Heating Facility have appeared. Regular periodic in space structure is rather stable for 2.5 hours of the heating. It seems to be not phased with the pump cycles. Significant variations of the electron density are also seen in EISCAT data. The natural magnetospheric activity is controlled by aurora images obtained by POLAR satellite and Finnish all-sky camera chain. At the beginning of the experiment very localized substorm intensifications are observed over Tromso. Then the active region shifts in the north-west direction. Stable spatial distribution of the precipitations, their clear relationship with the heated area, and absence of the natural disturbances there allows us to conclude about forced nature of the particle precipitations.
The mechanism of the enhancement of the field-aligned flux based on the interaction of Alfven wave with the magnetospheric particles is proposed. Under frozen-in conditions this wave is not able to modify the precipitation flux. However, the violation of the frozen-in conditions may be associated with inertia of the ions. In a case of strong pitch-angle diffusion the increasing of the field-aligned electron fluxes is expected in the region of the negative spatial charge. The precipitations can modify the ionospheric conductivity and form self-generated inhomogeneity of the electron density in the ionosphere. Proposed mechanism is explained the main experimental results of the study.