

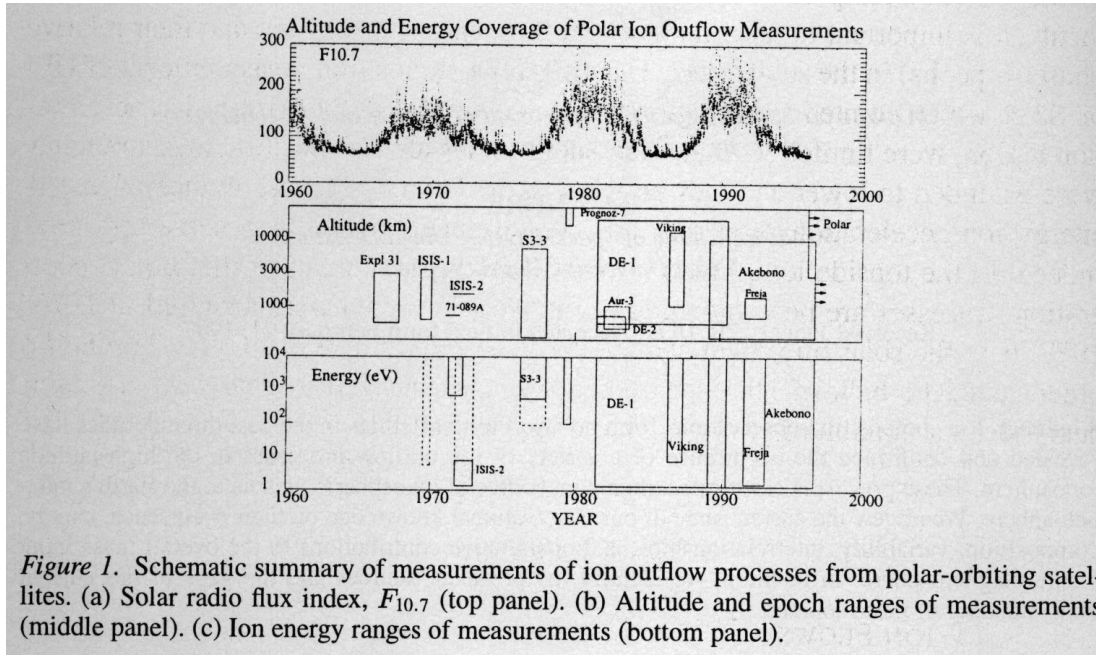


Figure 1. Schematic summary of measurements of ion outflow processes from polar-orbiting satellites. (a) Solar radio flux index, $F_{10.7}$ (top panel). (b) Altitude and epoch ranges of measurements (middle panel). (c) Ion energy ranges of measurements (bottom panel).

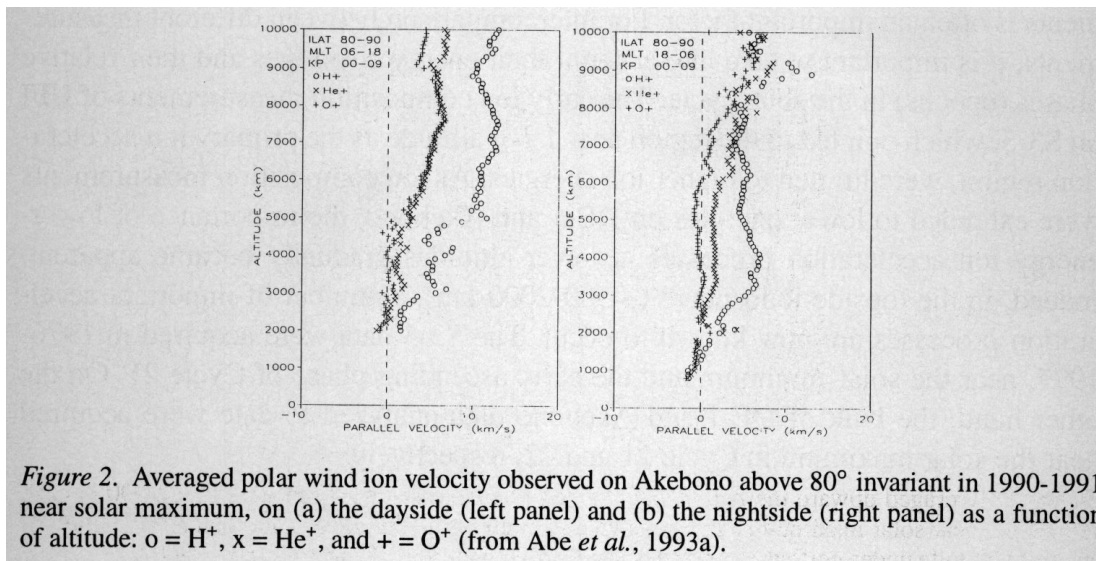


Figure 2. Averaged polar wind ion velocity observed on Akebono above 80° invariant in 1990-1991 near solar maximum, on (a) the dayside (left panel) and (b) the nightside (right panel) as a function of altitude: o = H^+ , x = He^+ , and + = O^+ (from Abe *et al.*, 1993a).

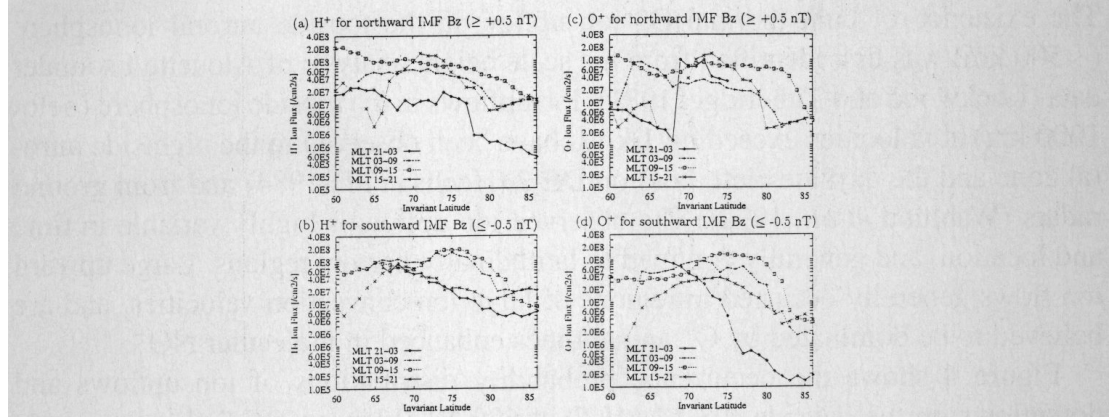


Figure 3. Averaged upward thermal H⁺ and O⁺ ion flux observed on Akebono at 6000-9000 km in 1990-1991 near solar maximum, and normalized to a reference altitude of 2000 km, as a function of invariant latitude under northward and southward IMF conditions (from Abe *et al.*, 1996).

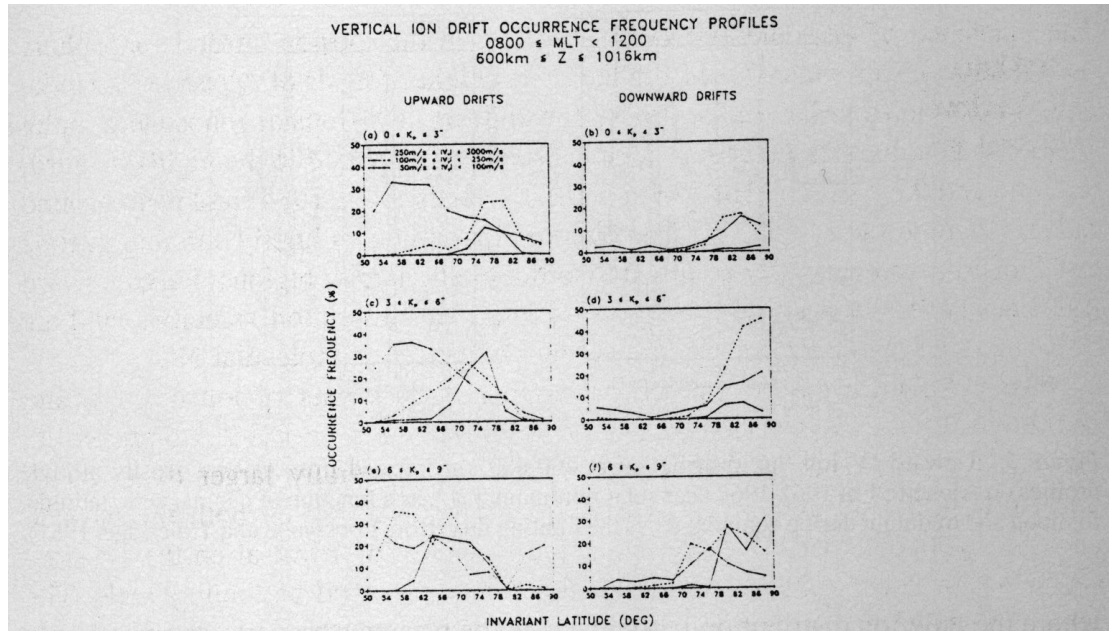


Figure 4. Occurrence probability of bulk thermal O⁺ upflows and downflows observed on DE-2 at 600-1000 km and 08-12 MLT, in 1981-1982 near solar maximum, as a function of invariant latitude (from Loranc *et al.*, 1991).

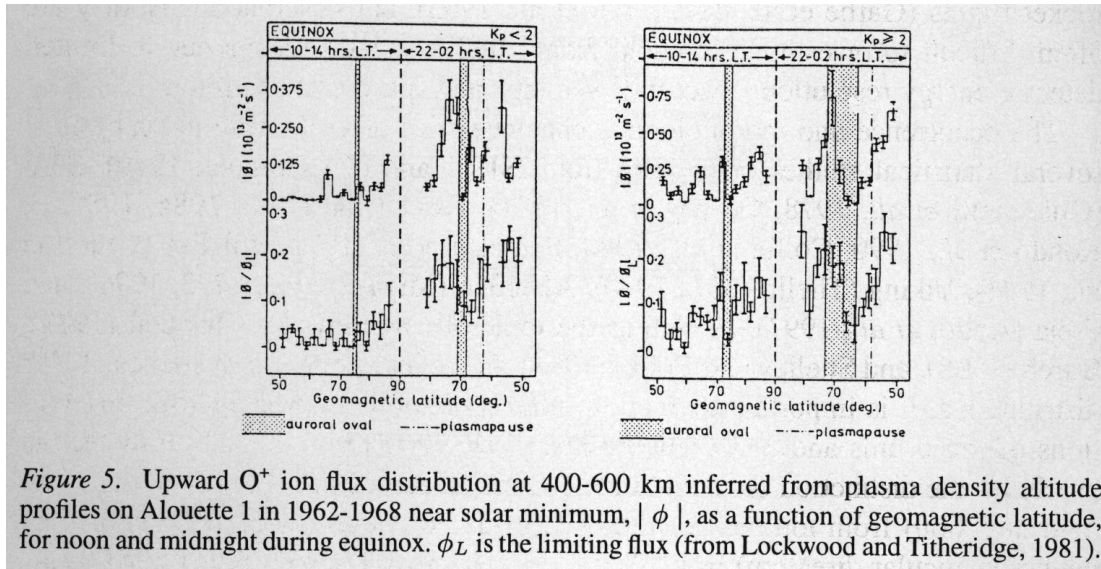


Figure 5. Upward O^+ ion flux distribution at 400-600 km inferred from plasma density altitude profiles on Alouette 1 in 1962-1968 near solar minimum, $| \phi |$, as a function of geomagnetic latitude, for noon and midnight during equinox. ϕ_L is the limiting flux (from Lockwood and Titheridge, 1981).

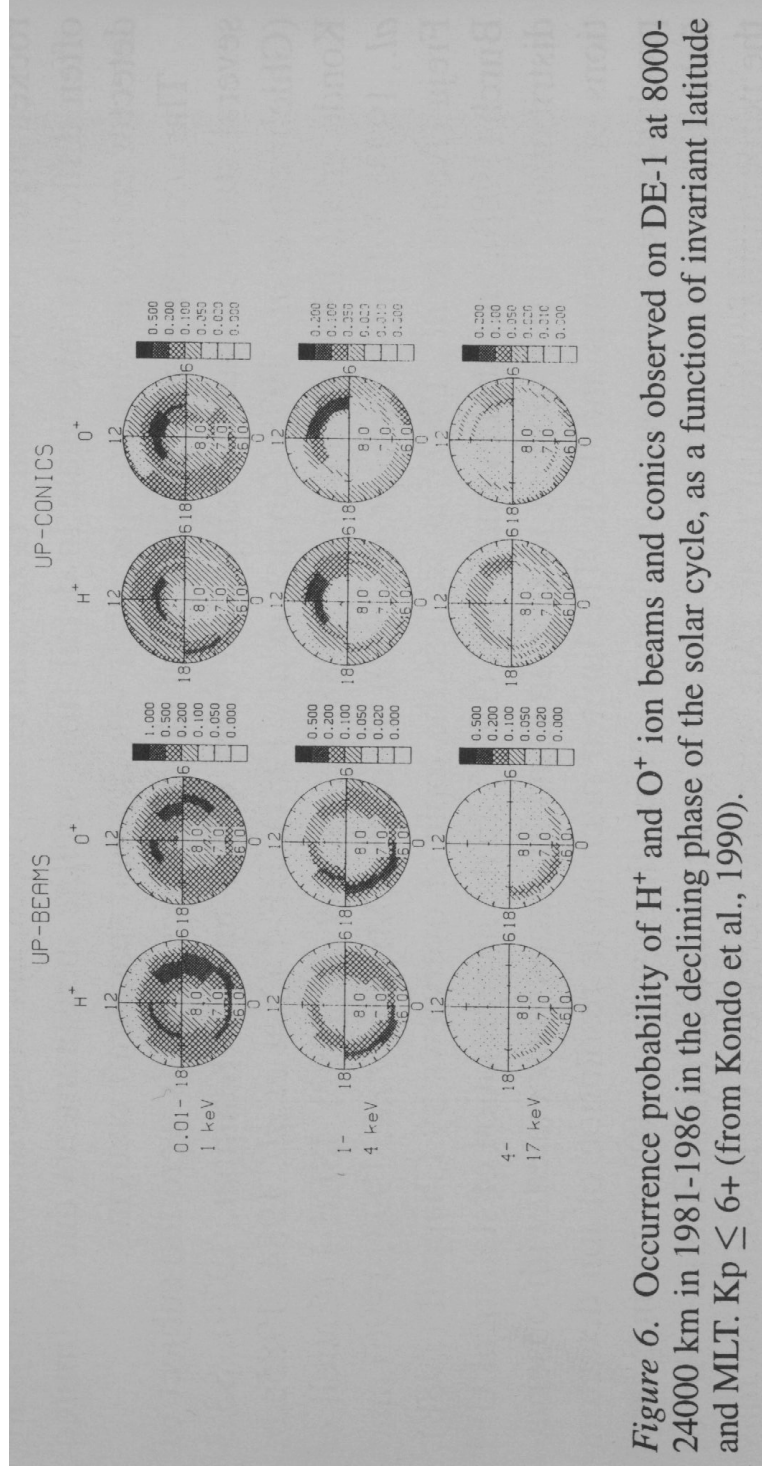


Figure 6. Occurrence probability of H^+ and O^+ ion beams and conics observed on DE-1 at 8000-24000 km in 1981-1986 in the declining phase of the solar cycle, as a function of invariant latitude and MLT. $K_p \leq 6+$ (from Kondo et al., 1990).

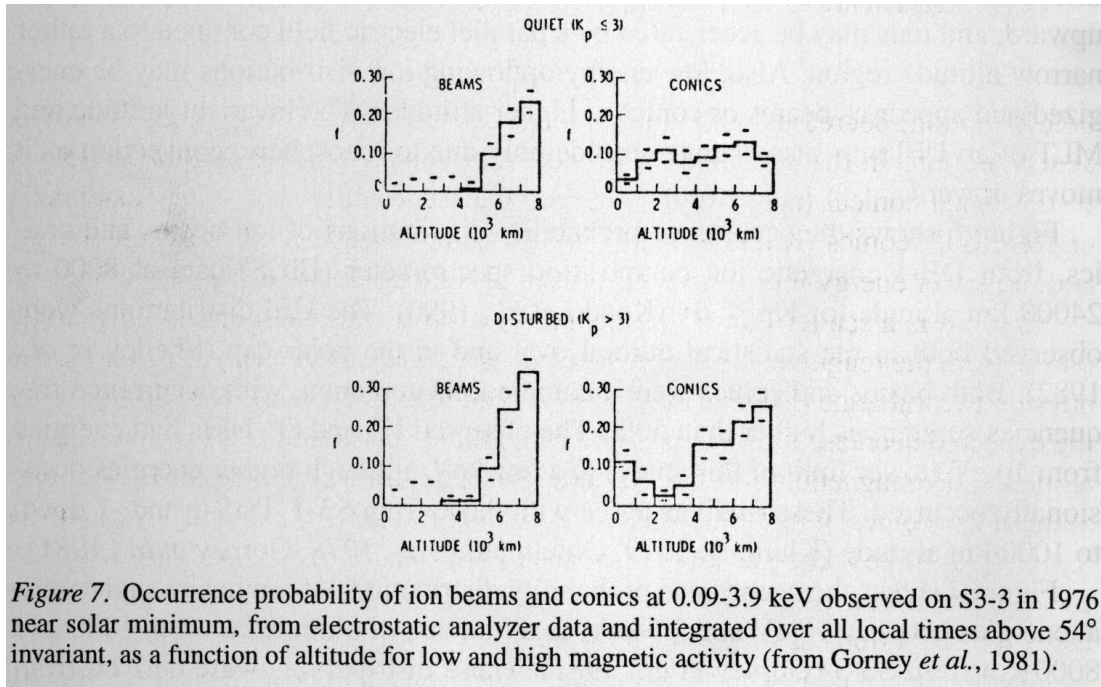


Figure 7. Occurrence probability of ion beams and conics at 0.09-3.9 keV observed on S3-3 in 1976 near solar minimum, from electrostatic analyzer data and integrated over all local times above 54° invariant, as a function of altitude for low and high magnetic activity (from Gorney *et al.*, 1981).

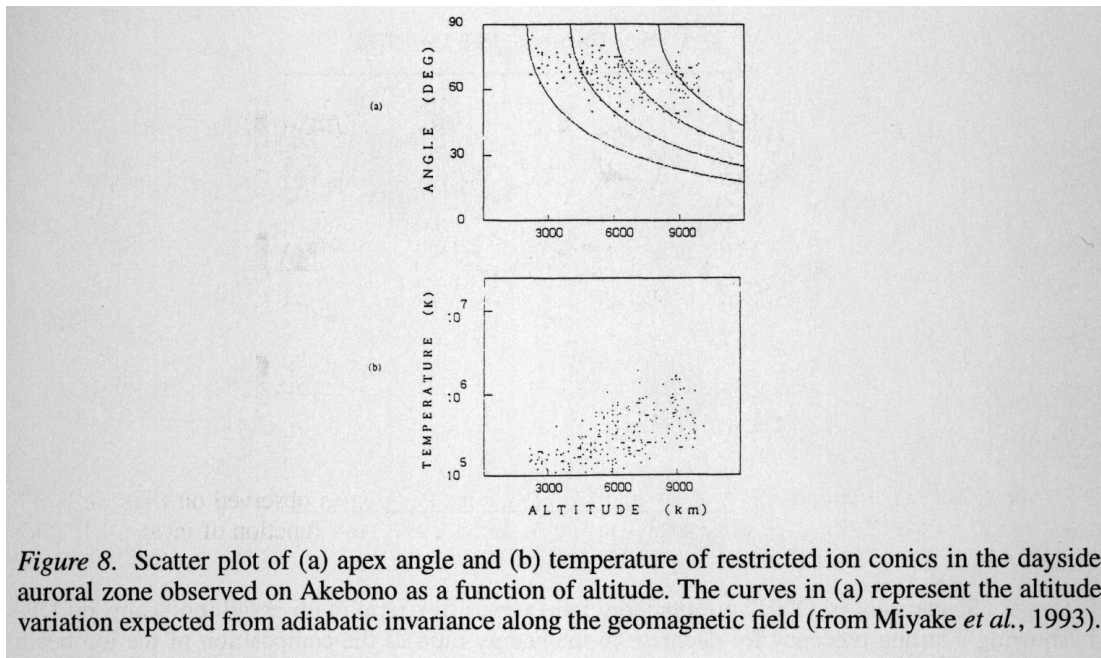


Figure 8. Scatter plot of (a) apex angle and (b) temperature of restricted ion conics in the dayside auroral zone observed on Akebono as a function of altitude. The curves in (a) represent the altitude variation expected from adiabatic invariance along the geomagnetic field (from Miyake *et al.*, 1993).

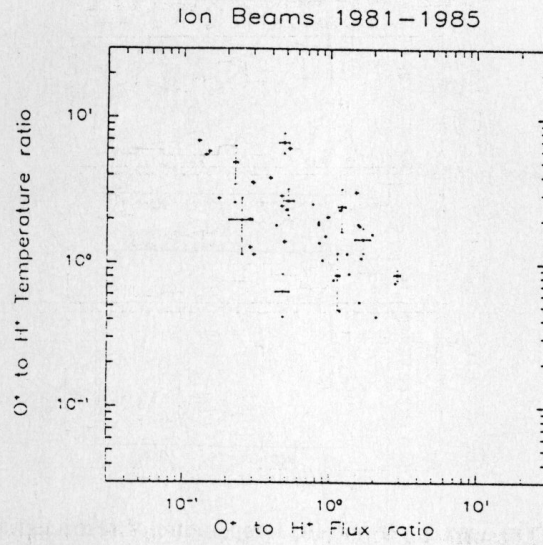


Figure 9. Scatter plot of O^+/H^+ mean energy ratio versus flux ratio in observed ion beams on DE-1, showing a strong tendency for decrease in the energy ratio as the composition of the ion beam becomes dominated by O^+ . Dots: data from 1981-1982; crosses: data from 1984-1985 (from Collin *et al.*, 1987).

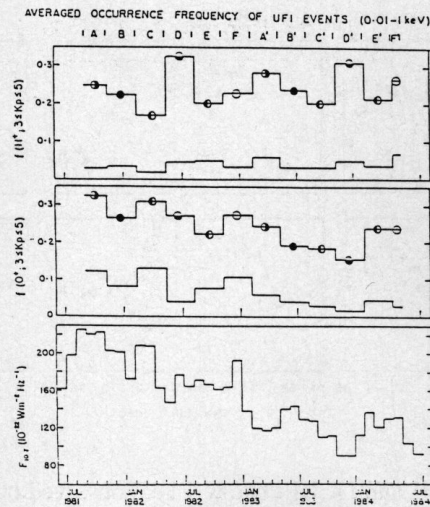


Figure 10. H^+ and O^+ UFI occurrence frequencies observed on DE-1 at 8000–24000 km and monthly mean solar radio flux at 10.7 cm between 1981 and 1984, showing the solar cycle and seasonal dependences of O^+ UFI occurrence. Solid circles: winter data; open circles: summer data; vertically semi-open circles: equinox data; see text (from Yau *et al.*, 1985a).

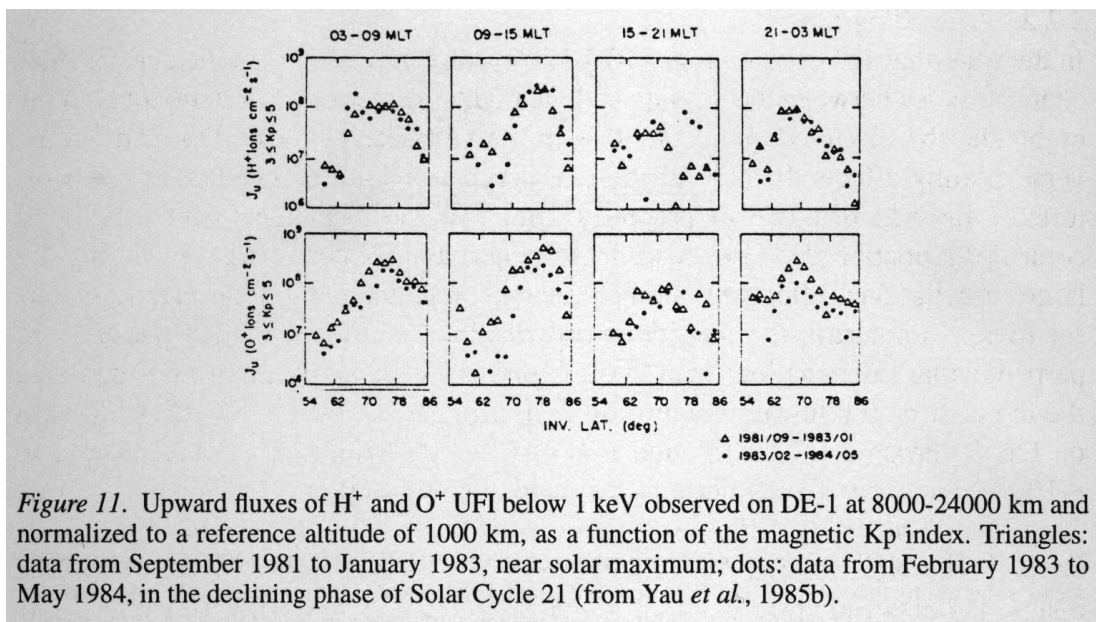


Figure 11. Upward fluxes of H^+ and O^+ UFI below 1 keV observed on DE-1 at 8000-24000 km and normalized to a reference altitude of 1000 km, as a function of the magnetic Kp index. Triangles: data from September 1981 to January 1983, near solar maximum; dots: data from February 1983 to May 1984, in the declining phase of Solar Cycle 21 (from Yau *et al.*, 1985b).

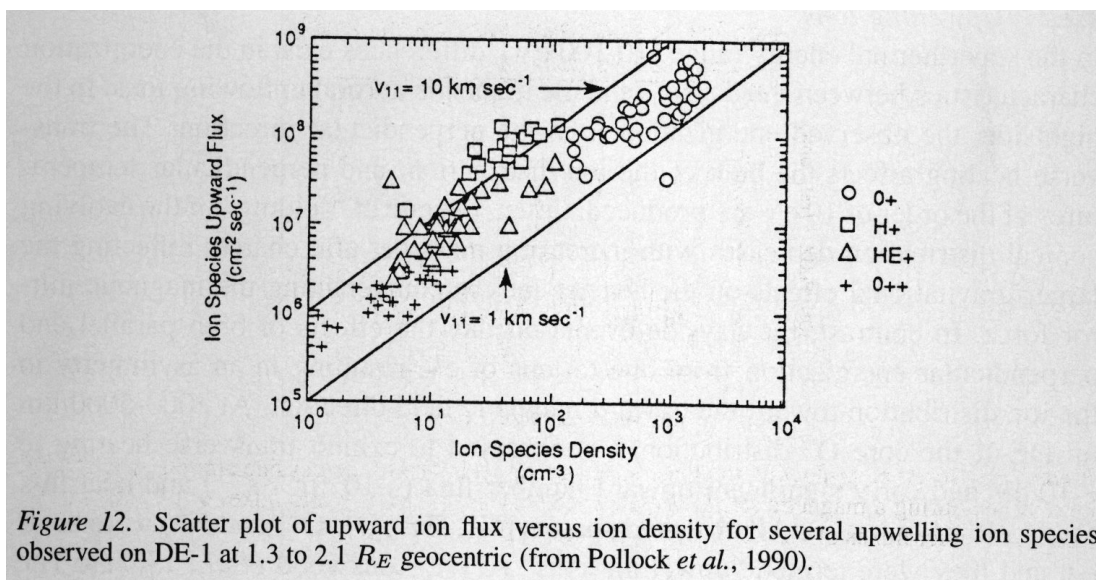


Figure 12. Scatter plot of upward ion flux versus ion density for several upwelling ion species observed on DE-1 at 1.3 to 2.1 R_E geocentric (from Pollock *et al.*, 1990).

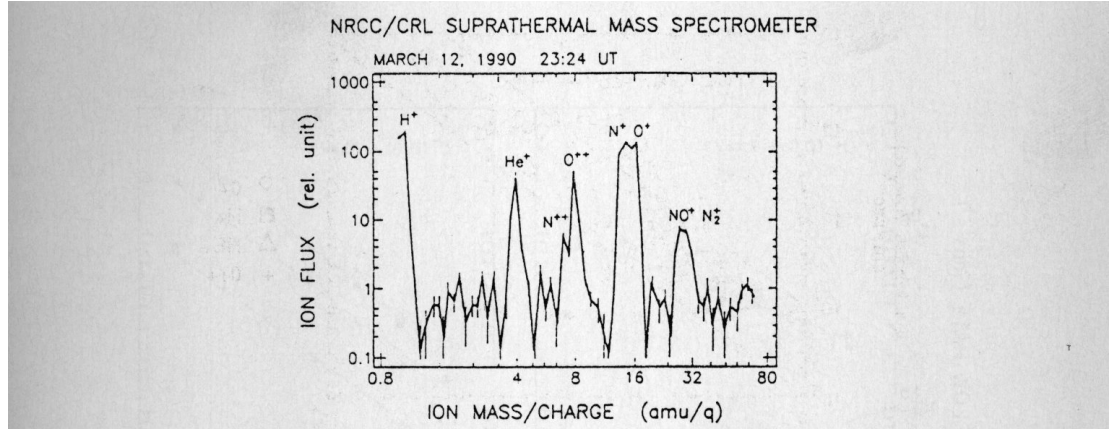


Figure 13. Observed upflowing ion mass spectrum on Akebono in the dayside auroral zone at 9000 km altitude during a magnetic storm, showing the presence of comparable fluxes of H^+ , N^+ , and O^+ ions and smaller fluxes of He^+ , O^{++} , and molecular NO^+ and N_2^+ ions.

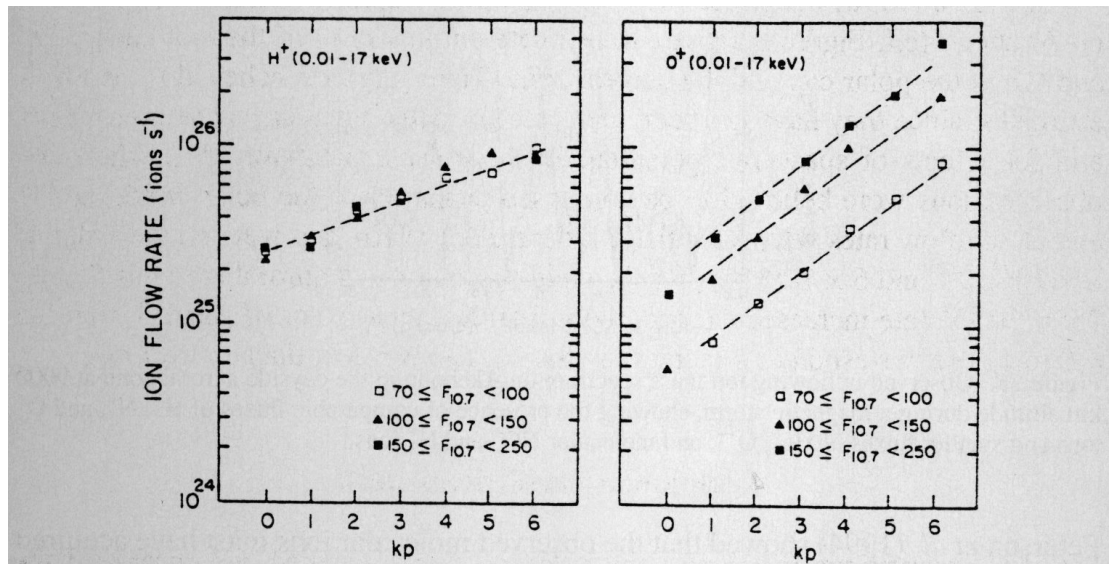


Figure 14. Outflow rates of H^+ and O^+ upflowing ions at 0.01-17 keV observed on DE-1, integrated over all MLT and invariant latitudes above 56° in both hemispheres, as a function of the magnetic Kp index, for different ranges of $F_{10.7}$ (from Yau *et al.*, 1988).