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# FABRY-PEROT DOPPLER IMAGING OBSERVATIONS AT SYOWA STATION, ANTARCTICA (EXTENDED ABSTRACT)

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There are a number of reports on strong upward winds ~100–150 m/s or more in the auroral region. These observations suggest that the heating due to auroral particle precipitation and Joule heating induce upward winds (REES *et al.*, 1984; WARDILL and JACKA, 1986; PRICE *et al.*, 1995). The strong upward winds play an important role for the dynamics of the polar thermosphere since a change of neutral atmosphere composition is caused by upward winds (FULLER-ROWELL *et al.*, 1991a, b).

In order to study the changes of thermospheric winds and temperatures associated

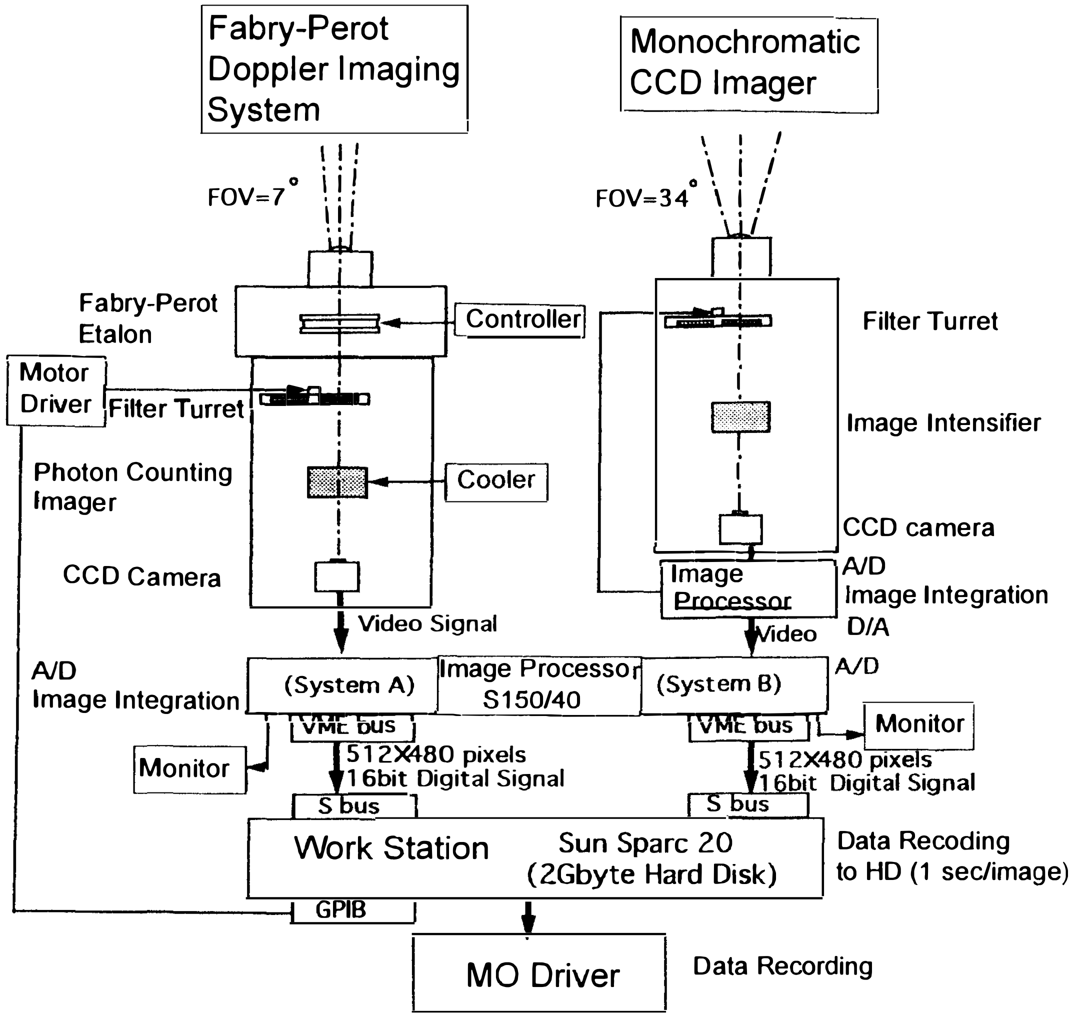


*Fig. 1. Schematic diagram of a Fabry-Perot Doppler Imaging System (FPDIS) and a monochromatic CCD imager.*

with auroral activity, observations with a Fabry-Perot Doppler Imaging System (FPDIS) were carried out at Syowa Station, Antarctica (66.4° MLAT) on 98 nights from April to October in 1996. A schematic diagram of FPDIS is shown in Fig. 1. On 37 nights out of 98 nights, a telephoto lens ($f$=180 mm) was adopted as an objective lens to measure vertical wind velocities within a narrow FOV of 7° in the zenith direction. Vertical wind velocities in the lower and upper thermosphere were estimated from Doppler shifts of two auroral emission lines, OI 557.7 nm and OI 630 nm with

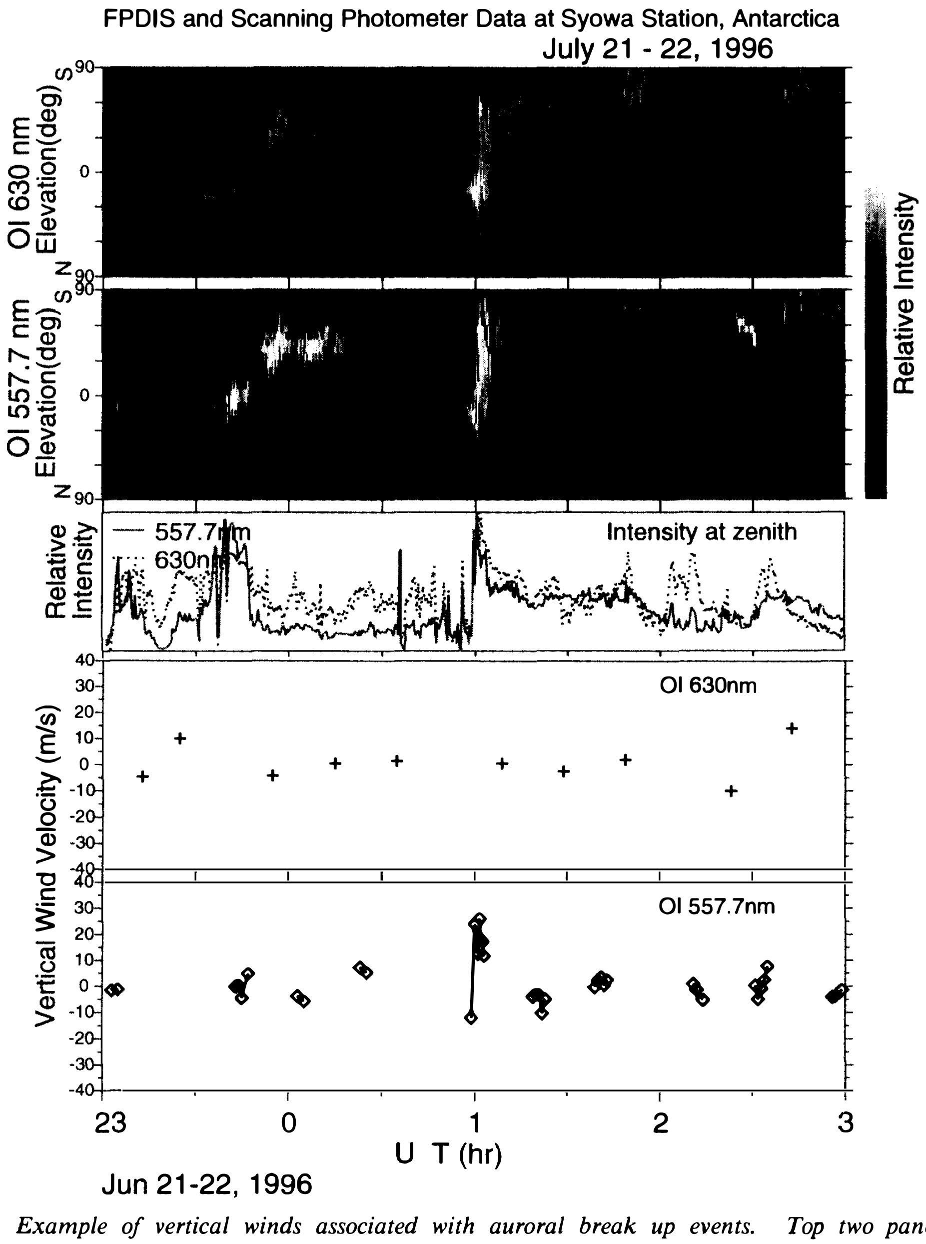


*Fig. 2. Example of vertical winds associated with auroral break up events. Top two panels show meridional scanning photometer data of 557.7 nm and 630 nm emissions. Third panel shows the auroral intensities of 557.7 nm and 630 nm emissions in the zenith obtained from the scanning photometer. Bottom two panels show the vertical wind velocities in the upper and lower thermosphere obtained from 630 nm and 557.7 nm Doppler image data of FPDIS, respectively.*

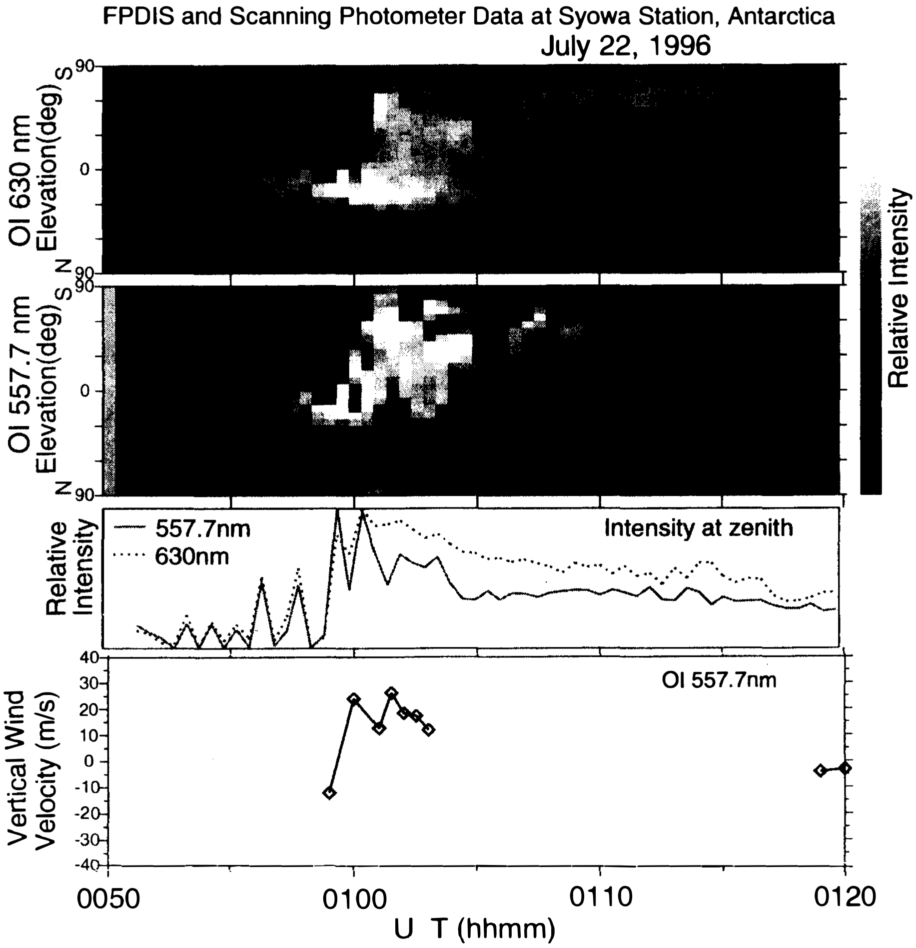


*Fig. 3. Extended display of Fig. 2 for the time interval from 0050 to 0120 UT on July 22, 1996.*

peak emission heights at ~120 km and ~250 km, respectively. Time resolution of vertical wind measurements was 30–300 s for OI 557.7 nm and 15–24 min for OI 630 nm. On the other hand, auroral activities were monitored with a SIT all-sky camera, a meridian scanning photometer, and a monochromatic CCD imager for OI 557.7 nm and OI 630 nm.

We analyzed vertical winds both on quiet and disturbed nights. An example of upward winds associated with auroral breakup events is shown in Fig. 2. Although geomagnetic activity was relatively low on this night ($K_p$ index was 2- or 2), an auroral breakup occurred at 0059 UT on 22 July as identified by the scanning photometer data. From the OI 557.7 nm data, it was found that localized upward winds were enhanced in the lower thermosphere associated with the auroral breakup. However, 630 nm data were missing during this breakup event, since the Doppler image data of 557.7 nm and 630 nm emissions were obtained alternatively by rotating the filter turret of FPDIS. For demonstrating the variations of upward winds in detail, Fig. 3 shows an extended display of Fig. 2 around the auroral breakup at 0059 UT. It is obvious that the variations of upward wind velocities are closely correlated with the variations of the 557.7 nm emission intensities. The maximum velocity of upward winds is 26 m/s. The time delay from the peak of auroral intensity at zenith to the peak of vertical velocity is shorter than 60 s. It is suggested, therefore, that upward vertical winds are generated locally in the lower thermosphere with a quick response to the auroral heating processes.

Recent observations (*e.g.*, REES *et al.*, 1984; PRICE *et al.*, 1995) demonstrated that large upward winds (100–150 m/s) occurred in the poleward portion of the auroral oval during the geomagnetically disturbed period, although our result showed that upward winds were generated in the auroral breakup region. Further, the maximum velocity of upward vertical wind obtained in this study (26 m/s) is much smaller than those obtained in the previous studies (100–150 m/s). The large vertical winds in the previous studies were interpreted as caused by Joule heating due to intense electric fields existing in the poleward portion of the auroral oval. If the previous result is correct, it is inferred that the electric fields in the poleward region were weak on July 21–22 due probably to low auroral activities revealed in $K_p$ values.

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