In figure 2, year-round values for the precipitable water vapor are shown. As expected, the values are very low; they are below 1 millimeter even during the warmer summer months. The surface temperature is included for reference and shows a clear correlation between the surface temperature and the precipitable water vapor.

The solar absorption spectrometer continued operation in the spring and fall. Tom Stephen and John Starkey from the University of Denver were at McMurdo to prepare the balloon instruments in January. The balloons will be flown by Steve Wood and Grant Avery (New Zealand, NIWA).

In addition to support from the National Science Foundation (grant OPP 92-19209), National Aeronautics and Space Administration grants NSG 1432 and NAG2-351 supported the ground-based and balloon experiments, respectively. The New Zealand National Institute of Water and Atmospheric Research Ltd. and the New Zealand Antarctic Programme also supported the solar observations at Arrival Heights and the balloon flight effort.

References

Murcray, F.J., and R. Heuberger. 1990. Infrared atmospheric absorption and emission measurements. *Antarctic Journal of the U.S.*, 25(5), 244–246.

Van Allen, R., X. Liu, and F.J. Murcray. In preparation. Seasonal variation of atmospheric nitric acid over the South Pole in 1992. *Geophysical Research Letters.*

Van Allen, R., F.J. Murcray, and X. Liu. In preparation. Mid infrared measurements of the atmospheric emission over the South Pole using a radiometrically calibrated FTS. *Applied Optics.*

Transient auroral events observed from South Pole Station

Frank T. Berkey *and* Carlos N. Kelly, *Center for Atmospheric and Space Sciences, Utah State University, Logan, Utah 84322-4405*

The transfer of energy from the solar wind to the Earth's magnetosphere is a problem of fundamental interest to magnetospheric physicists. The physical processes responsible for this energy transfer are assumed to occur on the dayside of the magnetosphere, near the interface with the solar wind. Current debate concerns how the transfer of energy occurs and whether it is a continuous process or whether it takes place in short-lived bursts (Newell and Sibeck 1993). Further, scientists believe that an ionospheric signature of these processes must exist and various candidate events have been suggested (Lanzerotti et al. 1986; Sandholt et al. 1986).

From the analysis of all-sky camera (ASC) film acquired at South Pole Station, we have identified a series of transient enhancements in the brightness of an unusually stable dayside arc system that was present for several hours in the late afternoon sector on 16 August 1985. The analysis of these data was facilitated by use of the automatic retrieval system for auroral data (ARSAD) developed at the National Institute of Polar Research in Tokyo. This system digitizes each 35-mm ASC frame, transforms the data into geophysical coordinates, and stores the resulting information. Our analysis was derived from data presented in the latitude-time (Keogram) format where a narrow segment along the magnetic meridian through the station was extracted from each ASC image. A black-and-white presentation of these data for the period 1700–2340 universal time (UT) is shown in figure 1.

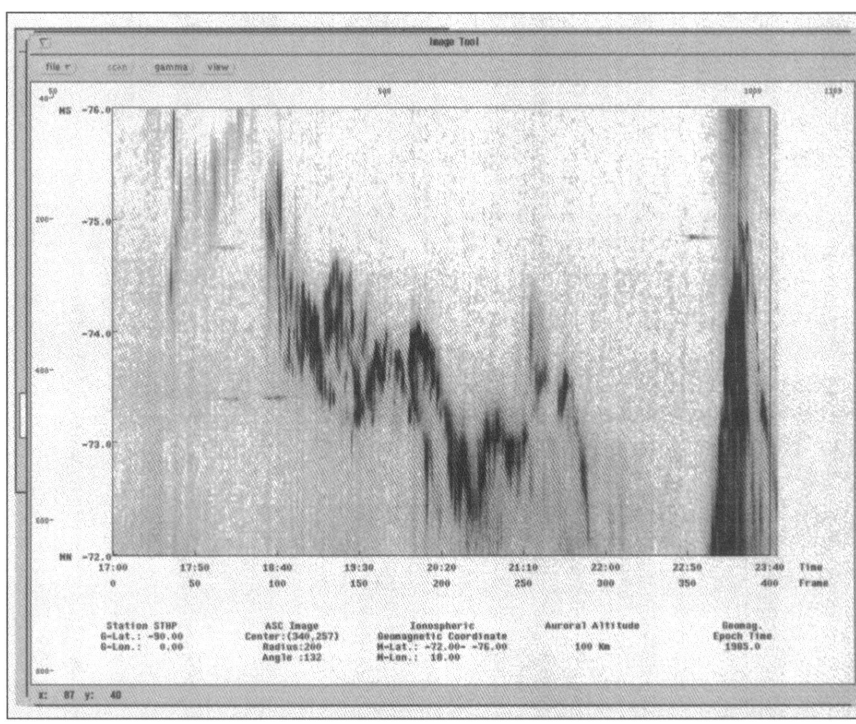

Figure 1. These data were derived from South Pole Station ASC measurements obtained between 1700 and 2340 UT on 16 August 1985. After digitization and coordinate transformation using the ARSAD system, a narrow segment along the magnetic meridian was extracted from each frame and displayed as a function of geomagnetic latitude, UT, and intensity in the Keogram format. Here, a height of 100 kilometers (Km) for the auroral emission has been assumed. (MS denotes magnetic south; MN denotes magnetic north.)

The time interval [approximately 15–18 magnetic local time (MLT)] over which the transient enhancements were observed was relatively undisturbed on both global and local scales (for 16 August, ΣK_p=18). Of relevance to this analysis is the observation of an impulsive magnetic perturbation which occurred at 1833 UT (1503 MLT), prior to the onset of the enhancements in the ASC data. This perturbation was identified in the South Pole magnetometer data using a computer algorithm (Lanzerotti et al. 1986). The photometric and magnetometer data for this interval are presented in figure 2. Note the increase in auroral activity following the magnetic perturbation event. Previous studies (L.J. Lanzerotti, R.M. Konik, A. Wolfe, F.T. Berkey, C.G. Maclennan, and D. Venkatesan unpublished data, 1994) have suggested that the auroral enhancements associated with impulsive magnetic perturbations tend to occur without prior and/or long-lasting subsequent auroral activity.

The analysis has shown that transient enhancements within the dayside arc had a temporal duration of approximately 2 minutes and occurred at intervals ranging from 2–8 minutes. The individual auroral arcs, imbedded in a broader arc system, appeared to brighten over a latitudinal width of up to 1°. The transient enhancements were observed to occur along the total length of the arc with a slight tendency to move westward; however, the rather long (16-second) time exposure of the ASC images precludes any definitive statement regarding azimuthal motions. In general character, the transient enhancements were similar to what Sandholt et al. (1989) have termed "midday aurora breakups" although these data exhibited no poleward motion subsequent to energization.

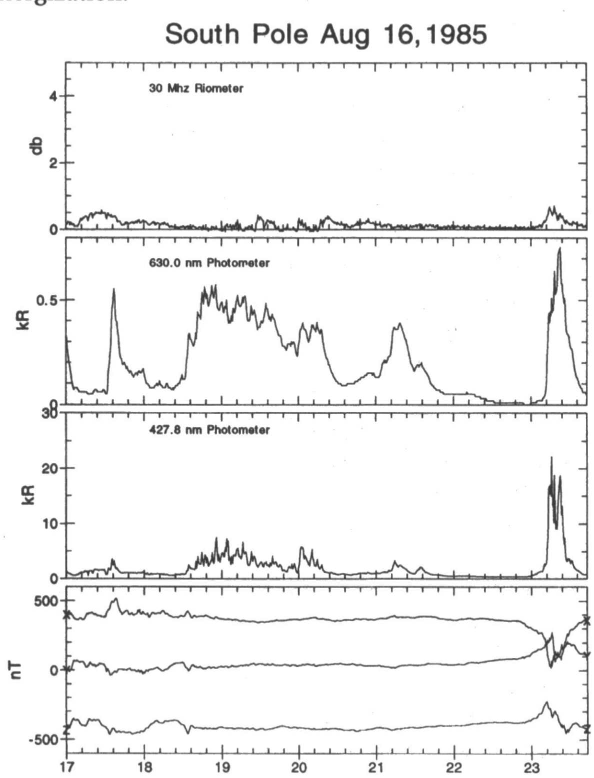

Figure 2. Zenithal photometric (60° field-of-view) and magnetometer data from South Pole Station for the 1700–2200 UT interval on 16 August 1985. The top panel denotes the ratio of the 630.0/427.8-nanometer (nm) auroral emissions. (kR denotes kilorad.)

During the time interval in question, the IMP-8 satellite recorded interplanetary magnetic field (IMF) data downstream of the Earth (X_{gsm}=28.7, Y_{gse}=–8.6, Z_{gse}=–12.5 R_e). The solar wind dynamic pressure was constant within 10 percent, B_z southward and B_y positive. The B_x component was the most dynamic, changing direction several times and varying between –4.5 and 5 nanoteslas (nT). These IMF data and the approximate latitude of the transient auroral enhancements are illustrated in figure 3.

A possible interpretation of the observed transient auroral enhancements is based on the variations of the IMF B_x component and the theoretical work of Miura (1992), who has shown that the tail flank boundary is unstable to the Kelvin-Helmholtz instability (KHI) and that plasma flow vortices can be excited there. Miura also argues that $|B_x|$ controls growth and initiation of the KHI. Here, we suggest that the KHI, responding to the variations in B_x, controls the transport of "blobs" of plasma from the low-latitude boundary layer into the dayside cusp (Kelly 1994). These energized blobs of plasma are, in turn, responsible for the auroral enhancements. We further suggest that the whole sequence of enhancements may have been triggered by the impulsive magnetic event which occurred at 1833 UT.

This research was supported by National Science Foundation grants OPP 83-13428, OPP 88-17365, and OPP 91-

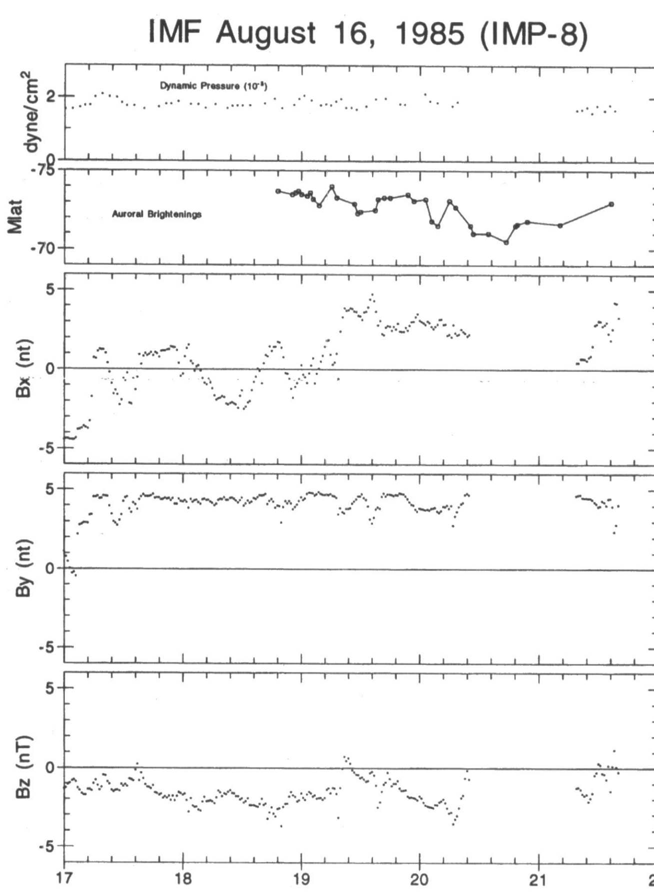

Figure 3. Interplanetary magnetic field measurements from the IMP-8 satellite for 16 August 1985. The second panel from the top identifies the approximate geomagnetic latitude at which the enhancements in the dayside auroral arcs observed in South Pole ASC data occurred.

19382 to Utah State University. Data from other ground-based instrumentation were kindly provided by Dan Detrick and acquired under grant OPP 91-19753 to T.J. Rosenberg (University of Maryland). We also thank World Data Center C2 and the National Institute of Polar Research, Tokyo, Japan, and T. Ono for providing access to the ARSAD system. The IMF data were furnished by Qi Chen from the University of California, Los Angeles.

References

Kelly, C.N. 1994. A study of the dynamics of the dayside aurora. (Masters of Science thesis, Department of Physics, Utah State University, Logan, Utah.)

Lanzerotti, L.J., L.C. Lee, C.G. Maclennan, A. Wolfe, and L.V. Medford. 1986. Possible evidence of flux transfer events in the polar ionosphere. *Geophysical Research Letters*, 13(11), 1089–1092.

Miura, A. 1992. Kelvin-Helmholtz instability at the magnetospheric boundary: Dependence on the magnetosheath sonic mach number. *Journal of Geophysical Research*, 97(7), 655.

Newell, P.T., and D.G. Sibeck. 1993. B_y fluctuations in the magnetosheath and azimuthal flow velocity transients in the dayside ionosphere. *Geophysical Research Letters*, 20(16), 1719–1722.

Sandholt, P.E., C.S. Deehr, A. Egeland, B. Lybekk, R. Viereck, and G.J. Romick. 1986. Signatures in the dayside aurora of plasma transfer from the magnetosheath. *Journal of Geophysical Research*, 91(A9), 10063.

Sandholt, P.E., B. Lybekk, A. Egeland, R. Nakamura, and T. Oguti. 1989. Midday auroral breakup. *Journal of Geomagnetism and Geoelectricity*, 41, 371–387.

Wide-aperture light source

K.C. Clark *and* G. Hernandez, *Graduate Program in Geophysics, University of Washington, Seattle, WA 98195*
R.W. Smith, *Geophysical Institute, University of Alaska, Fairbanks, AK 99705*

Quantitative investigations of emission line profiles by use of a Fabry–Perot spectrometer require periodic calibration of the optical finesse of the instrument. In a laboratory setting, this calibration procedure is relatively straightforward: it consists of measuring the reflection coefficients of the Fabry–Perot flats in a suitably equipped laboratory. To calibrate operating field instruments, however, such as the Fabry–Perot spectrometer running at Amundsen–Scott South Pole Station, specialized procedures must be employed to avoid disturbing the critical alignment of the spectrometer elements. We use the Giacomo method (Giacomo 1952; Hernandez 1988) of measuring Fabry–Perot etalon reflection coefficients, coupled with single wavelength laser measurements, to determine the overall instrumental finesse. To conduct these etalon reflectivity measurements with no disturbance of alignment, we have developed a novel, thin, large-aperture, broad-band continuum-light source. Because of its potential application in other field optical experiments that need large-aperture, broad-band continuum sources for their calibration and operation, we describe this new source in the context of its use in the Amundsen–Scott measurements. This calibration source is now being routinely used in our other field sites.

A Fabry–Perot etalon (*see*, for instance, Hernandez 1988) is the rigid assembly of a pair of extremely flat, semitransparent mirrors, whose adjacent faces are held at a very precise separation. The reflectivity of these semitransparent mirrors must be measured periodically, because it controls the accuracy of linewidth measurements with the Fabry–Perot spectrometer. The Giacomo method requires that the spectrometer be illuminated with a standard broad spectral light with and without the etalon in the path. The new extended source described here is a thin, edge-lighted plate that can be inserted without contact at the appropriate positions in the ray path of the present etalon, rather than disturbing the etalon physically.

In the tests, uniform sampling of the etalon area is required everywhere within the etalon diameter of 135 millimeters (mm). Such light can be obtained from an evenly spaced, square grid of points of about 5 mm separation. The employment of such a multipoint source is the principle of the thin-disk design to be described. A clear acrylic disk 6.3 mm thick and 165 mm wide, with a polished square edge, receives edge light from six evenly spaced incandescent lamps 3.3 mm wide (type CM7330), cemented around the rim. A constant-current source provides the power to the lamps. The resultant light from this arrangement is abundant for our instrumental sensitivity in the 500–1,000-nanometer range.

Internal reflection carries the light throughout the interior of the acrylic plate with little escape, little absorption, and an edge return aided by diffuse aluminum tape reflection at the rim. Useful light escapes principally via reflection and scattering by the regular array of very small conical indentations on one face; these indentations are viewed through the opposite face. These source points were produced by a weakly spring-loaded 60° conical (machine shop) punch. Since these indentations have very small area and are widely separated, a very large fraction of the acrylic source face is smooth, thus preserving multiple traversals of the internally trapped light within the disk and producing virtual uniformity of brightness among the point sources across its face.

Figure 1*A* illustrates this strategy of preservation in the plane of a row of cones. The actual 0.3-mm conical indentations are relatively much smaller than this diagram shows. Total internal plate reflections are dominant in comparison to the minor losses via cone reflections and scattering because the cones are very small and far apart. The travel paths extend even farther for rays moving out of this plane in slant directions.

This calibration source illuminates the etalon, which accepts only rays that are near normal to its etalon mirrors.