Proc. NIPR Symp. Upper Atmos. Phys., **11**, 154–158, 1998

SCANNING-BEAM VHF AURORAL RADAR AT SYOWA STATION (EXTENDED ABSTRACT)

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A new 50-MHz scanning-beam auroral radar with two sets of array antennas (STARS: Syowa Station Auroral Radar System) was installed at Syowa Station in 1995 by the 36th wintering party (IGARASHI *et al.*, 1995), see Fig. 1. The receiving beam direction is scanned in 5-degree steps by using two sets of array antennas with a beam width of about 5 degrees. The range resolution is 15 km. This radar can observe the whole region of radio auroral echoes generated by *E*-region irregularities. A two-dimensional echo region pattern is available every four minutes. The beam formation of the echo region was confirmed by a repeater experiment at many test positions far from Syowa Station. Continuous radar operation began in September, 1995. The operation periods of the radar are listed in the tables in JARE Data Reports (INAMORI *et al.*, 1997). Figure 1 shows also the field of view of the two SuperDARN VHF radars. It is possible to compare data (*E*-region and *F*-region plasma drift velocities in the overlapped region) of the VHF auroral radar and HF radars.

A time series of the echo power plots is shown in Fig. 2. Except for the region of azimuth angle 5–20 degrees the echo regions in Fig. 2 agree very well with the previously estimated echo pattern shown by the shaded region in Fig. 1 (IGARASHI *et al.*, 1982). The STARS detected strong echoes at 0558:08 UT on September 28, 1995 in the direction of an azimuth angle of 20°. The echo regions extended to the 1000 km slant range. Prior to this event the echoes appeared almost continuously at azimuth angles from 20° to 165°. The echo intensity in the beam direction of an azimuth angle of 150° became weak, and then the echo intensity in the direction of an azimuth angle of 20° became strong. It appears that the high electric field region moved to the eastward direction.

Figure 3 shows the range time intensity (RTI) plot along the azimuths 20° and 150°. Around 8 h UT the echoes appeared until the range 1180 km at the azimuth of 150°. The periodic echoes of 9–18 min periods appeared in both RTI plots. Figure 4 shows the geomagnetic variations and cosmic noise absorption (CNA) at Syowa Station and Husafell in Iceland near the conjugate point of Syowa. Around 0730 UT the start timing of CNA absorption at Syowa Station agreed with the enhancement of the radar echoe intensity along both beam directions. CLAUER *et al.* (1997) have suggested that long periodic geomagnetic variations of about 8–34 min were produced by the Kelvin-Helmholtz instability at the shear convection reversal boundary. The Kelvin-Helmholtz instability seems to be one of the likely causes of these long period intensity variations. Further analysis will be made by using both echo power and Doppler velocity data.

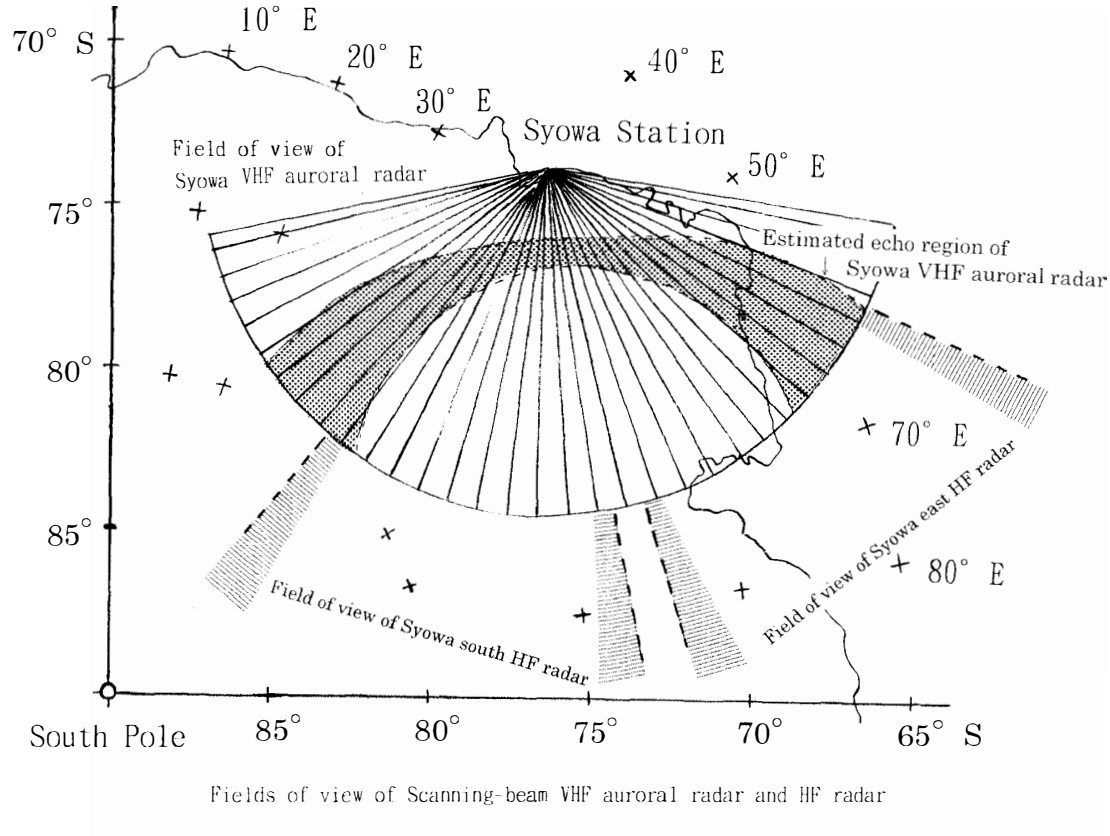

Fig. 1. Field of view of the scanning-beam VHF auroral radar and HF radars at Syowa Station. Shaded region shows the estimated echo region ($87° \leqq \alpha \leqq 93°$) using the aspect angle α between the radar beam direction and geomagnetic field direction at the altitude 110 km.

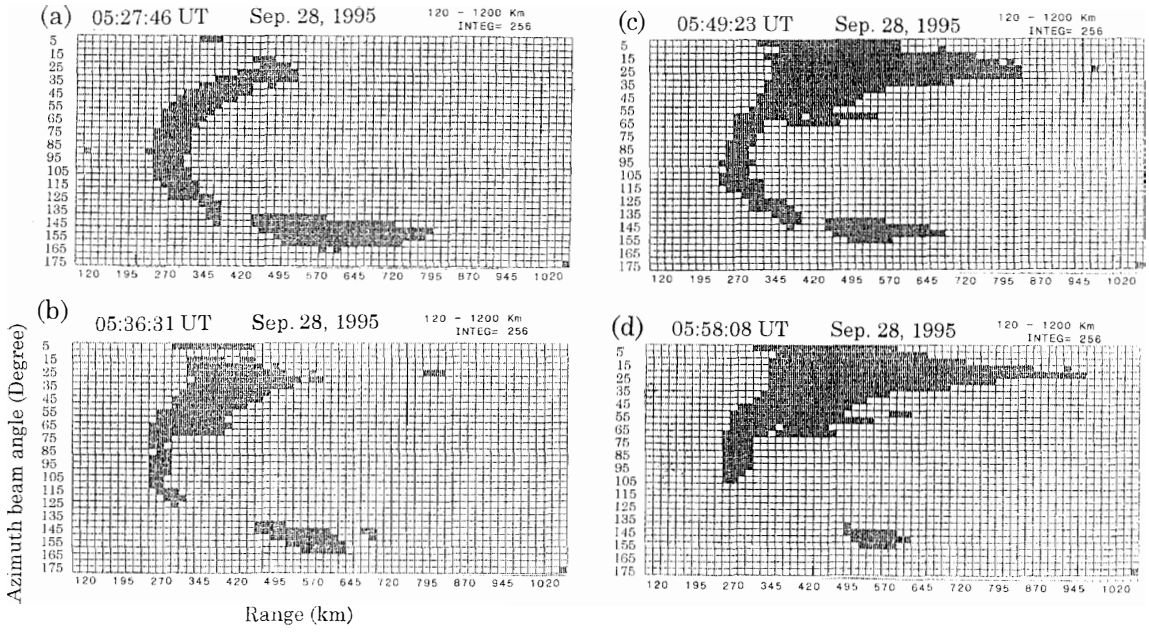

Fig. 2. Two-dimensional echo pattern plots. The angle is measured in a clockwise direction from the geomagnetic east. The azimuth angle 90° indicates the geomagnetic south direction.

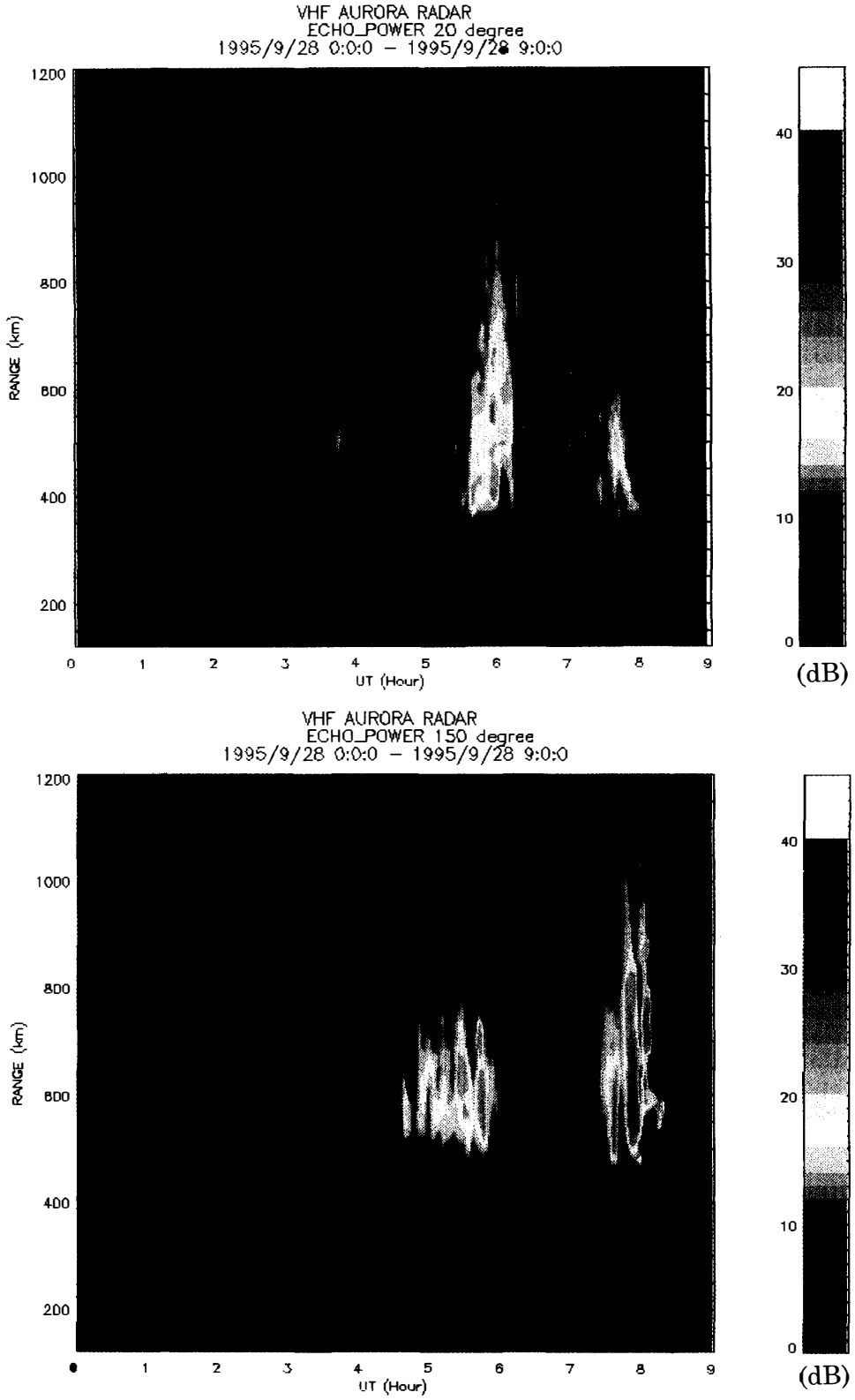

Fig. 3. Range time intensity plots for the beams of the azimuth angle 20° and 150°. The color bar shows the echo power in decibels.

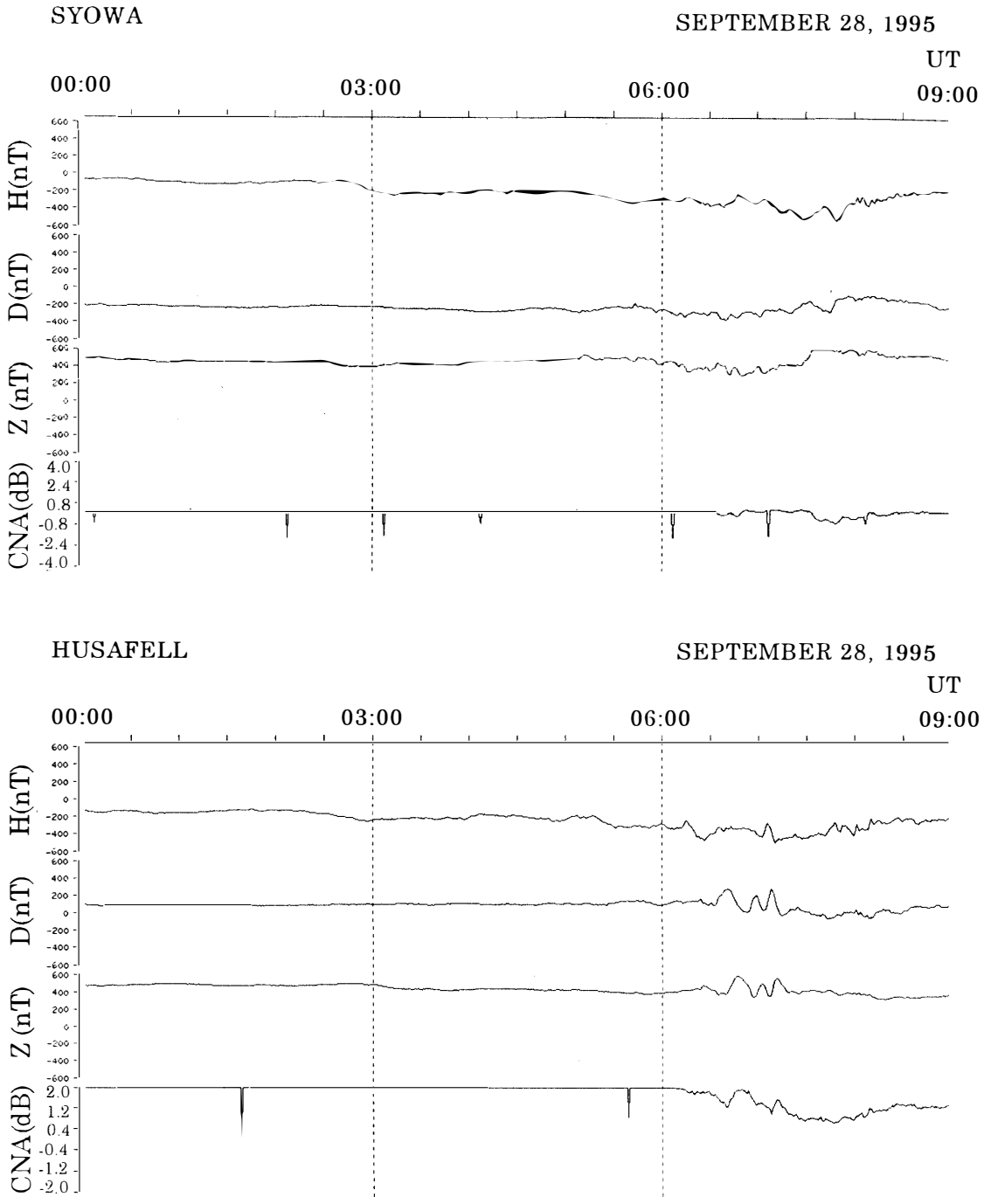

Fig. 4. Variations in geomagnetic field and cosmic noise absorption (CNA) at Syowa Station and Husafell in Iceland from 0000 to 0900 UT on September 28, 1995.

Acknowledgments

We sincerely thank the 36th wintering party, especially Koji INAMORI for operating the VHF auroral radar system.

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(Received June 5, 1997; Revised manuscript accepted July 23, 1997)