

Antarctic Climate Research Data, Part 5
PPI Radar Data at Syowa Station, Antarctica
from February to December 1989

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1. Introduction

A five-year program of Antarctic Climate Research (ACR) is carried out at Syowa, Asuka and Mizuho Stations surrounding the ice sheet and sea ice area from 1987 to 1991 by the Japanese Antarctic Research Expedition (JARE) as part of the international cooperating World Climate Research Program (WCRP) (Yamanouchi, 1989). The main research subjects are; 1) interannual variation of Antarctic atmosphere, 2) sea ice - atmosphere interaction, 3) variation of the ice sheet and the ice shelf, 4) ice core analysis. In JARE-29 and -30 (the 2nd and 3rd year of this program) we have mainly observed the items related to the interannual variation of Antarctic atmosphere. The data of precipitating clouds by using PPI (Plane Position Indicator) radar in 1989 are shown in this report and short- and long-term variations of clouds and precipitation will be analyzed using these data in the future. The data of clouds and precipitation in 1988 and 1989 observed by vertical pointing radar and microwave radiometer were already published (Wada, 1990; Konishi and Wada, 1991).

2. Instruments and Observations

A PPI radar was used to study the horizontal distribution of precipitation around Syowa Station. Specifications of the radar are shown in Table 1. System diagram including data collecting hardware is also shown in Fig. 1. The data obtained for a period from February to December 1989 are compiled in this report.

A PPI radar was set near the Earth Science Laboratory and the

data collecting hardware were set in the Laboratory. Radar data were collected every 18 minutes and all data were written into magnetic tape (2400 feet, 1600 BPI). One observation period consisted of 3 sweeps at different elevation angles of 2.0°, 3.5° and 6.0° in order to make constant altitude PPI. Radar echo intensity from 0.5 to 64 km at 128 points along distance (500 m interval) was sampled at intervals of 1 degree in azimuth angle. The echo intensity is expressed in 255 levels.

Figure 2 shows the location of Syowa Station and the detectable range by the PPI radar, which is depicted by a dotted circle. Observation period by the radar was from February 12 to December 21, 1989. If there was no precipitation echo at observation time, the recording was suspended by manual control. The total amount of recording time on 57 magnetic tapes was 3000 hours. The recording time for each month is summarized in Table 2.

3. Description of Figures

Figure 4 shows echo distribution every 6 hours at an elevation angle of 2.0 degrees from February 13 to November 28. Since the precipitation echo was shaded by ground, the area of the radar shadow at the elevation angle is shown in Fig. 3. The scale of echo intensity is shown in the right side column of each figure. Since the minimum detectable echo intensities at the different distances are not same, we define them as a function of the distance by the following equation:

$$S_m = 20 \cdot \log(r) + 0.02 \cdot r - 13.9$$

where S_m (dBZ) is minimum detectable echo intensity at the distance r (km).

References

- Konishi, K. and Wada, M. (1991): Antarctic climate research data, Part 3. Radar and microwave radiometer data at Syowa Station, Antarctica in 1989. JARE Data Rep., 165 (Meteorology 26), 111 p.
- Wada, M. (1990): Antarctic climate research data, Part 2. Radar

and microwave radiometer data at Syowa Station, Antarctica from March to December 1988. JARE Data Rep., 153 (Meteorology 24), 97 p.

Yamanouchi, T. (1989): Antarctic climate research data, Part 1. Radiation data at Syowa Station, Antarctica from February 1987 to January 1988. JARE Data Rep., 144 (Meteorology 22), 193 p.

Table 1. Specifications of PPI radar.

Parabolic antenna			
Diameter	:	1.2	m
Antenna gain	:	38.4	dB
Beam width-h	:	1.75	deg
Beam width-v	:	1.9	deg
Revolution	:	2	rpm
Transmitter and receiver			
Carrier frequency	:	9740	MHz
Peak power	:	40	kW
Pulse width	:	0.5	μ s
Repetition frequency	:	750	Hz
Receiver sensitivity	:	-105	dBm
Log amp linearity	:	70	dB

Table 2. Recording time of PPI radar data.

	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Time(h)	249	490	285	233	292	304	183	151	460	353	0

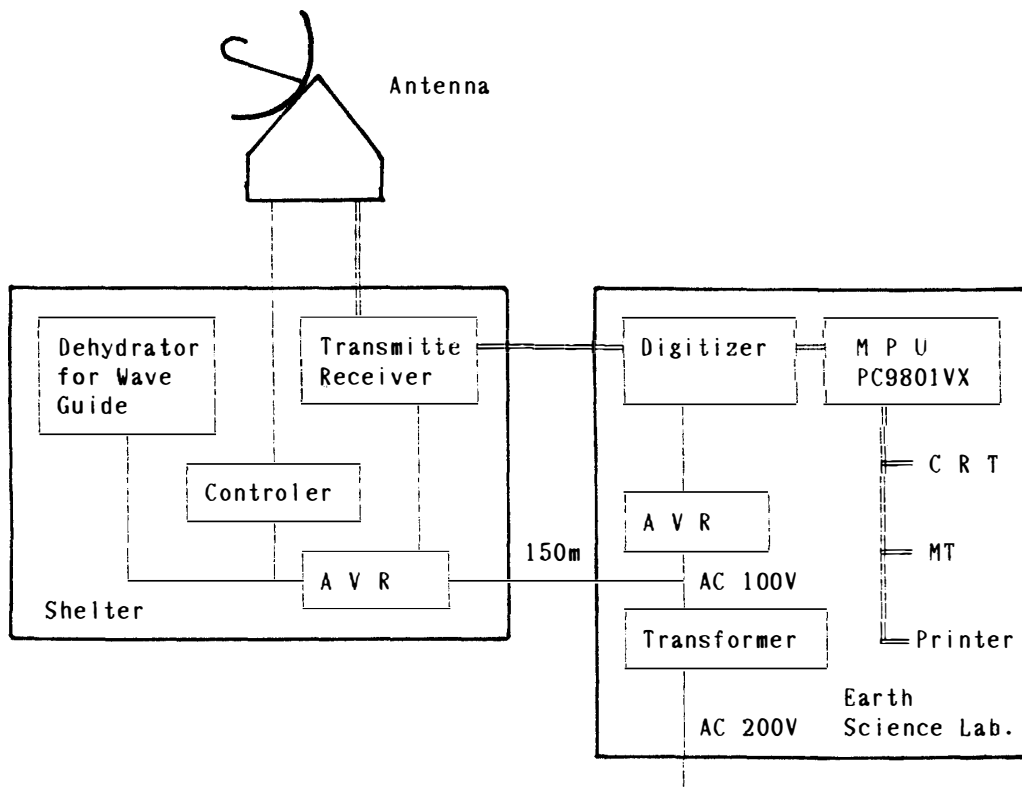


Fig. 1. System diagram of PPI radar.

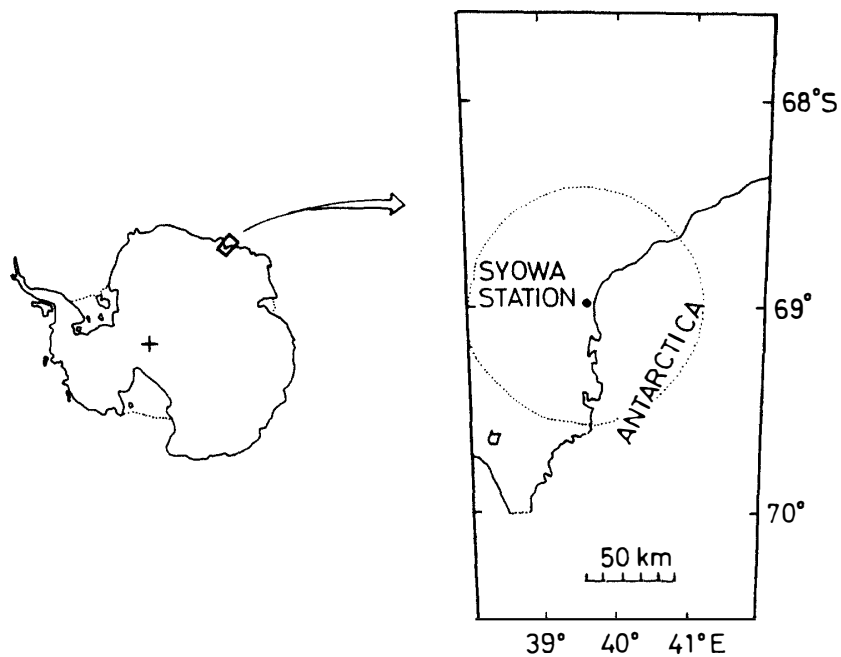


Fig. 2. Location of Syowa Station and detectable range of PPI radar.

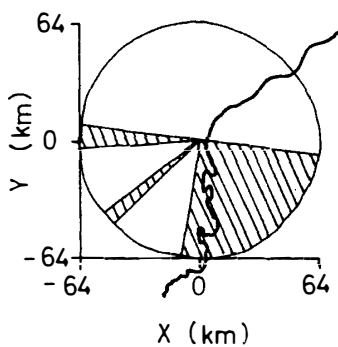


Fig. 3. Shade area from the PPI radar beam for the ground at an elevation angle of 2.0 degrees.

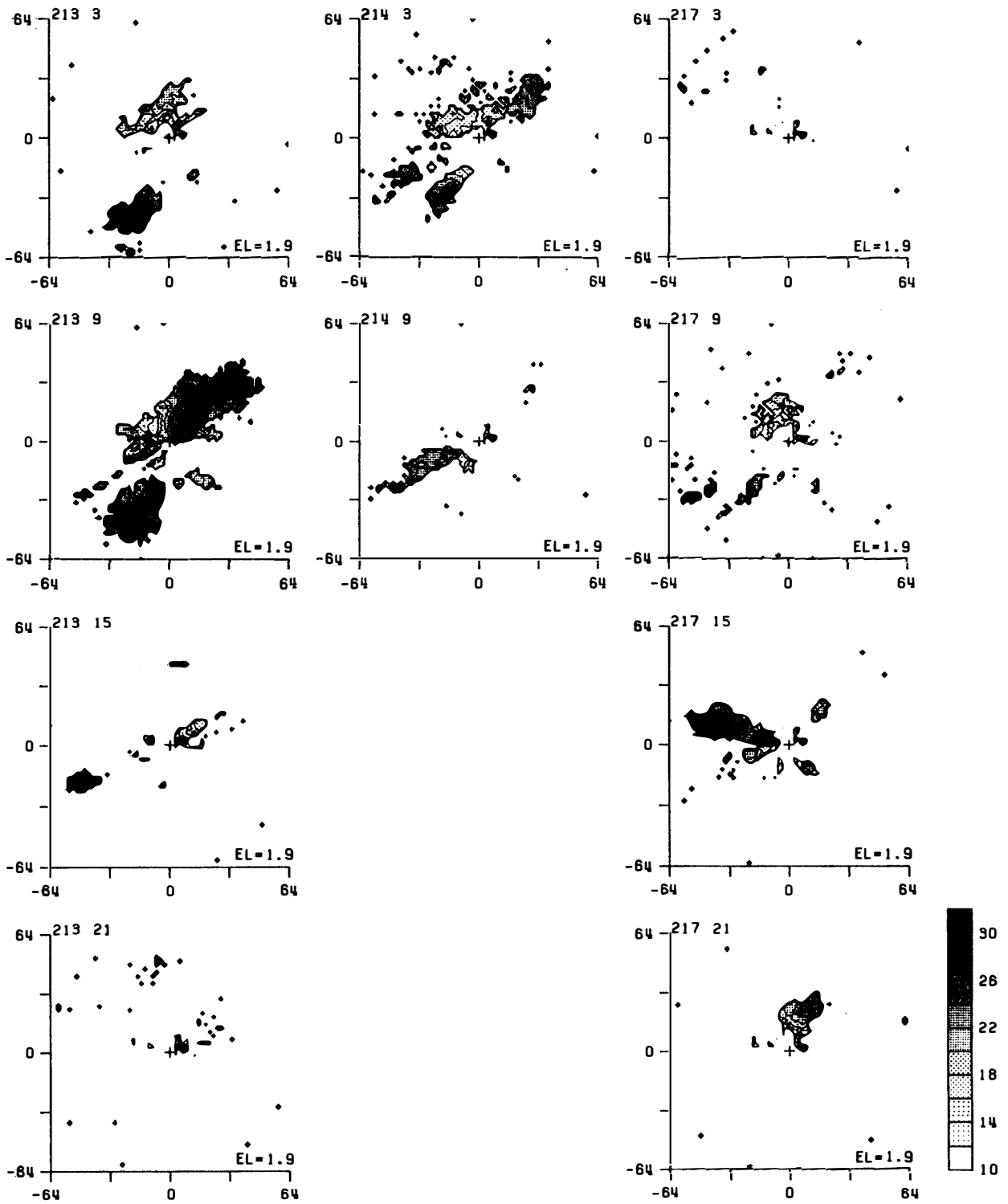


Fig. 4. PPI radar echoes at an elevation angle of 2.0 degrees.

