X-band polarimetric Doppler radar system

Purpose:

The radar system was installed to improve markedly the accuracy of analysis and forecasting of severe storms. Observed data will be used for understanding the development mechanism of localized heavy rainfall/snowfall and for the sophistication of a numerical meteorological model.

Outline:

Doppler radar radiates electromagnetic waves in the atmosphere and receives electromagnetic waves scattered from precipitation particles in cloud. Precipitation amount is estimated from the power intensity of received waves, and information on wind field in the atmosphere is estimated from phase shift accompanied by Doppler effect between transmitted and received waves. Our radar system can transmit and radiate both horizontally-polarized and vertically-polarized waves, although most existing radars use only horizontally-polarized waves. From the aspect of research, our radar system is expected to obtain information on the kind of a precipitation particles and more accurate information on precipitation amount.

Specifications:

(1) Transmitter and Receiver
- Polarization: horizontal polarization, and vertical polarization
- Wavelength (approximately): 3.2 cm (X-band)
- Beam width: 1.2 degree
- Pulse power: 200 W
- Pulse width: 1 μs (short), 32 μs (long)
- Pulse repetition frequency: 500 − 2000 Hz (precipitation mode), 20000 Hz (clear air mode)
- Amplifier: solid state module (GaN transistor)
- System noise power (maximum): -110 dBm, Dynamic range (minimum): 90 dB

(2) Equipment for the control of reflector
- Scanning rate (maximum): 4 rpm (azimuth), 1 rpm (elevation)

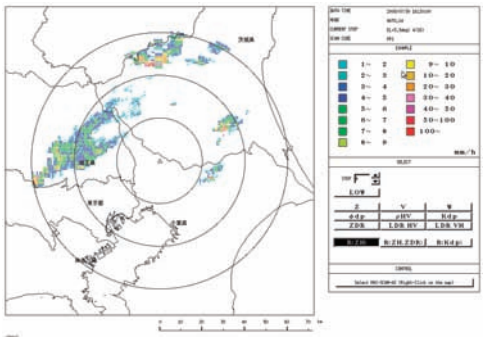
(3) Equipment for signal processing
- Resolution (finest): 150 m
- Observation range (shortest): 64 km for radial direction
- Estimation method of radial velocity: Pulse Pair method (precipitation mode), First Fourier Transformation (clear air mode)
- Canceller of ground clutters and second echoes
- Output data (after signal processing): radar reflectivity factor, (dealiased) radial velocity, velocity spectrum width, differential reflectivity, differential propagation phase, specific differential phase, correlation coefficient between polarizations, linear depolarization ratio, and precipitation intensity

Location and Date of Installation:

Abiko Area, March 2009

Exterior of our radar system

Equipment for the control of our radar system



Example of the estimated distribution of precipitation