Airborne Cloud Radar (ACR) Reflectivity, Wakasa Bay, Japan, Version 1

USER GUIDE

How to Cite These Data

As a condition of using these data, you must include a citation:

Stephens, G. L. and R. T. Austin. 2004. *Airborne Cloud Radar (ACR) Reflectivity, Wakasa Bay, Japan, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/3YXTPM48L5GY. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT NSIDC@NSIDC.ORG

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/NSIDC-0212

National Snow and Ice Data Center

TABLE OF CONTENTS

1 DATA DESCRIPTION

The University of Massachusetts and NASA Jet Propulsion Laboratory (JPL) collaborated to build and operate the ACR, which is a 94 GHz radar that provides measurements of vertical cloud structure in addition to radar backscatter and radiative properties of different cloud types. It has flown in four NASA-sponsored experiments on the NASA P-3. This system was developed to determine the feasibility of a future spaceborne radar program.

1.1 Parameters

The parameters for these data are co-polarized and cross-polarized reflectivity (more strictly, the equivalent radar reflectivity factor).

1.1.1 Unit of Measurement

Reflectivity is given in units of mm^6/m^3 Note that some clear-air regions have reflectivity values that are slightly negative, due to the noise characteristics of the signal when no target is present. These cases must be noted when converting reflectivity to logarithmic (dBZ) units.

1.1.2 Sample Data Record

The sample image below was taken from the file "acr.20030114.045539.2.nc." The sample shows the equivalent reflectivity factor (Zhh):

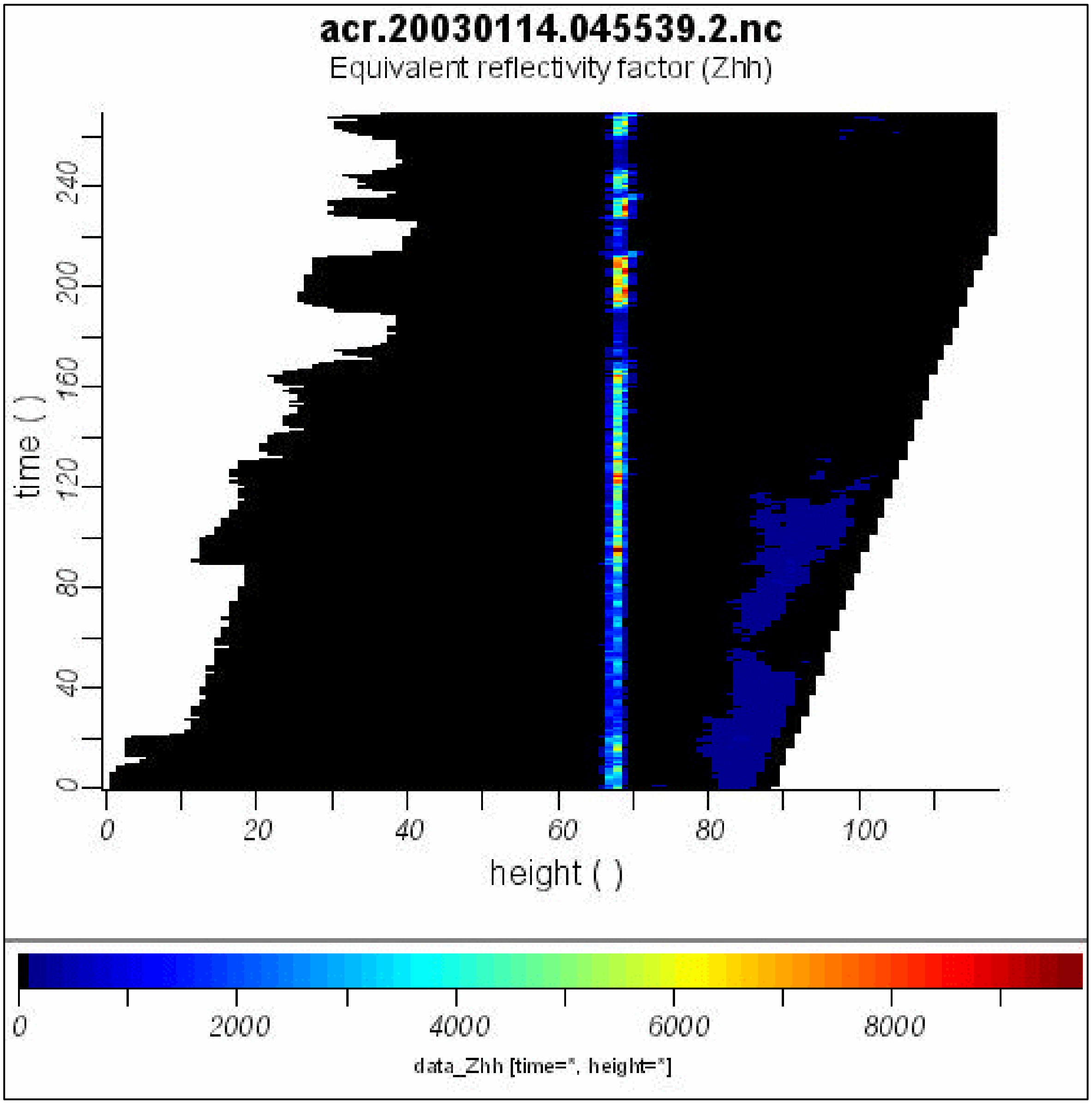

Figure 1. Sample image, from file acr.20030114.045539.2.nc., shows the equivalent reflectivity factor (Zhh)

1.2 File Information

1.2.1 Format

The University of Massachusetts and NASA Jet Propulsion Laboratory (JPL) collaborated to build and operate the ACR, which is a 94 GHz radar that provides measurements of vertical cloud structure in addition to radar backscatter and radiative properties of different cloud types. It has flown in four NASA-sponsored experiments on the NASA P-3. This system was developed to determine the feasibility of a future spaceborne radar program. File Size

File sizes range from 70 KB to 2.6 MB. Total data volume is approximately 67 MB.

1.2.2 Naming Convention

Files use the convention "acr.20030114.030048.1.nc" where acr=instrument, date, start time, and version. For example, the file "acr.20030115.034119.2.nc" contain data from 15 January 2003 starting at 03:41:19 UTC, and is a version 2 file. The "nc" extension stands for the netCDF file type.

1.3 Spatial Information

1.3.1 Coverage

Spatial coverage includes the Wakasa Bay coordinates shown below.

Southernmost Latitude: 30° N
Northernmost Latitude: 42° N
Westernmost Longitude: 132° E
Easternmost Longitude: 151° E

1.3.2 Resolution

Data were acquired in 60 or 120 m vertical resolution; 0.8 degree beamwidth.

1.4 Temporal Information

1.4.1 Coverage

14 January 2003 to 3 February 2003. Flights did not occur every day; the specific dates of coverage were: 14, 15, 19, 21, 23, 26-30 January, and 1 and 3 February 2003.

1.4.2 Resolution

Averaged profiles were collected every three seconds during P-3 flight legs.

2 DATA ACQUISITION AND PROCESSING

2.1 Acquisition

The ACR measured 94 GHz co- and cross-polarized radar reflectivity below the NASA P-3 aircraft during the Wakasa Bay Experiment. The radar was pointed in the nadir direction. The ACR was operated whenever the P-3 was above approximately 2,438 m (8000 ft) above ground level (AGL), and flight legs were usually flown at around 6,400 m (21,000 ft) above mean sea level (MSL). There were very few gaps in the data during the flights. The ACR has a beamwidth of 0.8° and was usually operated with a vertical resolution of 120 m, although 60 m vertical resolution was used for some flight lines. Vertical profiles were recorded every 0.3 seconds and then averaged in post-processing to one profile every 3 seconds. Altitude coordinates were determined from the ocean surface echo in the ACR Zhh reflectivity profile. (Radar determination of the P-3 aircraft altitude was necessary due to the inaccuracy of the pressure altitude supplied by the navigation system.) Start time and latitude/longitude information were obtained from the onboard GPS navigation system. The data set also includes measurements of oceanic backscatter collected while the P-3 was flown at a specified bank angle.

2.2 Instrumentation

2.2.1 Description

An ACR consists of a radio frequency/intermediate frequency (RF/IF) subsystem, a digital signal processor, and data handling and control electronics. The RF/IF subsystem uses a combination of frequency mixing and multiplication to generate the transmitted signal at one of four frequencies in a 50 MHz band centered at 94.92 GHz. The power of the transmitted signal is supplied by an extended interaction amplifier (EIA). The transmit RF pulses can be routed to either the V or H port of an orthomode transducer (OMT) using a ferrite switch matrix. The OMT then feeds a 30 cm lens antenna. A small portion of the transmitted power is coupled though an attenuator into the receiver for calibration purposes. The ACR system was designed to test the feasibility of a spaceborne cloud radar system, now under development as CloudSat.

3 SOFTWARE AND TOOLS

For a list of tools for reading/viewing netCDF files, please see the NetCDF Resources at NSIDC: Software and Tools Web page.

The netCDF format is an interface for array-oriented data access with an interface library. The netCDF library also defines a machine-independent format for representing scientific data. Together, the interface, library, and format support creating, accessing, and sharing scientific data. The netCDF software was developed at the Unidata Program Center in Boulder, Colorado. More information about netCDF and software for manipulating and displaying NetCDF is available from Unidata.

4 RELATED DATA SETS

- AMSR-E Validation Data
- AMSR-E Data at NSIDC
- Wakasa Bay Weather Forecast Maps

5 RELATED WEBSITES

University of Massachusetts/NASA JPL Airborne Cloud Radar Web site.

NetCDF Resources at NSIDC: https://nsidc.org/data/netcdf/

6 CONTACTS AND ACKNOWLEDGMENTS

Graeme L. Stephens
Richard T. Austin
Colorado State University

Acknowledgments:

The investigators would like to thank the following University of Massachusetts scientists for their work with these data: Jorge Roman-Nieves, Harry Figueroa, and Stephen Sekelsky.

7 REFERENCES

Sadowy, G. A., R. E. McIntosh, S. J. Dinardo, S. L. Durden, W. N. Edelstein, F. K. Li, A. B. Tanner, W. J. Wilson, T. L. Schneider, and G. L. Stephens. 1997. The NASA DC-8 airborne cloud radar: design and preliminary results. *Proceedings of IGARSS* '97. vol. 4, 1466-1469.

8 DOCUMENT INFORMATION

8.1 Publication Date

February 2004

8.2 Date Last Updated

17 December 2021

APPENDIX A - AIRBORNE CLOUD RADAR (ACR) DESCRIPTION

The University of Massachusetts and NASA Jet Propulsion Laboratory have collaborated to build and operate the Airborne Cloud Radar (ACR), which is a 94-GHz radar that provides measurements of vertical cloud structure in addition to radar backscatter and radiative properties of different cloud types. It has flown in four NASA sponsored experiments on the NASA DC-8. This system was developed to determine the feasibility of a future space borne radar program and to conduct cloud studies similar to those planned for the space borne system, albeit on a smaller geographical scale. The following table lists ACR operating parameters.

ACR consists of an RF/IF subsystem, a digital signal processor and data handling and control electronics. The RF/IF subsystem uses a combination of frequency mixing and multiplication to generate the transmitted signal at one of four frequencies in a 50-MHz band centered at 94.92 GHz. The power of the transmitted signal is supplied by an extended interaction amplifier (EIA). The transmit RF pulses can be routed to either the V or H port of an orthomode transducer (OMT) using a ferrite switch matrix. The OMT then feeds a 30 cm lens antenna. A small portion of the transmitted power is coupled though an attenuator into the receiver for calibration purposes.