NASA Polarimetric Radar (NPOL) Data from MC3E

Introduction

The NASA POLarimetric Radar (NPOL) is an S-band dual-polarization radar with a frequency of 2.7-2.9 GHz (S-band), providing simultaneous Receive/Transmit capability using a Vaisala (SIGMET) RVP-9 processor. The beam width is 0.95 degrees, the peak power is 850 kW, and it can operate at PRF's ranging from 250-2000 s^{-1} and pulse widths of 0.8 – 2.0 μs.

The principal use for NPOL during MC3E was targeted towards high-quality polarimetric observations of microphysical processes in the vertical column (Jensen et al. 2010). NPOL operational scans include Range Height Indicators (RHIs), as well as full (PPI) and sector volume scans (PPI Sector).

Data Contents

These directories contain, quality controlled and calibrated radar data taken by NPOL during the MC3E field campaign (04/22/2011 – 06/02/2011). The data are written to tar files by date, with one tar file containing all of the PPI, PPI Sector and RHI scans for a given day. In general, the time between each scan varied from less than one minute to six minutes. The size of each tar file ranges from 0.5 – 1.0 GB, depending on the amount of precipitation observed and scanning strategy employed.

The individual data files are stored in Universal Format (UF; Barnes 1980). The files consist of Plan Position Indicator (PPI), PPI Sector or Range Height Indicator (RHI) scan types. Each file contains the fields listed in Table 1.

Table 1. Fields contained within each NPOL UF file.

Field Name	*Units*	*Description*
CZ	dBZ	Quality controlled, calibrated reflectivity
DR	dB	Differential reflectivity
KD	deg km^{-1}	Specific differential phase
PH	deg	Differential phase
RH	None	Cross correlation
VR	m s^{-1}	Radial velocity
ZT	dBZ	Original (no QC or calibration) reflectivity
SW	m s^{-1}	Spectrum width
SQ	None	Signal quality index
SD	deg	Std. Deviation of PH (used in QC processing)

Data Processing

Data were quality controlled and calibrated with code employing NASA's Radar Software Library (RSL) using the IDL programming language RSL_in_IDL. The quality control (QC) algorithm uses the dual-polarization (DP) data within a

modular, physically-based framework. A flowchart of the DP QC algorithm is provided below.

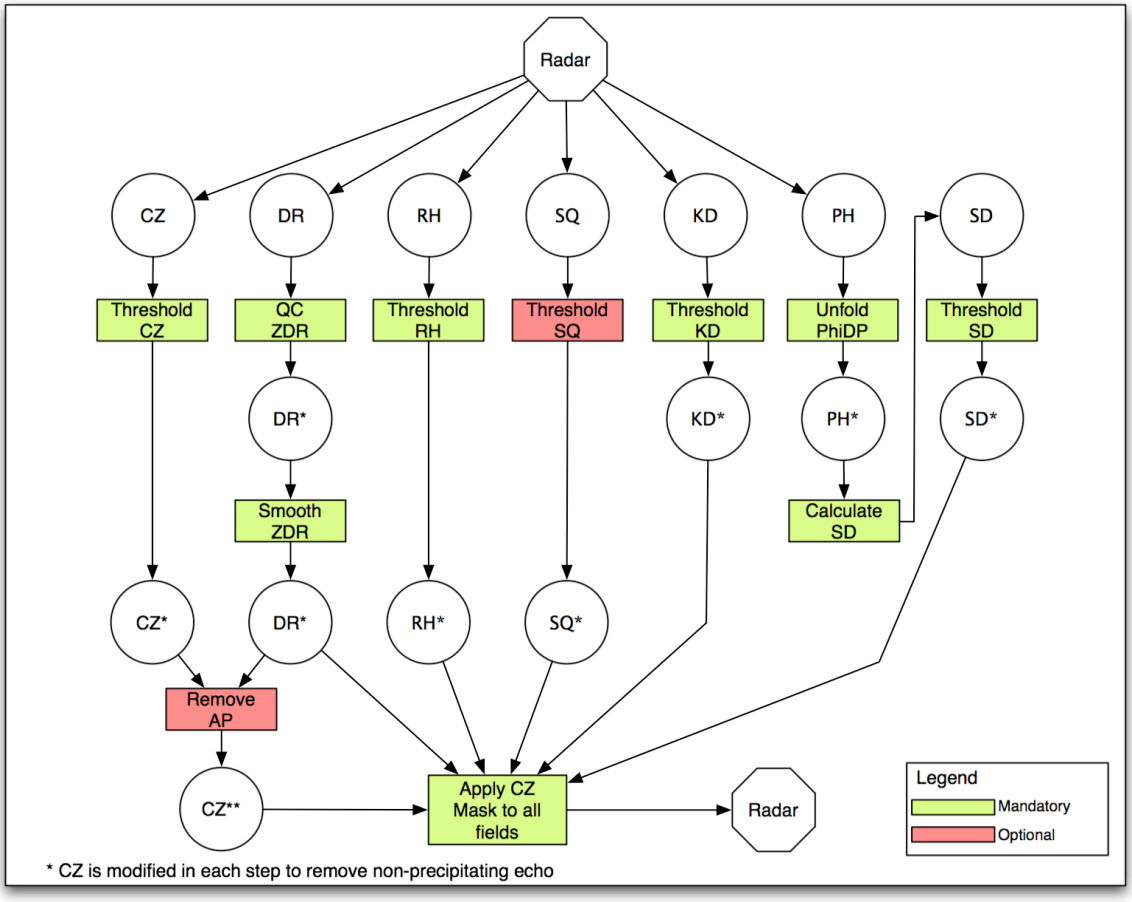

Fig. 1: Flowchart of DP QC algorithm showing modular design with RSL "radar" structure, fields, and QC tests, both mandatory and optional. Full surveillance, sector, and RHI volumes are supported in the DP QC algorithm.

The reflectivity (Z_H) data were calibrated via an adapted version of the self-consistency technique developed by Ryzkov et al. 2005. NPOL data were found to be less than 1 dB "hot", therefore the post-QC reflectivities were adjusted by -0.5 dB.

The Z_{DR} data were calibrated utilizing the "birdbath" (vertical profile) technique. Figure 2 shows a sample birdbath profile, showing Z_{DR} to be within ± 0.1 dB. The Z_{DR} data were adjusted by -0.05 dB.

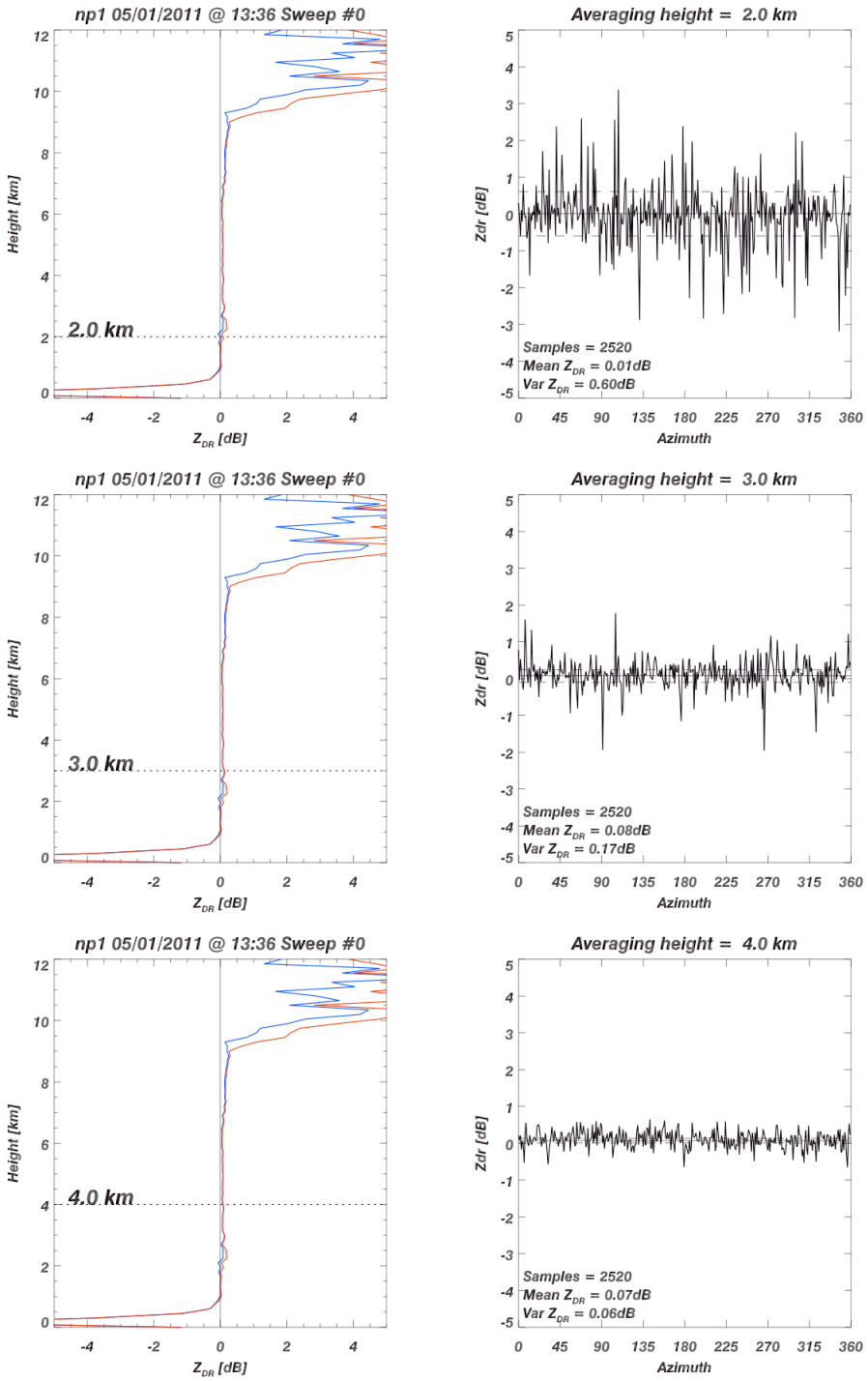

Figure 2: Z_{DR} profiles at 2.0, 3.0, and 4.0 km height in light rain showing a very consistent (slightly positive) Z_{DR} bias.

Correction for Attenuation

No corrections were made to the NPOL data for attenuation for either atmospheric gases or intervening precipitation.

Ingest and Visualization of Data

Numerous software packages exist for ingesting UF data, including NCAR's SOLO and NASA's RSL and RSL_in_IDL (which is an IDL port of the original C-based RSL). RSL_in_IDL can be used to generate imagery from the UF files.

Table 2: Selected software packages for viewing and/or analyzing UF data

Software	Location
SOLO	http://www.eol.ucar.edu/rdp/solo/solo_home.html
RSL	http://trmm-fc.gsfc.nasa.gov/trmm_gv/software/rsl/index.html
RSL_in_IDL	http://trmm-fc.gsfc.nasa.gov/trmm_gv/software/rsl_in_idl/RSL_in_IDL.html

References

Barnes, S.L., 1980: Report on a meeting to establish a common Doppler radar exchange format. *Bull. Amer. Meteor. Soc.*, 61, 1401-1404.

Jensen M. P., W. A. Petersen, A. D. Del Genio, S. E. Giangrande, A. Heymsfield, G. Heymsfield, A. Y. Hou, P. Kollias, B. Orr, S. A. Rutledge, M. R. Schwaller and E. Zipser, 2010: Midlatitude Continental Convective Clouds Experiment (MC3E). DOE/SC-ARM/10-004.

Ryzhkov, A.V., S.E. Giangrande, V.M. Melnikov, and T.J. Schuur, 2005: Calibration issues of dual-polarization radar measurements. J. Atmos. Oceanic Technol., **22,** 1138-1155.

Contact Information

For questions or comments, please use the following contacts:

David B. Wolff
NASA/GSFC, Code 612
Greenbelt, MD 20771
David.B.Wolff @ nasa.gov
301-286-3767

David A. Marks
NASA GSFC, Code 612
Greenbelt, MD 20771
David.A.Marks @ nasa.gov
301-286-4152