Background information on the eA.3 dataset

Context

On 7 June 1992, for a period of an hour, I froze the elevation angle of the McGill Radar at 2.2° elevation and collected short-range reflectivity PPIs at 20 s resolution while a thunderstorm was striking Montreal. The resulting dataset that was used in a radar hydrology study (Fabry et al. 1994) is available here in the NetCDF file eA\_3\_HighResolutionXYData.nc.

These data were collected before the McGill radar had any Doppler or dual-polarization capabilities. The echoes observed at 2.2° elevation include those from weather, ground clutter, and a few airplanes on final approach towards the Montreal Airport. To help distinguish ground clutter from weather, a map of where clutter is located and how strong it is expected to be is also provided.

Data format

Uncharacteristically, this data set is stored as Cartesian, or (*x*,*y*), arrays, and not in the polar format more usual for radar data. The NetCDF file contains two key datasets:

1) A set of 181 reflectivity PPIs, one every 20 s from 16:18UTC to 17:18UTC, each map being a 384 by 384 array of values at 250 m resolution. Each value is a byte from 0 (no echo) to 255 that must then be converted to dBZ.

2) A threshold “mask” that needs to be exceeded for echoes to be considered originating from weather and not from clutter. It is in the same units as the reflectivity maps.

Also provided is the set of times when each scan was collected (see Table eA3.1 for some detailed information on the NetCDF file).

Data reading and interpretation process

I will suppose that you are using a computer language that is able to read NetCDF files. In that context, you need to:

1. Open the NetCDF file eA\_3\_HighResolutionXYData.nc;
2. Read the integer array TIME (variable ID #0), and the byte arrays REFLECTIVITY (variable ID #1), and CLUTTER\_MASK (variable ID #2) in their native units;
3. Convert REFLECTIVITY and CLUTTER\_MASK byte arrays in dBZ floats by doing *dBZ =*REFLECTIVITY \* 0.375 – 30, and *dBZ\_Mask =*CLUTTER\_MASK \* 0.375 – 30;

Wherever *dBZ* ≥ *dBZ\_Mask*, reflectivity measurements are deemed to be from weather; if not, the echo is either severely contaminated by clutter or beyond the maximum range of data collection (48 km). Under these circumstances, these cells should be deemed as containing no information as opposed to no echo.

The (*x*,*y*) arrays start from the south-west corner, with x varying the fastest (each “line” of 384 values is a west-to-east row, and the next line is immediately north of it). Times are in seconds since 1970-01-01 00:00 and are not that important, except for the fact that images are 20 s apart. Examples of the images you should expect to obtain are shown in Fig. eA3.1 while a MATLAB routine reading the data but not doing the rescaling in the step 3 above is provided in Table eA3.2.

Table eA3.1: Automatically-generated header (context) information about the NetCDF file provided in the electronic supplement eA.3.

netcdf eA\_3\_HighResolutionXYData {

dimensions:

X = 384 ;

Y = 384 ;

T = 181 ;

variables:

int TIME(T) ;

TIME:units = "s" ;

TIME:description = "unix time since 01/01/1970 00:00:00" ;

byte REFLECTIVITY(T, Y, X) ;

REFLECTIVITY:offset = -30.f ;

REFLECTIVITY:slope = 0.375f ;

REFLECTIVITY:units = "dBZ" ;

REFLECTIVITY:description = "Cartesian reflectivity array starting from the SW corner" ;

byte CLUTTER\_MASK(Y, X) ;

CLUTTER\_MASK:offset = -30.f ;

CLUTTER\_MASK:slope = 0.375f ;

CLUTTER\_MASK:units = "dBZ" ;

CLUTTER\_MASK:description = "Threshold to match or exceed for data to be valid and above clutter strength" ;

// global attributes:

:DX = 250.f ;

:DY = 250.f ;

:DT = 20.f ;

:CENTER\_LAT = 45.4242f ;

:CENTER\_LON = -73.9372f ;

:PROJ\_NAME = "Mercator" ;

:RADAR\_NAME = "McGill S-band" ;

}

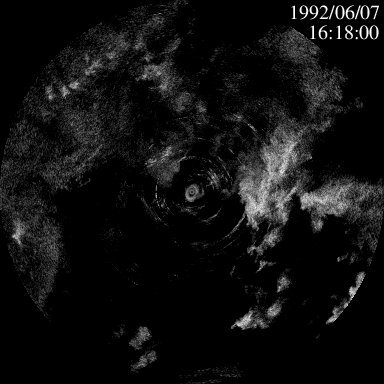
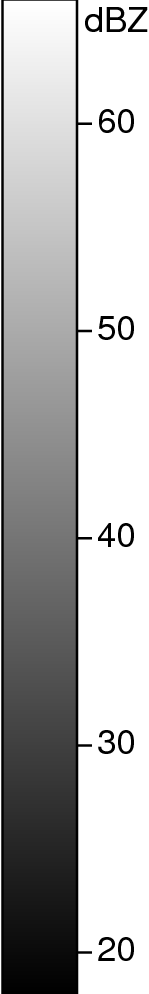
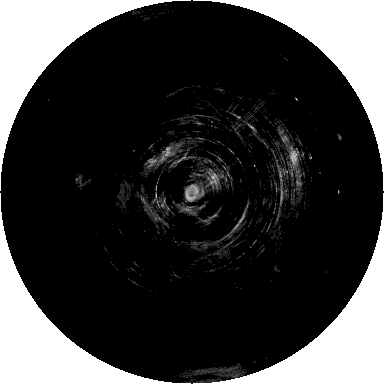
  

Figure eA3.1: Images expected for the first reflectivity map (left) and for the mask (right).

Table eA3.2: MATLAB routine to read eA\_3\_HighResolutionXYData.nc.

% \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* %

% \* \* %

% \* Routine Read\_eA3\_file: \* %

% \* reads the file eA\_3\_HighResolutionXYData.nc from \* %

% \* Radar Meteorology: Principles and Practice \* %

% \* \* %

% \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* %

function [date\_time\_UTC,clutter\_mask,reflectivity] = Read\_eA3\_file(path)

%% Input Variables

%

% path = path to location of the directory where the netcdf file is

% located

%

%% Output Variables

%

% date\_time\_UTC= 2D matrix containing date/time information in

% MATLAB-friendly format for each of the 181 maps

% clutter\_mask = 2D matrix (384\*384) byte array of coded

% reflectivity to exceed

% reflectivity = 3D matrix (384\*384\*181) byte array of coded

% reflectivity measured by the radar

%% Check for the existence of the file in the specified path

eval(['cd ', path]);

file\_name = ' eA\_3\_HighResolutionXYData.nc';

names =dir(file\_name);

check\_file=length(names);

if (check\_file == 0)

display('File not found: Please Check either the path or the file name');

else

%% If file found, open it and read the 3 data arrays

netcdf\_id = netcdf.open(filename,'NOWRITE');

UNIX\_time = netcdf.getVar(netcdf\_id,0);

reflectivity = netcdf.getVar(netcdf\_id,1);

clutter\_mask = netcdf.getVar(netcdf\_id,2);

netcdf.close(netcdf\_id);

%% Convert in an array operation the UNIX time to MATLAB date-time vector format

date\_time\_UTC = datevec((double(UNIX\_time(:)) ./ 86400) + datenum(1970,1,1));

end

References and credits

Thanks to Bernat Puigdomenech Tresserras for his help coding the original data file into a NetCDF file and to Véronique Meunier for writing the data reading routine above.

Fabry, F., A. Bellon, M.R. Duncan, and G.L. Austin, 1994. High resolution rainfall measurement by radar for very small basins: The sampling problem reexamined. *Journal* *of Hydrology*, **161**, 415–428.