Appendix C: Data File Reference

Raw Data File Format

Raw data files are stored in the directory /local0/RawData. The files are named using the hexadecimal unix epoch time stamp (8 characters), the radar site name, and the extension “raw”. For example:

raw.<sitename>.37fafeb3

corresponds to the acquisition cycle starting at “37fafeb3”, or at 0748 and 3 seconds on 6/10/1999 (UTC).
The beginning of the raw data files list the parameters describing the manner in which the data were acquired, including such information as the radar operating frequency, PRF, the start time of the acquisition, etc. These are set out as ASCII token/value pairs with each line terminated by a line feed (#10) character. The last token in the header of the file is the “DATA” token followed by the acquisition start time stamp. Following the data token, the raw data are written out in binary format. The data are stored as little-endian 16-bit signed integers in the following order:

- Data point 0, Gate 0, Receiver 1, IP
- Data point 0, Gate 0, Receiver 1, QP
- ……..
- Data point 0, Gate 0, Receiver 5, QP
- Data point 0, Gate 1, Receiver 1, IP
- Data point 0, Gate 1, Receiver 1, QP
- ……..
- Data point 0, Gate (M-1), Receiver 5, QP
- Data point 1, Gate 0, Receiver 1, IP
- ……..
- Data point (N-1), Gate 0, Receiver 5, QP
- ……..

where the number of range gates acquired is M, and the number of data points stored is N.

Note that gate zero contains data synchronisation check values and not acquired data. These “sign posts” can be utilised to verify data reading software if required.

Format of Meteor Position Data Files

The final result files are called "MPD" files which is an acronym for "Meteor Position Data". Each data file corresponds to a 24 hour time span starting at 0000 UTC and ending at 2359.59 UTC the same day. They have filenames of the form ‘*mpCCYYMMDD.site*.mpd’, and are found in the METEORS subdirectory of the results directory (usually */local0/Results).* At the start of each file are a list of parameters which are relevant to the manner in which the data were collected. These appear as token-value pairs, for example:

PRF 2144

might appear on a line in the parameter section of the data file.

After all of the parameters, there appears a line describing each of the fields in the data itself:

Date Time File Rge Ht Vrad delVr Theta Phi0 Ambig Delphase ant-pair IREX amax Tau vmet snrdb

After the header comes the actual data, usually one line per meteor detection. If a meteor cannot be unambiguously located, its various possible locations are each reported in the data file - one line per ambiguous location. This is noted in the "AMBIG" field of the data. If the AMBIG field is 3, for example, then there will be 3 consecutive entries in the

data file for this one meteor. Any further analyses performed on the MPD data usually discard the ambiguous detections before any crunching is done.

The data stored in the MPD files is also available in a binary format which can be useful if you wish to parse the files often since reading them in binary format is substantially faster. These files have the name '*mpCCYYMMDD.site.bin*' and are found in the same place as the MPD files. The ***catbin*** program is capable of reading these files and turning them into text (the format of its output is intended to be exactly the same as the MPD file). If you require the exact format of the BIN file then contact Genesis Software.

The data fields are described in the following table.

Data Field	Description
Date	The date of the detection CCYY/MM/DD relative to UTC.
Time	The time of the detection HH:MM:SS.XYZ in UTC where XYZ is the millisecond of the detection. (Note that this represents the relative accuracy of the detection, not the absolute accuracy which, in the normal mode of operation, is +/- 1 second).
File	The file name extension used to store the raw data for this detection (VWXYZ characters from [0..9, A..Z]).
Rge	The range of the detection in km to one decimal place (WXY.Z).
Ht	The corrected height above ground of the detection in km (WXY.Z).
Vrad	The radial drift velocity of the trail in m/s (WX.YZ).
DelVr	The standard deviation of the radial velocity measurement obtained from the 5 antenna pairs in the interferometer. Note that the analysis rejects data with delVr > 5.5 m/s so that this represents a limiting value for this field in the MPD file.
Theta	The zenith angle of the detection in degrees (XY.Z).
Phi0	The azimuth angle of the detection in degrees measured anticlockwise from East (WXY.Z).
Ambig	The number of locations this detection could have originated from (X).
Delphase	The worst phase error between antennas if the measured azimuth and zenith of the detection are correct (XY.Z). Measured in degrees.
ant-pair	The antenna pair with the worst phase error (XY).
IREX	The receive channel used in the analysis for certain single-channel data quality tests. This is always "1" during normal operation.
amax	The peak value of the amplitude of the meteor echo in digitiser units. This may be greater than 32767 if channel saturation has occurred (VWXYZ).
Tau	The decay time of the meteor in seconds. This is a half-life, *not* a 1/e time constant (.XYZ).
vmet	The entrance speed of the meteor in km/s. Bad values are characterised with "-9.99" (WX.YZ).
snrdb	The signal-to-noise ratio for this meteor (X.YZ).

Format of Preliminary Event Data Files

The first stage raw data files, or preliminary event files are produced by the detection algorithm and are written into a subdirectory of the event spool which is usually found in /local0/EventSpool. The PEV files are named using the hexadecimal unix epoch time stamp (8 characters) and a sequence number extension of a further five hexadecimal numerals. For example:

37fafeb3.00000

would correspond to the first preliminary detection during an acquisition cycle starting at "37fafeb3", or at 0748 and 3 seconds on 6/10/1999 (UTC).

The beginning of the PEV files list the parameters describing the manner in which the data were acquired, including such information as the radar operating frequency, PRF, the start time of the acquisition, etc. These are set out as ASCII token/value pairs with each line terminated by a line feed (#10) character. The last token in the header of the file is the "DATA" token. Following the data token, around four seconds of acquired data from a single range gate (containing the event which triggered the detection) are written out in binary format. The data are stored as little-endian 16-bit signed integers in the following order:

- Data point 0, Receiver 1, IP
- Data point 0, Receiver 1, QP
- ……..
- Data point 0, Receiver 5, QP
- Data point 1, Receiver 1, IP
- ……..
- Data point N, Receiver 5, QP

where the number of data points stored is (N+1).

Format of Confirmed Event Data Files

The second stage raw data files, or confirmed event files are produced by the primary analysis program (***skiycorr***) and written into one of the results spool directories according to the current date. There are 16 spool directories in all - one for every odd-numbered date in a calendar month. The file names used for the confirmed event data are constructed from a date string and a sequence number - this number is the same as that reported in the corresponding line of the MPD file under the heading "File". Confirmed event files all start with the characters "ME" followed by the date of the detection issued in the format "CCYYMMDD". For example,

ME19990929.00000

would correspond to the first detection file written on the 29th September, 1999.

The content of the CEV files includes a set of ASCII token-value pairs at the head of the file in much the same way as is described for the MPD files. The final entry in this section of the file is the token "DATA" (which has no corresponding value). Following the DATA token are three or more lines of information determined by the skiycorr program which are, in fact, the same as the data found in the corresponding line of the MPD file. I.e., the result of the analysis of the meteor event is entered into the CEV file in addition to the MPD file. Following the lines detailing the result of the analysis, the token "CORR12" appears followed by a set of floating point numbers in binary format. These binary-format floating point numbers provide information on the complex cross correlation between receiver channels one and two during the time of the meteor event. The data are arranged thus:

- Number of valid data points following (4-byte floating point)
- Time between adjacent data points, or "lags" in the correlation function in seconds (4-byte floating point)
- Time shift of first (negative) lag of correlation function in seconds (4-byte floating point)
- 500 correlation function amplitudes, not all of which may be valid (4-byte floating point)
- 500 correlation function phases, not all of which may be valid (4-byte floating point)

At the end of the cross correlation binary data, the ASCII token "DATA" appears once again and is terminated by a single line feed ASCII character (#10). Following this token is the raw data for the meteor event from a single range gate written in the following format:

- Four synchronisation characters - ASCII code 48
- Receiver 1, IP0, QP0, IP1, QP1, ……., IPN, QPN (all 16-bit signed integers)
- Four synchronisation characters - ASCII code 48

- Receiver 2 IP0, QP0, IP1, QP1, ……., IPN, QPN (all 16-bit signed integers)
- Four synchronisation characters - ASCII code 48
- ……
- Receiver 5 IP0, QP0, IP1, QP1, ……., IPN, QPN (all 16-bit signed integers)
- Four synchronisation characters - ASCII code 48

Note that the number of data points stored ("N" in the above description) is specified as a parameter in the file header. This parameter is denoted by the token "RECL_PTS".

Finally, note that all data stored in the CEV files in the binary format are stored in native machine architecture format. This means that all integers are stored as little-endian quantities. All floating point binary numbers are stored in IEEE format.

20.02.2008