temperature, humidity and liquid profile (atmospheric state) retrievals that best correlate with the radiometric observations. For GPS observations, a separate neural network file is used. The neural network files are trained using the Stuttgart Neural Network Simulator and a standard back propagation method.

New Profiling Radiometers are delivered with one set of neural network files included. The user must specify the region of operation, or radiosonde site to be used for training. Additional neural network files may be purchased for other sites. Contact Radiometrics Sales and Marketing for further information.

To change neural network files to be used for real-time level2 processing, simply add the new neural network files to the operating folder and specify these files in the **nnret** commands used for retrievals.

NOTE: Operation of the radiometer with neural network files trained for a different site may produce profiles with significant error. However, the level0 and level1 data will not be affected. In the event the radiometer is operated with incorrect neural network files, the level1 data can be reprocessed with the correct neural network files at a later time.

6.3 Output Files

There are 5 standard output files generated by the Operating Code. Common conventions used in all the files are described below, followed by descriptions of each output file type.

6.3.1 Output File Name Conventions

All output files use the .csv extension to indicate to other application programs that the files conform to the industry standard *comma separated variable* data base format. Most mathematical analysis, spreadsheet and database programs can open and manipulate the data in these files with little or no reformatting. All output files are named automatically using the following format:

yyyy-mm-dd_hh-mm-ss_xxx.csv

…where yyyy is the year when the file was started
mm is the month of the year
dd is the day of the month
hh is the hour of the day
mm is the minute of the hour
ss is the second of the minute

…and xxx defines the output file type as follows:

xxx=lv0	*level0* file
xxx=lv1	*level1* file
xxx=lv2	*level2* file
xxx=tip	*TIP* calibration file
xxx=ln2	*LN2* calibration file
xxx=ser	com port log

This file naming convention orders the files chronologically when sorted alphabetically by name.

6.3.2 Record Number

All output files contain a sequential record number in the first field, starting with the number 1. In the event a file has been sorted for analysis purposes by record type, elevation angle, or any other parameter in the file, the record number field can be used to restore the order of the file to its original order.

6.3.3 Date/Time Conventions

All output files contain a date/time stamp in the second field of all records that contain time dependent data. All output files use the following date/time stamp convention for each record in the file:

mm/dd/yyyy hh:mm:ss

…where mm is the month
dd is the day
yyyy is the year
hh is the hour
mm is the minute
ss is the second

The time corresponds to the time of the completion (end) of the observation set.

NOTE: If a file is opened in Excel or similar applications, the date/time stamp can be reformatted easily to any other standard format and saved in that revised format.

6.3.4 Record Type Conventions

All output files contain a record type number in the third field of all records. The record type number defines the header or data type in that record. Record types for each file type are grouped in blocks and numbered sequentially beginning with the number assigned to the header for that block. Record headers define all the fields in each block.

Data is logged sequentially in the order of the observations. For some types of analysis, it is more convenient to sort the data based on different parameters. Sorting a file by record type is often a useful first step to analysis. When a file is sorted by record type (third column in a spreadsheet, for example), the data automatically sorts into logical blocks with the appropriate header for each block appearing at the top of each block. Second level criteria can be used to sort the data within each block by elevation or azimuth angle, ambient temperature, or any other field appearing in the record.

6.3.5 *Level0* File

Level0 files contain raw, unprocessed data in engineering units. A *level0* file is produced for all modes of operation and all options that can be selected from the main menu. *Level0*

files contain 100% of the information needed to reprocess the raw data with alternative calibration information or algorithms. *Level0* files contain the following record types:

Record type	Description of Record Type
00	Record type for all error reports
15	Header for sky observations
16	obs command sky observation
17	cal21 command sky observation
25	Header for observation of internal ambient black body
26	BB observation for trcvcal command
30	Header for tdp command (GPS) records
31	GPS time/date/position data
40	Header for surface met records
41	Tamb, RH, pressure, Tir and rain sensor
60	Header for LN2 calibrations
61	Record of LN2 cal data (includes BB, LN2 observations)
90	Header for housekeeping data (eng command)
91	eng command data
99	Record type for echo of mp.cfg file to level zero file

Figure 39 *Level0* Record Types

6.3.6 *Level1* File

Level1 files contain real-time brightness temperatures for each channel specified in the configuration file. Real-time *level1* files are produced from contemporaneous *level0* data and calibration information in the configuration file. *Level1* files contain the following record types:

Record type	Description of Record Type
40	Header for surface met records
41	Surface met data record
50	Header for sky observations
51	obs command sky observation data record

Figure 40 *Level1* Record Types

6.3.7 *Level2* File

Level2 files contain records of real-time retrievals of temperature (K), water vapor (g/m^3), relative humidity (%) and liquid water (g/m^3) profiles. The retrievals are produced using the contemporaneous *level1* data and the neural network files specified in the configuration file. *Level2* files contain the following record types:

Record type	Description of Record Type
100	Header for vector retrieval index
101	Vector retrieval index entry
200	Header for surface met records
201	Tamb, RH, pressure, Tir and rain sensor
300	Header for scalar retrieval records
301	Scalar retrieval data record
400	Header for vector retrieval records (58 heights)
401	Temperature vector retrieval data record (profile)
402	Vapor Density vector retrieval data record (profile)
403	Liquid Density vector retrieval data record (profile)
404	Relative Humidity vector retrieval data record (profile)

Figure 41 *Level2* Record Types

6.3.8 *TIP* Calibration File

TIP files contain the results of *successful* tip calibration attempts. For each **cal21** command in a Procedure File, the *level0* data is processed in real-time by the TIP calibration algorithm. For each TIP frequency specified in the configuration file, atmospheric opacity is computed for each elevation angle. The TIP calibration algorithm attempts to fit all the opacity values for each frequency to a linear function of air mass (number of equivalent atmospheres for a given elevation angle). If the linear regression for all channels is better than the regression threshold “r” specified in the configuration file, then the tip is considered “good”, and the computed values of Tnd and r for each frequency are included in the *TIP* output data file. *TIP* files contain the following record types:

Record type	Description of Record Type
10	Header for current calibration data in configuration file
11	Current calibration data
30	Header for cal21 calibration results
31	Values of Tnd @ TkBB=290 K and r values for all frequencies in TIP Cal

Figure 42 *TIP* Calibration Record Types

A copy of the current Tnd calibration data contained in the configuration file is copied to the top of the *TIP* file (record types 10 and 11). This provides a quick way to compare new TIP calibration derived values of Tnd to the current operational values as described in Section 5.2.2. The values of Tnd are normalized to the value that would be observed when TkBB = 290 K.

6.3.9 *LN2* Calibration File

LN2 calibration files contain the values of Tnd computed from individual LN2/Black Body observation sets during an LN2 calibration, for all channels specified in the configuration file. *LN2* files contain the following record types:

Record type	Description of Record Type
10	Header for current calibration data in configuration file
11	Current calibration data
30	Header for LN2 results
31	Values of Tnd @ TkBB=290 K for all frequencies in configuration file[36]

Figure 43 *LN2* Calibration Record Types

A copy of the current Tnd calibration data contained in the configuration file is copied to the top of the *LN2* file (record types 10 and 11). This provides a quick way to compare new LN2 calibration derived values of Tnd to the current operational values. The values of Tnd are normalized to the value that would be observed when TkBB = 290 K.

6.4 Time Synchronization

The date/time stamp in files and output file names is derived from the date/time in the Microsoft Windows Operating System. The Windows calendar clock is updated using the GPS receiver time immediately before the beginning of each new set of output files.

6.5 Reprocessing

Users can reprocess *Level0* files with alternative calibration values or advanced algorithms to improve the accuracy or reduce the random noise in *level1* data. *Level1* files can be reprocessed with alternative retrieval algorithms.

[36] These values are calculated using a simplified receiver model. When the calibration ends, updated values of Tnd, Alpha, and dTdG are calculated and written to mp.cfg.