

GEO Propagation Analysis Tool

User's Guide

Ritsuko Pollard

Florida Atlantic University

and

Roberto Acosta

NASA Glenn Research Center

**Version 1.0
(Updated)**

TABLE OF CONTENTS

1. Introduction	1	
1.2 Data integrity check and logging event		1
1.3 Check time stamp	2	
1.4 Installation	3	
2. User's Manual	4	
2.1 Manual Instruction	4	
2.2 Getting started with GUI	4	
2.2.1 Getting started with GUI		5
2.2.2 Select days to be processed	5	
2.2.3 Convert rv0 to txt	5	
2.2.4 Calibration procedure	5	
2.2.5 Diurnal effect and DC Bias removal		5
2.2.6 Plot	12	
3. Matlab Program Description	17	
3.1 Introduction	17	
3.2	18	
3.1 Calculation of Microwave Propagation Model (MPM)		19
4.1 Introduction	28	
4.2 ACTS Propagation Experiment Calibration Method		29
4.3 Data Acquisition Using Surface Measurements		30
Attenuation Calculation Using Crane's Models		30
Appendices	55	
Appendix A ACTVIEW	55	
Appendix B CHECKFILE	55	
Appendix C LOGFILE	55	

1.0 Introduction

The "GEO Propagation Analysis Tool" is Matlab based program code graphical user interface (GUI) developed to provide user-friendly environment and ease of data processing.

1.1 Installation of the Analysis Program

The following setup procedure is required **before** running the analysis program for the first time. This set up needs to be **done only once** to create the input and output directories for which the new files will be located. The programs are design to look only at a specific directory names where the input and output files will be located.

Procedure by Steps - Installation

Step 1- Create a folder c: or d: or e:\ACTS\DATAIN\HA\yymm for input files

Input file type: `yymmddHA.rv0`

Step 2- Create a folder c: or d: or e:\ACTS\DATAOUT\HA\yymm for output file

Output file type: `minyymmddHA.txt`
`secyymmddHA.txt`
`pv2yymmddHA.txt`

Step 3- Create folder c: or d: or e:\ACTS\EXE\GEOPROP for Matlab programs location

Step 4- Place all matlab programs in directory in step 3

Program names: `geo_prop.m`, `geo_rdrv0.m`, `geo_clplt.m`,
`geo_clcalc1.m`, `geo_clcalc2.m`, `geo_wtpv2.m`,
`geo_uwplt.m`, `geo_uwcalc`, `geo_plot.m`

2.0 Data Checkout Procedure Description

Before starting the calibration procedure, the rv0 file integrity (anomalies in system are defined as power drops, gross system pointing errors, unexplained signal drops, system checkout, gaps in data, etc) needs to be accounted and log using the [actsview.exe](#) program. A monthly log file (**LOGyymm.xls**) is created to record any anomalies in the data collection system. This data will not be used in the calibration or statistical analysis. In addition a quick daily assessment of the percentage of time the signal fade due systems errors (LNB unstability, beacon unstability, small tracking errors) or rain and non-faded hours (clear days) is recorded in the log file as a reference for later use in the calibration procedure.

The measurement time stamp integrity for each day is checked using the program [ckfile.exe](#). If any time stamp sequence is corrupted, the time stamp needs to be corrected files are mark and not included in calibration until the time stamp is compensated.

Procedure by steps - [Generating LOG files](#)

Step 1- Start Actview ([c: or d: or e:\acts\exe\actsview.exe](#))

Step 2- Point to the monthly data files within the acts directory example- [c: or d: or e:\acts\data\yymm](#)

Step 3- View each rv0 files and make a quick assessment of any anomalies in data collection process, percent of hours faded and percent of hour clear

Step 4- Input all observations into a **LOGyymm.xls** log file in the [c: or d: or e:\acts\Z_HUMACAO\LOGfiles](#)

Step 5- Place only the acceptable (good data) rv0 files into [c: or d: or e:\acts\data\ha\yymm](#) directory for the calibration analysis

Procedure by steps - [Generating Check file](#)

Step 1- Run **ckfile5.exe** [c: or d: or e:\acts\exe](#)

Step 2- Review the output file (yymmHA.ck0) for any anomaly in time sequence of the measurements. The last sentence in the file gives you a summary of the data collection time sequence integrity.

Step 3- If anomaly sequence is found, the time stamps need to be corrected or the data needs to be eliminated.

3.0 GEO Propagation Analysis Tool Manual

2.1 Introduction

The main program GUI screen view is shown in *figure 2.1*. The analysis tool is divided into several executable windows that perform various functions: select days to be processed, convert rv0 to txt file, calibration, and view data. The main program calls several functions (other Matlab programs) to perform various functions.

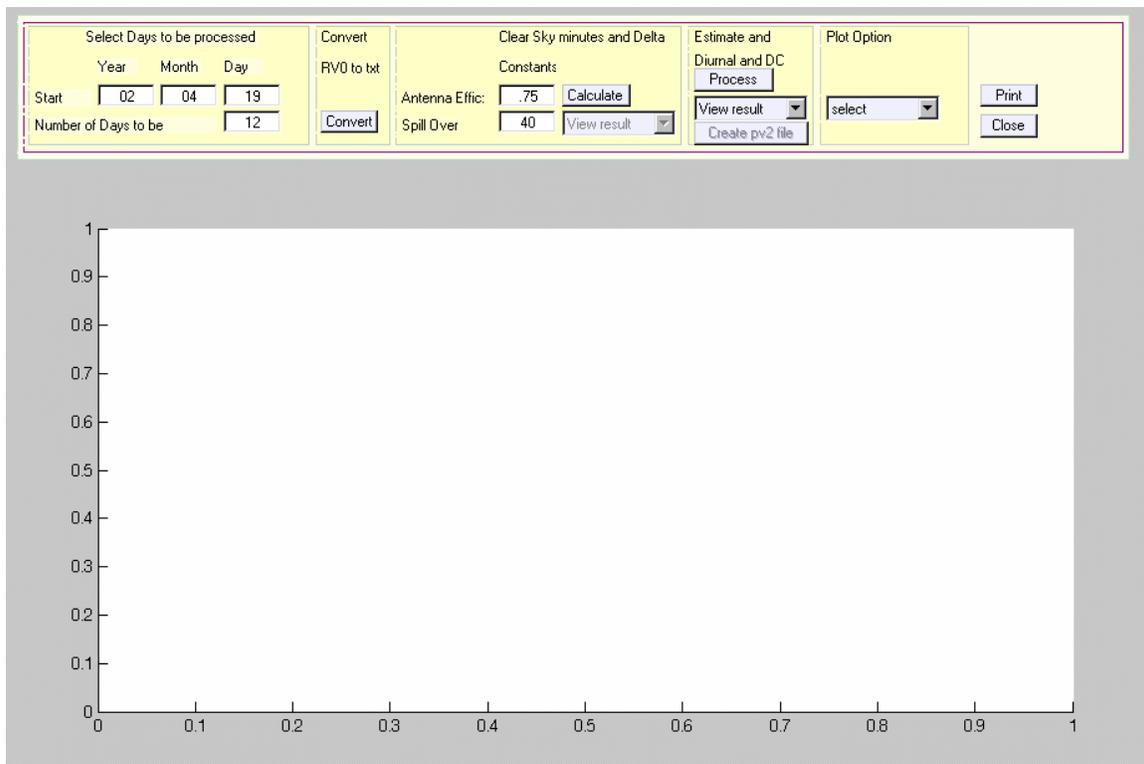


Figure 2.1 GUI Screen view of the analysis Program

Procedure by Steps - Running the Analysis Program Interface

Step 1- Start Matlab

Step 2- Change directory to the location of the Matlab programs
 ex: c: or d: or e:\ACTS\EXE\GEOPROP

Step 3- Run- geo_prop

The GUI "GEO Propagation Analysis Tool" will appear in the window

3.1 Calibration Procedure Description

The goal of calibration is to set the reference of measured beacon signal to 0 dB. Beacon attenuation consists of diurnal effect and DC bias and cannot establish 0dB level itself. Radiometer measurement does not contain these effect is used as a basis to set this reference. The attenuation due to gaseous absorption (AGA) estimation using the surface meteorological measurement is used to establish the attenuation derived from radiometer (ARD) at low attenuation under clear sky condition.

The radiometer measures sky temperature and output is stored in voltage. The voltage and ARD relationship needs to be established, so that ARD can be used as a basis to establish the reference of beacon signal level. Under clear sky condition, the attenuation derived from radiometer (ARD) and attenuation due to gaseous absorption (AGA) estimate using surface meteorological measurements: Barometric Pressure, Relative Humidity, and Outside Temperature, are equal within the range of 0.2 dB. Thus, the calibration constants are adjusted so that the clear sky delta (ARD - AGA) is forced to be 0 dB (within the range -.05 ~ .15 dB). Antenna efficiency and spill over temperature are used to adjust the ARD at clear air condition and low attenuation. The typical antenna efficiency is approximately .6.

Convert binary rv0 file to text file and create output file in txt format. Input data file is the RVO binary file in compressed format. The procedure performed in the Matlab programs: [geo_rdrv0.m](#) is explained in the section "RVO data decoding and internal status check", and "data stuffing".

Once the ARD is determined, ARD is used as a basis to remove the unwanted term, diurnal effect and DC bias, from the original beacon attenuation level to set the beacon reference level to 0 dB.

Diurnal effect is slow varying sinusoidal like signal. The time constant of three hours is used as a cut off frequency of the fourth order IIR filter to determine the diurnal effect. The time constant is selected based on the behavior of diurnal effect that is sinusoidal in nature and has period of approximately one ~ two cycle per day, thus only the diurnal effect is preserved and is the output signal of the IIR filter. The DC Bias changes in time and linear fit is performed every hour to estimate the DC bias level.

The diurnal effect and DC bias is then removed from the original beacon attenuation to achieve unbiased beacon signal level (the 0 dB beacon signal reference level). The beacon attenuation and ARD must agree for low attenuation.

Procedure by steps - Data Calibration

Step 1- Start Matlab

Step 2- Change directory to the location of the Matlab programs in the ACTS directory c: or d: or e:\ACTS\EXE\GEOPROP

Step 3- Execute geo_prop.m . The GUI "GEO Propagation Analysis Tool" will appear in the window (figure 2.1).

Step 4- Select days to be processed. On the "Select Days to be Process" panel, enter year **yy**, month **mm**, day **dd**, and number of days **dd**. If 02/04/19 ~ 02/04/30 need to be process, enter year **02**, month **04**, day **19**, and number of days **12**

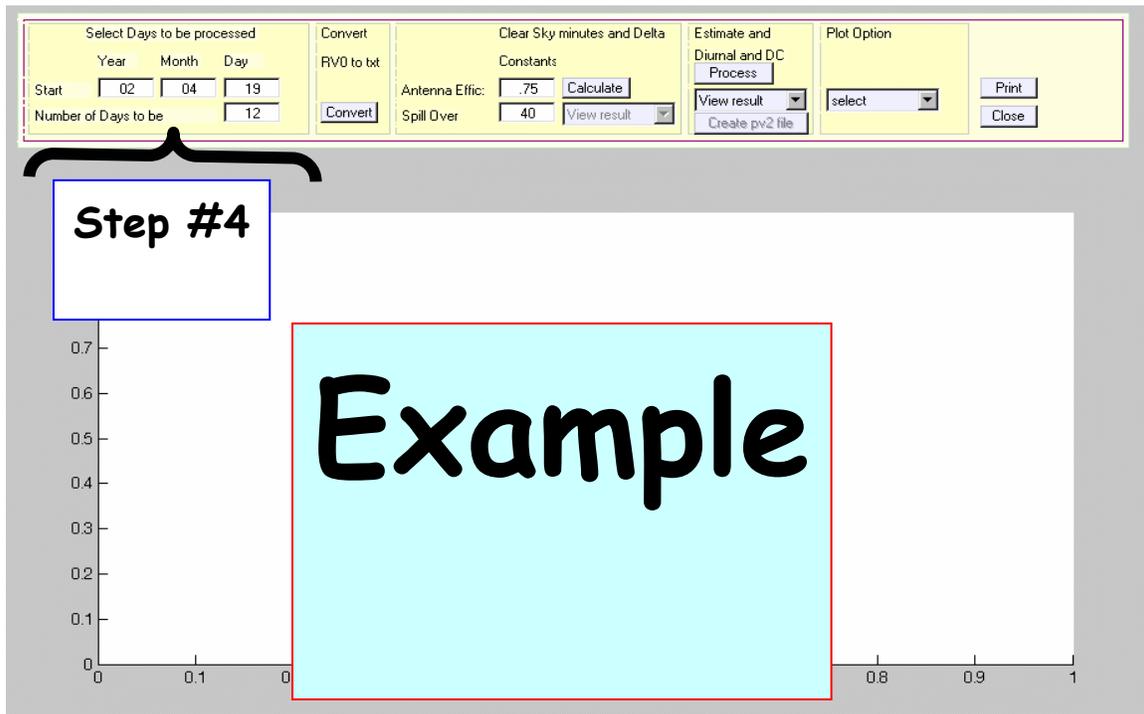


Figure 2.2 Selection of dates to be processed

Step 5- Convert rv0 to txt.

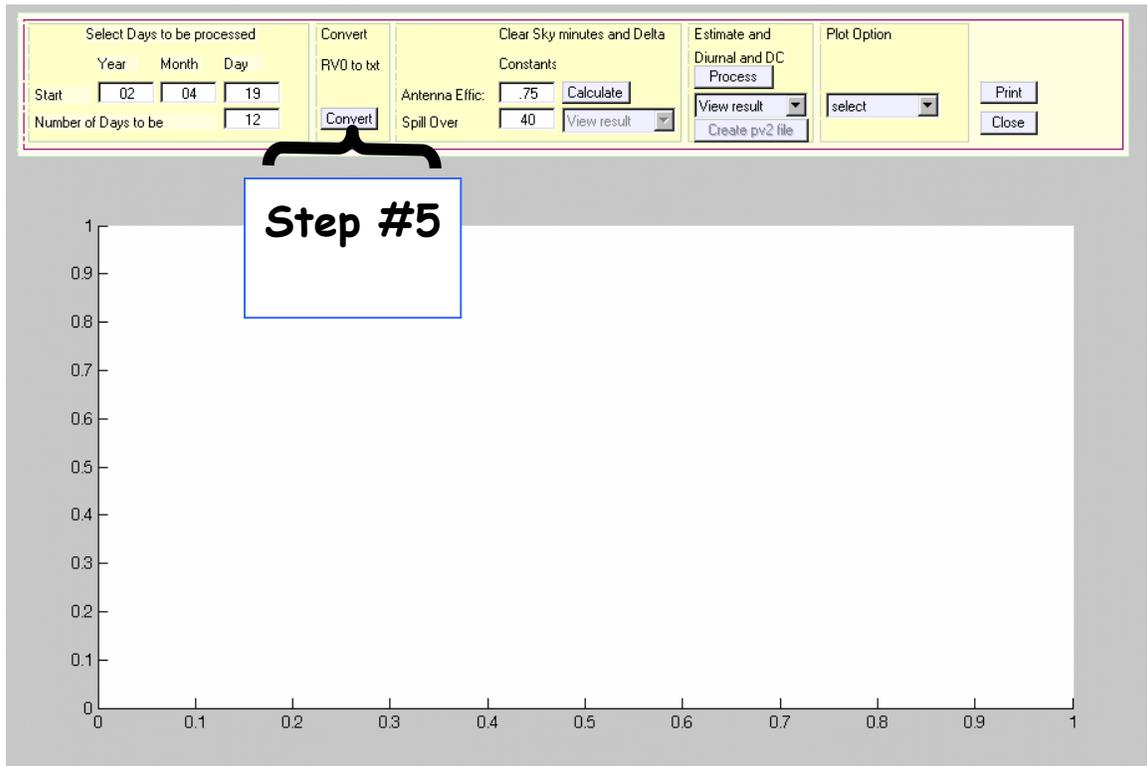


Figure 2.3 Execution box for selecting conversion rv0 to txt files

Step 6- Verify if the output text files are created. Open output file directory c: or d: or e:\acts\dataout\ha\yymm.

The output files created are:

minyymmddHA.txt: Per minute average data

secyymmddHA.txt: Per second data

i.e. **min020531HA.txt, sec020531HA.txt**

Note: Full-length second and minute data are approximately 6 M and 100 k byte long respectively.

Step7- Initialize Calibration. Select whole month for analysis

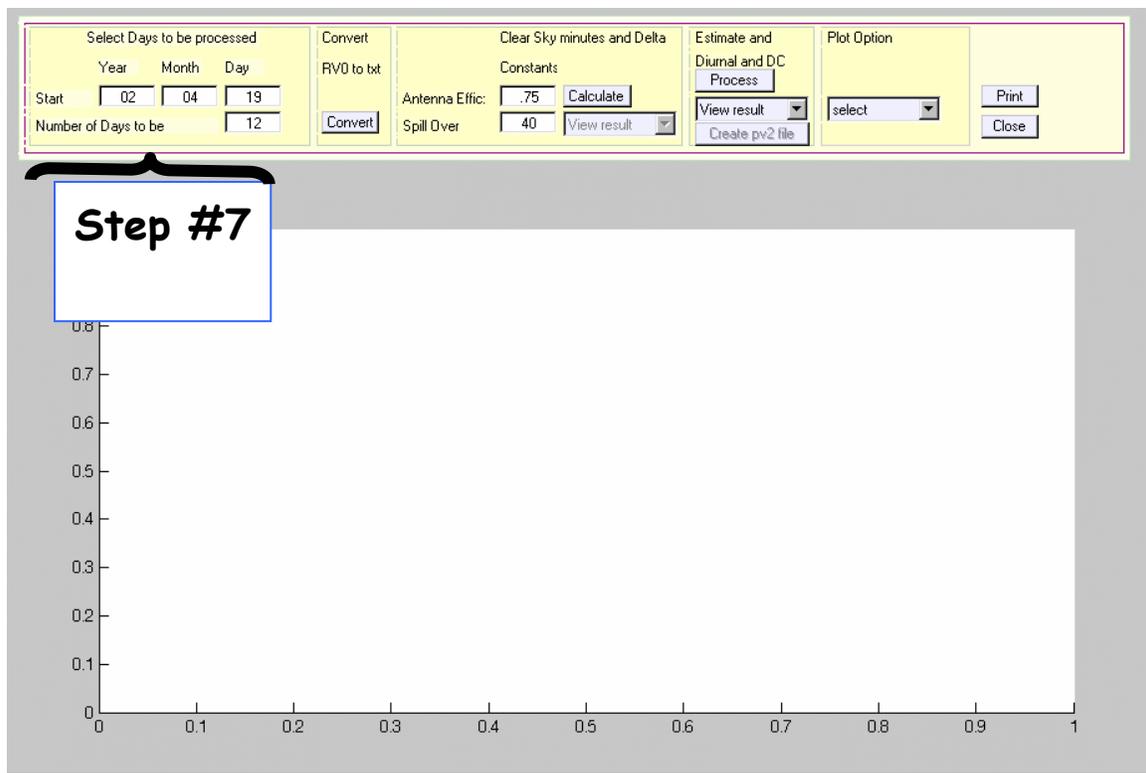


Figure 2.4 Select whole month for calibration

Step 8- Set the calibration constants. On the "clear sky minutes and delta" panel, enter calibration constants, antenna efficiency and spill over temperature, of previous month. The default value for calibration constants, antenna efficiency and spill over temperature are 0.75 and 40, respectively,

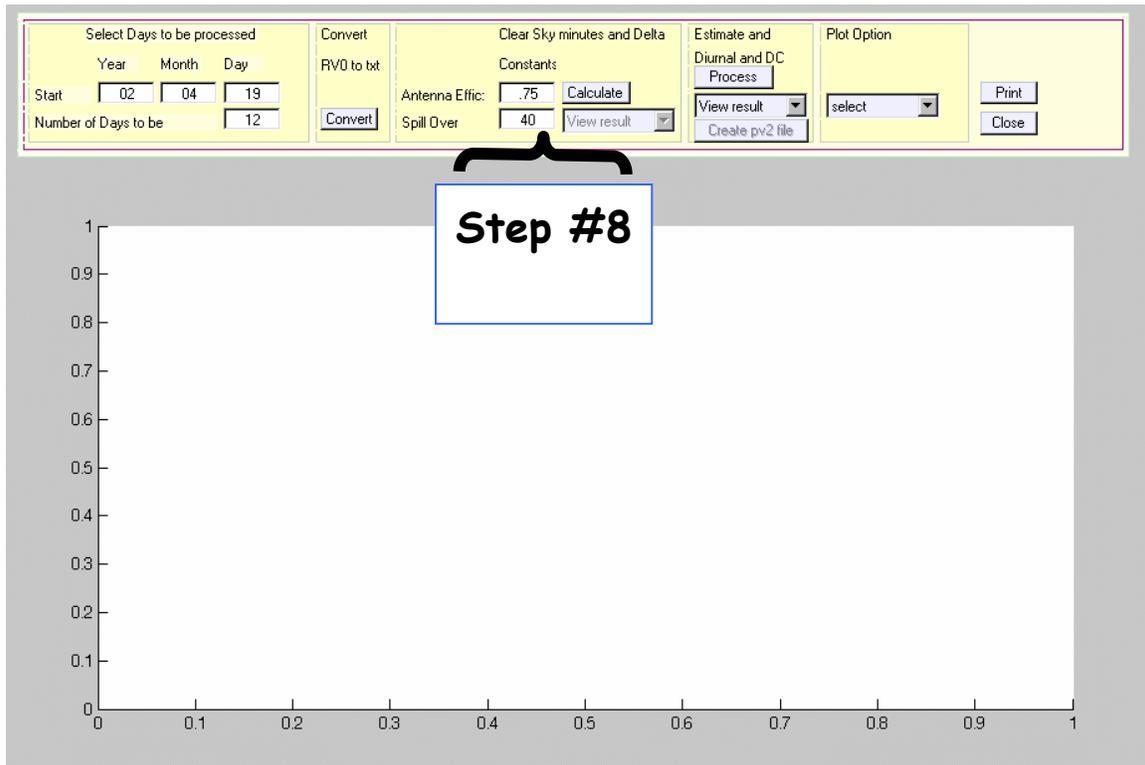


Figure 2.5 Input calibration constants.

Step9- Perform calculation of clear sky minutes and delta

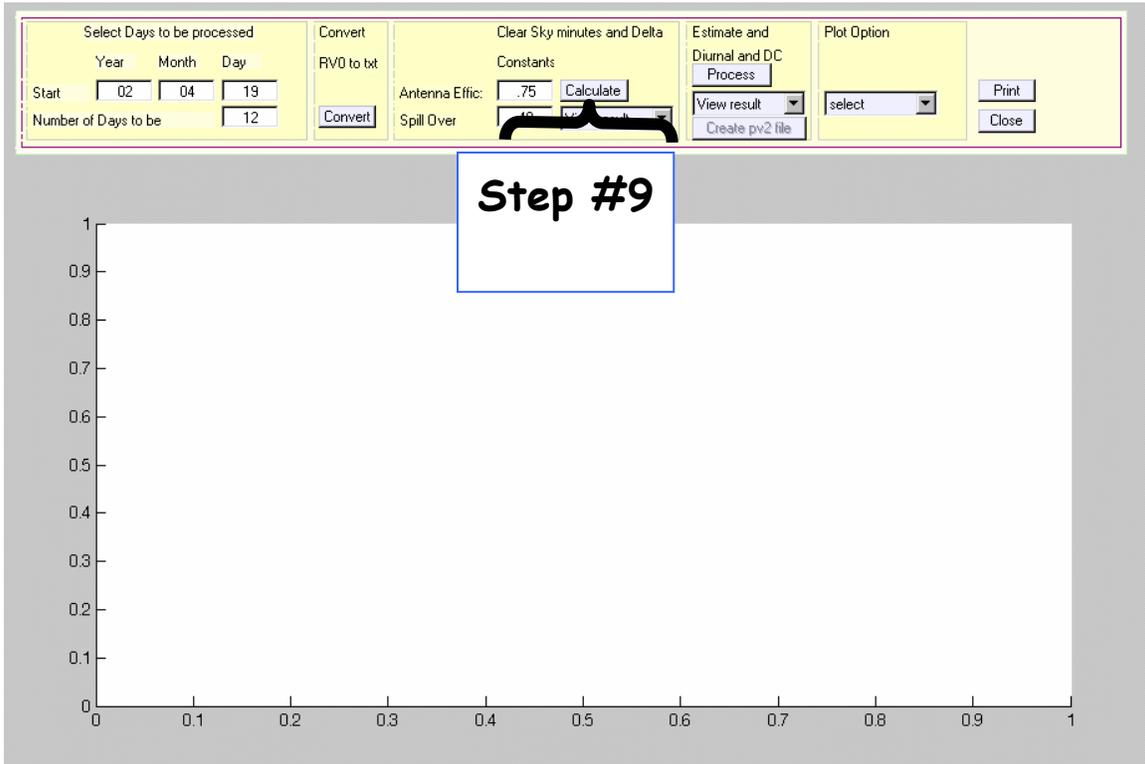


Figure 2.5 Calculate for clear minutes and clear delta

Step 10- Display clear sky minutes

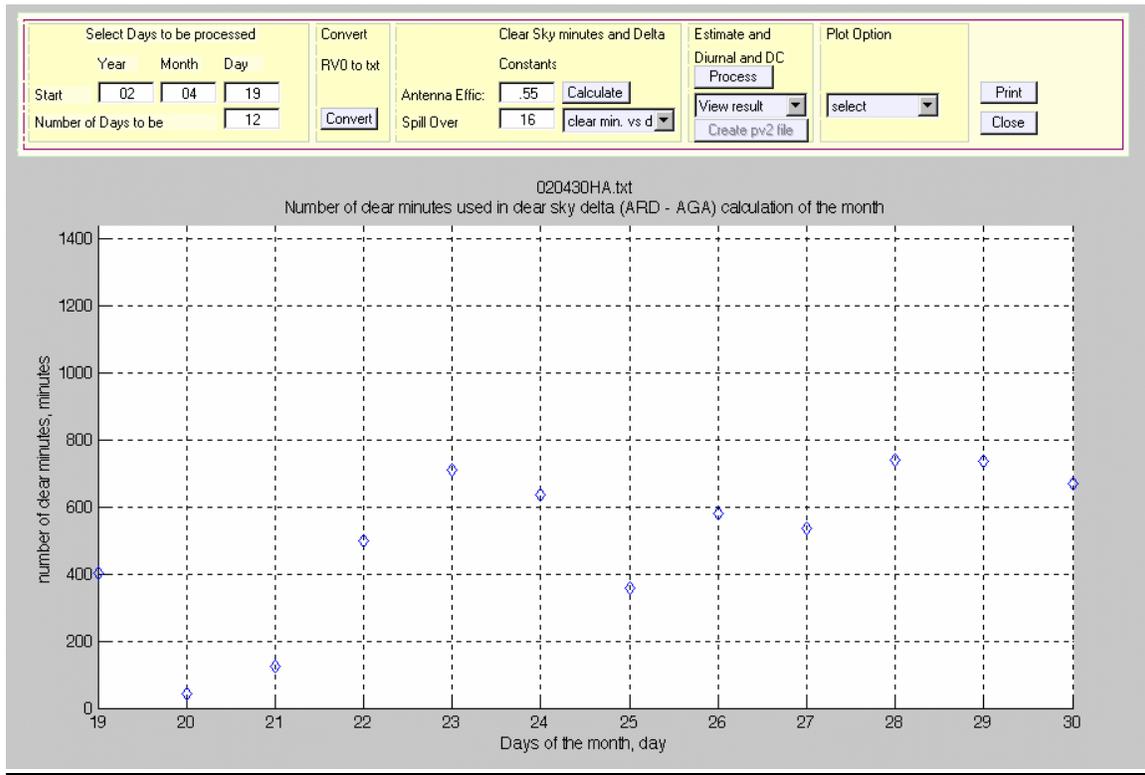


Figure 2.6 Example of clear sky minutes

CRITERIA of ANALYSIS Select three days with highest clear sky minutes of the month.

Step 11- Display clear sky delta

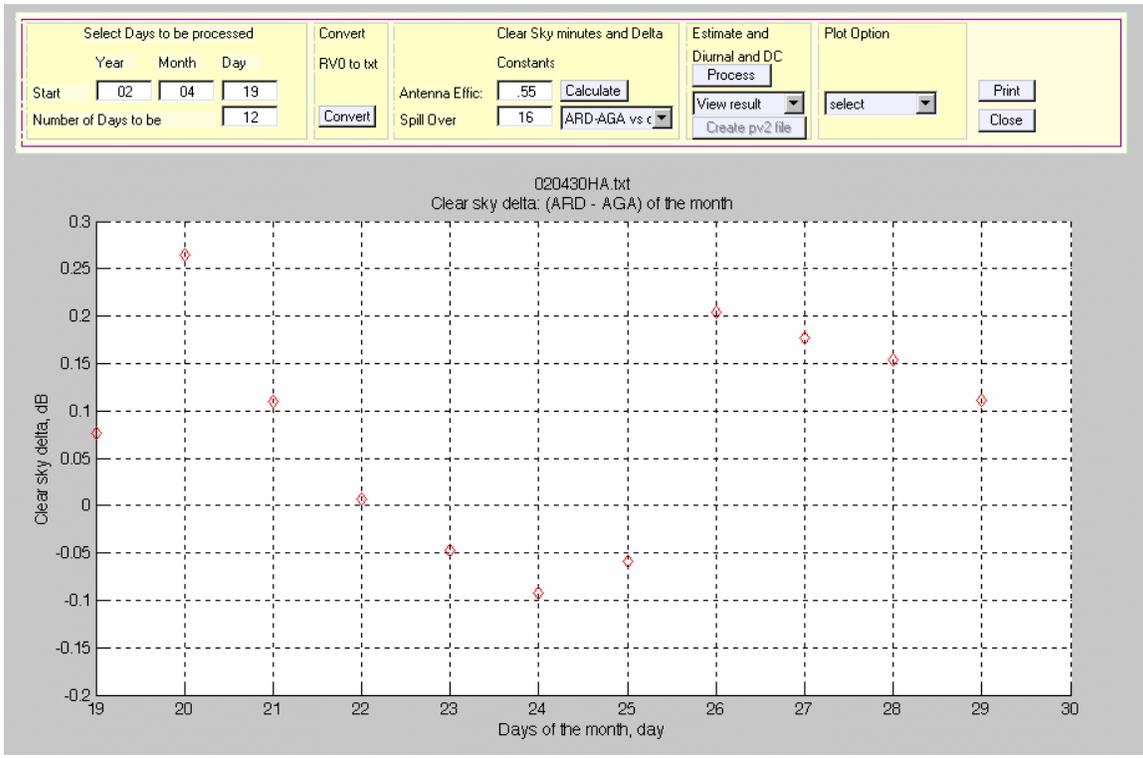


Figure 2.7 Example of clear sky delta minutes

CRITERIA of ANALYSIS - The clear sky delta, correspond to the chosen clearest sky minutes of days in step 10, need to be within the **range -.05 ~ 0.15 dB**

Step 12: If in case of criteria fail in step 11. Repeat step 8 to 11 (change calibration constants: antenna efficiency and spill over temperature in step 8, execute calculations and view results.)

CRITERIA of ANALYSIS - This process is iterative until the criteria in step 11 meet.

Step 13- Select three most rainy days in a given month reported in "LOGyymm.xls" . (see Appendix B)

Step 14- Select one of the three rainy days

Step 15- Estimate and remove diurnal effect and DC bias (execute process) with the initial constant values found in the iteration for the clear day.

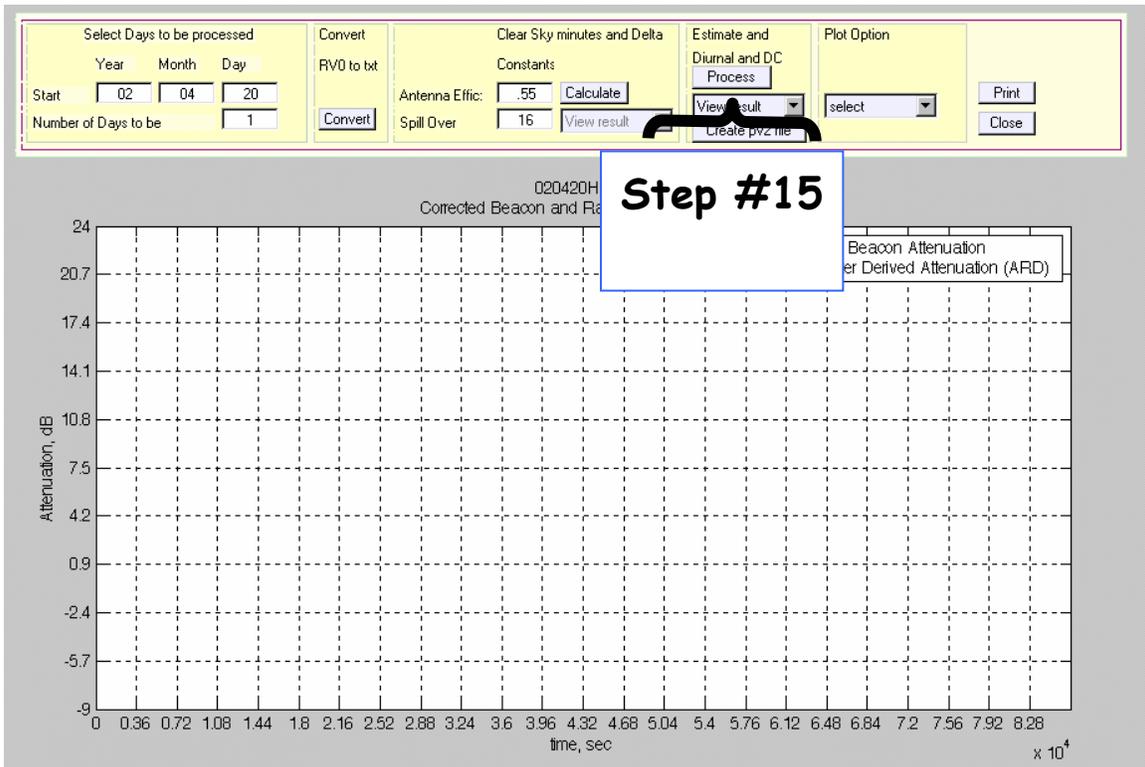


Figure 2.8 Process removal diurnal and dc bias

Step 16- Display calculated attenuation beacon and radiometer ratio, unwanted terms (diurnal plus dc bias), dc bias fit, corrected beacon and radiometer.

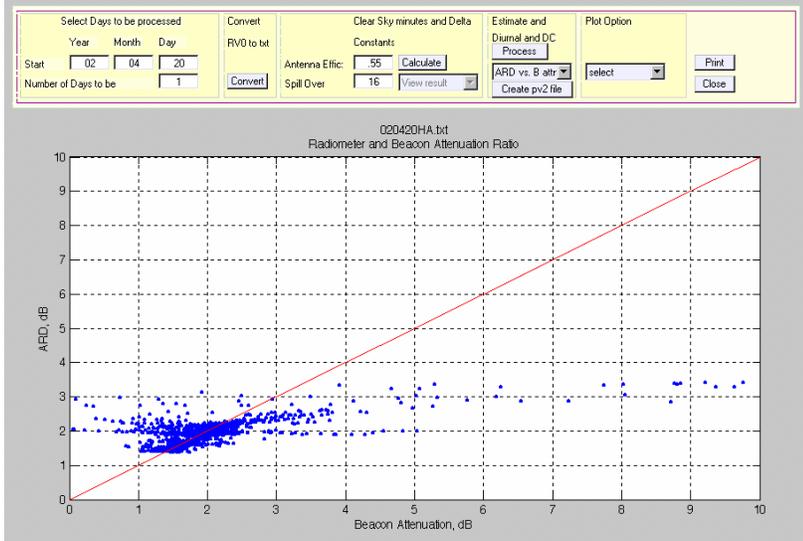


Figure 2.9a Display of Beacon and Radiometer Attenuation ratio

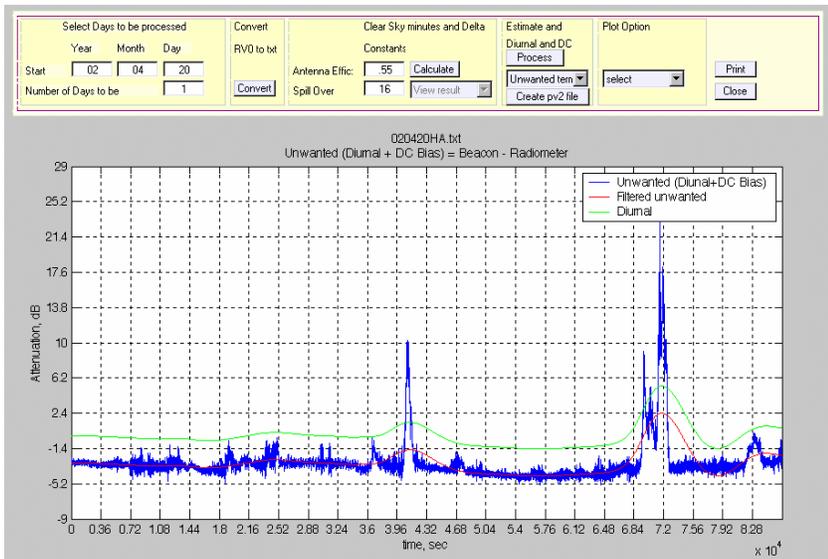


Figure 2.9b Display of diurnal and dc offsets

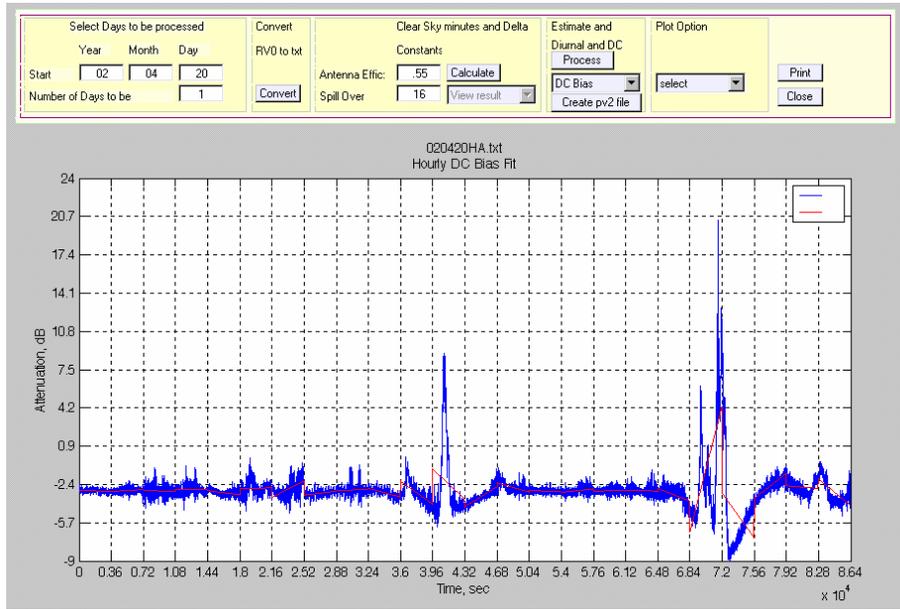


Figure 2.9c Display of DC Bias Fit (hourly)

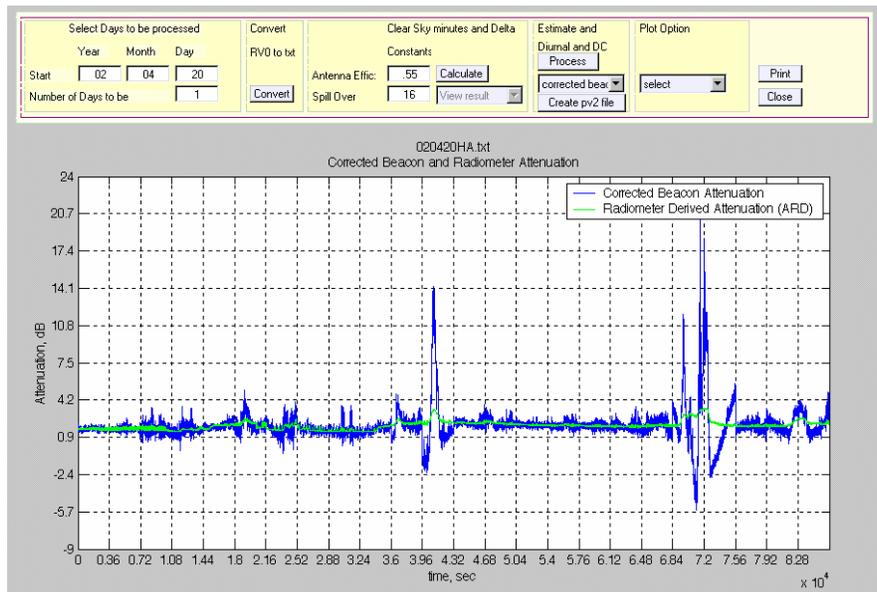


Figure 2.9d Corrected beacon and Radiometer Attenuation

Step 17- Judgment call needs to be made so that the radiometer and beacon attenuation ratio on the selected rainy day for low attenuation (< 4dB) is close to 1:1 ratio.

CRITERIA of ANALYSIS - The objective of this step is to match the ratio at low attenuation on the selected rainy day. If a better match is required then the constants (antenna efficiency and spill over temperature) are to be **adjusted slightly** to obtain a better match and the previous 3 steps repeated (steps 14,15 and 16). When criteria is meet then we proceed to check the other two selected rainy days.

Step 18- Performed step (14-to- 17) for the other two rainy days. Modified slightly the constants if required.

Step 19- Check if the clear days are still meeting the corresponding criteria in **step 11**, if it is not then additional iterations are required to satisfied conditions in **step 11** and **step 17**.

Step 20- Create pv2 output file for the whole month

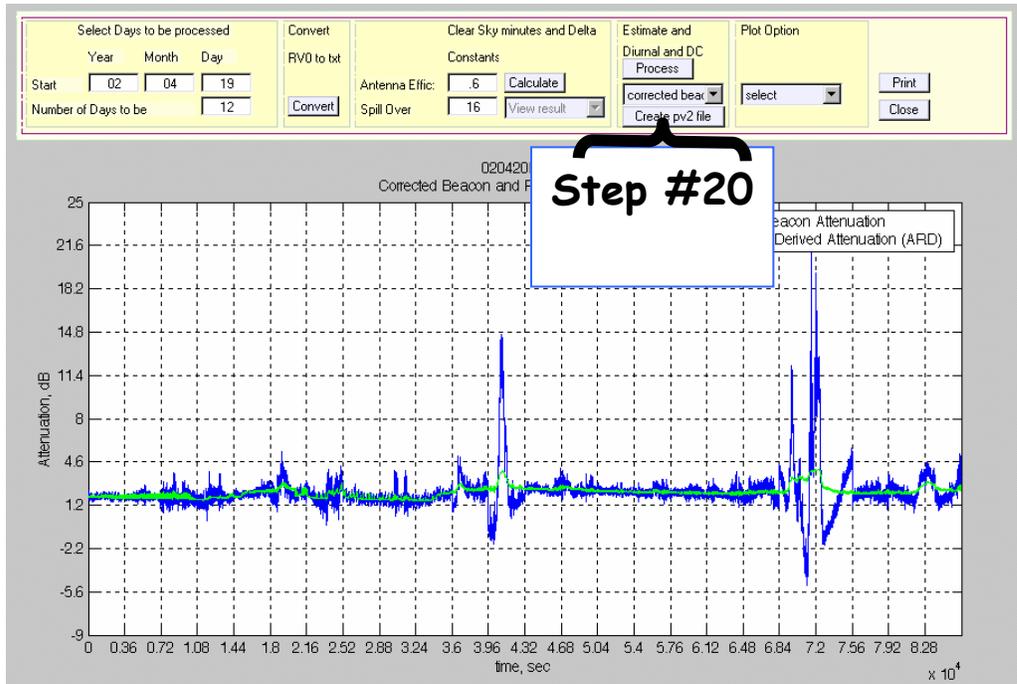


Figure 3.0 Create pv2 files

Step 21- Verify if the output text files are created. Open output file directory c: or d: or e:\acts\dataout\ha\yymm.

The output files created are:

pv2yymmddHA.txt: Per second data

i.e. pv2020531HA.txt

Note: Full length pv2 file is approximately 6 M byte.

Step 22- The plot options allows user to view rv0 and pv2 data. The raw data contains in rv0: the beacon co-pol, cross-pol, attenuation, radiometer voltage, minutes average surface meteorological measurements: barometric pressure, relative humidity, outside temperature, and the calibrated data contains in pv2: beacon co-pol, cross-pol, attenuation, ARD (attenuation derived from radiometer) and their status. The data is plotted versus day.

Select desired plot option below.

- rv0 beacon co-pol attenuation
- rv0 beacon cr-pol attenuation
- radiometer voltage
- barometric pressure
- relative humidity
- outside temperature
- pv2 beacon co-pol attenuation
- pv2 beacon cr-pol attenuation
- pv2 ARD
- status of above all

Step 23 - Print option of displays

Step 24 - Close GEO Analysis Tool

Appendix A

ACTSVIEW

Main Screen General Help

This screen is the main screen of the ACTSVIEW Program. It is divided into 6 regions:

- 1) Menu bar
- 2) Plotting area
- 3) Source box
- 4) Plot legend
- 5) Status box
- 6) Mini-spectrum box

1. The Menu Bar

The menu bar contains 4 menu options which are available to the user. The FILE menu option allows the user to issue a screen dump, switch to real time mode, load a data file, change the daily plot settings, issue a command to the DACS, or exit the program. The DISPLAY menu option allows the user to toggle the channels to be displayed, request a spectrum, switch to the full spectrum screen, switch to the full status screen, or turn on grid lines. The ZOOM menu option allows the user to alter the limits of any of the 3 axes: time, Beacon, or Radiometer. The PAUSE menu option freezes the program so that the user can view the displayed screen plot without the plot changing.

2. The Plotting Area

The plotting area contains plots of any or all of the 20 and 27 GHz Beacon and Radiometer signals.

3. The Source Box

The source box indicates whether ACTSVIEW is in real-time mode or file-view mode. "Real time" appears next to "Source:" for the former and a data file name appears for the latter. Also, if ACTSVIEW is in file-view mode, a file position box is displayed. This box indicates how far along in the file the plotting has progressed.

4. The Plot Legend

The plot legend shows which plotting color corresponds to which data channel. The user may click on any one of the channel boxes to toggle plotting of the corresponding signal. An "L" or "U" appears next to the Beacon prompts depending on whether they are locked or unlocked.

5. The Status Box

The status box shows various pieces of environmental and system information. A full screen of system status is selectable under the DISPLAY menu. The abbreviations are as follows:

RH = Relative Humidity
BP = Barometric Pressure
WS = Wind Speed
WD = Wind Direction
CRG = Capacitive Rain Gauge
ORG = Optical Rain Gauge (optional)
TRG = Tipping Bucket Rain Gauge (optional)
OT = Outside Temperature

"NORMAL" will appear next to "System Status" unless one of the system status items moves out of its tolerance range. In this case, "ALARM" appears next to "System Status".

6. The Mini-Spectrum Box

The mini-spectrum box displays the last FFT spectrum requested by the user. Above the plot is displayed either a 20 or 27 indicating the Beacon on which the FFT was taken. Also displayed is the frequency of the carrier and the time that the FFT was taken.

Print Screen

This command will issue a screen dump to the printer. Note that you can also press the Print Screen button on the keyboard. In either case, you must have an HP laser printer or compatible.

Daily Plot

Selecting this command will give you a submenu which allows you to turn automatic daily plot generation on or off, set the time for making the daily plot, and set the number of copies to make. You must have an HP laser printer or compatible to perform the daily plot function.

Daily Plot Options

Click on the Automatic field or press 'A' to toggle automatic daily plot generation. The daily plot will be generated at the 'Time of Day' specified in the input field. Click on the field or press 'T' to change this time. You can also set the number of copies to be printed. A separate plot is generated for 20 and 27 GHz channels.

NOTE: You must have an HP laser printer or compatible to perform the daily plot function.

Display Real Time

Selecting this will exit file-view mode and return you to real-time mode.

Load Source File

This option allows you to enter a data filename to be loaded and displayed. A new path can also be specified here. The default data path is the \ACTS\DATA directory.

Load Data File Menu

Enter a path after the "Path" prompt. Enter a filename after the "Filename" prompt. You may move to either one of these prompts by clicking on the input box or pressing the corresponding hotkey. The program will check to ensure that the path and filename actually do exist. Select "OK" or press ENTER to proceed with the loading. Select "CANCEL" or press ESC to exit without loading. Select "DIRECTORY" or press 'D' to select a data file from the current directory.

Pop Up Directory Menu

From this menu, you may directly choose a file to be loaded. Move through the directory by clicking on "UP" or "DOWN", or pressing PAGE UP or PAGE DOWN. Use the cursor to select the data file or click on the filename with the mouse. If you wish to return to the previous menu, press ESC or click on "CANCEL".

DACS Command

This option will give you a list of DACS commands to perform, as well as allow you to switch to fast sampling.

DACS Command Menu

1. 20 Radiometer Calibration

This command initiates a Radiometer calibration on the 20 GHz system.

2. 27 Radiometer Calibration

This command initiate a Radiometer calibration on the 27 GHz system.

3. Reset System

This command reloads the executable code for the DACS and digital receivers. ACTSVIEW will ask for confirmation before initiating this command.

4. 20 Hz Sampling Rate...

This command will allow you to enter a length of time to sample the data at the 20 Hz rate, as well as allow you to enter a filename for saving the data.

5. Set 20 IF Attenuator

This command allows you to enter a new setting for the 20 GHz IF Attenuator.

6. Set 27 IF Attenuator

This command allows you to enter a new setting for the 27 GHz IF Attenuator.

"Are You Sure?" Message box

Select "YES" to issue the command, or "NO" to cancel it.

20 Hz Sample Rate Menu

Move to the "Length" field and enter a length of time to collect 20 Hz data. Move to the "Filename" field and enter a filename for saving the 20 Hz sample rate file. You can click on the input box or press the appropriate hotkey. Select "OK" to proceed or "CANCEL" to exit without turning 20 Hz sampling on.

Quit

Select this option to exit the ACTSVIEW program and return to DOS.

Set IF Attenuator

Move to the Attenuator field by pressing '2' or by clicking on the input box. Enter a value for the 20 or 27 IF Attenuator. To quit without setting the IF Attenuator, click on CANCEL or press ESC. To accept, click on OK or press Enter. You will be prompted with an "Are You Sure" question before the Attenuator setting is changed.

NOTE: The IF Attenuators are automatically set by the system upon startup and do not need to be changed under normal circumstances. Also, you may get a message upon entering this menu indicating that the IF Attenuator setting is not yet available. This will occur if you have just started ACTSVIEW. You may still enter an IF attenuator value, however.

Display Channels

This option allows you to select which channels you want to be plotted. You can also select the desired channels by clicking on the corresponding box in the plot legend.

Display Channels Menu

Click on the box next to the channel you wish to toggle, or press the appropriate hot key. When you're done, select "OK" with the mouse or press Enter.

Mini Spectrum

This option will allow you to request a spectrum to be displayed in the mini-spectrum box.

20 G Beacon Mini Spectrum

Select this option to display a 1k 20 GHz Beacon spectrum in the mini-spectrum box.

27 G Beacon Mini Spectrum

Select this option to display a 1k 27 GHz Beacon spectrum in the mini-spectrum box.

Save Current Spectrum

Selecting this option will allow you to save the currently displayed spectrum to a file. A window will pop up asking you to enter a filename. Press ESC to abort.

Cancel Spectrum Request

Selecting this option will cancel the current request for a spectrum. You must wait for the spectrum to be transferred before requesting another spectrum, since only one spectrum request can be processed at any given time. ACTSVIEW will notify you when you may request another spectrum.

Full Spectrum

Select this option to switch to the full spectrum screen.

System Status

Select this option to switch to the system status screen.

Grids

Selecting this option will give you a pop up menu from which you can toggle a grid on any one of the three axes.

Grid Pop Up Menu

You can toggle grids for the Beacon, Radiometer, and time axes in this menu. Select the desired grid by clicking in the box next to the grid name or by pressing the hotkey in the grid name.

NOTE: You cannot turn the Radiometer and Beacon axis grids on at the same time since they both use the y axis.

Time Axis Zoom

This option will allow you to choose one of 4 preset axis time lengths or enter your own length for the time axis.

24 Hour Time Axis Zoom

Selecting this will give the time axis a span of twenty-four hours. Note that this option is designed to be used in file-view mode only.

3 Hour Time Axis Zoom

Selecting this will give the time axis a span of three hours.

1 Hour Time Axis Zoom

Selecting this will give the time axis a span of one hour.

8 Minute Time Axis Zoom

Selecting this will give the time axis a span of eight minutes.

Custom Time Axis Zoom

Selecting this will allow you to enter your own time span for the time axis.

Custom Time Axis Zoom Menu

Enter a time span value in the "Maximum" field. You can move to the maximum field by pressing the appropriate hotkey or clicking on the input box. When you are finished, select "OK" to re-scale the axis, or select "CANCEL" to exit without changing the axis. You cannot enter anything above 24 hours.

NOTE: The "Minimum" field is not used in this pop up menu.

Beacon Axis Zoom

This option will allow you to change the minimum and maximum Beacon axis limits.

0 to -40 dB Beacon Axis Zoom

Sets the maximum and minimum Beacon axis limits to 0 and -40 dB, respectively.

0 to -20 dB Beacon Axis Zoom

Sets the maximum and minimum Beacon axis limits to 0 and -20 dB, respectively.

Custom Beacon Axis Zoom

Allows you to enter your own minimum and maximum Beacon axis limits.

Custom Beacon Axis Zoom Menu

Enter a maximum axis value in the "Maximum" field. Enter a minimum axis value in the "Minimum" field. You can move to either of the fields by pressing the appropriate hotkey or clicking on the input box. When you are finished, select "OK" to re-scale the Beacon axis, or select "CANCEL" to exit without changing the axis.

NOTE: The maximum allowable range on the Beacon axis is +20 dB to -50 dB. Under normal operation, a range of +10 dB to -40 dB is sufficient for display of Beacon data. Also, you cannot enter fractional values for the axis limits (e.g. 0.5 dB).

Radiometer Axis Zoom

This option will allow you to change the minimum and maximum Radiometer axis limits.

0 to 10 V Radiometer Axis Zoom

Sets the minimum and maximum Radiometer axis limits to 0 and 10 V, respectively.

0 to 5 V Radiometer Axis Zoom

Sets the minimum and maximum Radiometer axis limits to 0 and 5 V, respectively.

Custom Radiometer Axis Zoom

Allows you to enter your own minimum and maximum Radiometer axis limits.

Custom Radiometer Axis Zoom Menu

Enter a maximum axis value in the "Maximum" field. Enter a minimum axis value in the "Minimum" field. You can move to either of the fields by pressing the appropriate hotkey or clicking on the input box. When you are finished select "OK" to re-scale the Radiometer axis, or select "CANCEL" to exit without changing the axis.

NOTE: The maximum allowable range on the Radiometer axis is -1V to 11 V. Under normal operation, a range of 0 V to 10 V is sufficient for display of Radiometer data. Also, you cannot enter fractional values for the axis limits (e.g. 5.5 V).

Spectrum Screen General Help

This screen displays an FFT spectrum of either the 20 or 27 GHz Beacon signal.

The menu bar contains 2 menu options. The FILE menu option allows you to select general help, print the screen, save or load a spectrum, or return to the main screen. The DISPLAY menu option allows you to request a spectrum or cancel a previous spectrum request.

Print Screen

This command will issue a screen dump to the printer. Note that you can also press the Print Screen button on the keyboard. In either case, you must have an HP laser printer or compatible.

Save Spectrum

Selecting this option will allow you to save the currently displayed spectrum to a file. A window will pop up asking you to enter a filename. Press ESC to abort.

Overwrite Existing File

The file you have selected already exists. You may overwrite it by selecting YES or pressing Enter. To abort saving, select NO or press ESC.

Load Spectrum

Selecting this option will allow you to load a previously-saved spectrum from disk.

Exit

Selecting this will return you to the main screen.

Get 20 G Beacon Spectrum

Selecting this will cause the 20 GHz Beacon spectrum to be displayed.

Get 1k 20 G Spectrum

Select this option to obtain a 1k spectrum of the 20 GHz Beacon signal. Note that some delay will be observed before the spectrum is plotted since it must be transferred from the digital receiver to the computer.

Get 2k 20 G Spectrum

Select this option to obtain a 2k spectrum of the 20 GHz beacon signal. Note that some delay will be observed before the spectrum is plotted since it must be transferred from the digital receiver to the computer.

Get 4k 20 G Spectrum

Select this option to obtain a 4k spectrum of the 20 GHz Beacon signal. Note that some delay will be observed before the spectrum is plotted since it must be transferred from the digital receiver to the computer.

Get 8k 20 G Spectrum

Select this option to obtain a 8k spectrum of the 20 GHz beacon signal. Note that some delay will be observed before the spectrum is plotted since it must be transferred from the digital receiver to the computer. Also, spectra greater than 4k result in at least 30 seconds of lost Beacon data due to limitations in digital receiver storage space.

Get 16k 20 G Spectrum

Select this option to obtain a 16k spectrum of the 20 GHz Beacon signal. Note that some delay will be observed before the spectrum is plotted since it must be transferred from the digital receiver to the computer. Also, spectra greater than 4k result in at least 30 seconds of lost Beacon data due to limitations in digital receiver storage space.

Get 32k 20 G Spectrum

Select this option to obtain a 32k spectrum of the 20 GHz Beacon signal. Note that some delay will be observed before the spectrum is plotted since it must be transferred from the digital receiver to the computer. Also, spectra greater than 4k result in at least 30 seconds of lost Beacon data due to limitations in digital receiver storage space.

Get 27 G Beacon Spectrum

Selecting this will cause the 27 GHz Beacon spectrum to be displayed.

Get 1k 27 G Spectrum

Select this option to obtain a 1k spectrum of the 27 GHz Beacon signal. Note that some delay will be observed before the spectrum is plotted since it must be transferred from the digital receiver to the computer.

Get 2k 27 G Spectrum

Select this option to obtain a 2k spectrum of the 27 GHz Beacon signal. Note that some delay will be observed before the spectrum is plotted since it must be transferred from the digital receiver to the computer.

Get 4k 27 G Spectrum

Select this option to obtain a 4k spectrum of the 27 GHz Beacon signal. Note that some delay will be observed before the spectrum is plotted since it must be transferred from the digital receiver to the computer.

Get 8k 27 G Spectrum

Select this option to obtain a 8k spectrum of the 27 GHz Beacon signal. Note that some delay will be observed before the spectrum is plotted since it must be transferred from the digital receiver to the computer. Also, spectra greater than 4k result in at least 30 seconds of lost Beacon data due to limitations in digital receiver storage space.

Get 16k 27 G Spectrum

Select this option to obtain a 16k spectrum of the 27 GHz Beacon signal. Note that some delay will be observed before the spectrum is plotted since it must be transferred from the digital receiver to the computer. Also, spectra greater than 4k result in at least 30 seconds of lost Beacon data due to limitations in digital receiver storage space.

Get 32k 27 G Spectrum

Select this option to obtain a 32k spectrum of the 27 GHz Beacon signal. Note that some delay will be observed before the spectrum is plotted since it must be transferred from the digital receiver to the computer. Also, spectra greater than 4k result in at least 30 seconds of lost Beacon data due to limitations in digital receiver storage space.

Cancel Spectrum Request

Selecting this option will cancel the current request for a spectrum. You must wait for the spectrum to be transferred before requesting another spectrum, since only one spectrum request can be processed at any given time. ACTSVIEW will notify you when you may request another spectrum.

Spectrum Warning

You have requested a spectrum greater than 4k. This size spectrum will result in at least 30 seconds of lost data due to limitations in receiver storage space. Spectra less than or equal to 4k result in only 5 seconds of lost data. To continue, press Enter. To abort, press ESC.

System Status Screen General Help

This screen illustrates the status of all the analog channel items available from the DACS. It takes at least 60 seconds for a full update of all the information. You can obtain a history plot any of the channels listed on this screen.

The menu bar has two options: the FILE menu, and the DISPLAY menu. The FILE menu item allows you to print the screen or return to the main screen. The DISPLAY menu allows you to make a status history graph of any of the status items on the screen.

Print Screen

This command will issue a screen dump to the printer. Note that you can also press the Print Screen button on the keyboard. In either case, you must have an HP laser printer or compatible.

Exit

Selecting this will return you to the main screen.

Status History Graph

This option allows you to plot any of the status options graphically. You can use this feature to diagnose problems in the system since you can look back in time at any of the system parameters. Up to two items may be plotted at once. If you are in real-time mode, the plot will start at 00:00:00 GMT of the current day and continue to the present time. If you are in file-view mode, the full 24 hours of the file will be plotted.

Status History Plot Item Selection

You may select up to two items to display on the status history plot. Select each item by clicking on the prompt or moving the cursor to the prompt and pressing the space bar. The cursor is displayed in blue when not selected and red when the highlighted item is selected. You may deselect an item in the same manner. When you have finished selecting the items to be plotted, press Enter or click on DONE. Press ESC to exit without plotting.

Status History Graph Screen

This screen displays a history plot of the items you selected from the Status Screen. In real-time mode, the data from 00:00:00 GMT to the present is plotted. In file-view mode, the full 24 hours of the current file are plotted. The menu bar has two options: the FILE menu, and the ZOOM menu. In the FILE menu, you can print

the screen or return to the Status Screen. In the ZOOM menu, you can re-scale either of the y axes.

Print Screen

This command will issue a screen dump to the printer. Note that you can also press the Print Screen button on the keyboard. In either case, you must have an HP laser printer or compatible.

Exit

Select this option to return to the status screen.

Time Axis Zoom

This option will allow you to choose one of 4 preset axis time lengths or enter your own length for the time axis.

24 Hour Time Axis Zoom

Selecting this will give the time axis a span of twenty-four hours. If twenty-four hours are not available, the entire range of available data is displayed.

3 Hour Time Axis Zoom

Selecting this will give the time axis a span of three hours.

1 Hour Time Axis Zoom

Selecting this will give the time axis a span of one hour.

8 Minute Time Axis Zoom

Selecting this will give the time axis a span of eight minutes.

Custom Time Axis Zoom

Selecting this will allow you to enter your own time span for the time axis.

Left y Axis Zoom

This option will allow you to change the axis limits on the left y axis of this graph. You cannot modify those axes which have only two labels (e.g. "ON" and "OFF", "LOCKED" and "UNLOCKED", etc.).

Default Range for Left y Axis

Select this option to re-scale the left y axis to its default settings.

Custom Axis Menu for Left y Axis

Select this option to enter a custom range for the left y axis.

Right y Axis Zoom

This option will allow you to change the axis limits on the right y axis of this graph. You cannot modify those axes which have only two labels (e.g. "ON" and "OFF", "LOCKED" and "UNLOCKED").

Default Range for Right y Axis

Select this option to re-scale the right y axis to its default settings.

Custom Axis Menu for Right y Axis

Select this option to enter a custom range for the right y axis.

Custom History Graph Axis Zoom Menu

Enter a maximum axis value in the "Maximum" field. Enter a minimum axis value in the "Minimum" field. You can move to either of the fields by pressing the appropriate hotkey or clicking on the input box. When you are finished, select "OK" to re-scale the left or right y axis, or select "CANCEL" to exit without changing the axis.

Grids

Selecting this option will give you a pop up menu from which you can toggle a grid on any one of the three axes.

Grid Pop Up Menu

You can toggle grids for the Left y axis, Right y axis, and time axes in this menu. Select the desired grid by clicking in the box next to the grid name or by pressing the hotkey in the grid name.

NOTE: You cannot turn the Left and Right y axis grids on at the same time since they both use the y axis.

Message Box

This pop up box alerts you to an error or problem. Select the OK button or press Enter after you have read the message.

Input Field

Enter the requested item or value. You can delete the previous character by pressing the Backspace key. Press ENTER when you are done or press ESC

to exit.

Daily Plot Interruption

You have temporarily stopped generation of the daily plot. Press 'Y' to stop generation of the plot or 'N' to continue creating the daily plot.

Hot & Cold Load Temperature Window

You have just performed a hot and cold load calibration. You must now enter temperatures for the hot and cold loads, or accept the defaults given. You can move to the desired field by clicking on the appropriate input box or by pressing the corresponding hotkey. Press Enter or select DONE when you are finished.

NOTE: The hot load temperature is given in C for convenience, while the cold load temperature is given in Kelvin. Also, If you have just started the ACTSVIEW program, a hot load default temperature may not be available and will display 0.0 °C.

Appendix B

Check Files

Procedure for Ckfiles5.exe Program

Step #1: Record the RVO data

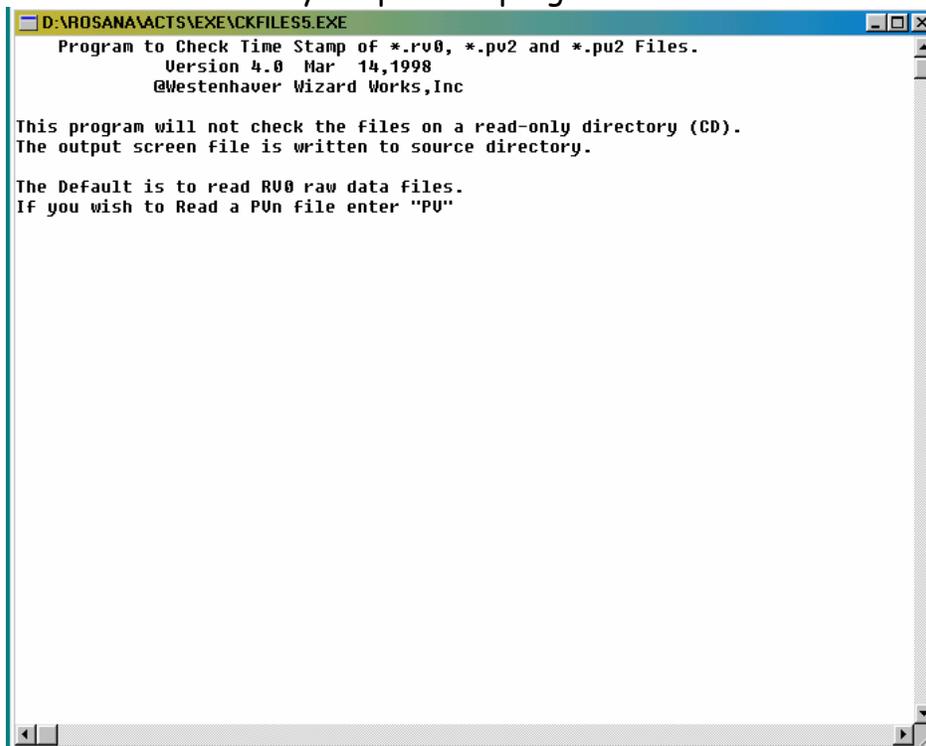
1. Save the RVO files in the computer directory: D:\ACTS\Datain\yyymm

Step #2: Install

1. Install the program in computer directory: D:\ACTS\Exe

Step #3: Execute the program Ckfiles5.exe

- a. When you open the program the screen view is:

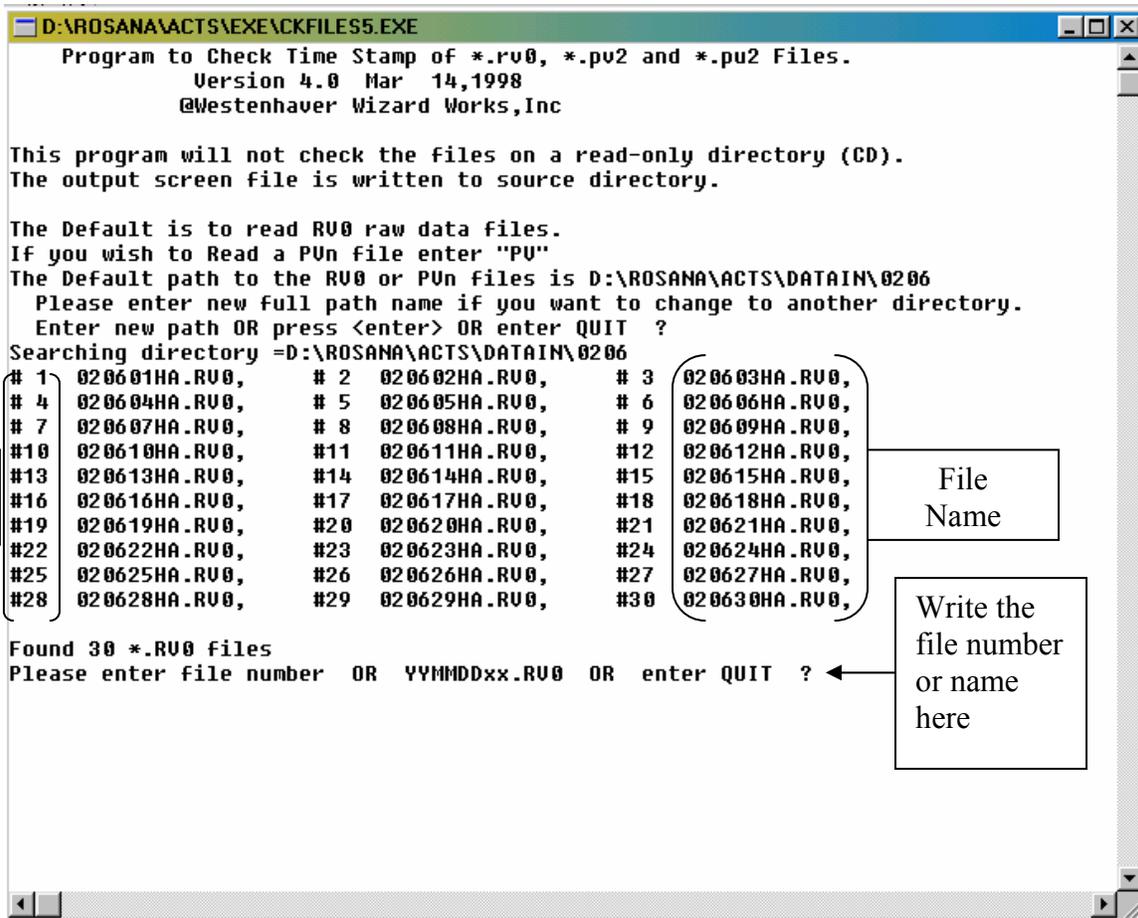


- b. Procedure by Steps?

- i. Option 1: Read rv0 files, press **ENTER**.

Step #4: Processing RVO files.

1. Write the path name D:\ ACTS\Datain\0204.
2. PRESS ENTER.
3. Enter the file number or name (yymmddha.rv0) that you want to process.
 - a. Write the file number or name.



4. Press ENTER.
5. The next option in this program is the number of days that you want to process.

```

D:\ROSANA\ACTS\EXE\CKFILES5.EXE
Program to Check Time Stamp of *.rv0, *.pv2 and *.pu2 Files.
Version 4.0 Mar 14,1998
@Westenhaver Wizard Works,Inc

This program will not check the files on a read-only directory (CD).
The output screen file is written to source directory.

The Default is to read RV0 raw data files.
If you wish to Read a PUn file enter "PU"
The Default path to the RV0 or PUn files is D:\ROSANA\ACTS\DATAIN\0206
Please enter new full path name if you want to change to another directory.
Enter new path OR press <enter> OR enter QUIT ?
Searching directory =D:\ROSANA\ACTS\DATAIN\0206
# 1 020601HA.RV0, # 2 020602HA.RV0, # 3 020603HA.RV0,
# 4 020604HA.RV0, # 5 020605HA.RV0, # 6 020606HA.RV0,
# 7 020607HA.RV0, # 8 020608HA.RV0, # 9 020609HA.RV0,
#10 020610HA.RV0, #11 020611HA.RV0, #12 020612HA.RV0,
#13 020613HA.RV0, #14 020614HA.RV0, #15 020615HA.RV0,
#16 020616HA.RV0, #17 020617HA.RV0, #18 020618HA.RV0,
#19 020619HA.RV0, #20 020620HA.RV0, #21 020621HA.RV0,
#22 020622HA.RV0, #23 020623HA.RV0, #24 020624HA.RV0,
#25 020625HA.RV0, #26 020626HA.RV0, #27 020627HA.RV0,
#28 020628HA.RV0, #29 020629HA.RV0, #30 020630HA.RV0,

Found 30 *.RV0 files
Please enter file number OR YYMMDDxx.RV0 OR enter QUIT ? 1
Select = D:\ROSANA\ACTS\DATAIN\0206\020601HA.RV0

Input = D:\ROSANA\ACTS\DATAIN\0206\020601HA.RV0
Screen = D:\ROSANA\ACTS\DATAIN\0206\0206HA.ck0
Number of days to process or "A" all (in the same subdirectory) ? _
    
```

- a. If you want to process one day, write "1".
 - b. If you want to process more than one day, write the number of days that you want process.
 - c. If you want to process one month write "A".
6. Press **ENTER**.

Step #5: Output File

1. Data is save on yymmha.ck0 files in the D: \ACTS\Datain\yymm
2. The program saves the data in the same folder that you have the RVO data files.
3. The name of the files that you obtain is *ha.ck0 (* mean the name of the file that you process.

Step #6: Understanding the data that the Ckfiles5.exe program has

1. Open the file *ha.ck0
2. If good data is achieved, the data file should look like the following example.

```
Input= D:\ROSANA\ACTS\DATAIN\0205\020521HA.RV0
Begin file at 00:00:00 Record=1
***Funny sec old=0 new=0 delta=0 at 00:00:00 Record=53831
***Funny sec old=0 new=0 delta=0 at 00:00:00 Record=53832
***Funny sec old=0 new=0 delta=0 at 00:00:00 Record=53833
-- Gap found 11828 Days, 54087 seconds or 15:01:27 starting at 00:00:01
Record=53834
-- Gap found 41 seconds or 00:00:41 starting at 15:01:34 Record=53840
End of file at 23:59:59 Seconds Processed=86104
```

Description of file:

- i. Input - where the data is
- ii. Begin file - where the file start reading the time
- iii. Funny sec - the seconds that are not in chronological (sequence) order
- iv. Gap found - the program found a sequence of seconds that not contain data
- v. End of file - where the file finish reading the time

Example of a data file for one month

```
Input= D:\ROSANA\ACTS\DATAIN\0204\020430HA.RV0
Begin file at 00:00:00 Record=1
-- Gap found 1 seconds or 00:00:01 starting at 12:31:06 Record=45067
-- Gap found 2 seconds or 00:00:02 starting at 12:32:00 Record=45120
End of file at 23:59:59 Seconds Processed=86397
```

Totals in seconds= 1457962, Days= 17, Total Gap sec=10838
Total Days Missing=4, Number of days with Funny Sec=0
Run Time= 00:19 Done.

- vi. Input - where the data is
- vii. Begin file - where the file start reading the time
- viii. Gap found - the program found a determined seconds that not contain data
- ix. End of file - where the file finish reading the time
- x. Totals in seconds - are the second that you process.

- xi. Days - are the number of days that you process.
- xii. Total Gap sec - is the total seconds that you don't have data.
- xiii. Total Days Missing - are the days that you don't have data.
- xiv. Number of days with funny - number of days in seconds that are not in chronological order
- xv. Run Time - the second that the program use for process data

Appendix C

Example Log File

LOG0204.xls

Rain Raw Data for April 2002					
Day	# Intervals	Fade Time (min)	Time of Fading % Time	Clear Sky % Time	Observations Anomalies
04/01/2002	0	0	0.000	0.000	No Data Available
04/02/2002	0	0	0.000	0.000	No Data Available
04/03/2002	0	0	0.000	0.000	No Data Available
04/04/2002	0	0	0.000	0.000	No Data Available
04/05/2002	0	0	0.000	0.000	No Data Available
04/06/2002	0	0	0.000	0.000	No Data Available
04/07/2002	0	0	0.000	0.000	No Data Available
04/08/2002	0	0	0.000	0.000	No Data Available
04/09/2002	0	0	0.000	0.000	No Data Available
04/10/2002	0	0	0.000	0.000	No Data Available
04/11/2002	0	0	0.000	0.000	No Data Available
04/12/2002	0	0	0.000	0.000	No Data Available
04/13/2002	0	0	0.000	0.000	No Data Available
04/14/2002	0	0	0.000	0.000	No Data Available

04/15/2002	0	0	0.000	0.000	No Data Available
04/16/2002	0	0	0.000	0.000	No Data Available
04/17/2002	0	0	0.000	0.000	No Data Available
04/18/2002	0	0	0.000	0.000	No Data Available
04/19/2002	6	432	30.000	70.000	Data Collection Started Faded Normal
04/20/2002	10	720	50.000	50.000	Faded-Rainy Normal
04/21/2002	11	792	55.000	45.000	Faded-Rainy Normal
04/22/2002	0	0	0.000	100.000	Clear Cross single point drop Normal
04/23/2002	0	0	0.000	100.000	Clear Co single point drop Normal
04/24/2002	5	360	25.000	75.000	Clear Normal
04/25/2002	3	216	15.000	85.000	Clear Normal
04/26/2002	4	288	20.000	80.000	Faded-Rainny Normal
04/27/2002	6	432	30.000	70.000	Faded-Rainny Normal
04/28/2002	4	288	20.000	80.000	Faded-Rainny Normal
04/29/2002	6	432	30.000	70.000	Clear Rad single drop Normal
04/30/2002	4	288	20.000	80.000	Clear Normal