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1.0 PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) outlines collection of optical visibility monitoring data from sites operated according to IMPROVE Protocol. Optical monitoring sites include those equipped with an Optec LPV transmissometer and/or Optec NGN nephelometer.

The IMPROVE Program has partitioned visibility-related characteristics and measurements into three groups: optical, scene, and aerosol. This SOP pertains to the optical group and encompasses the following:

- Optical properties pertaining to the ability of the atmosphere to scatter or absorb light passing through it
- Physical properties of the atmosphere described by the atmospheric extinction coefficient (b_{ext}), absorption coefficient (b_{abs}), scattering coefficient (b_{scat}), and scattering phase function, an angular dependence of the scattering
- Optical characteristics integrating the effects of atmospheric aerosols and gases
- Optical extinction measurements made with transmissometers
- Optical scattering measurements made with nephelometers

Data are generally logged on-site by one of four data logging approaches:

- Satellite data collection platforms (DCPs) (Handar 540/570 or Synergetics)
- Campbell Scientific 21XL dataloggers
- Telephone modems
- Primeline strip chart recorders

This SOP serves as a guide to assure high quality data collection from transmissometer and nephelometer stations operated according to IMPROVE Protocol by:

- Assuring complete, error-free data downloads from Wallops Island or directly from the individual stations via telephone modem.
- Assuring complete, error-free data downloads from sites with Campbell Scientific data storage modules.
- Reducing data from strip chart recorders at transmissometer sites.
- Processing data to reformat raw, downloaded data to Level-A validation.
- Reviewing data and examining error files for details regarding monitoring system performance, datalogger problems, or data acquisition problems.

Because most stations are remote, daily data review is critical to the identification and resolution of field problems.

At sites with a DCP or Campbell Scientific datalogger and telephone modem, data are collected daily. At sites with a Campbell Scientific datalogger and storage module, or at sites where back-up strip chart recorders must be used, data are collected at approximately two-week intervals.

Separate technical instructions (TIs) are developed for the following cases:

- TI 4300-4000 *Data Collection via DCP (IMPROVE Protocol)*
- TI 4300-4002 *Nephelometer Data Collection via Telephone Modem (IMPROVE Protocol)*
- TI 4300-4004 *Nephelometer Data Compilation and Review of DCP-Collected Data (IMPROVE Protocol)*
- TI 4300-4006 *Nephelometer Data Collection via Campbell Scientific Data Storage Module (IMPROVE Protocol)*
- TI 4300-4023 *Transmissometer Daily Compilation and Review of DCP-Collected Data (IMPROVE Protocol)*
- TI 4300-4025 *Transmissometer Data Collection via Strip Chart Recorder*

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Review data collection procedures with the data coordinator to identify and correct problems.
- Review editing of instrument constants files with the data coordinator.
- Coordinate with the NESDIS for allocation of DCP assignments.

2.2 DATA COORDINATOR

The data coordinator shall:

- Update all constants files pertaining to data collection and review with the project manager.
- Set up and initiate the automatic data collection program(s).
- Check the status of the automatic data collection and review data daily to assure the integrity of the monitoring systems and to achieve complete, error-free data collection.
- Perform periodic data collection via data storage module or strip chart reduction for sites without DCP or modem communication.

- Provide technical support to the site operator via telephone.
- Enter any information relating to the collection of the data and operation of the specific monitoring system into the site-specific Quality Assurance Database.
- Review Level-A files with the project manager to identify instrument problems.
- Ship supplies, tools, and replacement instrumentation to the site operator.
- Digitize and convert strip chart recorder data into transmissometer format.

2.3 FIELD SPECIALIST

The field specialist shall:

- Train the site operator in strip chart recorder operation and maintenance.
- Provide technical support to the site operator via telephone.

2.4 SITE OPERATOR

The site operator shall:

- Operate and maintain strip chart recorders.
- Document strip chart recorder operation.
- Report instrument collection inconsistencies to the data coordinator or field specialist.

3.0 REQUIRED EQUIPMENT AND MATERIALS

All data collection occurs on IBM-PC compatible systems. Refer to the individual TIs for the monitoring system-specific computer system requirements. Required computer system components are as follows:

- IBM-PC compatible 386/486 computer system with VGA and 80 megabyte hard disk
- Internal or external Hayes compatible modem configured for COM port #2
- Microsoft Windows 3.0/3.1
- Software for collection DCP data via Wallops Island
- Software for processing of optical data collected via DCP
- Software for telephone modem collection
- Campbell Scientific software for processing optical data:
 - TELCOM Version 1.0 or later

- SPLIT Version 1.0 or later
- SMCOM Version 1.0 or later
- TERM Version 1.0 or later
- Campbell Scientific SC532 storage module interface
- NGN_PULL software Version 3.0 or later (ARS)
- Jandel Scientific Sigma Scan software for digitizing strip charts
- Jandel Scientific digitizing table

Information on the Campbell Scientific software is detailed in the *Campbell Scientific PC208 Datalogger Support Software Instruction Manual*.

4.0 METHODS

This section includes two (2) major subsections:

- 4.1 Optical Monitoring Station Configurations
- 4.2 Collection of Optical Monitoring Data

These subsections describe the station configurations and data collection methods for each configuration. Collection of optical monitoring data is dependent on the configuration of individual sites. Transmissometer and nephelometer sites are generally configured differently.

4.1 OPTICAL MONITORING STATION CONFIGURATIONS

Optical monitoring stations are configured based on the following:

- Transmissometer stations are generally configured with a DCP and strip chart recorder.
- Nephelometer stations are generally configured with a Campbell Scientific datalogger, telephone modem, storage module, or optionally, a DCP.

4.1.1 Transmissometer Stations

Transmissometers measure the ability of the atmosphere to transmit light. These measured light transmission properties can be represented in terms of the atmospheric extinction coefficient (b_{ext}).

IMPROVE transmissometer sites generally include:

- A transmitter station with shelter, transmitter telescope, transmitter control box, and battery-backed power supply.
- A receiver station with shelter, receiver telescope, receiver computer, battery-backed power supply.

- A data collection platform (DCP).
- An optional strip chart recorder.
- A collocated air temperature and relative humidity sensor (naturally aspirated).
- A solar powered operation (at some sites).

The following data are collected via DCP from transmissometer sites operated according to IMPROVE Protocol:

- Ten-minute average raw transmissometer transmission values that are later converted to atmospheric extinction coefficient.
- Standard deviation of the 10 one-minute raw transmission values that make up the 10-minute average transmission value.
- Hourly, single reading ambient air temperature and relative humidity.

Strip charts serve as the backup logger at transmissometer sites. Strip charts are only used in the event of DCP failure. The strip chart recorder from transmissometer sites operated according to IMPROVE Protocol collects 10-minute average raw transmissometer transmission values that are later converted to atmospheric extinction coefficient.

4.1.2 Nephelometer Stations

Nephelometers measure the ability of the atmosphere to scatter light. These measured light scattering properties can be represented in terms of the atmospheric scattering coefficient (b_{scat}).

IMPROVE nephelometer sites generally include:

- An NGN-2 nephelometer mounted on a three-meter tower along with datalogger and power supply support system.
- A Campbell Scientific 21XL datalogger.
- A Campbell Scientific storage module.
- An optional telephone modem.
- An optional DCP.
- A collocated air temperature and relative humidity sensor (force aspirated).
- A solar powered operation (at some sites).

The following data are collected via telephone modem and storage module from nephelometer sites operated according to IMPROVE protocol:

- Five-minute nephelometer serial data stream

- Five-minute nephelometer analog channels A1 and A2
- Five-minute ambient air temperature and relative humidity
- Hourly codes summarizing the past hour's operation of the nephelometer and support system.

The following data are collected via DCP from nephelometer sites operated according to IMPROVE Protocol:

- Ten-minute nephelometer analog channels A1 and A2
- Hourly codes summarizing the past hour's operation of the nephelometer and support system.
- Last clean air and span calibrations
- Hourly, single-reading ambient air temperature and relative humidity

4.2 COLLECTION OF OPTICAL MONITORING DATA

The method used to collect optical monitoring data depends on the type of site (transmissometer or nephelometer) and the site-specific configuration (telephone modem, storage module, DCP or strip chart). The following subsections describe data collection procedures for the above listed station configurations.

4.2.1 Collection of Transmissometer Data via DCP

Specific transmissometer data collection procedures are detailed in TI 4300-4000, *Data Collection via DCP (IMPROVE Protocol)*. Collection of transmissometer data via DCP includes:

- Updating the current list of sites in the site information file.
- Updating the next time to download data in the Wallops information file.
- Configuring the computer used for automatic data acquisition that downloads the data from Wallops the following day.
- Reviewing all downloaded data file for communication errors or indications of monitoring, logging and data collection problems.
- Initiating data collection programs if automatic data collection failed.
- Executing the STRIP_T program which removes invalid characters and reformats the raw file.
- Executing the APPEND_T program to add the raw data to site-specific Level-A files.
- Resolving identified system inconsistencies according to TI 4110-3300, *Troubleshooting and Emergency Maintenance Procedures for Optec LPV-2 Transmissometer Systems (IMPROVE Protocol)*.

4.2.2 Collection of Transmissometer Data via Strip Chart Recorder

Strip chart recorder data are only used as a backup logging method at sites where DCP system failures occur, and are only used until the malfunctioning DCP can be repaired or replaced. Specific procedures are detailed in TI 4300-4025, *Transmissometer Data Collection via Strip Chart Recorder*. Collection of transmissometer data via strip chart recorder includes the following:

- Obtaining strip charts.
- Digitizing the strip chart trace.
- Scaling the digitized values to yield raw transmission values.
- Transferring raw transmission data from the strip chart file into the site-specific Level-A file.
- Changing the validity code in the site-specific Level-A file to reflect the use of an alternate datalogger.

4.2.3 Collection of Nephelometer Data via Telephone Modem

Collection of nephelometer data via telephone modem from sites configured with a Campbell Scientific datalogger is handled by the NGN_PULL software. Specific procedures are detailed in TI 4300-4002, *Nephelometer Data Collection via Telephone Modem (IMPROVE Protocol)*. Collection of nephelometer data via modem includes the following:

- Updating the current list of sites.
- Updating the next time to download data.
- Initiating the automatic download timer.
- Polling each telephone modem station daily using the Campbell Scientific TELCOM program for all data since the last download.
- Dividing each downloaded data file into three parts using the Campbell Scientific SPLIT program:
 - Nephelometer serial data, ambient temperature, and relative humidity
 - Nephelometer analog data, ambient temperature, and relative humidity
 - Hourly nephelometer status code and support system status code
- Reformatting and appending each site's nephelometer serial data to site-specific Level-A plottable data files.
- Creating a daily nephelometer log file that contains a summary of the performance of all of the sites downloaded.

- Resolving identified system inconsistencies according to TI 4100-3100, *Routine Site Operator Maintenance Procedures for Optec NGN-2 Nephelometer Systems (IMPROVE Protocol)*.

4.2.4 Collection of Nephelometer Data via DCP

Collection of nephelometer data via DCP is handled by the NGN_PULL software. Specific procedures are detailed in TI 4300-4004, *Nephelometer Data Compilation and Review of DCP-Collected Data (IMPROVE Protocol)*. Collection of nephelometer data via DCP includes the following:

- Updating the current list of sites.
- Extracting each site's data from the stripped daily download file into site-specific daily data files compatible with data obtained via telephone modem.
- Dividing each reformatted data file into three parts using the Campbell Scientific SPLIT program:
 - Nephelometer analog data, ambient temperature, and relative humidity
 - Hourly nephelometer status code and support system status code
- Reformatting and appending each site's nephelometer analog data to site-specific Level-A plottable data files.
- Creating a daily nephelometer log file that contains a summary of the performance of all of the sites downloaded.
- Resolving identified system inconsistencies according to TI 4100-3100, *Routine Site Operator Maintenance Procedures for Optec NGN-2 Nephelometer Systems (IMPROVE Protocol)*.

4.2.5 Collection of Nephelometer Data via Campbell Scientific Storage Module

Collection of nephelometer data via Campbell Scientific storage module is handled by the NGN_PULL software. Specific procedures are detailed in TI 4300-4006, *Nephelometer Data Collection via Campbell Scientific Data Storage Module (IMPROVE Protocol)*. Collection of nephelometer data via storage module includes the following:

- Updating the current list of sites.
- Downloading data from the storage module using the Campbell Scientific SMCOM program into site-specific files compatible with data obtained via telephone modem.
- Dividing each downloaded data file into three parts using the Campbell Scientific SPLIT program:
 - Nephelometer serial data, ambient temperature, and relative humidity
 - Nephelometer analog data, ambient temperature, and relative humidity
 - Hourly nephelometer status code and support system status code

- Reformatting and appending each site's nephelometer serial data to site-specific plottable data files.
- Creating a nephelometer log file that contains a summary of the performance of all of the sites downloaded.
- Resolving identified system inconsistencies according to TI 4100-3100.

5.0 REFERENCES

Campbell Scientific, Inc., 1989, Campbell Scientific PC208 Datalogger Support Software Instruction Manual, February.

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1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes the collection of data logged by data collection platforms (DCPs) at transmissometer, nephelometer, and meteorological sites operated according to IMPROVE Protocol. The purpose of this TI is to assure quality data capture and minimize data loss by:

- Monitoring DCP operating parameters, including: transmission time, DCP battery voltage, signal strength, and transmission frequency deviation.
- Identifying and resolving problems affecting transmissometer and nephelometer systems, meteorological sensors, data acquisition and control systems, and support equipment.

This TI, as referenced from Standard Operating Procedure (SOP) 4300, *Collection of Optical Monitoring Data (IMPROVE Protocol)*, specifically describes:

- General information about data collection via DCP and data acquisition via the National Environmental Satellite Data and Information Service (NESDIS) downlink facility in Camp Springs, Maryland, via the satellite downlink station at Wallops Island, Virginia.
- Automatic and manual data acquisition procedures.
- Daily data handling of DCP data.
- Verification of DCP transmission parameters.
- Procedures for updating the NESDIS Platform Description Tables (PDTs).

Troubleshooting procedures for DCPs are described in TI 4110-3300, *Troubleshooting and Emergency Maintenance Procedures for Optec LPV-2 Transmissometer Systems (IMPROVE Protocol)*.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall:

- Coordinate with NESDIS for the allocation of DCP assignments for data collection.
- Review data acquired via DCP to detect and resolve problems.

2.2 DATA COORDINATOR

The data coordinator shall:

- Verify that automatic data collection via DCP is successful and perform manual data collection if unsuccessful.
- Review DCP-transmitted data to determine if the DCP and monitoring equipment are functioning properly.

- Provide technical support to the site operator via telephone to assure high quality data capture from the DCP and monitoring equipment.
- Update NESDIS DCP platform description tables (PDTs) via telephone modem.

3.0 REQUIRED EQUIPMENT AND MATERIALS

Equipment and materials generally required for data collection via DCP includes the following:

- IBM-PC compatible 386/486 computer system with VGA and 80 megabyte hard disk
- Internal or external Hayes compatible modem configured for COM port #2
- Crosstalk-4 PC communications software
- WALLOPS4 PC interface software (ARS)
- User Interface Manual (UIM) for the Data Collection System Automatic Processing System (DAPS), Version 1.1
- Wallops Island log book
- Julian calendar
- Plain ASCII text editor such as WordStar

4.0 METHODS

This section includes six (6) major subsections:

- 4.1 General Information
- 4.2 Automatic Data Collection
- 4.3 Manual Data Collection
- 4.4 DCP Transmission Quality Check
- 4.5 Daily DCP Data Handling
- 4.6 Updating NESDIS Platform Description Tables (PDTs)

4.1 GENERAL INFORMATION

Data logged on data collection platforms (DCPs) are processed by several entities before being available for downloading via modem. Monitoring stations with DCPs undergo the following data downloading sequence:

- The DCP logs transmissometer, nephelometer, and/or meteorological data at pre-programmed intervals.
- At three-hour intervals, the DCP transmits the past three hours' data and its internal battery voltage to the GOES satellite.

- The GOES satellite retransmits the data to the NOAA/NESDIS downlink facility at Wallops Island, Virginia.
- The data are made available via the dissemination facility at Camp Springs, Maryland.
- The data are downloaded via telephone modem to ARS.

4.1.1 GOES Satellite System

The following general information summarizes how satellite data collection works:

SATELLITE USE Use of the Geostationary Orbiting Earth Satellite (GOES) is free to government agencies. Authorization and operation to use the satellite system is directed by the National Environmental Satellite Data and Information Service (NESDIS), a branch of the National Oceanic and Atmospheric Administration (NOAA).

DCP ASSIGNMENTS NESDIS assigns each DCP a one-minute data transmit time slot every three hours and a unique DCP identification code. Platform Description Tables (PDTs) describe the location and other operational parameters of each DCP. The PDTs must be updated via modem to reflect the status of all operational DCPs.

SATELLITE SYSTEM CAPACITY Relay of data from DCPs to the downlink facility is a minor portion of the satellite's job. Its primary function is to provide weather-related data and images to aid in weather forecasting.

Each satellite is capable of utilizing 233 frequencies for a total capacity of over 12,000 DCPs per hour. The data transmission rate is 100 baud (bits per second). The majority of the DCPs in use throughout the United States help support early warning flood monitoring systems.

4.1.2 Data Collection Platforms (DCPs)

DCPs manufactured by Handar and Synergetics are used at IMPROVE optical monitoring sites. Transmissometer sites are generally configured with Handar DCPs and nephelometer sites are generally configured with Synergetics DCPs. Both types of DCPs have the following features:

- Low power, programmable, microprocessor based system
- Analog sensor inputs
- Real-time clock
- GOES compatible radio transmitter

The dissemination facility makes the following data available via telephone modem a short time after the DCP transmits its data:

- Data logged by the DCP
- Transmission date and time
- DCP signal strength and deviation from the specified frequency
- Quality of the DCP transmission

DCP transmission parameters are used to evaluate the performance of the DCP and to resolve DCP-related problems quickly.

4.2 AUTOMATIC DATA COLLECTION

Automatic data collection via DCP includes the following steps:

- Log onto the ARS_NET2 network at a designated DCP data collection computer.
- Type **LOGIN BATCH**. Enter **OH** for project code and **2** (server number for an IMPROVE2 auto pull job).
- Update the DCP data collection identification file "WALDCP.DAT."
- Check the date and time of the next automatic batch job and change if necessary.
- Start the batch software.
- Verify the success of the data collection.

The following detailed procedures describe automatic data collection of DCP data:

LOG ONTO NETWORK

Log onto ARS_NET2 on the data handling computer using your assigned user name and password.

UPDATE THE "WALDCP.DAT" FILE

The "WALDCP.DAT" file includes DCP and site-specific information required to download data via modem. The file includes:

- Site abbreviation
- DCP identification number
- DCP transmission time
- DCP transmission period

An example "WALDCP.DAT" file is provided as Figure 4-1.

Site|Site_id | Ch.|Time|Interval

ACAD,FA42914E,009E,0227,X3
BADL,FA4315A0,038W,0220,X3
BAND,FA4380C2,038W,0227,X3
BIBE,FA4356AA,038W,0224,X3
BRID,FA43A62E,038W,0229,X3
CANY,FA44F466,014W,0218,X3
CHIR,FA450618,014W,0219,X3
GRBA,FA44E710,014W,0217,X3

Format:

Site Abbrv, DCP Iden, DCP Channel and Satellite, Transmit Time and Interval

Figure 4-1. Example "WALDCP.DAT" DCP Definition File for WALLOPS4 Software.

Update the "WALDCP.DAT" file to include all operational DCPs, using any plain ASCII editor such as WordStar. The WordStar command is **WS F:\USERS\WALLOPS\WALDCP.DAT**.

CHECK THE
BATCH JOB
DATE AND
TIME

The batch software runs the data collection software at a predetermined date and time. The list of programs the batch software is scheduled to run is included in the batch queue. The batch queue may be edited to add or delete scheduled batch jobs.

The following procedures detail how to edit the batch queue:

- To examine the batch queue enter **BATCH #Q**.
- To delete a job in the batch queue enter **BATCH #D @XXXX**, where "XXXX" is the number of the batch job.
- To add a new batch job for DCP data collection enter **F:\USERS\WALLOPS\NEWBATCH HH:MM NN/DD/YY**, where "HH" is the hour, "MM" is the minute, "NN" is the month, "DD" is the day, and "YY" is the year the batch job is next scheduled to run.

START THE
BATCH
SOFTWARE

Start the automatic batch software by entering **LOGIN BATCH**.

The result of a successful batch run is a file with the name "GALYYDDD.DAT" where "YY" is the year and "DDD" is the Julian day.

EXIT THE
BATCH
SOFTWARE

The batch software must be running to perform automatic data collection. To exit the PS-BATCH software enter **X** at the PS BATCH prompt.

4.3 MANUAL DATA COLLECTION

Data may be collected manually via telephone modem from the data dissemination facility as follows:

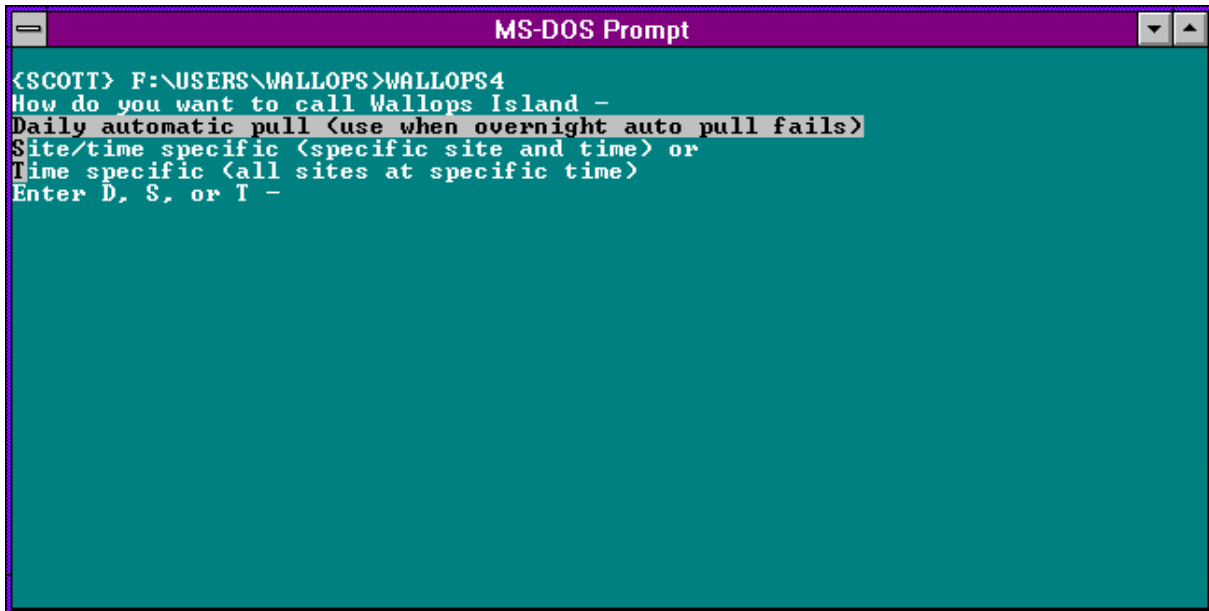
- Log onto the network.
- Run the WALLOPS4 software.
- Enter the site, DCP identification, date, and time at the WALLOPS4 software prompts.

The following procedures detail manual data collection of DCP data:

LOG ONTO NETWORK	Log onto the ARS_NET2 network on the data collection computer using your assigned user name and password.
START THE WALLOPS4 SOFTWARE	<p>The WALLOPS4 software performs all functions of the user interface for manual data collection. To start the WALLOPS4 software, enter WALLOPS4 at the DOS prompt. Choose one of the following available download options (detailed in Figure 4-2):</p> <ul style="list-style-type: none">• S Download one site.• D Download all sites.• T Download all sites at specific beginning and ending time interval.
ENTER THE FILE NAME	If the D or T option is chosen, enter the file name for the manual data pull using the "GALYYDDD.DAT" format where "YY" is the year and "DDD" is the Julian day.
ENTER THE SITE ABBREVIATION	If <S> is chosen, enter the four-character site abbreviation. The site must exist in the "WALDCP.DAT" file. Figure 4-3 shows the WALLOPS4 site entry display.
EXAMINE THE DCP PARAMETERS	Verify that the DCP parameters displayed are correct for DCP data desired. Figure 4-4 shows the parameter verification display.
ENTER THE DATE AND TIME	Enter the date and time of the start of the interval desired. Figure 4-5 shows the date and time entry display. The download will proceed upon entering Y at the prompt. Figure 4-6 shows the display during the download process.

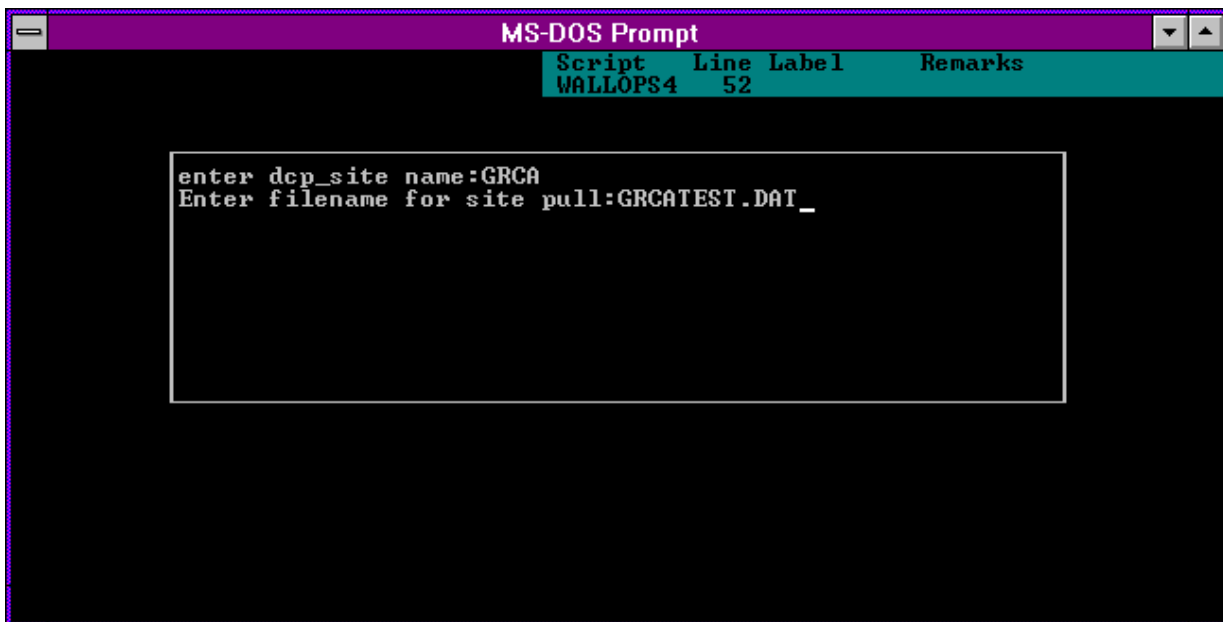
4.4 DCP TRANSMISSION QUALITY CHECK

The data satellite downlink facility analyzes DCP transmissions for transmission strength and quality. The data coordinator should check the downloaded data file for correct DCP operation as follows:



```
<SCOTT> F:\USERS\WALLOPS>WALLOPS4
How do you want to call Wallops Island -
Daily automatic pull <use when overnight auto pull fails>
Site/time specific <specific site and time> or
Time specific <all sites at specific time>
Enter D, S, or T -
```

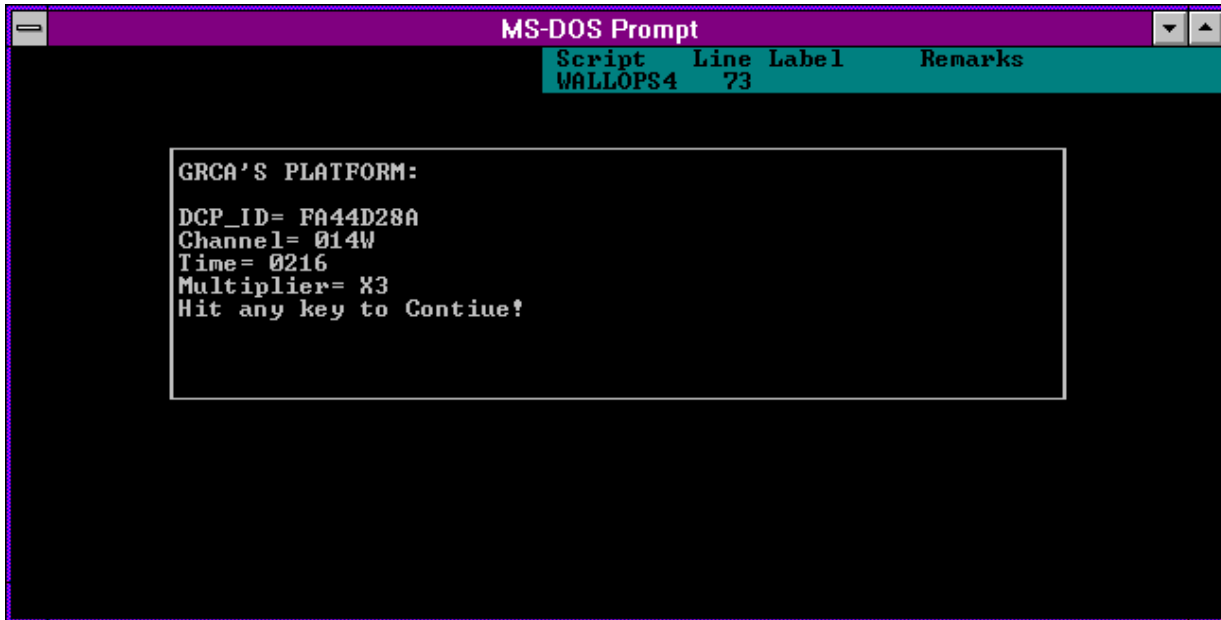
Figure 4-2. Starting WALLOPS4 Software.



```
Script Line Label Remarks
WALLOPS4 52
```

```
enter dcp_site name:GRCA
Enter filename for site pull:GRCATEST.DAT_
```

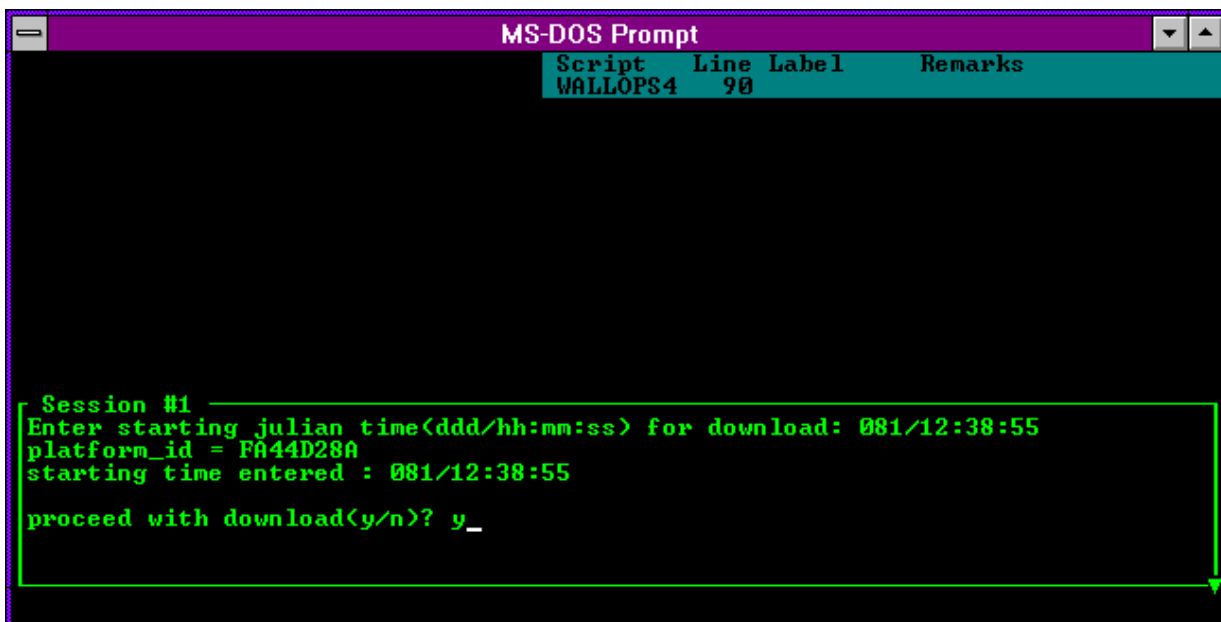
Figure 4-3. Entering Site Abbreviation and File Name in WALLOPS4 Software.



```
MS-DOS Prompt
Script Line Label Remarks
WALLOPS4 73

GRCA'S PLATFORM:
DCP_ID= FA44D28A
Channel= 014W
Time= 0216
Multiplier= X3
Hit any key to Continue!
```

Figure 4-4. Verifying Download Parameters in WALLOPS4 Software.



```
MS-DOS Prompt
Script Line Label Remarks
WALLOPS4 90

Session #1
Enter starting julian time(ddd/hh:mm:ss) for download: 081/12:38:55
platform_id = FA44D28A
starting time entered : 081/12:38:55
proceed with download(y/n)? y_
```

Figure 4-5. Starting the Download in WALLOPS4 Software.

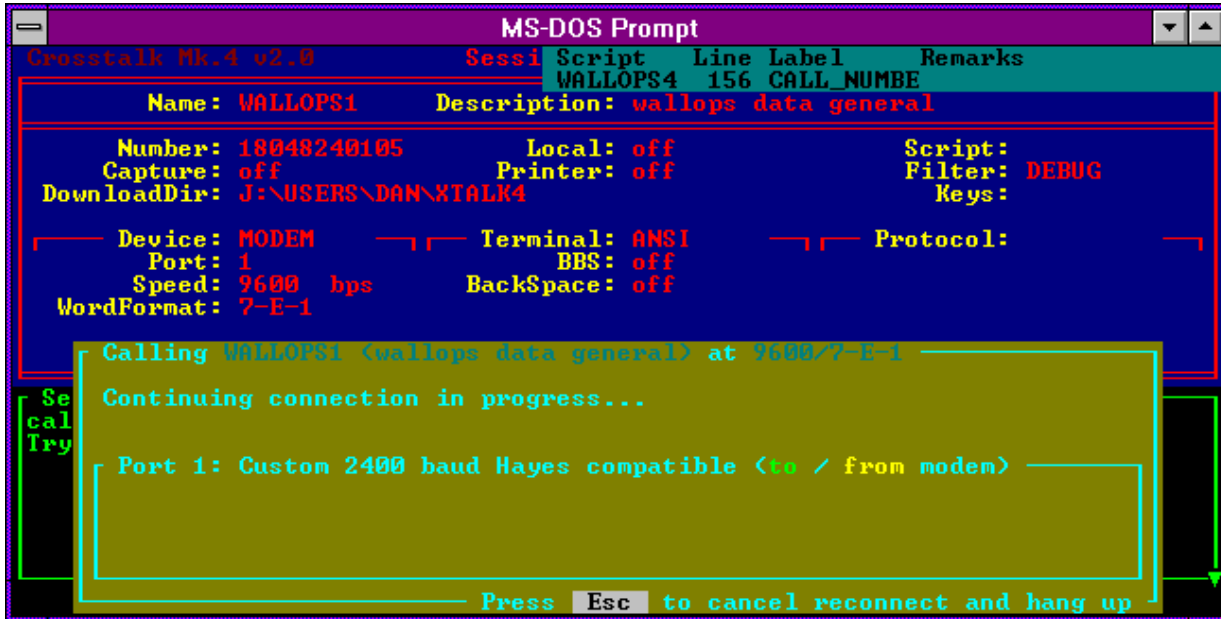


Figure 4-6. Downloading Data Display in WALLOPS4 Software.

- Edit the downloaded data file.
- Check the messages and news information at the beginning of the file.
- Check each DCP data transmission regarding:
 - DCP address.
 - Transmission time (year, Julian day, hour, minute, and second).
 - Failure code.
 - DAMS data quality measurements (signal strength, frequency deviation, modulation index, and modulation quality).
 - DCP transmission channel.
 - Message length.
 - Transmissometer, nephelometer, or meteorological data transmission format.

The following procedures detail the DCP transmission quality check:

EDIT THE
DOWNLOADED
FILE

Edit the downloaded file using any plain ASCII editor such as WordStar. The WordStar command is **WS FILENAME**. "FILENAME" is the downloaded data file, usually of the format "GALYYDDD.DAT," where "YY" is the year, and "DDD" is the Julian date.

CHECK
MESSAGES
AND NEWS

The downloaded data file may contain information about data dissemination processes, solar eclipses, data archiving, etc. This information may provide clues to failed DCP transmissions or poor quality data.

CHECK DCP
TRANSMISSIONS

Each DCP transmission has associated quality assurance information added to the downloaded data file. Figure 4-7 details the information for a Handar DCP and Figure 4-8 details the information for a Synergetics DCP. Figure 4-9 details the ranges of acceptable values for the DCP transmission information. If any parameter is out of range, refer to TI 4110-3300, *Troubleshooting and Emergency Maintenance Procedures for Optec LPV-2 Transmissometer Systems (IMPROVE Protocol)*.

CHECK
DATA
FORMAT

Each type of monitoring station (transmissometer, nephelometer, or meteorological) logs different data and transmits a different data format. Figures 4-7 and 4-8 detail the data transmission formats for transmissometer and nephelometer stations, respectively. If the transmitted data are not in the correct format, refer to TI 4110-3000, *Troubleshooting and Emergency Maintenance Procedures for Optec LPV-2 Transmissometer Systems (IMPROVE Protocol)*, or TI 4100-3100, *Routine Site Operator Maintenance Procedures for NGN-2 Nephelometer Systems (IMPROVE Protocol)*.

<u>Example Data</u>	<u>Row Description</u>
FA42914E93085112729G38+1HN009EFF00143	Identification and quality
0501 001 004 0137 090 000 000 000 00.0 13.8	First hourly data
0495 000 004 0138 088 000 000 000 00.0 13.8	Second hourly data
<u>0496 001 003 0138 086 000 000 000 00.0 13.8</u>	Third hourly data

1	2	3	4	5	6	7	8	9	10	<u>Data column</u>
---	---	---	---	---	---	---	---	---	----	--------------------

<u>Column</u>	<u>Description</u>
1	Raw transmission average (counts)
2	Receiver computer toggle
3	Standard deviation of the raw transmission (counts)
4	Ambient temperature (°F) (+ 100)
5	Ambient relative humidity (%)
6-9	Not used
10	DCP battery voltage (VDC)

Identification and transmission quality:

<u>Characters</u>	<u>Example</u>	<u>Description</u>
1-8	FA42914E	DCP identification
9-10	93	Year of transmission
11-13	085	Julian date of transmission
14-15	11	Hour of transmission
16-17	27	Minute of transmission
18-19	29	Second of transmission
20	G	Failure code
21-22	38	Signal strength
23-24	+1	Modulation frequency deviation from normal
25	H	Modulation quality
26	N	Modulation index
27-29	009	Satellite channel
30	E	Satellite (East or West)
31-32	FF	IFPD (Intermediate Frequency Presence Detector)
33-37	00143	Message length

Figure 4-7. Handar DCP Transmissometer Data Format.

<u>Example Data</u>									<u>Description</u>	
FA40643E93085122318G43-1NN002W4C00432# 1									1716	Identification and quality
# 2	114	173	210	224	383	407	297	302		
# 2	383	140	135	140	125	132	138	128		
# 2	141	155								
# 3	498	498	498	498	498	498	498	498		
# 3	498	498	498	498	498	498	498	498		
# 3	498	498								
# 4	524	423	324							
# 5	50	50	50							
# 6	-1	-1	-1							
# 7	209	209	209							
# 8	1020	1020	1020							
# 9	96	92	102							
#10	960	954	926							
#11	1388									

Data Group

<u>Number</u>	<u>Description</u>
#1	Synergetics operation status
#2	10-minute nephelometer analog A1 readings
#3	10-minute nephelometer analog A2 readings
#4	Nephelometer time when 21X datalogger time is xx:30
#5	Hourly nephelometer code summary
#6	Hourly support code summary
#7	Last clean air calibration (counts) (x10)
#8	Last span calibration (counts) (x10)
#9	Ambient temperature at top of hour (°C) (x10)
#10	Ambient relative humidity at top of hour (%) (x10)
#11	DCP battery voltage (VDC) (x100)

Identification and transmission quality:

<u>Characters</u>	<u>Example</u>	<u>Description</u>
1-8	FA40643E	DCP identification
9-10	93	Year of transmission
11-13	085	Julian date of transmission
14-15	12	Hour of transmission
16-17	23	Minute of transmission
18-19	18	Second of transmission
20	G	Failure code
21-22	43	Signal strength
23-24	-1	Modulation frequency deviation from normal
25	N	Modulation quality
26	N	Modulation index
27-29	002	Satellite channel
30	W	Satellite (East or West)
31-32	4C	IFPD (Intermediate Frequency Presence Detector)
33-37	00432	Message length

Figure 4-8. Synergetics DCP Nephelometer Data Format.

<u>PARAMETER</u>	<u>RANGE</u>	<u>INTERPRETATION</u>
SIGNAL STRENGTH	32 to 57	Signal strength should never exceed 50. Normal strength is 44 to 48. A signal strength less than 43 or greater than 49 indicates a possible malfunction or improper installation. Reliable data can be received with a signal strength as low as 37 if no other signal problems exist.
FREQUENCY	± 0 to $\pm A$	50 Hz increments. Reliable data should be possible between -8 and +8 (-449 to +449 Hz). Frequency drift due to temperature (+200 Hz) and Aging (+400 Hz/year) can cause a platform to drift outside the +500 HZ range very quickly. ± 250 Hz is a safe range for normal operations.
MODULATION INDEX	N,H,L	N is normal. H (High); messages may be truncated or lost due to loss of demodulator lock. Signal strength readings may indicate too low. L (Low); high error rate, missing messages, and signal strength readings may read too high.
MODULATION QUALITY	N,F,P	N is normal. F indicates malfunction or misalignment, error rate between 10^{-4} and 10^{-6} . P indicates malfunction or misalignment, error rate worse than 10^{-4} .

Figure 4-9. DCP Transmission Quality Description.

4.5 DAILY DCP DATA HANDLING

Daily DCP data handling includes automatic removal of invalid characters from the downloaded file and reformatting the downloaded file into a form usable by processing software. Specifically, DCP data handling includes:

- Updating the "SITEINFO" file.
- Running the STRIP_T program to remove invalid characters and reformat the downloaded data file.
- Examining the stripped file to determine the beginning and ending dates and times for the interval of the file.
- Recording the interval in the Wallops Island log book.
- Examining the "ERROR.DAT" file for incomplete transmissions.
- Examining the "MESSAGE.DAT" file for information included in the header of the downloaded data file.

EDIT AND UPDATE THE "SITEINFO" FILE

The site list information file (SITEINFO) includes information for the current transmissometer and nephelometer sites, including associated DCP ID, site abbreviation, GMT time offset to Local Standard Time (LST), and number of lines in the DCP transmission. The information in the "SITEINFO" file is used by the STRIP_T and APPEND_T programs to define which DCP IDs are valid and to which site they are assigned. The "SITEINFO" file is located in the F:\USERS\WALLOPS directory. The "SITEINFO" file must be updated to reflect changes to DCP-related site configurations. The following procedures describe editing of the "SITEINFO" file:

- Edit the "SITEINFO" file using any plain ASCII editor such as WordStar. The WordStar command is **WS F:\USERS\WALLOPS\SITEINFO**.
- The file format for "SITEINFO" is detailed in Figure 4-10.
- Add, delete, or change the lines in the file to reflect the currently operating DCP-equipped stations.
- Update the number of stations in the first line of "SITEINFO" to reflect the number of stations listed in the file.
- Save the "SITEINFO" file. The WordStar command is **ALT F S**.

23

FA42914E,ACADH,4,3,ACADIA,OK,BEXT
FA4315A0,BADLH,7,3,BADLANDS,OK,BEXT
FA4380C2,BANDT,7,3,BANDELIER,OK,BEXT
FA4356AA,BIBEH,6,3,BIGBEND,OK,BEXT
FA43A62E,BRIDH,7,3,BRIDGER,OK,BEXT
FA44220E,BRME0,7,6,BRYCECANYON,OK,NONE
FA44F466,CANYH,7,3,CANYONLANDS,OK,BEXT
FA450618,CHIRH,7,3,CHIRICAHUA,OK,BEXT
FA441794,GLACT,7,3,GLACIER,OK,BEXT
FA44E710,GRBAH,8,3,GREATBASIN,OK,BEXT
FA44D28A,GRCAL,7,3,GRANDCANYON(SOUTHRIM),OK,BEXT
FA43F652,GRCWH,7,3,GRANDCANYON(IN-CANYON),OK,BEXT
FA42F4A8,GRCMM,7,11,GRANDCANYONMET,OK,NONE
FA437046,GUMOH,6,3,GUADALUPE,OK,BEXT
FA4393B4,MEVEH,7,3,MESAVERDE,OK,BEXT
FA436330,PEFOH,7,3,PETRIFIEDFOREST,OK,BEXT
FA43203A,PINNH,8,3,PINNACLES,OK,BEXT
FA44C1FC,ROMOH,7,3,ROCKYMOUNTAIN,OK,BEXT
FA4306D6,SAGOH,8,3,SANGORGONIO,OK,BEXT
FA42C132,SHENH,4,3,SHENANDOAHLONGPATH,OK,BEXT
FA43B558,YELLH,6,3,YELLOWSTONE,OK,BEXT
FA42D244,YOSEH,8,3,YOSEMITE,OK,BEXT
FA40643E,MACAN,4,14,MAMMOTHCAVESNEPH,OK,NONE

Format:

The first line is the number of DCP definitions in the file.

All other lines:

DCP Identification
Site abbreviation and site type
Hourly offset to GMT
Number of lines in each transmission
Site name
Always OK if active; TEST if not active
Always b_{ext} if transmissometer; NONE if nephelometer

Site types:

T Transmissometer sites with Handar AT/RH sensor
H Transmissometer sites with Rotronics AT/RH sensor
N Nephelometer sites
O Bryce Canyon meteorological site

Figure 4-10. Example SITEINFO File for Daily Data Processing.

RUN STRIP_T

The STRIP_T program performs the following functions:

- Strips the downloaded data file of invalid characters.
- Saves the logon and file header information in the "MESSAGE.DAT" file.
- Saves incomplete transmissions in the "ERROR.DAT" file.
- Reformats the downloaded data file and sorts it by transmission date and time (GALYYDDD.TMP file).

The downloaded data file must be run through STRIP_T before daily data processing of transmissometer or nephelometer data can proceed. The STRIP_T program is started by:

- Changing to the F:\USERS\WALLOPS directory.
- Entering **STRIP_T** to start the program.

RECORD START AND END TIMES

The stripped downloaded data file is sorted by transmission data and time. Examine the first and last transmissions in the "GALYYDDD.TMP" file and record them in the Wallops Island logbook.

EXAMINE ERROR FILE

The "ERROR.DAT" file in F:\USERS\WALLOPS contains incomplete transmissions from the downloaded data file. Examine this file for error messages. If error(s) exist, the data file contains incomplete transmissions that must be corrected.

The following procedures describe how to edit the "GALYYDDD.DAT" file that generated an error in the "ERROR.DAT" file:

- Edit the "GALYYDDD.DAT" file using any plain ASCII editor such as WordStar. The WordStar command is **WS F:\USERS\WALLOPS\GALYYDDD.DAT**.
- Each transmissometer data transmission format contains three lines of data following the header line as follows:

```
FA44D28A93110141630G51-1NN014WFF00143  
0473 000 004 0136 026 000 000 000 00.0 12.8  
0470 001 005 0135 026 000 000 000 00.0 12.8  
0470 000 003 0139 023 000 000 000 00.0 13.1
```

- Add, delete, or change the lines in the data file so that the transmission format is complete. For example: the error is "FA44D28A93110011630, 2 lines does not = 3 lines," and the transmission in the "GALYYDDD.DAT" file looks like -

FA44D28A93110141630G51-1NN014WFF00143
0473 000 004 0136 026 000 000 000 00.0 12.8
0470 001 005 0135 026 000 000 000 00.0 12.8

Add a third line with 999's so the transmission looks like -

FA44D28A93110141630G51-1NN014WFF00143
0473 000 004 0136 026 000 000 000 00.0 12.8
0470 001 005 0135 026 000 000 000 00.0 12.8
9999 999 999 9999 999 999 999 999 9999 9999

Once errors are corrected, run STRIP_T again and reexamine the "ERROR.DAT" file. Do not proceed to the next processing stage until the "ERROR.DAT" file is free of errors. (See TI 4300-4023, *Transmissometer Daily Compilation and Review of DCP-Collected Data (IMPROVE Protocol)* or TI 4300-4004, *Nephelometer Data Compilation and Review of DCP-Collected Data (IMPROVE Protocol)*).

EXAMINE
MESSAGE
FILE

The "MESSAGE.DAT" file in F:\USERS\WALLOPS contains the header information from the downloaded data file. Print out a copy of "MESSAGE.DAT" daily and file the printout in the message archive file.

PERFORM
DAILY DATA
COMPILATION
AND REVIEW

Once the primary data collection is complete, the next phase in daily data handling includes compilation and review of the collected data. Refer to the following data-specific TIs:

TI 4300-4004: *Nephelometer Data Compilation and Review of DCP-Collected Data (IMPROVE Protocol)*

TI 4300-4023: *Transmissometer Daily Compilation and Review of DCP-Collected Data (IMPROVE Protocol)*

4.6 UPDATING NESDIS PLATFORM DESCRIPTION TABLES (PDTs)

The NESDIS program information tables must be updated when any change in an operational parameter (location, etc.) occurs. Figure 4-11 details the contents of a typical PDT. Refer to the User Interface Manual (UIM) for the Data Collection System Automatic Processing System (DAPS), Version 1.1 for details on updating PDTs.

5.0 REFERENCES

Integral Systems, Inc., 1990, User Interface Manual (UIM) for the Data Collection System Automatic Processing System (DAPS), Version 1.1, September.

<u>PARAMETER</u>	<u>DESCRIPTION</u>
OWNER_ID	Owner user ID (must be in UDT)
PRIME_TYPE	Primary Type: S: Self-timed I: Interrogate R: Random D: Dual
PRIME_CHAN	Primary CHANNEL: 1 - 266 (must be in CDT)
PRIME_SCD	Primary GOES spacecraft assigned: E: East, W: West
SECND_ADDR	Secondary address or Null
SECND_TYPE	Secondary type: R: Random I: Interrogate, or Null Note: Valid PRIME/SECND types are S/I, S/R
SECND_CHAN	Secondary channel: 0 - 266 (must be in CDT if > 0)
SECND_SCID	Secondary GOES spacecraft assigned: E: East, W: West, or Null
TRIGGER_MODE	Trigger mode: S: Special, T: Test, or Null Note: if not Null then: (a) PRIME_TYPE must be R (b) SECND_ADDR (trigger id) required FIRST_XMT Time of first interrogation for I type platforms in HMMSS format
XMT_PERIOD	Time period between transmissions (S/D)
	Time period between interrogations (I) in HHMMSS format
XMT_WINDOW	Maximum transmission window size in MMSS (S/D)
XMT_RATE	Data transmission rate in bps (100/300/1200)
MAX_RETRIES	Maximum number of interrogation retries (I)
DATA_FORMAT	DCPRS data format: A: ASCII, B: Binary
PRIME_PREAMBLE	DCPRS preamble type: L: Long, S: Short
SECND_PREAMBLE	DCPRS preamble type: L: Long, S: Short, or Null
LOC_CODE	Three-character location code
LOC_REGION	Location category: A: United States, B: Canada, C: South America, O: Other
LOC_NAME	Location name (31 characters)
LATITUDE	Latitude in DDMMSS
LONGITUDE	Longitude in DDMMSS
MIN_ELEVATION	Minimum elevation angle of platform (in DD)
CATEGORY	Platform category: Fixed: Fixed-buoy, D: Drifting-buoy A: Aircraft, S: Ship B: Balloon, L: Land-based O: Other

Figure 4-11. DCP Platform Description Table (PDT) Description.

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	NEPHELOMETER DATA COLLECTION VIA TELEPHONE MODEM (IMPROVE PROTOCOL)
TYPE	TECHNICAL INSTRUCTION
NUMBER	4300-4002
DATE	MARCH 1993

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
ORIGINATOR	D. Scott Cismoski	
PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
1.0	File format change	January 1995	
1.1	Minor text modifications.	June 1996	

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1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes the steps of daily telephone modem collection, compilation, and review of nephelometer and meteorological data from an Optec NGN-2 ambient nephelometer station operated according to IMPROVE Protocol. The primary purpose of daily data collection via telephone modem is to assure quality data capture and minimize data loss by:

- Calling the Campbell 21X datalogger at each nephelometer/meteorological station via telephone modem and downloading the past day's data into site-specific daily files.
- Processing the raw data into Level-A validated form.
- Reviewing the daily nephelometer information file to verify nephelometer system operation or identify problems.

This TI, as referenced from Standard Operating Procedure (SOP) 4300, *Collection of Optical Monitoring Data (IMPROVE Protocol)*, is a guide for using the NGN_PULL nephelometer data processing software under Microsoft Windows to:

- Setup and update nephelometer station configurations.
- Perform automatic and manual data downloads.
- Perform automatic and manual daily data processing.
- Review daily nephelometer error files.

This TI assumes the operator has basic knowledge of IBM-PC compatible personal computers, the MS-DOS operating system, and Microsoft Windows 3.1.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall review daily error files and plots with the data coordinator to identify and correct problems.

2.2 DATA COORDINATOR

The data coordinator shall:

- Check the status of the automatic data collection daily to assure complete and error-free data collection.
- Verify correct operation of the automatic data processing.
- Review daily nephelometer information files with the project manager to identify and correct data collection problems.
- Enter any information relating to the collection of the data and operation of the nephelometer station into the site-specific Quality Assurance Database.

3.0 REQUIRED EQUIPMENT AND MATERIALS

The nephelometer data collection system consists of the following hardware and software:

- IBM-PC compatible 386/486 computer system with VGA and 80 megabyte hard disk
- Internal or external Hayes compatible modem configured for COM port #2
- Microsoft Windows 3.0/3.1
- Campbell Scientific software:
 - TELCOM Version 1.0 or later
 - SMCOM Version 1.0 or later
 - TERM Version 1.0 or later
 - SPLIT Version 1.0 or later
- NGN_PULL software Version 3.0 or later (ARS software)

Information regarding Campbell Scientific software is detailed in the *Campbell Scientific PC208 DataLogger Support Software Instruction Manual*.

4.0 METHODS

This section includes three (3) major subsections:

- 4.1 Automatic Data Collection and Handling
- 4.2 Manual Data Collection and Handling
- 4.3 File Names and Contents

4.1 AUTOMATIC DATA COLLECTION AND HANDLING

Automatic data collection and processing is handled by NGN_PULL software which performs the following tasks:

- Polls each telephone modem station daily using the Campbell Scientific TELCOM program and retrieves data since the last download into site-specific daily files.
- Processes each site-specific daily file into instrument-specific parts:
 - 5-minute nephelometer, ambient temperature, and relative humidity
 - Hourly average wind speed, wind direction, temperature, and relative humidity
 - Hourly nephelometer status code and support system status code summaries
- Reformats, validates, and appends nephelometer data to seasonal site-specific Level-A data files.
- Reformats, validates, and appends meteorological data to seasonal site-specific files.
- Creates a daily nephelometer log file that contains a summary of the performance of all of the downloaded sites.

General automatic data collection and handling procedures include:

- Running the NGN_PULL software in Microsoft Windows 3.1.
- Updating the nephelometer station list to include all currently operating nephelometer stations to poll for data.
- Setting the time automatic data collection and processing is to begin.
- Starting the automatic data collection timer.
- Examining the daily nephelometer error files upon completion of daily downloading and processing, for information concerning the operation of the nephelometer stations.
- Examining and/or plotting the data in the Level-A files in accordance with TI 4400-5010, *Nephelometer Data Reduction and Validation (IMPROVE Protocol)*.
- Performing manual data collection and processing, if automatic data collection or processing failed.

The following procedures detail the steps of nephelometer daily compilation and review:

LOGON TO
NETWORK

Logon to the nephelometer data handling computer using your assigned user name and password.

RUNNING THE
NGN-PULL
PROGRAM

The NGN_PULL program runs in Microsoft Windows and coordinates both automatic and manual data downloading and processing functions. The program is run by double-clicking on the NGN-PULL icon in Windows, or selecting **FILE, RUN, NGN_PULL.EXE** from the program manager. Refer to the *Microsoft Windows 3.1 User's Guide* for details on running Windows programs. Figure 4-1 presents the screen display of the NGN_PULL program.

ADDING TO OR
EDITING THE
STATION LIST

The station list includes the nephelometer stations and station types that are currently operating. The list includes:

- Site abbreviation
- Site type (telephone modem or DCP)
- Days of the week to call
- ARS project code
- First and last date and time of last downloaded file
- Plot title
- DCP station ID and GMT time offset (if applicable)

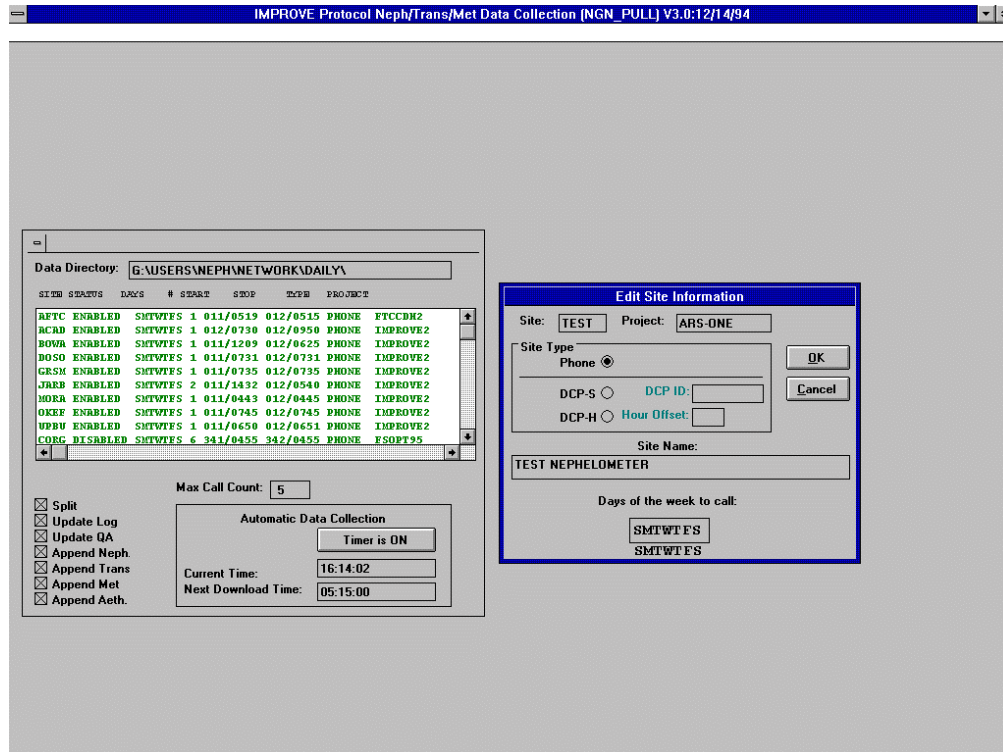


Figure 4-1. NGN_PULL Windows Program Screen.

The list may be edited by clicking **SITE** from the menu bar and then selecting **EDIT**, **ADD**, or **DELETE**. A site can be disabled (from calling) or enabled (to call) by clicking **SITE** from the menu bar and selecting **DISABLE** or **ENABLE**.

The telephone-type stations have a corresponding station definition file (XXXX.STN) that the TELCOM program uses for datalogger and modem-specific parameters (including the telephone number). The following procedures are used to add, edit, or remove a site from the station list:

To add a new site:

- Click **SITE** from the menu bar and select **ADD**.
- Complete the fields in the "Edit Site Information" dialog box.
- Click **OK**.

To edit an existing site:

- Highlight the site to edit in the site list box.
- Click **SITE** from the menu bar.
- Click **EDIT**.
- Complete the "Edit Site Information" dialog box.
- Click **OK**.
- Set the following parameters in the station definition file (see Figure 4-2):
 - Type of datalogger (21X)
 - Type of data file
 - Modem type, COM port, and baud rate
 - Telephone number

To remove a site:

- Highlight the site to remove in the site list box.
- Click **SITE** from the menu bar.
- Click **DELETE**.

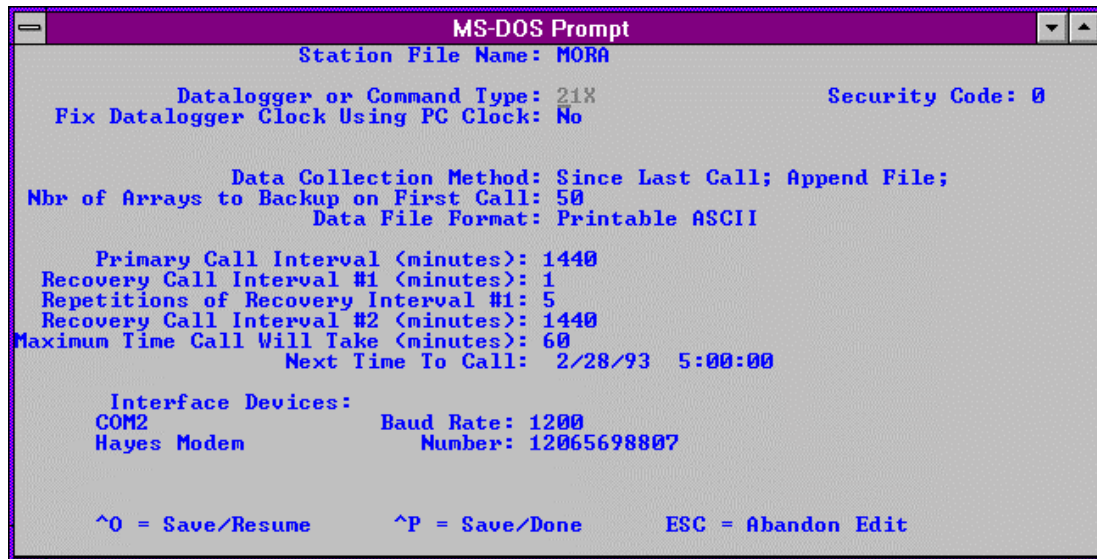


Figure 4-2. Editing a Station Definition File From NGN_PULL Using the TELCOM Program.

SETTING THE CALL (DATA DOWNLOAD) TIME

The call time is the time the first telephone modem station on the station list is called for data. The stations are called in the order of the station list. The call time may be changed as follows (see Figure 4-1):

- Click **OTHER** on the menu bar. Click **SET CALL/PROCESS TIME**.
- Enter the new call time in the dialog box that appears on the screen. The time format is HH:MM:SS (hour:minute:second).
- Click **OK** to save the time or **CANCEL** to ignore the change.

STARTING THE AUTOMATIC DATA COLLECTION TIMER

When the automatic data collection timer is running, the system time is compared to the call time and process time at 5-second intervals. When the times match, the call or process steps are started. When the timer is running, the system time is displayed on the screen. The timer may be started or stopped as follows (see Figure 4-1):

- Click the **TIMER IS ON** button to start the timer. The button will change to "TIMER IS OFF" and the current time will be displayed next to the button.

EXAMINE THE
DAILY
NEPHELOMETER
ERROR FILES

- Click the **TIMER IS OFF** button to stop the timer. The button will change to "TIMER IS ON" and the current time will disappear from the box next to the button.

Daily nephelometer error files contain details about the success of the datalogger interrogation and operation of the nephelometer station. This information is contained in the downloaded data file and is extracted automatically during daily data processing. The following error files are created:

- **NGNYYJJJ.ERR**
An error file created by TELECOM software when calling the site modem. The file contains the list of problems encountered while connecting with the on-site datalogger.
- **NGNYYJJJ.INF**
A nephelometer system error file that includes non-ambient nephelometer occurrences (calibrations, rain, etc.) and problems with AC and DC power levels.
- **NGNYYJJJ.PER**
A processing error file that includes processing problems of the raw data file.

Note: "YY" is the year and "JJJ" is the Julian date in these files.

The error files can be viewed as follows:

- Click **ERRORS** on the menu bar.
- Click one of the error files to view:
 - View **TELCOM** Errors
 - View **NEPHELOMETER** Errors
 - View **PROCESSING** Errors
- The error file will be loaded into Microsoft Notepad for viewing.

Figure 4-3 presents examples of the three types of error files. The data coordinator will review the daily error files and note problems requiring corrective actions. If required, the corrective actions highlighted in Table 4-1 will be implemented by the data coordinator as described in TI 4100-3100, *Routine Site Operator Maintenance Procedures for Optec NGN-2 Nephelometer Systems (IMPROVE Protocol)*.

Example Telcom Error File

```
TELCOM error at SHRO: 01/13/95 06:02:33 Smartmodem did not detect carrier!  
TELCOM error at SHRO: 01/13/95 06:03:24 Smartmodem did not detect carrier!  
TELCOM error at SHRO: 01/13/95 06:04:14 Smartmodem did not detect carrier!  
TELCOM error at SHRO: 01/13/95 06:05:05 Smartmodem did not detect carrier!  
TELCOM error at SHRO: 01/13/95 06:05:56 Smartmodem did not detect carrier!  
TELCOM error at SHRO: 01/13/95 06:06:47 Smartmodem did not detect carrier!  
TELCOM error at SEWZ: 01/13/95 06:30:20 Warning: 1 retries were logged.  
TELCOM error at JUNZ: 01/13/95 06:39:22 Smartmodem did not detect carrier!
```

Example Nephelometer System Error File

```
=====  
==                ACAD                ==  
=====  
SERIAL DATA: 1995  12 1447  3  49 2039  48 10  2.02  1 1433  49.42 2991  .748  95.6  
SERIAL DATA: 1995  12 1448  5 152  .92  48 10  2.02  1 1433  49.42 4986  .817  95.5  
RAIN EVENT      ( 1050 )  DATE: 1995  12 TIME: 1500  
ZERO            ( 1150 )  DATE: 1995  12 TIME: 1600  
BLUE EARTH RESET ( 2000 )  DATE: 1995  12 TIME: 2000  
  
=====  
==                BOWA                ==  
=====  
SERIAL DATA: 1995  12  700  2 129 3006  85 10 -2.31  1  647  87.3 1998 -4.222  92.2  
ZERO          ( 150 )  DATE: 1995  12 TIME:  800  
SERIAL DATA: 1995  12 1320  2 137 3023  90 10 -1.11  1 1307  92.1 1998 -2.71  93  
ZERO          ( 150 )  DATE: 1995  12 TIME: 1400  
SERIAL DATA: 1995  12 1940  2 161 3017 106 10 -2.11  1 1927 107.2 1998 -3.741  92.7  
ZERO          ( 150 )  DATE: 1995  12 TIME: 2000  
SERIAL DATA: 1995  13  25  5 217  .92 187  2 -4.48  1  20 187 4992 -5.73  91.2
```

Example Processing Error File

```
TRANSGETSITE: No lamp file! F:\USERS\SITE.CON\MACA_L  
TRANSGETSITE: No lamp file! F:\USERS\SITE.CON\LOPE_L  
TRANSGETSITE: No lamp file! F:\USERS\SITE.CON\SEWZ_L  
VORZ: Suspect analog A2=-294.3) JD= 12 TIME= 1605  
VORZ: Suspect analog A2=-128.3) JD= 12 TIME= 1610  
TRANSGETSITE: No lamp file! F:\USERS\SITE.CON\VORZ_L  
TRANSGETSITE: No lamp file! F:\USERS\SITE.CON\VORZ_L
```

Figure 4-3. Example Nephelometer Error Files Generated by NGN_PULL.

Table 4-1
Nephelometer Data Collection
Corrective Actions

Daily Nephelometer Information File			Corrective Action
Status Code	Site Abbry.	Date/Time	
CHOPPER FAILURE	(xxxx)	DATE: 1993 063 TIME: 13:55	Reset nephelometer via phone modem or contact site operator.
RAIN EVENT	(xxxx)	DATE: 1993 063 TIME: 13:55	None required.
LAMP OUT	(xxxx)	DATE: 1993 063 TIME: 13:55	Have site operator change lamp.
SPAN	(xxxx)	DATE: 1993 063 TIME: 13:55	Enter span value in site- specific calibration file.
ZERO	(xxxx)	DATE: 1993 063 TIME: 13:55	None required.
BUFFER RESET	(xxxx)	DATE: 1993 063 TIME: 13:55	None required.
AC POWER OUT	(xxxx)	DATE: 1993 063 TIME: 13:55	Have site operator check support system AC fuse and main circuit breaker.
DC POWER LOW	(xxxx)	DATE: 1993 063 TIME: 13:55	Have site operator check support system DC fuse.
21X POWER LOW	(xxxx)	DATE: 1993 063 TIME: 13:55	None required.

4.2 MANUAL DATA COLLECTION AND HANDLING

Data may be collected from individual nephelometer stations. This manual method includes the following procedures:

- Running the NGN_PULL program in Windows software.
- Updating the nephelometer station list to include the currently operating nephelometer station to be polled (if necessary).
- Highlighting the station to be polled on the station list.
- Initiating the download.
- Processing the downloaded data file.
- Reviewing the daily nephelometer error files for information concerning the operation of the nephelometer stations.

Operation of the NGN_PULL program is described above in Section 4.1, Automatic Data Collection and Handling. Additional information related to manual data collection and handling and not covered above includes:

INITIATE MANUAL DOWNLOAD

The following procedures describe downloading data from a single station:

- Highlight the station to download on the station list.
- Click **DOWNLOAD** on the menu bar.
- Click **DOWNLOAD RECENT**, **DOWNLOAD ALL**, or **DOWNLOAD/PROCESS** to initiate manual data collection.
- Downloaded data will be placed in a file named "XXXXYYDN.JJJ", where "XXXX" is the site abbreviation, "YY" is the year, "N" is a character from A through 9, and "JJJ" is the julian date.
- If "DOWNLOAD/PROCESS" was clicked, the raw data file will process as during automatic operation.
- Review the error files as described in Section 4.1.

PROCESS MANUAL DOWNLOAD DATA

Downloaded data files may be processed similar to the automatic data collection sequence:

- Highlight the station to process in the station list.
- Click **PROCESS** on the menu bar.
- Click **PROCESS PHONE/SM**.

- A file selection dialog box will appear. Highlight the raw data file to process in the dialog box.
- Click **OK** on the menu bar.

4.3 FILE NAMES AND CONTENTS

4.3.1 Daily Data Compilation and Processing Files

Daily compilation and processing of nephelometer data involves several files. The following describes the processing steps and files used:

- Data for individual nephelometer stations are downloaded into site-specific data files (XXXXYYDN.JJJ, where "XXXX" is the site abbreviation, "YY" is the year, "N" is a character from A through 9, and "JJJ" is the Julian date). These files contain all data collected from the datalogger.
- Data in the site-specific files are divided into several instrument-specific temporary data files. Five-minute nephelometer and meteorological data are placed in "XXXX.NEP," hourly code summary information is placed in "XXXX.INF," and hourly meteorological data are placed in "XXXX.FSM."
- The 5-minute nephelometer and hourly meteorological data in the temporary files (XXXX.NEP) are appended to the following site-specific Level-A files:

Nephelometer: XXXX_N.YYS

Meteorological: XXXX_M.YYS

(where "XXXX" is the site abbreviation, "YY" is the year, and "S" is the season code)

- Hourly code summary data are formatted and written to the daily nephelometer error file.
- Level-A files may be examined or plotted. These files serve as the initial files for further processing as detailed in TI 4400-5010, *Nephelometer Data Reduction and Validation (IMPROVE Protocol)*. The Level-A files are maintained on the system hard disk until completion of seasonal processing.
- Other files used by NGN_PULL include:

NGN_SITE.LST A list of active sites that appear in the site list window of NGN_PULL

NGN_FILE.LST A list of raw data file names already in use by NGN_PULL

4.3.2 Site-Specific Data File Description

The site-specific daily file consists of the following sets of data:

- Five-minute data synchronized to the 21X datalogger clock including nephelometer analog channels A1 and A2, ambient temperature, and relative humidity. The format is:

5-Minute Analog Data

01+0163. 02+1993. 03+0059. 04+0755. 05+582.6 06+0999. 07+2.234 08+097.1

<u>Element #</u>	<u>Description</u>
01	Datalogger program location identifier (not used)
02	Year
03	Julian date
04	Time (HHMM) at the end of the data period
05	Nephelometer A1 channel (mV x 2.0)
06	Nephelometer A2 channel (mV x 2.0)
07	Ambient air temperature (°C)
08	Ambient relative humidity (%)

- Five-minute data output when the nephelometer provides a serial data stream, including nephelometer serial data, analog channels A1 and A2, ambient temperature, and relative humidity. The format is:

5-Minute Serial

01+0119. 02+1993. 03+0059. 04+0757. 05+1.000 06+0891. 07+3493. 08+510.0
09+2.000 10+3.510 11+2.000 12+0755. 13+509.3 14+0999. 15+2.456 16+097.1

<u>Element #</u>	<u>Description</u>
01	Datalogger program location identifier (not used)
02	Year
03	Julian date
04	Time (HHMM) the serial stream was received by the datalogger
05	Nephelometer status code
06	Nephelometer raw scattered light reading (counts)
07	Nephelometer direct light reading (counts)
08	Nephelometer normalized scattered light reading (counts)
09	Nephelometer integration time (minutes)
10	Nephelometer chamber temperature (°C)
11	Not used
12	Nephelometer time (HHMM)
13	Nephelometer A1 channel (mV x 2.0)
14	Nephelometer A2 channel (mV x 2.0)
15	Ambient air temperature (°C)
16	Ambient relative humidity (%)

- Hourly code summary for the nephelometer and support system. The format is:

Hourly Code Summary

01+0104. 02+1993. 03+0059. 04+0800. 05+50.00 06+0.000

<u>Element #</u>	<u>Description</u>
01	Datalogger program location identifier (not used)
02	Year
03	Julian date
04	Time (HHMM) at the end of the data period
05	Nephelometer code summary for the past hour
06	Support system code summary for the past hour

The nephelometer code summary is the sum of any or all of the following:

50	Ambient reading
100	Clean air calibration
300	Span calibration
500	Lamp burned out
1000	Precipitation event detected
2000	Chopper motor start-up failure

The support system code summary is the sum of any or all of the following:

300	21X datalogger power low
500	DC power supply voltage low
1000	AC power outage
2000	Blue Earth serial data buffer restarted

- Hourly average meteorological data including wind speed, wind direction, ambient temperature, and relative humidity. The format is:

Hourly Meteorological Data

01+0171. 02+1995. 03+0013. 04+0700. 05-3.765 06+090.2 07+6.975 08+312.9 09+13.67

<u>Element #</u>	<u>Description</u>
01	Datalogger program location identifier (not used)
02	Year
03	Julian date
04	Time (HHMM) at the end of the data period
05	Ambient temperature (°F)
06	Relative humidity (%)
07	Wind speed (mph)
08	Wind direction (degrees true)

4.3.3 Level-A Nephelometer File Description

The level-A nephelometer file is a formatted ASCII site-specific file. A key to the Level-A file format is presented in Figure 4-4.

Field

1	2	3	4	5	6	7	8	9	10	11	12	13	14
< 10 line informational header at start of file >													
VORZ	941228	362	0110	10	212.17	212.60	-99.00	-99.00	-99.000	-5.68	-5.44	83.10	3912
VORZ	941228	362	0115	10	209.77	207.90	-99.00	-99.00	-99.000	-5.74	-5.37	83.20	3909
VORZ	941228	362	0120	10	210.58	209.90	-99.00	-99.00	-99.000	-5.74	-5.51	83.30	3913

<u>Field #</u>	<u>Description</u>
1	Site abbreviation
2	Year, month , day (YYMMDD)
3	Julian date (JJJ)
4	Time (HHMM)
5	Code summary (3-characters) 1: Power code (non-space character = power problem) 2: Nephelometer status code 1 = ambient 2 = zero 3 = span 4 = lamp 5 = rain 6 = chopper 3: Nephelometer data type code 0 = serial 1 = analog 2 = DCP
6	Nephelometer serial or analog normalized reading (counts)
7	Nephelometer serial normalized reading calculated from the raw readings (counts)
8-10	Not used
11	Chamber temperature (°C)
12	Ambient air temperature (°C)
13	Ambient relative humidity (%)
14	Raw lamp brightness (counts)

Figure 4-4. Key to the Level-A Nephelometer File Format.

4.3.4 Level-A Meteorological File Description

The level-A meteorological file is a formatted ASCII site-specific file. A key to the Level-A file format is presented in Figure 4-5.

5.0 REFERENCES

Campbell Scientific, Inc., Feb. 1989, Campbell Scientific PC208 Datalogger Support Software Instruction Manual.

Microsoft Corporation, 1992, Microsoft Windows 3.1 User's Guide.

Field

	1	2	3	4	5	6	7	8	9
CORG	941201	335	0000		50.30	69.12	17.36	273.00	12.27
CORG	941201	335	0100		49.27	73.80	14.20	268.80	34.81
CORG	941201	335	0200		49.51	74.30	14.98	275.60	8.25

<u>Field #</u>	<u>Description</u>
1	Site abbreviation
2	Year, month , day (YYMMDD)
3	Julian date (JJJ)
4	Time (HHMM), hour ending
5	Hourly average ambient air temperature (°F)
6	Hourly average ambient relative humidity (%)
7	Hourly average wind speed (mph)
8	Hourly average wind direction (degrees true)
9	Hourly standard deviation wind direction (degrees)

Figure 4-5. Key to the Level-A Meteorological File Format.

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	NEPHELOMETER DATA COMPILATION AND REVIEW OF DCP-COLLECTED DATA (IMPROVE PROTOCOL)
TYPE	TECHNICAL INSTRUCTION
NUMBER	4300-4004
DATE	JULY 1993

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
ORIGINATOR	D. Scott Cismoski	
PROJECT MANAGER	James H. Wagner	
PROGRAM MANAGER	David L. Dietrich	
QA MANAGER	Gloria S. Mercer	
OTHER		

REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
1.0	File format change	March 1995	
1.1	Minor text modifications	June 1996	

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1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes the steps of daily compilation and review of DCP nephelometer and meteorological data from an Optec NGN-2 ambient nephelometer station operated according to IMPROVE Protocol. The primary purpose of daily data compilation and review is to assure quality data capture and minimize data loss by:

- Extracting each site's DCP nephelometer and meteorological data from the daily data file downloaded from the NOAA/NESS data dissemination facility at Wallops Island, Virginia. This file is obtained according to Standard Operating Procedure (SOP) 4300, *Collection of Optical Monitoring Data (IMPROVE Protocol)* and TI 4300-4000, *Data Collection via DCP (IMPROVE Protocol)*.
- Reformatting downloaded DCP data to provide a format compatible with NGN_PULL nephelometer data processing software.
- Processing raw data into Level-A validated form using NGN_PULL software.
- Reviewing the daily nephelometer information file to verify nephelometer system operation or identify problems.

This TI is a guide for using the NGN_PULL nephelometer data processing software under Microsoft Windows to:

- Setup and update the nephelometer station configurations.
- Reformat the daily stripped downloaded DCP data file.
- Perform automatic and manual daily data processing.
- Review the daily nephelometer log file.

This TI assumes the operator has basic knowledge of IBM-PC compatible personal computers, the MS-DOS operating system, and Microsoft Windows 3.1.

This TI also assumes that data from operational nephelometer stations have been downloaded from Wallops Island in accordance with TI 4300-4000.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall review daily nephelometer log files and plots with the data coordinator to identify and correct problems.

2.2 DATA COORDINATOR

The data coordinator shall:

- Perform daily processing of DCP data.

- Verify correct operation of the data processing software.
- Review the daily nephelometer log file with the project manager to identify and correct nephelometer station operation problems.
- Enter any information relating to the collection of the data and operation of the nephelometer station into the site-specific Quality Assurance Database.

3.0 REQUIRED EQUIPMENT AND MATERIALS

The nephelometer data collection system consists of the following hardware and software:

- IBM-PC compatible 386/486 computer system with VGA and 80 megabyte hard disk
- Internal or external Hayes compatible modem configured for COM port #2
- Microsoft Windows 3.0/3.1
- NGN_PULL software Version 3.0 or later (ARS software)

4.0 METHODS

This section includes two (2) major subsections:

- 4.1 Data Collection and Processing
- 4.2 File Names and Contents

4.1 DATA COLLECTION AND PROCESSING

Collection of DCP data is performed in accordance with TI 4300-4000, *Data Collection via DCP (IMPROVE Protocol)*. DCP data processing is handled by NGN_PULL software which performs the following tasks:

- Extracts nephelometer data from the stripped downloaded DCP file into site-specific daily data files formatted to be compatible with data obtained via telephone modem.
- Processes each site-specific daily file into instrument-specific parts:
 - 10-minute nephelometer, ambient temperature, and relative humidity
 - Hourly nephelometer status code and support system status code summaries
- Reformats, validates, and appends nephelometer data to seasonal site-specific Level-A data files.
- Creates a daily nephelometer log file that contains a summary of the performance of all of the sites.

The following procedures detail the steps of nephelometer data compilation and review:

LOGON TO NETWORK

Logon to the nephelometer data handling computer using your assigned user name and password.

RUNNING THE NGN-PULL PROGRAM

The NGN_PULL program runs in Microsoft Windows and coordinates both automatic and manual data downloading and processing functions. The program is run by double-clicking on the NGN_PULL icon in Windows, or selecting **FILE, RUN, NGN_PULL.EXE** from the program manager. Refer to the *Microsoft Windows 3.1 User's Guide* for details on running Windows programs. Figure 4-1 presents the screen display of the NGN_PULL program.

ADDING TO OR EDITING THE STATION LIST

The station list includes the nephelometer stations and station types that are currently operating. The list includes the following:

- Site abbreviation
- Site type (telephone modem or DCP)
- Days of the week to call
- ARS project code
- First and last date and time of last downloaded file
- Plot title
- DCP station ID and GMT time offset (if applicable)

The list may be edited by clicking **SITE** from the menu bar and then selecting **EDIT, ADD, or DELETE**. A site can be disabled (from calling) or enabled (to call) by clicking **SITE** from the menu bar and selecting **DISABLE** or **ENABLE**.

To add a new site:

- Click **SITE** from the menu bar and select **ADD**.
- Complete the fields in the "Edit Site Information" dialog box.
- Click **OK**.

To edit an existing site:

- Highlight the site to edit in the site list box.
- Click **SITE** from the menu bar.
- Click **EDIT**.
- Complete the "Edit Site Information" dialog box.
- Click **OK**.

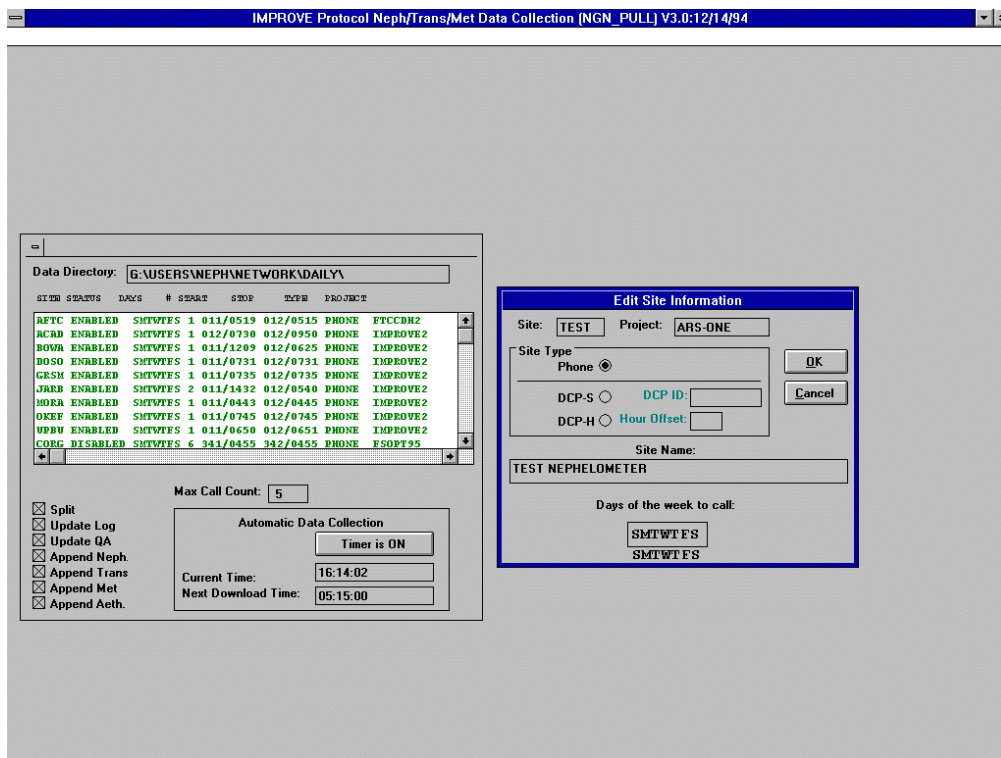


Figure 4-1. NGN_PULL Windows Program Screen.

To remove a site:

- Highlight the site to remove in the site list box.
- Click **SITE** from the menu bar.
- Click **DELETE**.

PROCESS
MANUAL
DOWNLOAD
DATA

A downloaded data file is processed as follows:

- Highlight the station to process in the station list.
- Click **PROCESS** on the menu bar.
- Click **PROCESS DCP**.
- A file selection dialog box will appear. Highlight the stripped data file to process in the dialog box.
- Click **OK** on the menu bar.

EXAMINE THE
DAILY
NEPHELOMETER
ERROR FILES

Daily nephelometer error files contain details about the success of the datalogger interrogation and operation of the nephelometer station. This information is contained in the downloaded data file and is extracted automatically during daily data processing. The following error files are created:

- **NGNYYJJJ.INF**
A nephelometer system error file that includes non-ambient nephelometer occurrences (calibrations, rain, etc.) and problems with AC and DC power levels.
- **NGNYYJJJ.PER**
A processing error file that includes processing problems of the raw data file.

Note: "YY" is the year and "JJJ" is the Julian date in these files.

The error files can be viewed as follows:

- Click **ERRORS** on the menu bar.
- Click one of the error files to view:
 - View **NEPHELOMETER** Errors
 - View **PROCESSING** Errors
- The error file will be loaded into Microsoft Notepad for viewing.

Figure 4-2 presents examples of the two types of error files. The data coordinator will review the daily error files and note problems requiring corrective actions. If required, the corrective actions highlighted in Table 4-1 will be implemented by the data coordinator as described in TI 4100-3100, *Routine Site Operator Maintenance Procedures for Optec NGN-2 Nephelometer Systems (IMPROVE Protocol)*.

4.2 FILE NAMES AND CONTENTS

4.2.1 Daily Data Compilation and Processing Files

Daily compilation and processing of nephelometer data involves several files. The following describes the processing steps and files used:

- Data for all DCP sites are included in one daily file downloaded via telephone from the Wallops Island ground station. The file name is of the form "GALYYJJ.DAT," where "YY" is the year and "JJJ" is the Julian date. Raw data are stripped of invalid characters and reformatted. The name of the stripped data file is of the form "GALYYJJ.TMP." DCP data includes only a small subset of all data collected by the on-site Campbell 21X datalogger.
- Data in the stripped file are divided into several instrument-specific temporary data files. Ten-minute nephelometer and meteorological data are placed in "XXXX.NEP," and hourly code summary information is placed in "XXXX.INF."
- The 10-minute nephelometer and hourly meteorological data in the temporary files (XXXX.NEP) are appended to the following site-specific Level-A files:

Nephelometer: XXXX_N.YYS

Meteorological: XXXX_M.YYS

(where "XXXX" is the site abbreviation, "YY" is the year, and "S" is the season code)

- Hourly code summary data are formatted and written to the daily nephelometer error file.
- Level-A files may be examined or plotted. These files serve as the initial files for further processing as detailed in TI 4400-5010, *Nephelometer Data Reduction and Validation (IMPROVE Protocol)*. The Level-A files are maintained on the system hard disk until completion of seasonal processing.
- Other files used by NGN_PULL include:

NGN_SITE.LST A list of active sites that appear in the site list window of NGN_PULL

NGN_FILE.LST A list of raw data file names already in use by NGN_PULL

Example Nephelometer System Error File

```
=====
==                               ==
SERIAL DATA: 1995 12 1447 3 49 2039 48 10 2.02 1 1433 49.42 2991 .748 95.6
SERIAL DATA: 1995 12 1448 5 152 .92 48 10 2.02 1 1433 49.42 4986 .817 95.5
RAIN EVENT      ( 1050 )  DATE: 1995 12 TIME: 1500
ZERO           ( 1150 )  DATE: 1995 12 TIME: 1600
BLUE EARTH RESET ( 2000 ) DATE: 1995 12 TIME: 2000

=====
==                               ==
SERIAL DATA: 1995 12 700 2 129 3006 85 10 -2.31 1 647 87.3 1998 -4.222 92.2
ZERO          ( 150 )  DATE: 1995 12 TIME: 800
SERIAL DATA: 1995 12 1320 2 137 3023 90 10 -1.11 1 1307 92.1 1998 -2.71 93
ZERO          ( 150 )  DATE: 1995 12 TIME: 1400
SERIAL DATA: 1995 12 1940 2 161 3017 106 10 -2.11 1 1927 107.2 1998 -3.741 92.7
ZERO          ( 150 )  DATE: 1995 12 TIME: 2000
SERIAL DATA: 1995 13 25 5 217 .92 187 2 -4.48 1 20 187 4992 -5.73 91.2
```

Example Processing Error File

```
TRANSGETSITE: No lamp file! F:\USERS\SITE.CON\MACA_L
TRANSGETSITE: No lamp file! F:\USERS\SITE.CON\LOPE_L
TRANSGETSITE: No lamp file! F:\USERS\SITE.CON\SEWZ_L
VORZ: Suspect analog A2=-294.3) JD= 12 TIME= 1605
VORZ: Suspect analog A2=-128.3) JD= 12 TIME= 1610
TRANSGETSITE: No lamp file! F:\USERS\SITE.CON\VORZ_L
TRANSGETSITE: No lamp file! F:\USERS\SITE.CON\VORZ_L
```

Figure 4-2. Example Nephelometer Error Files Generated by NGN_PULL.

Table 4-1
Nephelometer Data Collection
Corrective Actions

Daily Nephelometer Information File			Corrective Action
Status Code	Site Abbrev.	Date/Time	
CHOPPER FAILURE	(xxxx)	DATE: 1993 063 TIME: 13:55	Reset nephelometer via phone modem or contact site operator.
RAIN EVENT	(xxxx)	DATE: 1993 063 TIME: 13:55	None required.
LAMP OUT	(xxxx)	DATE: 1993 063 TIME: 13:55	Have site operator change lamp.
SPAN	(xxxx)	DATE: 1993 063 TIME: 13:55	Enter span value in site- specific calibration file.
ZERO	(xxxx)	DATE: 1993 063 TIME: 13:55	None required.
BUFFER RESET	(xxxx)	DATE: 1993 063 TIME: 13:55	None required.
AC POWER OUT	(xxxx)	DATE: 1993 063 TIME: 13:55	Have site operator check support system AC fuse and main circuit breaker.
DC POWER LOW	(xxxx)	DATE: 1993 063 TIME: 13:55	Have site operator check support system DC fuse.
21X POWER LOW	(xxxx)	DATE: 1993 063 TIME: 13:55	None required.

4.2.2 Daily Stripped Downloaded DCP File

The daily stripped downloaded data file consists of the following:

- 10-minute data synchronized to the DCP clock including nephelometer analog channels A1 and A2.
- Hourly data including nephelometer and support system code summaries, last clean air and span calibrations, and single point air temperature and relative humidity.

A key to the daily stripped data file format is presented in Figure 4-3.

4.2.3 Level-A Nephelometer File Description

The level-A file is a formatted ASCII site-specific file. A key to the Level-A data file format is presented in Figure 4-4.

5.0 REFERENCES

Microsoft Corporation, 1992, Microsoft Windows 3.1 User's Guide.

<u>Line #</u>	<u>Data</u>
1	FA4051A4 93 052 21:22:15
2	32 32 32 32 33 33 33 33
3	33 32 32 41 41 2 2 32
4	32 32
5	999 999 999 999 999 999 999 999
6	999 1995 2990 999 999 0 0 999
7	999 1995
8	1526 1410 1125
9	50 150 150
10	0 0 500
11	290 290 290
12	801 801 801
13	212 213 209
14	195 179 194
15	1364

<u>Line #</u>	<u>Description</u>
1	Wallops ID, year, Julian date, time (HH:MM:SS) of the DCP transmission
2-4	Last 18 nephelometer analog channel A1 readings (mV)
5-7	Last 18 nephelometer analog channel A2 readings (mV)
8	Last 3 hourly nephelometer time when 21X datalogger time is XX:30
9	Last 3 hourly nephelometer code summaries
10	Last 3 hourly support system code summaries
11	Last 3 hourly clean air calibrations (counts)
12	Last 3 hourly span calibrations (counts)
13	Last 3 hourly single-reading ambient air temperature readings (°C x 10.0)
14	Last 3 hourly single-reading relative humidity readings (% x 10.0)
15	DCP battery voltage (VDC x 100.0)

Figure 4-3. Key to the Daily Stripped Data File Format.

Field

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>
< 10 line informational header at start of file >													
VORZ	941228	362	0110	10	212.17	212.60	-99.00	-99.00	-99.000	-5.68	-5.44	83.10	3912
VORZ	941228	362	0115	10	209.77	207.90	-99.00	-99.00	-99.000	-5.74	-5.37	83.20	3909
VORZ	941228	362	0120	10	210.58	209.90	-99.00	-99.00	-99.000	-5.74	-5.51	83.30	3913

<u>Field #</u>	<u>Description</u>
1	Site abbreviation
2	Year, month , day (YYMMDD)
3	Julian date (JJJ)
4	Time (HHMM)
5	Code summary (3-characters) 1: Power code (non-space character = power problem) 2: Nephelometer status code 1 = ambient 2 = zero 3 = span 4 = lamp 5 = rain 6 = chopper 3: Nephelometer data type code 0 = serial 1 = analog 2 = DCP
6	Nephelometer serial or analog normalized reading (counts)
7	Nephelometer serial normalized reading calculated from the raw readings (counts)
8-10	Not used
11	Chamber temperature (°C)
12	Ambient air temperature (°C)
13	Ambient relative humidity (%)
14	Raw lamp brightness (counts)

Figure 4-4. Key to the Level-A Data File Format.

QUALITY ASSURANCE/QUALITY CONTROL DOCUMENTATION SERIES	
TITLE	NEPHELOMETER DATA COLLECTION VIA CAMPBELL SCIENTIFIC DATA STORAGE MODULE (IMPROVE PROTOCOL)
TYPE	TECHNICAL INSTRUCTION
NUMBER	4300-4006
DATE	MARCH 1993

AUTHORIZATIONS		
TITLE	NAME	SIGNATURE
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REVISION HISTORY			
REVISION NO.	CHANGE DESCRIPTION	DATE	AUTHORIZATIONS
1.0	File format change	January 1995	
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1.0 PURPOSE AND APPLICABILITY

This technical instruction (TI) describes the collection, compilation, and review of Optec NGN-2 nephelometer and associated meteorological data stored on Campbell Scientific data storage modules. It specifically addresses data from nephelometer stations operated according to IMPROVE Protocol. The primary purpose of data collection via storage module is to assure quality data capture and minimize data loss by:

- Downloading data from the storage module into site-specific daily files.
- Processing raw data into Level-A validated form.
- Reviewing the nephelometer information file to verify nephelometer system operation or to identify problems.

This TI, as referenced from Standard Operating Procedure (SOP) 4300, *Collection of Optical Monitoring Data (IMPROVE Protocol)*, is a guide for using the NGN_PULL nephelometer data processing software under Microsoft Windows to:

- Setup and update the nephelometer station configurations.
- Download data from Campbell Scientific storage modules.
- Perform manual data processing.
- Review the nephelometer information file.

This TI assumes the operator has basic knowledge of IBM-PC compatible personal computers, the MS-DOS operating system, and Microsoft Windows 3.0/3.1.

2.0 RESPONSIBILITIES

2.1 PROJECT MANAGER

The project manager shall review information files and plots with the data coordinator to identify and correct problems.

2.2 DATA COORDINATOR

The data coordinator shall:

- Download the storage module and process the raw data.
- Review the nephelometer information files with the project manager to identify and correct data collection problems.
- Enter any information relating to the collection of the data and operation of the nephelometer station into the site-specific Quality Assurance Database.

3.0 REQUIRED EQUIPMENT AND MATERIALS

The nephelometer data collection system consists of the following hardware and software:

- IBM-PC compatible 386/486 computer system with VGA and 80 megabyte hard disk
- Internal or external Hayes compatible modem configured for COM port #2
- Microsoft Windows 3.0/3.1
- Campbell Scientific software:
 - TELCOM Version 4.0 or later
 - SMCOM Version 4.0 or later
 - TERM Version 4.0 or later
- NGN_PULL software Version 3.0 or later (ARS)
- Campbell Scientific SC532 storage module interface

Information on the Campbell Scientific software is detailed in the *Campbell Scientific PC208 Datalogger Support Software Instruction Manual*.

4.0 METHODS

This section includes two (2) major subsections:

- 4.1 Storage Module Data Collection and Handling
- 4.2 File Names and Contents

4.1 STORAGE MODULE DATA COLLECTION AND HANDLING

Storage module data collection and handling is executed by the NGN_PULL program which performs the following tasks:

- Downloads data from the storage module using the Campbell Scientific SMCOM software into site-specific files.
- Processes each site-specific daily file into instrument-specific parts:
 - 5-minute nephelometer, ambient temperature, and relative humidity
 - Hourly average wind speed, wind direction, temperature, and relative humidity
 - Hourly nephelometer status code and support system status code summaries
 - Hourly average transmissometer, temperature, and relative humidity
- Reformats, validates, and appends each site's nephelometer data to seasonal site-specific Level-A data files.

- Creates a daily nephelometer log file that contains a summary of the performance of all the downloaded sites.

Collection and handling procedures of data on storage modules include:

- Running the NGN_PULL program in Microsoft Windows 3.0/3.1.
- Updating the nephelometer station list to include all currently operating nephelometer stations to poll for data.
- Verifying that the SC532 interface is installed to COM1 and powered.
- Verifying that the storage module is attached to the SC532 interface.
- Downloading the data from the storage module.
- Processing the site-specific data file manually.
- Examining the daily information file for information concerning the operation of the nephelometer stations upon completion of the download and process steps.
- Examining or plotting the data in Level-A files in accordance with TI 4400-5010, *Nephelometer Data Reduction and Validation (IMPROVE Protocol)*.

The following procedures detail the steps for data collection from a storage module:

LOGON TO
NETWORK

Logon to the nephelometer data handling computer using your assigned user name and password.

RUNNING THE
NGN_PULL
PROGRAM

The NGN_PULL program runs in Microsoft Windows and coordinates both automatic and manual data downloading and processing functions. The program is run by double-clicking on the NGN_PULL icon in Windows, or selecting **FILE, RUN, NGN_PULL.EXE** from the program manager. Refer to the *Microsoft Windows 3.1 User's Guide* for details on running Windows programs. Figure 4-1 presents the screen display of the NGN_PULL program.

ADDING TO OR
EDITING THE
STATION LIST

The station list includes the nephelometer stations and station types that are currently operating. The list includes the following:

- Site abbreviation
- Site type (telephone modem or DCP)
- Days of the week to call
- ARS project code
- First and last date and time of last downloaded file

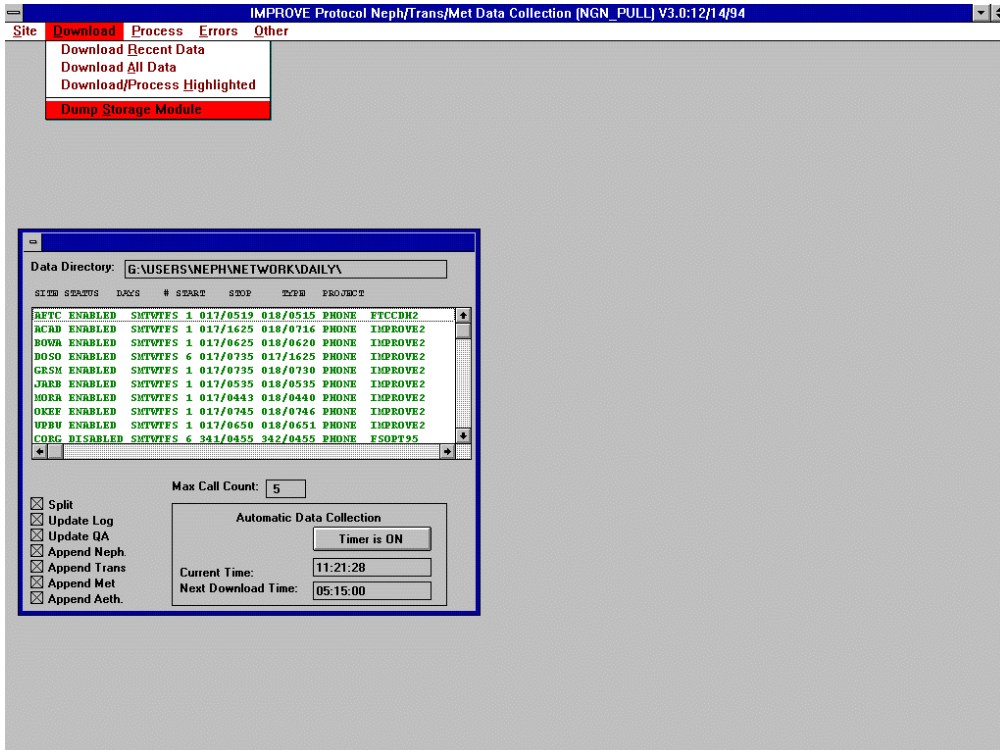


Figure 4-1. NGN_PULL Windows Program Screen.

- Plot title
- DCP station ID and GMT time offset (if applicable)

The list may be edited by clicking **SITE** from the menu bar and then selecting **EDIT**, **ADD**, or **DELETE**. A site can be disabled (from calling) or enabled (to call) by clicking **SITE** from the menu bar and selecting **DISABLE** or **ENABLE**.

Telephone-type stations have a corresponding station definition file (XXXX.STN) that the TELCOM program uses for datalogger and modem-specific parameters (including the telephone number). The following procedures are used to add, edit, or remove a site from the station list.

To add a new site:

- Click **SITE** from the menu bar and select **ADD**.
- Complete the fields in the "Edit Site Information" dialog box.
- Click **OK**.

To edit an existing site:

- Highlight the site to edit in the site list box.
- Click **SITE** from the menu bar.
- Click **EDIT**.
- Complete the "Edit Site Information" dialog box.
- Click **OK**.
- Set the following parameters in the station definition file:
 - Type of datalogger (21X)
 - Type of data file
 - Modem type, COM port, and baud rate
 - Telephone number

To remove a site:

- Highlight the site to remove in the site list box.
- Click **SITE** from the menu bar.
- Click **DELETE**.

USING THE SC532 STORAGE MODULE INTERFACE

The Campbell Scientific SC532 Storage Module Interface provides the means for the computer RS232 serial port to communicate with the storage module. The SC532 attaches to one of the PC's serial ports (COM1-4) via the 23-pin connector. The 9-pin connector attaches to the storage module. The SC532 is powered by its own AC power adapter. Consult the user's manual or hardware manual for the PC being used for information on the PC's serial COM ports.

DOWNLOADING THE STORAGE MODULE

Data in the storage module are downloaded using the Campbell Scientific SMCOM program. The SMCOM program provides the means to download the data, set storage module parameters, clear the storage module, and store or retrieve datalogger programs in the storage module. The following procedures describe downloading data from the storage module:

- Run the NGN_PULL program.
- Click **DOWNLOAD** from the menu bar and then **DUMP STORAGE MODULE** to start the SMCOM program.
- Click **DUMP** from the menu bar to bring up the SMCOM program opening screen.
- Select the COM port that the SC532 interface is attached to (see Figure 4-2).
- Select **A** to collect all data files from the storage module (see Figure 4-3).
- Enter the four-character site abbreviation when prompted for the file name (see Figure 4-3).
- Select **D** to download the data into printable ASCII format (see Figure 4-4).
- The raw storage module file will be named "XXXXYYSM.JJJ," where "XXXX" is the site abbreviation, "YY" is the year, and "JJJ" is the Julian date.

EXAMINE THE DAILY NEPHELOMETER ERROR FILES

Daily nephelometer error files contain details about the success of the datalogger interrogation and operation of the nephelometer station. This information is contained in the downloaded data file and is extracted automatically during daily data processing. The following error files are created:

- NGNYYJJJ.ERR
A telcom error file that includes problems connecting with the on-site datalogger.

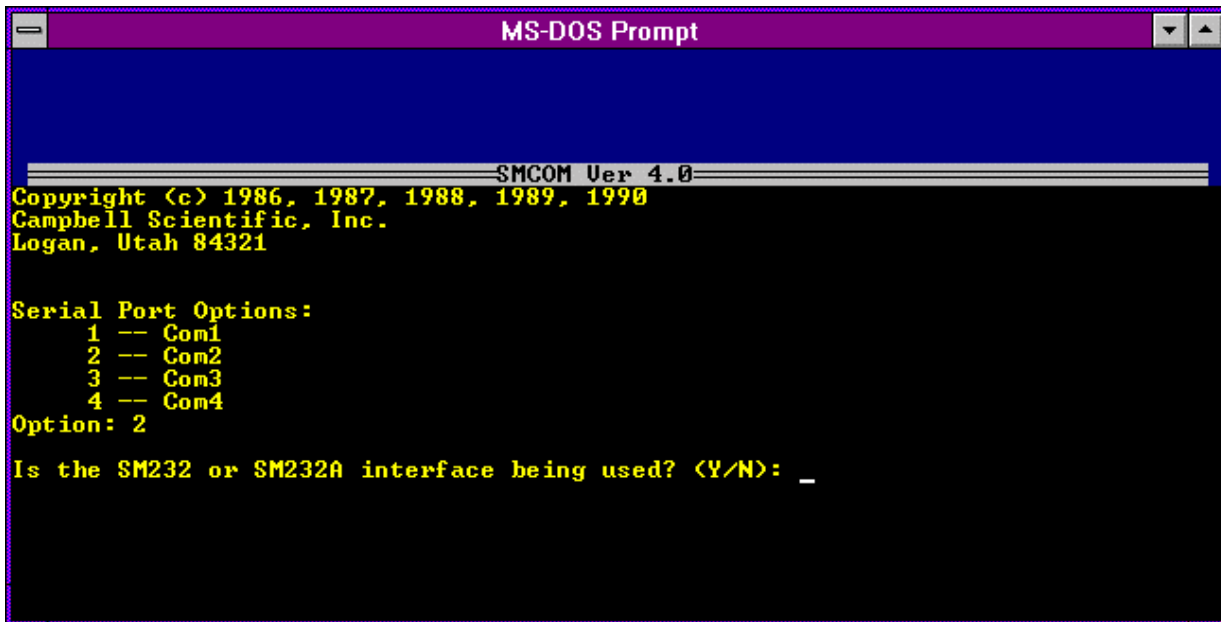


Figure 4-2. Campbell Scientific SMCOM Program Opening Screen.

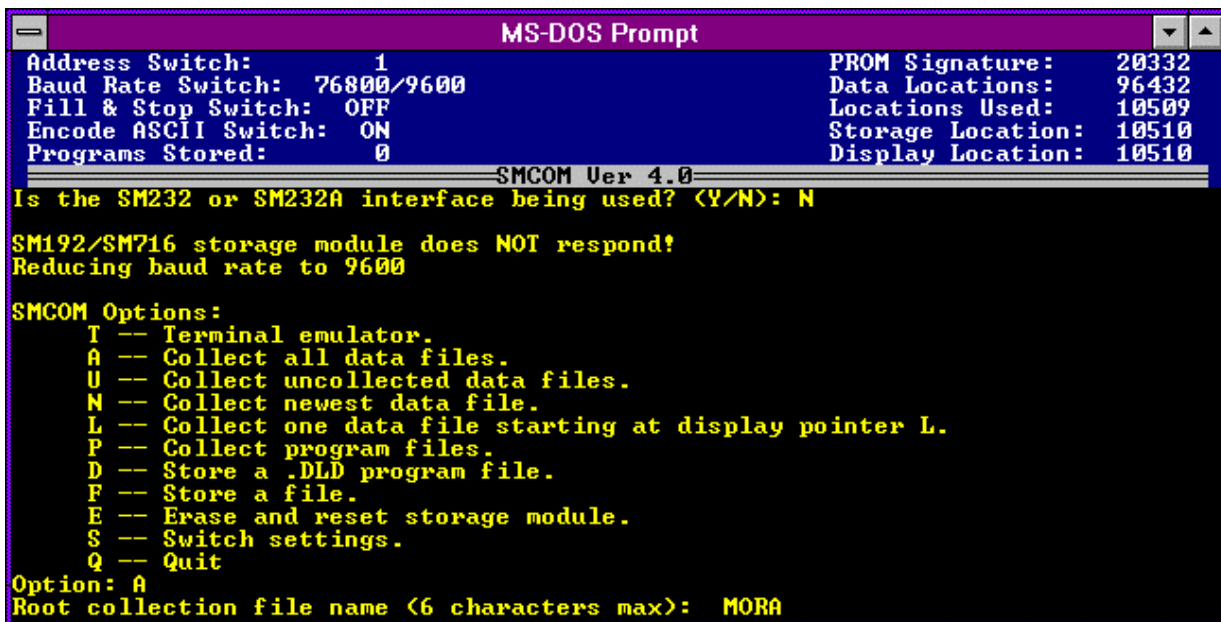


Figure 4-3. Campbell Scientific SMCOM Program Option Screen.


```
MS-DOS Prompt
Address Switch: 1          PROM Signature: 20332
Baud Rate Switch: 76800/9600 Data Locations: 96432
Fill & Stop Switch: OFF   Locations Used: 10509
Encode ASCII Switch: ON   Storage Location: 10510
Programs Stored: 0       Display Location: 1000
-----SMCOM Ver 4.0-----
File Formats:
F -- Final storage <FS> format
D -- FS converted to ASCII arrays with IDs
C -- FS converted to comma delineated ASCII arrays
A -- As stored <8 bit data>
P -- As stored <strip parity>
Esc -- Escape
Format: D
2: Writing to computer file mora005.DAT .._
```

Figure 4-4. Campbell Scientific SMCOM Program File Format Screen.

```
MS-DOS Prompt
Address Switch: 1          PROM Signature: 20332
Baud Rate Switch: 76800/9600 Data Locations: 96432
Fill & Stop Switch: OFF   Locations Used: 10509
Encode ASCII Switch: ON   Storage Location: 10510
Programs Stored: 0       Display Location: 10510
-----SMCOM Ver 4.0-----
This option will ERASE and RESET the storage module!
Are you sure? (Y/N): Y
1248K
+++_
```

Figure 4-5. Campbell Scientific SMCOM Program Storage Module Clear and Reset.

- **NGNYYJJJ.INF**
A nephelometer system error file that includes non-ambient nephelometer occurrences (calibrations, rain, etc.) and problems with AC and DC power levels.
- **NGNYYJJJ.PER**
A processing error file that includes processing problems of the raw data file.

Note: "YY" is the year and "JJJ" is the Julian date in these files.

The error files can be viewed as follows:

- Click **ERRORS** on the menu bar.
- Click one of the error files to view:
 - View **TELCOM** Errors
 - View **NEPHELOMETER** Errors
 - View **PROCESSING** Errors
- The error file will be loaded into Microsoft Notepad for viewing.

Figure 4-6 displays examples of the three error files. The data coordinator will review the daily error files and note problems requiring corrective actions. If required, the corrective actions highlighted in Table 4-1 will be implemented by the data coordinator as described in TI 4100-3100, *Routine Site Operator Maintenance Procedures for Optec NGN-2 Nephelometer Systems (IMPROVE Protocol)*.

PROCESS
STORAGE
MODULE DATA

The downloaded storage module data file is processed as follows:

- Highlight the station to process in the station list.
- Click **PROCESS** on the menu bar.
- Click **PROCESS PHONE/SM**.
- A file selection dialog box will appear. Highlight the raw data file to process in the dialog box.
- Click **OK** on the menu bar.

Example Telcom Error File

```
TELCOM error at SHRO: 01/13/95 06:02:33 Smartmodem did not detect carrier!  
TELCOM error at SHRO: 01/13/95 06:03:24 Smartmodem did not detect carrier!  
TELCOM error at SHRO: 01/13/95 06:04:14 Smartmodem did not detect carrier!  
TELCOM error at SHRO: 01/13/95 06:05:05 Smartmodem did not detect carrier!  
TELCOM error at SHRO: 01/13/95 06:05:56 Smartmodem did not detect carrier!  
TELCOM error at SHRO: 01/13/95 06:06:47 Smartmodem did not detect carrier!  
TELCOM error at SEWZ: 01/13/95 06:30:20 Warning: 1 retries were logged.  
TELCOM error at JUNZ: 01/13/95 06:39:22 Smartmodem did not detect carrier!
```

Example Nephelometer System Error File

```
=====  
==                ACAD                ==  
=====  
SERIAL DATA: 1995  12 1447  3  49 2039  48 10  2.02  1 1433 49.42 2991  .748 95.6  
SERIAL DATA: 1995  12 1448  5 152  .92  48 10  2.02  1 1433 49.42 4986  .817 95.5  
RAIN EVENT      ( 1050 )  DATE: 1995  12 TIME: 1500  
ZERO            ( 1150 )  DATE: 1995  12 TIME: 1600  
BLUE EARTH RESET ( 2000 )  DATE: 1995  12 TIME: 2000  
  
=====  
==                BOWA                ==  
=====  
SERIAL DATA: 1995  12  700  2 129 3006  85 10 -2.31  1  647 87.3 1998 -4.222 92.2  
ZERO          ( 150 )  DATE: 1995  12 TIME: 800  
SERIAL DATA: 1995  12 1320  2 137 3023  90 10 -1.11  1 1307 92.1 1998 -2.71 93  
ZERO          ( 150 )  DATE: 1995  12 TIME: 1400  
SERIAL DATA: 1995  12 1940  2 161 3017 106 10 -2.11  1 1927 107.2 1998 -3.741 92.7  
ZERO          ( 150 )  DATE: 1995  12 TIME: 2000  
SERIAL DATA: 1995  13  25  5 217  .92 187  2 -4.48  1  20 187 4992 -5.73 91.2
```

Example Processing Error File

```
TRANSGETSITE: No lamp file! F:\USERS\SITE.CON\MACA_L  
TRANSGETSITE: No lamp file! F:\USERS\SITE.CON\LOPE_L  
TRANSGETSITE: No lamp file! F:\USERS\SITE.CON\SEWZ_L  
VORZ: Suspect analog A2=-294.3) JD= 12 TIME= 1605  
VORZ: Suspect analog A2=-128.3) JD= 12 TIME= 1610  
TRANSGETSITE: No lamp file! F:\USERS\SITE.CON\VORZ_L  
TRANSGETSITE: No lamp file! F:\USERS\SITE.CON\VORZ_L
```

Figure 4-6. Example Nephelometer Error Files Generated by NGN_PULL.

Table 4-1
Nephelometer Data Collection
Corrective Actions

Daily Nephelometer Information File			Corrective Action
Status Code	Site Abbrv.	Date/Time	
CHOPPER FAILURE	(xxxx)	DATE: 1993 063 TIME: 13:55	Reset nephelometer via phone modem or contact site operator.
RAIN EVENT	(xxxx)	DATE: 1993 063 TIME: 13:55	None required.
LAMP OUT	(xxxx)	DATE: 1993 063 TIME: 13:55	Have site operator change lamp.
SPAN	(xxxx)	DATE: 1993 063 TIME: 13:55	Enter span value in site- specific calibration file.
ZERO	(xxxx)	DATE: 1993 063 TIME: 13:55	None required.
BUFFER RESET	(xxxx)	DATE: 1993 063 TIME: 13:55	None required.
AC POWER OUT	(xxxx)	DATE: 1993 063 TIME: 13:55	Have site operator check support system AC fuse and main circuit breaker.
DC POWER LOW	(xxxx)	DATE: 1993 063 TIME: 13:55	Have site operator check support system DC fuse.
21X POWER LOW	(xxxx)	DATE: 1993 063 TIME: 13:55	None required.

4.2 FILE NAMES AND CONTENTS

4.2.1 Data Collection and Processing Files

Compilation and processing of nephelometer data involves several files. The following describes the processing steps and files used:

- Data for individual nephelometer stations are downloaded from the storage module into site-specific data files. The file name is of the form "XXXXYYSN.JJJ," where "XXXX" is the site abbreviation, "YY" is the year, "N" is a character from A through 9, and "JJJ" is the Julian date. These files contain all data collected by the datalogger.
- Data in the site-specific files are divided into several instrument-specific temporary data files. Five-minute nephelometer and meteorological data are placed in "XXXX.NEP," hourly code summary information is placed in "XXXX.INF," and hourly meteorological data are placed in "XXXX.FSM."
- The 5-minute nephelometer and hourly meteorological data in the temporary files (XXXX.NEP) are appended to the following site-specific Level-A files:

Nephelometer: XXXX_N.YYS

Meteorological: XXXX_M.YYS

("XXXX" is the site abbreviation, "YY" is the year, and "S" is the season code)

- Hourly code summary data are formatted and written to the daily nephelometer error file.
- Level-A files may be examined or plotted. These files serve as the initial files for further processing as detailed in TI 4400-5010, *Nephelometer Data Reduction and Validation (IMPROVE Protocol)*. Level-A files are maintained as active on the system hard disk until completion of seasonal processing.
- Other files used by NGN_PULL include:

NGN_SITE.LST A list of active sites that appear in the site list window of NGN_PULL

NGN_FILE.LST A list of raw data file names already in use by NGN_PULL

4.2.2 Site-Specific Data File Description

The site-specific raw storage module file consists of the following sets of data:

- Five-minute data synchronized to the 21X datalogger clock including nephelometer analog channels A1 and A2, ambient temperature, and relative humidity. The format is:

5-Minute Analog Data

01+0163. 02+1993. 03+0059. 04+0755. 05+582.6 06+0999. 07+2.234 08+097.1

<u>Element #</u>	<u>Description</u>
01	Datalogger program location identifier (not used)
02	Year
03	Julian date
04	Time (HHMM) at the end of the data period
05	Nephelometer A1 channel (mV x 2.0)
06	Nephelometer A2 channel (mV x 2.0)
07	Ambient air temperature (°C)
08	Ambient relative humidity (%)

- Five-minute data output when the nephelometer provides a serial data stream, including nephelometer serial data, analog channels A1 and A2, ambient temperature, and relative humidity. The format is:

5-Minute Serial

01+0119. 02+1993. 03+0059. 04+0757. 05+1.000 06+0891. 07+3493. 08+510.0
09+2.000 10+3.510 11+2.000 12+0755. 13+509.3 14+0999. 15+2.456 16+097.1

<u>Element #</u>	<u>Description</u>
01	Datalogger program location identifier (not used)
02	Year
03	Julian date
04	Time (HHMM) the serial stream was received by the datalogger
05	Nephelometer status code
06	Nephelometer raw scattered light reading (counts)
07	Nephelometer direct light reading (counts)
08	Nephelometer normalized scattered light reading (counts)
09	Nephelometer integration time (minutes)
10	Nephelometer chamber temperature (°C)
11	Not used
12	Nephelometer time (HHMM)
13	Nephelometer A1 channel (mV x 2.0)
14	Nephelometer A2 channel (mV x 2.0)
15	Ambient air temperature (°C)
16	Ambient relative humidity (%)

- Hourly code summary for the nephelometer and support system. The format is:

Hourly Code Summary

01+0104. 02+1993. 03+0059. 04+0800. 05+50.00 06+0.000

<u>Element #</u>	<u>Description</u>
01	Datalogger program location identifier (not used)
02	Year
03	Julian date
04	Time (HHMM) at the end of the data period
05	Nephelometer code summary for the past hour
06	Support system code summary for the past hour

The nephelometer code summary is the sum of any or all of the following:

50	Ambient reading
100	Clean air calibration
300	Span calibration
500	Lamp burned out
1000	Precipitation event detected
2000	Chopper motor start-up failure

The support system code summary is the sum of any or all of the following:

300	21X datalogger power low
500	DC power supply voltage low
1000	AC power outage
2000	Blue Earth serial data buffer restarted

- Hourly average meteorological data including wind speed, wind direction, ambient temperature, and relative humidity. The format is:

Hourly Meteorological Data

01+0171. 02+1995. 03+0013. 04+0700. 05-3.765 06+090.2 07+6.975 08+312.9 09+13.67

<u>Element #</u>	<u>Description</u>
01	Datalogger program location identifier (not used)
02	Year
03	Julian date
04	Time (HHMM) at the end of the data period
05	Ambient temperature (°F)
06	Relative humidity (%)
07	Wind speed (mph)
08	Wind direction (degrees true)

4.3.3 Level-A Nephelometer File Description

The level-A nephelometer file is a formatted ASCII site-specific file. A key to the Level-A file format is presented in Figure 4-7.

4.3.4 Level-A Meteorological File Description

The level-A meteorological file is a formatted ASCII site-specific file. A key to the Level-A file format is presented in Figure 4-8.

5.0 REFERENCES

Campbell Scientific, Inc., 1989, Campbell Scientific PC208 Datalogger Support Software Instruction Manual, February.

Microsoft Corporation, 1992, Microsoft Windows 3.1 User's Guide.

Field

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>
< 10 line informational header at start of file >													
VORZ	941228	362	0110	10	212.17	212.60	-99.00	-99.00	-99.000	-5.68	-5.44	83.10	3912
VORZ	941228	362	0115	10	209.77	207.90	-99.00	-99.00	-99.000	-5.74	-5.37	83.20	3909
VORZ	941228	362	0120	10	210.58	209.90	-99.00	-99.00	-99.000	-5.74	-5.51	83.30	3913

<u>Field #</u>	<u>Description</u>
1	Site abbreviation
2	Year, month , day (YYMMDD)
3	Julian date (JJJ)
4	Time (HHMM)
5	Code summary (3-characters) 1: Power code (non-space character = power problem) 2: Nephelometer status code 1 = ambient 2 = zero 3 = span 4 = lamp 5 = rain 6 = chopper 3: Nephelometer data type code 0 = serial 1 = analog 2 = DCP
6	Nephelometer serial or analog normalized reading (counts)
7	Nephelometer serial normalized reading calculated from the raw readings (counts)
8-10	Not used
11	Chamber temperature (°C)
12	Ambient air temperature (°C)
13	Ambient relative humidity (%)
14	Raw lamp brightness (counts)

Figure 4-7. Key to the Level-A Nephelometer File Format.

Field

<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>
CORG	941201	335	0000	50.30	69.12	17.36	273.00	12.27
CORG	941201	335	0100	49.27	73.80	14.20	268.80	34.81
CORG	941201	335	0200	49.51	74.30	14.98	275.60	8.25

<u>Field #</u>	<u>Description</u>
1	Site abbreviation
2	Year, month , day (YYMMDD)
3	Julian date (JJJ)
4	Time (HHMM), hour ending
5	Hourly average ambient air temperature (°F)
6	Hourly average ambient relative humidity (%)
7	Hourly average wind speed (mph)
8	Hourly average wind direction (degrees true)
9	Hourly standard deviation wind direction (degrees)

Figure 4-8. Key to the Level-A Meteorological File Format.