

# Darwin

## On-Site Observers Training Manual

MAN(OPS)-012.002



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Prepared by  
ARM Tropical Western Pacific Office

[www.twppo.lanl.gov](http://www.twppo.lanl.gov)



# Darwin On-Site Observers Training Manual

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## **Darwin On-Site Observers Training Manual**

Darwin On-Site Observers Training Manual contains essential information about the Tropical Western Pacific Office (TWPO), a component of the U.S. Department of Energy's (DOE) Atmospheric Radiation Measurement (ARM) Program. The manual is designed to help Observers at the ARM Atmospheric Radiation and Cloud Station (ARCS) in Darwin, Northern Territory, Australia, to obtain familiarity with the operational details of the TWPO Site. The information should also help Observers feel comfortable explaining the ARM Program and the TWPO operations to visitors to the site and other interested people.

This training manual consists of nine units and an appendix. Each unit includes the following components:

- Reference materials relevant to the unit
- Goals for the unit
- Brief summary of the information in the unit
- Exercise activities to ensure the trainee's understanding of the unit

It is important to answer the questions at the end of each unit before the RESET team leaves. This will help improve training packages.

Note: TWPO uses a large number of acronyms or abbreviations for lengthy names or titles. Do not try to learn these all at once. They are included in this manual (Appendix A) for future reference.

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## **Unit 1: The ARM Program – *How do we fit in?***

### **Reference Materials:**

- ARM Tropical Western Pacific Briefing Book

### **Goals for the Unit:**

- To be able to explain what the ARM program is.
- To know the main goals for the ARM program.
- To know why the TWPO program and this ARCS site are important.

### **Summary of Information:**

1. **ARM** stands for “Atmospheric Radiation Measurement.” The U.S. Department of Energy funds the ARM Program whose goal is to improve large computer models that are used to predict global climate (General Circulation Models, or GCMs) and climate change. The most needed improvement is for these models to be more effective in showing how clouds of all types affect heating and cooling of the Earth’s surface.
2. Radiation, the “R” in ARM, refers to both solar energy (or sunlight) and the heat given off by the surface of the Earth. Sunlight, or solar energy, is also called short-wave radiation. The atmosphere and the ground absorb some of the solar energy reaching the Earth, while some is reflected back to space by the surface and clouds. The surface then emits heat energy, which is sometimes called long-wave radiation or terrestrial (i.e., coming from the Earth) radiation.
3. The ARM program has three goals:
  - Establish field study sites (“CARTs” or **Cloud And Radiation Testbeds**) where scientists can observe the effects of clouds on the way sunlight energy heats the Earth.
  - Develop instruments to measure important details of all the ongoing processes.
  - Use the data from all the CARTs to model the Earth’s climate and improve the models so that the global climate is more accurately predicted.
4. There are three CART locales on the planet. The first one was established in the Southern Great Plains (SGP) region in the United States (Oklahoma and Kansas states). The second one is here in the Tropical Western Pacific (TWPO) region, and the third is on the North Slope of Alaska (NSA). Each CART locale is unique and important in understanding clouds and radiation. A CART site has many instruments

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spread out to cover a large area; for example, the SGP site is about 200 km by 300 km in size, while the TWPO locale is about 7000 km by 2000 km. Scientists will need data from all the three CART sites to really figure out how to model the clouds and radiation although some of the studies will focus on the TWPO data.

5. The TWPO site was chosen because it has complex cloud structures that are typical of the western tropical ocean environment. In addition, the very warm water here produces a large amount of heat and moisture into the atmosphere, and is also partly responsible for weather patterns throughout the world. This warm water is called the “warm pool” because it floats on the surface of the ocean, somewhat like an oil slick. During El Niño events, this warm pool of water spreads out towards South America, causing a great many weather patterns to change.
6. TWPO uses Atmospheric Radiation and Cloud Stations (ARCS) to do the research in the TWPO. Each ARCS is an integrated system of instruments, computers, and communication systems to capture the scientific data. The collected data are sent to the TWPO (TWPO) at Los Alamos National Laboratory in New Mexico and to the Data Management Center at Pacific Northwest National Laboratory (PNNL) in Washington state.
7. To be successful, we must deliver continuous and accurate scientific data as well as excellent and complete records on operations. We need the operational data to interpret the scientific data.

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**Activity:**

Look at maps that show where the three CARTs are, and how the TWPO ARCS sites will be deployed. You should also review TWPO Briefing Book to see some of the basic goals and functions of ARM and TWPO.

**Questions:**

1. What does “ARM” mean?
2. What do we mean by the term “radiation” in weather and climate studies?
3. What are the three ARM goals?
4. What does “ARCS” mean?
5. How big is the TWPO site? How many ARCS will it have?
6. What are some of the reasons scientists think the TWPO is an important region for climate studies?



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## Unit 2: Safety and Environment – *Are they really important?*

### Reference Materials:

- Darwin (ARCS-3) Site Safety Plan

### Goals for the unit:

- To know about TWPO's basic philosophy for your safety and care for the environment.
- To know how to do your work safely.

### Summary of Information:

1. Everyone at TWPO must work in a safe and responsible manner. **YOUR LIFE AND HEALTH ARE MORE IMPORTANT THAN THE DATA OR THE EQUIPMENT.** We will NEVER knowingly ask you to perform dangerous tasks. If you ever get a request to do a task that seems dangerous, **do not do it**; instead, call and let us know the situation. Everyone must be a "best mate" for each other. This means that if you see one of your co-workers (another Observer or one of the TWPO RESET team members, or TWPO staff) doing something dangerous, stop them and tell them that it is not safe.
2. It is very important to protect the Darwin environment. This is your home and our home too. Do not allow anyone to pollute or litter. Help us be good guests and visitors by being clean and safe.
3. When working on electrical systems, remember the following restrictions:
  - a) You may only work on electrical systems of the instruments, vans, or the GENSET after proper training and under proper supervision.
  - b) Do not ever open a power cabinet without an approved procedure.
  - c) Do not drill into any power cabinets;
  - d) Do not disconnect instruments for replacement without reading how to **turn off power first** and following the procedure exactly.

**Note: When performing a new task, ask for guidance and a written procedure.**

4. If you or a co-worker gets hurt **GET HELP IMMEDIATELY.** Then call or fax TWPO to let us know what happened and send an SDL message.
5. Review the Emergency Contact Information Sheet (the local phone list with hospital, police, and hotel information, and the TWPO phone list), pin it to the bulletin boards, and know how to phone and fax TWPO.

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**Activity:**

1. Learn where the local emergency phone numbers are posted.
2. Phone and send fax to TWPO as a test to see how the international phone system works.

**Questions:**

1. What is more important, getting the Daily Rounds or taking care of your safety?
2. Is it acceptable to throw ARCS garbage over the fence or into the ocean?
3. What do you do if you are instructed to open the GENSET power cabinet and work on the energized system?
4. What do you do if someone gets hurt at the ARCS site?

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### **Unit 3: Darwin Site (ARCS-3) Instruments – *What do they measure?***

#### **Reference Materials:**

- Darwin Site (ARCS-3) Instrument Book

#### **Goals for the Unit:**

- To learn the acronyms for the instruments.
- To gain the basic information about what each system measures.
- To be able to explain, in your own words, what the instruments measure.

#### **Summary of Information:**

- See information in *Darwin Site (ARCS-3) Instrument Book*.

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**Activity:**

1. Walk through site identifying each system.
2. Practice giving each other short presentations on what the instruments are called and what they measure – You can use the books as reference materials.

**Question:**

Fill in the work sheet on the following page, using your own words wherever possible.

### Instruments/System Work Sheet – Page 1

Instrument	Full Name	Location	What is its function? What is measured?
PSP unshaded		SKYRAD Stand	
PSP shaded (B&W)		SKYRAD Stand	
PIR unshaded		SKYRAD Stand	
PIR shaded		SKYRAD Stand	
NIP		SKYRAD Stand	
UVB		SKYRAD Stand	
MFRSR		SKYRAD Stand	
PSP Downward		SMET Tower	
PIR Downward		SMET Tower	
IRT Downward		SMET Tower	
Temp/ Humidity Sensor		SMET Tower	

## Instruments Work Sheet – Page 2

Instrument	Full Name	Location	What is its function? What is measured?
Barometer		Inside SMET Logger	
ORG		Near SMET Tower	
Wind Sensor		SMET Tower	
MWR		Instrument Field	
MWR Computer		I-Van	
CEIL		Instrument Field	
CEIL Computer		I-Van	
WSI		Instrument Field	
MPL		I-Van	
MPL Computer		I-Van	
MMCR		I-Van	
TSI		Instrument Field	

### Instruments Work Sheet – Page 3

Instrument	Full Name	Location	What is its function? What is measured?
MFRSR logger		SKYRAD Stand	
SKYRAD logger		Near SKYRAD Stand	
GNDRAD Logger		SMET Tower	
SMET Logger		Near SMET Tower	
Data System (SDS)		D-Van	
SAM/RACE (ACCESS)		D-Van	
GENSET (Emergency Generator)		U-Van	

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## Unit 4: Daily Rounds – *Routine and essential!*

### Materials:

- Darwin On-Site Observers Training Manual
- Daily Rounds, Weekly Rounds, and Monthly Rounds Checklists
- Daily, Weekly, and Monthly Fax Sheets

### Goal for this unit:

- To know and understand the important features of Daily Rounds.

### Summary of information:

1. Daily Rounds is the routine maintenance activity that is done every day. This includes checking on every instrument and system in the ARCS. **Daily Rounds are one of the most important functions for properly operating the ARCS. They insure that the instruments are operating properly and that the data are correct. Without accurate daily rounds, we could be recording data that are incorrect and useless to the scientists.**
2. Daily Rounds can be changed, but ONLY if we all agree to the change(s). As we determine the correct way to check on an instrument's performance, we can change a procedure and the Daily Rounds to reflect the proper sequence of tasks. We can also change the order in which things are done so that it is logical and easy to walk from one system to the next.
3. The results of daily, weekly or monthly rounds are recorded on a Daily or Weekly/Monthly fax sheet. As you complete the checklist tasks, make notes of anything you think is important on the fax sheet. Fax the daily Rounds fax sheet to TWPO according to the instructions at the top of each fax sheet. File the fax sheets in daily or weekly/monthly files. The Daily Rounds report is also sent back to the United States on the computer application, Site Data Log.
4. New Daily, Weekly, and Monthly Rounds tasks: RESET team members will explain any changes to the rounds.
5. Every set of tasks in the Daily Rounds has a written procedure. The procedures are collected in ARCS Operations Manual, which are available on CD-ROM and on the TWPO website.



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**Activity:**

1. Practice with RESET team members to obtain complete and accurate reports.
2. Teach someone else to do Daily Rounds (someone who is not part of the RESET team).
3. Select a procedure for an occasional task (e.g., monthly rounds, changing desiccant, leveling radiometers).
4. Find the procedure in the manual.
5. Do the task.
6. Report on the tasks in the SDL. Make sure to include a comment that you are practicing!

**Questions:**

1. As you do the Daily Rounds for each instrument or system, are there maintenance tasks listed? If yes, enter Y (for “yes”) in the Daily Rounds column on the attached Instrument/System Maintenance Worksheet. If there are no daily tasks, enter N (for “no”).
2. Are there any procedure references in the Daily Rounds? Find the referenced procedures for each instrument/system in TWPO Operations Manual and write the name and procedure number on the attached Instrument/System Maintenance Worksheet.
3. Did you perform all referenced procedures? If “yes,” enter Y in the last column of the worksheet.
4. Repeat 1, 2, and 3 for Weekly Rounds.
5. Repeat 1, 2, and 3 for Monthly Rounds.
6. Are there any changes to the rounds? What are they?

### Instrument/System Maintenance Work Sheet – Page 1

<b>Instrument/ System</b>	<b>Daily Round? Y/N</b>	<b>Weekly Round? Y/N</b>	<b>Monthly Round? Y/N</b>	<b>List referenced procedure and number (if noted in Rounds)</b>	<b>Performed Referenced Procedures? Y/N</b>
PSP unshaded (SKYRAD)					
PSP shaded (B&W) (SKYRAD)					
PIR unshaded (SKYRAD)					
PIR shaded (SKYRAD)					
NIP					
IRT (SKYRAD)					
UVB					
MFRSR					
PSP (GNDaily RoundsAD)					
PIR (GNDaily RoundsAD)					
IRT (GNDaily RoundsAD)					

### Instrument/System Maintenance Work Sheet – Page 2

Instrument/ System	Daily Round? Y/N	Weekly Round? Y/N	Monthly Round? Y/N	List referenced procedure and number (if noted in Rounds)	Performed Referenced Procedures? Y/N
Temp/Humidity Sensor					
Barometer					
ORG					
Wind Sensor					
MWR					
MWR Computer					
CEIL					
CEIL Computer					
WSI					
MPL					
MPL Computer					
MMCR					

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### Instrument/System Maintenance Work Sheet – Page 3

<b>Instrument/ System</b>	<b>Daily Round? Y/N</b>	<b>Weekly Round? Y/N</b>	<b>Monthly Round? Y/N</b>	<b>List referenced Procedure and Number (if noted in Rounds)</b>	<b>Performed Referenced Procedures? Y/N</b>
TSI					
MFRSR Logger					
SKYRAD Logger					
GNDRAD Logger					
SMET Logger					
Data System (SDS)					
SAM/RACE (ACCESS)					

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## Unit 5: Using Site Data Log (SDL) to Report Data

### Reference Materials:

- Site Data Log (SDL) User Manual
- Daily Rounds Checklist

### Goals for the Unit:

- To give an effective overview of the Site Data Log (SDL) and its new features.
- To know how to use the SDL.

### Summary of Information:

1. The Site Data Log (SDL) is a computer application for transmitting daily round reports, daily weather observations and general messages between ARCS sites and TWPO in the United States.
2. Why do we need the SDL? ARM needs to have a consistent and accurate record of ALL operations and maintenance activities at every site. It is easier to enter the information into a computer format and transmit each day than to rely on phone and faxes for routine activities. Finally, if phone and fax do not work, the SDL can be used to send emergency information to TWPO.
3. The two types of data that can be entered into the SDL are Daily Rounds and General Comments. Daily Rounds should be entered **every day**. If the Daily Rounds and weather are not entered on a certain day, enter it into the SDL the next day with the correct date.
4. There are six steps in the SDL process:
  - a) Observer enters the report into SDL on the computer, using the Daily Rounds checklist as a guide.
  - b) Observer checks the report on the computer screen to make sure it is correct.
  - c) Observer transmits report by clicking "transmit" on the SDL screen.
  - d) Message is transmitted.
  - e) TWPO receives message.
  - f) Daily Operations Coordinator (David Reass) reads messages and acts accordingly.

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**Activity:**

1. Use SDL and Manual.
2. Enter Daily Rounds and comments.
3. Enter general comments.

**Questions:**

1. What is the SDL?
2. Why do we need to have the SDL instead of making a phone call or using a fax machine?
3. What are the two kinds of data that can be entered into the SDL?
4. What do you do if you have to enter data from two days ago?
5. How do you enter a comment about needing more desiccants?

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## Unit 6: Files and Records – *Keeping track of who does what!*

### Reference Materials:

- ARCS Operations Manual

### Goals for the Unit:

- To be familiar with the need for complete records
- To learn how to file reports and retrieve already filed reports.

### Summary of Information:

- 1 Record Keeping:
  - Keep records of on-site maintenance activities, equipment and supplies.
  - File all Genset maintenance reports, air conditioner maintenance reports, shipping airwaybill listings, monthly resupply lists, and any other important information after faxing to TWPO.
- 2 Each piece of equipment should have its **technical manuals** in the filing system to provide more detailed information to supplement the procedures.

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**Activity:**

1. Review current filing – Discussions on improvements needed.
2. Check the files for completeness – Do we need to improve?

**Questions:**

1. What needs to be filed?
2. Where is the instrument technical manual file?
3. Where are the report files?



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## **Unit 7: Troubleshooting and Communications**

### **Reference Materials:**

- Phone (land and satellite)
- Fax machine
- SDL
- Internet
- Email

### **Goals for the Unit:**

- To identify the methods of troubleshoot unexpected problems as they arise.
- To learn how to communicate with TWPO in the United States to fix problems.

### **Summary of Information:**

1. Communication methods:
  - TWPO and 24-hour answering service: 00-1-505-667-1186
  - TWPO fax machine: 00-1-505-667-9122
  - SDL "General" messaging (see Unit 5)
2. Call TWPO at 00-1-505-667-1186 in case of an emergency situation such as:
  - Site operations are not safe.
  - An Observer is injured.
  - Large data losses are likely.
3. If you need help with a non-emergency problem at the site, do either of the following:
  - Call TWPO in the United States at 00-1-505-667-1186 and leave a message to call you during regular hours.
  - Fax TWPO in the United States at 00-1-505-667-9122.
4. When TWPO personnel in the United States notice problems at the site, they will call an Observer at the site. During troubleshooting, you can communicate TWPO primarily by phone or fax:
  - Phone to TWPO at 00-1-505-667-1186
  - Fax to TWPO at 00-1-505-667-9122

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5. If phones at the site are not working, use the phone in the Darwin MET Office.
6. Do not troubleshoot any part of the ARCS systems without first contacting and getting approval from TWPO in the United States.

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**Activities:**

1. Use each communication method to contact TWPO personnel in the United States.

**Questions:**

1. When should you call TWPO?
2. How do you contact TWPO?
3. Who decides when to troubleshoot an ARCS instrument or system?
4. Discuss how to communicate during troubleshooting. Have you had trouble communicating with TWPO?

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## **Unit 8: Resupply and Shipping**

### **Reference Materials:**

- Monthly Resupply List
- Shipping Forms
- Shipment and Receival Forms

### **Goals for the Unit:**

- To know how to reorder office equipment and other expendables using the Monthly Resupply List.
- To learn how to communicate shipments and receivals to TWPO.

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### Activities:

1. Review the attached *Monthly Resupply List*. Fax a test list to TWPO.
2. Review the attached *Shipping and Receival List* form – **for Observer reference only**.
3. Go over shipping process (see *TWP Shipping/Inventory Procedure, PRO(OPS)-033*), packing and shipping forms. **Note: Do not pack white shields with radiometers.**

### Questions:

1. What is on YOUR list of things you want to learn? Is there anything you want help with?
2. What did you and the other Observers learn with the RESET team and the Operations Manager?
3. What did you and the other Observers learn during the visit?

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**Resupply Monthly Checklist (Example):** Fill out this form the first of every month, and fax to Monty Apple in the United States at: 011-1-307-674-1504

Site: Darwin ARCS-3

Date: \_\_\_\_\_

Observer: \_\_\_\_\_

ITEM	QUANTITY	LOCATION	NOTES or P/N
4 mm tape blanks (MMCR)			From all vans
HP DDS 4mm Cleaning Tapes			
PRINTERS/FAXES			
Toner Cartridge for AdaM Printer			HP P/N SC4096A
Toner Cartridge for Observer Printer			HP P/N 92295A
Ink Cartridge for HP Fax Machine			HP P/N 51626A
DESICCANT			
Desiccant, Indicating, Bottle			
Desiccant Cylinder for WSI			
Inline Desiccant Packs for MMCR			
Desiccant Tubes for Net Radiometer			
GENERAL			
Compressed Air Cans (10 oz.)			
Net Radiometer Domes			
Net Radiometer Gaskets			
Kim Wipes (# of smallest boxes)			
Light Bulbs (R-20 for Track Lighting)			
Light Bulbs (Regular size)			
Tape Mailers (14" x 20")			
Bard AC Filter, 16" x 25" x 1"			
Bard AC Filter, 12" x 20" x 1"			
SMET TRH Filters			
WSI Metal Filters			
WSI Coolant, Prestone 5/150			# of Gallons
<b>DIESEL GENERATOR</b> (Runtime Hours)			
Racor Fuel Filter on Wall			







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## **Unit 9: General**

### **Goals for the Unit:**

- To generate ideas and suggestions.
- To request help in needed areas of operations.

### **Information and Activities:**

1. Discuss with RESET team and/or the Operations Manager how often you are using the office machines, and what would be most useful to learn to do. Some of the things to practice are how to change a fax ink cartridge and, how to find and print computer files.
2. Start a list of things you want to learn and do with the office machines, or what software you need.
3. Prioritize the list of what you want to learn this visit. Plan to do it before RESET leaves!
4. You are an essential participant in running the ARCS-3 and improving it is maintained. We need to keep improving the way we run the ARCS and make the tasks as easy to perform as possible.
5. List and discuss with the RESET team and the Operations Manager your suggestions for improvement in the checklists, fax sheets or tasks. Also, provide a list of needs or concerns.

## Appendix A: ARM/TWPO Acronyms

ACCESS	Automated Communication Control and Environmental Supervision System
ADaM	ARCS Data and Management System
AERI	Atmospheric Emitted Radiance Interferometer
ARCS	Atmospheric Radiation and Cloud Station
ARM	Atmospheric Radiation Measurement
ATLAS	Atmospheric Laboratory for Applications and Science
AVHRR	Advanced Very High Resolution Radiometer
AWOG	ARM Ocean Working Group
BBSS	Balloon Borne Sounding System
BNL	Brookhaven National Laboratory
CLASS	Cross-Chain LORAN Atmospheric Sounding System
CSP	Combined Sensor Program
DOE	U.S. Department of Energy
ECMWF	European Centre for Medium-Range Weather Forecasts
ENSO	El Niño Southern Oscillation
GNDaily	Groundward Looking Radiometer Stand
RoundsAD	
GOES	Geostationary Operational Environmental Satellite
HRPT	High Resolution Picture Transmission
INU	Nauru
IOP	Intensive Operational Period
IRT	Infrared Radiometer
ISS	Integrated Sounding System
JAMSTEC	Japanese Marine Science and Technology Center
MAS	Manus
MFRSR	Multi-Filter Rotating Shadowband Radiometer
MPL	Micro-Pulse Lidar
MWR	Microwave Radiometer
N	Number
NCAR	National Center for Atmospheric Research
NIP	Normal Incidence Pyreheliometer
NOAA	National Oceanic and Atmospheric Administration
NSA/AO	North Slope of Alaska and Adjacent Arctic Ocean
NTS	National Tidal Facility
NWS	National Weather Service
OMS	Operations Management System
PIR	Precision Infrared Radiometer
PMEL	Pacific Marine Environmental Laboratory
PNG	Papua New Guinea
PSP	Precision Spectral Radiometer
RACE	Remote Accessibility Communication Equipment (ACCESS)
RASS	Radio-Acoustic Sounding System
RESET	REgional Service Team
SAM	Supervision and Management (ACCESS system)
SE	Significant Event
SGP	Southern Great Plains
SKYRAD	Skyward Looking Radiometer Stand
SPaRCE	Schools of the Pacific Rainfall Climate Experiment
SPREP	South Pacific Regional Environment Program
SST	Sea-Surface Temperature
TAO	Tropical Atmosphere-Ocean
TOCS	Tropical Ocean Climate Study

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TOGA Tropical Ocean and Global Atmosphere  
 TOGA COARE Tropical Ocean Global Atmosphere Coupled Ocean-Atmosphere Response  
 Experiment  
 TRITON Triangle Trans-Ocean Buoy Network  
 TSI Total Sky Imager  
 TWPO Tropical Western Pacific Office  
 VCEIL Vaisala Ceilometer  
 VISSR Visible and IR Spin Scan Radiometer  
 VOS Volunteer Observing Ship  
 VSOS Volunteer Ship Observing System  
 WMO World Meteorological Organization  
 WSI Whole Sky Imager