Beaufort Coastal Stations Summary and Data Review, May 2008

Wind direction and wind velocity instruments at Milne Point – F Pad Meteorological Station photo taken 03.14.08 by M. Lilly

by

HoracioToniolo, Michael Lilly,

Dan Reichardt, and Austin McHugh

August 2008

Minerals Management Service and

North Slope Lakes Hydrologic Project

Report No. INE/WERC 08.01

Water and Environmental Research Center

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- Minerals Management Service

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[1] University of Alaska Fairbanks, Water and Environmental Research Center
[2] Geo-Watersheds Scientific, Fairbanks, Alaska

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For additional information write to:

Publications,
Water and Environmental Research Center
University of Alaska Fairbanks
Fairbanks, Alaska 99775
www.uaf.edu/water/

For Project Information write to:

Horacio Toniolo – Project Manager
Box 755900, UAF
Fairbanks, AK 99775-5900
907-474-7977
ffhat@uaf.edu

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DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the accuracy of the data presented herein. This research was funded by the Minerals Management Service (MMS), and with supporting In-Kind support from Geo-Watersheds Scientific (GWS). The contents of the report do not necessarily reflect the views or policies of MMS, GWS, or any local sponsor. This work does not constitute a standard, specification, or regulation.

The use of trade and firm names in this document is for the purpose of identification only and does not imply endorsement by the University of Alaska Fairbanks, MMS, GWS, or other project sponsors.

ABBREVIATIONS AND SYMBOLS

DOE	Department of Energy
C	degree Celsius
F	degree Fahrenheit
ft/s	feet/second
GWS	Geo-Watersheds Scientific
hp/ft^2	horse power/square feet
mb	mili bar
m/s	meter/second
MMS	Minerals Management Service
NPR-A	National Petroleum Reserve – Alaska
UAF	University of Alaska Fairbanks
WERC	Water and Environmental Research Center

PROJECT COOPERATORS

This project was developed in coordination with the North Slope Lakes project, which covers a large area of the North Slope and benefits from a number of positive partnerships. All project partners contribute to the overall project objectives.

- BP Exploration (Alaska) Inc.
- Conoco Phillips Alaska (CPA)
- Geo-Watersheds Scientific
- Bureau of Land Management
- Alaska Department of Natural Resources
- The Nature Conservancy
- Northern Alaska Environmental Center
- Minerals Management Service

ACKNOWLEDGEMENTS

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Beaufort Coastal Stations Summary and Data Review

INTRODUCTION

The Department of the Interior Minerals Management Service (MMS) and the University of Alaska Fairbanks, Institute of Northern Engineering, signed a Memorandum of Understanding in 2006. As a result of this agreement, MMS transferred five meteorological stations along the Beaufort Sea Coast, Alaska (Figure 1) (named as: Badami, Milne Point, Cottle Island, Northstar and Endicott) to the University. These meteorological stations each collected data on wind speed, wind direction, barometric pressure, relative humidity, solar radiation, and air temperature. The stations at Badami, Milne Point (F Pad), and Cottle Island remain at their current locations; the meteorological stations located on the Northstar Production Island and Endicott were decommissioned. Two new stations will be installed at the ConocoPhillips CD3 drilling pad, located north of the Alpine facility and in the Colville Delta, and on the northern end of Duck Island which is located in the Prudhoe Bay area. The Department of Energy (DOE), through the North Slope Lakes Project provided funding to help upgrade the existing stations and relocate the two new stations. These station updgrades and relocations were initiated to support additional meteorological and soils data collection along the Beaufort Sea coastal area. These data not only help with studies and applications related to inland water resources and tundra travel, but also with coastal erosion and off-shore oceanographic studies and operations.

The data from these stations serve multiple data applications. The coastal stations are used for coastal oceanographic projects as well as traveler-safety information for coastal marine logistics. The sites also provide information helpful to water-resource projects and management, and future tundra-travel management applications. Adverse weather conditions can create harzardous working conditions and weather information during these period is critical for both forecasters and people doing field work in these areas.

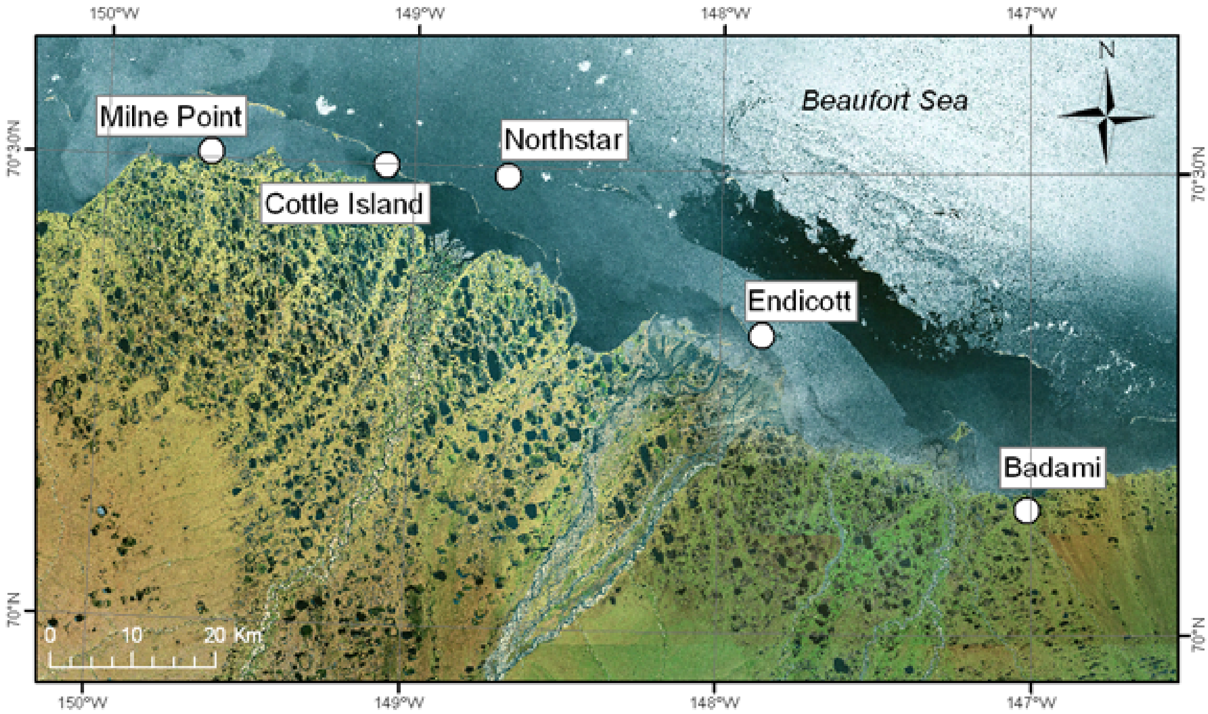


Figure 1. Historical locations of Beaufort coastal weather station locations.

STATION STATUS

The status of each meteorological station is described below:

1. Cottle Island: During Fall 2007, GWS personnel tried to visit the station two times. None of the attempted trips were accomplished due to bad weather conditions (high winds and rough seas).
2. Badami: UAF and GWS personnel visited the station on May 16, 2008. Meteorological data were downloaded and station was inspected. Data were reported electronically to MMS following the requested data format.
3. CD3: This is a new stations to be installed with DOE funding support. GWS, UAF, and ConocoPhillips personnel reached an initial agreement on the location of this station. Datalogger and wind measurement devices will be located on an existing building near the CD3 runway. Additional instruments will be located on the adjacent tundra to the east of the building location. Permits are being prepared.
4. Duck Island: This is a new station. GWS, UAF, and BP personnel reached an initial agreement on the location of this station. The station is located near the Endicott Road, on the North End of Duck Island. Sensors to measure basic parameters (i.e., air temperature, wind speed, wind direction, etc) were installed on May 26, 2008.

5. Milne Point – F Pad: In 2008, the station was visited in February and March by GWS and UAF personnel. Meteorological data were downloaded. The existing datalogger (CR10X) was replaced by a new datalogger (CR1000); wiring diagram is shown in Appendix I. The data acquisition program was upgraded (see Appendices II and III), and standards to support BP air-quality studies were maintained. Data were reported electronically to MMS following the requested data format.

FUTURE ACTIONS

The following actions for each station are planned by UAF and GWS personnel

1. Cottle Island: GWS and UAF personnel will plan to visit the site on August 14, 2008, using a MMS charter vessel. The station will be upgraded and data will be downloaded from the existing datalogger. It is expected that after upgrading, data from the station will be available to MMS in near-real time via a link to a specific web site.
2. Badami: UAF and GWS will plan to visit the site early in summer. The station will be upgraded. It is expected that after upgrading, data from the station will be available to MMS in near-real time via a link to a specific web site.
3. CD3: Initial (basic) installation will be conducted during April-May trips to Alpine facility as part of the North Slope Lakes Project. It is expected that the station will be fully installed by the end of Summer 2008. By that time, it is expected that data from the station will be available to MMS in near-real time via a link to a specific web site.
4. Duck Island: It is expected that the station will be fully installed by the end of Summer 2008, providing data in near-real time via a link to a specific web site.
5. Milne Point – F Pad: This station will be upgraded during the June trip to BP – Prudhoe Bay oil field as part of the North Slope Lakes Project. It is expected that the station will be fully installed by the end of Summer 2008. It is also expected that data from the station will be available to MMS in near-real time via a link to a specific web site.

DATA REVIEW FOR MILNE POINT - F PAD AND BADAMI STATIONS

Data were downloaded from Milne Point - F Pad and Badami. Data from the Milne Point – F Pad station ranged from December 17, 2000 to March 14, 2008 (date of data download). Data downloaded from the Badami station ranged from December 8, 2005 to May 16, 2008 (date of data download). However, data up to September 30, 2006 were reported by a previous contractor, Hoefler Consulting Group; for details see the Final Report for the Nearshore Beaufort

Sea Meteorological Monitoring and Data Synthesis Project (Hoefler Consulting Group, 2007). Thus, data from October 1, 2006 to March 14, 2008 (Milne Point – F Pad) and from October 1, 2006 to May 16, 2008 (Badami) were reported electronically to MMS following the required data format.

The instruments installed in the stations as well as their ranges are described in Table 1 (Hoefler, 2007). Quality Assurance and Quality Control analyses were conducted on the 2006 – 2008 data sets. Criteria used in the analyses consisted of:

- Check for missing data
- Check for values outside the instrument's range
- Check for realistic range (dependent on the season) and for realistic change between readings.
- Air temperature
    - Average air temperature, check the difference between sensors
    - Maximum, average, and minimum, check that average temperature falls between maximum and minimum temperature for a given time.
- Wind Speed, Wind direction,
    - Check for zero values

Table 1: Instruments installed at Milne Point - F Pad and Badami Weather Stations

Make/Model	Range	Parameter
Climatronics F460	0.0 m/s to 60 m/s	Wind Speed
Climatronics F460	0^{o} to 360^{o}	Wind Direction
Climatronics 100093-2	$-50\,^{o}C$ to $+50\,^{o}C$	Air Temperature
Campbell Scientific HMP 45C	$-40\,^{o}C$ to $+60\,^{o}C$	Air Temperature
Campbell Scientific HMP 45C	0 % to 100 %	Relative Humidity
Campbell Scientific 105	600 mb to 1060 mb	Barometric Pressure
Campbell Scientific LI200X	400 nm to 1100 nm	Solar Radiation
Campbell Scientific CR10X-XT	$-55\,^{o}C$ to $+85\,^{o}C$	Datalogger, (used to calculate Wind Sigma)

Results indicate that over a total possible of 13,457 hourly readings in Milne Point –F Pad station, only 3 were missing (these missing data correspond to August 23, 2007 from 2 PM to 4 PM). In addition, 155 readings of average air temperature in the HMP 45C sensor were below -40^{o}C (lower range). No readings above the upper range were detected. Average temperatures were located between minimum and maximum ranges over the analysis period. Most of the time, readings for relative humidity were within the specified range (0 to 100%), however 534 values were above 100%. Temporal variation of measured or calculated parameters is presented in the following figures.

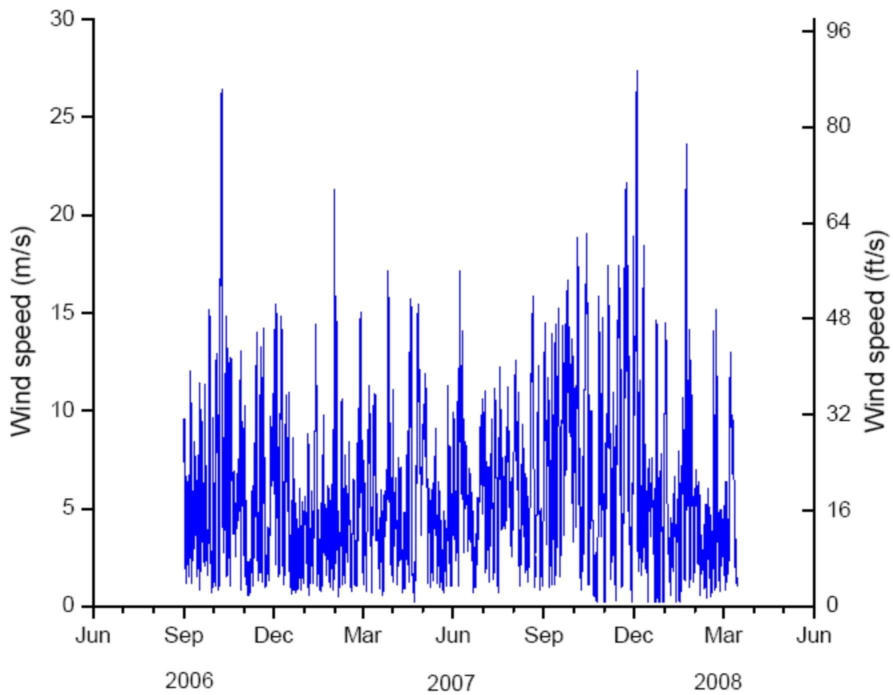


Figure 2. Milne Point – F Pad: Wind Speed

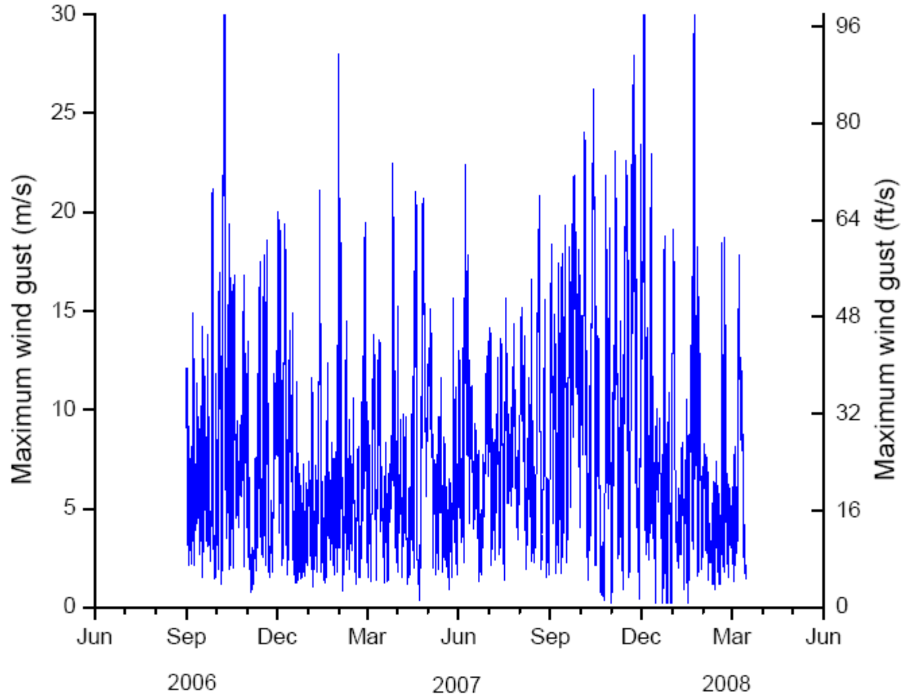


Figure 3. Milne Point – F Pad: Maximum Wind Gust

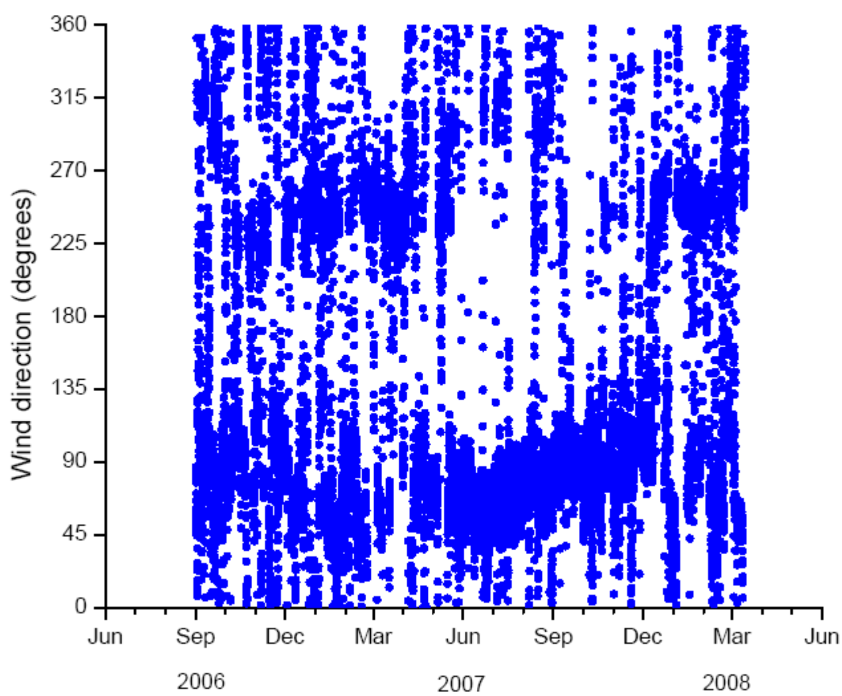


Figure 4. Milne Point – F Pad: Wind Direction

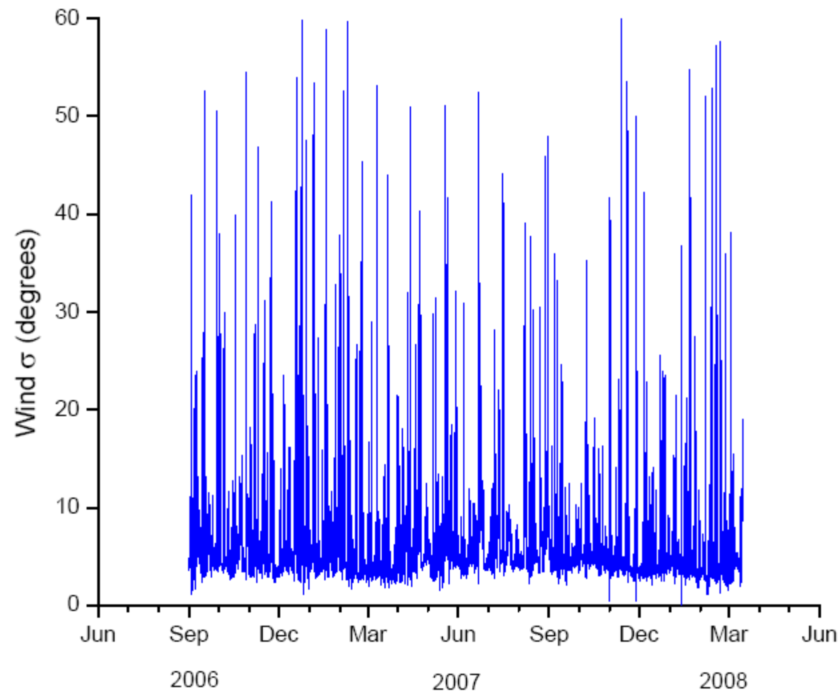


Figure 5. Milne Point – F Pad: Wind Standard Deviation

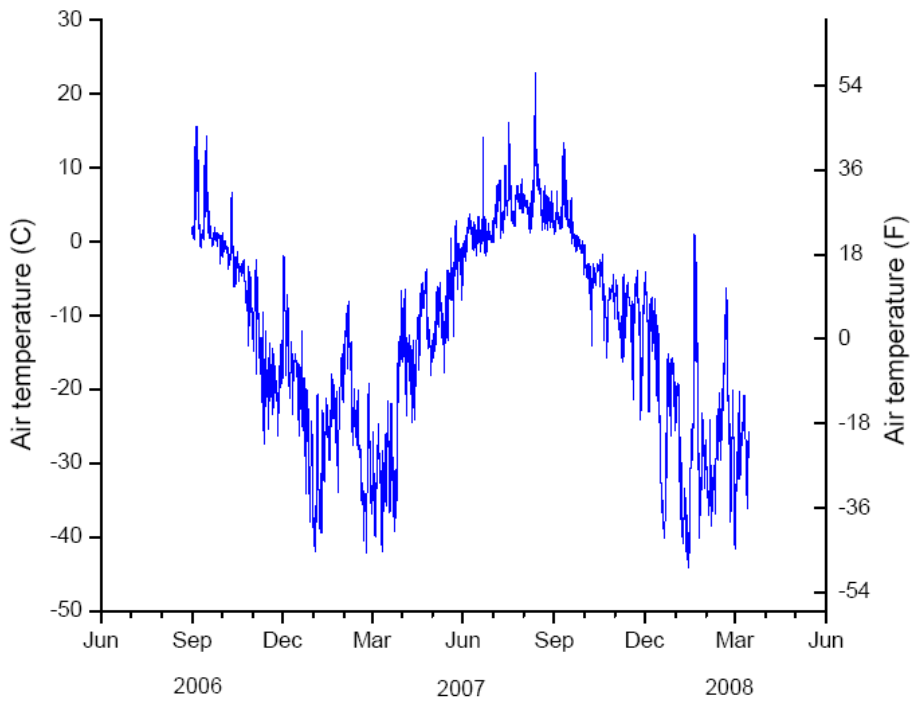


Figure 6. Milne Point – F Pad: Average Air Temperature - PRT Sensor

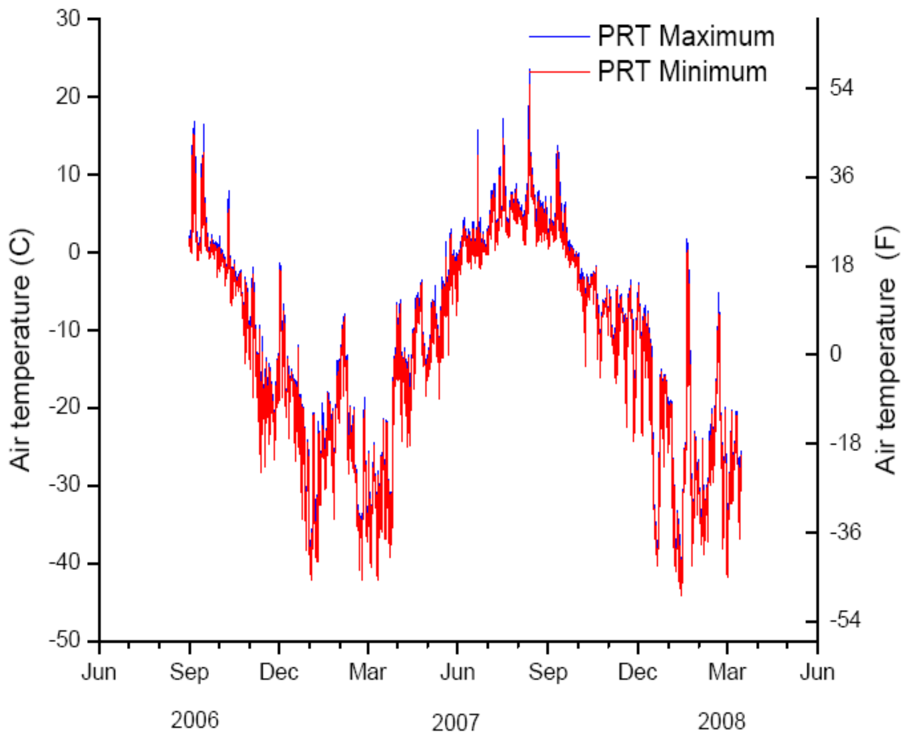


Figure 7. Milne Point – F Pad: Maximum and Minimum Air Temperatures - PRT Sensor

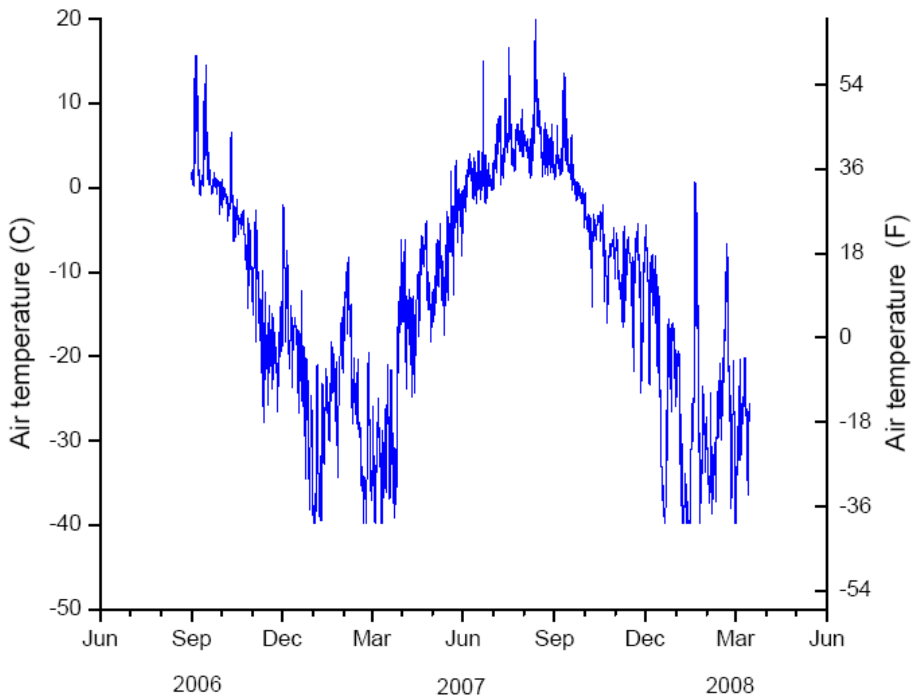


Figure 8. Milne Point – F Pad: Average Air Temperature - HMP 45C Sensor

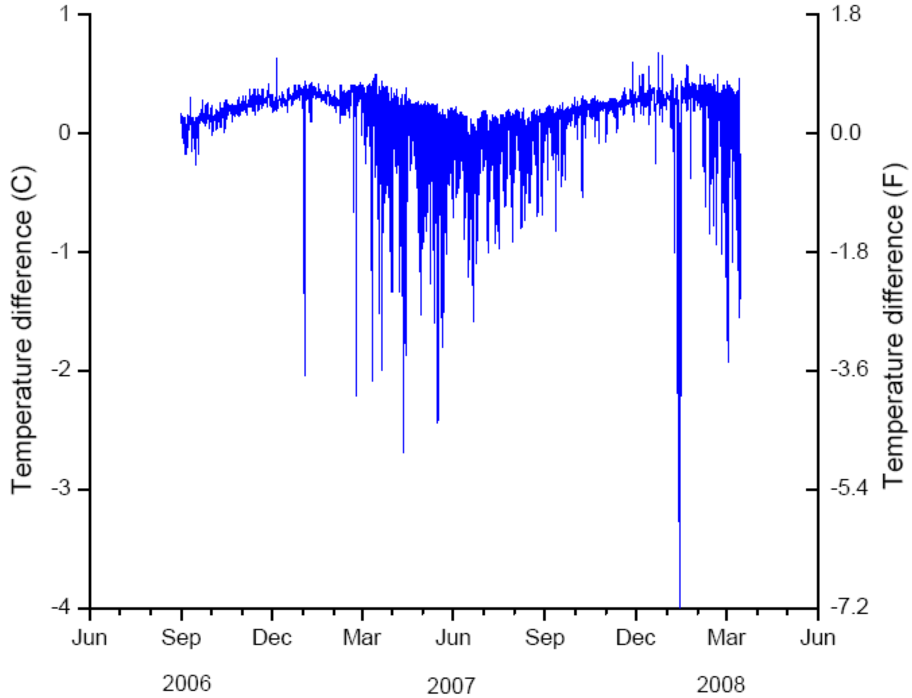


Figure 9. Milne Point – F Pad: Temperature difference between PRT and HMP 45C Sensors [ΔT=PRT-HMP 45C]

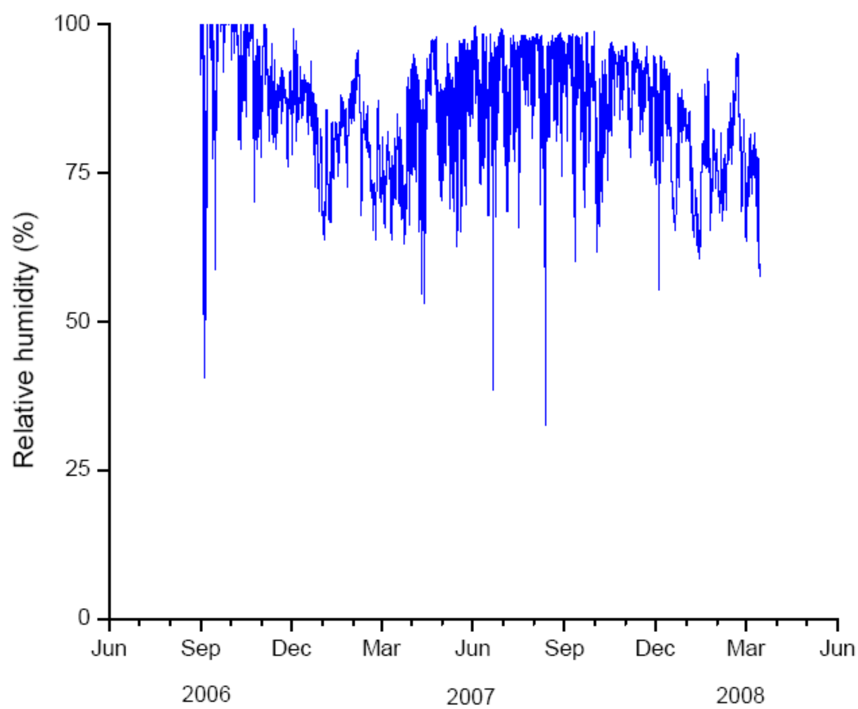


Figure 10. Milne Point – F Pad: Relative Humidity

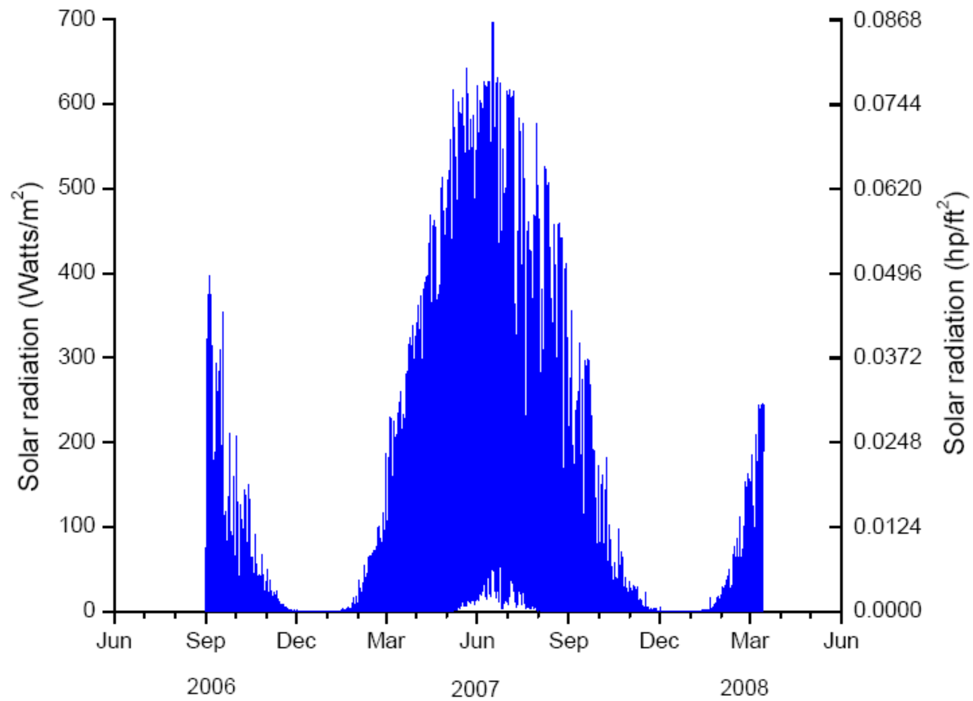


Figure 11. Milne Point – F Pad: Solar Radiation

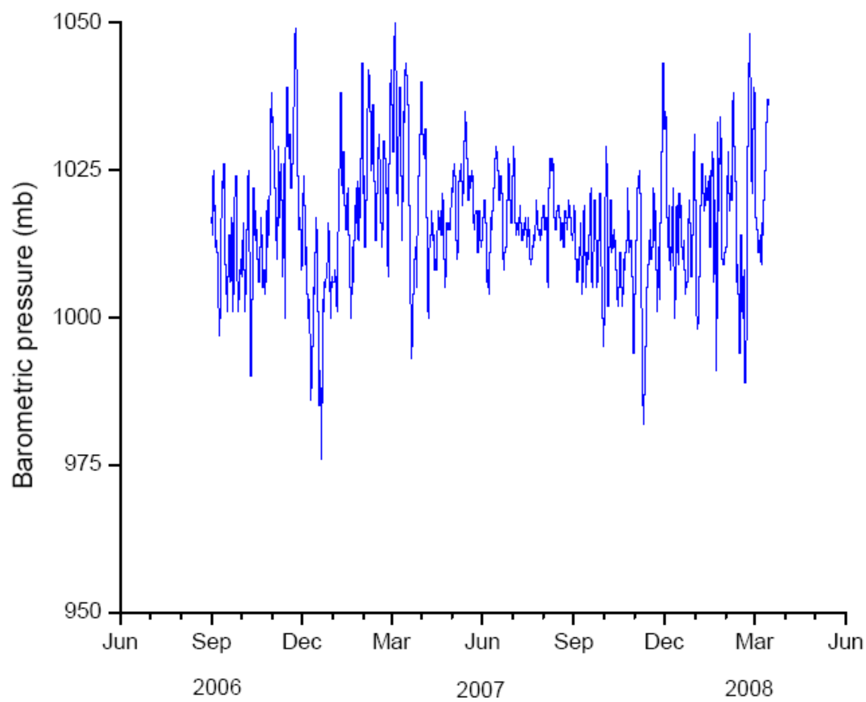


Figure 12. Milne Point – F Pad: Barometric Pressure

Data analyses indicate that all the possible 14,246 hourly readings were available at Badami station. However, unrealistic readings were detected and eliminated in the HMP 45 C sensor (back up air temperature) from July 19, 2007 (7 AM) to July 31, 2007 (5 AM). In addition, Figure 20indicates an increase in the difference between the PRT and HMP 45C sensors from March to May 08. During the May site visit, the temperature sensor was found to be pulled out of the radiation shield. The sensor was replaced and future data will be used to determine the impact of direct solar exposure. The negative differences shown during the winter of 2007/08 could represent the time when the HMP 45C sensor was exposed to the sun (i.e, out of the shield). Values for relative humidity were deleted from July 20, 2007 (2 AM) to July 31, 2007 (4 PM). No air temperature readings outside range were detected. Average temperature was located between minimum and maximum for a given time. Temporal variation of measured or calculated parameters is presented in the following figures.

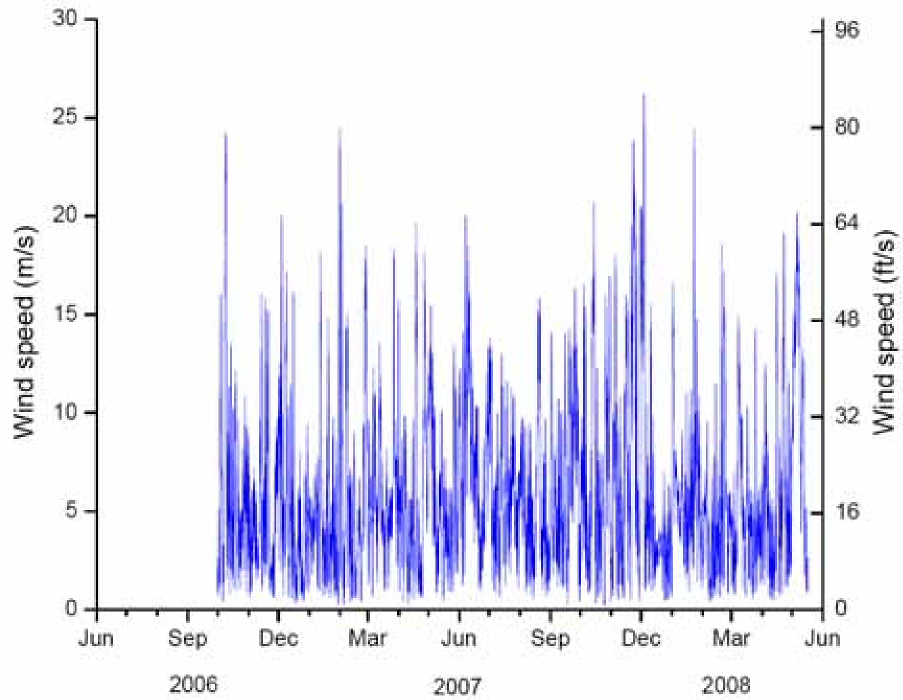


Figure 13. Badami: Wind Speed

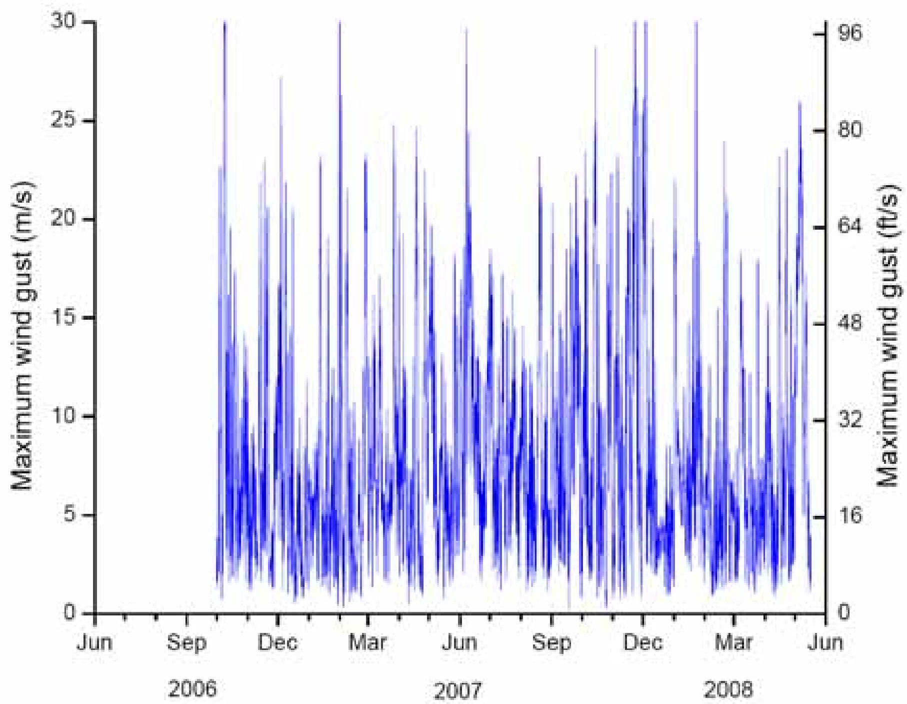


Figure 14. Badami: Maximum Wind Gust

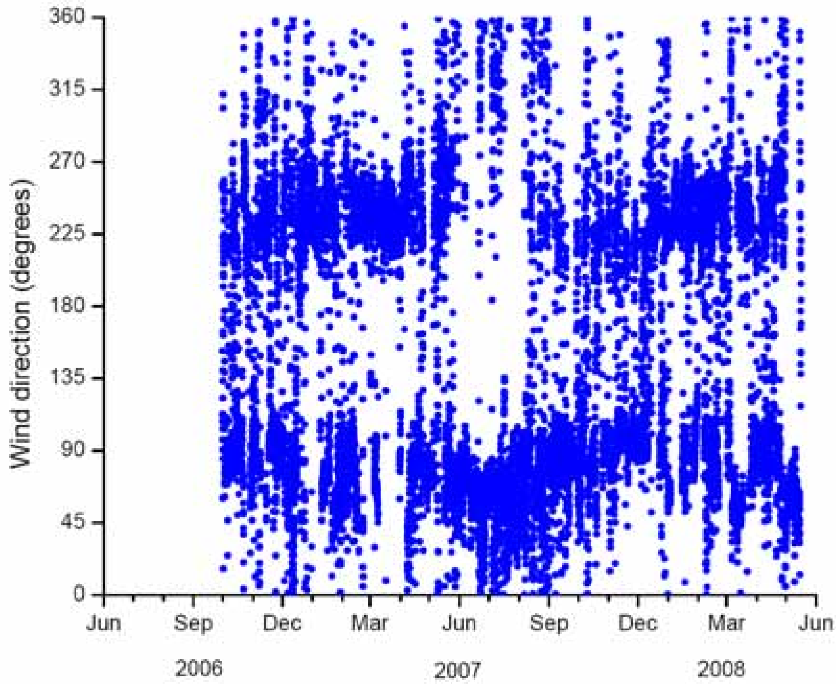


Figure 15. Badami: Wind Direction

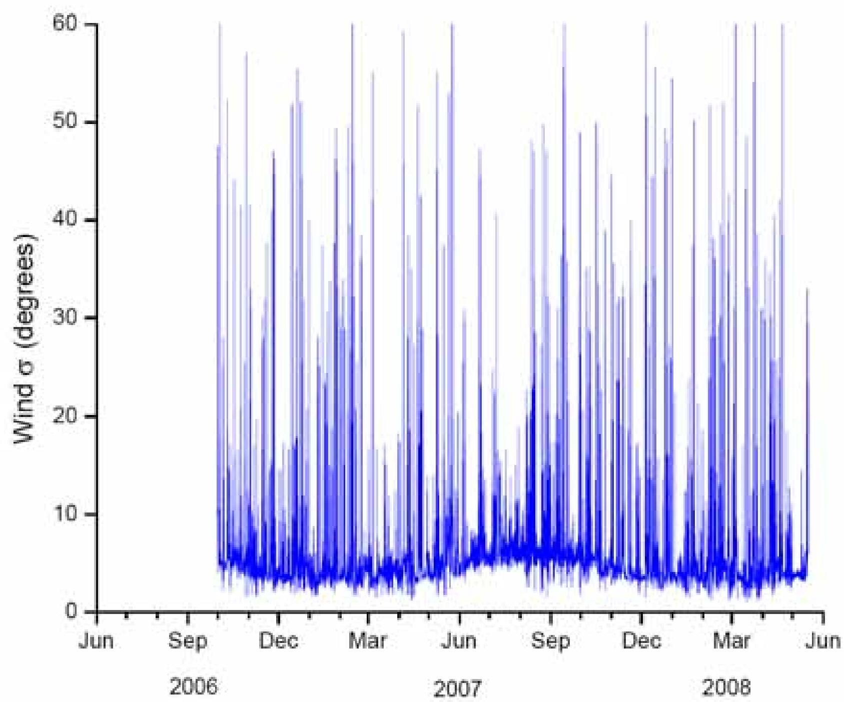


Figure 16. Badami: Wind Standard Deviation

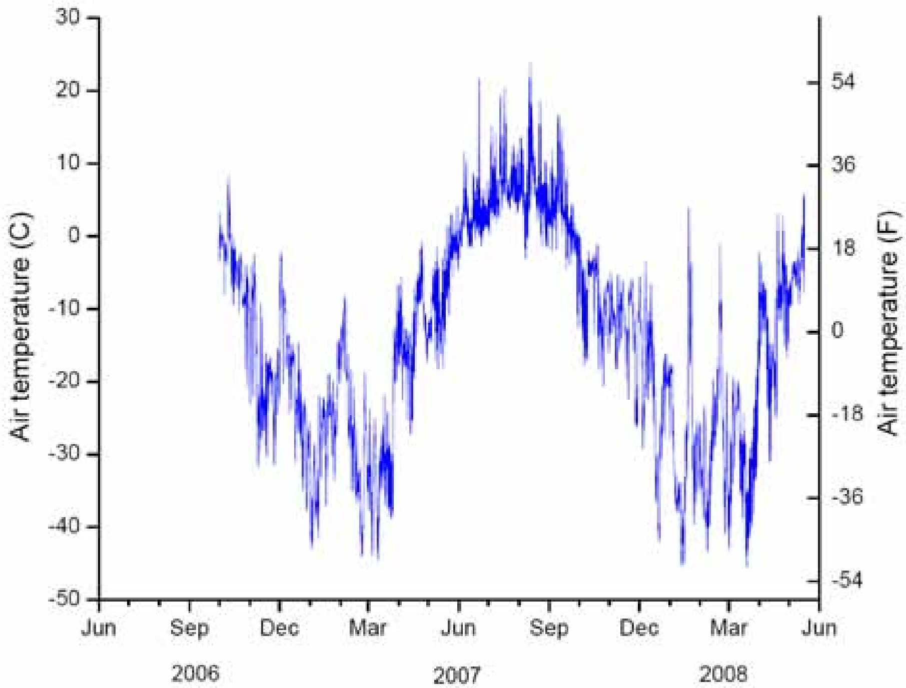


Figure 17. Badami: Average Air Temperature - PRT Sensor

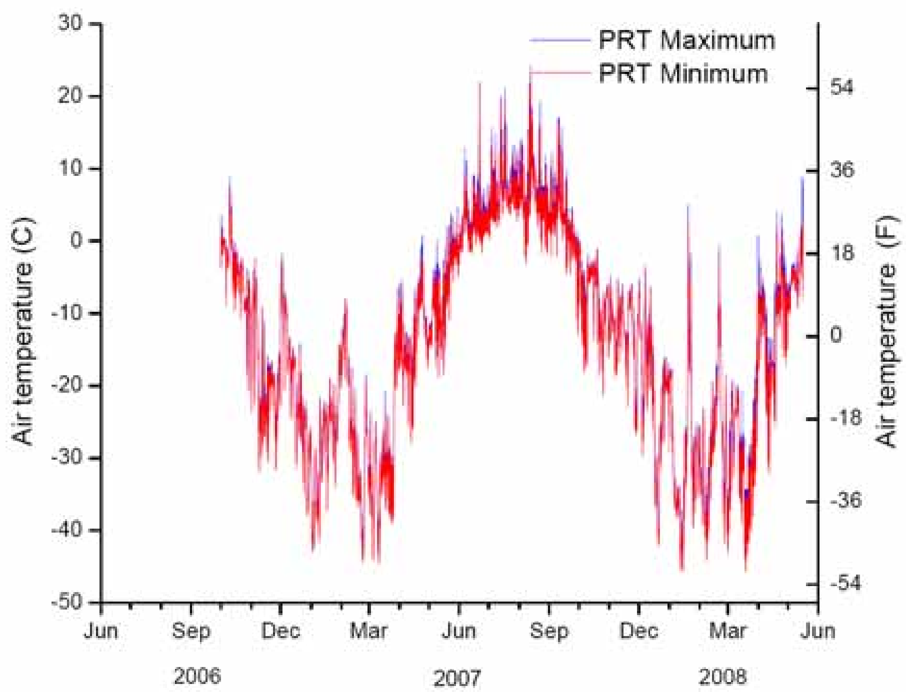


Figure 18. Badami: Maximum and Minimum Air Temperatures - PRT Sensor

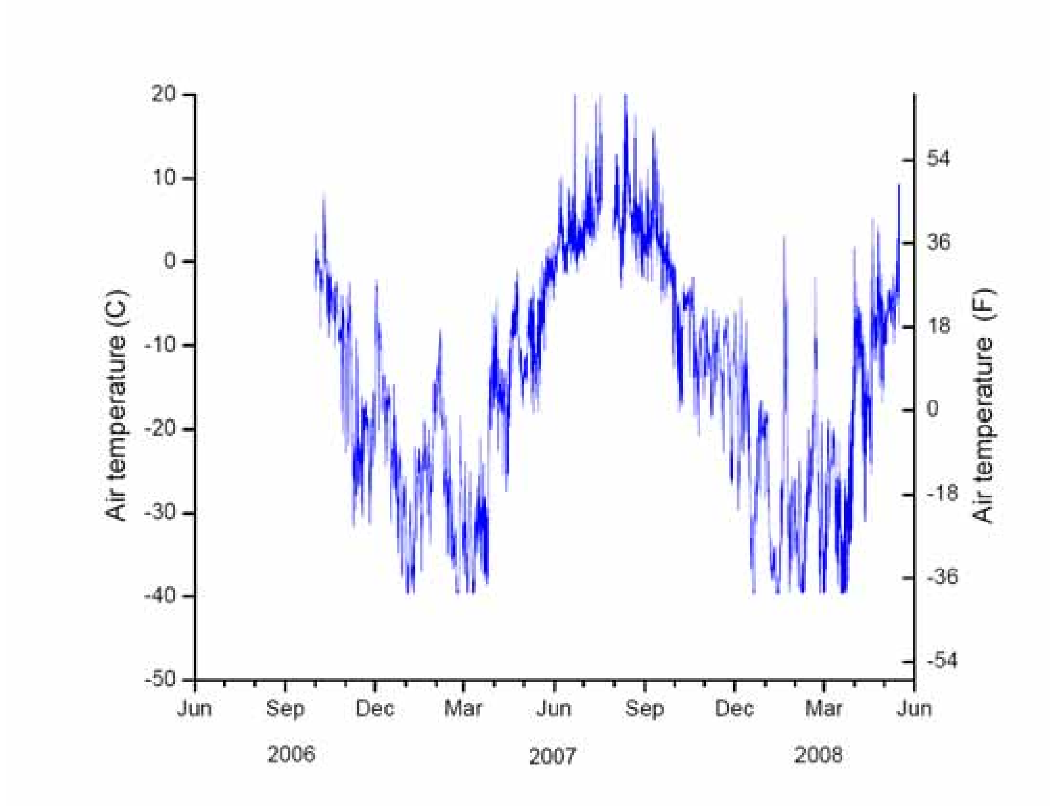


Figure 19. Badami: Average Air Temperature - HMP 45C Sensor

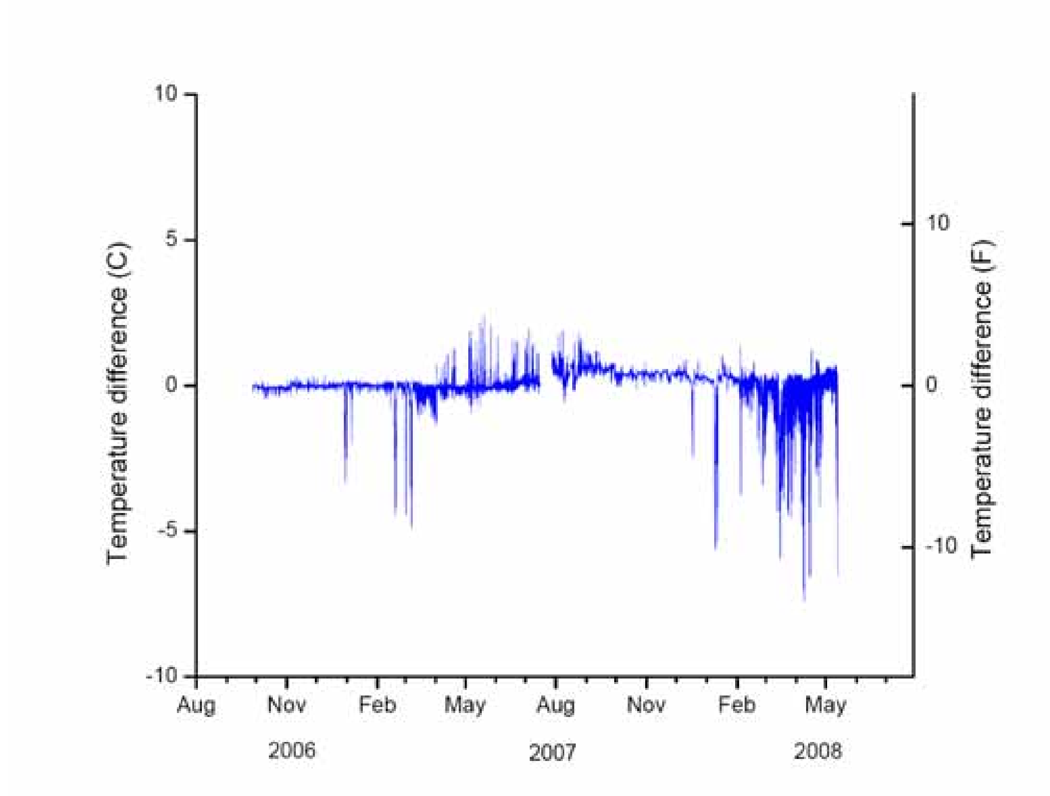


Figure 20. Badami: Temperature difference between PRT and HMP 45C Sensors [ΔT=PRT-HMP 45C]

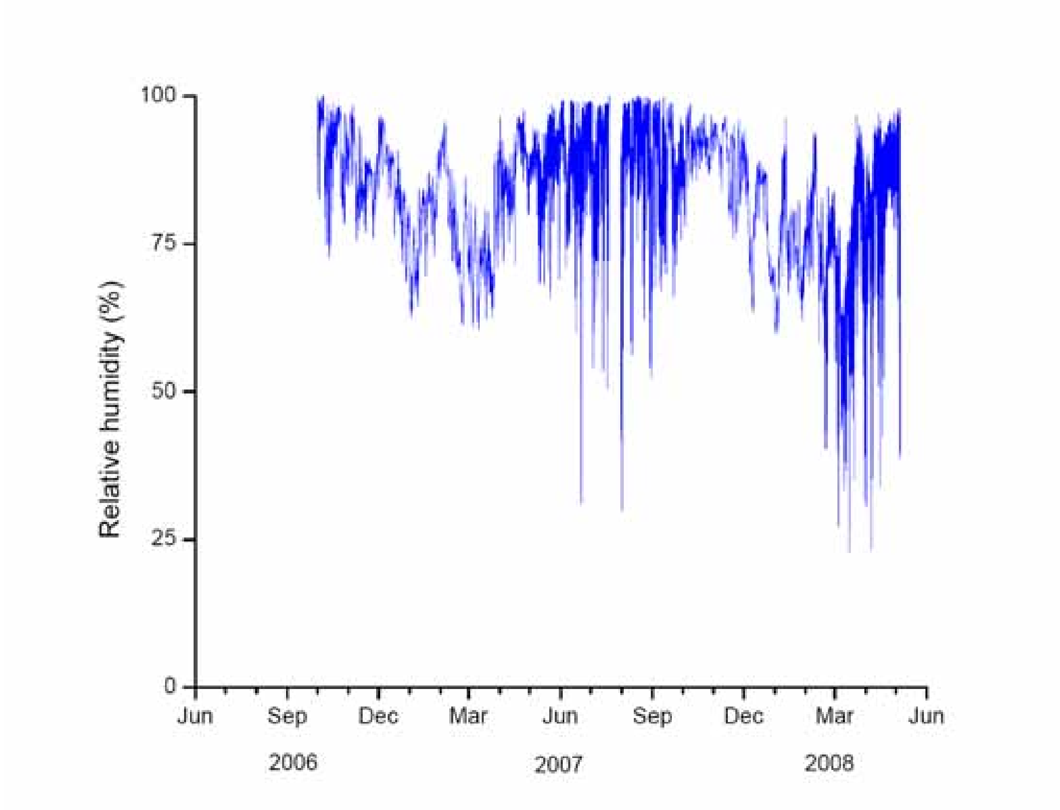


Figure 21. Badami: Relative Humidity

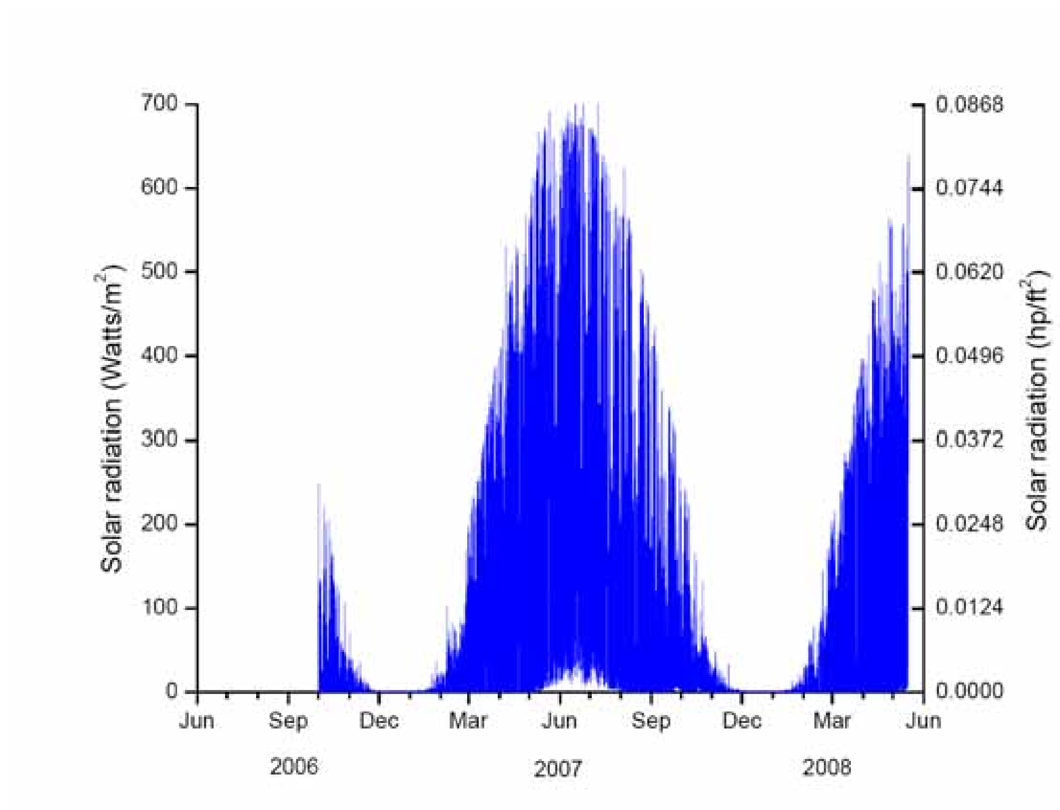


Figure 22. Badami: Solar Radiation

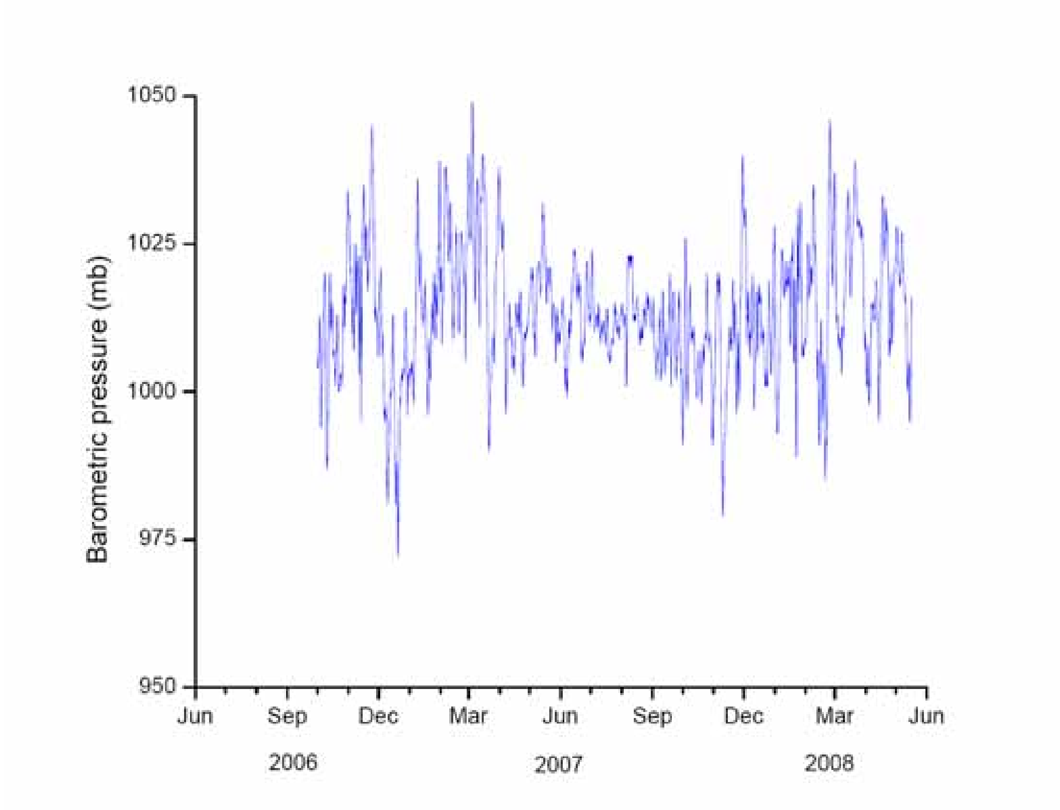


Figure 23. Badami: Barometric Pressure

SUMMARY

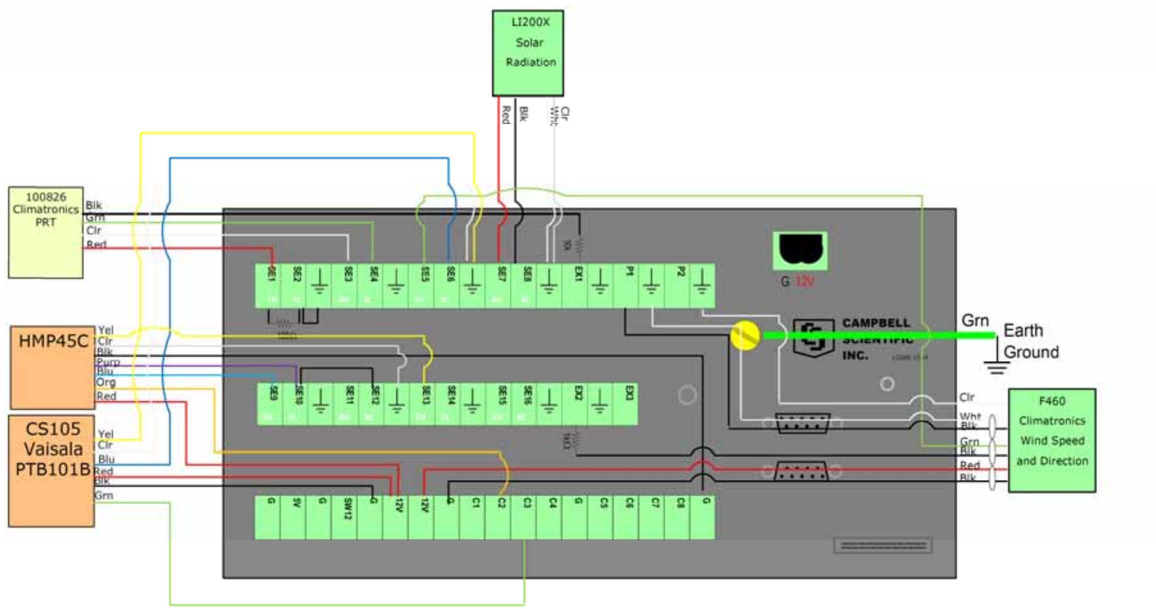
Temporal variation for wind speed, maximum gust, standard deviation, average air temperature minimum and maximum air temperature, solar radiation, relative humidity, and barometric pressure for two weather stations (Milne Point – F Pad and Badami) on the Beaufort coastal areas were reported. Data indicate that maximum wind gusts in Badami are higher than in Milne Point – F Pad. Air temperature and solar radiation follow well defined seasonal patterns.

It is anticipated that all the weather stations will provide data in near-real time after upgrading and telemetry system are in place by the end of 2008.

REFERENCES

Hoefler Consulting Group (2007). Final Report for the Nearshore Beaufort Sea Meteorological Monitoring and Data Synthesis Project. 107 p. OCS Study MMS 2007-011 Available at: http://www.mms.gov/alaska/reports/2007rpts/2007_011/2007_011.pdf

APPENDIX I: MILNE POINT F-PAD CR1000 - WIRING DIAGRAM



Title: Milne Point CR1000 Datalogger Wiring Diagram	
Author: AMcHugh, Geo-Watersheds Scientific	
Date: 7 Feb 2008	Sheet: 1 of 1
Revision: DRAFT 1	

APPENDIX II: MILNE POINT F-PAD CR10X PROGRAM

The following Campbell Scientific Inc. program is was used on the CR10X datalogger, which was originally installed on the Milne-Point F-Pad weather station.

```
};CR10X
MODE 1
SCAN RATE 1
1:P20
1:8889
2:9997

2:P92
1:300
2:1440
3:11

3:P92
1:1020
2:1440
3:21

4:P91
1:11
2:41

5:P91
1:21
2:30

6:P91
1:48
2:41

7:P91
1:58
2:51

8:P95
```

9:P3

1:1

2:1

3:20

4:3

5:.047

6:.22352

10:P4

1:1

2:25

3:5

4:2

5:0

6:2200

7:4

8:.18

9:0

11:P9

1:1

2:23

3:23

4:1

5:1

6:2100

7:1

8:.99651

9:0

12:P16

1:1

2:1

3:2

4:1

5:0

13:P10

1:6

14:P2

1:1

2:22

3:4

4:8

5:200

6:0

15:P89

1:8

2:4

3:0

4:30

16:P30

1:0

2:0

3:8

17:P95

18:P86

1:42

19:P22

1:3

2:0

3:15

4:0

20:P2

1:1

2:5

3:5

4:5

5:.1

6:0

21:P2

1:1

2:5

3:6

4:7

5:.1

6:-40

22:P86

1:52

23:P89

1:5

2:3

3:104

4:30

24:P30

1:100

2:0

3:5

25:P95

26:P92

1:59

2:60

3:43

27:P92

1:0

2:60

3:30

28:P1

1:1

2:25

3:6

4:9

5:.184

6:600

29:P86

1:53

30:P95

31:P92

1:0

2:60

3:10

32:P80

1:1

2:333

33:P77

1:1220

34:P69

1:1

2:900

3:0

4:3

5:4

35:P71

1:1

2:2

36:P71

1:1

2:7

37:P71

1:1

2:5

38:P71

1:1

2:6

39:P71

1:1

2:8

40:P70

1:1

2:9

41:P73

1:1

2:0

3:3

42:P74

1:1

2:0

3:2

43:P73

1:1

2:0

3:2

44:P96

1:71

45:P0

MODE 2

SCAN RATE 0

MODE 3

1:P0

MODE 10

1:28

2:500

3:0

4:1097729

5:2048

MODE 12

1:0

1:0

1:0

MODE 13

13:8

8:0

MODE 13

13:9

9:0

MODE 13

13:10

10:0

MODE 13

13:13

13:0

MODE 11

1:18654

2:4573

3:2304

4:9

5:0

6:1

7:13

8:3.314

9:99

10:00--

11:.375

APPENDIX III: MILNE POINT F-PAD CR1000 PROGRAM

The following program is for the Campbell Scientifcic Inc. CR1000 datalogger. It is written in CRBasic and is for the Milne-Point F-Pad weather station.

```
'Program name: MilnePt2008-2-4.CR1

' Modifications from previous CR10X version
' - Execution interval to 5 seconds from 1 second
' - CR1000s do not support storage modules.
' - The original multiplier was 0.047 which is Heavy Duty Aluminum cups meter/sec
' The offset was 0.223 HD Aluminum cups meters/sec.
' - removed phone modem control

'Date written: 2/4/2008
'Transform Version: 0.5
'Transform file: C:\Program Files\Campbellsci\LoggerNet\CR10X.TRN Version: 1.1
'
'This program was converted from C:\Documents and Settings\Austin McHugh\My
Documents\GWS\Projects\MMS\MilnePt\MilnePt Datalogger
Programs\MILNEPTRECREATED2008-2-4.CSI
'using Campbell Scientific's Transformer application.
'
'CRBasic angle units are in Radians by default.
'Switch to Degrees as CR10 used Degrees.
AngleDegrees
'
' Declare array of flags as the CR10 had.
Public Flag(8) as boolean


'\\\\\\\\\\\\\\\\\\\\\\\\\ DECLARATIONS /////////////////////////

Public PRTohms
Public WSpd_ms, WSpd_mph
Public WDir
Public RH
Public BattVolts_V, LoggerTemp_C
Public AirTemp_C, AirTempPRT_C, AirTempPRT_F, WindChill_F, WindChill_C, DewPt_C
Public SolRad_W_m2
Public BP_NC_mB



'\\\\\\\\\\\\\\\\\\\\\\\\ OUTPUT SECTION ////////////////////////


DataTable(HourlyDiag, true, -1)
	DataInterval(0,60,Min,10)
	Sample (1,LoggerTemp_C,FP2)
	Average (1,LoggerTemp_C,FP2,False)
	Sample (1,BattVolts_V,FP2)
	Average (1,BattVolts_V,FP2,False)
	Maximum (1,BattVolts_V,FP2,False,False)
	Minimum (1,BattVolts_V,FP2,False,False)
EndTable
```

```
DataTable(Hourly333, true, -1)
	DataInterval (0,60,min,10)
	WindVector (1,WSpd_ms,WDir,FP2,False,900,0,0)
	Average (1,AirTempPRT_C,FP2,False)
	Average (1,AirTemp_C,FP2,False)
	Average (1,RH,FP2,False)
	Average (1,BattVolts_V,FP2,False)
	Average (1,SolRad_W_m2,FP2,False)
	Sample (1,BP_NC_mB,FP2)
	Maximum (1,WSpd_ms,FP2,False,False)
	Minimum (1,AirTempPRT_C,FP2,False,False)
	Maximum (1,AirTempPRT_C,FP2,False,False)
EndTable


DataTable(HourlyAtmospheric, true, -1)
	DataInterval (0,60,min,10)

	Sample (1,AirTemp_C,FP2)
	Average (1,AirTemp_C,FP2,False)
	Maximum (1,AirTemp_C,FP2,False,False)
	Minimum (1,AirTemp_C,FP2,False,False)

	Sample (1,AirTempPRT_C,FP2)
	Average (1,AirTempPRT_C,FP2,False)
	Maximum (1,AirTempPRT_C,FP2,False,False)
	Minimum (1,AirTempPRT_C,FP2,False,False)

	Sample (1,RH,FP2)
	Average (1,RH,FP2,False)
	Maximum (1,RH,FP2,False,False)
	Minimum (1,RH,FP2,False,False)

	WindVector(1,WSpd_ms,WDir, FP2, 0, 0, 0, 0)
	FieldNames("MeanWindSpeed:ms,VectorWindDir:deg,WindDirStdDev")
	Maximum(1,WSpd_ms, FP2, 0, False)

	Sample (1,SolRad_W_m2,FP2)
	Average (1,SolRad_W_m2,FP2,SolRad_W_m2<0) ' SolRad<0 added to remove any
negative readings from the average.
	Maximum (1,SolRad_W_m2,FP2,False,False)
	Minimum (1,SolRad_W_m2,FP2,False,False)

	Sample (1,BP_NC_mB,FP2)
EndTable


DataTable (DailyAtmospheric, true, -1)
	DataInterval (0,1440,min,10)
```

```
        Average (1,AirTemp_C,FP2,False)
        Maximum (1,AirTemp_C,FP2,False,False)
        Minimum (1,AirTemp_C,FP2,False,False)

        Average (1,AirTempPRT_C,FP2,False)
        Maximum (1,AirTempPRT_C,FP2,False,False)
        Minimum (1,AirTempPRT_C,FP2,False,False)

        Average (1,RH,FP2,False)
        Maximum (1,RH,FP2,False,False)
        Minimum (1,RH,FP2,False,False)

        WindVector(1,WSpd_ms,WDir, FP2, 0, 0, 0, 0)
        FieldNames("MeanWindSpeed:ms,VectorWindDir:deg,WindDirStdDev")
        Maximum(1,WSpd_ms, FP2, 0, False)

        Sample (1,BP_NC_mB,FP2)
        Maximum (1,BP_NC_mB,FP2,False,False)
        Minimum (1,BP_NC_mB,FP2,False,False)

EndTable


'\\\\\\\\\\\\\\\\\\\\\\\\\\\\ PROGRAM ////////////////////////////

BeginProg
        ' we are using a 1 second scan rate to match EPA's requirements as requested by Steve
MacKey
        Scan(1,Sec, 3, 0)

                Battery(BattVolts_V)
                PanelTemp(LoggerTemp_C, 250)

                ';;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                ';                                                      ;;
                ';        Measure WS & WD, compute WindChill_F          ;;
                ';                                                      ;;
                ';;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;


                ' The multiplier 0.047 assumes Heavy Duty Aluminum cups with wind in m/s.
                ' The offset is 0.223 for HD Al  cups meters/sec.
                PulseCount(WSpd_ms, 1, 1, 0, 1, 0.047,0.223)

                'The BrHalf divides the resulting mV output by the excitation
                'voltage so normally the multiplier is 360 or 355 but with the added
                '1K resistor in series w/ the excitation the mult needs to be
                '360*(11k/10k) = 396.
                BrHalf(WDir, 1, mV2500, 5, VX2, 1, 2200,True, 0, _60Hz, 396, 0)
```

```
'From page 180 of the 2006 Alaska Safety Handbook (BP Exploration (Alaska) Inc., ConocoPhillips Alaska)
'Wind Chill (°F) = 35.74 + 0.6215T - 35.75 (V^0.16 ) + 0.4275T(V^0.16 )
' this equation does not applies if WS >= 1mph OR AT <= 40F
'     Where, T=Air Temperature (°F)   V=Wind Speed (mph)
'Air temperature is measured every 1 minute off the mux, wind chill is computed every 5 seconds with the current wind speed and previous 1 minute
' air temperature reading.  We use the YSI thermistor off the mux because it will measure colder.
WSpd_mph=WSpd_ms*2.237
AirTempPRT_F=AirTempPRT_C*1.8+32
' set wind chill temp to air temp
WindChill_F = AirTempPRT_F
' the equation only applies if ws is >= 3 mph and air temp is <= 50 F then apply the equation, other wise WindChill temp remains Air Temp.

WindChill_F = 35.74+0.6215*AirTempPRT_F-35.75*(WSpd_mph^0.16)+0.4275*AirTempPRT_F*(WSpd_mph^0.16)
If WSpd_mph < 3 OR AirTempPRT_F > 50 Then WindChill_F = AirTempPRT_F

WindChill_C = (WindChill_F-32)/1.8

';;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
';                                          ;;
';         Measure Climatronics PRT                   ;;
';                                          ;;
';;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;


BrFull6W(PRTohms, 1, mV25, mV25, 1, VX1, 1, 2100, true, true, 0, _60Hz, 996.5, 0)
PRT(AirTempPRT_C,1,PRTohms,1,0)


';;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
';                                          ;;
'                 Measure  Solar Radiation          ;;
';                                          ;;
';;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;


VoltDiff(SolRad_W_m2, 1, mV7_5, 4, true, 0, _60Hz, 200, 0)

If (SolRad_W_m2 < 0) Then
        SolRad_W_m2 = 0
EndIf

';;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
';                                          ;;
';         Measure HMP45C AT & RH, compute DewPt.     ;;
```

```
        ';                                              ;;
        ';;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;


        PortSet(2, 1)
        Delay(0,150,MSEC)
        VoltDiff(RH, 1, mV2500, 5, true, 0, 250, 0.1, 0)
        VoltDiff(AirTemp_C, 1, mV2500, 6, true, 0, 250, 0.1, -40)
        PortSet(2, 0)
        If (RH >= 104) Then
            RH = 100
        EndIf
        ' compute Dew Point C

        DewPoint (DewPt_C,AirTemp_C,RH)

        ';;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
        ';                                              ;;
        ';      Measure Barometric Pressure once an hour    ;;
        ';                                              ;;
        ';;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;


        If  TimeInToInterval(59,60,Min) Then PortSet(3, 1)
        If  TimeIntoInterval(0,60,Min) Then
            ' mult = 0.184 mB/mv
            VoltSE(BP_NC_mB, 1, mV2500, 6, False, 0, _60Hz, 0.184, 600)
            PortSet(3, 0)
        EndIf


        CallTable (DailyAtmospheric)
        CallTable (HourlyAtmospheric)
        CallTable (HourlyDiag)
        CallTable (Hourly333)
    NextScan
EndProg
```