



Bell Bay Pulp Mill
Hydrodynamic Modelling Project
Five Mile Bluff Meterological Station Final Data
Report.

Prepared for the Commonwealth Minister for Sustainability, Environment, Water,
Population and Communities in accordance with approval EPBC 2007/3385

Prepared by:

Gunns Limited

78 Lindsay St

Launceston. 7250

Tasmania

Date: 4 October 2010

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Introduction

A comprehensive hydrodynamic modelling project has been completed, addressing Conditions of the Commonwealth Government's Approval Decision 2007/3385 and Conditions of the Government of Tasmania's State Permit for the Bell Bay Pulp mill Project.

A comprehensive and detailed Scope of Works (SoW) was developed in consultation with State & Commonwealth regulators. The Scope of Works describes amongst other matters the design of a field monitoring component to support the numerical modelling component

Study Design

Gunns Limited awarded the marine field measurement component of the SoW to RPS MetOcean Pty Ltd of Jolimont, Western Australia, with the exception of a land based meteorological station sub-component which is being managed by Gunns' internal resources. The marine field measurements, when combined with the land based meteorological station comprise Item 1 of the overall project which is used to inform the development of the numerical model.

Component Reports

Gunns have committed to provide 'milestone' reports to the Commonwealth through the modelling project's life. This report includes data for the full 12 month period coinciding with the deployment of field instrumentation in Bass Strait.

The MetOcean component for this data report is provided under separate cover, whereas this document contains presentations of the meteorological data collated by Gunns.

Measurements

Site

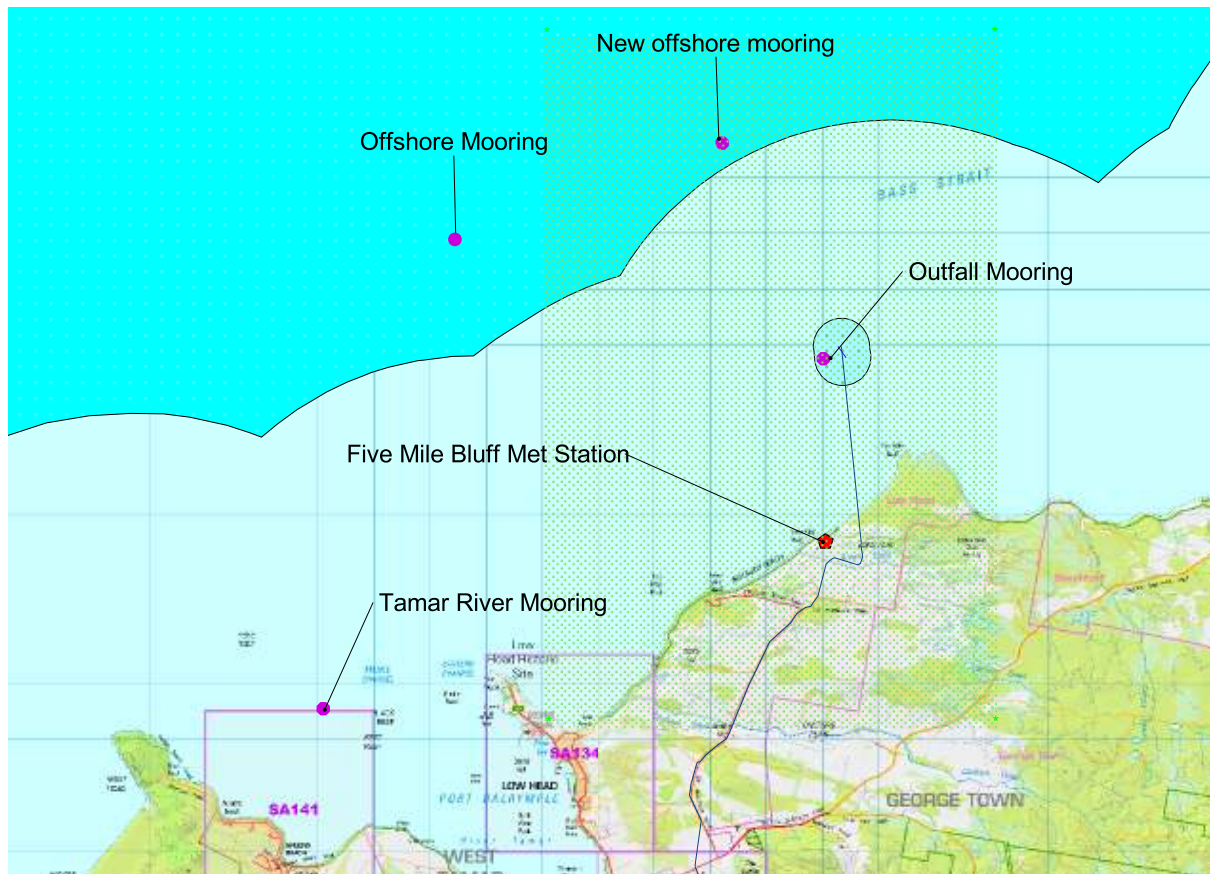


Figure 1 Infrastructure locations

Instrumentation

Table 1 Meteorological Station (Five Mile Bluff region), measurement parameters, sensors, data return for measurement period and measurement units.

Parameter	Sensor	Data Return	Units
Vector average wind speed	RM Young 85000 Ultrasonic	97%	m.s ⁻¹
Vector average wind direction	As above	97%	Degree
Temperature (2m & 10m)	RM Young 41342LC	97%	Degree C
Relative Humidity	RM Young 41382LC	97%	%
Solar Radiation	Middleton SKO8 pyranometer	97%	W.m ⁻²

Parameters and Data Presentation

Parameters and measurement equipment are detailed in Table 1. All data collected and presented are based on 5 minute averages. The reporting period for meteorological data covers the period 2nd September 2009 to 2nd September 2010, that is, covering the same period as reported by MetOcean for the marine field measurements¹.

Data is presented as:

- Annual Wind Roses
- Time series plots, covering the period 2/09/2009 to 2/09/2010.

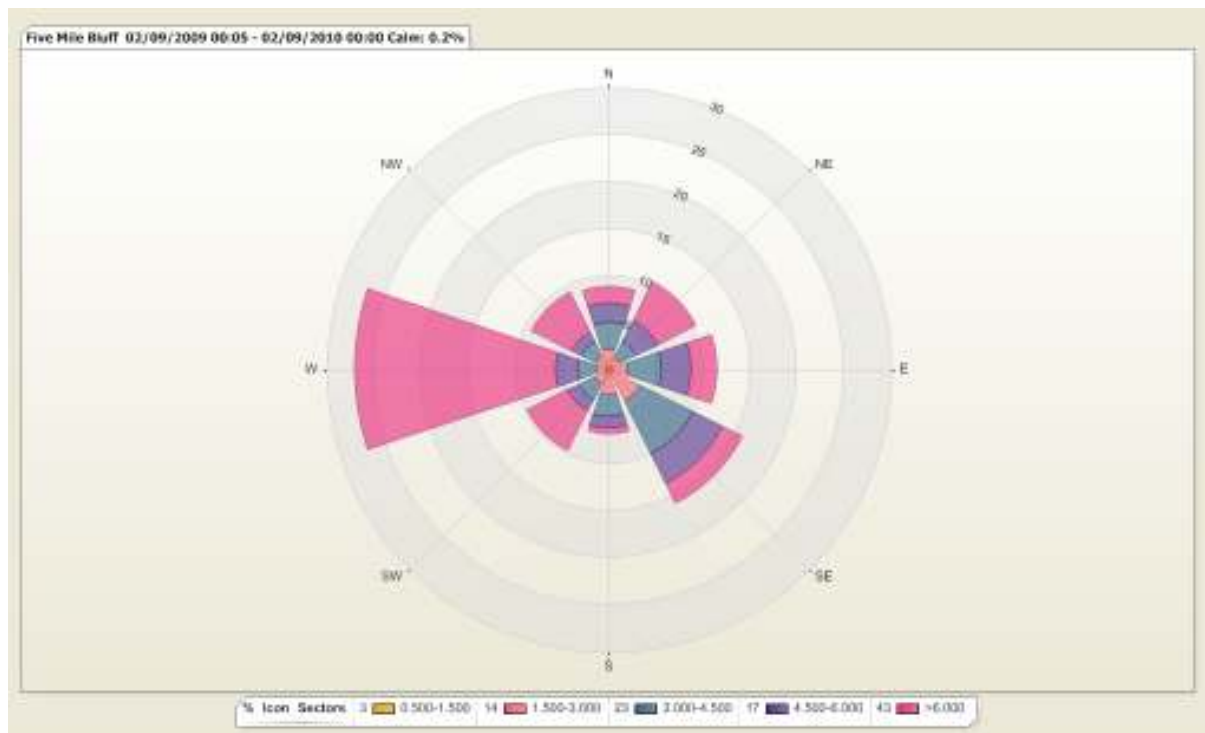


Figure 2 Wind Rose for the period from September 2, 2009 to September 2, 2010

¹ Unless otherwise indicated.

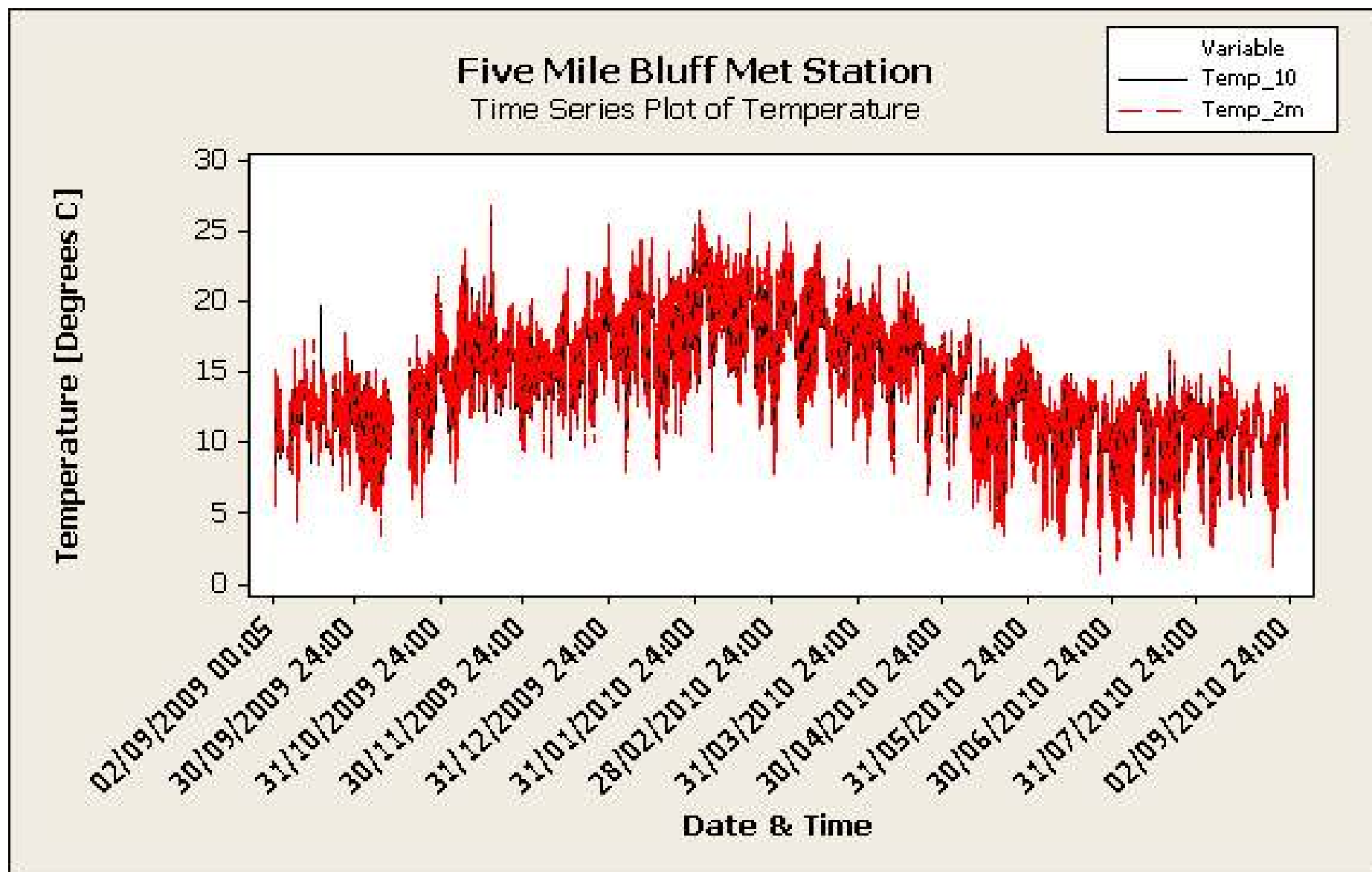


Figure 3 Time series plot of Temperature at 2m and 10m for the period from September 2, 2009 to September 2, 2010

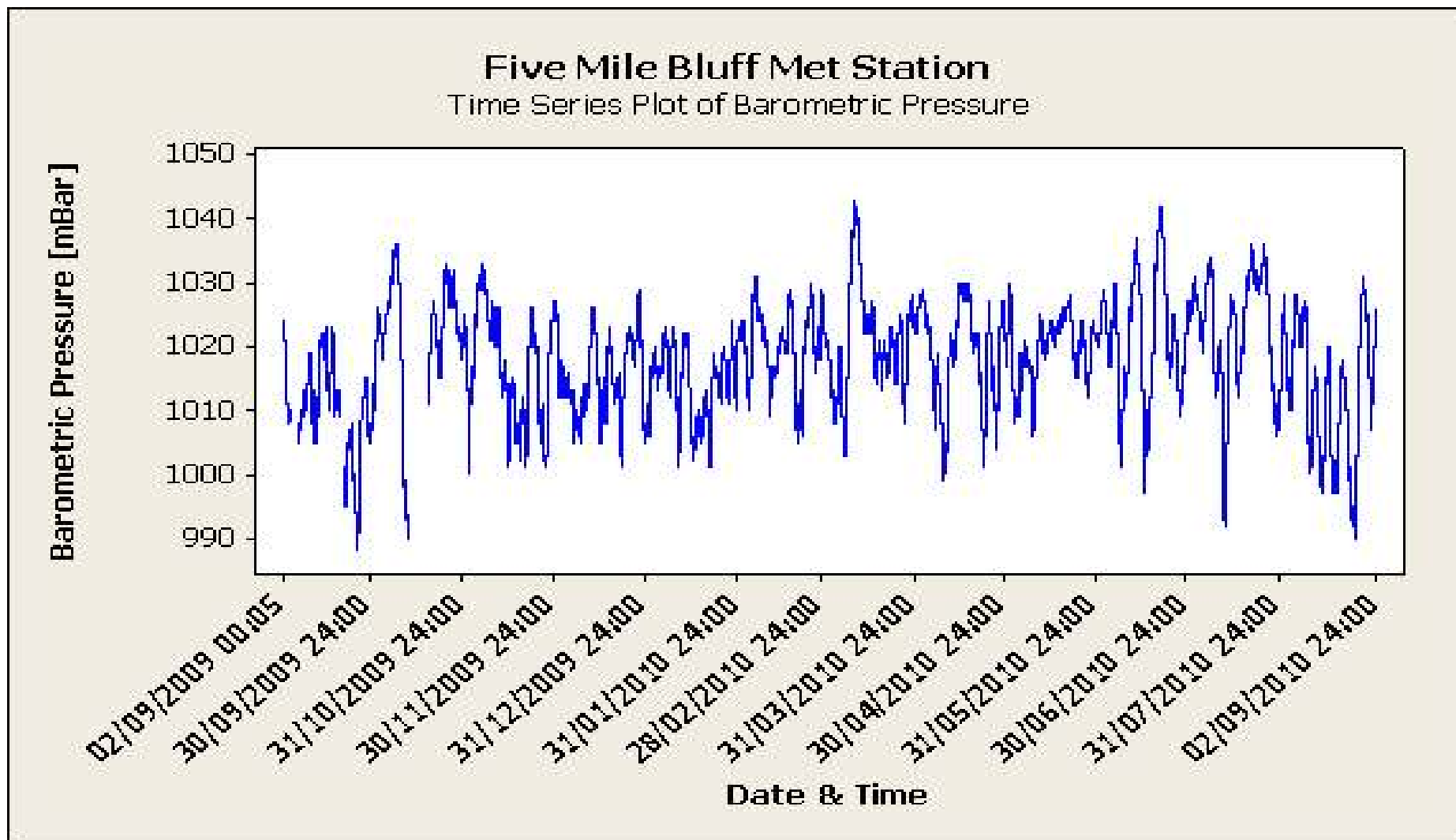


Figure 4 Time series plot of Barometric Pressure for the period from September 2, 2009 to September 2, 2010

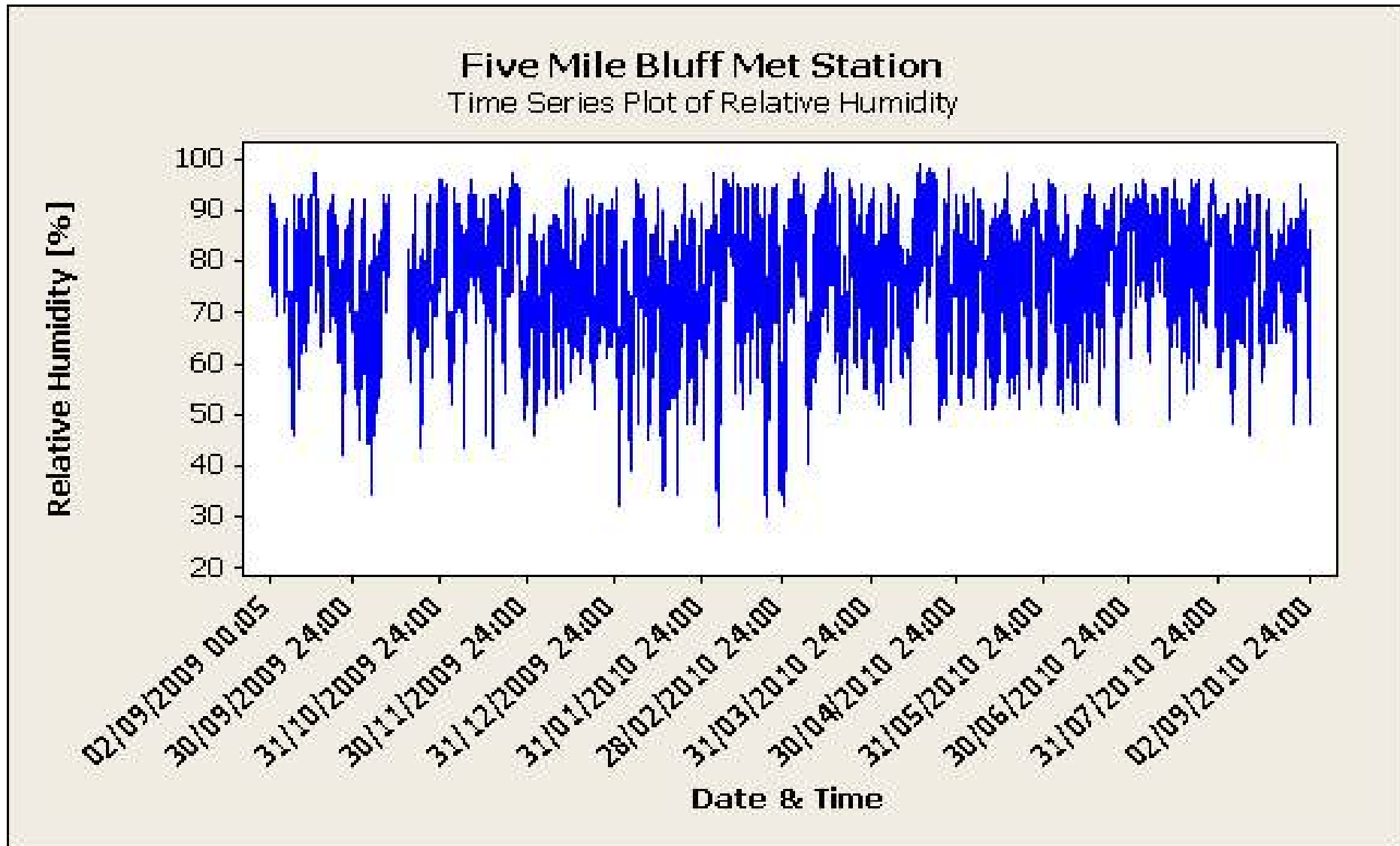


Figure 5 Time series plot of Relative Humidity for the period from September 2, 2009 to September 2, 2010

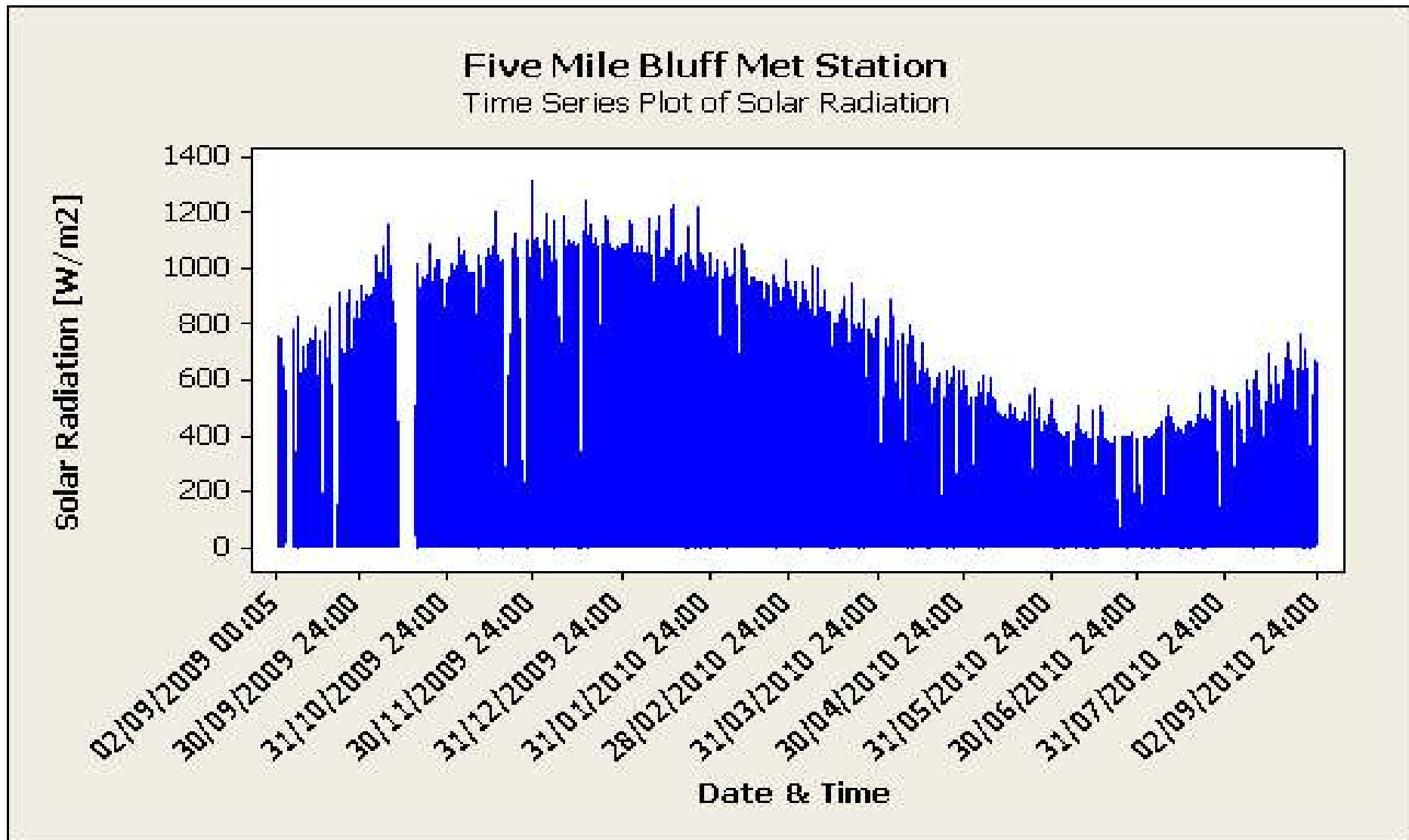


Figure 6 Time series plot of Solar Radiation for the period from September 2, 2009 to September 2, 2010

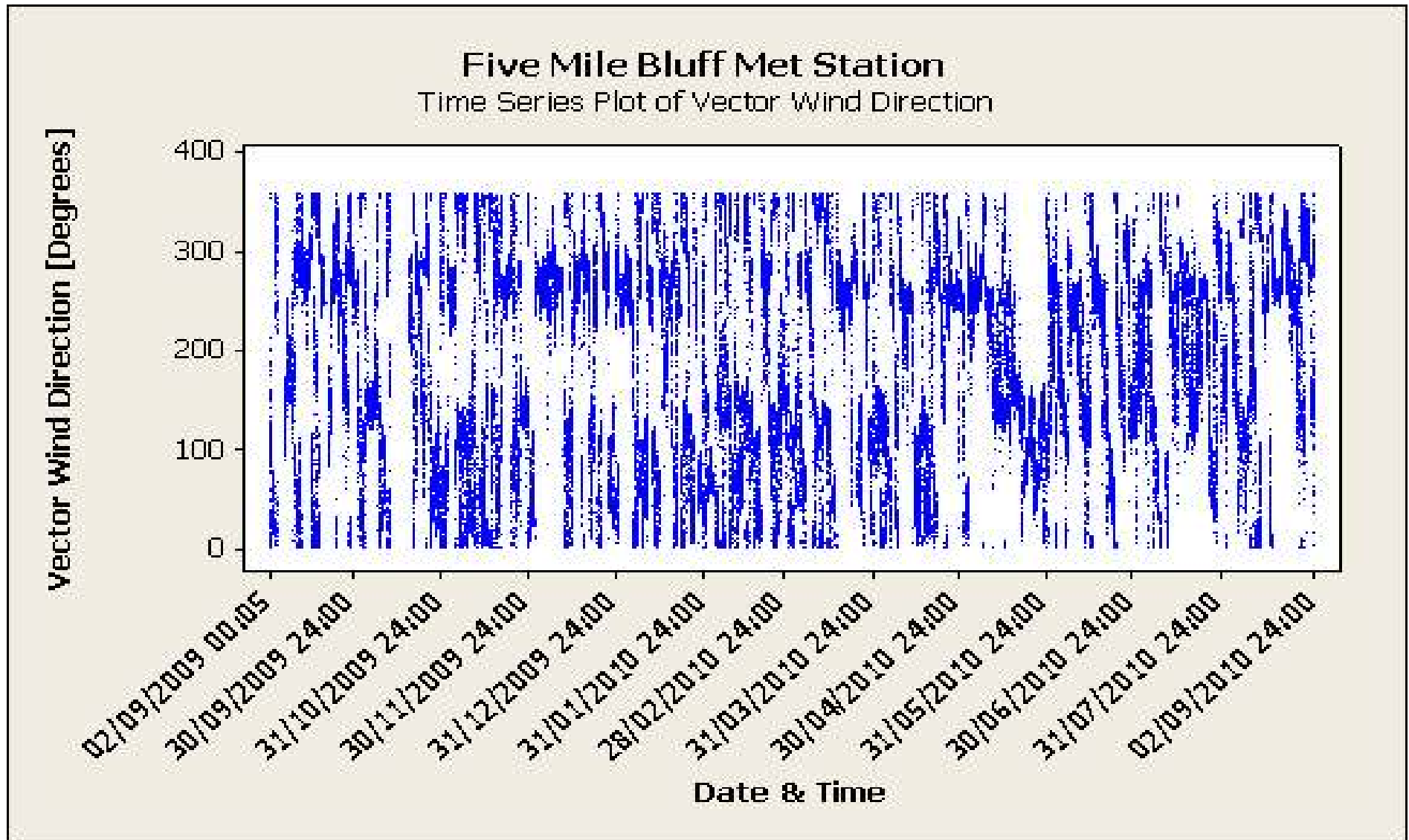


Figure 7 Time series plot of Vector Wind Direction for the period from September 2, 2009 to September 2, 2010

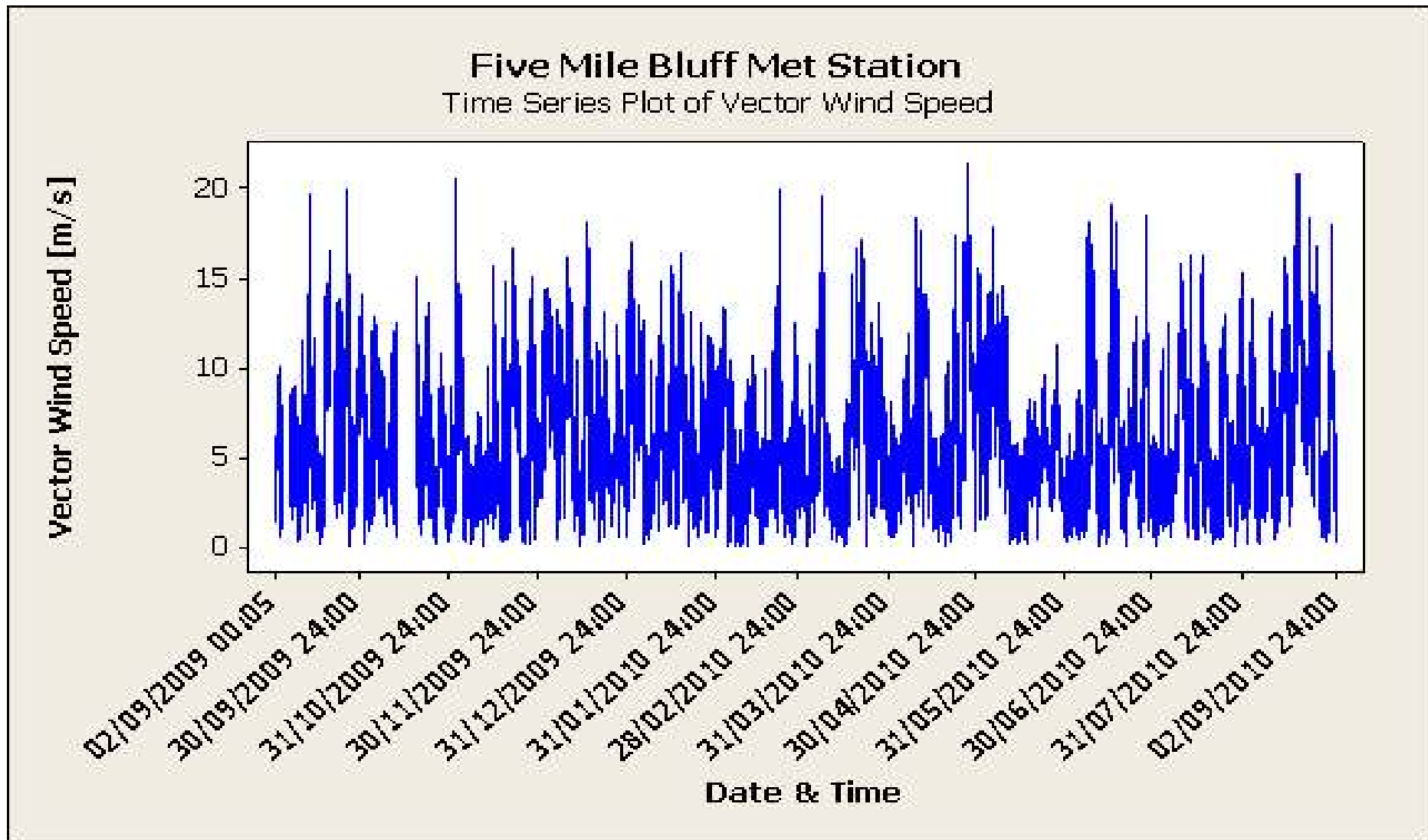


Figure 8 Time series plot of Vector Wind Speed for the period from September 2, 2009 to September 2, 2010

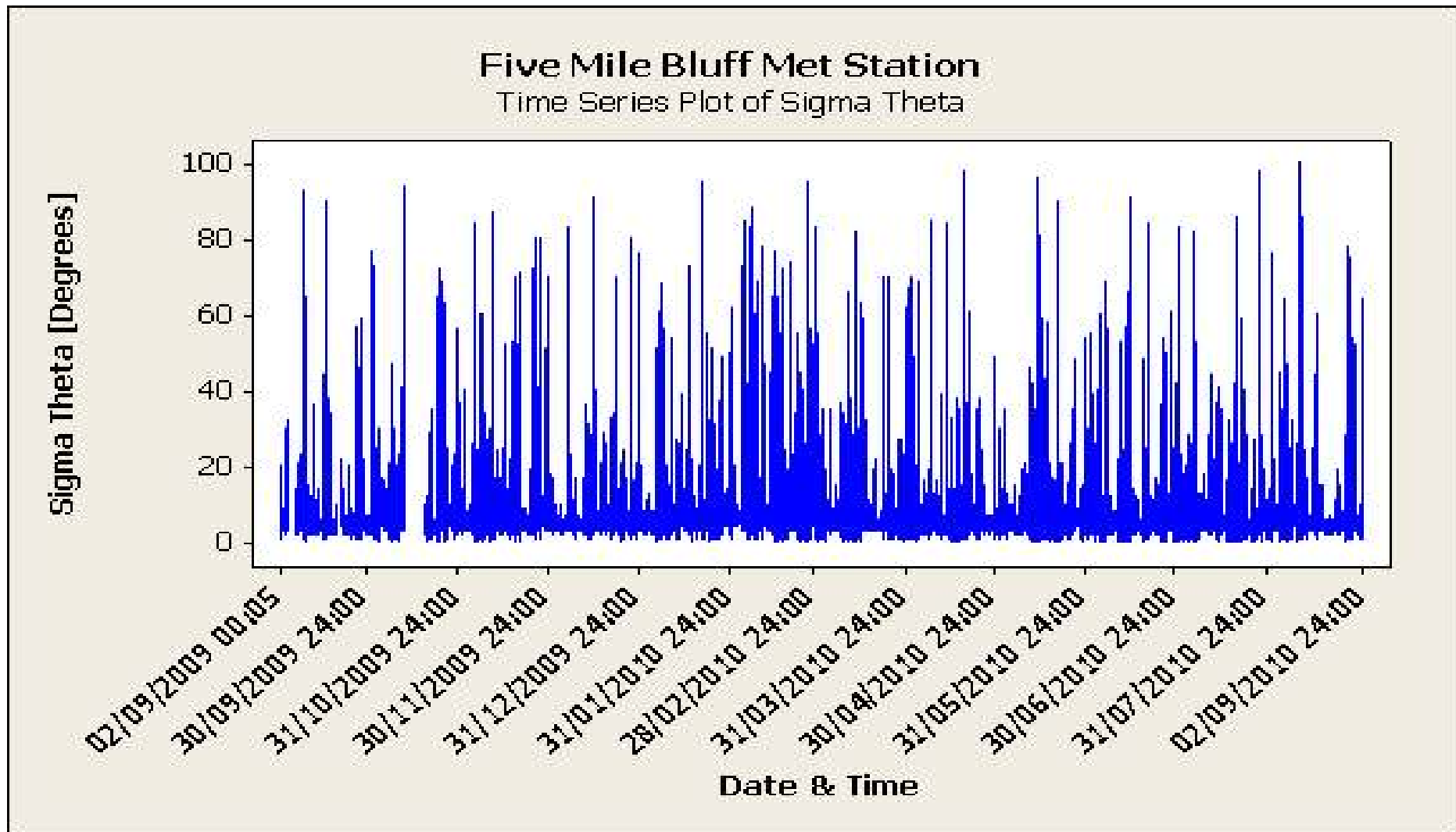


Figure 9 Time series plot of Sigma Theta for the period from September 2, 2009 to September 2, 2010

Appendix 1 Instrument Calibration Records

Aurecon Australia Pty Ltd
ABN 54 005 139 873
3 Lignite Court
Morwell
Vic 3840

Telephone: +61 3 5116 7205
Facsimile: +61 3 5116 7207
Email: kitwoodm@conwag.com
www.conwag.com

Calibration Ref: 2009/01/AEC

Description: RTD Calibration

Date of test: 23/7/2009

Sensor Type: RM YOUNG RTD – Model 41342LC

Serial Number: 16480
(taken from sensor body)

Standards & laboratory conditions:

- Temperature bath
- Ice point – “Zero-Con”
- Reference Thermometer
- Digital Meter – Fluke 725

Ambient temperature
Relative Humidity
Barometric Pressure
Excitation voltage

Serial No. 92MML/46480-1
Serial No. 4021818
Serial No. 0027464
Serial No. 1004826

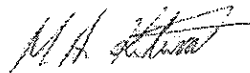
21 °C
54 %
1003 hPa
12.5 volts

Test Results

Reference Temperature °C	Reference Correction	Test reading mV	Test Temperature °C	Error
0	0.02	12.03	0.2	0.2°C
25	-0.02	15.97	24.8	-0.2°C
50	0.04	20.00	50	0.0°C

Test by:

Authorised by:



Mike Kitwood
Senior Technical Officer
NATA Signatory
Aurecon



Scott Thompson
Senior Technical Officer
NATA Signatory
Aurecon



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Morwell
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www.conwag.com

Calibration Ref: 2009/02/AEC

Description: RTD Calibration

Date of test: 23/7/2009

Sensor Type: RM YOUNG RTD – Model 41342LC

Serial Number: 16481
(taken from sensor body)

Standards & laboratory conditions:

- Temperature bath
- Ice point – “Zero-Con”
- Reference Thermometer
- Digital Meter – Fluke 725

Ambient temperature
Relative Humidity
Barometric Pressure
Excitation voltage

Serial No. 92MML/46480-1
Serial No. 4021818
Serial No. 0027464
Serial No. 1004826

21 °C
52 %
1003 hPa
12.5 volts

Test Results

Reference Temperature °C	Reference Correction	Test reading mV	Test Temperature °C	Error
0	0.02	12.02	0.1	0.1°C
25	-0.02	15.98	24.9	-0.1°C
50	0.04	20.02	50.1	0.1°C

Test by:

Mike Kitwood
Senior Technical Officer
NATA Signatory
Aurecon

Authorised by:

Scott Thompson
Senior Technical Officer
NATA Signatory
Aurecon



Gas Technology Services

PRIVATE BAG 16
PORT MELBOURNE, VICTORIA 3207
AUSTRALIA

TELEPHONE +61 3 9647 9800
FACSIMILE +61 3 9646 4370

EMAIL gastech@vipac.com.au

WEBSITE
<http://www.gastechnology.com.au>

Calibration of a Barometric Pressure Sensor

Report Distribution: Joe Foti - Lear Siegler
**Suite 101, 5-7 Redwood Drive
Notting Hill VIC3168**
Department File

Report Number: 441761-0
Job Number: 30M-09-0115
Date: 27 Jul 2009

REPORT ON

Calibration of a Barometric Pressure Sensor

Instrument

Make : Young Type : 61202L
Range : 600 to 1100 hPa Output : 4 to 20 mA
Serial No. : BP 06253

Customer

Lear Siegler

Calibration Conditions

Test Medium : Air
Test Conditions : Pressure port vertical
Test Temperature : 20 ± 1 °C
Test Method : WI-OS-033
Test Date : 27 July 2009

Reference Standards :

The results in this report are traceable to one, or more, of the reference standards below

<u>Manufacturer</u>	<u>Type</u>	<u>Serial Number</u>
Brooks	Piston Prover	237738/1E
GTS	Bell Prover	M1-41-005
GTS	Sonic Nozzle Rig	HIST4342
Casella	Water Manometer	720
HASS	Std Barometer	3388
Budenberg	Dead Weight Tester	4802
Budenberg	Dead Weight Tester	25502/450
Desgranges et Huot	Dual Piston Dead Weight Tester	3620
Leeds & Northrup	Platinum Resistance Thermometer	1816137
Hewlett Packard	Digital Multimeter 3458A	2823A08617
Hewlett Packard	Universal Counter 5316A	2632A10056
Sodium Chloride	Relative Humidity Salt ASTM E104-85	315638/1 592
Lithium Chloride	Relative Humidity Salt ASTM E104-85	294143/1 192



NATA Accredited
Laboratory
Number: .799

.....KEVIN.....MAPSON.....
NATA Signatory Name

.....K. Maps.....
Signature

28 July 2009
Date

This document is issued in accordance with NATA's accreditation requirements. Accredited for compliance with ISO / IEC 17025. The results of the tests, calibrations and/or measurements included in this document are traceable to Australian / national standards.

Calibration Procedure

The calibration results have been adjusted to provide transducer readings commensurable with the nominal pressures given in the tables. The calibration results have been adjusted using the following equation:

$$I_n = I_a + \left((P_n - P_t) \times \frac{I_s}{P_s} \right)$$

The correction data provided has been calculated using the following equation:

$$C_n = P_n - \left((I_n - I_z) \times \frac{P_s}{I_s} + P_{offset} \right)$$

Where

- I_n = The Sensor signal current (@ Nominal Pressure) (mA)
- I_a = The actual Sensor signal current (mA)
- P_n = The Nominal Pressure (hPa)
- P_t = The Accepted True Pressure (hPa)
- I_s = The full scale signal range (16 mA)
- P_s = The full scale pressure range (500 hPa)
- C_n = The Correction (@ Nominal Pressure) (hPa)
- I_z = The Sensor zero pressure signal (4 mA)
- P_{offset} = The Sensor zero signal pressure offset (600 hPa)



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.....KEVIN MARSON.....
NATA Signatory Name

.....K. Marson.....
Signature

.....28 July 2009.....
Date

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Test Results

Nominal Pressure	Average Signal Current		Average Correction	
hPa	mA		hPa	
	Up	Down	Up	Down
900.00	13.604	13.603	- 0.12	- 0.08
950.00	15.200	15.202	0.00	- 0.06
1000.00	16.801	16.800	- 0.03	0.00
1050.00	18.406	18.405	- 0.19	- 0.15
1100.00	19.999		+ 0.04	

Table 1

Uncertainty of Test

± 0.23 hPa

This represents the expanded uncertainty, calculated using a coverage factor of 2.0 and defines an interval estimated to have a level of confidence of 95 %.

Comments

The transducer was powered from a nominal 10 volt DC supply and a nominal 250 ohm shunt was used in the current loop.



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 Number: .799

.....KEVIN.....MARSON.....
 NATA Signatory Name

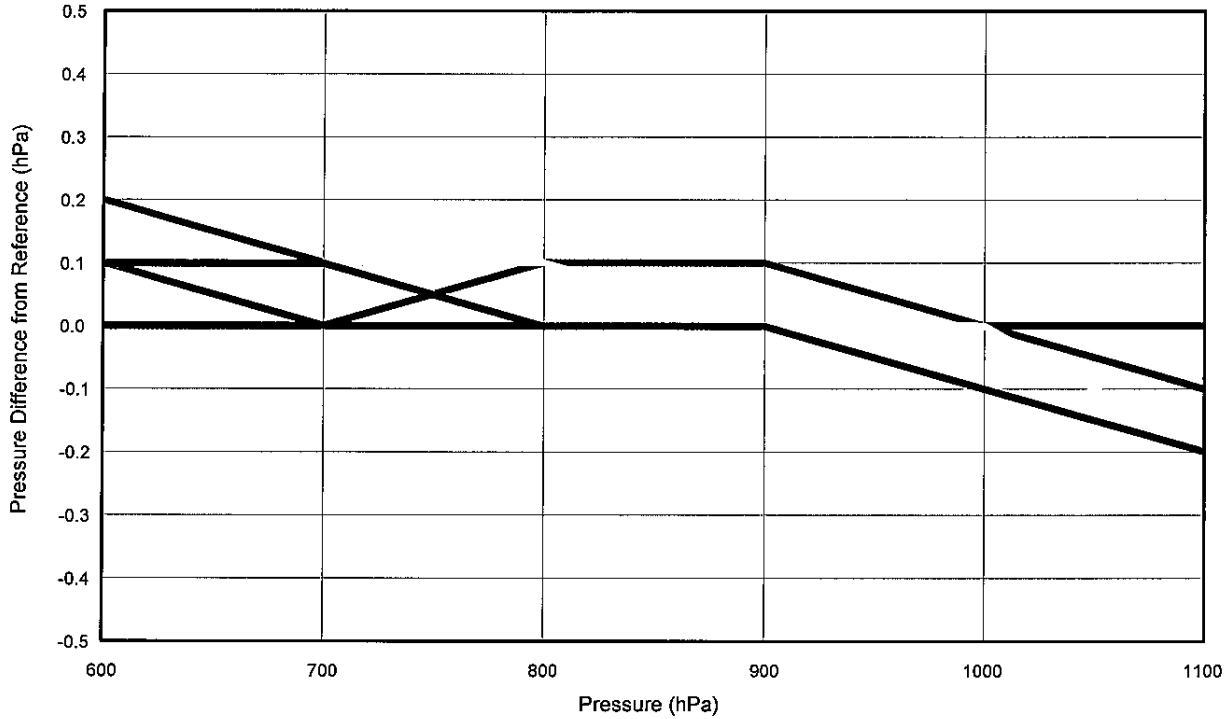
.....K. Marson.....
 Signature

28 July 2009
 Date

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R. M. Young Company
Barometric Pressure Sensor Calibration Record
Serial Number: BP06253
Calibration Date: April 17, 2009



LEGEND:

- 46°C
- 25°C
- 0°C
- 25°C
- 55°C

Sensor calibration checked from 600 to 1100 hPa in 100 hPa increments at 5 temperatures.
Pressure reference traceable to NIST.

Average Difference from Pressure Reference: 0.02 hPa
Standard Deviation: 0.09 hPa



Aurecon Australia Pty Ltd
ABN 54 005 139 873
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Morwell
Vic 3840

Telephone: +61 3 5116 7205
Facsimile: +61 3 5116 7207
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www.conwag.com

Calibration Ref: 2009/03/AEC

Description: Relative Humidity Calibration

Date of test: 23/7/2009

Sensor Type: RM YOUNG RH – Model 41382LC

Serial Number: 16482
(taken from sensor body)

Standards & laboratory conditions:

- Lithium Chloride
- Sodium Chloride
- Vaisala Humidity Chamber
- Reference Thermometer
- Digital Meter – Fluke 725

Ambient temperature
Relative Humidity
Barometric Pressure
Excitation voltage

Serial No. 371097
Serial No. 0027464
Serial No. 1004826

21 °C
50 %
1002 hPa
12.5 volts

Test Results

Nominal Reference %	Reference Correction	Test reading mV	Test Humidity %	Error
12.4% @ 20°C	-0.1%	6.00	12.5	0.2%
75.5% @ 20°C	0.1%	16.2	76.3	0.7%

Test by:

Mike Kitwood
Senior Technical Officer
NATA Signatory
Aurecon

Authorised by:

Scott Thompson
Senior Technical Officer
NATA Signatory
Aurecon

CALIBRATION CERTIFICATE

Middleton Solar SK08 First Class Pyranometer

Date of issue	27 th May 2009	
Certificate Number	C3640	
Instrument Serial No.	3068	
Short Wave Sensitivity	21.5	$\mu\text{V/W.m}^{-2}$
Response Time (95%)	10.4	sec.
Internal Resistance	40	ohm
Directional Response	(30°-80°): $<\pm 20\text{W/m}^2$	
Reference Pyranometer	EQ08-S, S/No.4802	
Calibration uncertainty	$\pm 3\%$	

Comments:

Approved Signatory _____



Procedure: Short wave calibration carried out at normal incidence using a reference Pyranometer and the sun as a source (ISO 9847, type 1c).

Reference Pyranometer traceable to the World Radiometric Reference.

Annual calibration is recommended.

Middleton Solar
20/155 Hyde St.
Yarraville
Victoria 3013
Australia.

www.middletonsolar.com



WORLD RECOGNISED
ACCREDITATION

NATA Accredited Laboratory
Number: 245

ANEMOMETER CALIBRATION REPORT

TEST DETAILS

Test Report Number: 036/78/09
Test Date: 17 July 2009
Type of Test: Wind Speed and Direction
Range of Test: 2.00 m/s to 27.00 m/s
Wind Tunnel Operator: Zenon Dawid 03 9239 4691

INSTRUMENT DETAILS

Instrument Manufacturer: R.M.Young
Instrument Model: 85000 Ultrasonic Anemometer
Serial Number (Instrument): 01878
Plant Number: n/a

CLIENT DETAILS

Test Report Client: Lear Siegler Australia Pty. Ltd.
Despatch Address: 5-7 Redwood Drive
Caringbah, NSW 2229

Invoice Client: Lear Siegler Australia Pty. Ltd.
Invoice Address: Unit 5A, 2 Resolution Drive
Notting Hill, VIC 3168

Purchase Order Number: 4192

REPORT APPROVED BY:

Dale Hughes
Authorised Signatory

Dale Hughes
Signed

DATE OF APPROVAL:

20/7/09

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TEST REPORT NUMBER: 036/78/09
DATE OF CALIBRATION: 17 July, 2009



ANEMOMETER CALIBRATION REPORT



NATA Accredited Laboratory
Number: 245

TEST TYPE: Wind Speed and Direction
TEST REPORT NUMBER: 036/78/09
SERIAL NUMBER (INSTRUMENT): 01878
PLANT NUMBER: n/a
INSTRUMENT TYPE: 85000 Ultrasonic Anemometer
INSTRUMENT MANUFACTURER: R.M.Young
INSTRUMENT SIGNAL OUTPUT: Volts
SIGNAL OUTPUT RESOLUTION: 0.001 Volts
RANGE OF TEST: 2.00 to 27.00 m/s
WORKING STANDARD USED: Red 09 s.no.7325

ORDER OF POLYNOMIAL FIT TO DATA: 1

Instrument Output* (Volts)	0.104	0.128	0.152	0.177	0.201	0.225	0.250	0.274
True Speed (m/s)	2.00	2.50	3.00	3.50	4.00	4.50	5.00	5.50
± Total Uncertainty in Calibration** (m/s)	0.06	0.06	0.07	0.08	0.09	0.10	0.11	0.12

Instrument Output* (Volts)	0.298	0.323	0.347	0.371	0.396	0.420	0.444	0.469
True Speed (m/s)	6.00	6.50	7.00	7.50	8.00	8.50	9.00	9.50
± Total Uncertainty in Calibration** (m/s)	0.13	0.14	0.15	0.16	0.17	0.18	0.19	0.20

Instrument Output* (Volts)	0.493	0.517	0.542	0.566	0.590	0.615	0.639	0.663
True Speed (m/s)	10.00	10.50	11.00	11.50	12.00	12.50	13.00	13.50
± Total Uncertainty in Calibration** (m/s)	0.21	0.22	0.23	0.24	0.25	0.26	0.27	0.28

Instrument Output* (Volts)	0.688	0.712	0.736	0.761	0.785	0.834	0.882	0.931
True Speed (m/s)	14.00	14.50	15.00	15.50	16.00	17.00	18.00	19.00
± Total Uncertainty in Calibration** (m/s)	0.29	0.30	0.31	0.32	0.33	0.35	0.37	0.39

Instrument Output* (Volts)	0.979	1.028	1.077	1.125	1.174	1.223	1.271	1.320
True Speed (m/s)	20.00	21.00	22.00	23.00	24.00	25.00	26.00	27.00
± Total Uncertainty in Calibration** (m/s)	0.41	0.43	0.45	0.47	0.49	0.51	0.53	0.55

* See Note 5

** Total Uncertainty in Calibration includes uncertainties associated with the primary standard and instrument resolution.

REMARKS: 12 V DC excitation applied. Instrument calibrated at nominal direction of 210 degrees using Interface Unit s. no. 20012031G
Total uncertainty in calibration is $\pm 2\%$ or ± 0.05 m/s (whichever is greater) plus instrument resolution uncertainty. This is due to the scatter in the calibration data for instrument.

Approved: DH 20/7/09

CALIBRATION CHART

TEST REPORT NUMBER: 036/78/09
DATE OF CALIBRATION: 17 July, 2009
SERIAL NUMBER: 01878

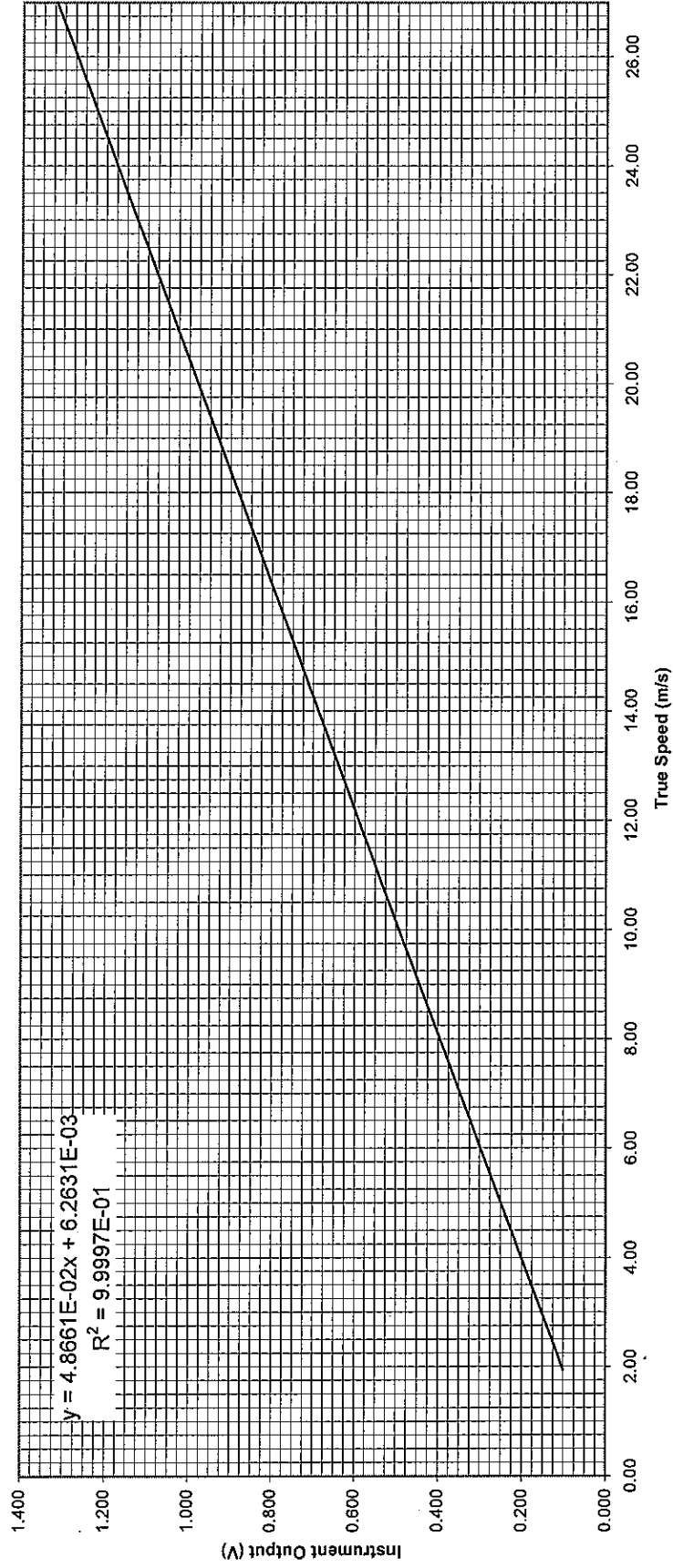


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NATA Accredited Laboratory
Number: 245



CSIRO



Approved: *PH* 20/7/09

TEST REPORT NUMBER: 036/78/09
 DATE OF CALIBRATION: 17 July, 2009



WIND DIRECTION CALIBRATION REPORT



NATA Accredited Laboratory Number:
245

TEST REPORT NUMBER: 036/78/09
SERIAL NUMBER (INSTRUMENT): 01878
PLANT NUMBER: n/a
INSTRUMENT TYPE: 85000 Ultrasonic Anemometer
INSTRUMENT MANUFACTURER: R.M.Young
INSTRUMENT SIGNAL OUTPUT: Volts
SIGNAL OUTPUT RESOLUTION: 0.001 Volts
RANGE OF TEST: 10 degrees to 350 degrees
WORKING STANDARD USED: Rotary Table
UNCERTAINTY OF PRIMARY STANDARD: \pm 2.0 degrees

Nominal Direction (deg)	10	30	60	90	120	150	180
WD Instrument Output* (Volts)	0.147	0.413	0.833	1.244	1.654	2.079	2.493
WS Instrument Output* (Volts)	0.305	0.307	0.302	0.300	0.305	0.306	0.297
True Speed (m/s)	6.11	6.13	6.16	6.17	6.14	6.17	6.15
Uncertainty in wind Direction** (deg)	2.8	2.8	2.8	2.8	2.8	2.8	2.8

Nominal Direction (deg)	210	240	270	300	330	350
WD Instrument Output* (Volts)	2.909	3.324	3.740	4.149	4.575	4.845
WS Instrument Output* (Volts)	0.305	0.306	0.300	0.307	0.309	0.308
True Speed (m/s)	6.12	6.16	6.11	6.16	6.14	6.12
Uncertainty in wind Direction** (deg)	2.8	2.8	2.8	2.8	2.8	2.8

* See Note 5

** Total Uncertainty in Calibration includes uncertainties associated with the primary standard and instrument resolution.

REMARKS: Wind direction calibrated with interface unit s.no. 20012031G.
12.0 VDC excitation applied for wind direction.

Approved: *DH 20/7/09*