MARINE MANAGEMENT SUPPORT:
PILBARA

WATER TEMPERATURE VARIATIONS IN NINGALOO MARINE PARK AND ADJACENT SHELF WATERS OFF TANTABIDDI, WESTERN AUSTRALIA, FROM OCTOBER 1998 TO MAY 1999

Data Report: MMS/PI/NMP - 23/2000

A collaborative project funded and conducted by CALM Marine Conservation Branch, the Department of Zoology of the University of Western Australia and the Australian Institute of Marine Science, Townsville

Prepared by
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September 2000

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Department of Conservation and Land Management
47 Henry Street, Fremantle
Western Australia 6160

INTRODUCTION

This data report presents time series of water temperature data collected within the lagoonal waters of the Ningaloo Marine Park at Tantabiddi and over the adjacent offshore slope area in water depths of up to 100 m during two individual deployments within the period October 1998 to May 1999.

The field survey was conducted as a collaboration between the Marine Conservation Branch (MCB) of CALM and the Australian Institute of Marine Science (AIMS) and forms a contribution to the broader oceanographic program currently underway in the area by AIMS. The data processing and production of this data report has been performed as a collaboration between the Department of Zoology of The University of Western Australia, AIMS and CALM.

Deployment 1 ran from October 1998 to February 1999, and Deployment 2 from February to May of 1999. Operational details have been recorded and documented in operational reports produced by AIMS for the field survey. Queries related to operational details may be directed to AIMS.

Temperature was monitored within the lagoon and also at various depths at adjacent 50 m and 100 m depth sites during Deployment 1 and then within the lagoon and at various depths at the 50 m site during the second deployment.

The location of the monitoring sites and the vertical arrangement of the various thermister arrays were designed in order to allow an exploration of possible dynamical characteristics of the water as might be indicated by spatial and temporal patterns in the temperature signals. The data have been collected to allow an examination of key hydrodynamic processes, such as vertical mixing, cross-shelf water movements and upwelling.

From a management perspective, CALM believes that the understanding of the movement and mixing of these waters is important for management because of the need to understand the potential for currents and mixing patterns to advect and spread dissolved or waterborne substances of interest (eg. coral larvae, nutrients, contaminants). Furthermore, it is important to understand important relationships between physical factors and the floral and faunal diversity and abundance of key species throughout the area. The data were also collected to assist in studies which aim to understand possible links between the oceanography and behavioral characteristics of marine wildlife in the area, such as the whale sharks which frequent the region in relatively large numbers on an annual basis during autumn. Issues of primary productivity were also prominent in motivating the field campaign. It was thought important to investigate the possibility of upwelling as a mechanism which might introduce nutrients to the waters adjacent to the Ningaloo Reef and that is why temperature loggers were deployed concurrently at various depths along vertical arrays.

An adequate understanding of the links between the physical and biological characteristics of the Ningaloo Marine Park is highlighted as a high priority research and monitoring strategy in the Ningaloo Marine Park (State Waters) Management Plan 1989-1999 (CALM, 1989).
In this report the water temperature data are presented in conjunction with meteorological and tidal data so that causal links between environmental forcings and the response of the vertical and cross-shelf temperature structure could be investigated. The spatial intensity of the

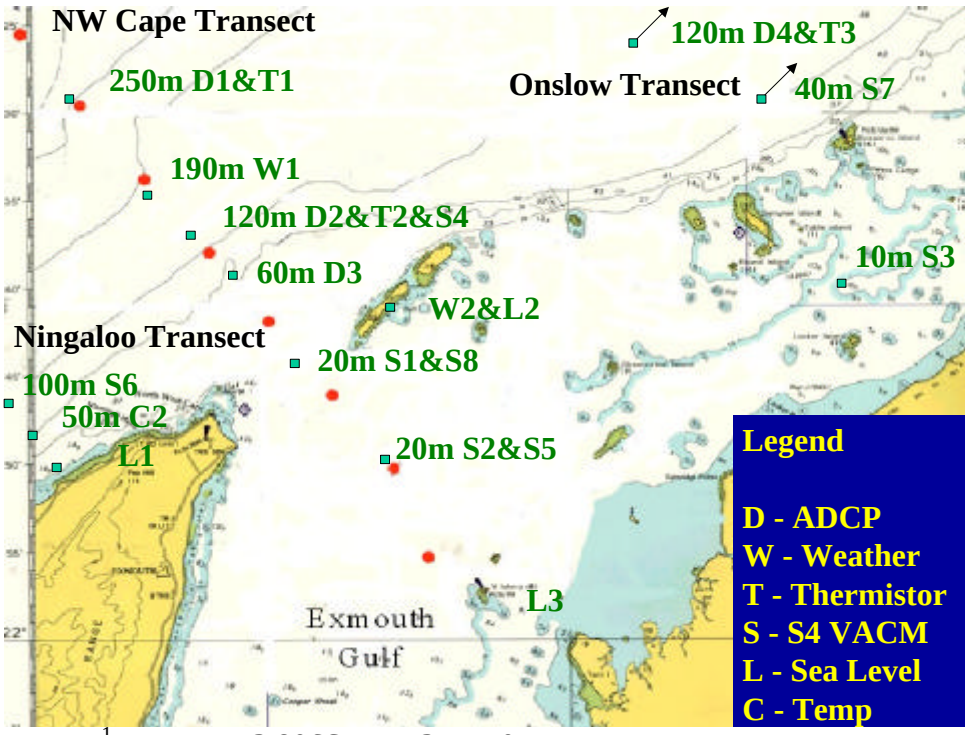
temperature arrays deployed in this survey represent the most intense set of sustained water temperature measurements for this region of the State's coastal waters.

METHODS

This report presents only data from the Ningaloo transect shown in Fig. 1. The Ningaloo transect is off Tantabiddi (which is actually further south than is shown). Data collected along the NW Cape and Onslow transects will be published in AIMS publications.
Figure 1.

Dataflow thermistors (sampling: averaged reading every 10 minutes) were deployed to following locations:

Deployment 1 (October 1998 – February 1999)



Lagoon[1]	21 53.806S	113 57.402E	
50 m Station[2]	21 52.304S	113 56.799E	(35 and 5 m above sea floor)
100 m Station	21 50.974S	113 54.847E	(80, 35 and 20 m above sea floor)

[1]Lagoon t-logger depth 3 m
[2]Not good buoyancy – may have been pulled under

Figs. 2 and 3 show vertical arrays of thermistors deployed at 50 and 100 m stations (in deployment 1).

Mooring C2 C3 50m

In water:
Pos: 21’ 52.304"S
113’ 56.799"E

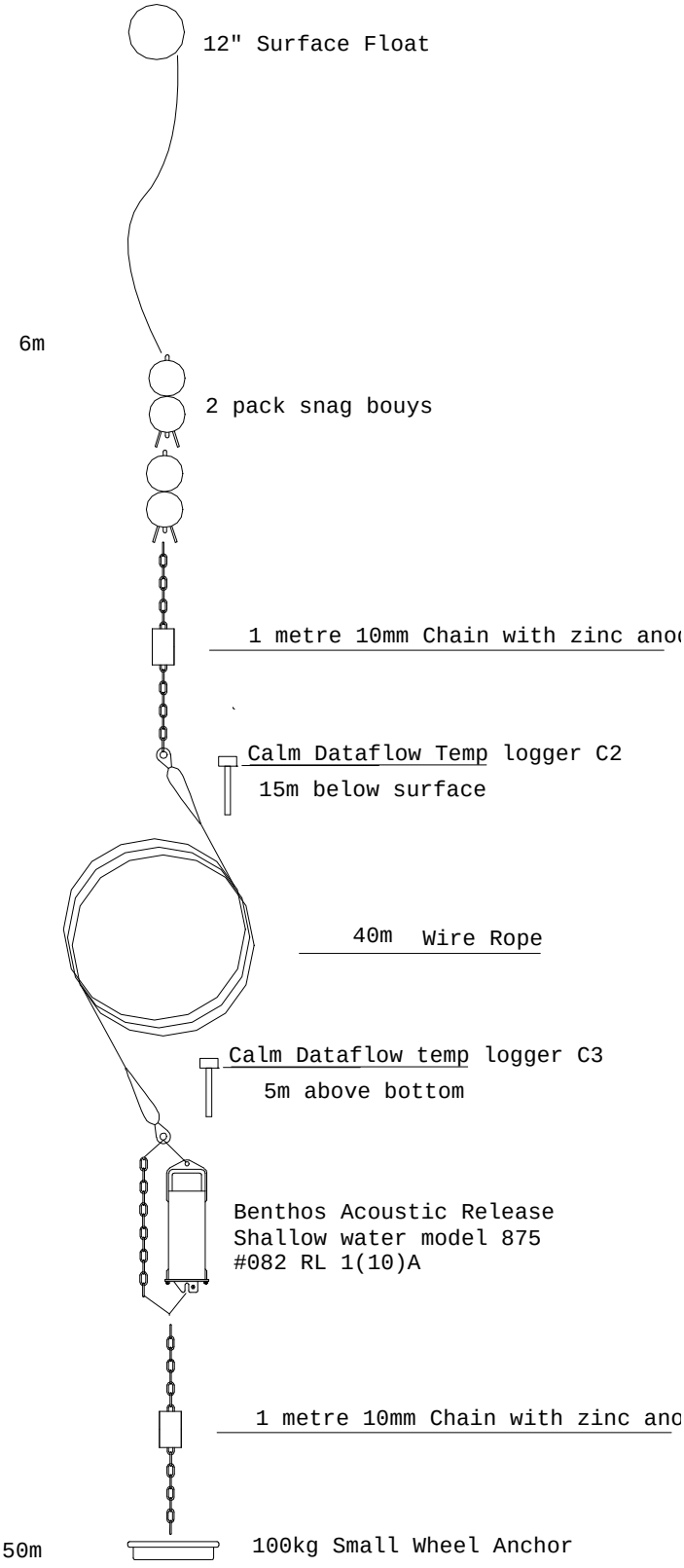


Figure 2.

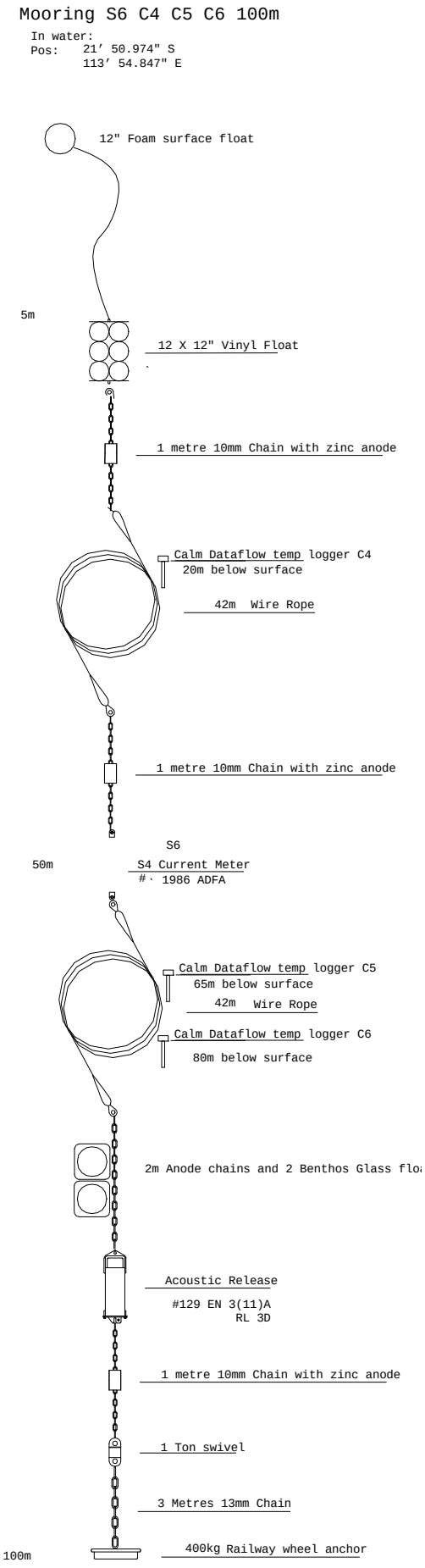

Mooring S6 C4 C5 C6 100m
In water:
Pos: 21’ 50.974" S
113’ 54.847" E
12" Foam surface float
5m
12 X 12" Vinyl Float
1 metre 10mm Chain with zinc anode
Calm Dataflow temp logger C4
20m below surface
42m Wire Rope
1 metre 10mm Chain with zinc anode
S6
50m
S4 Current Meter
#、1986 ADFA
Calm Dataflow temp logger C5
65m below surface
42m Wire Rope
Calm Dataflow temp logger C6
80m below surface
2m Anode chains and 2 Benthos Glass flo
Acoustic Release
#129 EN 3(11)A
RL 3D
1 metre 10mm Chain with zinc anode
1 Ton swivel
3 Metres 13mm Chain
100m
400kg Railway wheel anchor

Figure 3.

Deployment 2 (February 1999 – May 1999)

Reef Front	21 53.47S	113 56.92E	
50 m Station	21 52.256S	113 56.725E	(41, 31, 9 and 3 m above sea floor)
Reef Front	21 53.47S	113 56.92E	

Data from thermistors deployed at progressively shallower depths at the 50 and 100 m stations are plotted with progressively thicker lines in this report.

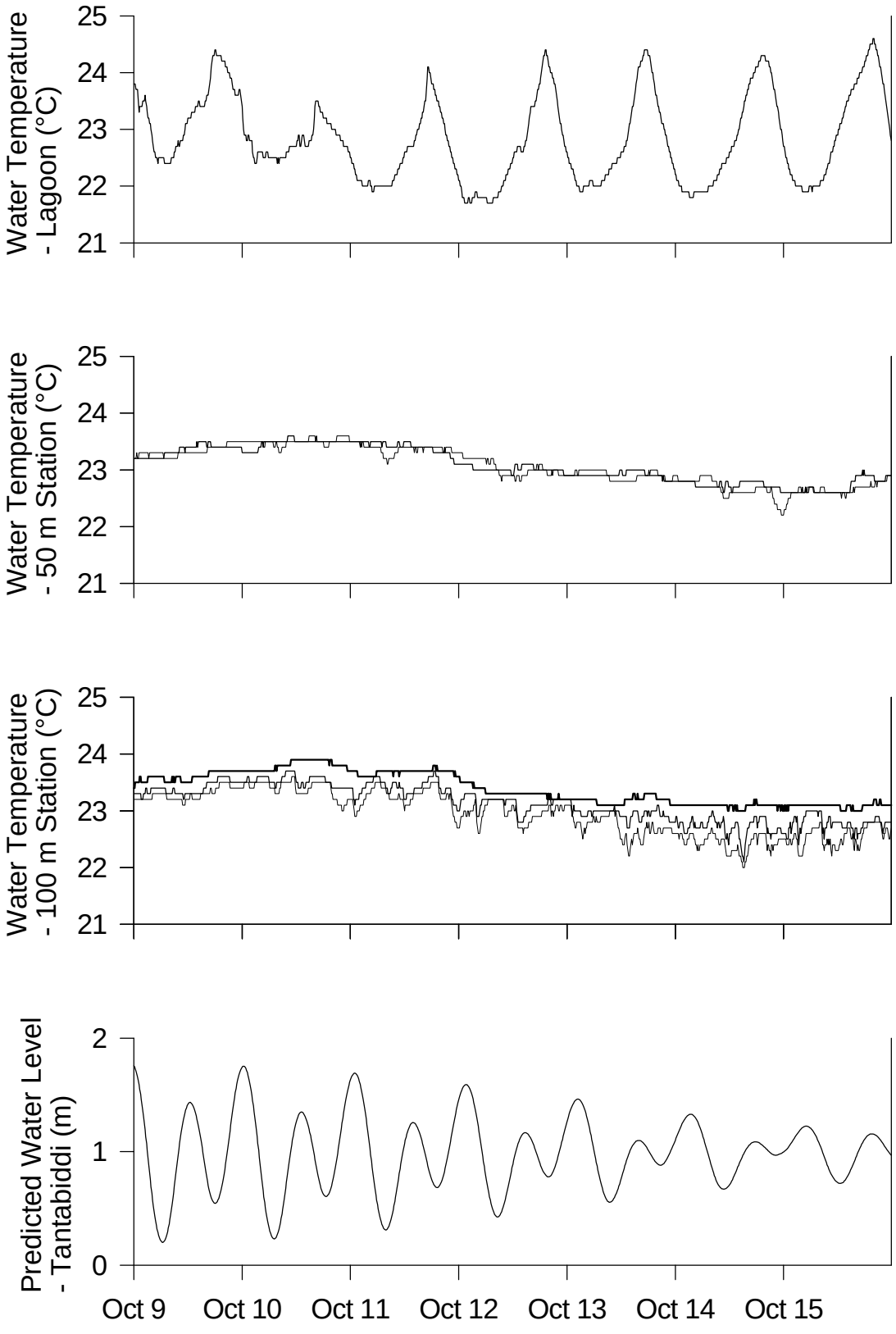
Aanderaa WLR7 tide gauge/ temperature sensor (41 second averaged reading every 5 minutes) was deployed at Reef Front (21 53.47S 113 56.92E) from February 1999 – May 1999.

Predicted water levels are for Tantabiddi (21 55S 113 59E) with respect to chart datum. Chart datum = 3.453 m below PWD B950 (Public Works Department Benchmark 950). LAT = 0.06 m above chart datum (LAT = lowest astronomical tide). Data supplied by Tony Lamberto, Department of Transport – Maritime Division, Fremantle, WA.

Milyering weather station located near the beach at the CALM Milyering Visitor's Centre (22 1.816S 113 55.316E). Data loggers located approximately 10 m above ground level. Reading every 30 minutes.

Acknowledgements: We thank Cary McLean for his technical expertise and the crew of the *RV Lady Basten* for their assistance in the field.

Deployment 1


Water Temperature
- Lagoon (°C)
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Water Temperature
- 50 m Station (°C)
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Water Temperature
- 100 m Station (°C)
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Predicted Water Level
- Tantabiddi (m)
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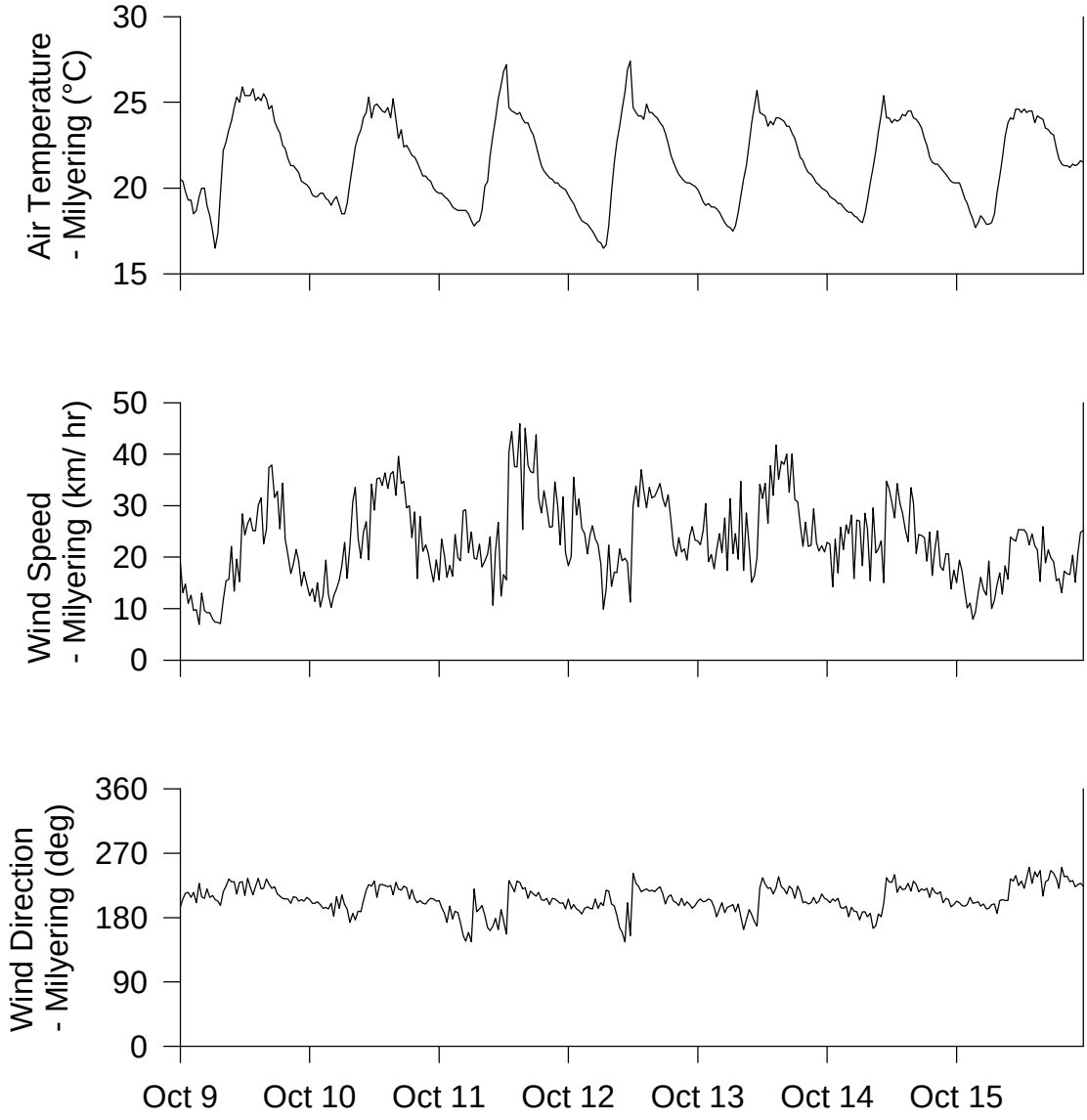
Air Temperature
- Milyering (°C)
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Wind Speed
- Milyering (km/ hr)
50
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Wind Direction
- Milyering (deg)
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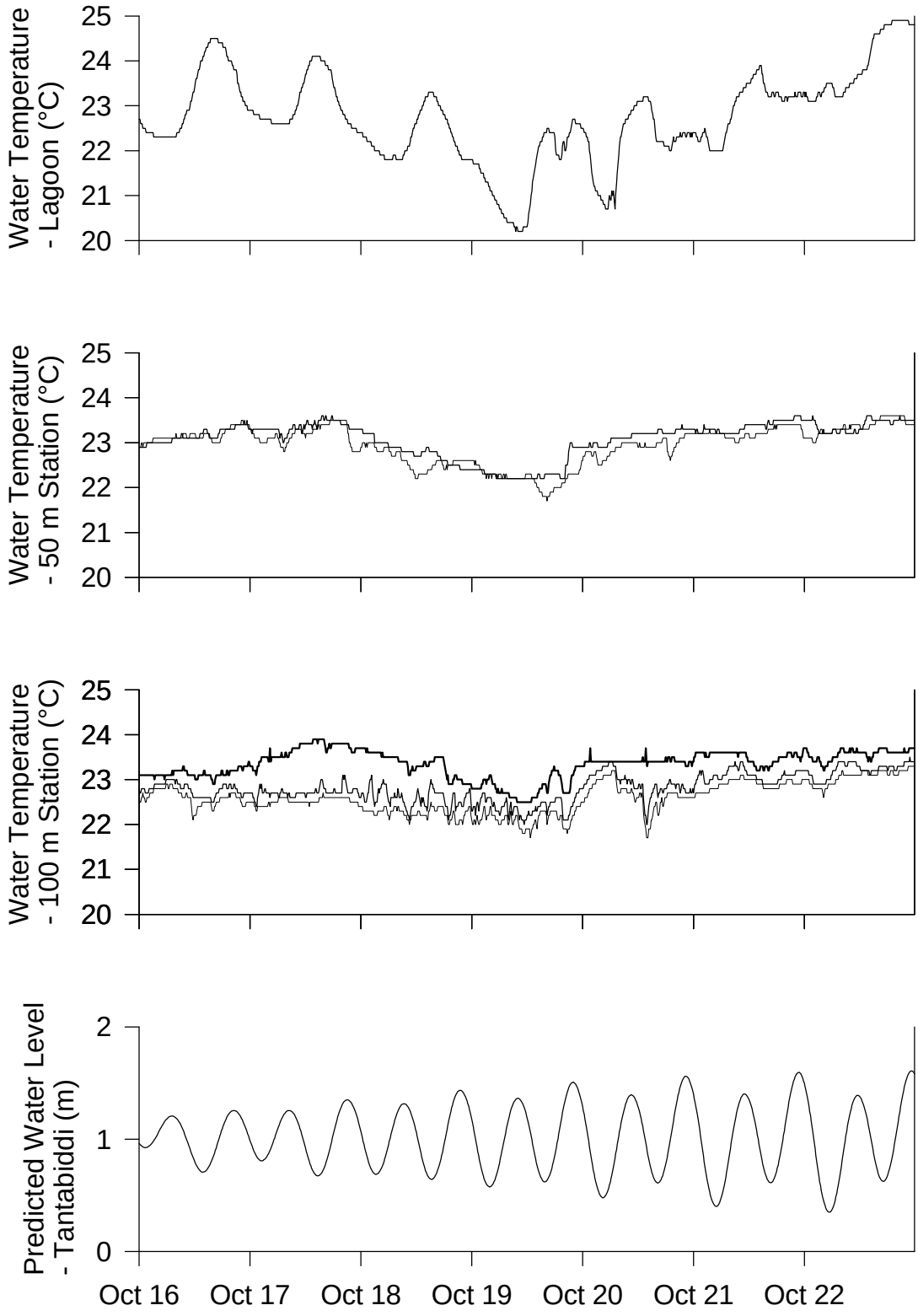
Water Temperature
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Water Temperature
- 50 m Station (°C)
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Water Temperature
- 100 m Station (°C)
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Predicted Water Level
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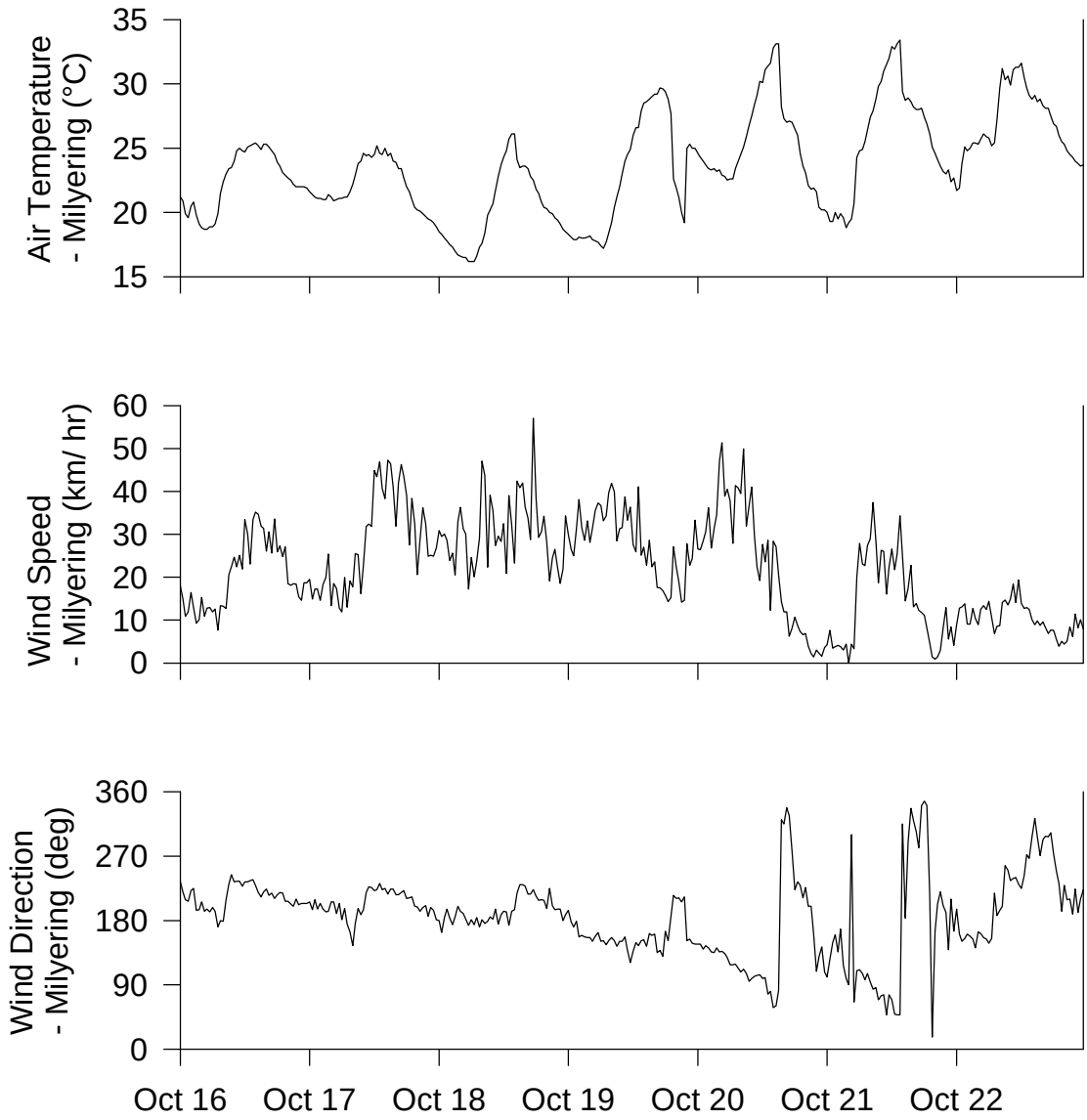
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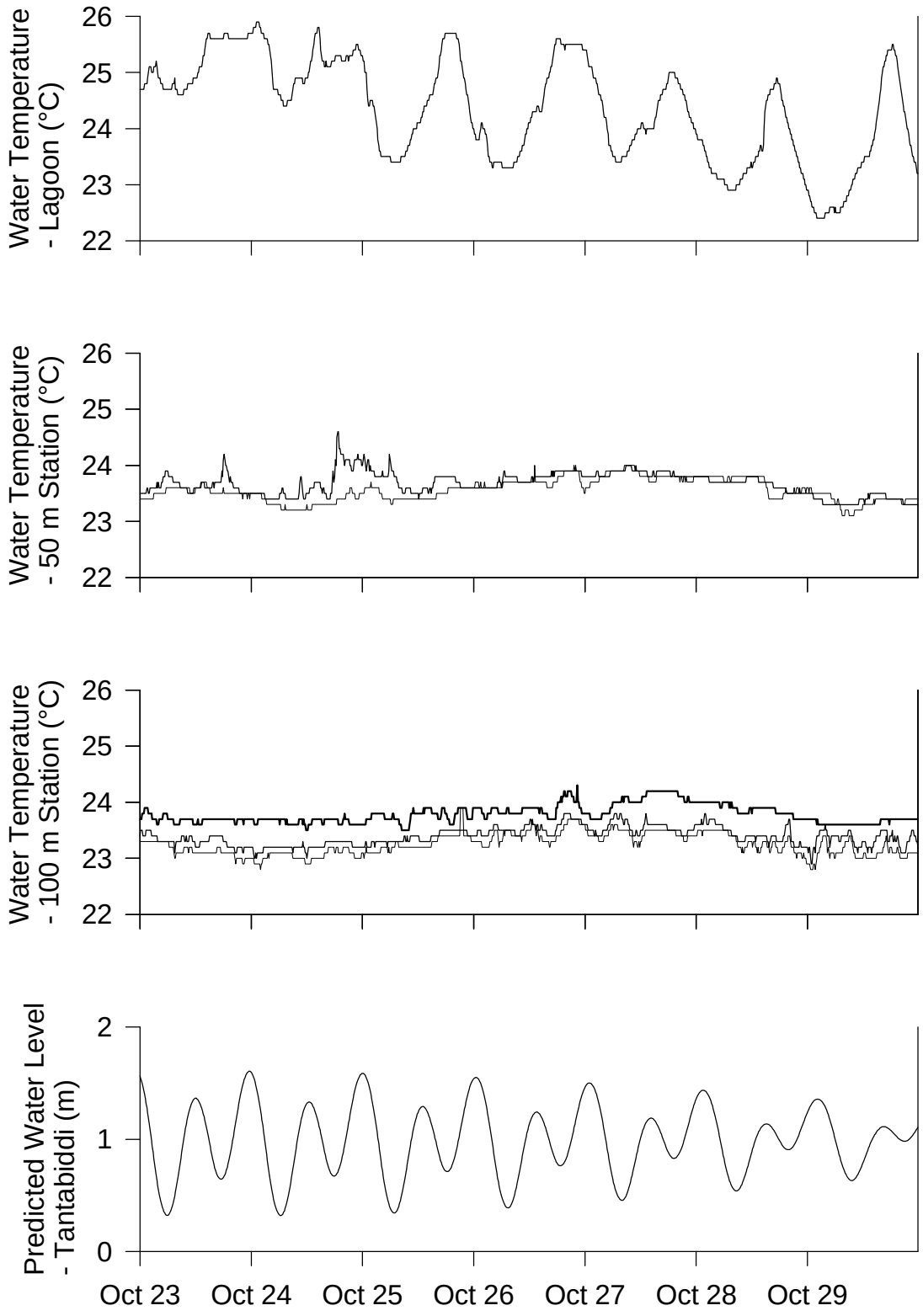
Water Temperature
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Water Temperature
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Water Temperature
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Predicted Water Level
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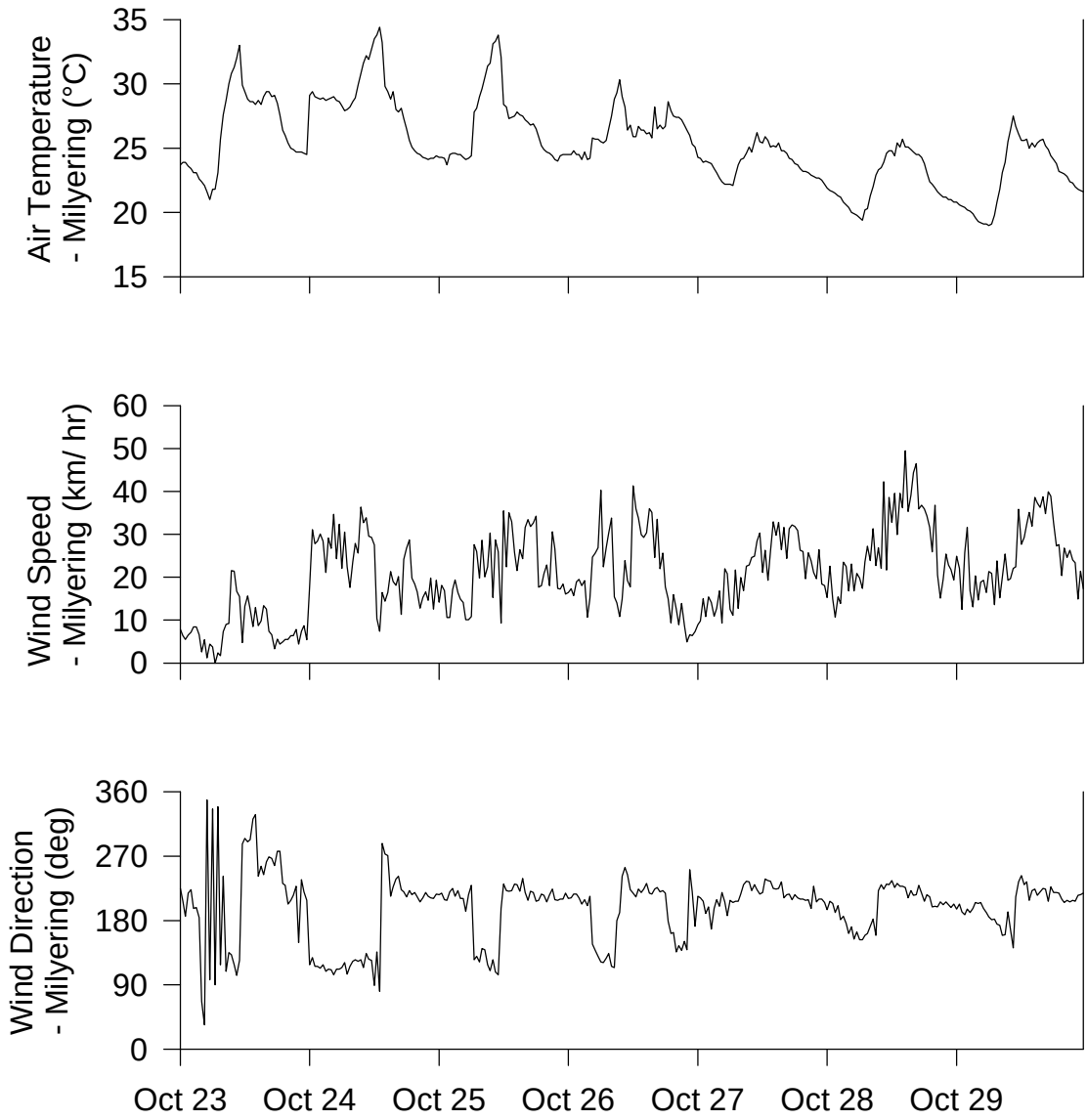
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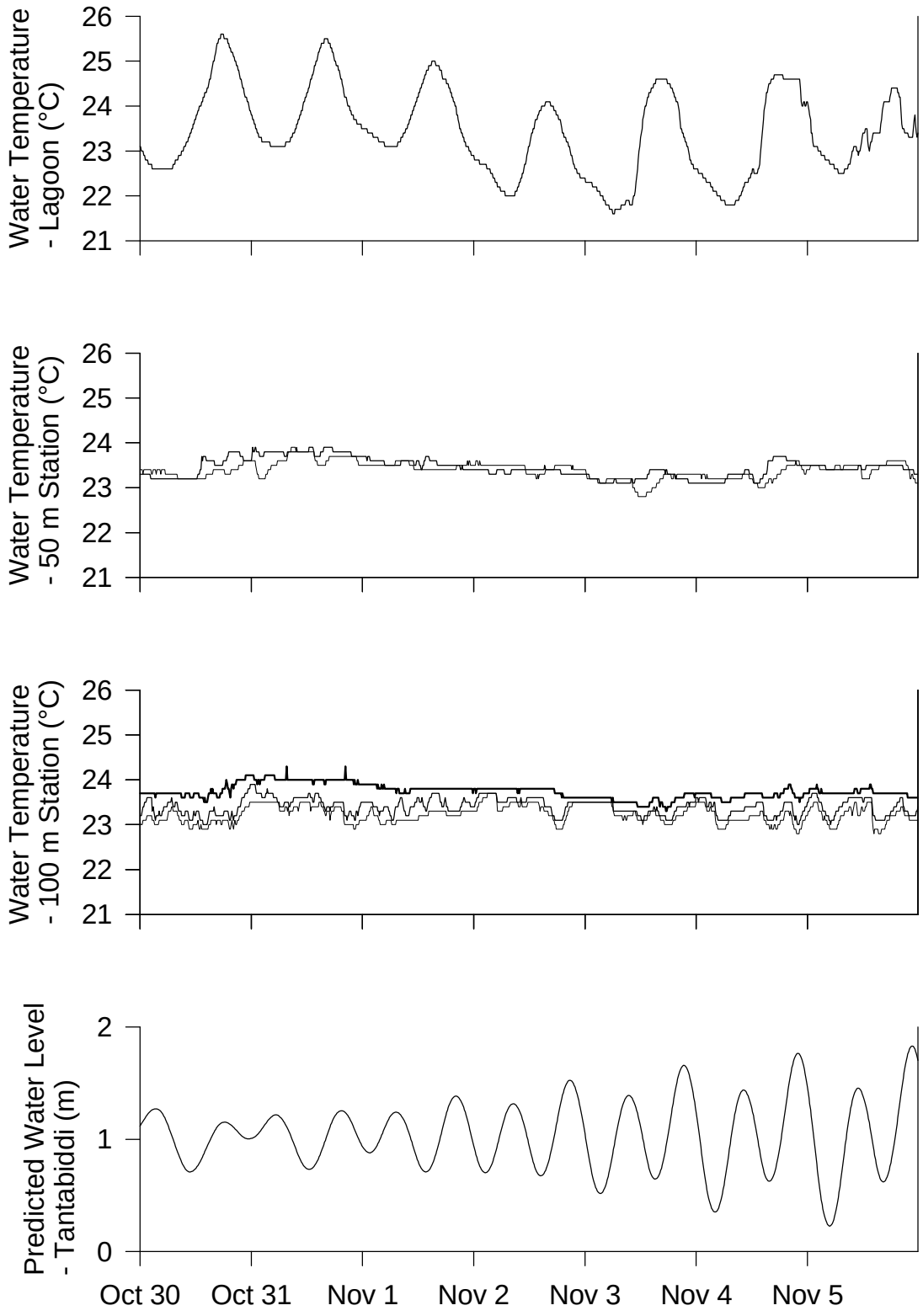
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Water Temperature
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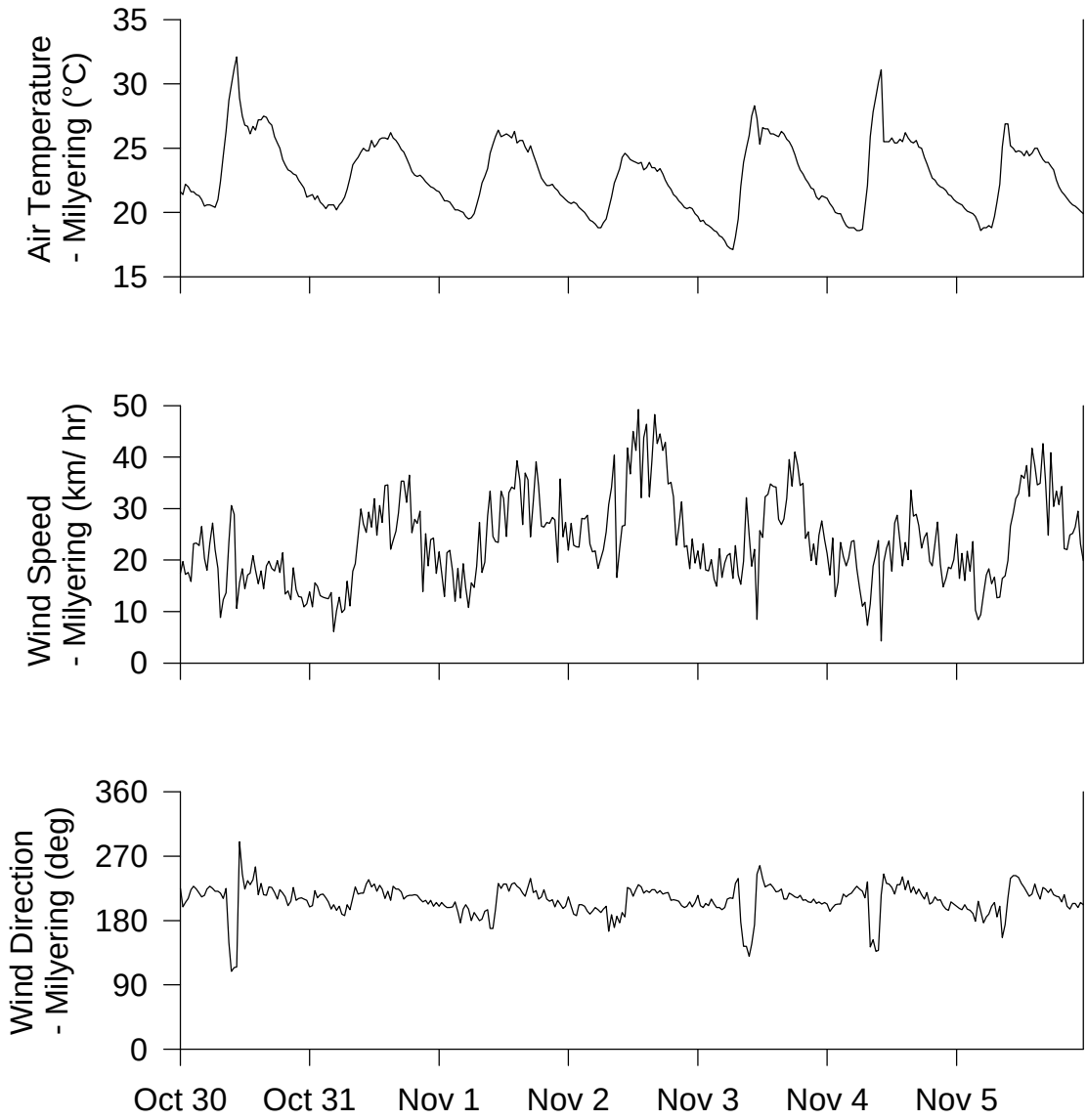
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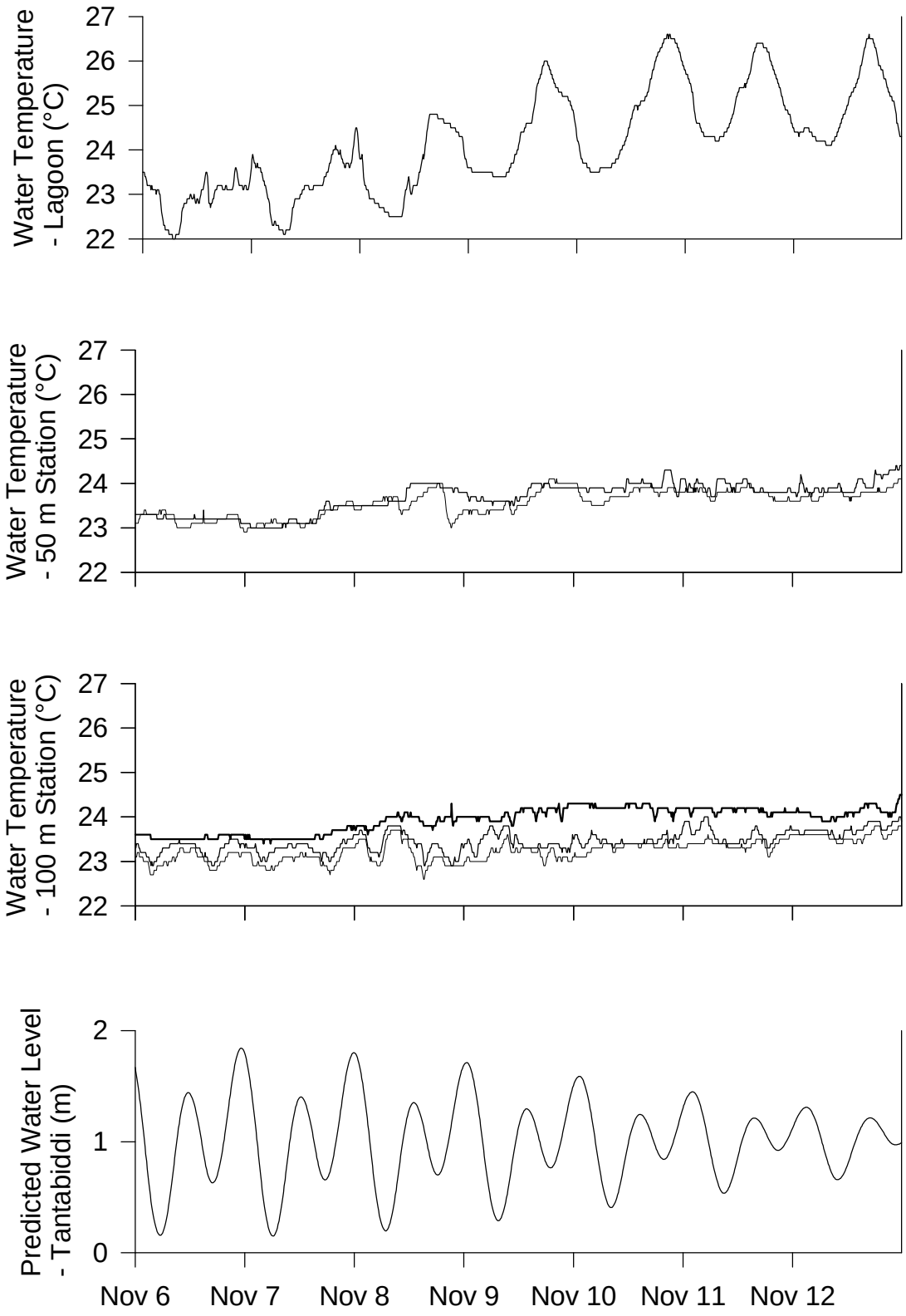
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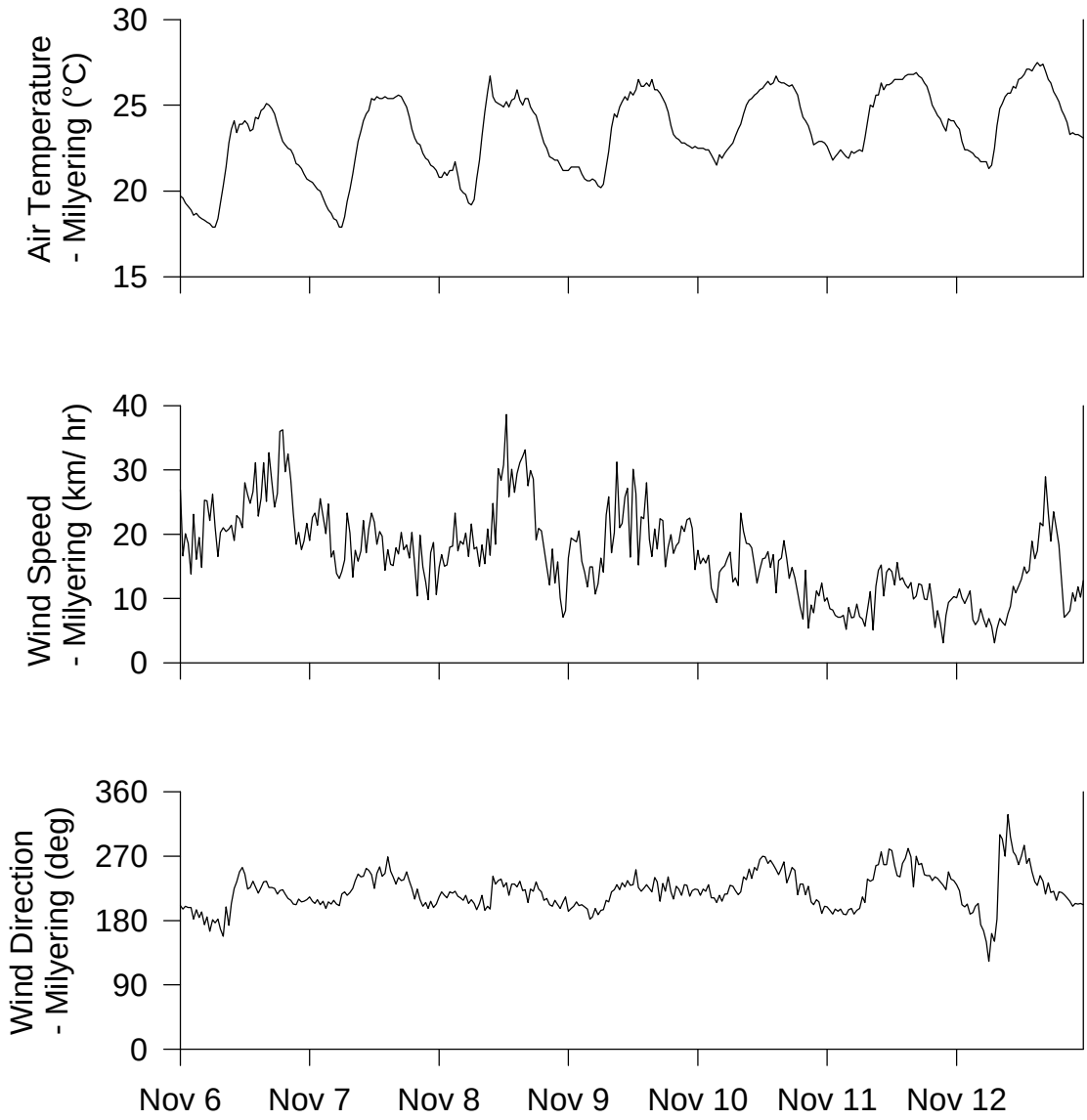
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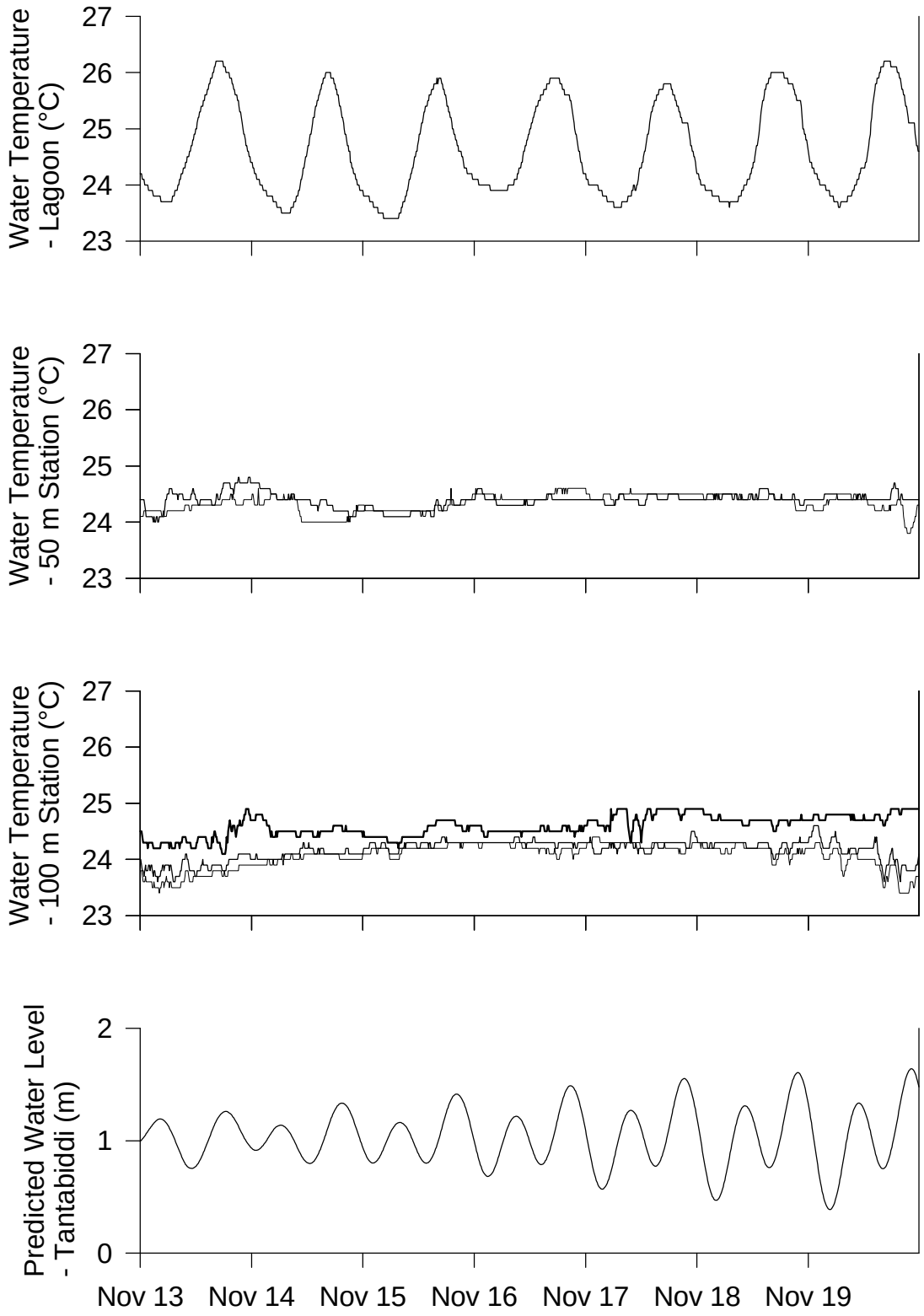
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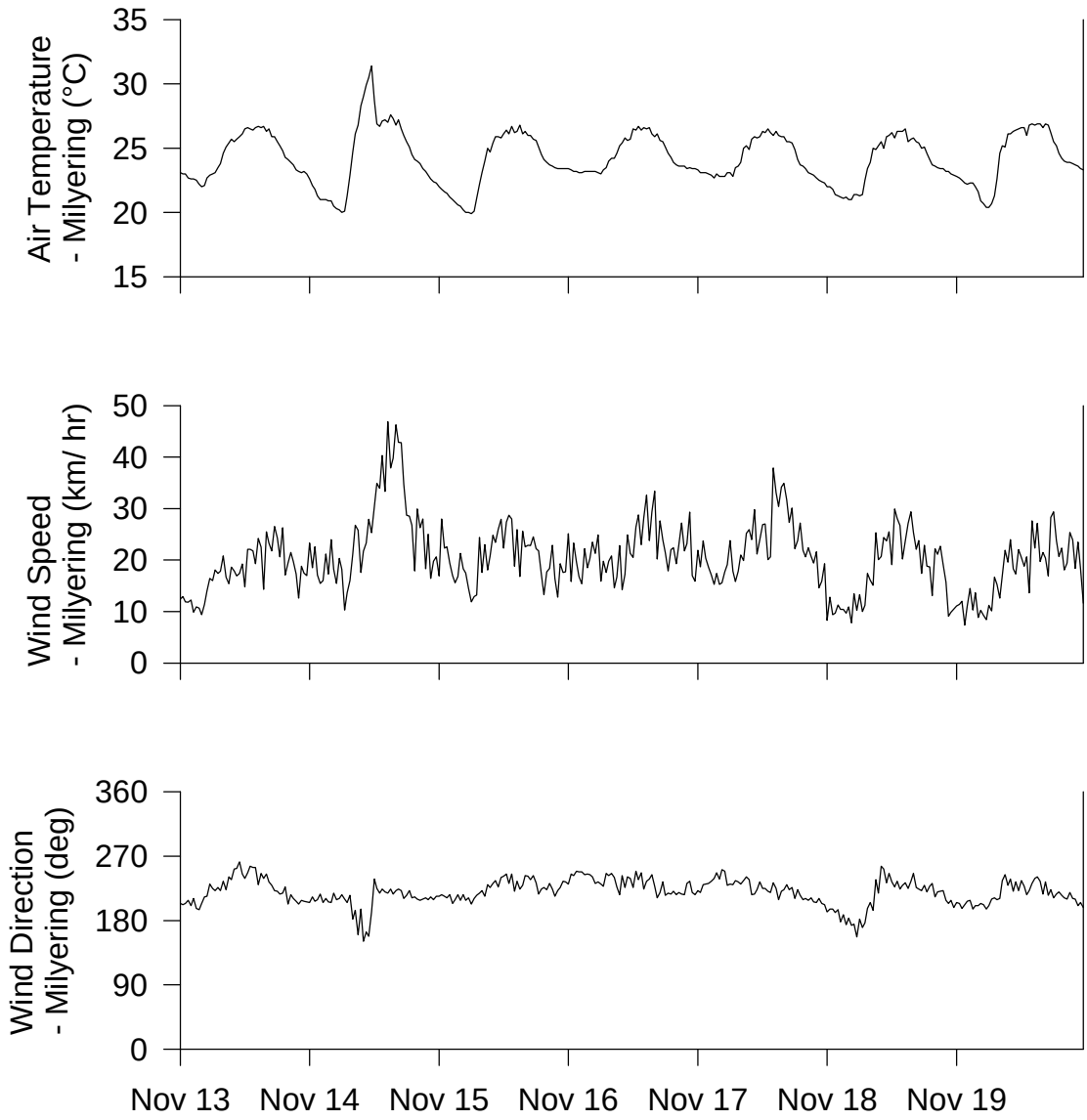
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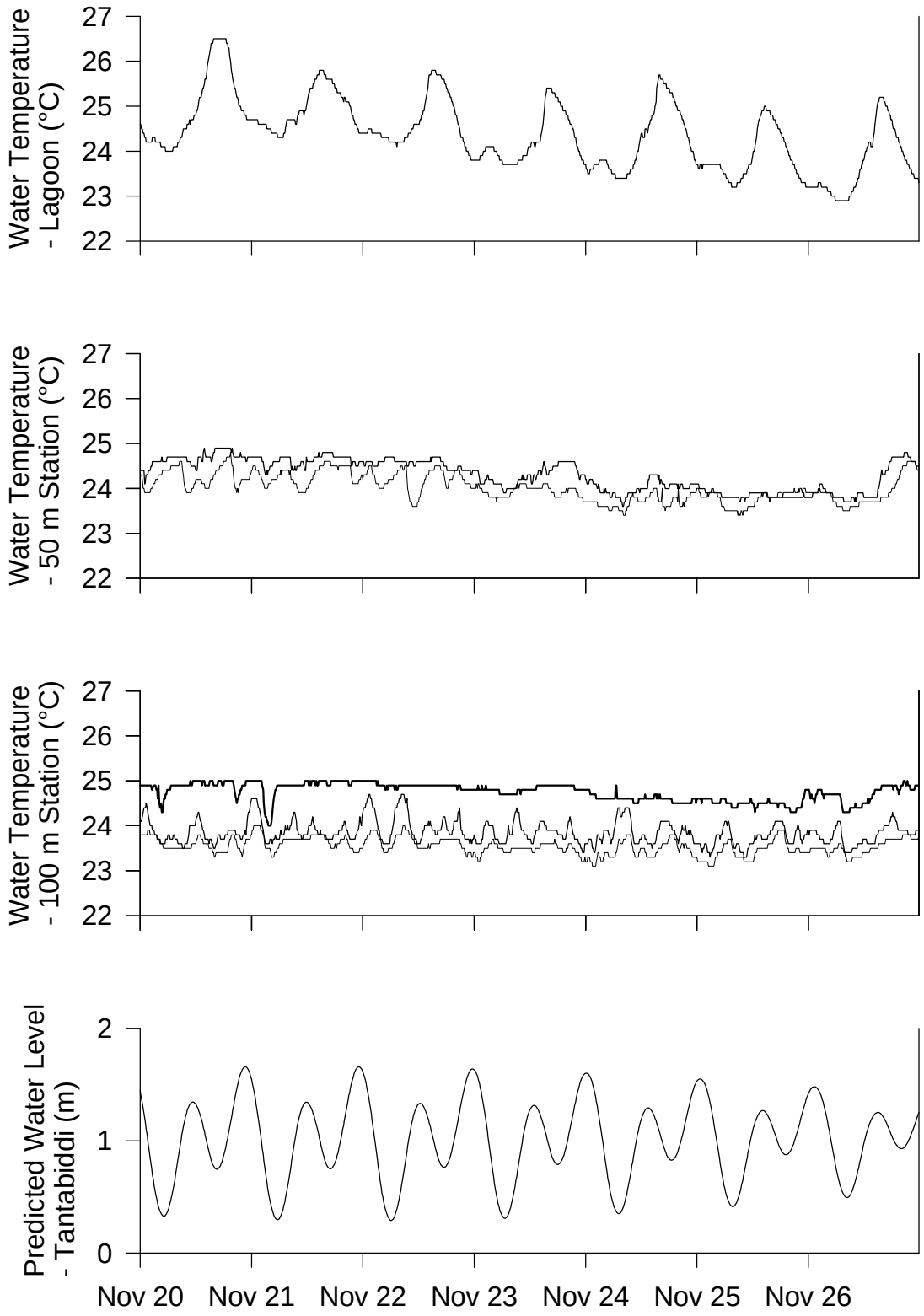
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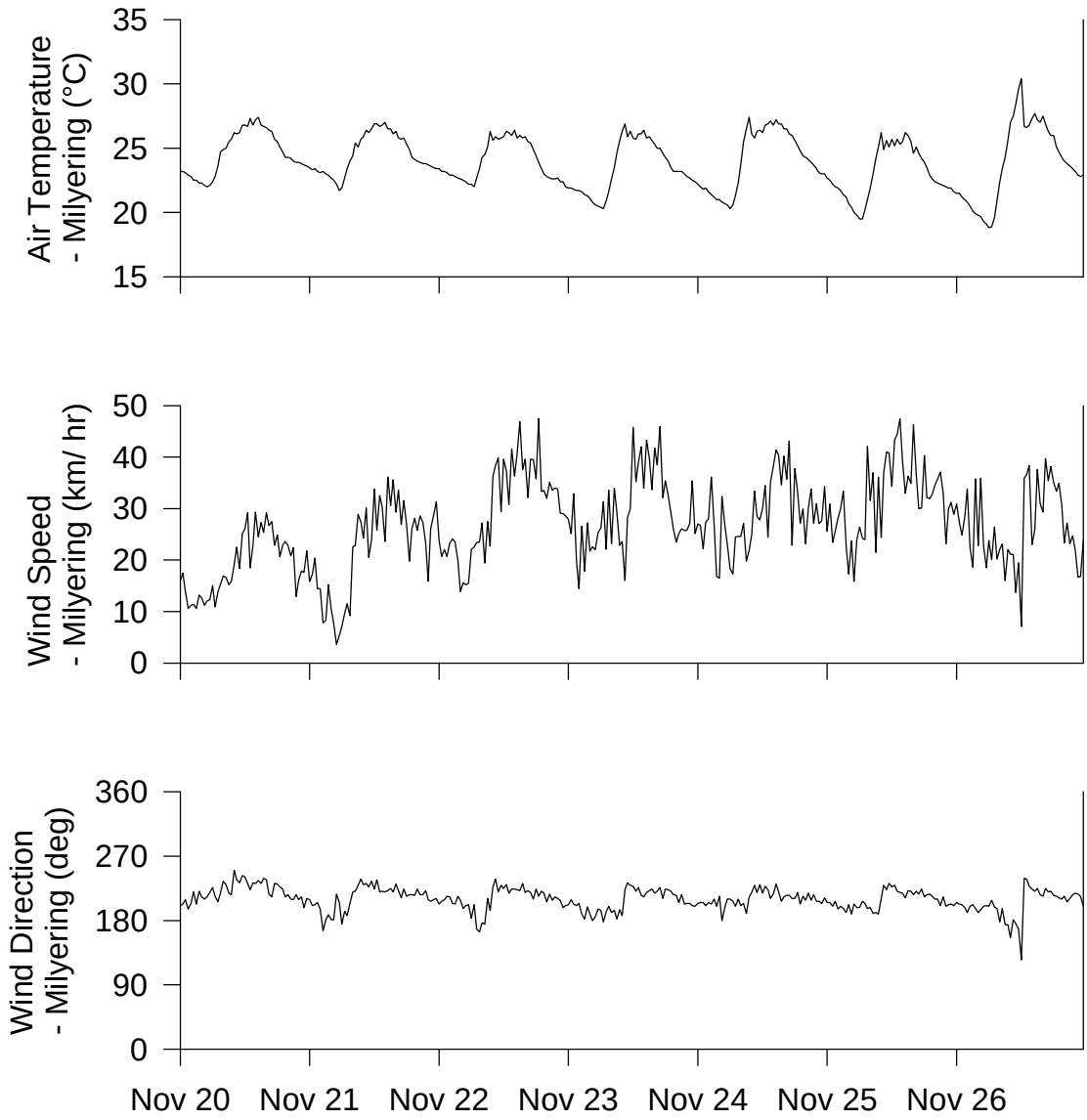
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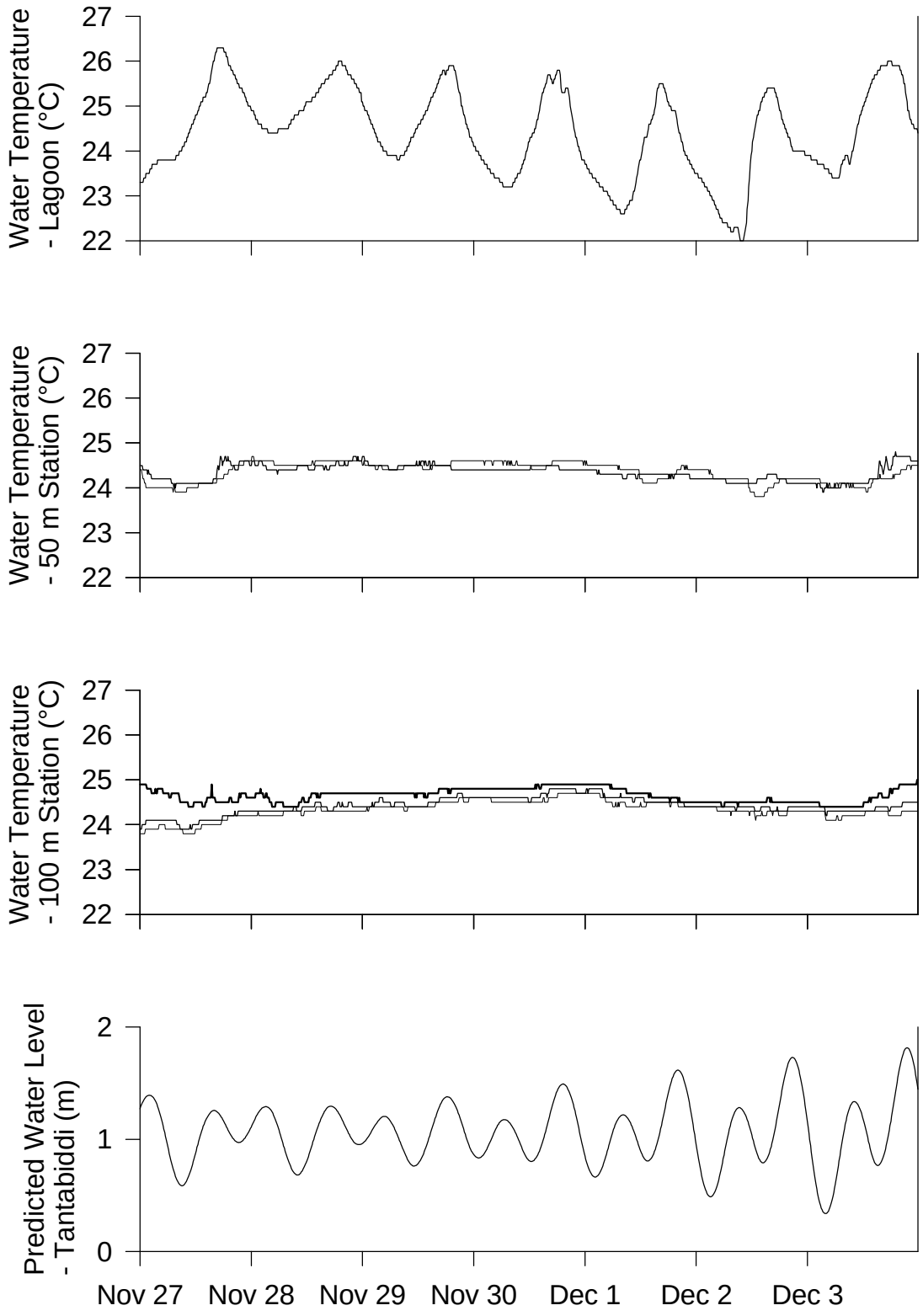
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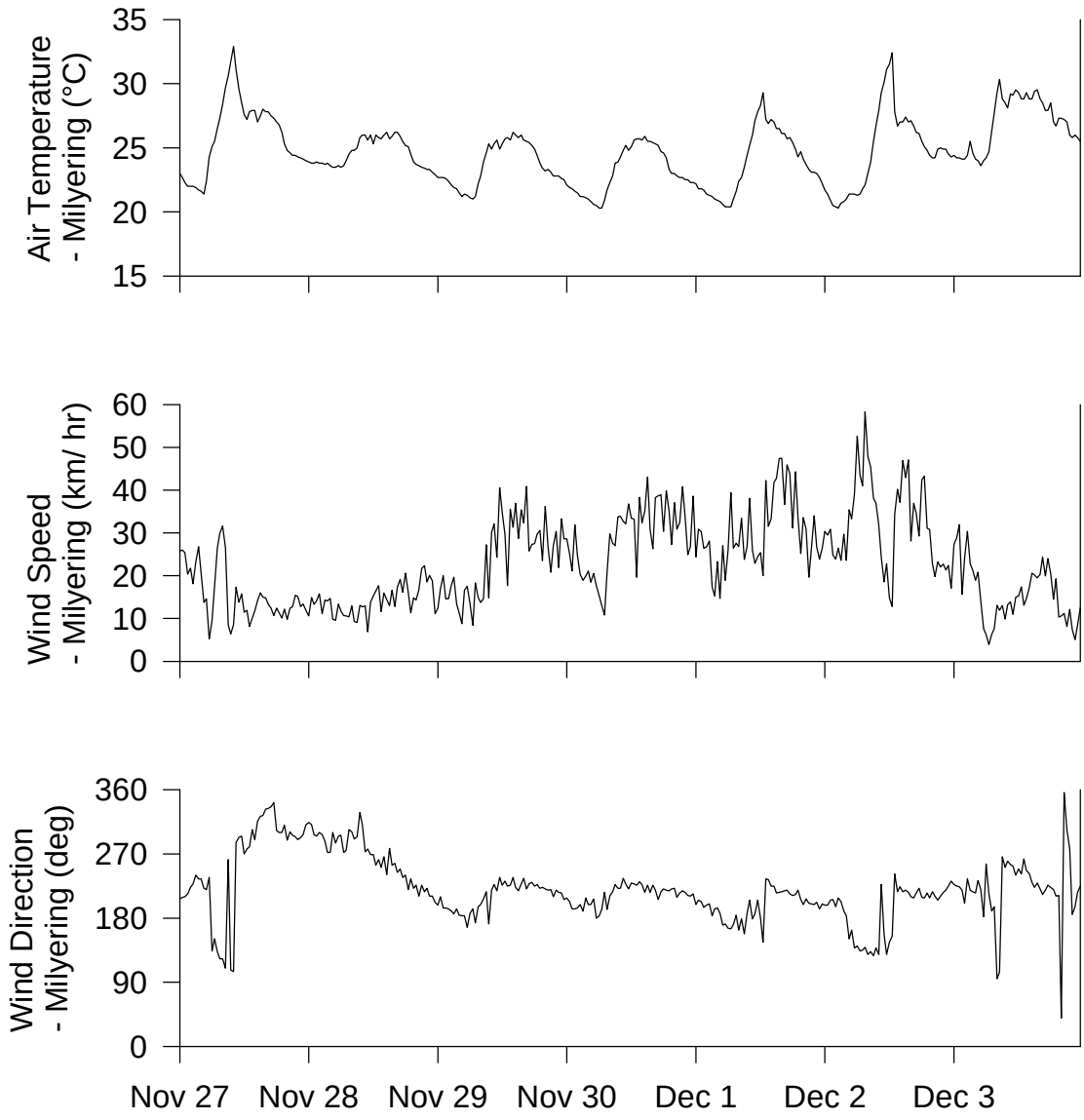
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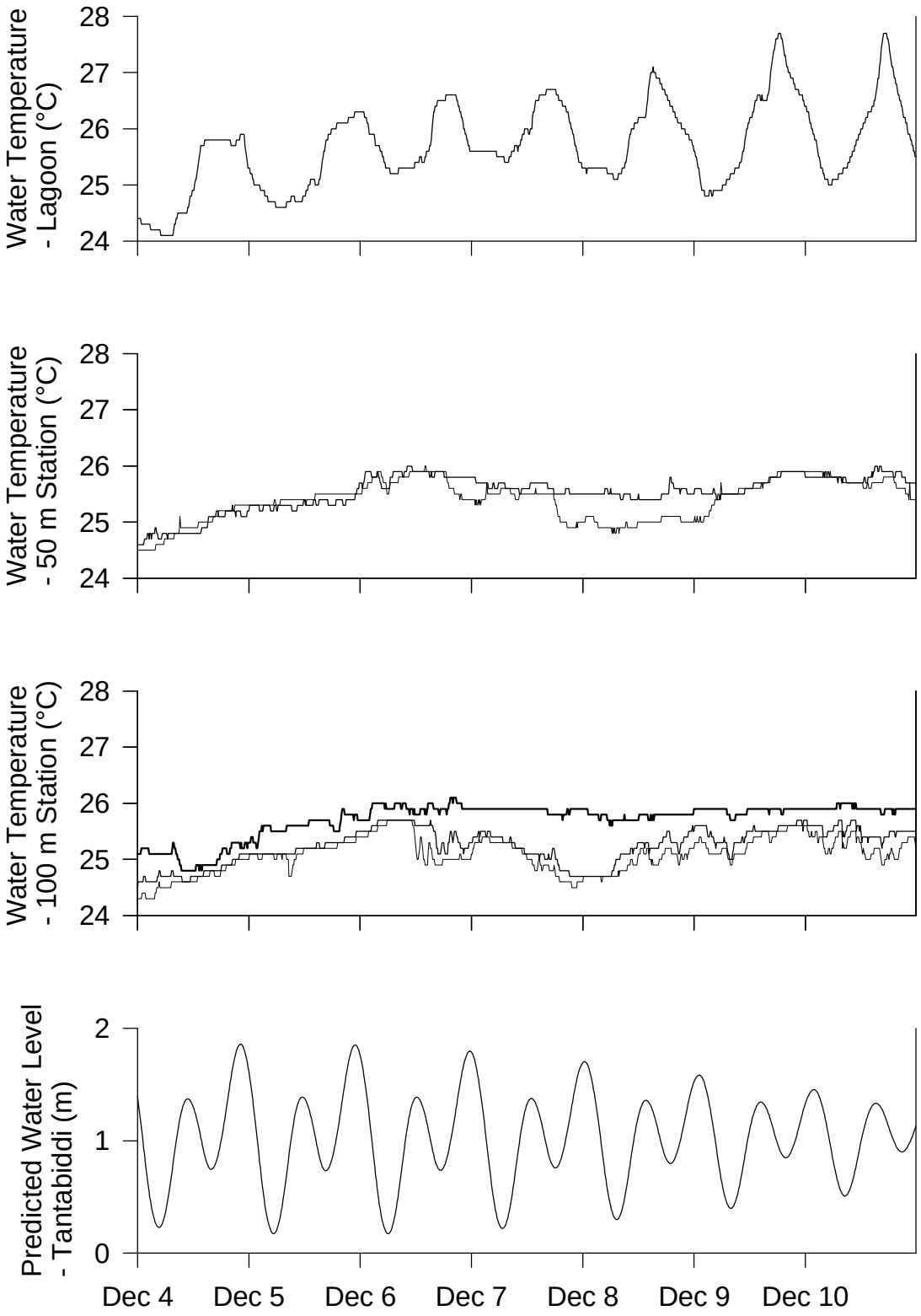
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Predicted Water Level
- Tantabiddi (m)
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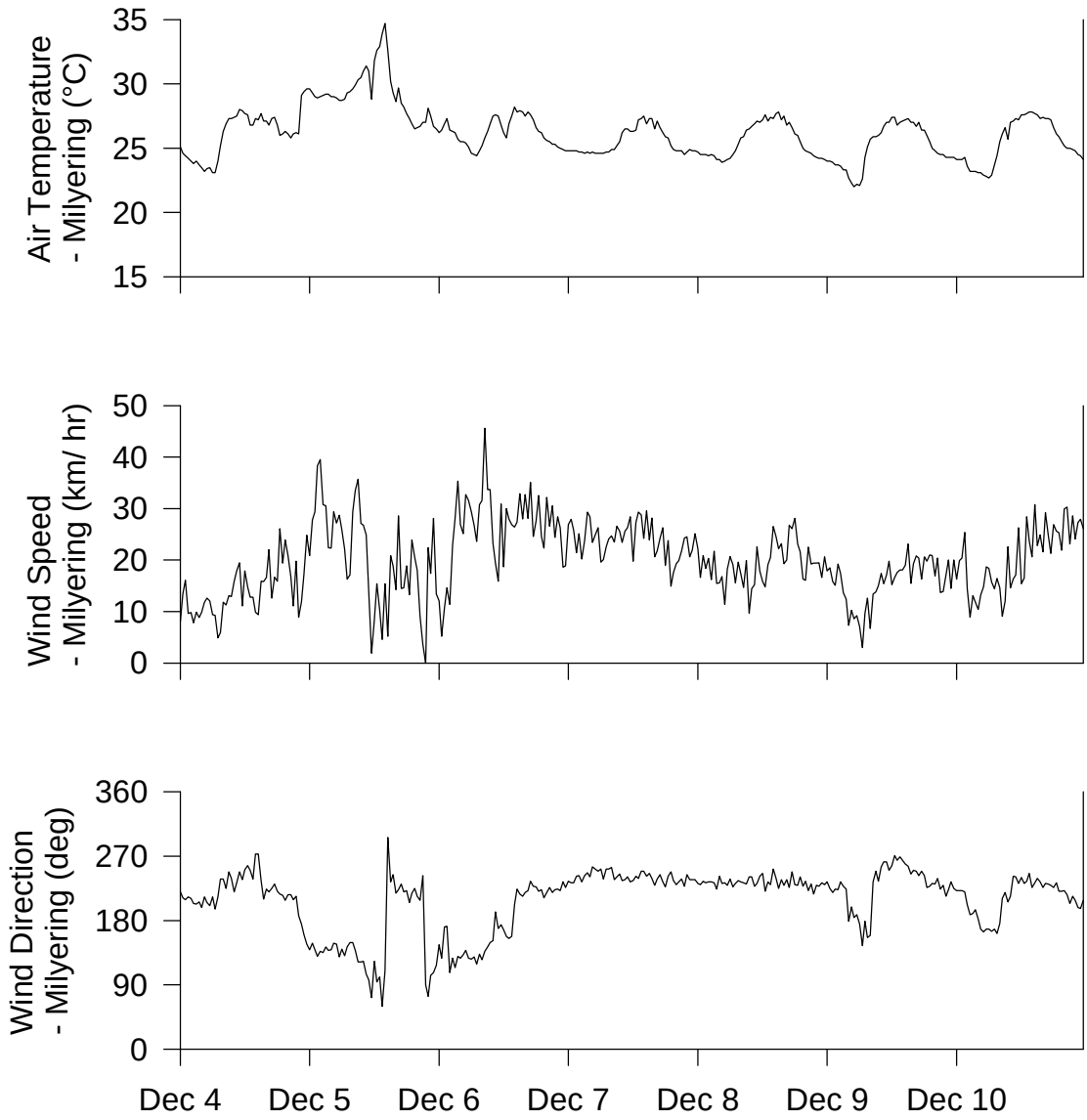
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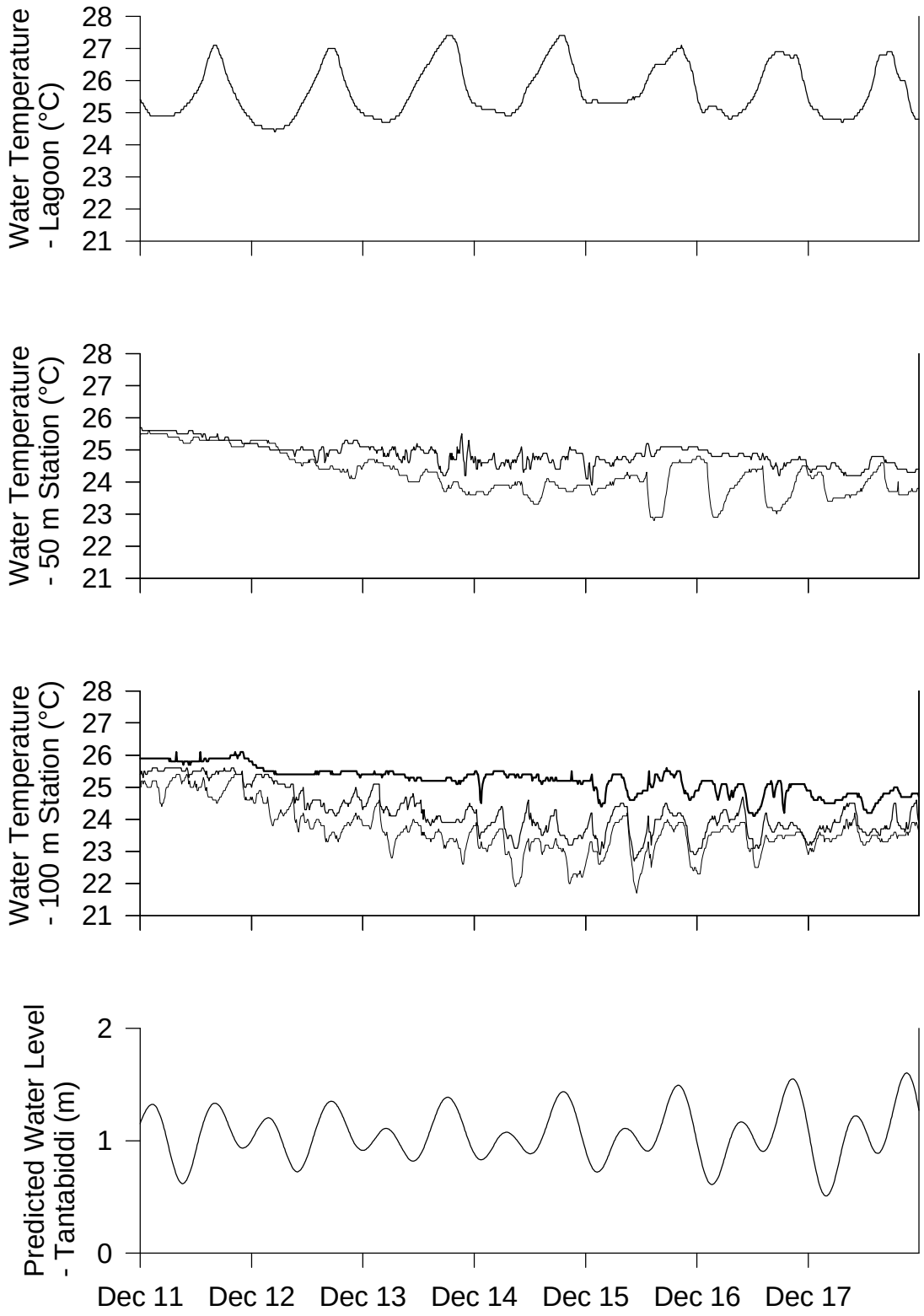
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Water Temperature
- 100 m Station (°C)
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Predicted Water Level
- Tantabiddi (m)
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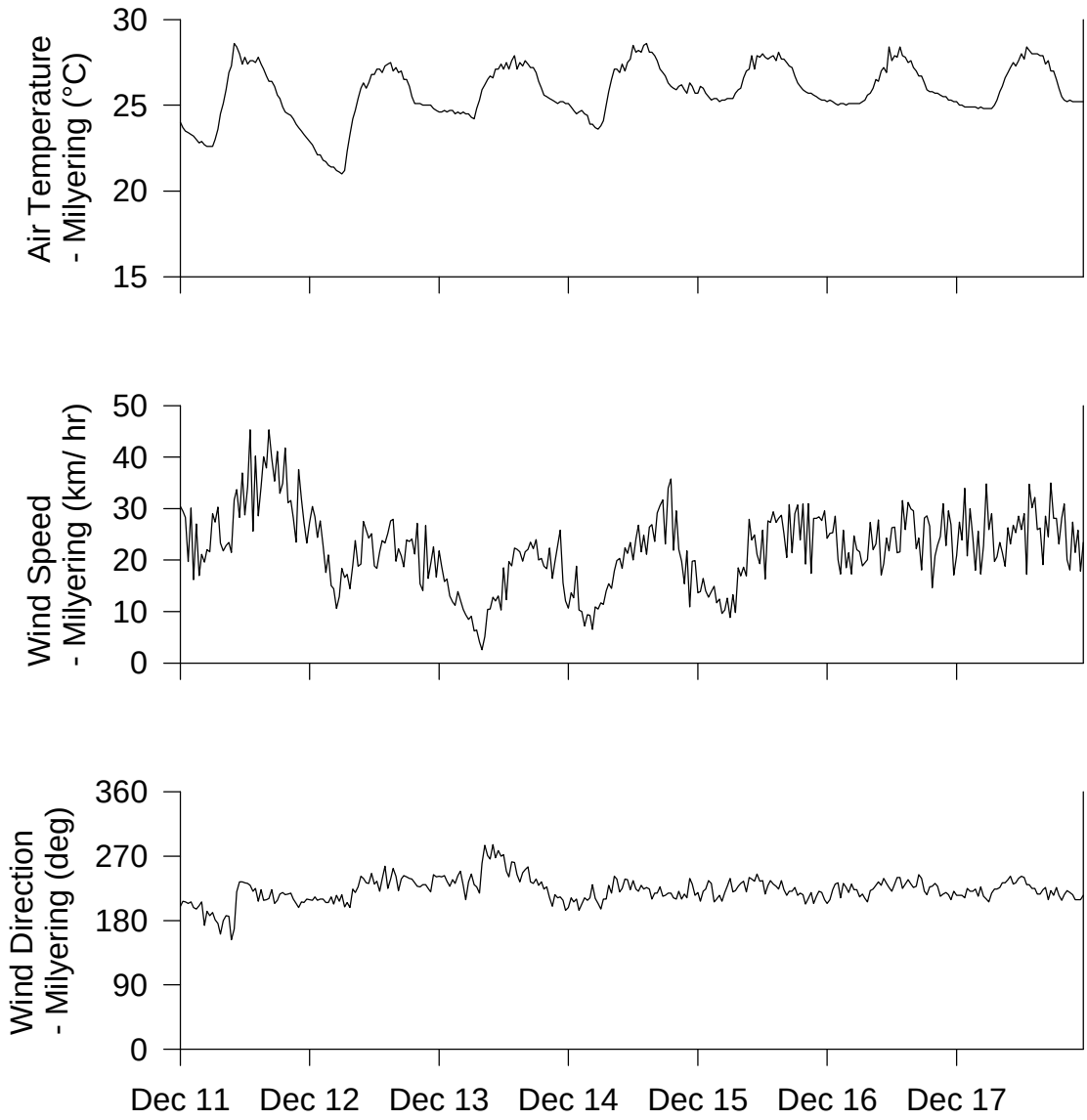
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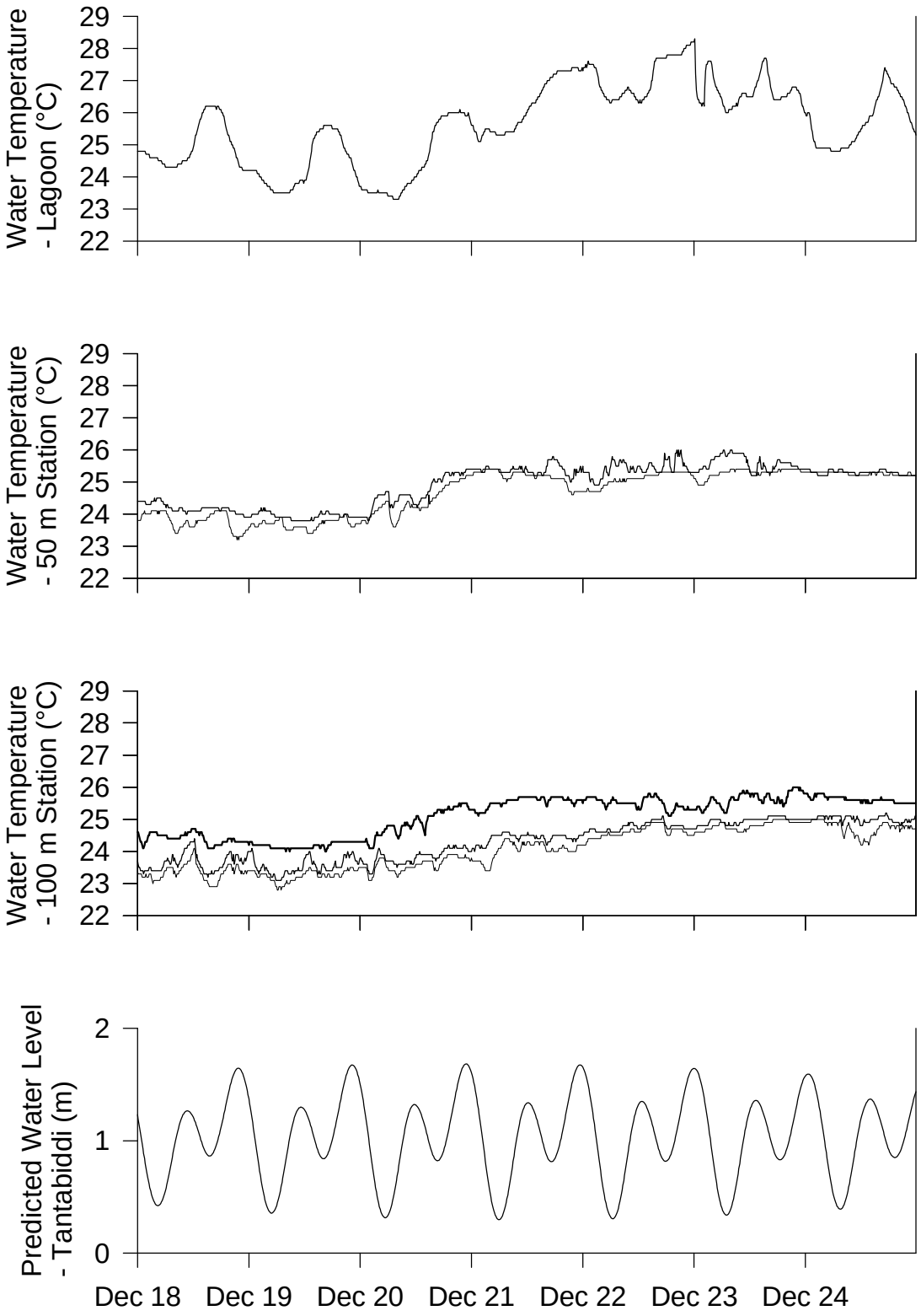
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Water Temperature
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Predicted Water Level
- Tantabiddi (m)
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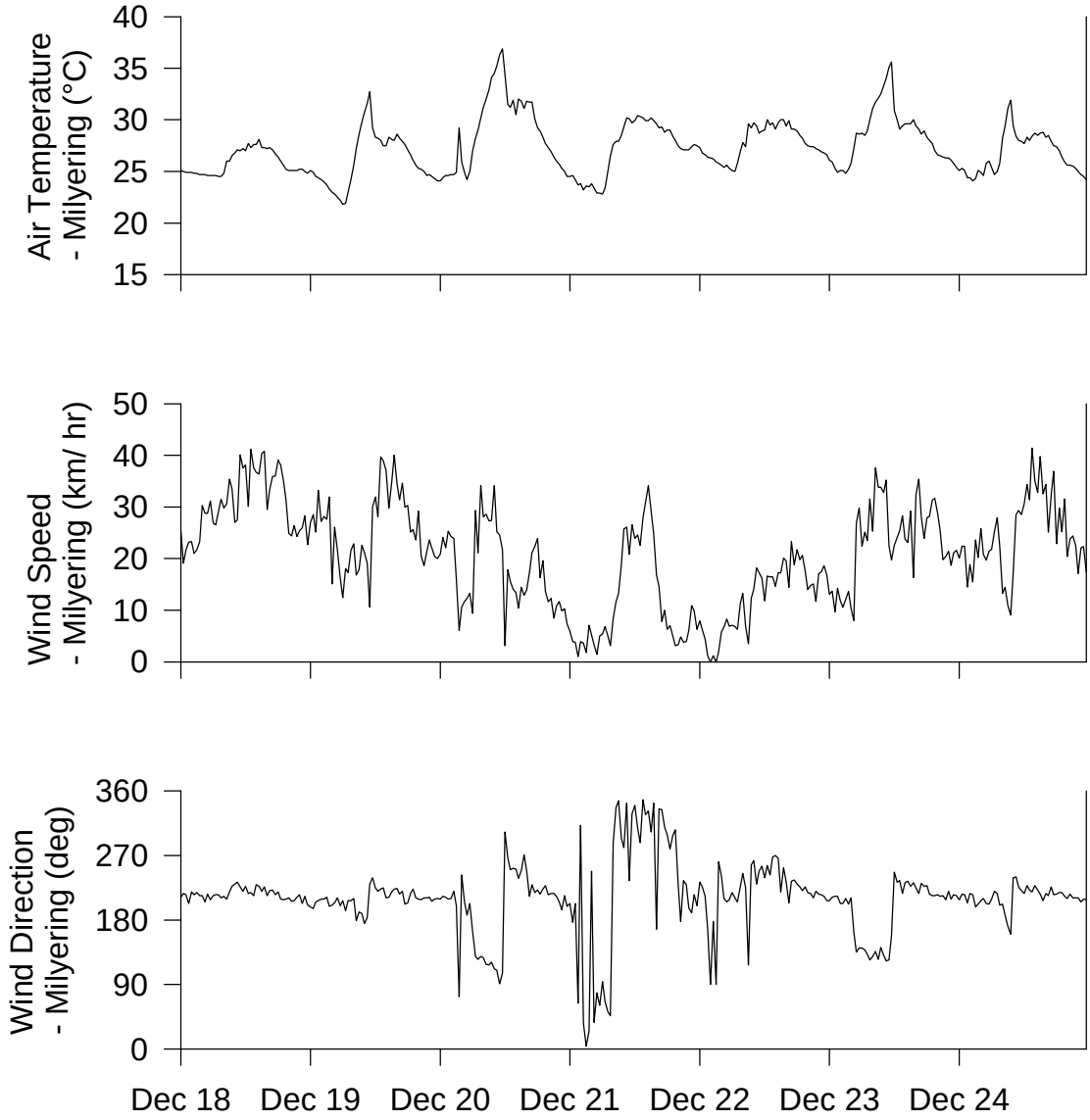
Air Temperature
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Wind Speed
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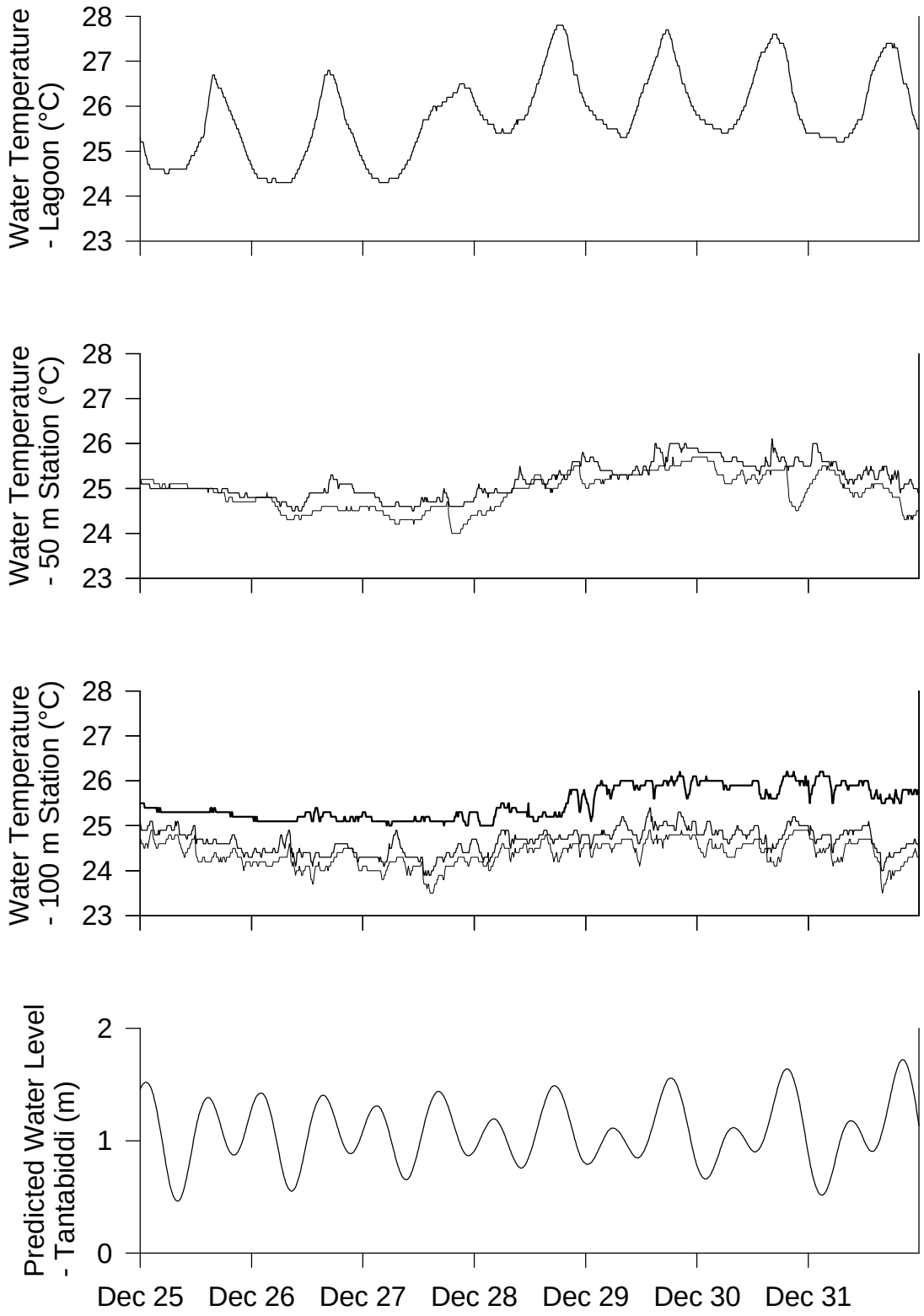
Water Temperature
- Lagoon (°C)
28
27
26
25
24
23
Water Temperature
- 50 m Station (°C)
28
27
26
25
24
23
Water Temperature
- 100 m Station (°C)
28
27
26
25
24
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Predicted Water Level
- Tantabiddi (m)
2
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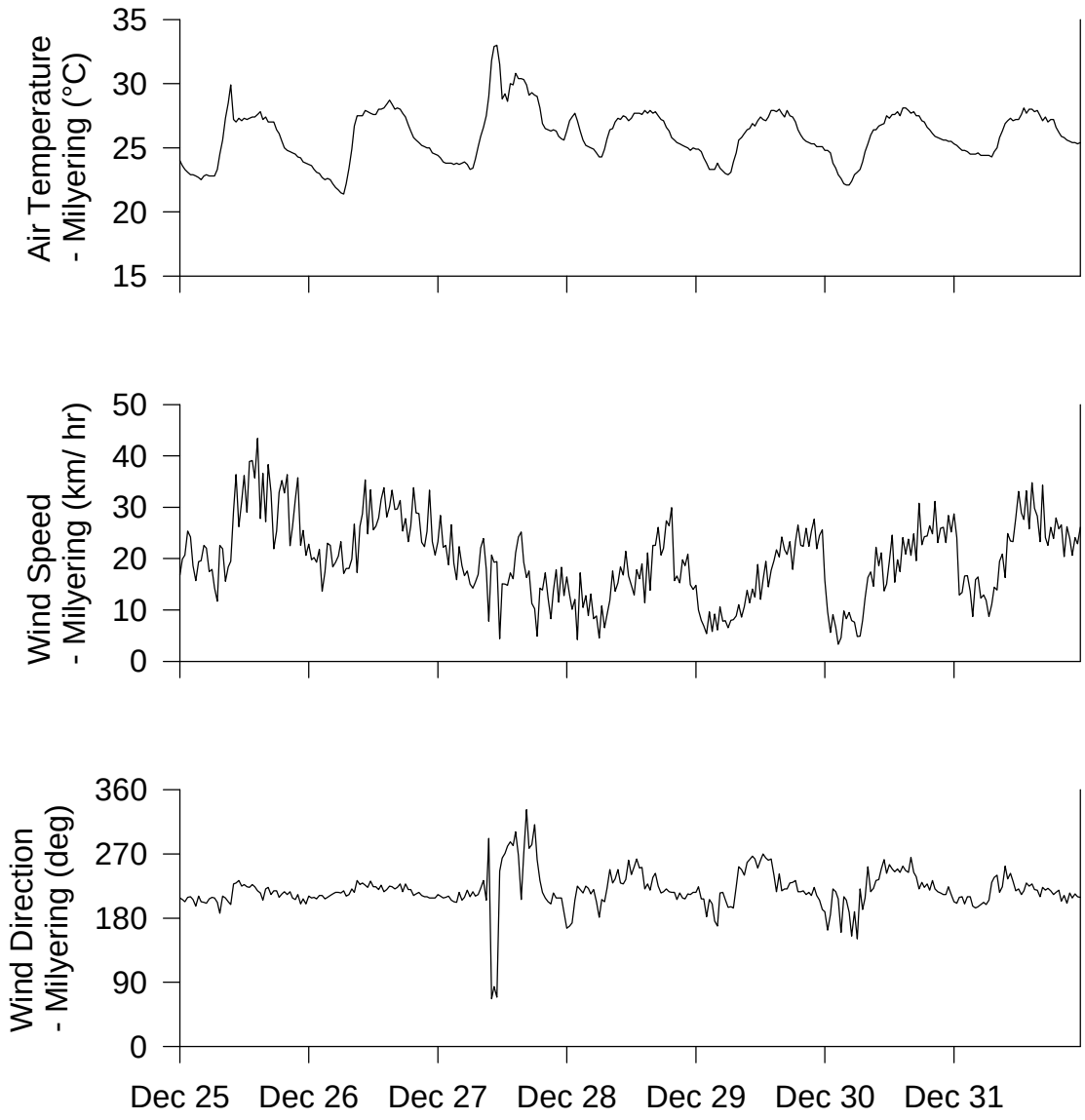
Dec 25
Dec 26
Dec 27
Dec 28
Dec 29
Dec 30
Dec 31


Air Temperature
- Milyering (°C)
35
30
25
20
15
Wind Speed
- Milyering (km/ hr)
50
40
30
20
10
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Wind Direction
- Milyering (deg)
360
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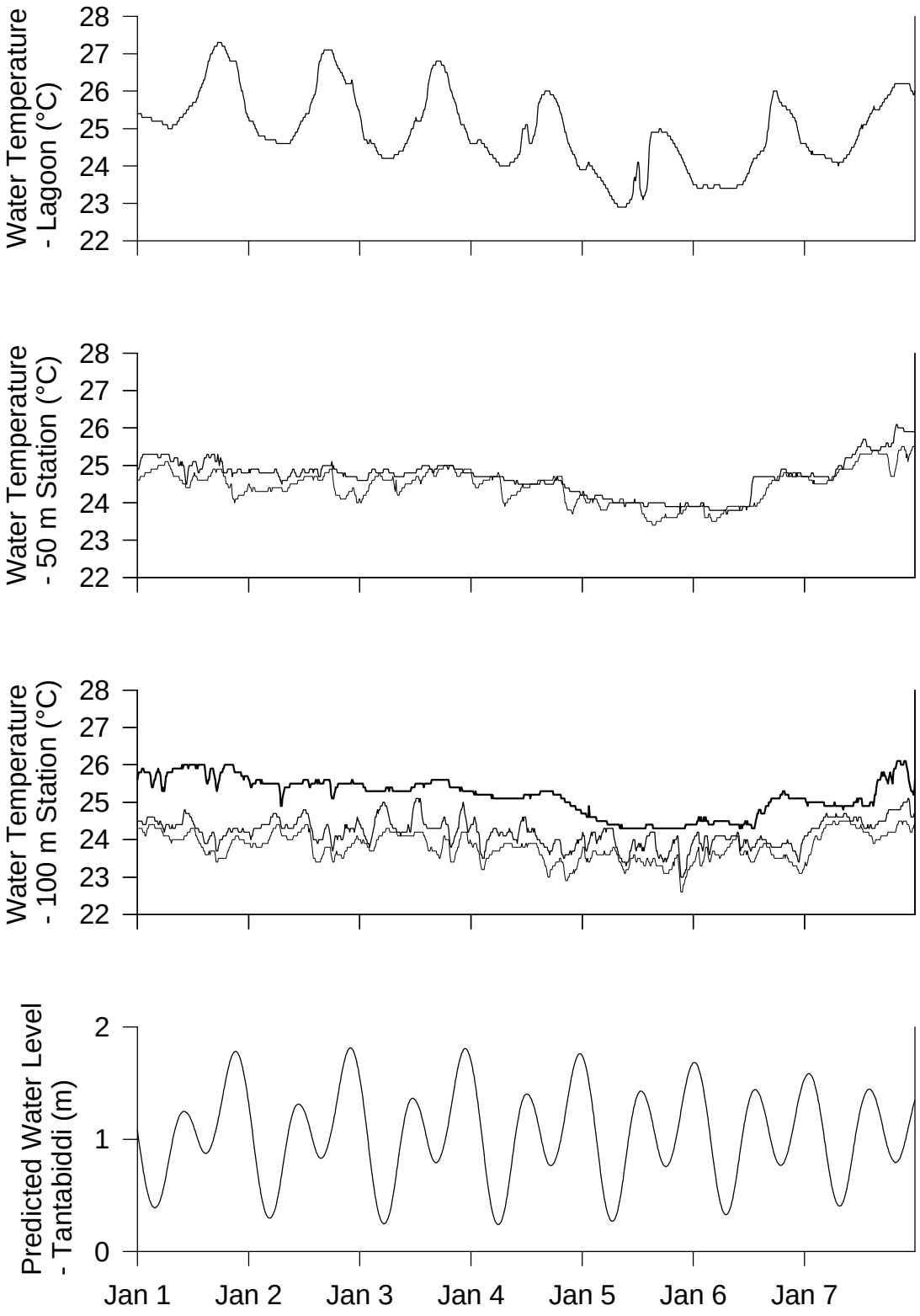
Dec 31


Water Temperature
- Lagoon (°C)
28
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Water Temperature
- 50 m Station (°C)
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24
23
22
Water Temperature
- 100 m Station (°C)
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27
26
25
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Predicted Water Level
- Tantabiddi (m)
2
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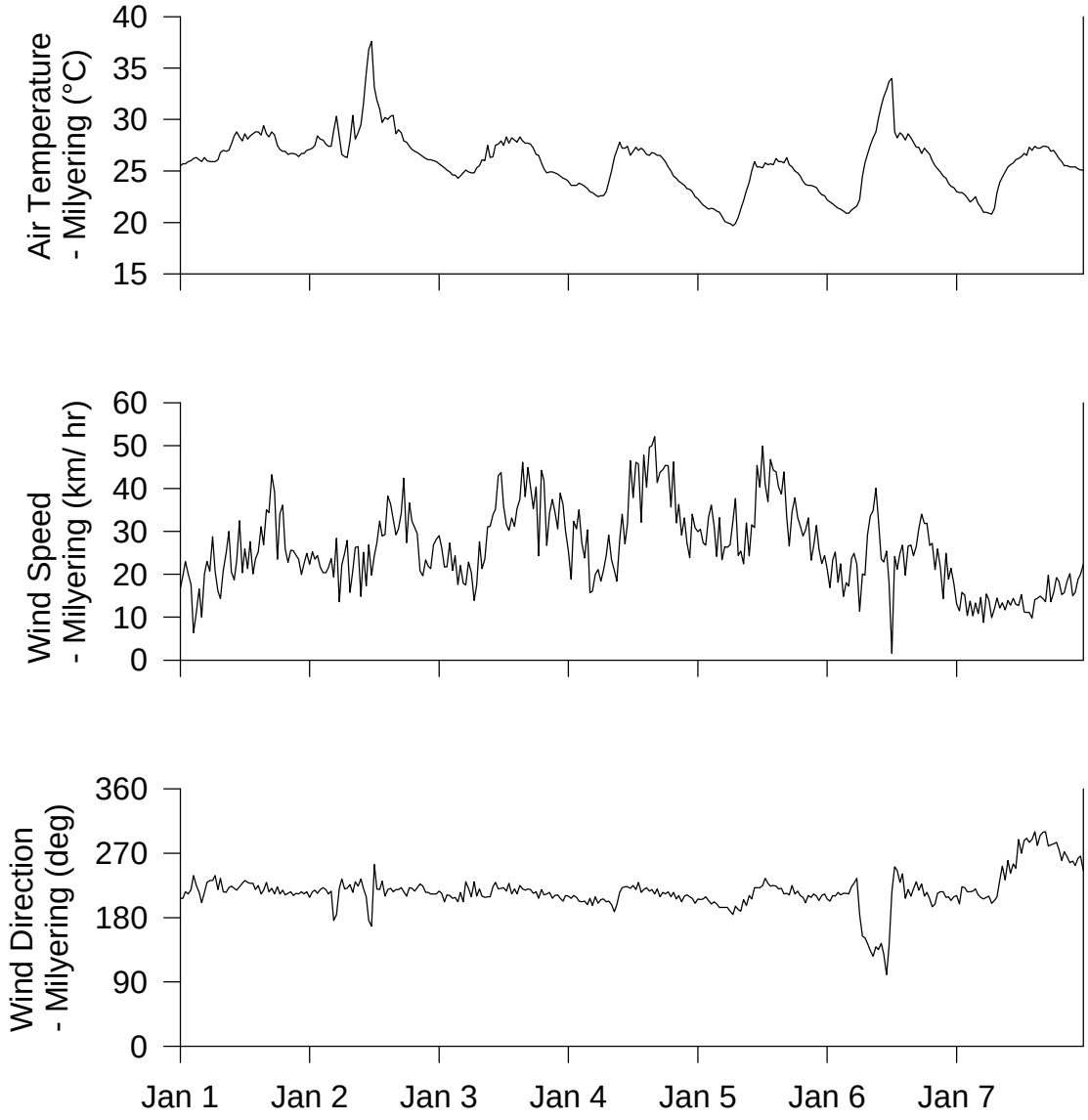
Jan 1
Jan 2
Jan 3
Jan 4
Jan 5
Jan 6
Jan 7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- Milyering (°C)
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20
15
Wind Speed
- Milyering (km/ hr)
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50
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Wind Direction
- Milyering (deg)
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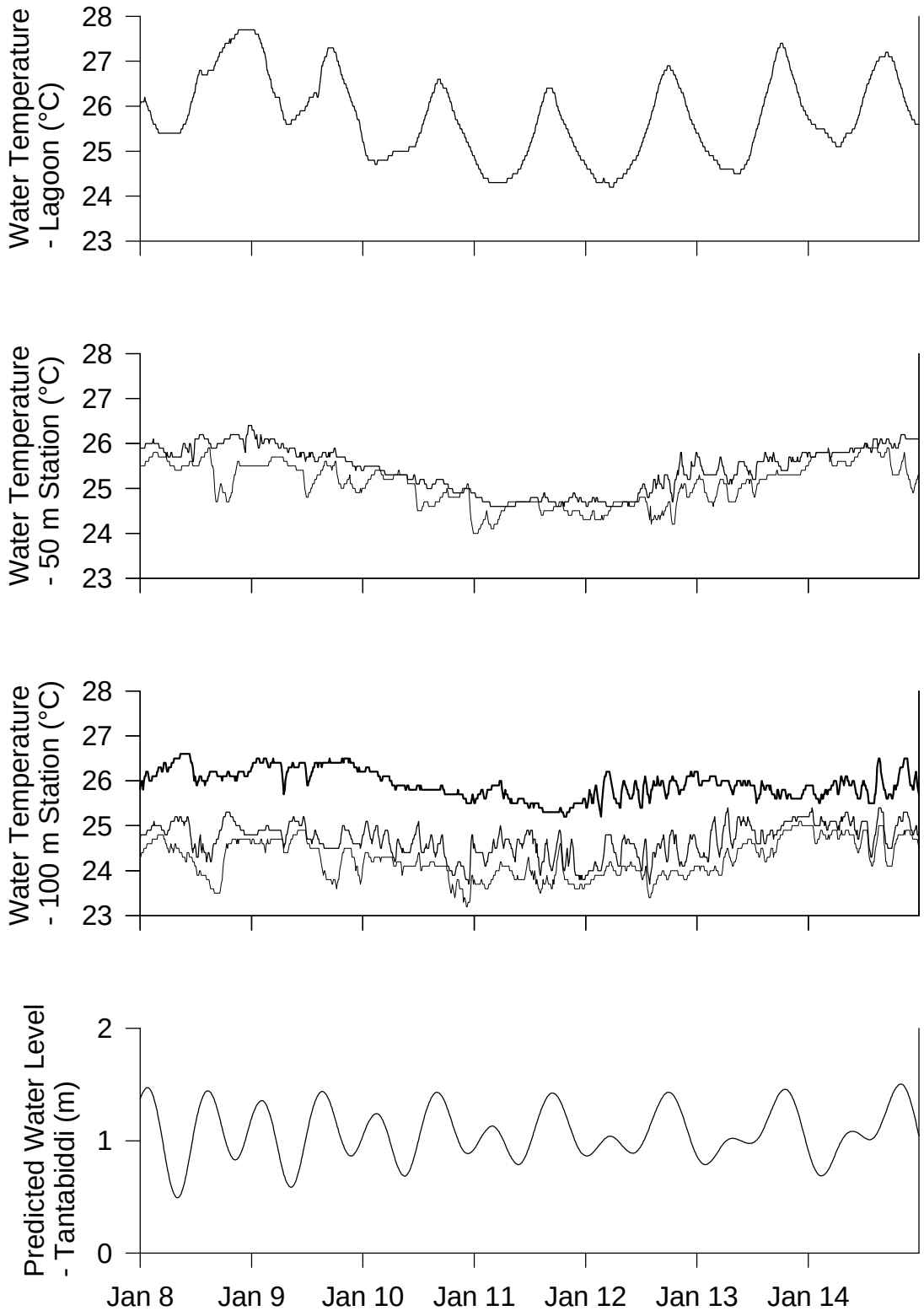
Water Temperature
- Lagoon (°C)
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Water Temperature
- 50 m Station (°C)
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26
25
24
23
Water Temperature
- 100 m Station (°C)
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27
26
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Predicted Water Level
- Tantabiddi (m)
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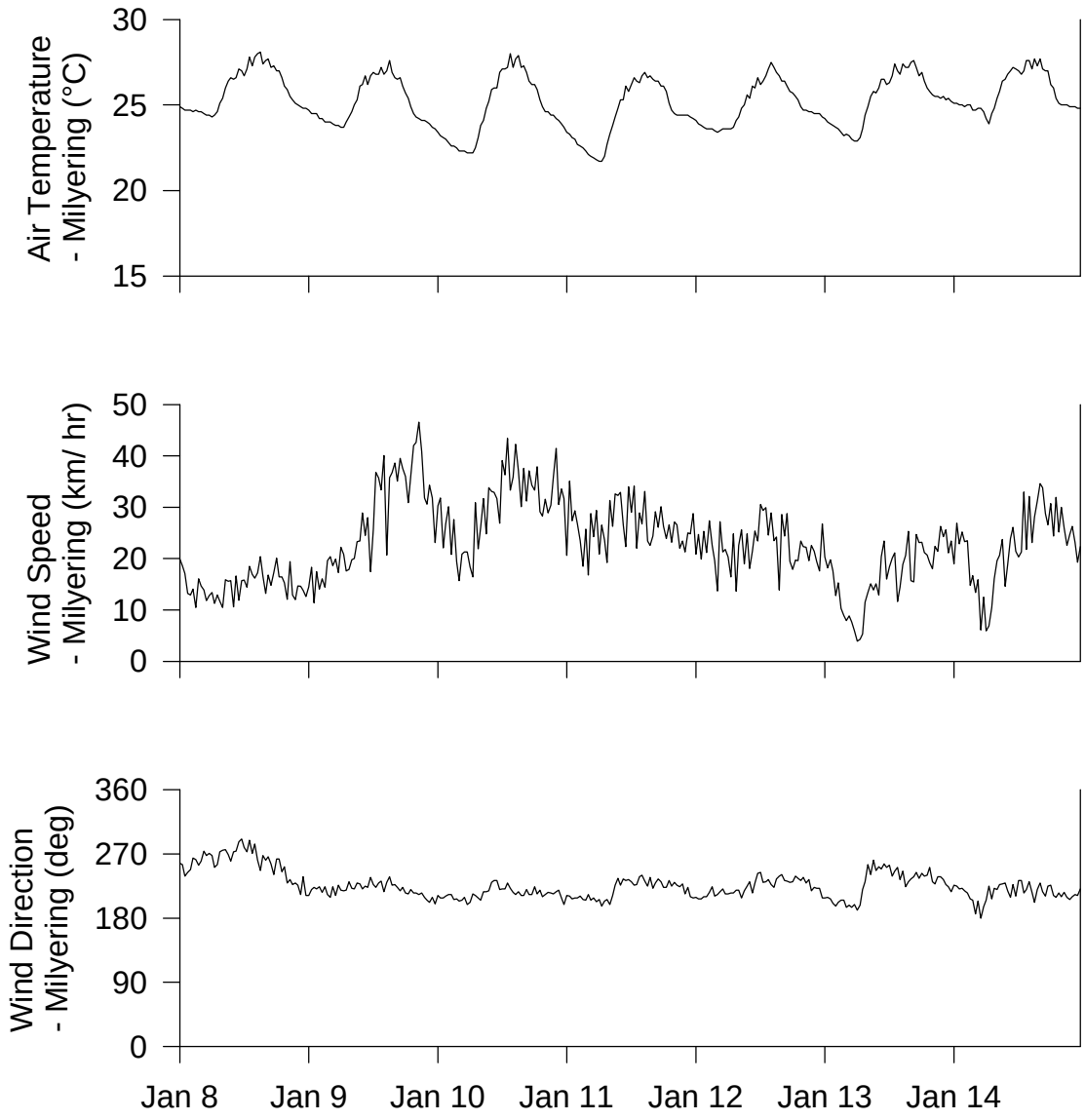
Jan 8
Jan 9
Jan 10
Jan 11
Jan 12
Jan 13
Jan 14


Air Temperature
- Milyering (°C)
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Wind Speed
- Milyering (km/ hr)
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Wind Direction
- Milyering (deg)
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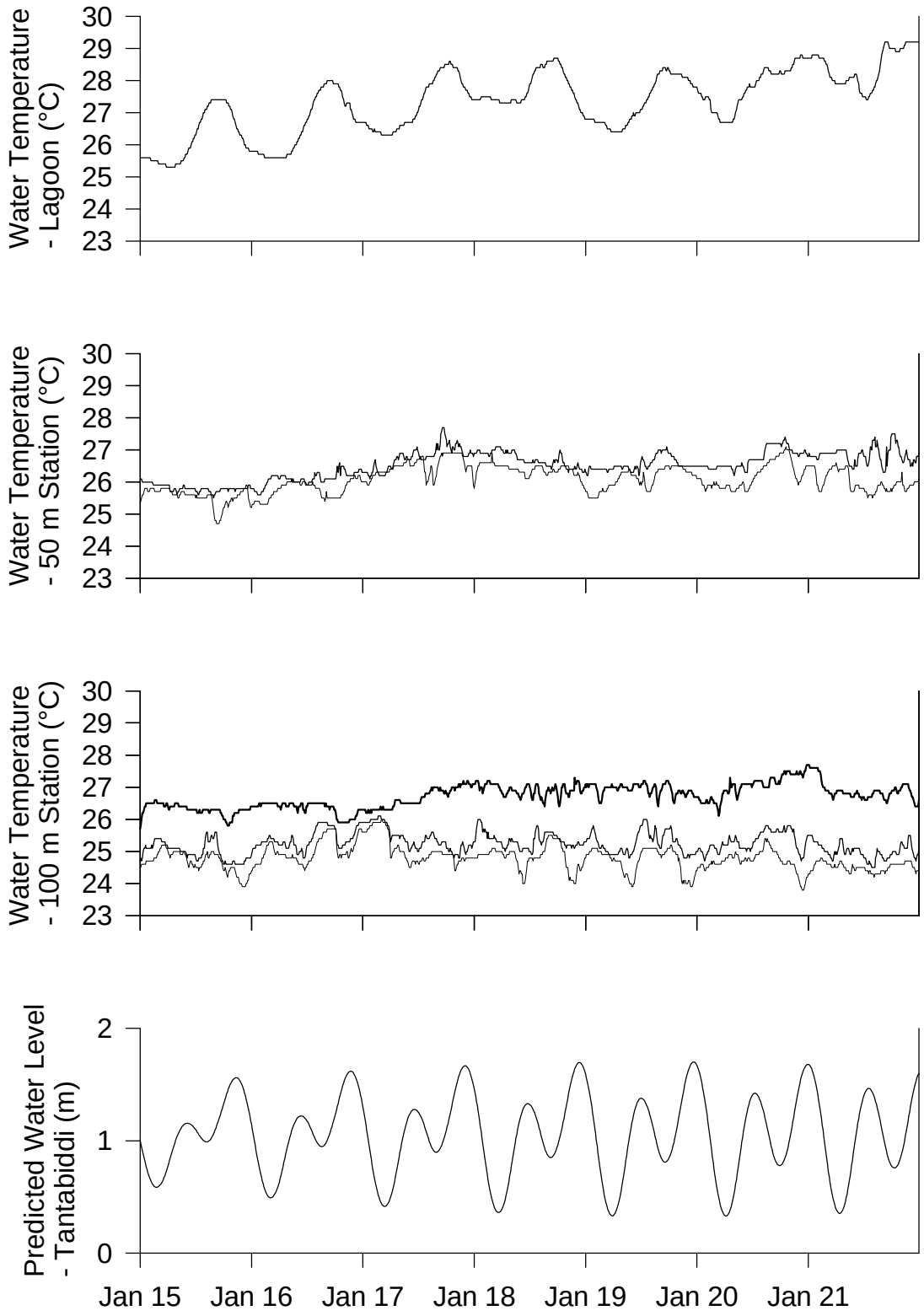
Water Temperature
- Lagoon (°C)
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Water Temperature
- 50 m Station (°C)
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26
25
24
23
Water Temperature
- 100 m Station (°C)
30
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26
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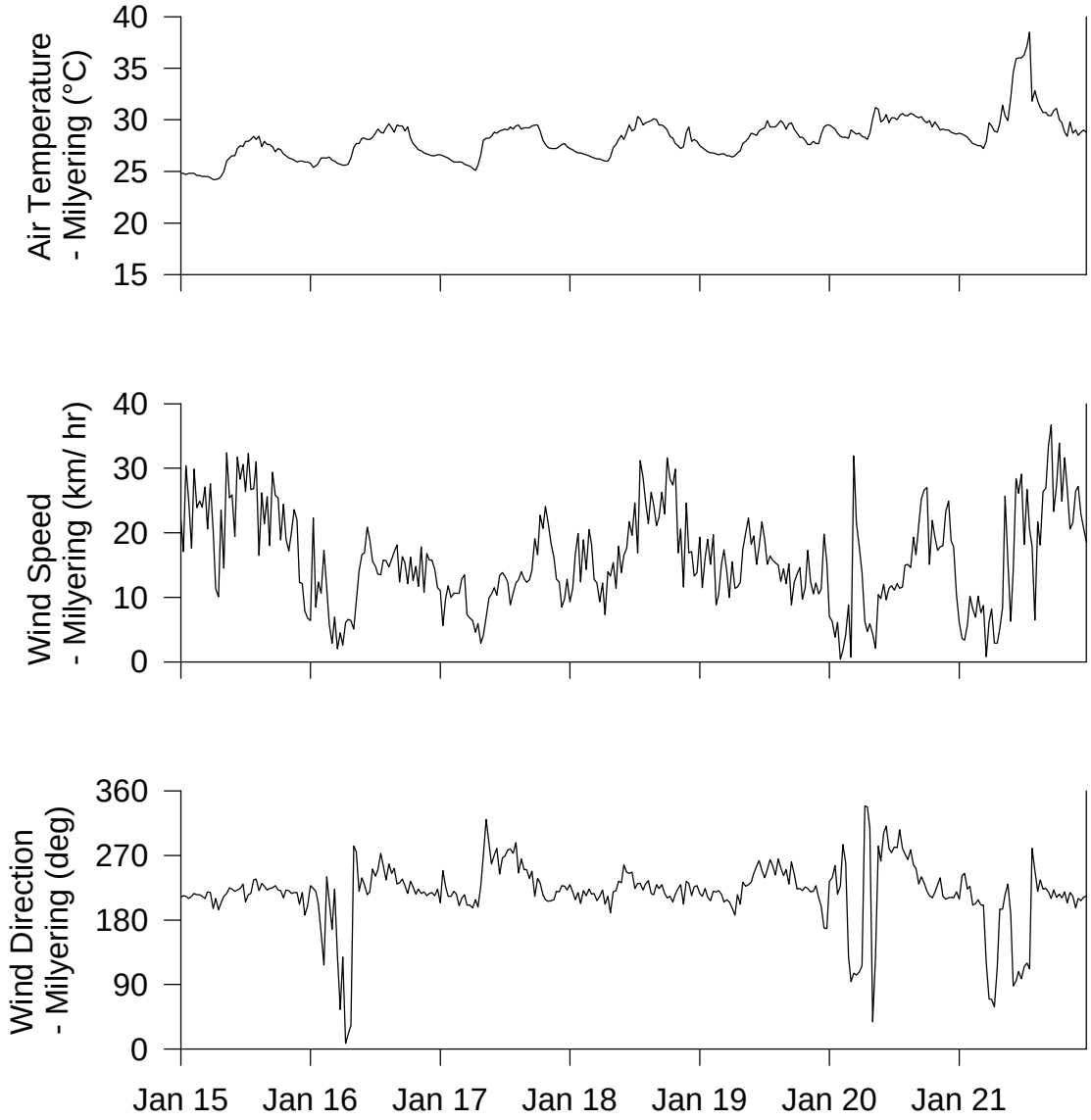
Predicted Water Level
- Tantabiddi (m)
2
1
0
Jan 15
Jan 16
Jan 17
Jan 18
Jan 19
Jan 20
Jan 21


Air Temperature
- Milyering (°C)
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35
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Wind Speed
- Milyering (km/ hr)
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Wind Direction
- Milyering (deg)
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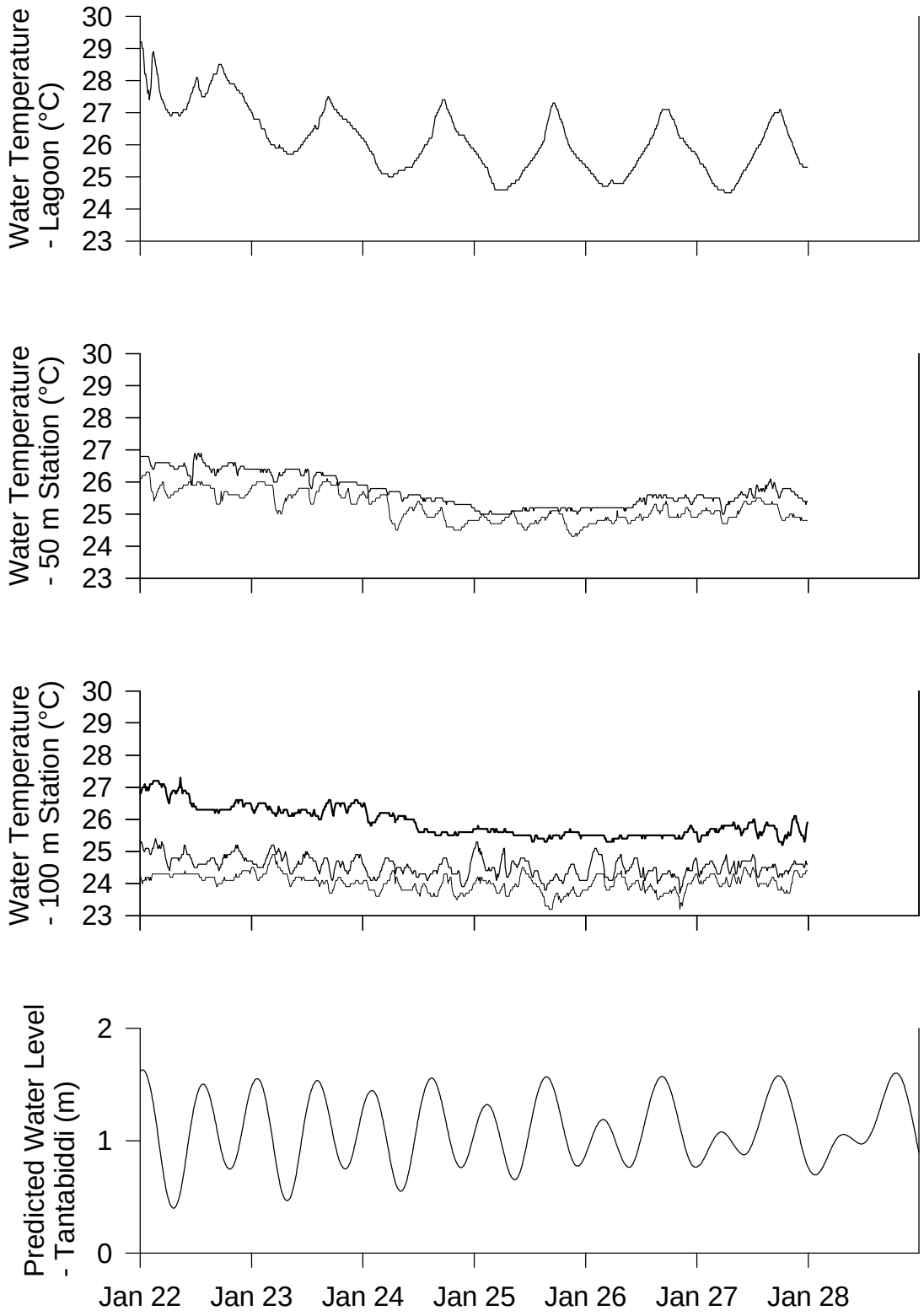
Jan 21


Water Temperature
- Lagoon (°C)
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Water Temperature
- 50 m Station (°C)
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26
25
24
23
Water Temperature
- 100 m Station (°C)
30
29
28
27
26
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Predicted Water Level
- Tantabiddi (m)
2
1
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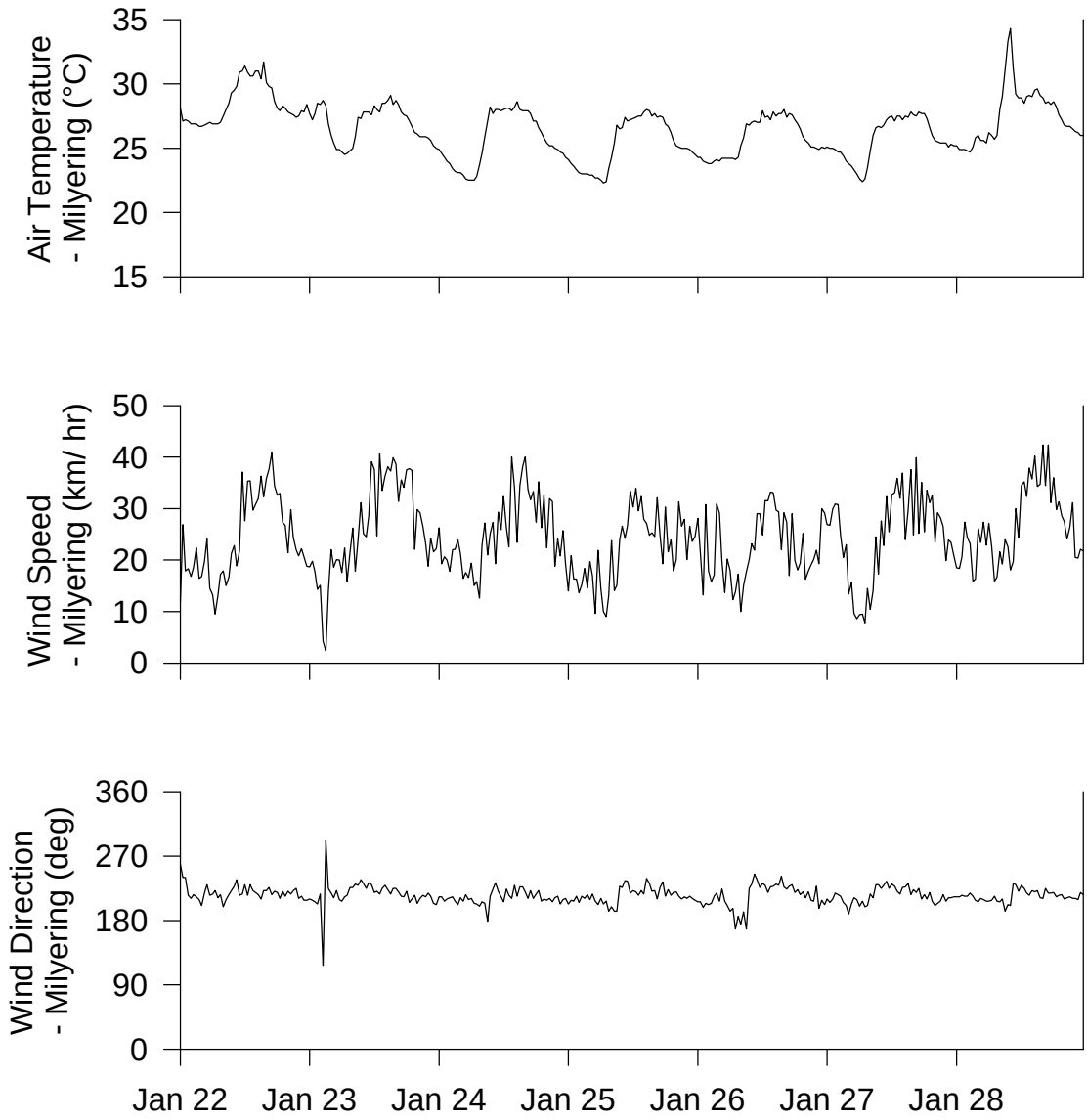
Jan 22
Jan 23
Jan 24
Jan 25
Jan 26
Jan 27
Jan 28


Air Temperature
- Milyering (°C)
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30
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20
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Wind Speed
- Milyering (km/ hr)
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Wind Direction
- Milyering (deg)
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Jan 23
Jan 24
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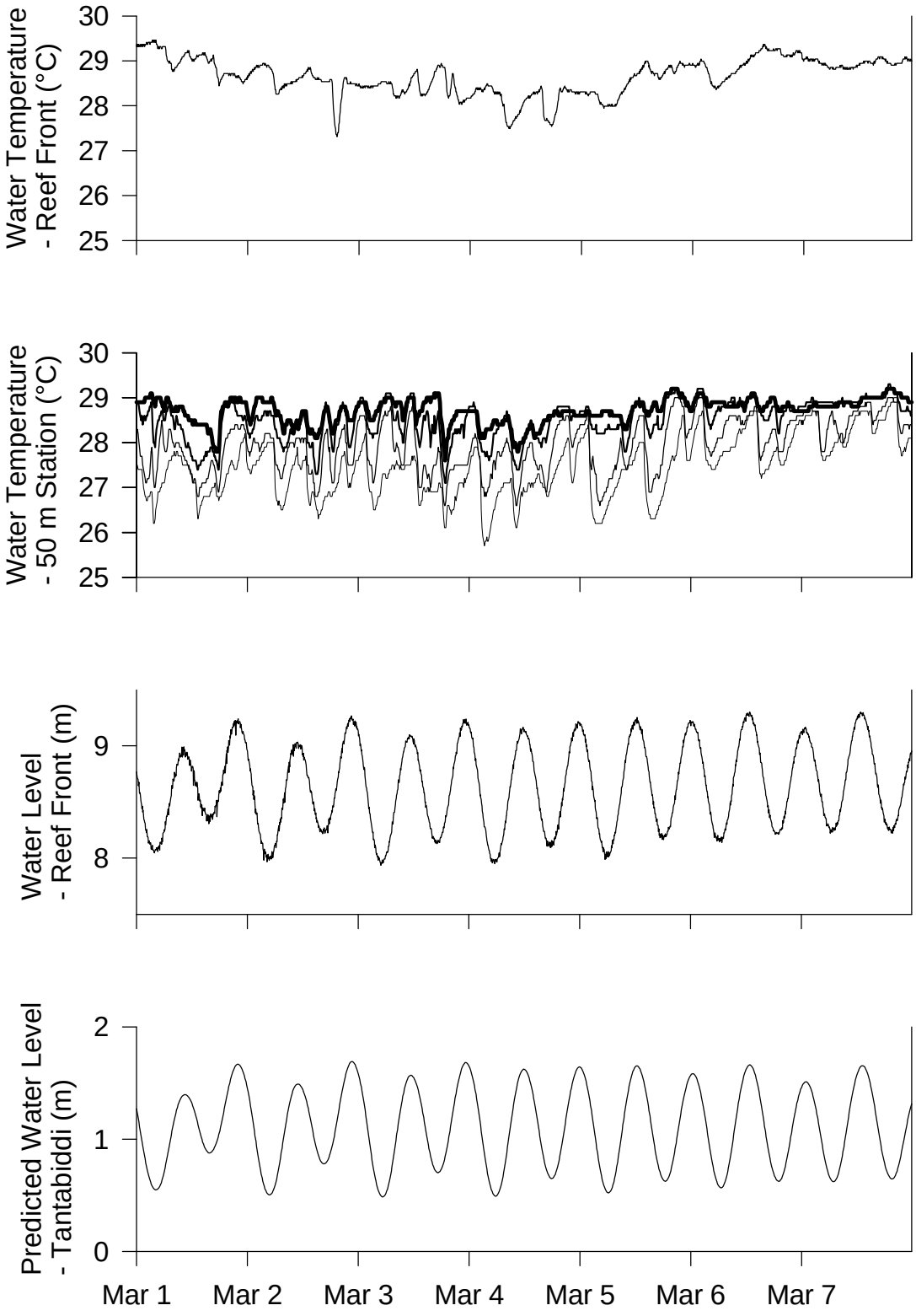
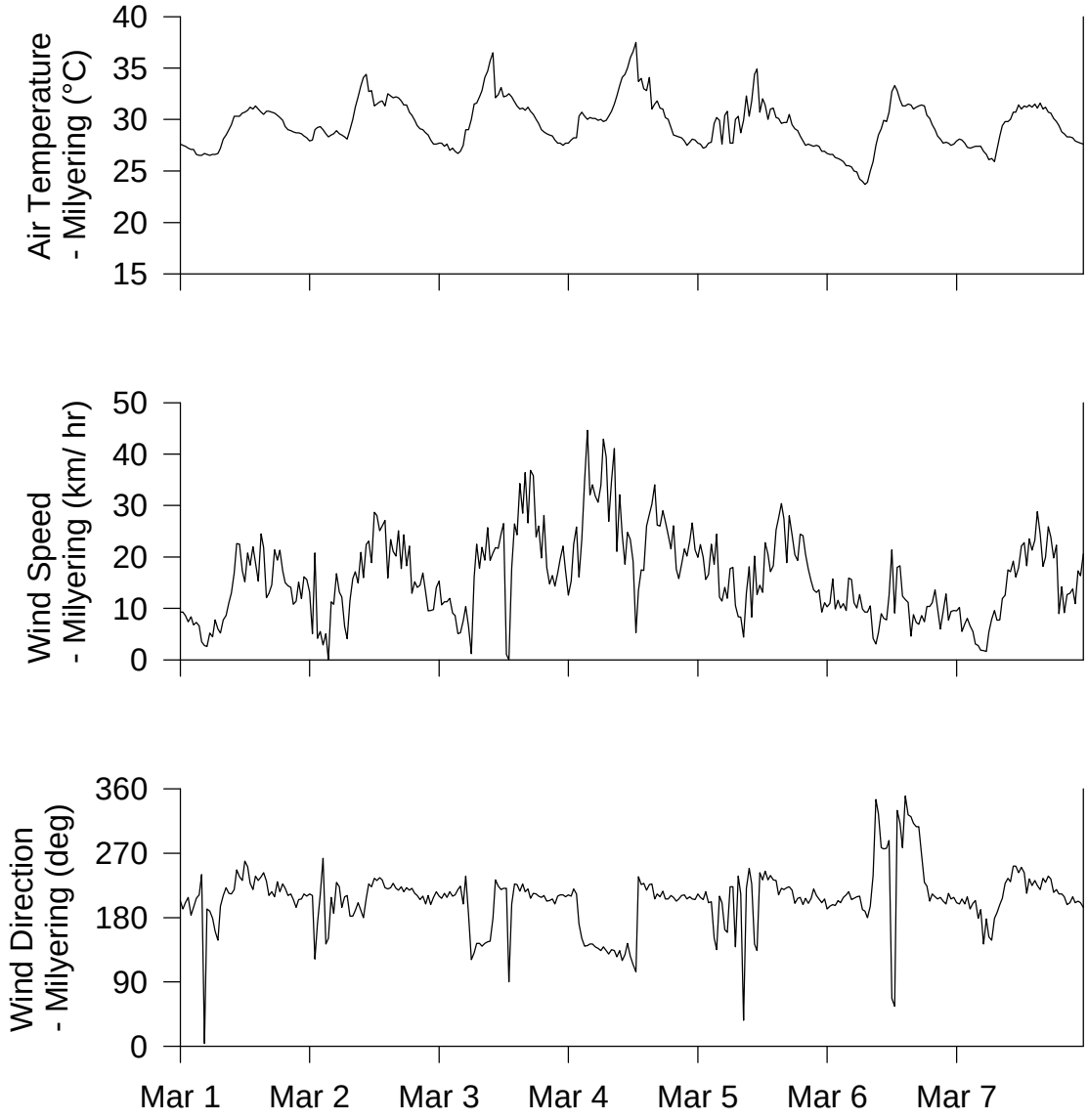
Jan 27
Jan 28

Deployment 2


Water Temperature
- Reef Front (°C)
30
29
28
27
26
25
Water Temperature
- 50 m Station (°C)
30
29
28
27
26
25
Water Level
- Reef Front (m)
9
8
Predicted Water Level
- Tantabiddi (m)
2
1
0
Mar 1
Mar 2
Mar 3
Mar 4
Mar 5
Mar 6
Mar 7


Air Temperature
- Milyering (°C)
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Wind Speed
- Milyering (km/ hr)
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Wind Direction
- Milyering (deg)
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Mar 2
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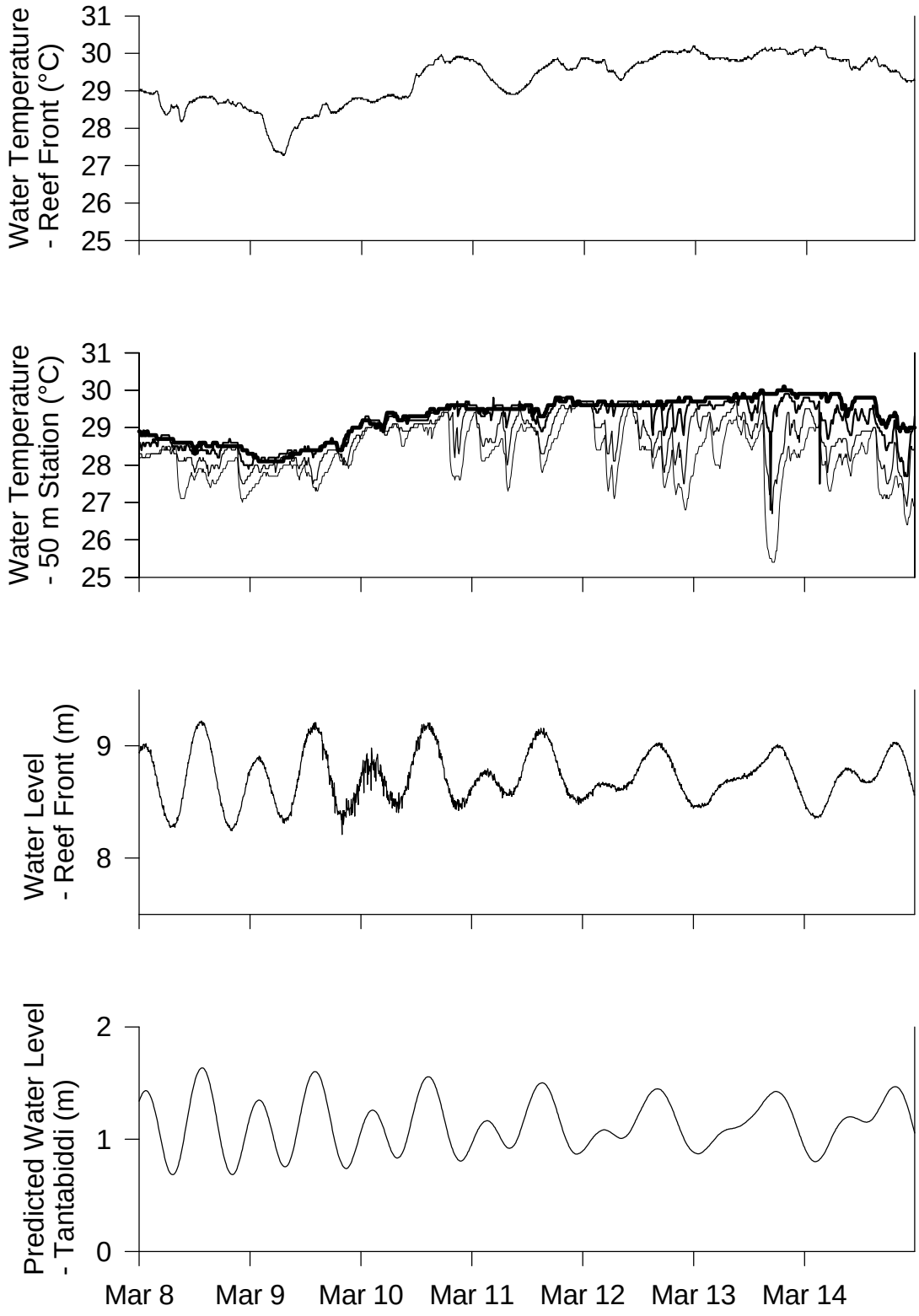
Mar 7


Water Temperature
- Reef Front (°C)
31
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Water Temperature
- 50 m Station (°C)
31
30
29
28
27
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25
Water Level
- Reef Front (m)
9
8
Predicted Water Level
- Tantabiddi (m)
2
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Mar 8
Mar 9
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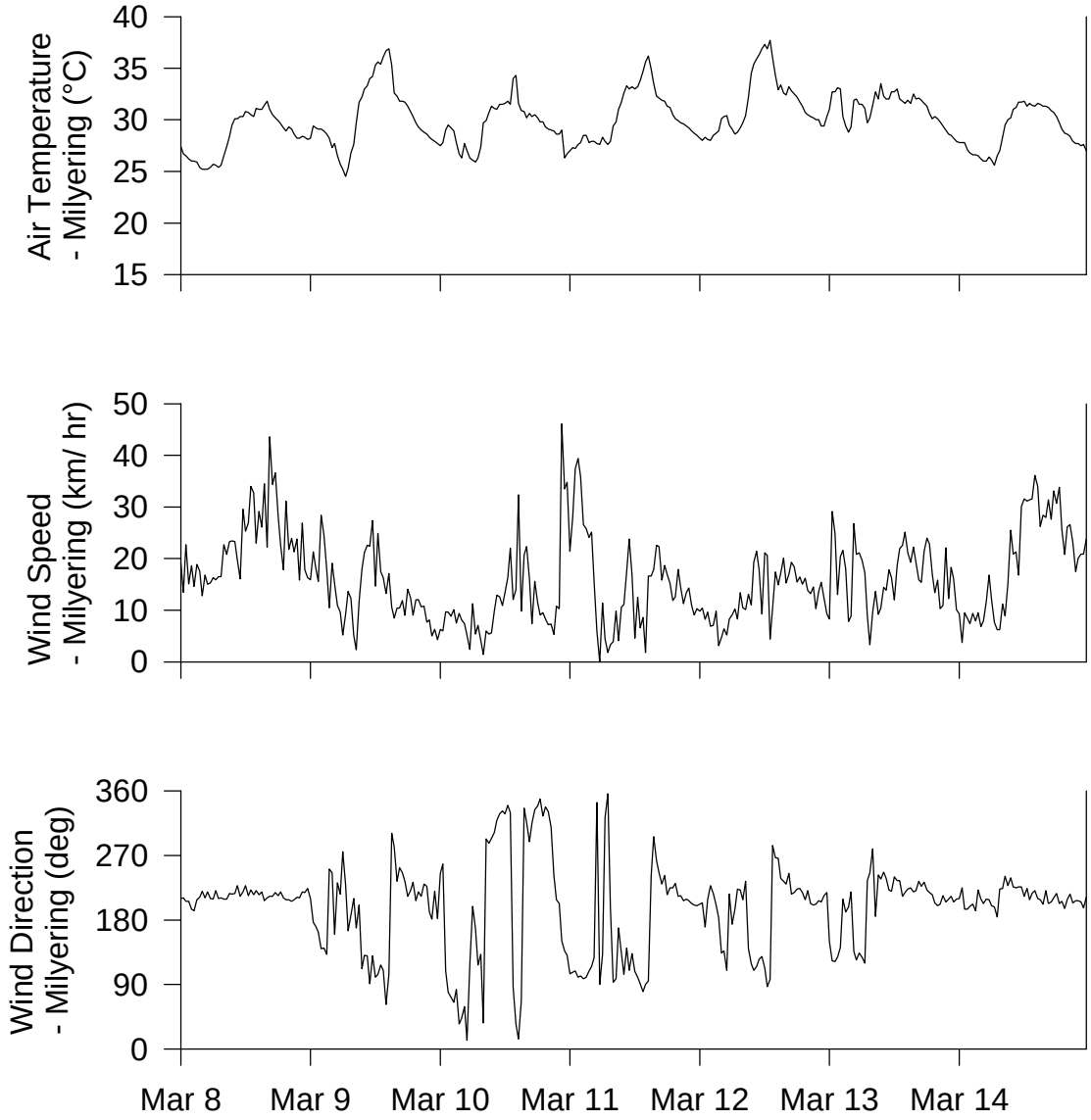
Mar 13
Mar 14


Air Temperature
- Milyering (°C)
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Wind Speed
- Milyering (km/ hr)
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Wind Direction
- Milyering (deg)
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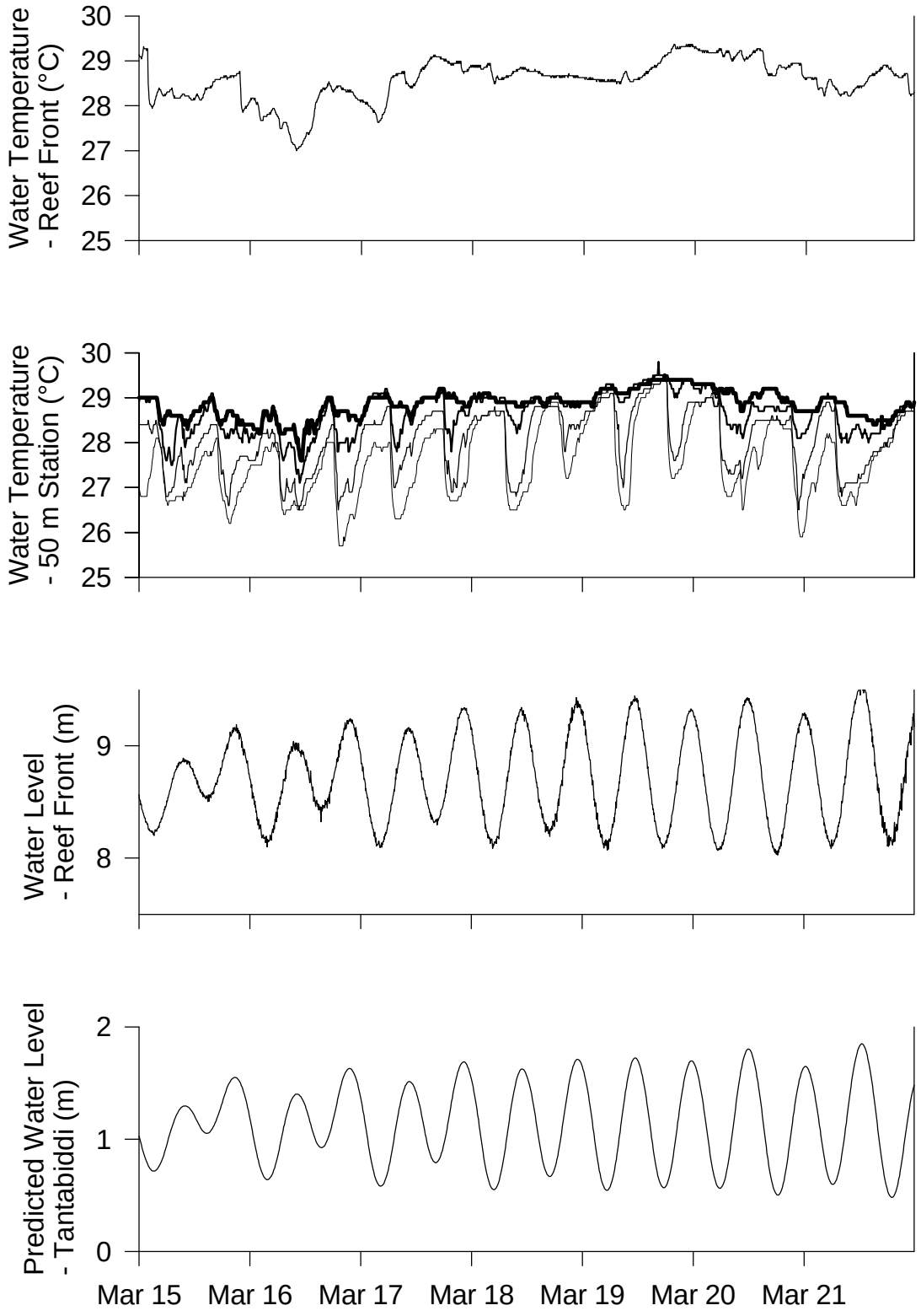
Water Temperature
- Reef Front (°C)
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Water Temperature
- 50 m Station (°C)
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25
Water Level
- Reef Front (m)
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Predicted Water Level
- Tantabiddi (m)
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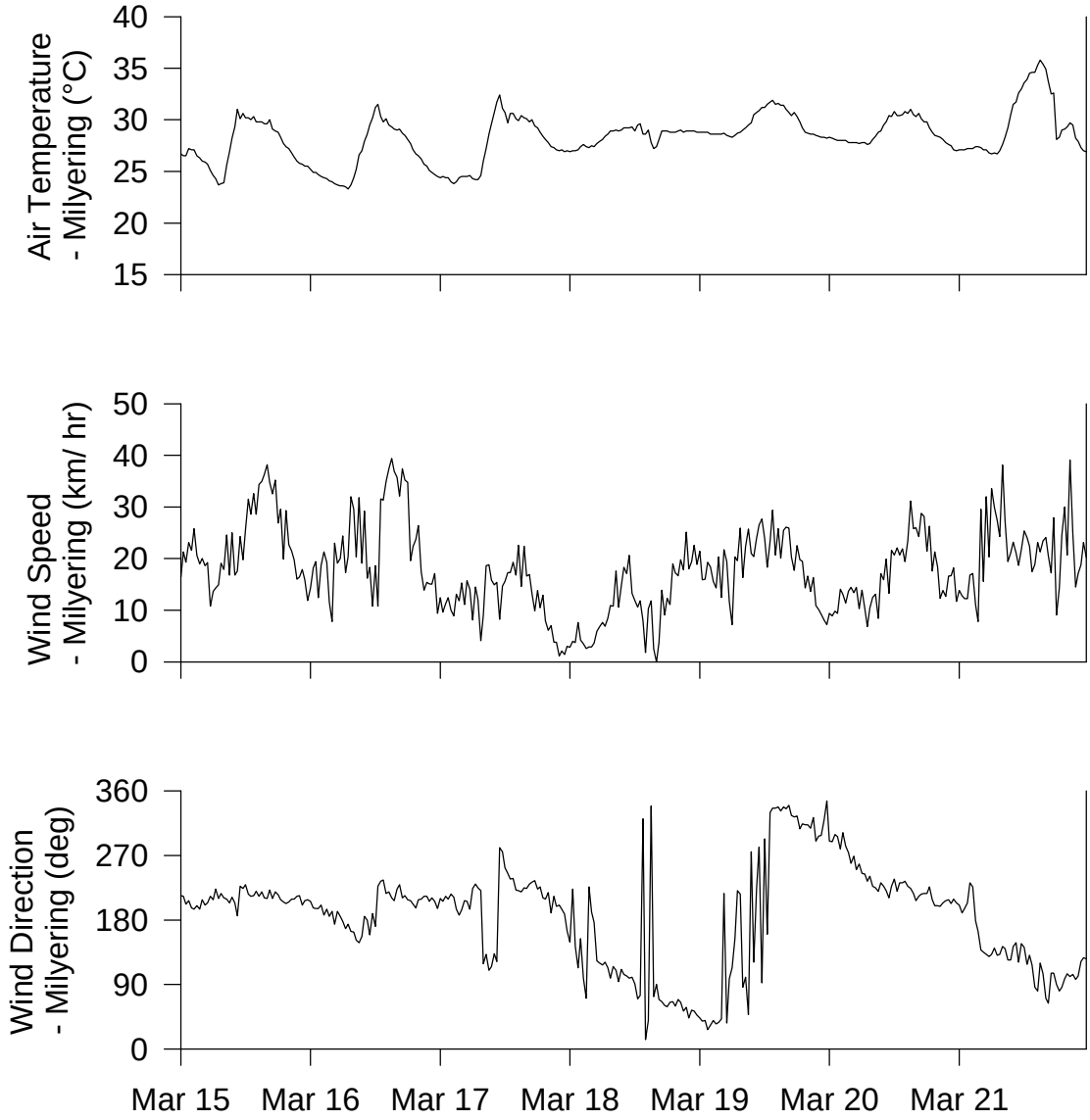
Mar 21


Air Temperature
- Milyering (°C)
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Wind Speed
- Milyering (km/ hr)
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Wind Direction
- Milyering (deg)
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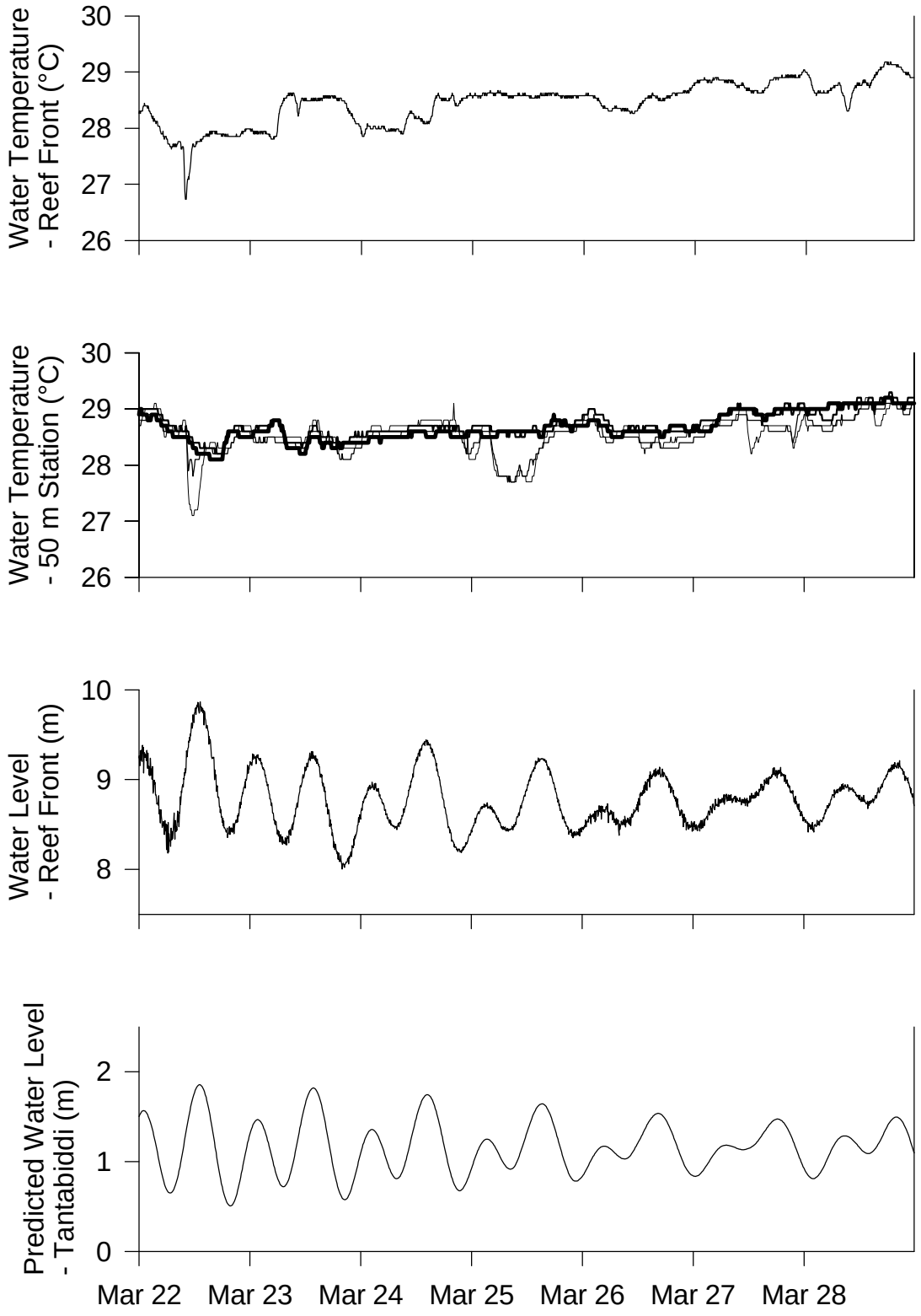
Water Temperature
- Reef Front (°C)
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Water Temperature
- 50 m Station (°C)
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26
Water Level
- Reef Front (m)
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Predicted Water Level
- Tantabiddi (m)
2
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Mar 22
Mar 23
Mar 24
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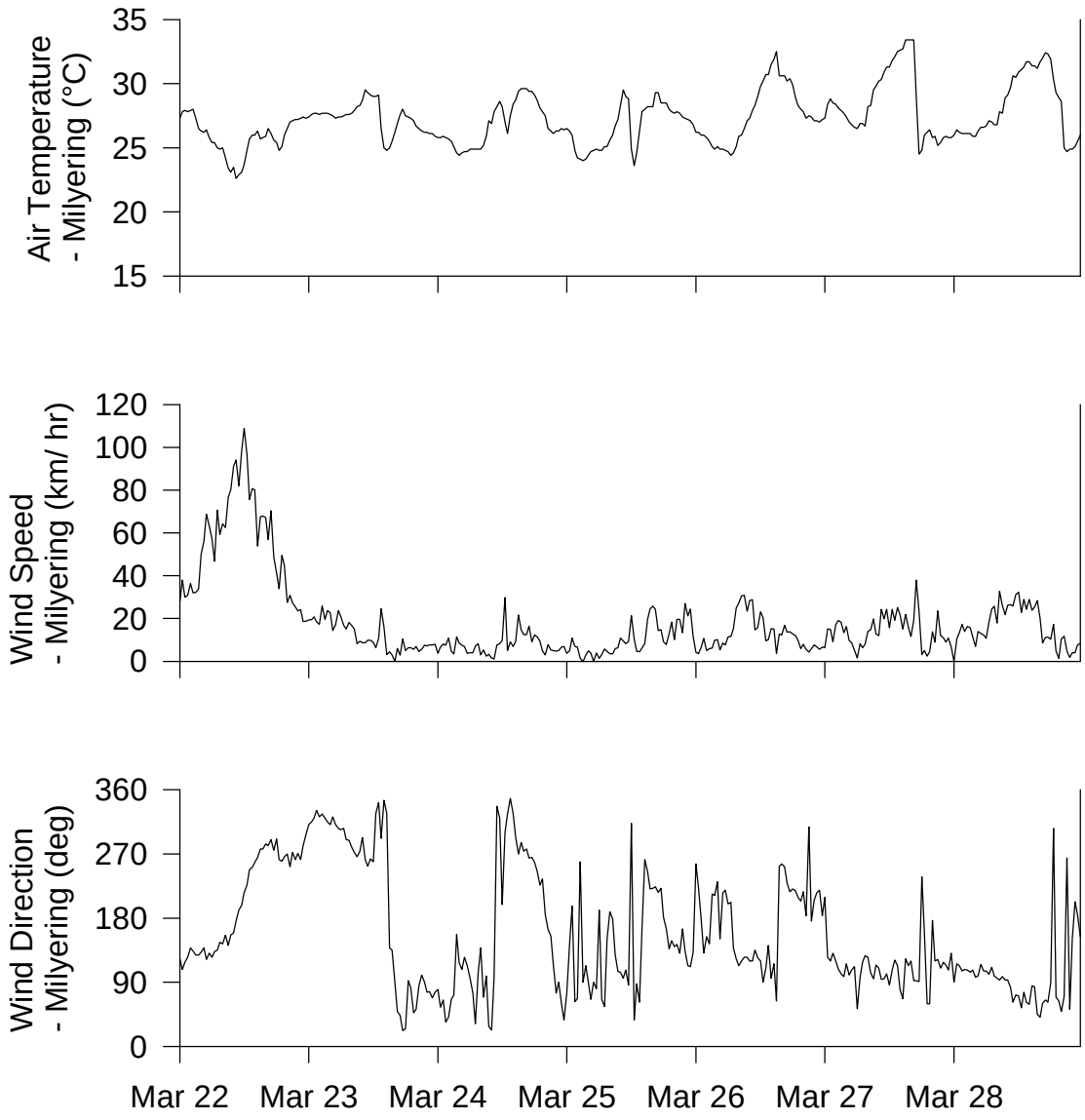
Mar 27
Mar 28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Wind Speed
- Milyering (km/ hr)
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100
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Wind Direction
- Milyering (deg)
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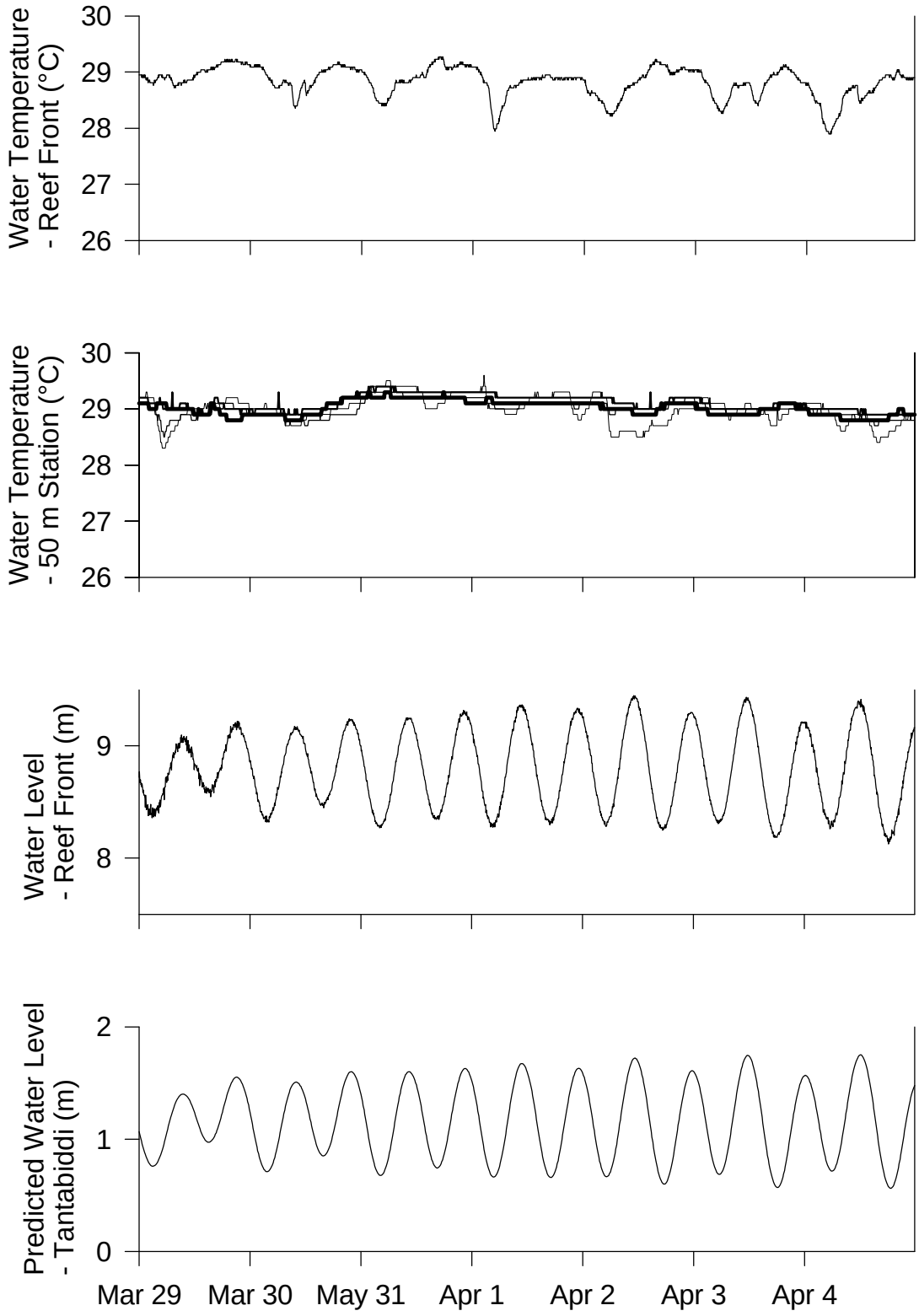
Mar 28


Water Temperature
- Reef Front (°C)
30
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Water Temperature
- 50 m Station (°C)
30
29
28
27
26
Water Level
- Reef Front (m)
9
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Predicted Water Level
- Tantabiddi (m)
2
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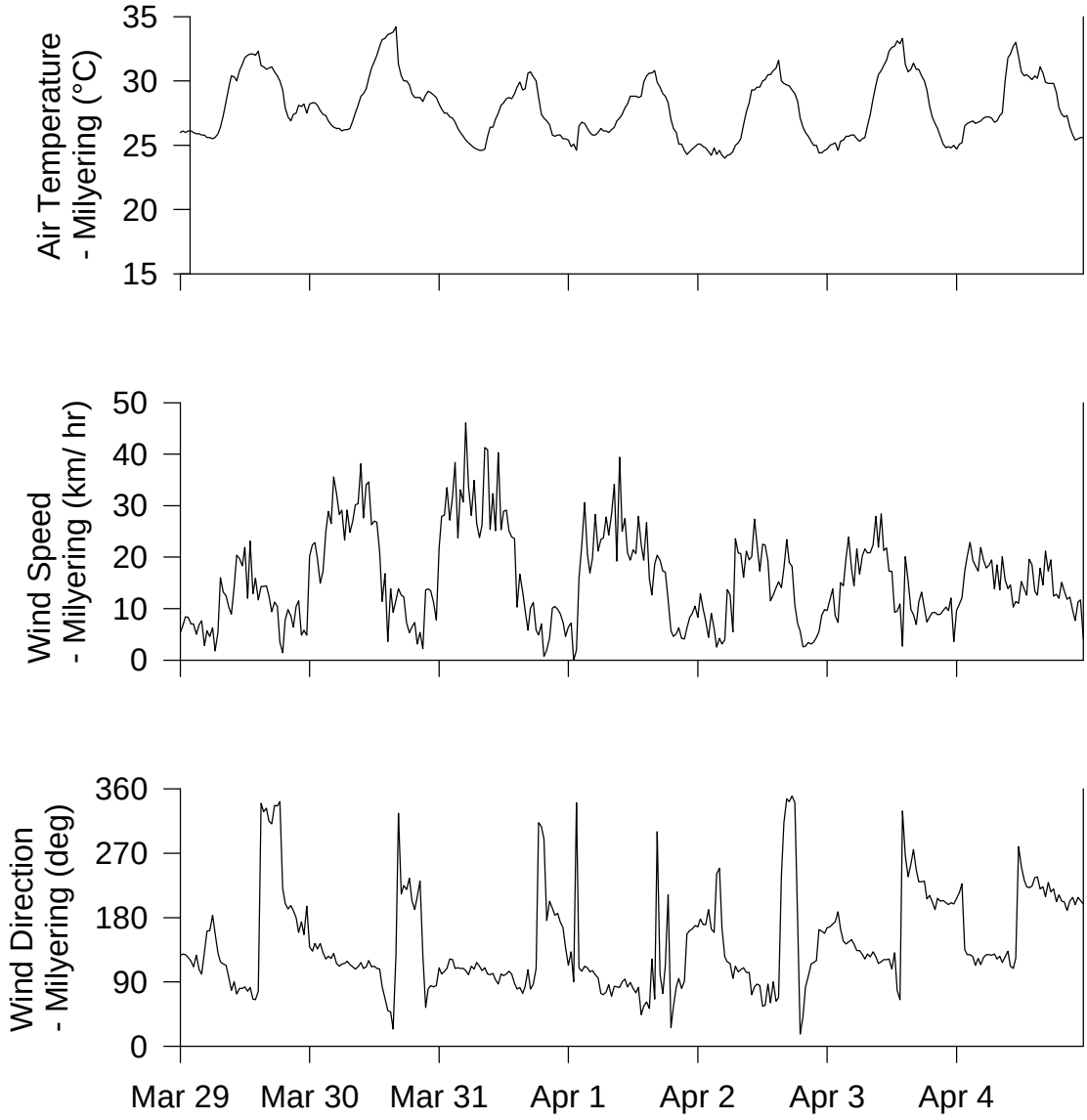
Mar 29
Mar 30
May 31
Apr 1
Apr 2
Apr 3
Apr 4


Air Temperature
- Milyering (°C)
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Wind Speed
- Milyering (km/ hr)
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Wind Direction
- Milyering (deg)
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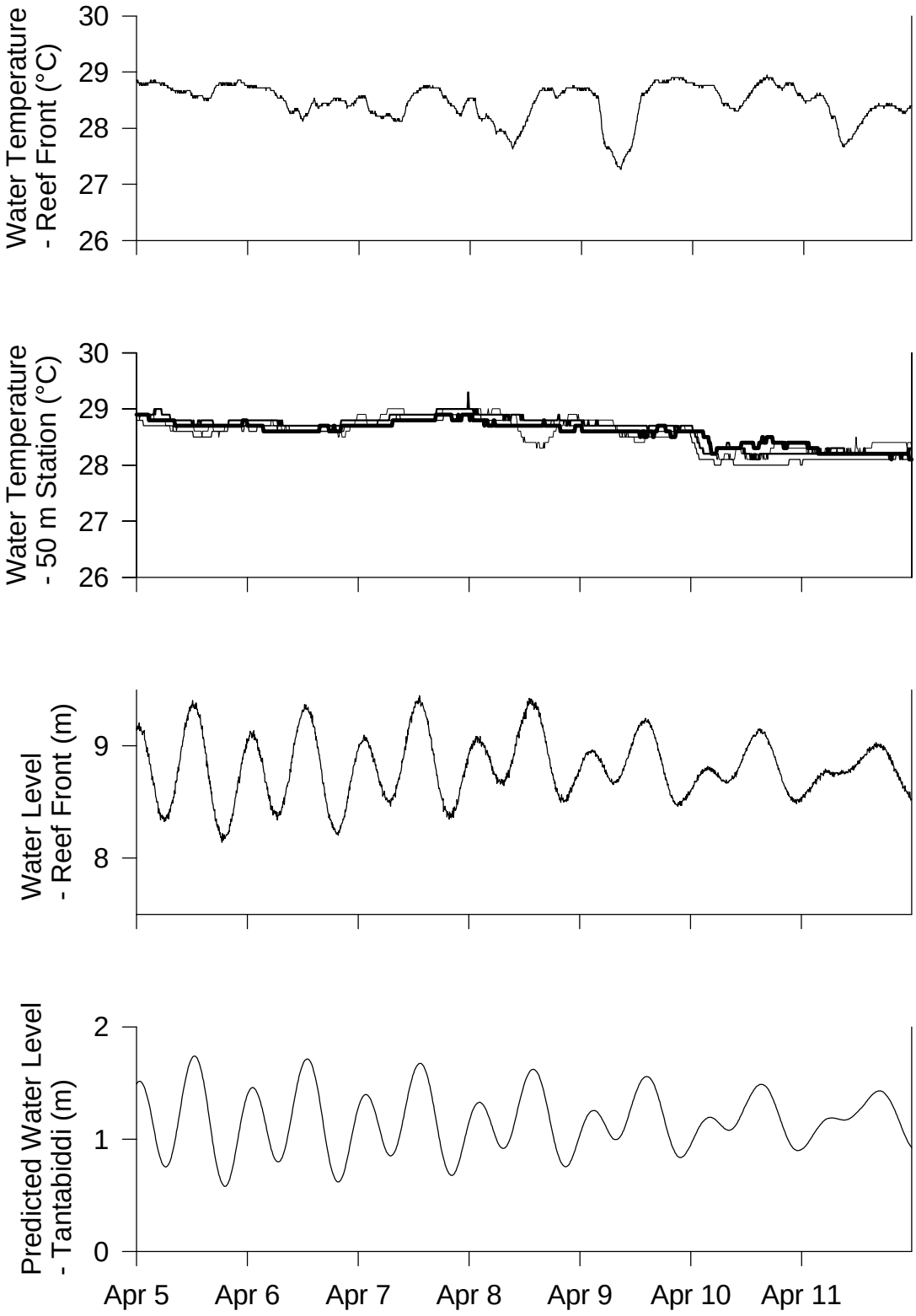
Mar 30
Mar 31
Apr 1
Apr 2
Apr 3
Apr 4


Water Temperature
- Reef Front (°C)
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Water Temperature
- 50 m Station (°C)
30
29
28
27
26
Water Level
- Reef Front (m)
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8
Predicted Water Level
- Tantabiddi (m)
2
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Apr 6
Apr 7
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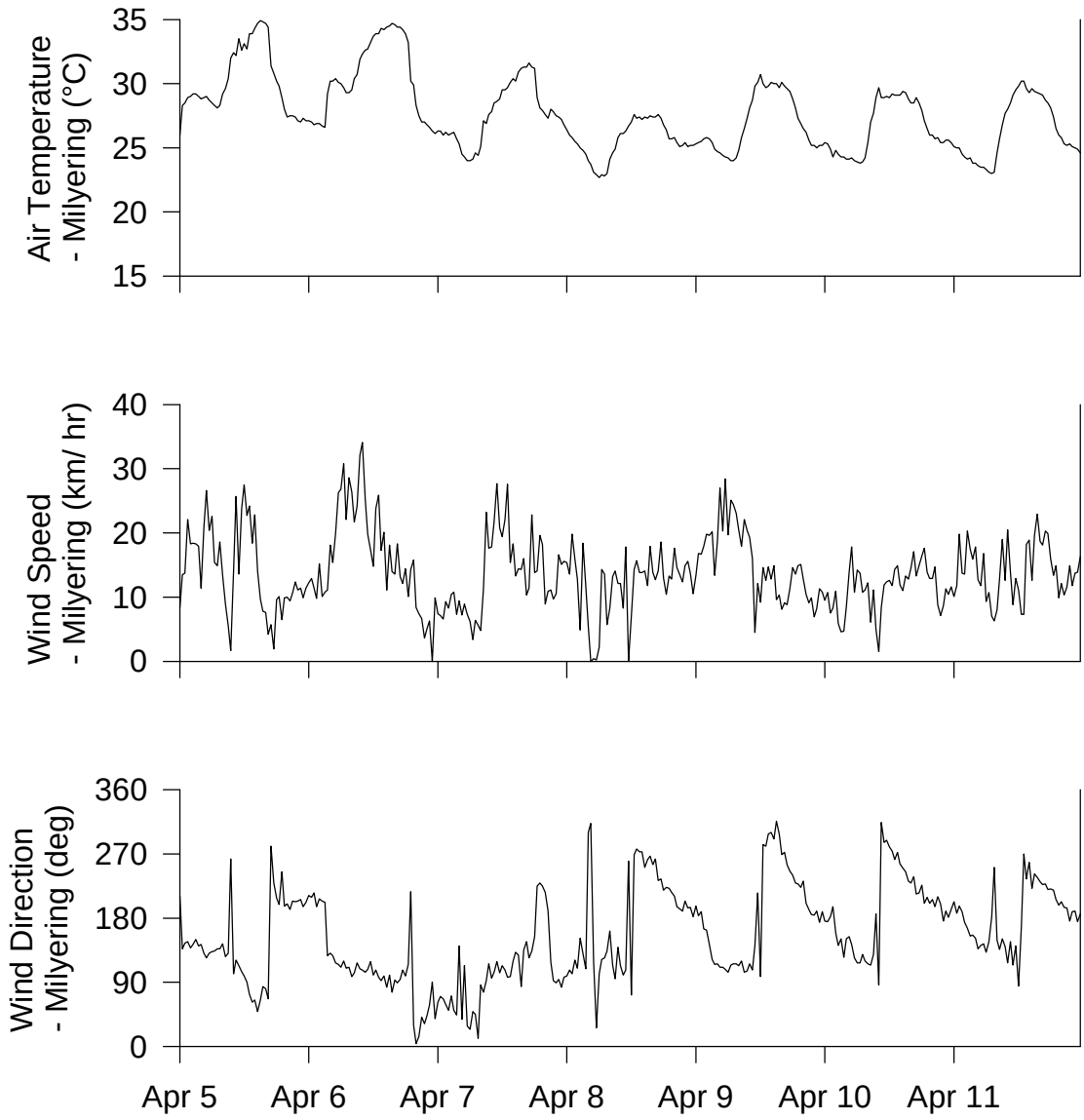
Apr 9
Apr 10
Apr 11


Air Temperature
- Milyering (°C)
35
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Wind Speed
- Milyering (km/ hr)
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Wind Direction
- Milyering (deg)
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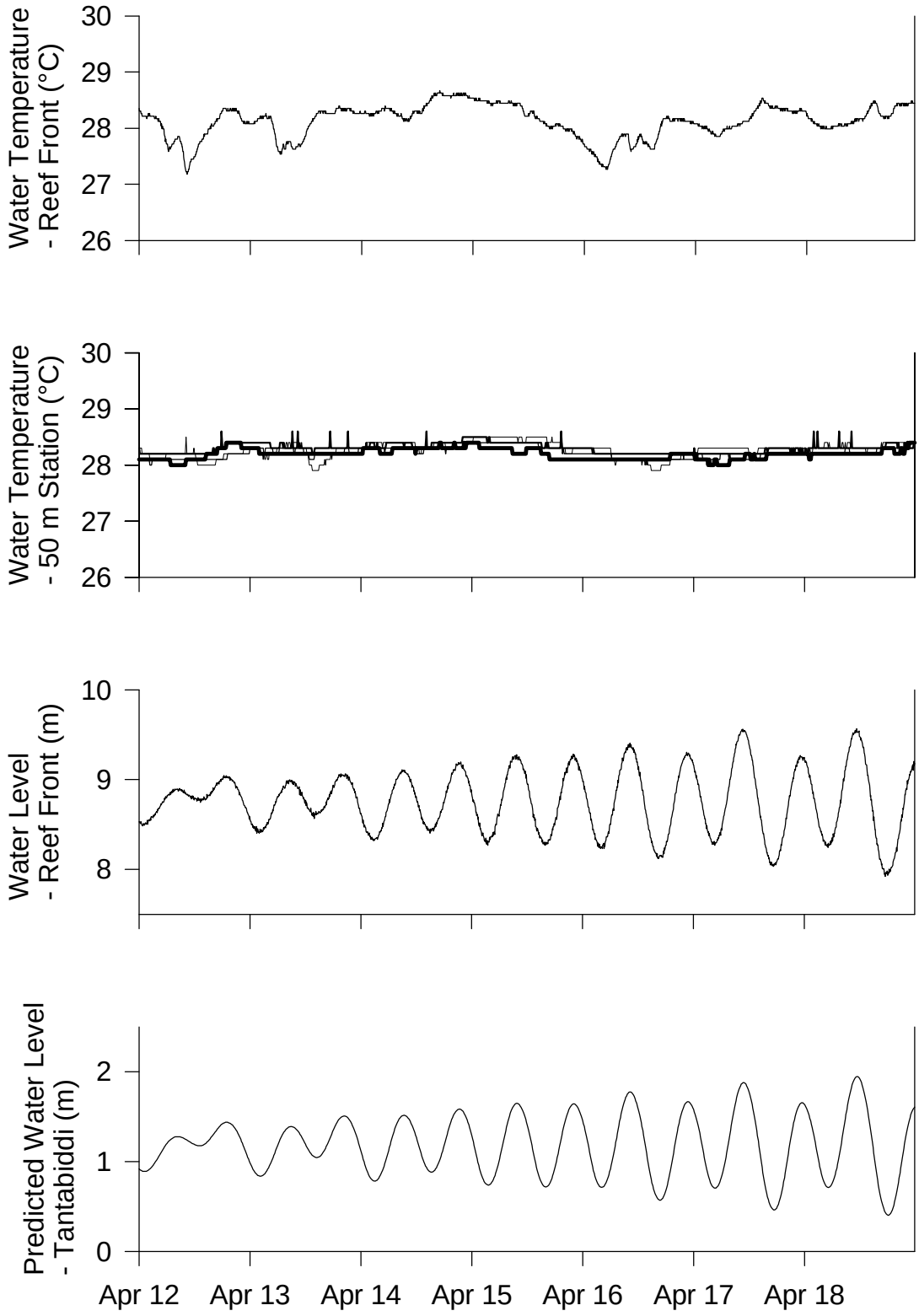
Water Temperature
- Reef Front (°C)
30
29
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Water Temperature
- 50 m Station (°C)
30
29
28
27
26
Water Level
- Reef Front (m)
10
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Predicted Water Level
- Tantabiddi (m)
2
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Apr 12
Apr 13
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Apr 15
Apr 16
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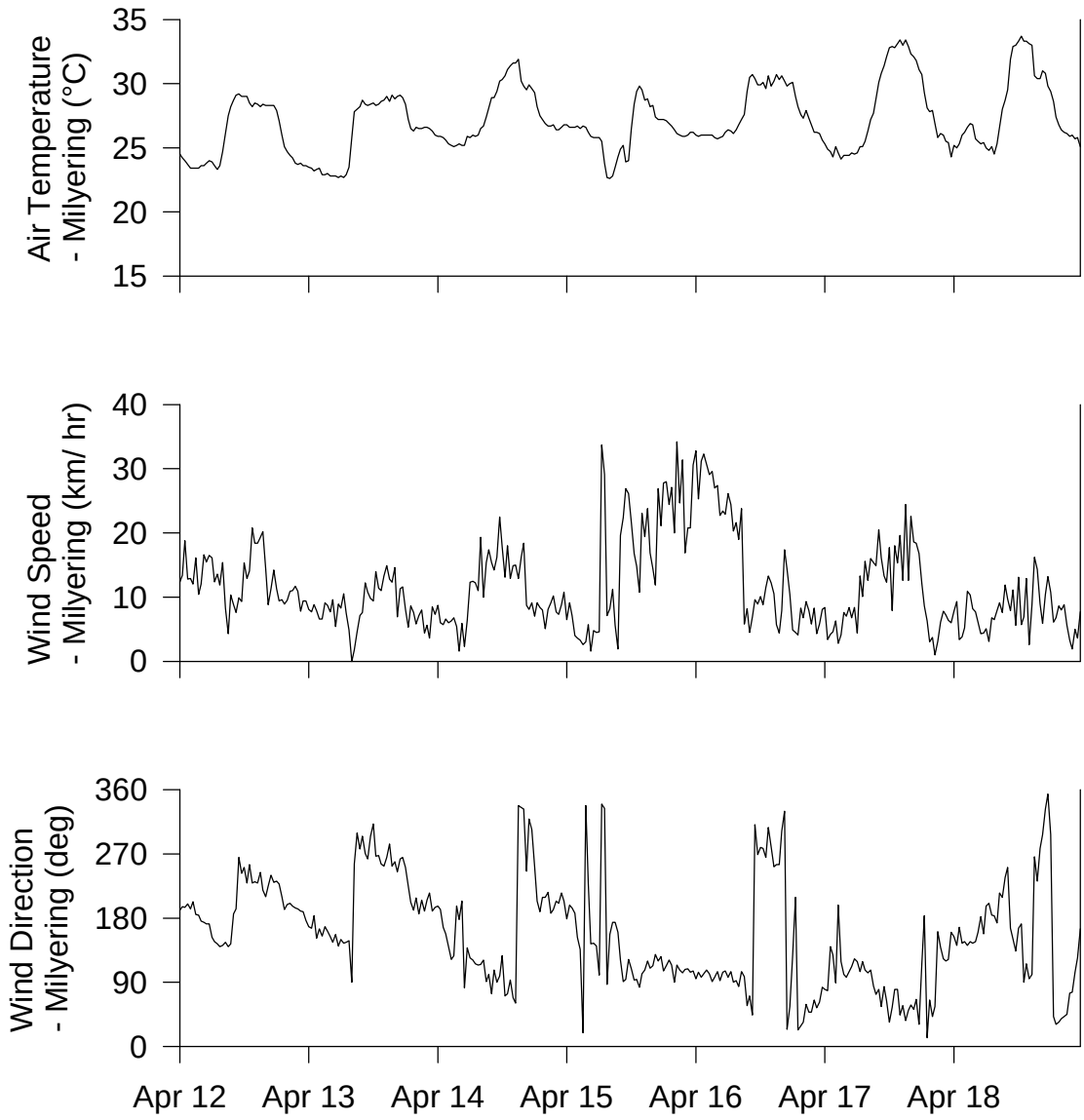
Apr 18


Air Temperature
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Wind Speed
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Wind Direction
- Milyering (deg)
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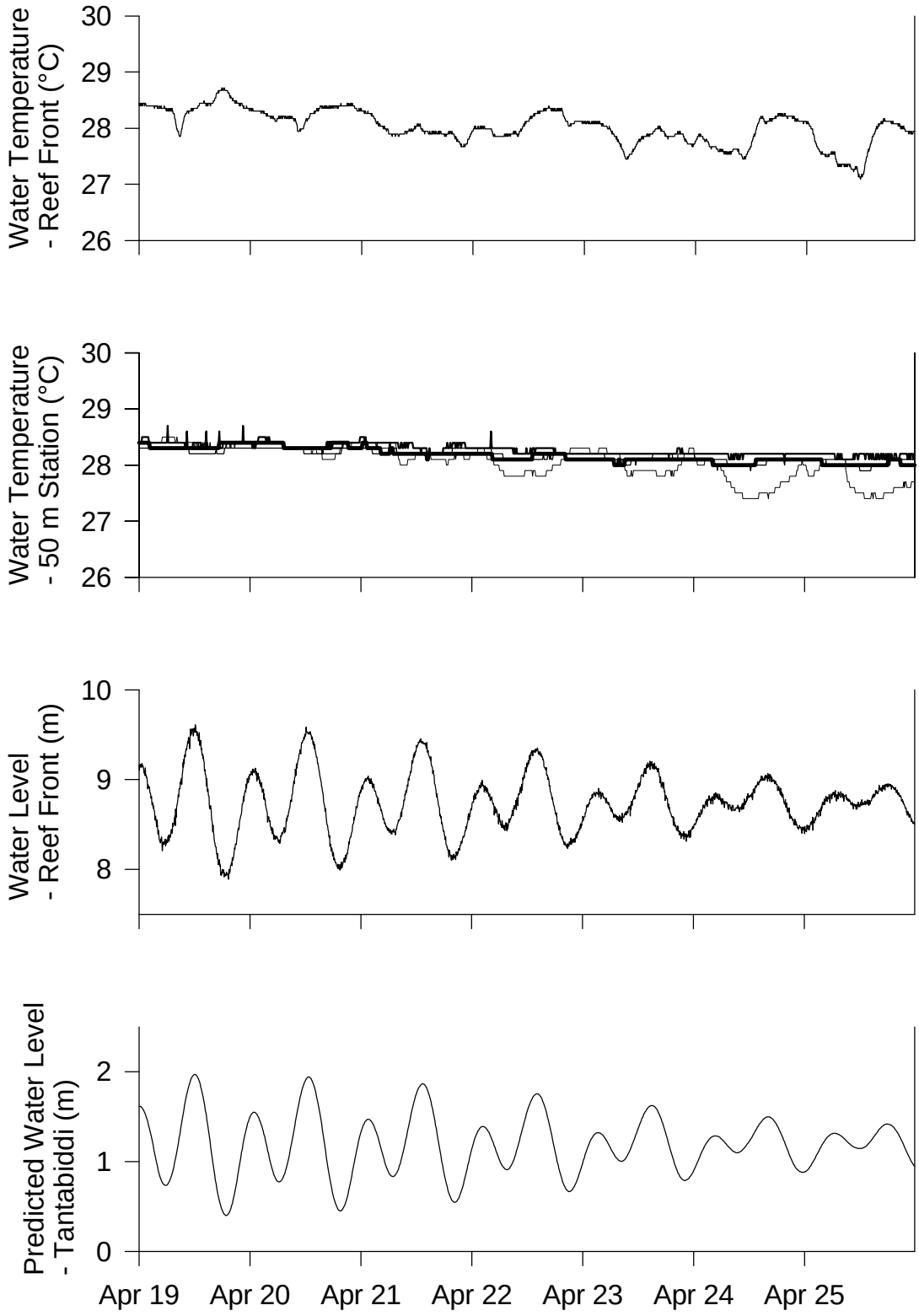
Water Temperature
- Reef Front (°C)
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Water Temperature
- 50 m Station (°C)
30
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26
Water Level
- Reef Front (m)
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9
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Predicted Water Level
- Tantabiddi (m)
2
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Apr 19
Apr 20
Apr 21
Apr 22
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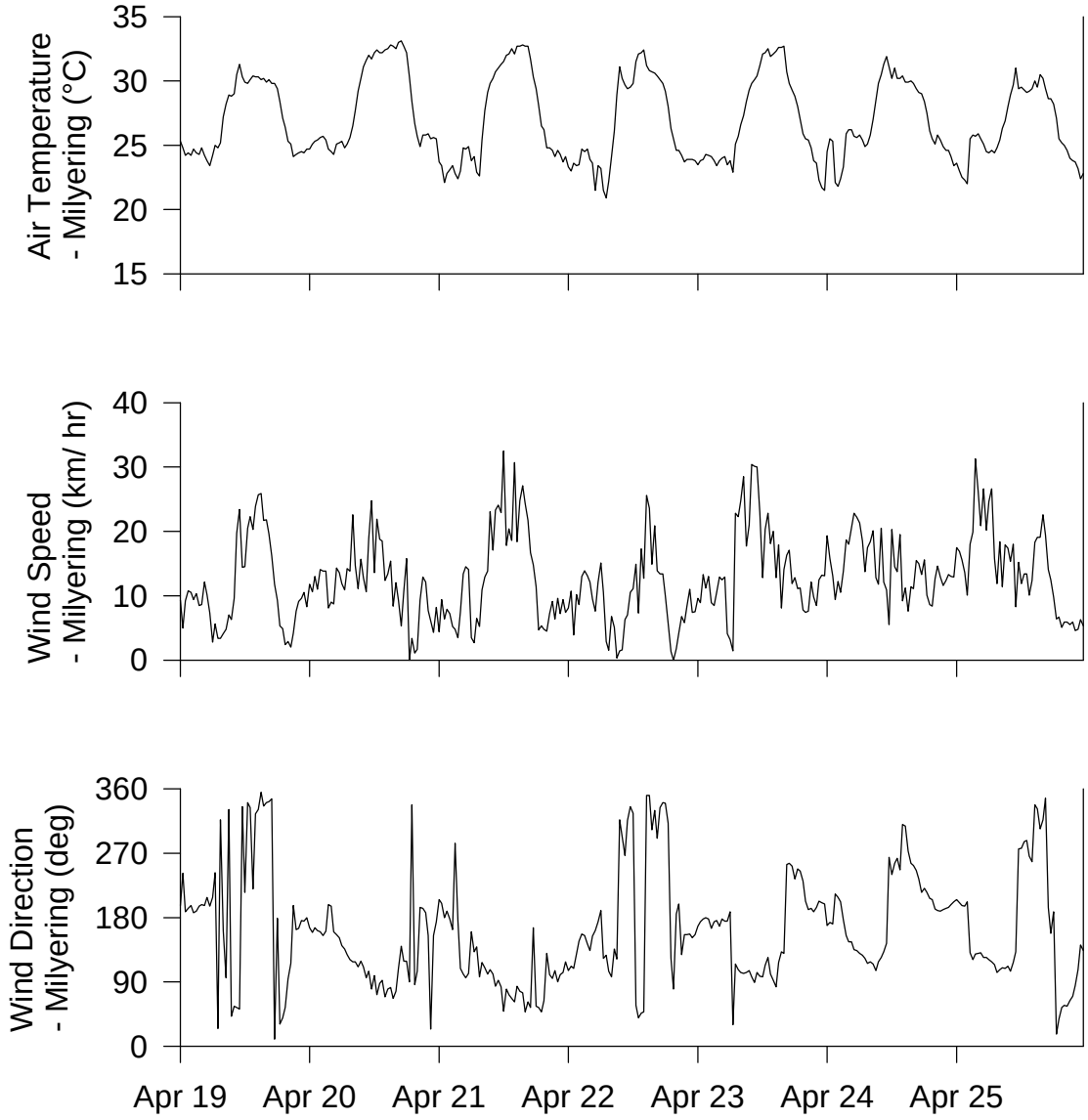
Apr 24
Apr 25


Air Temperature
- Milyering (°C)
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Wind Speed
- Milyering (km/ hr)
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Wind Direction
- Milyering (deg)
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Apr 20
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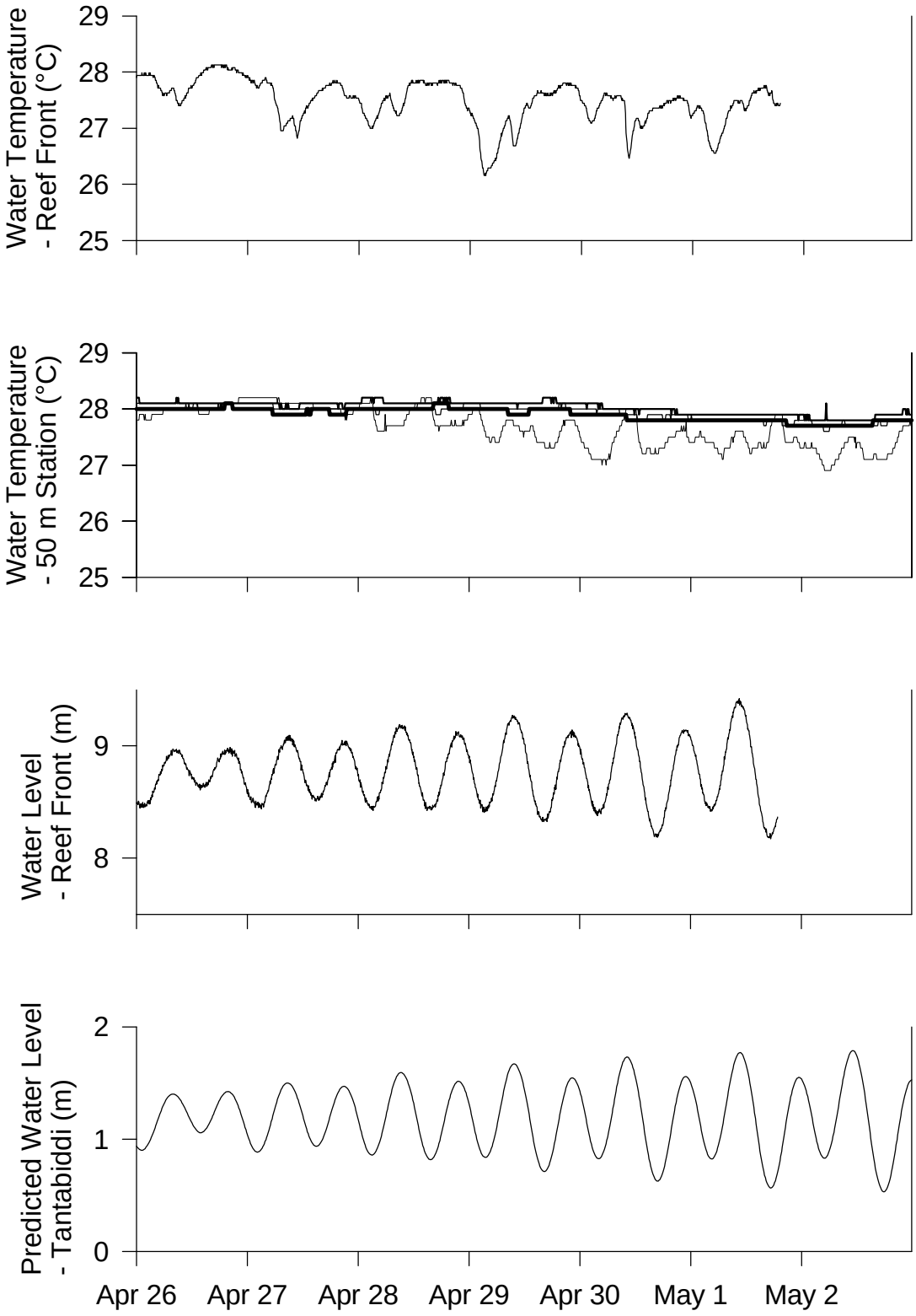
Apr 25


Water Temperature
- Reef Front (°C)
29
28
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26
25
Water Temperature
- 50 m Station (°C)
29
28
27
26
25
Water Level
- Reef Front (m)
9
8
Predicted Water Level
- Tantabiddi (m)
2
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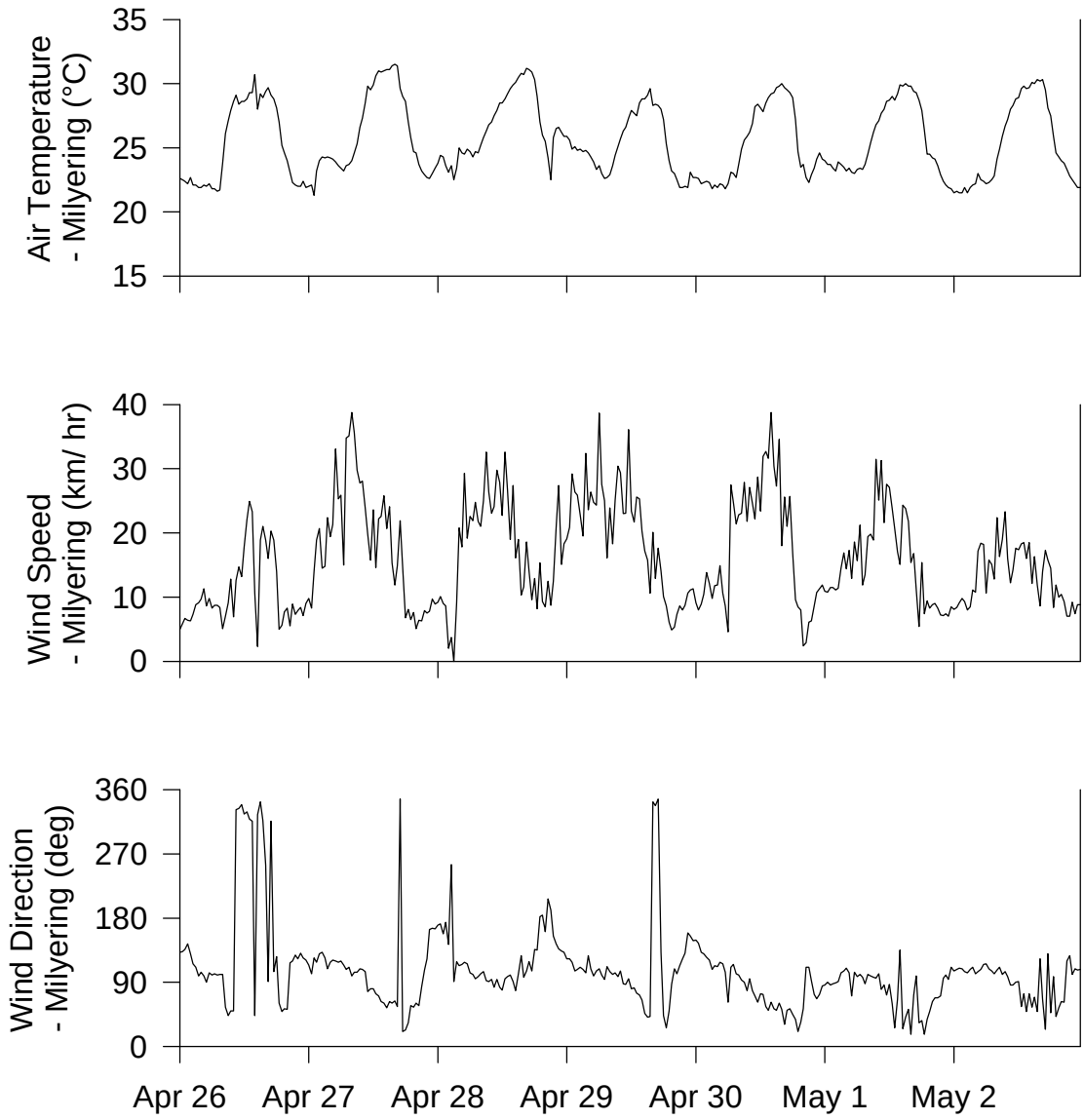
0
Apr 26
Apr 27
Apr 28
Apr 29
Apr 30
May 1
May 2


Air Temperature
- Milyering (°C)
35
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Wind Speed
- Milyering (km/ hr)
40
30
20
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Wind Direction
- Milyering (deg)
360
270
180
90
0
Apr 26
Apr 27
Apr 28
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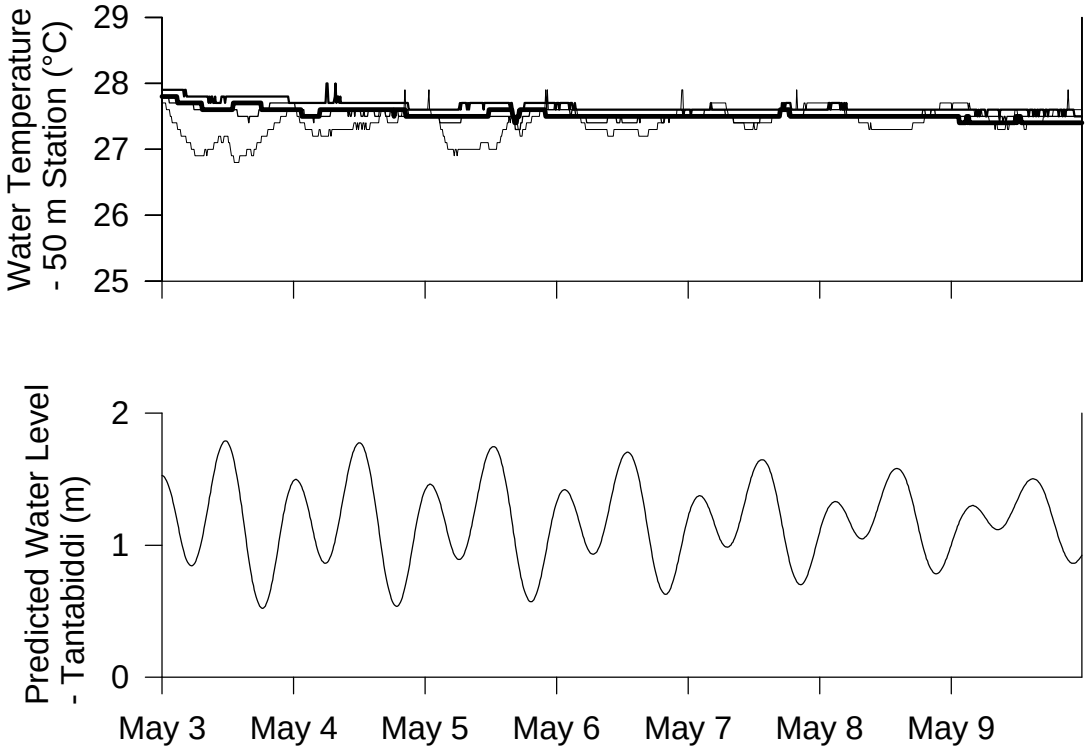
Apr 30
May 1
May 2


Water Temperature
- 50 m Station (°C)
29
28
27
26
25
Predicted Water Level
- Tantabiddi (m)
2
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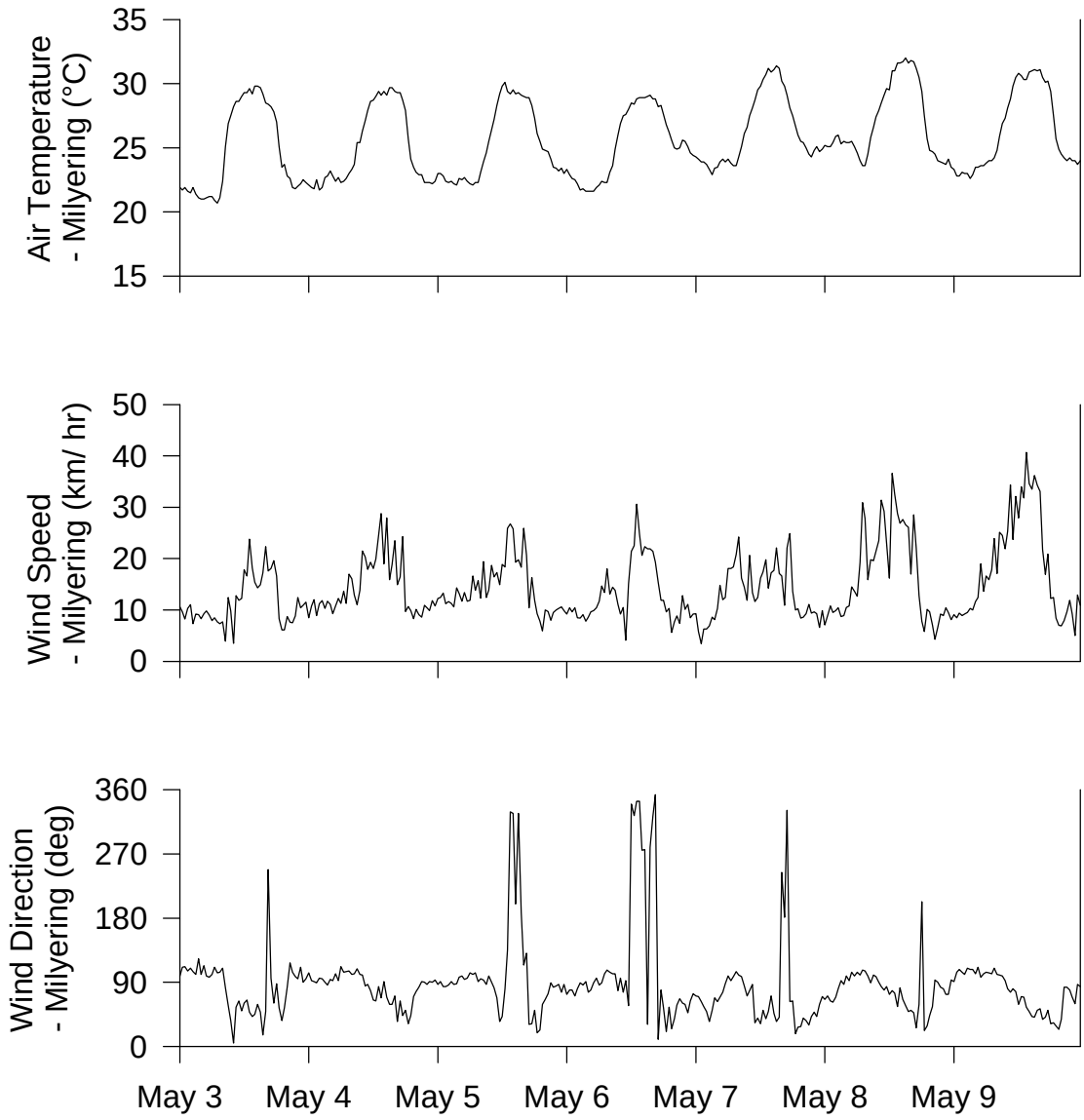
May 3
May 4
May 5
May 6
May 7
May 8
May 9


Air Temperature
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Wind Speed
- Milyering (km/ hr)
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Wind Direction
- Milyering (deg)
360
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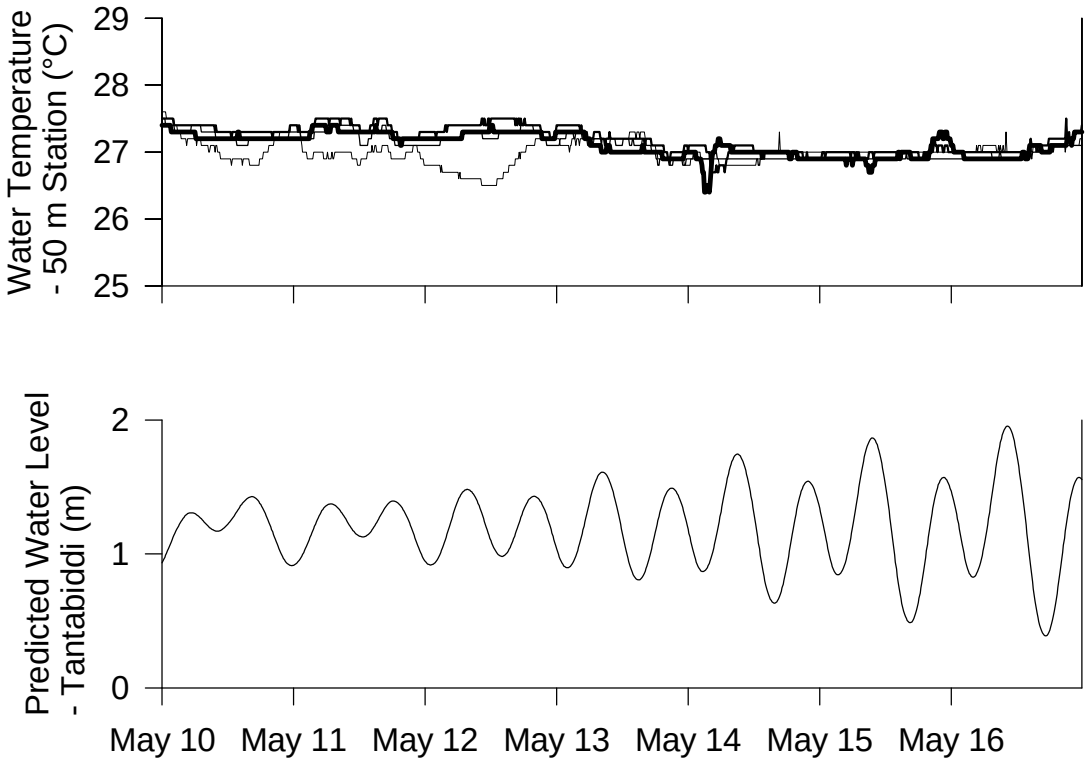
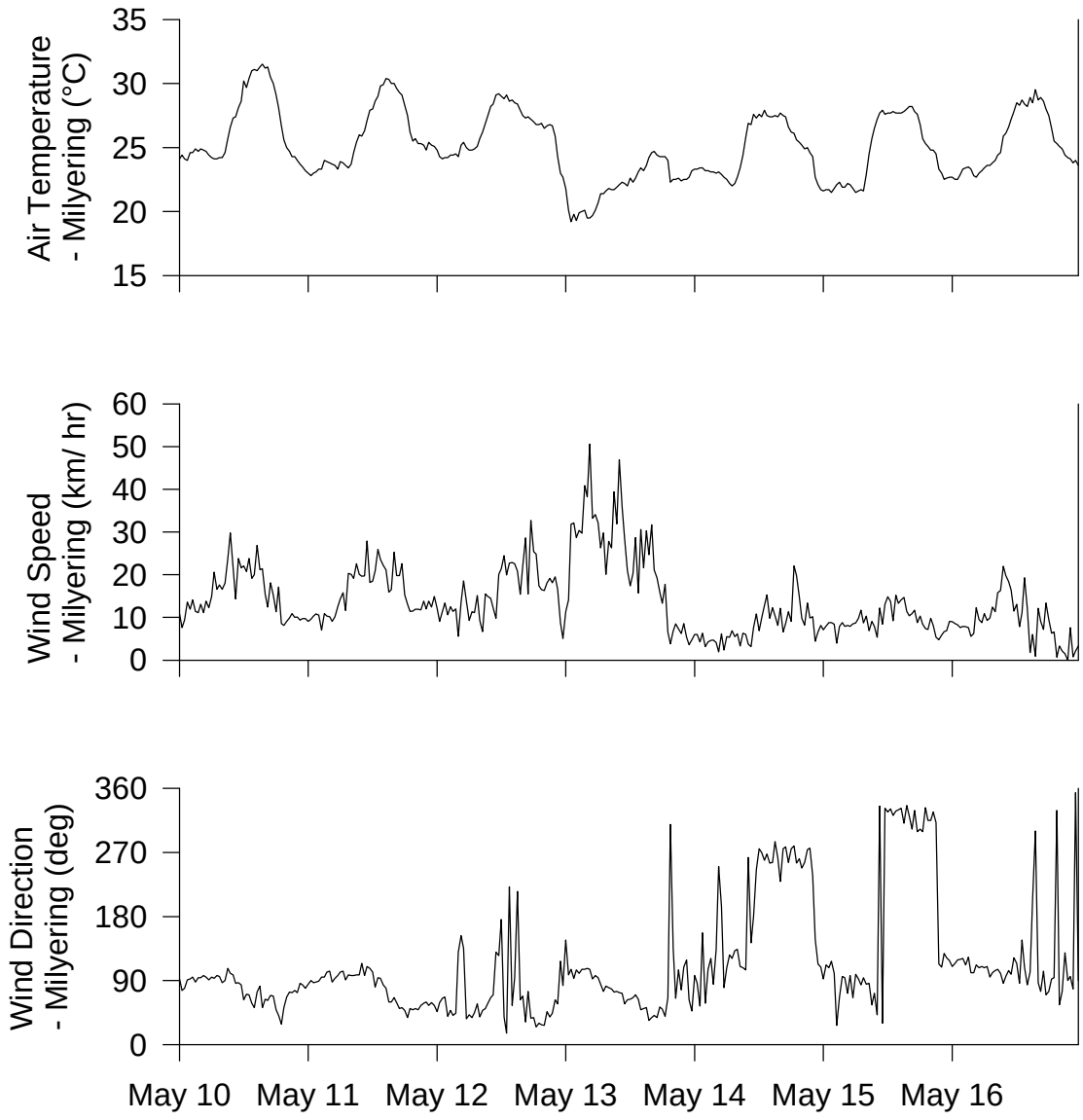
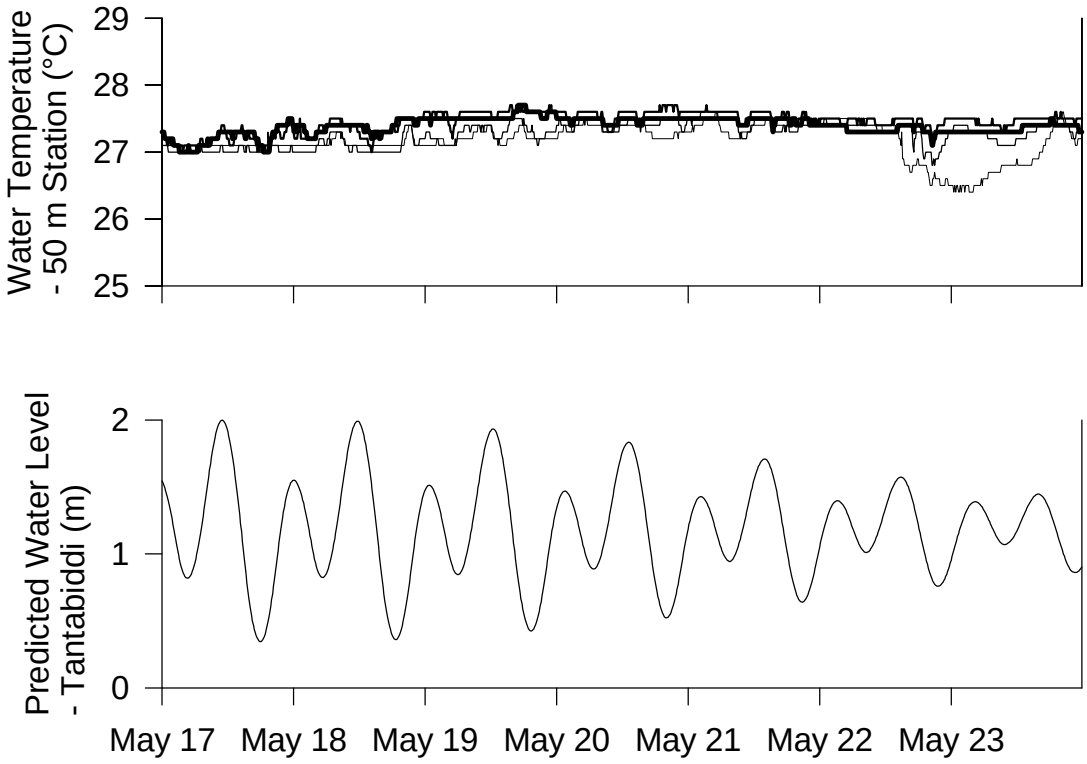
May 3
May 4
May 5
May 6
May 7
May 8
May 9

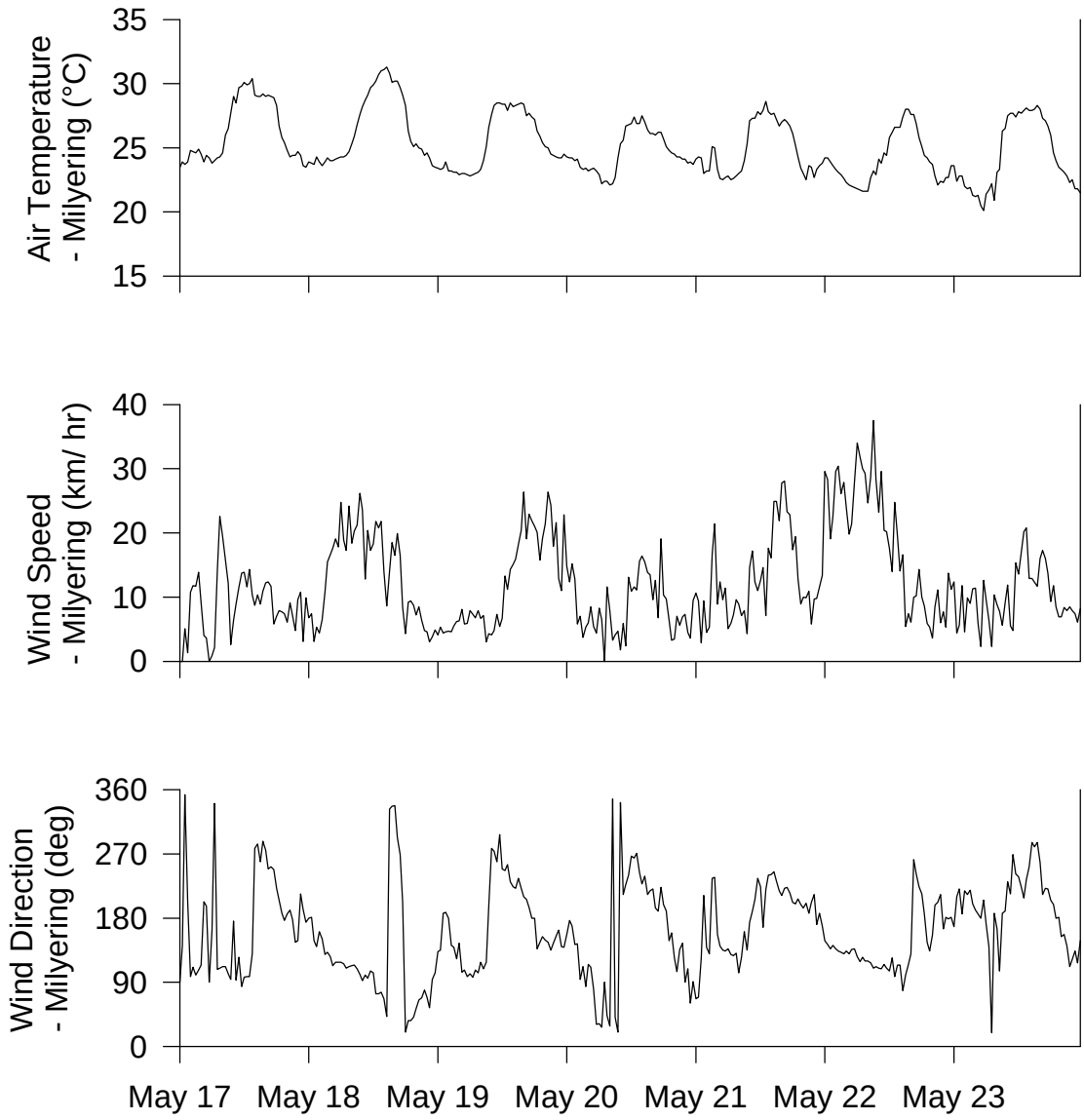

Water Temperature
- 50 m Station (°C)
29
28
27
26
25

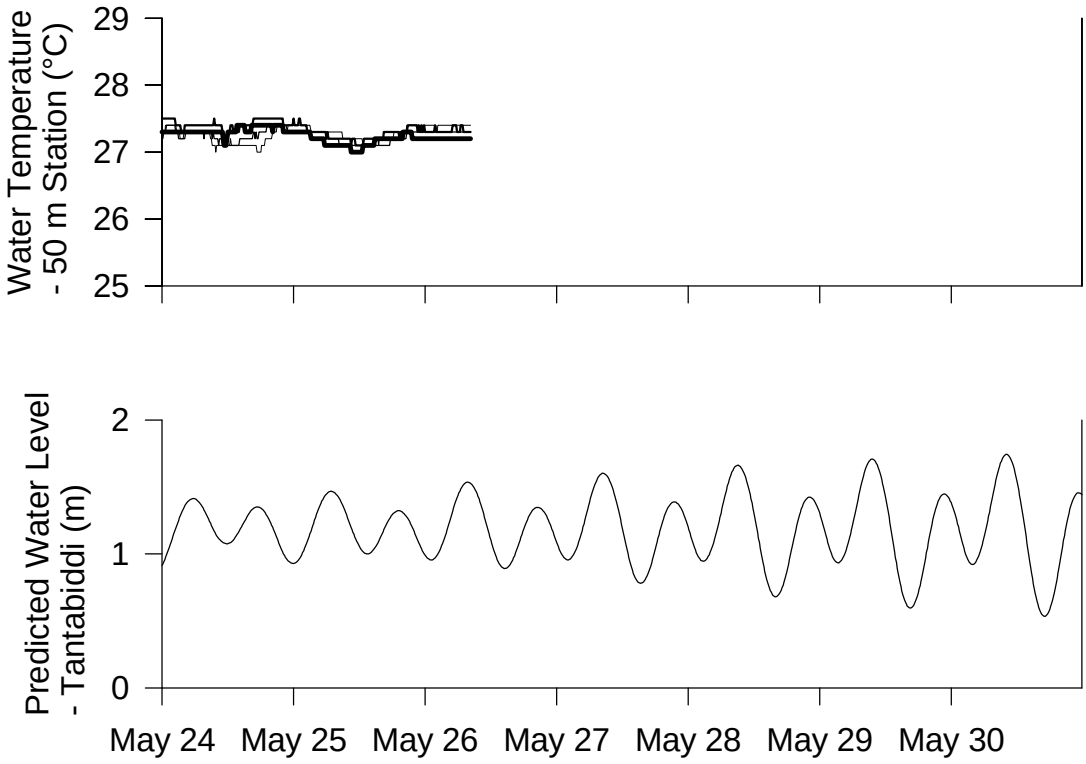
Predicted Water Level
- Tantabiddi (m)
2
1
0
May 10
May 11
May 12
May 13
May 14
May 15
May 16


Air Temperature
- Milyering (°C)
35
30
25
20
15
Wind Speed
- Milyering (km/ hr)
60
50
40
30
20
10
0
Wind Direction
- Milyering (deg)
360
270
180
90
0
May 10
May 11
May 12
May 13
May 14
May 15
May 16

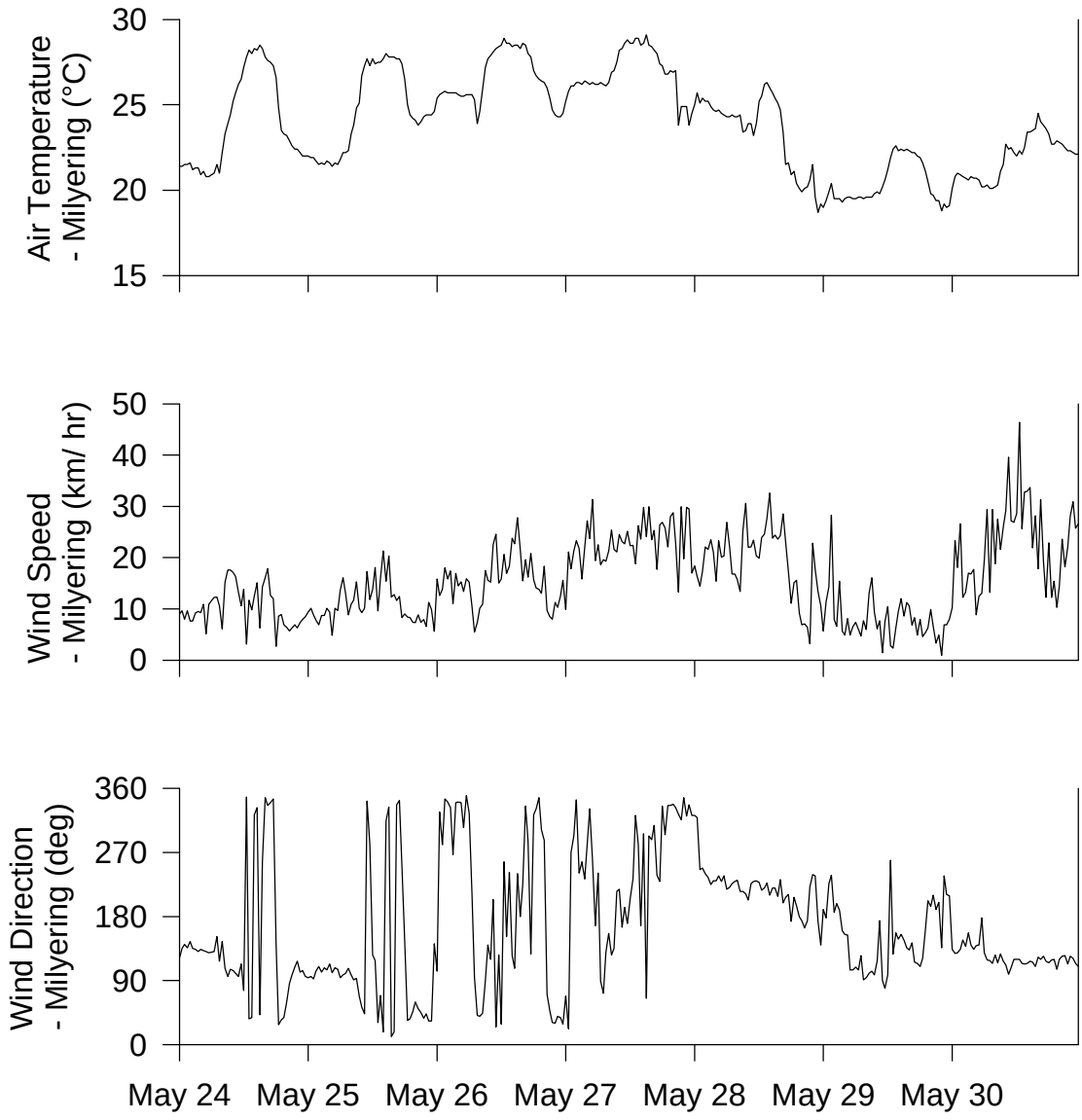

Water Temperature
- 50 m Station (°C)
29
28
27
26
25

Predicted Water Level
- Tantabiddi (m)
2
1
0
May 17
May 18
May 19
May 20
May 21
May 22
May 23


Air Temperature
- Milyering (°C)
35
30
25
20
15
Wind Speed
- Milyering (km/ hr)
40
30
20
10
0
Wind Direction
- Milyering (deg)
360
270
180
90
0
May 17
May 18
May 19
May 20
May 21
May 22
May 23


Water Temperature
- 50 m Station (°C)
29
28
27
26
25

Predicted Water Level
- Tantabiddi (m)
2
1
0
May 24
May 25
May 26
May 27
May 28
May 29
May 30


Air Temperature
- Milyering (°C)
30
25
20
15
Wind Speed
- Milyering (km/ hr)
50
40
30
20
10
0
Wind Direction
- Milyering (deg)
360
270
180
90
0
May 24
May 25
May 26
May 27
May 28
May 29
May 30