APPENDIX A: eReefs biogeochemical configuration and model assessment - simulation 926

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Contents

1 Outline **11**

2 Acknowledgments **11**

3 Skill metrics **12**

4 Observation sites **13**

5 Model configuration **23**

6 Model assessment **36**

The list of tables and figures below provides both a page number and a link to each figure.

List of Tables

1 Observational sources used in modelcomparison 14

2 Environmental parameters in GBR4 BGC model. 24

3 Phytoplankton parameters GBR4 BGC model. 25

4 Zooplankton parameters GBR4 BGC model. 26

5 Detritus parameters GBR4 BGC model. 27

6 Benthic parameters GBR4 BGC model. 28

7 Seagrass parameters GBR4 BGC model. 29

8 Pelagic parameter values for the GBR4 model 30

9 Detritus parameter values for the GBR4 model 31

10 Benthic parameter values for the GBR4 model . . . 32
11 Original eReef BGC river parameter values and origins for the GBR4 model. . . . 34
12 Catchment information for the model . . . 35

List of Figures

1 Map of northern GBR sites . . . 15
2 Map of southern GBR sites . . . 16
3 Google maps of sites 1 . . . 17
4 Google maps of sites 2 . . . 18
5 Google maps of sites 3 . . . 19
6 Google maps of sites 4 . . . 20
7 Google maps of sites 5 . . . 21
8 Google maps of sites 6 . . . 22
9 Schematic of EMS model . . . 23
10 Rivers into the model . . . 33
11 Statistical plots of IMOS moorings Chlorophyll . . . 36
12 Statistical plots of IMOS moorings TSS . . . 37
13 Statistical plots of AIMS WQ sites . . . 38
14 Statistical plots of Coral survey sites . . . 39
15 Statistical plots of Reef Rescue moorings . . . 40
16 Statistical plots of NRS nutrients . . . 41
17 Coral dataset (AIMS): Barren Island . . . 42

18 Coral dataset (AIMS): Daydream Island 43
19 Coral dataset (AIMS): Double Cone Island 44
20 Coral dataset (AIMS): Dunk Island 45
21 Coral dataset (AIMS): Fitzroy Reef 46
22 Coral dataset (AIMS): Fitzroy Reef 47
23 Coral dataset (AIMS): Geoffrey Bay 48
24 Coral dataset (AIMS): High Island 49
25 Coral dataset (AIMS): Humpy Island 50
26 Coral dataset (AIMS): Pandora Island 51
27 Coral dataset (AIMS): Pelican Island 52
28 Coral dataset (AIMS): Pelorous/Orpheus Island 53
29 Coral dataset (AIMS): Pelorous/Orpheus Island 54
30 Coral dataset (AIMS): Pine Island 55
31 Coral dataset (AIMS): Russell Island 56
32 Coral dataset (AIMS): Snapper Island 57
33 Coral dataset (NRS/AIMS): Yongala (NRSYON) 58
34 Coral dataset (NRS/AIMS): Yongala (NRSYON) 59
35 Coral dataset (NRS/AIMS): Yongala (NRSYON) 60
36 Coral dataset (NRS/AIMS): Yongala (NRSYON) 61
37 IMOS Moorings CHL: Capricorn Channel (GBRCCH) CHL 62
38 IMOS Moorings CHL: Capricorn Channel (GBRCCH) CHL 63
39 IMOS Moorings CHL: Heron Island South (GBRHIS) CHL 64

40 IMOS Moorings CHL: Heron Island South (GBRHIS) CHL 65
41 IMOS Moorings CHL: Lizard Shelf (GBRLSH) CHL 66
42 IMOS Moorings CHL: Lizard Shelf (GBRLSH) CHL 67
43 IMOS Moorings CHL: Myrmidon (GBRMYR) CHL 68
44 IMOS Moorings CHL: Myrmidon (GBRMYR) CHL 69
45 IMOS Moorings CHL: One Tree (GBROTE) CHL 70
46 IMOS Moorings CHL: One Tree (GBROTE) CHL 71
47 IMOS Moorings CHL: Palm Passage(GBRPPS) CHL 72
48 IMOS Moorings CHL: Palm Passage(GBRPPS) CHL 73
49 IMOS Moorings TSS: Capricorn Channel (GBRCCH) TSS 74
50 IMOS Moorings TSS: Capricorn Channel (GBRCCH) TSS 75
51 IMOS Moorings TSS: Heron Island South (GBRHIS) TSS 76
52 IMOS Moorings TSS: Heron Island South (GBRHIS) TSS 77
53 IMOS Moorings TSS: Lizard Shelf (GBRLSH) TSS 78
54 IMOS Moorings TSS: Lizard Shelf (GBRLSH) TSS 79
55 IMOS Moorings TSS: North Stradbroke (GBRNSI) TSS 80
56 IMOS Moorings TSS: North Stradbroke (GBRNSI) TSS 81
57 IMOS Moorings TSS: One Tree (GBROTE) TSS 82
58 IMOS Moorings TSS: One Tree (GBROTE) TSS 83
59 IMOS Moorings TSS: Palm Passage(GBRPPS) TSS 84
60 IMOS Moorings TSS: Palm Passage(GBRPPS) TSS 85
61 IMOS/NRS Moorings CHL: North Stradbroke (GBRNSI) CHL 86

62 IMOS/NRS Moorings CHL: North Stradbroke (GBRNSI) CHL 87
63 IMOS/NRS Moorings CHL: Yongala (NRSYON) CHL 88
64 IMOS/NRS Moorings CHL: Yongala (NRSYON) CHL 89
65 IMOS/NRS Moorings CHL: Yongala (NRSYON CHL 90
66 IMOS/NRS Moorings Nutrients: North Stradbroke (GBRNSI) 91
67 IMOS/NRS Moorings Nutrients: North Stradbroke (GBRNSI) 92
68 IMOS/NRS Moorings Nutrients: North Stradbroke (GBRNSI) 93
69 IMOS/NRS Moorings Nutrients: North Stradbroke (GBRNSI) 94
70 IMOS/NRS Moorings Nutrients: North Stradbroke (GBRNSI) 95
71 IMOS/NRS Moorings Nutrients: North Stradbroke (GBRNSI) 96
72 IMOS/NRS Moorings Nutrients: Yongala (NRSYON) 97
73 IMOS/NRS Moorings Nutrients: Yongala (NRSYON) 98
74 IMOS/NRS Moorings Nutrients: Yongala (NRSYON) 99
75 IMOS/NRS Moorings Nutrients: Yongala (NRSYON) 100
76 Reef Rescue moorings (AIMS): Barren Island 101
77 Reef Rescue moorings (AIMS): Daydream Island 102
78 Reef Rescue moorings (AIMS): Double Cone Island 103
79 Reef Rescue moorings (AIMS): Dunk Island 104
80 Reef Rescue moorings (AIMS): Fitzroy Reef 105
81 Reef Rescue moorings (AIMS): Geoffrey Bay 106
82 Reef Rescue moorings (AIMS): High Island 107
83 Reef Rescue moorings (AIMS): Humpy Island 108

84 Reef Rescue moorings (AIMS): Pandora Island . . . 109
85 Reef Rescue moorings (AIMS): Pelican Island . . . 110
86 Reef Rescue moorings (AIMS): Pelorous/Orpheus Island . . . 111
87 Reef Rescue moorings (AIMS): Pine Island . . . 112
88 Reef Rescue moorings (AIMS): Russell Island . . . 113
89 Reef Rescue moorings (AIMS): Snapper Island . . . 114
90 IMOS/NRS Moorings: North Stradbroke (GBRNSI) . . . 115
91 IMOS/NRS Moorings: Yongala (NRSYON) . . . 116
92 AIMS Water Quality Monitoring (WQM): Barren Island . . . 117
93 AIMS Water Quality Monitoring (WQM): Cape Tribulation . . . 118
94 AIMS Water Quality Monitoring (WQM): Daydream Island . . . 119
95 AIMS Water Quality Monitoring (WQM): Daydream Island . . . 120
96 AIMS Water Quality Monitoring (WQM): Double Cone Island . . . 121
97 AIMS Water Quality Monitoring (WQM): Double Cone Island . . . 122
98 AIMS Water Quality Monitoring (WQM): Double Island . . . 123
99 AIMS Water Quality Monitoring (WQM): Double Island . . . 124
100 AIMS Water Quality Monitoring (WQM): Dunk Island . . . 125
101 AIMS Water Quality Monitoring (WQM): Fairlead buoy . . . 126
102 AIMS Water Quality Monitoring (WQM): Fitzroy Reef . . . 127
103 AIMS Water Quality Monitoring (WQM): Fitzroy Reef . . . 128
104 AIMS Water Quality Monitoring (WQM): Geoffrey Bay . . . 129
105 AIMS Water Quality Monitoring (WQM): Green Island . . . 130

106 AIMS Water Quality Monitoring (WQM): Green Island 131
107 AIMS Water Quality Monitoring (WQM): Green Island 132
108 AIMS Water Quality Monitoring (WQM): High Island 133
109 AIMS Water Quality Monitoring (WQM): High Island 134
110 AIMS Water Quality Monitoring (WQM): High Island 135
111 AIMS Water Quality Monitoring (WQM): Humpy Island 136
112 AIMS Water Quality Monitoring (WQM): Humpy Island 137
113 AIMS Water Quality Monitoring (WQM): Pandora Island 138
114 AIMS Water Quality Monitoring (WQM): Pelican Island 139
115 AIMS Water Quality Monitoring (WQM): Pelorous/Orpheus Island 140
116 AIMS Water Quality Monitoring (WQM): Pelorous/Orpheus Island 141
117 AIMS Water Quality Monitoring (WQM): Pelorous/Orpheus Island 142
118 AIMS Water Quality Monitoring (WQM): Pine Island 143
119 AIMS Water Quality Monitoring (WQM): Pine Island 144
120 AIMS Water Quality Monitoring (WQM): Port Douglas 145
121 AIMS Water Quality Monitoring (WQM): Port Douglas 146
122 AIMS Water Quality Monitoring (WQM): Russell Island 147
123 AIMS Water Quality Monitoring (WQM): Russell Island 148
124 AIMS Water Quality Monitoring (WQM): Russell Island 149
125 AIMS Water Quality Monitoring (WQM): Snapper Island 150
126 AIMS Water Quality Monitoring (WQM): Yorkeys Knob 151
127 AIMS Water Quality Monitoring (WQM): Yorkeys Knob 152

128 Remote sensing comparisons: Barren Island 153
129 Remote sensing comparisons: Capricorn Channel (GBRCCH) 154
130 Remote sensing comparisons: Daydream Island 155
131 Remote sensing comparisons: Double Cone Island 156
132 Remote sensing comparisons: Dunk Island 157
133 Remote sensing comparisons: Fitzroy Reef 158
134 Remote sensing comparisons: Heron Island South (GBRHIS) 159
135 Remote sensing comparisons: Lizard Shelf (GBRLSH) 160
136 Remote sensing comparisons: Lizard Slope(GBRLSL) 161
137 Remote sensing comparisons: One Tree (GBROTE) 162
138 Remote sensing comparisons: Palm Passage(GBRPPS) 163
139 Remote sensing comparisons: Pandora Island 164
140 Remote sensing comparisons: Pelorous/Orpheus Island 165
141 Remote sensing comparisons: Port Douglas 166
142 Remote sensing comparisons: Russell Island 167
143 Remote sensing comparisons: Yongala (NRSYON) 168
144 Remote sensing comparisons: Barren Island 169
145 Remote sensing comparisons: Capricorn Channel (GBRCCH) 170
146 Remote sensing comparisons: Daydream Island 171
147 Remote sensing comparisons: Double Cone Island 172
148 Remote sensing comparisons: Dunk Island 173
149 Remote sensing comparisons: Fitzroy Reef 174

150 Remote sensing comparisons: Heron Island South (GBRHIS) 175
151 Remote sensing comparisons: Lizard Shelf (GBRLSH) 176
152 Remote sensing comparisons: Lizard Slope(GBRLSL) 177
153 Remote sensing comparisons: One Tree (GBROTE) 178
154 Remote sensing comparisons: Palm Passage(GBRPPS) 179
155 Remote sensing comparisons: Pandora Island 180
156 Remote sensing comparisons: Pelorous/Orpheus Island 181
157 Remote sensing comparisons: Port Douglas 182
158 Remote sensing comparisons: Russell Island 183
159 Remote sensing comparisons: Yongala (NRSYON) 184

1 Outline

This report displays technical specifications of model parameterisation and initialisation for the eReef biogeochemical model (run 926) and comparison of model simulation results with observations from individual sites and moorings in the GBR domain.

Results: observations are blue; model simulations are black

Specific details for model results

- The model (926) uses gauged flow and SOURCE catchment model loads for GBR rivers and uses gauged flows and linear loads for rivers outside the GBR domain.
- If the model grid shown in the figures is shallower than the observational depth then the model will take the deepest water column cell.
- The deepest observational depths at the sites varied throughout the 4 years of sampling but were generally within the same horizontal grid cell within the model.

2 Acknowledgments

The eReefs BGC model analysis would not be possible without the continuing observational analysis datasets which play a highly significant role in the successful interpretation of the biogeochemical cycles and management of this model.

Primary observational data sources: Integrated Marine Observing System (IMOS) - IMOS is supported by the Australian Government through the National Collaborative Research Infrastructure Strategy and the Super Science Initiative IMOS moorings and includes the National Reference Stations (Yongala and Stradbroke used in this study). Other key observations were sourced from AIMS data center and include AIMS Water Quality monitoring sites, carbon chemistry projects and Reef Rescue Project moorings. Satellite data from MODIS Aqua processed using the OC3 and MIM are also compared in this docment within the eReef model domain.

3 Skill metrics

The following shows the skill metrics used for model and observation comparison within this document.

- RMSE - Root Mean Square Error: $RMSE = \sqrt{\frac{1}{n}\sum_{j=1}^{n}(y_j - \hat{y}_j)^2}$
- r - correlation coefficient: $r = cov(y_j, \hat{y}_j)/\sqrt{cov(y_j, y_j)cov(\hat{y}_j, \hat{y}_j)}$
- bias - model bias: $bias = \frac{1}{n}\sum_{j=1}^{n}(y_j - \hat{y}_j)$
- normalised bias (given in bar graphs only) - bias is normalised to make it non-dimensionless and has an ideal value of 0
- MAE - mean absolute error: $MAE = \frac{1}{n}\sum_{j=1}^{n}|y_j - \hat{y}_j|$
- d2 - Willmot's skill metric, ratio of the MAE and the mean absolute deviation about the observed mean (Willmott et al., 1985).(ideal value - close to 1)

The metric values for each variable and site are calculated from the duration of the simulation and does not include periods where observations or model have no data. The manhatten plots are normalised from the results shown in the figures to allow comparisons of tracers with different ranges.

Willmott CJ, Ackleson SG, Davis RE, Feddema JJ, Klink KM,Legates DR, ODonnell J, Rowe CM. 1985. Statistics for the evaluation of model performance. Journal of Geophysical Research 90: 8995-9005.

4 Observation sites

The observation sites that are used to compare with the model are shown in this section. They include AIMS water quality monitoring sites, Reef Rescue sites, IMOS/NRS moorings. Satellite views showing the location of the sites and their proximity to Islands adn QLD shoreline are shown using Google maps

.

Table 1: Observational sources used in modelcomparison

Database type	Number of sites/voyages with WQM	Holdings	BGC Parameters
AIMS WQM standard sites	16-20 sites with many taken at 2 depths most at approx 3 month intervals	AIMS WQM	NH4 NOX DIP Chla (not HPLC) TSS DOC DON DOP
Reef rescue Sites	14 Sites that correspond with AIMS WQM sites above (2009-2014)	Reef Rescue/AIMS	Chl (fluorescence), turbidity
IMOS moorings chlorophyll and TSS	6 moorings with WQM instruments, generally 2 WQM depths per mooring (continuous fluorescence)	IMOS	Chl (fluorescence) and turbidity
IMOS/NRS Moorings chlorophyll	2 continuous Chl (fluorescence) and turbidty moorings at Yongala and Stradbroke	IMOS	Chl (fluorescence) and turbidity
NRS IMOS Moorings	WQM monthly samples and Chl monthly at two moorings at Yongala and Stradbroke,	Aims database and IMOS	NH4 NOX DIP Chla (HPLC) TSS Aragonite saturation state, DIC, pH, alkalinity
Alkalinity Surveys	Sample set from mid 2011 to 2013 of 14 sample sites (same as reef rescue sites)	Miles Furnas	Aragonite saturation state, DIC, pH, alkalinity
HPLC chlorophyll samples	assorted HPLC chls samples from moorings and voyages and one off transects in the barrier reef region and at model boundaries	AESOP and IMOS and Data Trawler	Chla (HPLC)
Flood plumes	4 regional areas where flood plume WQ samples are taken (15 per site over the flooding period(weekly): Burdekin, Burnett Mary, Fitzroy and wet tropics	James Cook University	Note some parameters not always taken: Kd, TSS, Chla (HPLC), turbidity, NH3, NOX DIP, DON NOX, DOP
Samples North of the Noosa River to Fitzroy	Received 4 WQ datasets 21 Nov 2014 that are predominantly very close to shore and up into estuaries from Noosa to Fitzroy mainly close inshore and estuary samples	Jonathon Hodge via CQAMP	Alkalinity, Chl-a, NH4, NOx, DON, DOC, Oxygen, DIP, TSS,
Sporadic Aims WQM sites throughout the 2010 to 2014 period, underway or special research	$\tilde{5}$0 sites temporally sporadic or ad hoc most near the coast or very close to inner reef Islands	Aims WQM	NH4, NOX, DIP, CHL, TSS, DOC, DON, DOP, NOx
Voyage sites Coral Sea	Historic: 1920 until present ($\tilde{1}$00 sites) sporadic or ad hoc	marlin and data trawler	NH4 NOX DIP Chl TSS
Voyages near Fly river	Historic: 1920 until present ($\tilde{2}$0 sites) sporadic or ad hoc	marlin and data trawler	NH4 NOX DIP Chl TSS
Voyage sites Coral Sea near PNG gulf	Historic:1920 until present ($\tilde{5}$0 sites) sporadic or ad hoc	marlin and data trawler	NH4 NOX DIP Chl TSS
Voyage sites Torres strait	Historic:1920 until present ($\tilde{3}$0 sites) sporadic or ad hoc	marlin and data trawler	NH4 NOX DIP Chl TSS
Voyage sites or longitudinal surveys from new and Queensland border	Historic:1970 until present ($\tilde{2}$00 sites) sporadic or ad hoc	marlin and data trawler	NH4 NOX DIP Chl TSS

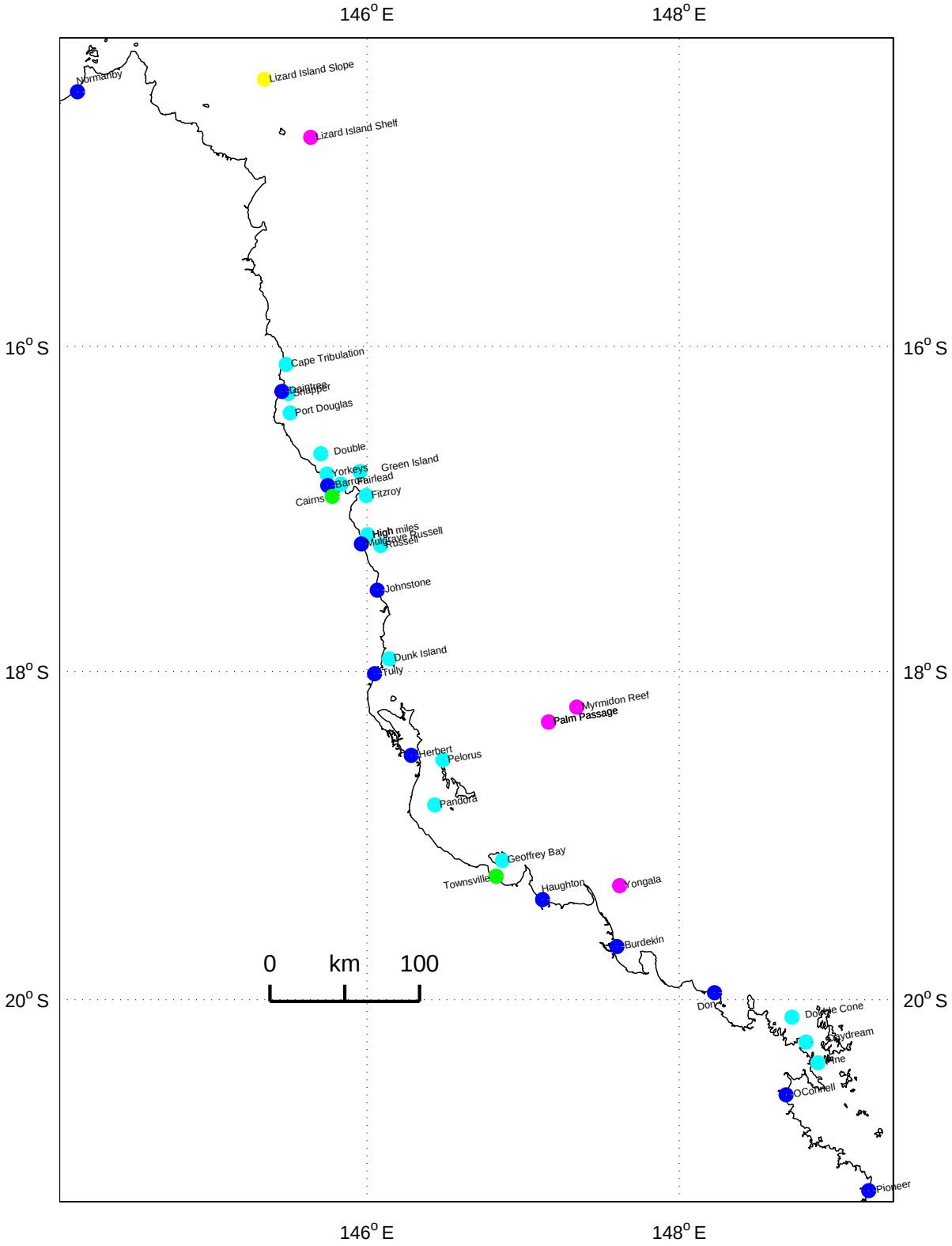


Figure 1: Map of northern GBR sites: Pink: IMOS/NRS sites and mooring locations. Aqua: AIMS WQM sites, Yellow: IMOS moorings that have only hydrological data. Green: Towns. Blue: Rivers included in the model domain.

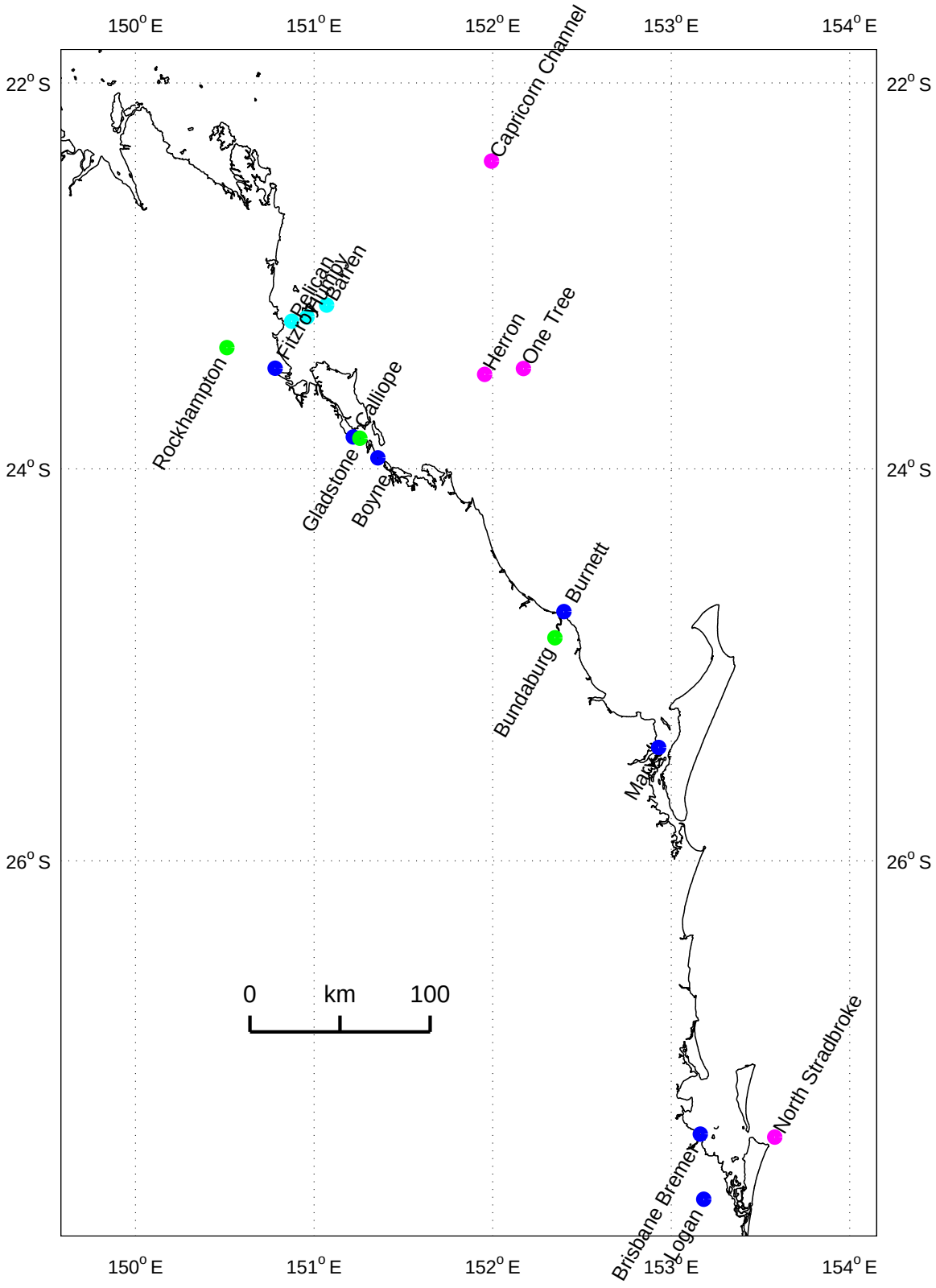


Figure 2: Map of southern GBR sites: Pink: IMOS/NRS sites and mooring locations. Aqua: AIMS WQM sites, Yellow: IMOS moorings that have only hydrological data. Green: Towns. Blue: Rivers included in the model domain.

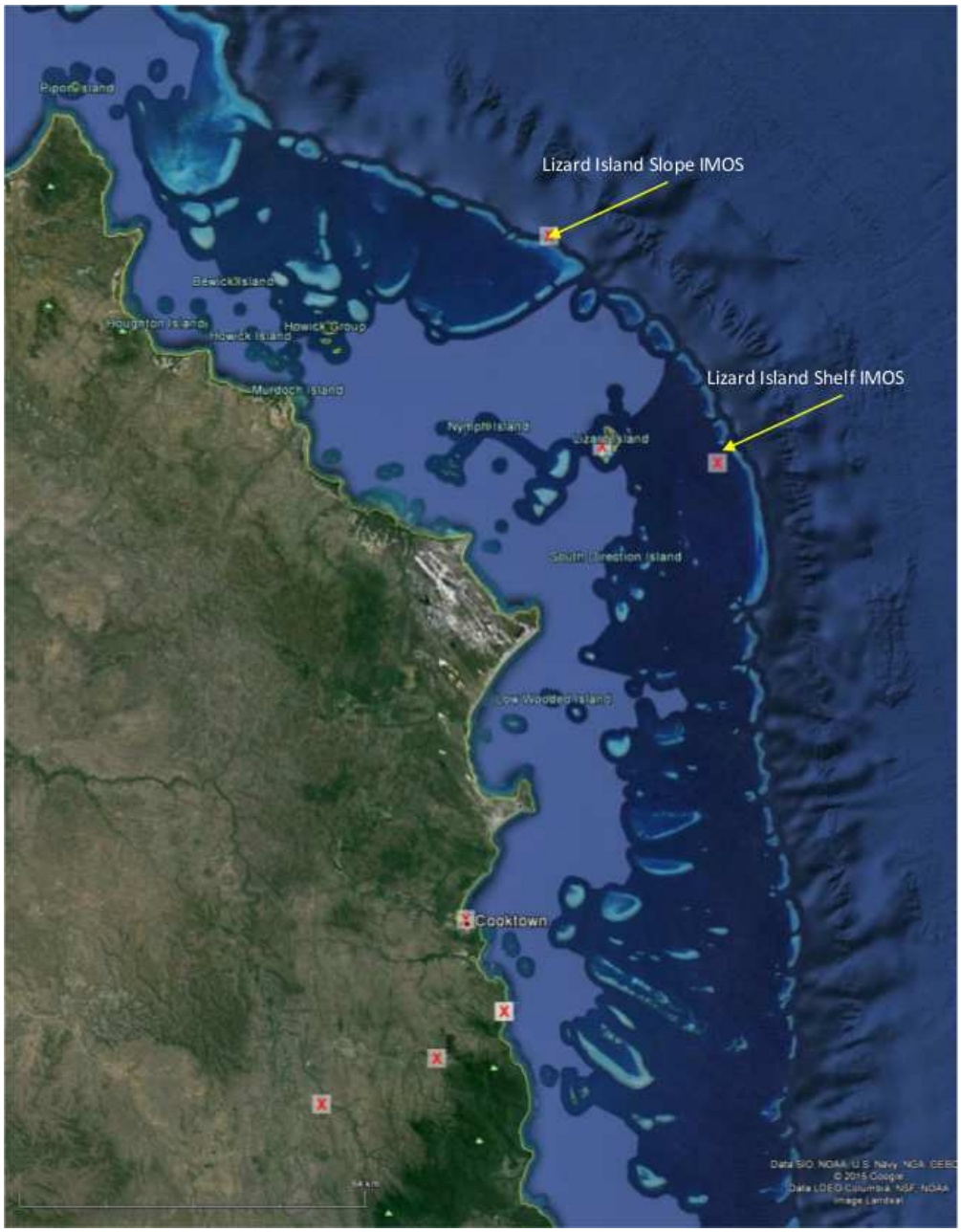


Figure 3: Google maps of sites: Lizard Island Slope and Lizard Island Shelf IMOS mooring sites

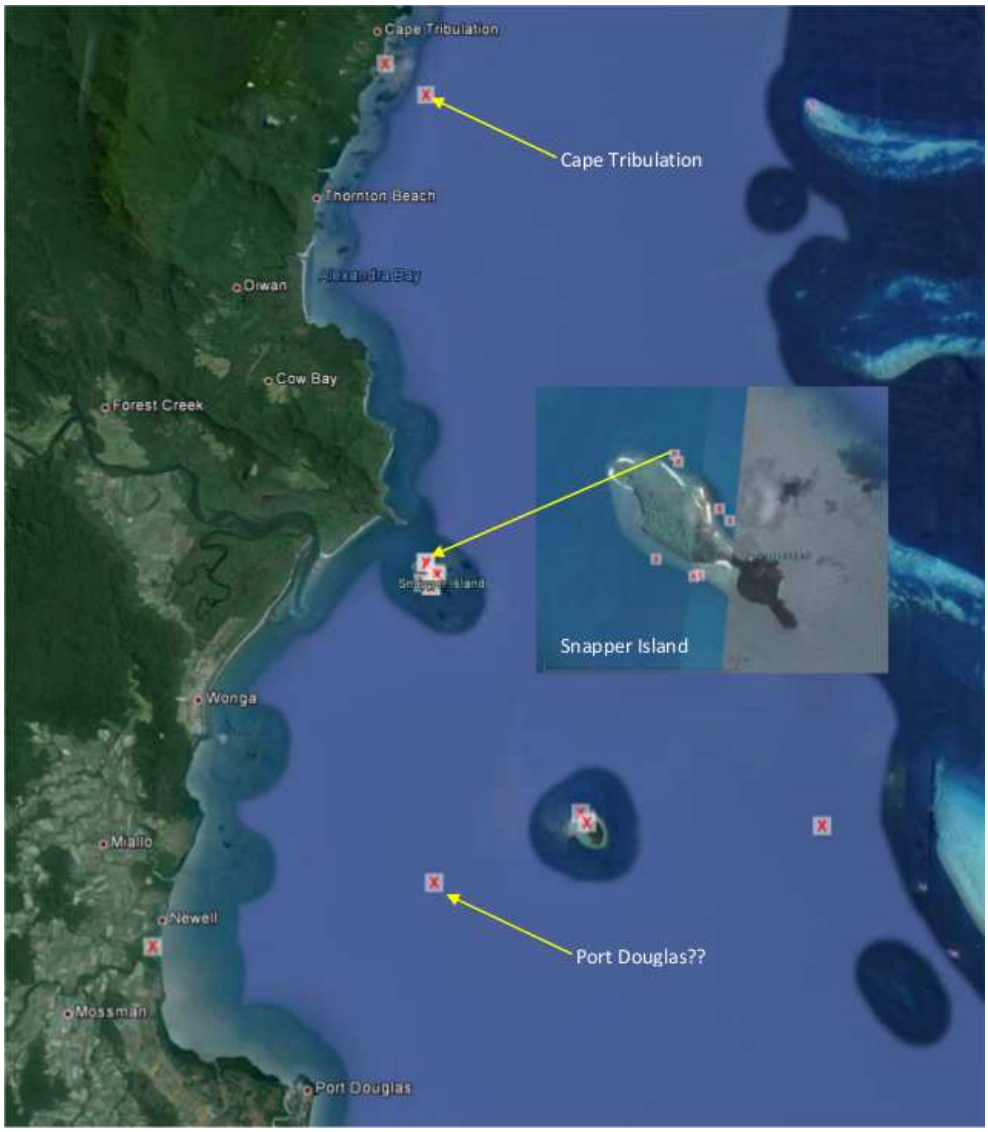


Figure 4: Google maps of sites: Cape Tribulation and Snapper and Port Douglas

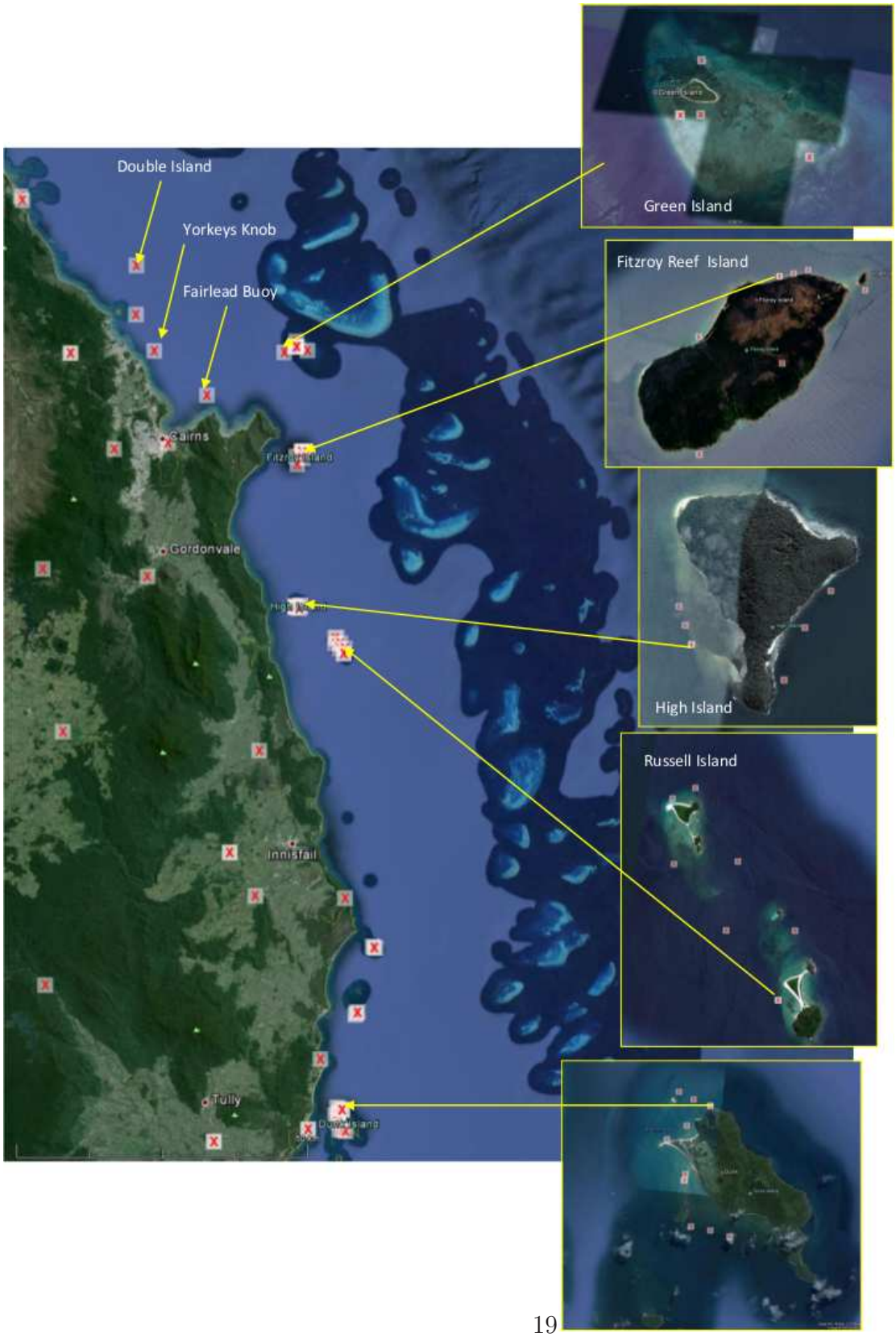


Figure 5: Google maps of sites:Double Island, Yorkeys Knob, Fairlead Buoy, Green Island, Fitzroy Reef Island, High Island, Russell Island and Dunk Island



Figure 6: Google maps of sites: Geoffrey Bay and Yongala

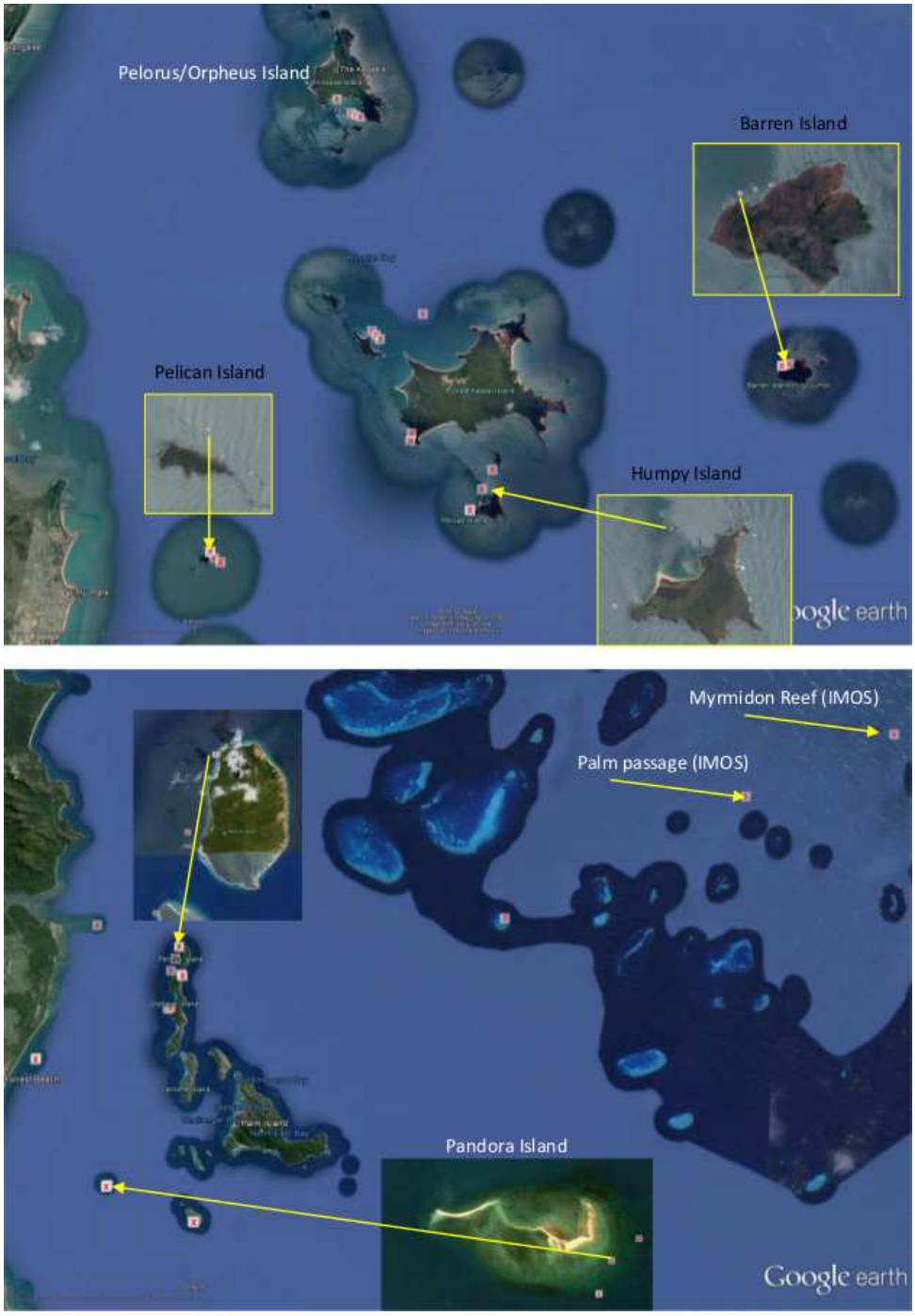


Figure 7: Google maps of sites: Top map Pelorus/Orpheus Island, Barren Island, Pelican Island, Humpy Island. Bottom map Myrmidon Reef and Palm passage moorings (IMOS), Pelorus Island and Pandora Island

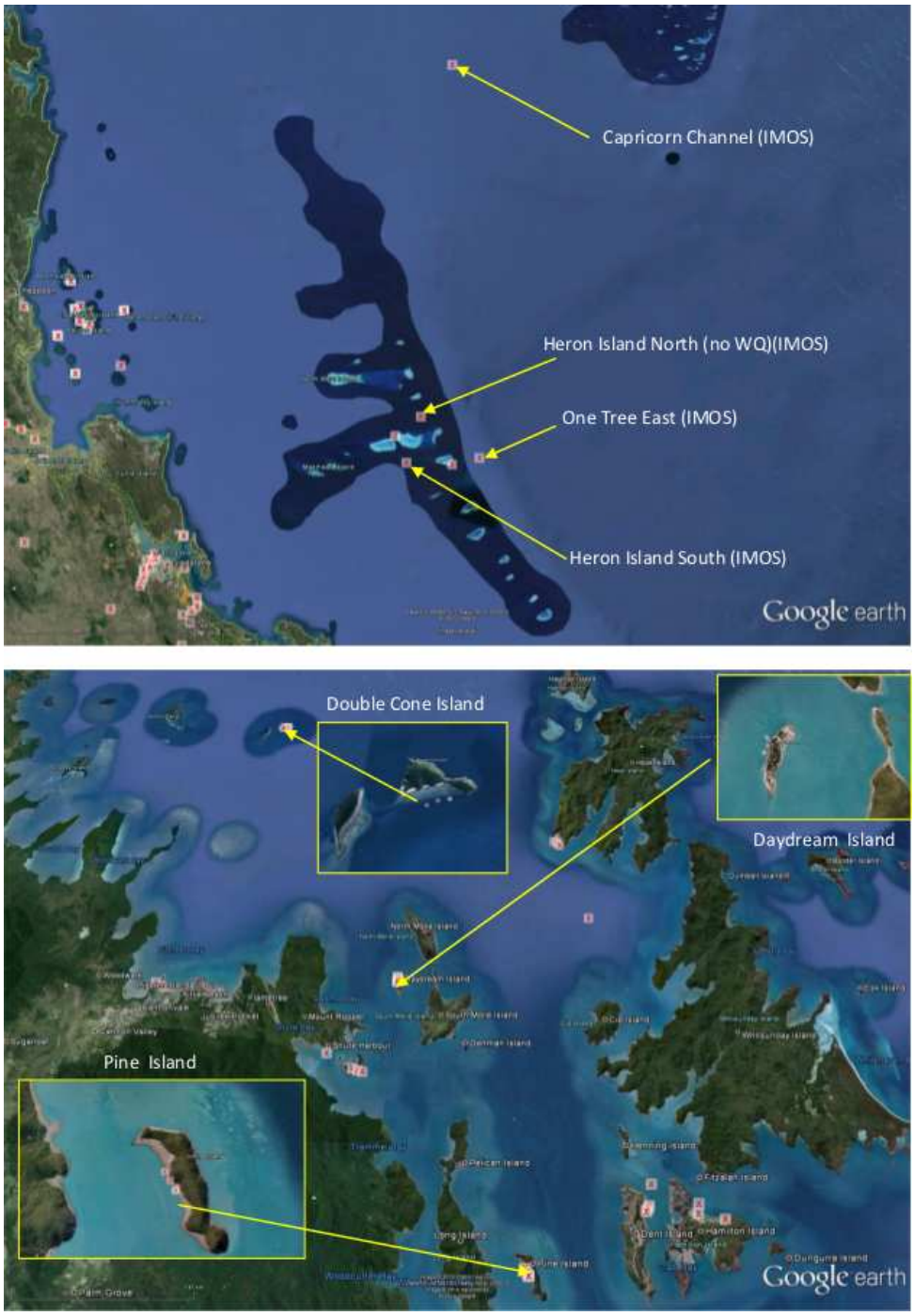


Figure 8: Google maps of sites:Top map Capricorn Channel, Herron Island and One Tree East. Bottom map Double Cone island, Daydream island and Pine Island.

5 Model configuration

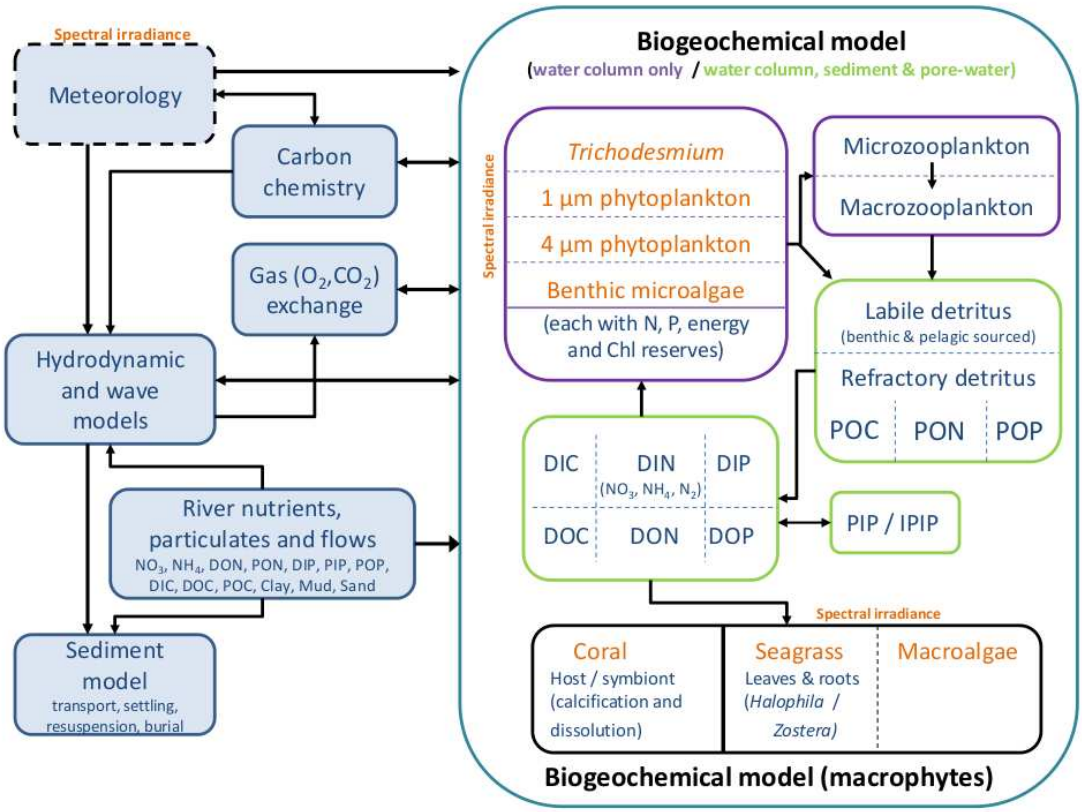


Figure 9: Schematic of EMS model with enhanced processes for eReefs shown in red.

Table 2: Environmental parameters in GBR4 BGC model run 918 to 924.

Description	Name in code	Symbol	Value	Units
Reference temperature	Tref	T_{ref}	20.000000	Deg C
Temperature coefficient for rate parameters	Q10	$Q10$	2.000000	none
Nominal rate of TKE dissipation in water column	TKEeps	ϵ	0.000001	$m^2\ s^{-3}$
Atmospheric CO2	xco2_in_air	pCO_2	396.480000	ppmv
Concentration of dissolved N2	N2	$[N_2]_{gas}$	2000.000000	mg N m^{-3}
DOC-specific absorption of CDOM 443 nm	acdom443star	$k_{CDOM,443}$	0.000130	m^2 mg C^{-1}

Table 3: Phytoplankton parameters GBR4 BGC model run 918 to 924.

Description	Name in code	Symbol	Value	Units
Maximum growth rate of PL at Tref	PLumax	μ_{PL}^{max}	1.400000	d^{-1}
Radius of the large phytoplankton cells	PLrad	r_{PL}	0.000004	m
Natural (linear) mortality rate, large phyto.	PhyL_mL	$m_{L,PL}$	0.100000	d^{-1}
Natural (linear) mortality rate in sediment, large phyto.	PhyL_mL_sed	$m_{L,PL,sed}$	1.000000	d^{-1}
Maximum growth rate of PS at Tref	PSumax	μ_{PL}^{max}	1.600000	d^{-1}
Radius of the small phytoplankton cells	PSrad	r_{PS}	0.000001	m
Natural (linear) mortality rate, small phytoplankton	PhyS_mL	$m_{L,PS}$	0.100000	d^{-1}
Natural (linear) mortality rate in sediment, small phyto.	PhyS_mL_sed	$m_{L,PS,sed}$	1.000000	d^{-1}
Maximum growth rate of MB at Tref	MBumax	μ_{MPB}^{max}	0.839000	d^{-1}
Radius of the MPB cells	MBrad	r_{MPB}	0.000010	m
Natural (quadratic) mort. rate, microphytobenthos, sediment	MPB_mQ	$m_{Q,MPB}$	0.000100	d^{-1}(mg N m^{-3})$^{-1}$
Ratio of xanthophyll to chl a of PS	PSxan2chl	$\Theta_{xan2chl,PS}$	0.510000	mg mg $^{-1}$
Ratio of xanthophyll to chl a of PL	PLxan2chl	$\Theta_{xan2chl,PL}$	0.810000	mg mg $^{-1}$
Ratio of xanthophyll to chl a of MPB	MBxan2chl	$\Theta_{xan2chl,MPB}$	0.810000	mg mg $^{-1}$
Maximum growth rate of Trichodesmium at Tref	Tricho_umax	μ_{MPB}^{max}	0.240000	d^{-1}
Radius of Trichodesmium colonies	Tricho_rad	r_{MPB}	0.000005	m
Sherwood number for the Tricho dimensionless	Tricho_Sh	Sh_{Tricho}	1.000000	none
Linear mortality for Tricho in sediment NEEDS ATT	Tricho_mL	$m_{L,Tricho}$	0.140000	d^{-1}
Quadratic mortality for Tricho due to phages in wc	Tricho_mQ	$m_{Q,Tricho}$	0.200000	d^{-1}(mg N m^{-3})$^{-1}$
Critical Tricho above which quadratic mortality applies	Tricho_crit		0.000200	mg N m^{-3}
Minimum density of Trichodesmium	p_min	$\rho_{min,Tricho}$	990.000000	kg m^{-3}
Maximum density of Trichodesmium	p_max	$\rho_{max,Tricho}$	1060.000000	kg m^{-3}
DIN conc below which Tricho N fixes	DINcrit	DIN_{crit}	10.000000	mg N m^{-3}
Ratio of xanthophyll to chl a of Trichodesmium	Trichoxan2chl	$\Theta_{xan2chl,Tricho}$	0.500000	mg mg $^{-1}$
Chl-specific scattering coef. for microalgae	bphy	b_{phy}	0.200000	m^{-1}(mg Chla m^{-3})$^{-1}$
Nominal N:Chl a ratio in phytoplankton by weight	NtoCHL	$R_{N:Chl}$	7.000000	g N(g Chla)$^{-1}$
Minimum carbon to chlorophyll a ratio	C2Chlmin	θ_{min}	20.000000	wt/wt

Table 4: Zooplankton parameters GBR4 BGC model run 918 to 924.

Description	Name in code	Symbol	Value	Units
Maximum growth rate of ZS at Tref	ZSumax	μ_{max}^{ZS}	4.000000	d^{-1}
Radius of the small zooplankton cells	ZSrad	r_{ZS}	0.000005	m
Swimming velocity for small zooplankton	ZSswim	U_{ZS}	0.000200	m s^{-1}
Grazing technique of small zooplankton	ZSmeth		rect	none
Maximum growth rate of ZL at Tref	ZLumax	μ_{max}^{ZL}	1.330000	d^{-1}
Radius of the large zooplankton cells	ZLrad	r_{ZL}	0.000320	m
Swimming velocity for large zooplankton	ZLswim	U_{ZL}	0.003000	m s^{-1}
Grazing technique of large zooplankton	ZLmeth		rect	none
Growth efficiency, large zooplankton	ZL_E	E_{ZL}	0.426000	none
Growth efficiency, small zooplankton	ZS_E	E_{ZS}	0.462000	none
Natural (quadratic) mortality rate, large zooplankton	ZL_mQ	$m_{Q,ZL}$	0.012000d^{-1}(mg N m^{-3})$^{-1}$	
Natural (quadratic) mortality rate, small zooplankton	ZS_mQ	$m_{Q,ZS}$	0.007000d^{-1}(mg N m^{-3})$^{-1}$	
Fraction of growth inefficiency lost to detritus, large zooplankton	ZL_FDG	γ_{ZL}	0.500000	none
Fraction of mortality lost to detritus, large zooplankton	ZL_FDM	N/A	1.000000	none
Fraction of growth inefficiency lost to detritus, small zooplankton	ZS_FDG	γ_{ZS}	0.500000	none
Fraction of mortality lost to detritus, small zooplankton	ZS_FDM	N/A	1.000000	none

Table 5: Detritus parameters GBR4 BGC model run 918 to 924.

Description	Name in code	Symbol	Value	Units
Fraction of labile detritus converted to refractory detritus	F_LD_RD	ζ_{Red}	0.190000	none
Fraction of labile detritus converted to dissolved organic matter	F_LD_DOM	ϑ_{Red}	0.100000	none
fraction of refractory detritus that breaks down to DOM	F_RD_DOM	ϑ_{Ref}	0.050000	none
Breakdown rate of labile detritus at 106:16:1	r_DetPL	r_{Red}	0.040000	d^{-1}
Breakdown rate of labile detritus at 550:30:1	r_DetBL	r_{Atk}	0.001000	d^{-1}
Breakdown rate of refractory detritus	r_RD	r_R	0.001000	d^{-1}
Breakdown rate of dissolved organic matter	r_DOM	r_O	0.000100	d^{-1}
Respiration as a fraction of umax	Plank_resp	ϕ	0.025000	none
Oxygen half-saturation for aerobic respiration	KO_aer	K_{OA}	256.000000	mg O m^{-3}
Maximum nitrification rate in water column	r_nit_wc	$\tau_{nit,wc}$	0.100000	d^{-1}
Maximum nitrification rate in water sediment	r_nit_sed	$\tau_{nit,sed}$	20.000000	d^{-1}
Oxygen half-saturation for nitrification	KO_nit	$K_{O_2,nit}$	500.000000	mg O m^{-3}
Rate at which P reaches adsorbed/desorbed equilibrium	Pads_r	τ_{Pabs}	0.040000	d^{-1}
Freundlich Isothermic Const P adsorption to TSS in water column	Pads_Kwc	$k_{Pads,wc}$	300.000000	mg P kg TSS^{-1}
Freundlich Isothermic Const P adsorption to TSS in sediment	Pads_Ksed	$k_{Pads,sed}$	74.000000	mg P kg TSS^{-1}
Oxygen half-saturation for P adsorption	Pads_KO	$K_{O_2,abs}$	2000.000000	mg O m^{-3}
Exponent for Freundlich Isotherm	Pads_exp	N/A	1.000000	none
Maximum denitrification rate	r_den	τ_{denit}	5.000000	d^{-1}
Oxygen half-saturation constant for denitrification	KO_den	$K_{O_2,denit}$	10000.000000	mg O m^{-3}
Rate of conversion of PIP to immobilised PIP	r_immob_PIP	τ_{Pimm}	0.001200	d^{-1}

Table 6: Benthic parameters GBR4 model run 918 to 924, excluding seagrass

Description	Name in code	Symbol	Value	Units
Sediment-water diffusion coefficient	EpiDiffCoeff	D	0.000000	$m^2\ s^{-1}$
Thickness of diffusive layer	EpiDiffDz	h	0.006500	m
Maximum growth rate of MA at Tref	MAumax	μ_{MA}^{max}	1.000000	d^{-1}
Natural (linear) mortality rate, macroalgae	MA_mL	ζ_{MA}	0.010000	d^{-1}
Nitrogen-specific leaf area of macroalgae	MAleafden	Ω_{MA}	1.000000	$m^2\ g\ N^{-1}$
Respiration as a fraction of umax	Benth_resp	ϕ	0.025000	none
net dissolution rate of sediment without coral	dissCaCO3_sed	d_{sand}	0.000700	$mmol\ C\ m^{-2}\ s^{-1}$
Grid scale to reef scale ratio	CHarea	A_{CH}	0.100000	$m^2\ m^{-2}$
Nitrogen-specific host area of coral polyp	CHpolypden	Ω_{CH}	2.000000	$m^2\ g\ N^{-1}$
Max. growth rate of Coral at Tref	CHumax	μ_{CH}^{max}	0.050000	d^{-1}
Max. growth rate of zooxanthellae at Tref	CSumax	μ_{CS}^{max}	0.400000	d^{-1}
Radius of the zooxanthellae	CSrad	r_{CS}	0.000005	m
Quadratic mortality rate of coral polyp	CHmort	ζ_{CH}	0.010000	$(g\ N\ m^{-3})^{-1}\ d^{-1}$
Linear mortality rate of zooxanthellae	CSmort	ζ_{CS}	0.040000	d^{-1}
Fraction of coral host death translocated.	CHremin	f_{remin}	0.500000	-
Rate coefficent for particle uptake by corals	Splank	S_{part}	3.000000	$m\ d^{-1}$
Maximum daytime coral calcification	k_day_coral	k_{day}	0.013200	$mmol\ C\ m^{-2}\ s^{-1}$
Maximum nightime coral calcification	k_night_coral	k_{night}	0.006900	$mmol\ C\ m^{-2}\ s^{-1}$
Carbonate sediment dissolution rate on shelf	dissCaCO3_shelf	d_{shelf}	0.000100	$mmol\ C\ m^{-2}\ s^{-1}$
Age tracer growth rate per day	ageing_decay	n/a	1.000000	$d\ d^{-1}$
Age tracer decay rate per day outside source	anti_ageing_decay	Φ	0.100000	d^{-1}

Table 7: Seagrass parameters GBR4 BGC run 918 to 924.

Description	Name in code	Symbol	Value	Units
Maximum growth rate of SG at Tref	SGumax	μ_{SG}^{max}	0.400000	d^{-1}
Half-saturation of SG N uptake in SED	SG_KN	$K_{SG,N}$	420.000000	mg N m^{-3}
Half-saturation of SG P uptake in SED	SG_KP	$K_{SG,P}$	96.000000	mg P m^{-3}
Natural (linear) mortality rate aboveground seagrass	SG_mL	ζ_{SG_A}	0.040000	d^{-1}
Natural (linear) mortality rate belowground seagrass	SGROOT_mL	ζ_{SG_B}	0.004000	d^{-1}
Fraction (target) of SG biomass below-ground	SGfrac	$f_{below,SG}$	0.500000	-
Time scale for seagrass translocation	SGtransrate	$\tau_{tran,SG}$	0.033300	d^{-1}
Nitrogen-specific leaf area of seagrass	SGleafden	Ω_{SG}	1.500000	m^2 g N^{-1}
Seagrass seed biomass as fraction of 63 % cover	SGseedfrac	$f_{seed,SG}$	0.010000	-
Sine of nadir Zostera canopy bending angle	SGorient	$\sin\beta_{blade,SG}$	0.500000	-
Compensation irradiance for Zostera	SGmlr	$E_{comp,SG}$	4.500000	mol m^{-2}
Maximum depth for Zostera roots	SGrootdepth	$z_{root,SG}$	-0.150000	m
Maximum growth rate of SGH at Tref	SGHumax	μ_{SGH}^{max}	0.400000	d^{-1}
Half-saturation of SGH N uptake in SED	SGH_KN	$K_{SGH,N}$	420.000000	mg N m^{-3}
Half-saturation of SGH P uptake in SED	SGH_KP	$K_{SGH,P}$	96.000000	mg P m^{-3}
Nitrogen-specific leaf area of SGH	SGHleafden	Ω_{SGH}	1.900000	m^2 g N^{-1}
Natural (linear) mortality rate, aboveground SGH	SGH_mL	ζ_{SGH_A}	0.080000	d^{-1}
Natural (linear) mortality rate, belowground SGH	SGHROOT_mL	ζ_{SGH_B}	0.004000	d^{-1}
Fraction (target) of SGH biomass below-ground	SGHfrac	$f_{below,SGH}$	0.250000	-
Time scale for seagrass translocation	SGHtransrate	$\tau_{tran,SGH}$	0.033300	d^{-1}
Halophila seed biomass as fraction of 63 % cover	SGHseedfrac	$f_{seed,SGH}$	0.010000	-
Sine of nadir Halophila canopy bending angle	SGHorient	$\sin\beta_{blade,SGH}$	1.000000	-
Compensation irradiance for Halophila	SGHmlr	$E_{comp,SGH}$	2.800000	mol m^{-2}
Maximum depth for Halophila roots	SGHrootdepth	$z_{root,SGH}$	-0.080000	m

Table 8: Pelagic parameter values for the GBR4 model

Tref	20.000000	Deg C
Q10	2.000000	none
xco2_in_air	396.480000	ppmv
bphy	0.200000	m^{-1}(mg Chla m^{-3})$^{-1}$
NtoCHL	7.000000	g N(g Chla)$^{-1}$
PLumax	1.400000	d^{-1}
PLrad	0.000004	m
PhyL_mL	0.100000	d^{-1}
PSumax	1.6000	d^{-1}
PSrad	0.000001	m
PhyS_mL	0.100000	d^{-1}
MBumax	0.839000	d^{-1}
MBrad	0.000010	m
MPB_mQ	0.000100	d^{-1}(mg N m^{-3})$^{-1}$
PSxan2chl	0.51	mg mg $^{-1}$
PLxan2chl	0.81	mg mg $^{-1}$
MBxan2chl	0.81	mg mg $^{-1}$
Tricho_umax	0.24	d^{-1}
Tricho_rad	0.000005	m
Tricho_Sh	1.000000	none
Tricho_mL	0.140000	d^{-1}
Tricho_mQ	0.2	d^{-1}(mg N m^{-3})$^{-1}$
Tricho_crit	0.000200	mg N m^{-3}
p_min	990.000000	kg m^{-3}
p_max	1060.000000	kg m^{-3}
N2	2000.000000	mg N m^{-3}
DINcrit	10.000000	mg N m^{-3}
Trichoxan2chl	0.500000	mg mg $^{-1}$
ZSumax	4.000000	d^{-1}
ZSrad	0.000005	m
ZSswim	0.000200	m s^{-1}
ZSmeth	rect	none
ZLumax	1.330000	d^{-1}
ZLrad	0.000320	m
ZLswim	0.003000	m s^{-1}
ZLmeth	rect	none
ZL_E	0.426	none
ZS_E	0.462	none
ZL_mQ	0.012000	d^{-1}(mg N m^{-3})$^{-1}$
ZS_mQ	0.007000	d^{-1}(mg N m^{-3})$^{-1}$30
ZL_FDG	0.500000	none
ZL_FDM	1.00000	none
ZS_FDG	0.500000	none
ZS_FDM	1.000000	none

Table 9: Detritus parameter values for the GBR4 model

F_LD_RD	0.190000	none
F_LD_DOM	0.100000	none
F_RD_DOM	0.050000	none
r_DetPL	0.0400000	d^{-1}
r_DetBL	0.0010000	d^{-1}
r_RD	0.001	d^{-1}
r_DOM	0.00010	d^{-1}
Plank_resp	0.025000	none
KO_aer	256.000000	mg O m^{-3}
r_nit_wc	0.100000	d^{-1}
r_nit_sed	20.000000	d^{-1}
KO_nit	500.000000	mg O m^{-3}
Pads_r	0.040000	d^{-1}
Pads_Kwc	300.000000	mg P kg TSS^{-1}
Pads_Ksed	74.000000	mg P kg TSS^{-1}
Pads_KO	2000.000000	mg O m^{-3}
Pads_exp	1.000000	none
r_den	5.000000	d^{-1}
KO_den	10000.000000	mg O m^{-3}

Table 10: Benthic parameter values for the GBR4 model

EpiDiffCoeff	3e-10	$m^2\ s^{-1}$
EpiDiffDz	0.006500	m
MAumax	1.000000	d^{-1}
MA_mL	0.010000	d^{-1}
MAleafden	1.000000	$m^2\ g\ N^{-1}$
Benth_resp	0.025000	none
SGumax	0.4	d^{-1}
SG_KN	420.000000	mg N m^{-3}
SG_KP	96.000000	mg P m^{-3}
SG_mL	0.04000	d^{-1}
SGROOT_mL	0.00400	d^{-1}
SGfrac	0.5000	-
SGtransrate	0.033300	d^{-1}
SGleafden	1.5	$m^2\ g\ N^{-1}$
SGseedfrac	0.010000	-
SGHumax	0.4	d^{-1}
SGH_KN	420.000000	mg N m^{-3}
SGH_KP	96.000000	mg P m^{-3}
SGHleafden	1.900000	$m^2\ g\ N^{-1}$
SGH_mL	0.080	d^{-1}
SGHROOT_mL	0.00400	d^{-1}
SGHfrac	0.25	-
SGHtransrate	0.033300	d^{-1}
SGHseedfrac	0.010000	-
CHpolypden	2.000000	$m^2\ g\ N^{-1}$
CHumax	0.050000	d^{-1}
CSumax	0.400000	d^{-1}
CSrad	0.000005	m
CHmort	0.010000	$(g\ N\ m^{-3})^{-1}\ d^{-1}$
CSmort	0.040000	d^{-1}
CStoCHfrac	0.900000	-
CHremin	0.500000	-
Splank	3.000000	md^{-1}
k_day_coral	0.0132	mmol C $m^{-2}\ s^{-1}$
k_night_coral	0.0069	mmol C $m^{-2}\ s^{-1}$
ageing_decay	1.0	d^{-1}
anti_ageing_decay	0.1	d^{-1}
dissCaCO3_Sed	0.0007	mmol C $m^{-2}\ s^{-1}$
acdom443star	0.00013	m^2 mg C^{-1}
CHarea	0.1	mm^{-1}
ZLdvmrate	0.0	md^{-1}
ZLpar	1.0e-12	mol photon $m^{-2}\ s^{-1}$
PhyL_mL_sed	1.0	d^{-1}
PhyS_mL_sed	1.0	d^{-1}
SGorient	0.5	
C2Chlmin	20.0	wt/wt

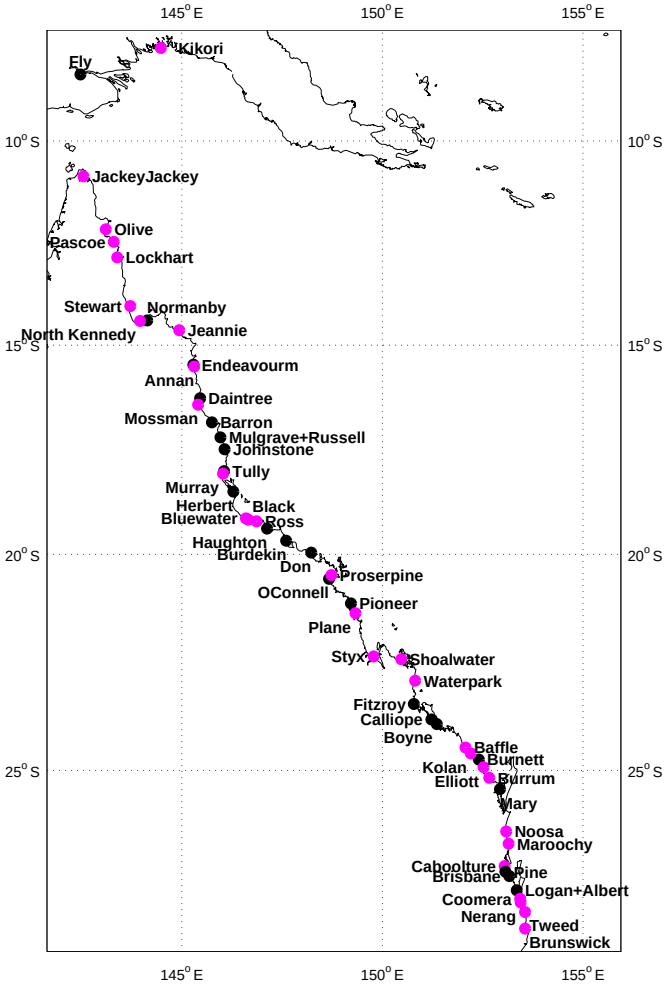


Figure 10: Rivers in the GBR model: Rivers for 926 model run (black) and future rivers for input into the 2016 models (pink)

Table 11: Original eReef BGC river parameter values and origins for the GBR4 model. Note that these are only relevant for rivers outside the GBR for the model run presented in this report. Rivers within the GBR for this report use the cathcment model loads with gauged flow

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Parameter	units	Wet Rivers	Dry rivers	Fly River
FineSed	kgm-3	0.066	0.231	0.066
Mud	kgm-3	0	0	0
Sand	kgm-3	0	0	0
NO3	mgm-3	171	197	197
NH4	mgm-3	0.1	0.1	0.1
DIP	mgm-3	4.2	25.8	25.8
PIP	mgm-3	4.2*54.5719	25.8*54.5719	25.8*54.5719
PIPI	mgm-3	0	0	0
DOR_N	mgm-3	80	139	469.69
DOR_P	mgm-3	5.8	8.9	29.24
DOR_C	mgm-3	528	917.4	3100
DetR_N	mgm-3	101.5	352.1	352.1
DetR_P	mgm-3	22.4	91	91
DetR_C	mgm-3	669.9	2323	2323
DetPL_N (Labile Detrital Planktonic N)	mgm-3	43.5	150.9	150.9
DetBL_N (Benthic Labile Detrital N)	mgm-3	0	0	0
alkalinity	mmol m-3	900	900	900
DIC	mgm-3	900.0*12.01/1.16	900.0*12.01/1.16	13400
Oxygen	mgm-3	0.9*8234.0	0.9*8234.0	3290
PhyS_N	mgm-3	1*7	1*7	1*7
PhyL_N	mgm-3	1*7	1*7	1*7
PhyS_NR (Phyto N reserve)	mgm-3	1*7/2	1*7/2	1*7/2
PhyL_NR (Phyto N reserve)	mgm-3	1*7/2	1*7/2	1*7/2
PhyS_PR (Phyto P reserve)	mgm-3	1*7/2/16*32/14	1*7/2/16*32/14	1*7/2/16*32/14
PhyL_PR (Phyto P reserve)	mgm-3	1*7/2/16*32/14	1*7/2/16*32/14	1*7/2/16*32/14
PhyS_I (Phyto energy reserve)	mmol photon m-3	1*7/2/14*1060/16	1*7/2/14*1060/16	1*7/2/14*1060/16
PhyL_I (Phyto energy reserve)	mmol photon m-3	1*7/2/14*1060/16	1*7/2/14*1060/16	1*7/2/14*1060/16
PhyS_Chl	mgm-3	1	1	1
PhyL_Chl	mgm-3	1	1	1
ZooS_N	mgm-3	1.0*7.0	1.0*7.0	1.0*7.0
ZooL_N	mgm-3	1.0*7.0	1.0*7.0	1.0*7.0

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Table 12: Catchment information for the model: Note that until 2016 Plane Creek, Olive, Pascoe, Endeavour, Proserpine, Baffle and Murray were not included in the model domain and not in model run 926 (data adapted from Steven, ADL, Hodge, J, Cannard, T, Carlin, G, Franklin, H, McJannet, D, Moeseneder, C, Searle, R, 2014. Continuous Water Quality Monitoring on the Great Barrier Reef. CSIRO Final Report to Great Barrier Reef Foundation, 158pp.)

Rivers within the GBR	River included in 918 to 923 model	Percent of river ungauged	Order of rivers north to south	Load based catchment prioritisation: Weighted rank of runoff, TSS and nutrient loads	Yields based catchment prioritisation: Weighted rank of TSS and nutrient yields	Catchment information	Percentage increase in riverloads for model 919 to 923 for nutrients and TSS
Pioneer	yes	8	16	18	14	NA	50
Johnstone	yes	41	7	6	1	High TP conc. in surface soil (0.15g/g)	50
Calliope	yes	42	19	23	19	not ranked in top 18, High TP conc. in surface soil (0.15g/g)	50
Mulgrave-Russell	yes	52	6	5	2	High TP conc. in surface soil (0.15g/g)	50
Daintree	yes	61	4	13	6	NA	50
Normanby	yes	67	2	4	27	NA	50
O'Connell	yes	70	15	10	3	intense cropping	50
Don	yes	84	13	18	22	not ranked in top 18	50
Tully	yes	12	8	12	10	intense cropping	20
Herbert	yes	13	10	7	19	intense cropping	20
Mary	yes	19	23	3	8	NA	20
Haughton	yes	32	11	17	16	NA	20
Barron River	yes	11	5	31	24	not ranked in top 18, High TP conc. in surface soil (0.15g/g)	0
Boyne	yes	12	20	31	27	not ranked in top 18. High TP conc. in surface soil (0.15g/g)	0
Burdekin	yes	ok (0%)	12	1	27	NA	0
Burnett	yes	ok (2%)	22	8	27	intense cropping	0
Fitzroy	yes	ok (5%)	18	2	27	?	0
Plane Creek	no	81	17	9	3	intense cropping	NA
Olive Pascoe	no	unknown	1	11	12	pristine	NA
Endeavour	no	72	3	14	11	?	NA
Proserpine	no	87	14	15	6	?	NA
Baffle	no	63	21	16	16	?	NA
Murray	no	86	9	23	8	?	NA

6 Model assessment

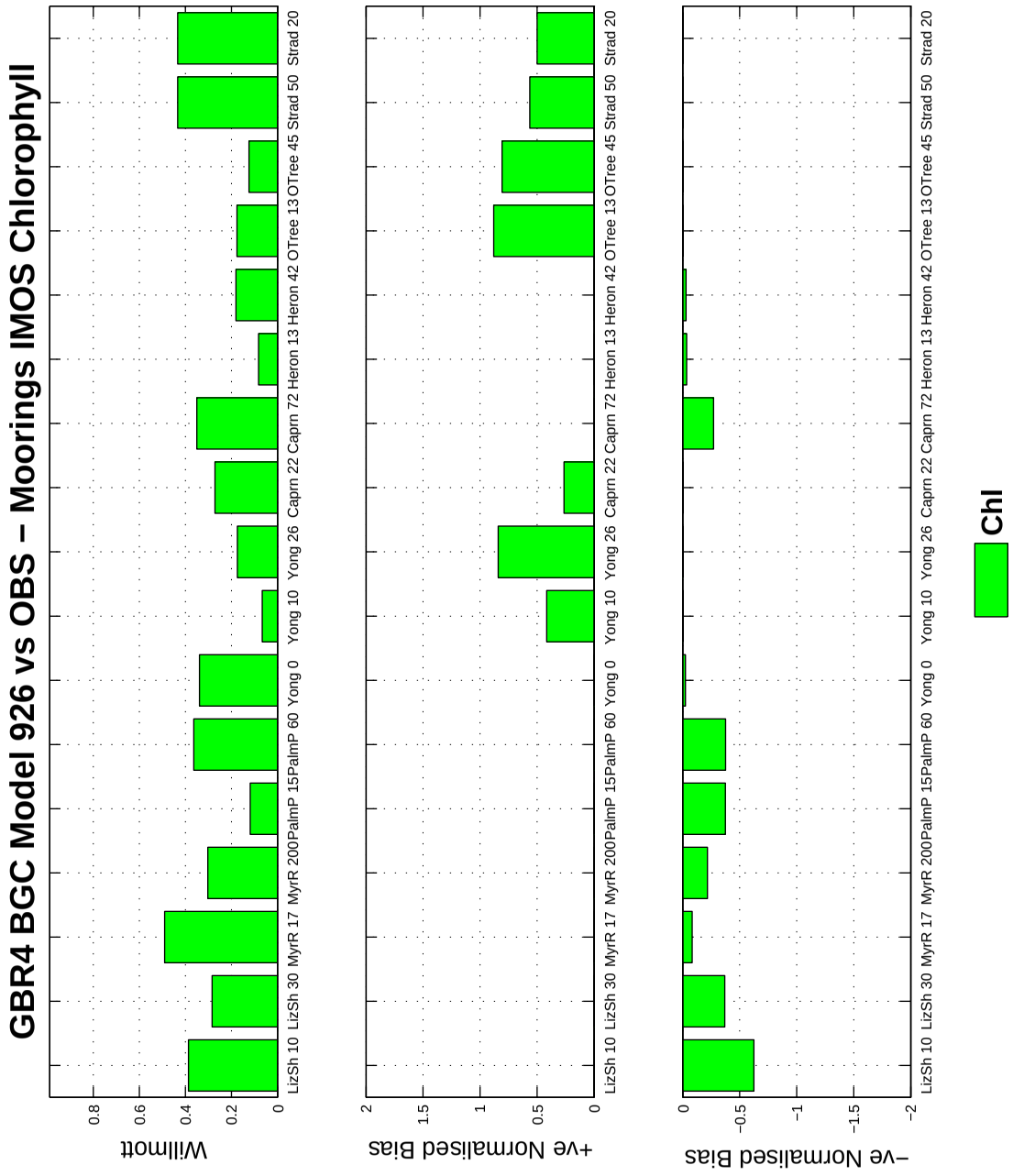


Figure 11: Statistical plots for the normalised bias and willmott index metrics for chlorophyll at the IMOS moorings.

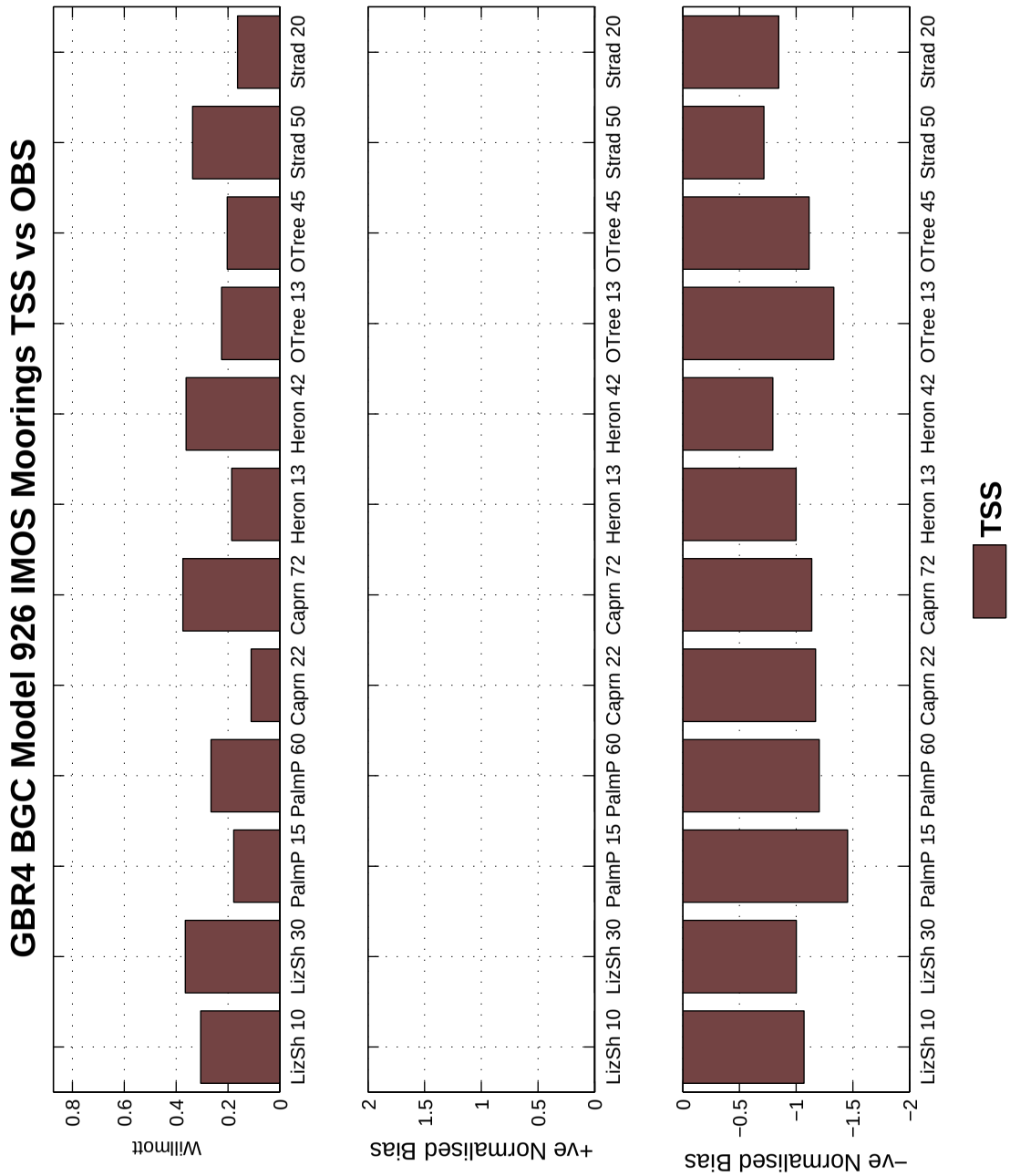


Figure 12: Statistical plots for the normalised metrics shown in the figures for the IMOS moorings TSS. Numbers at end of site name indicate depth

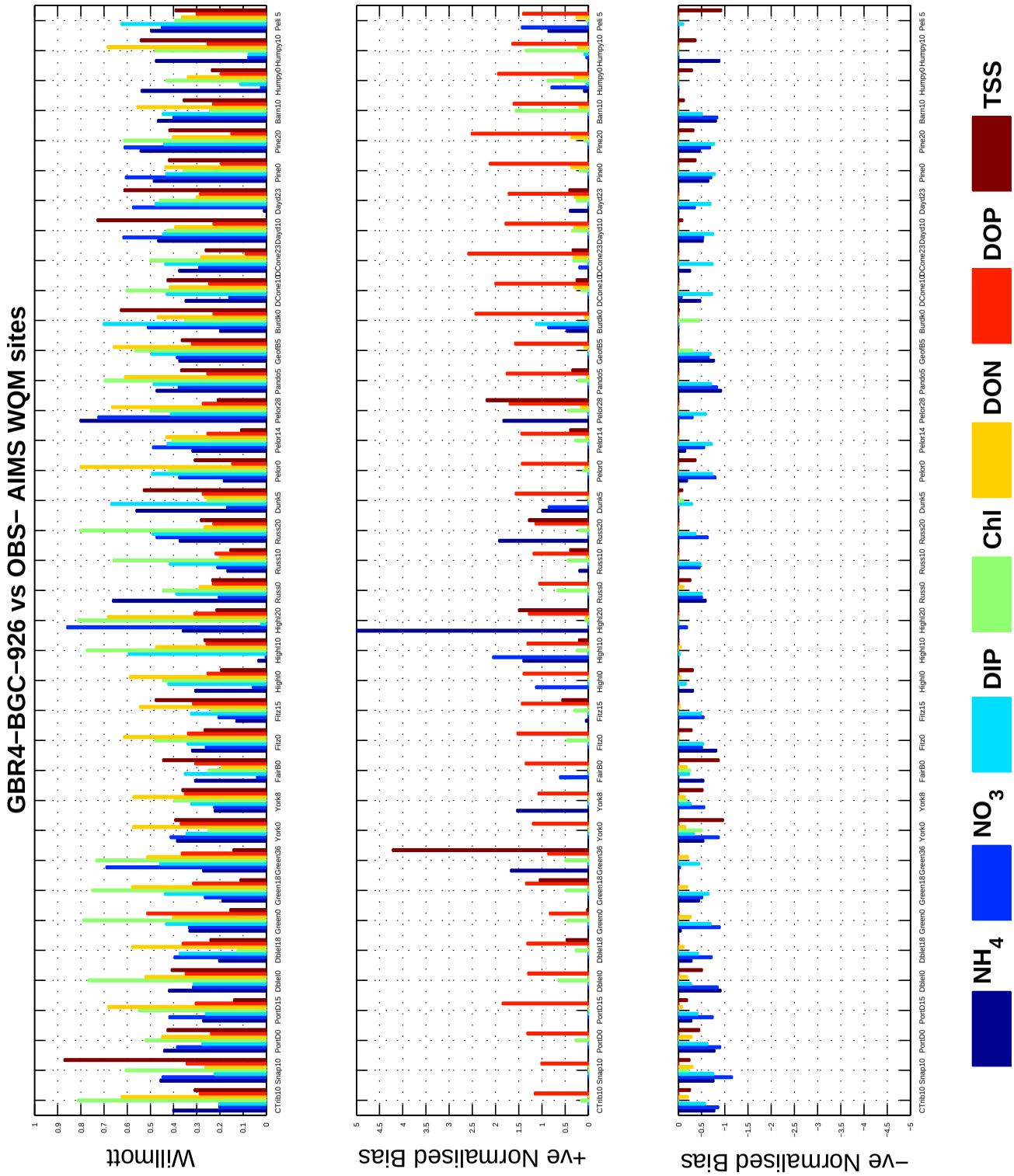


Figure 13: Statistical plots for the normalised metrics shown in the figures for the AIMS water qualtiy monitoring sites. Numbers at end of site name indicate depth

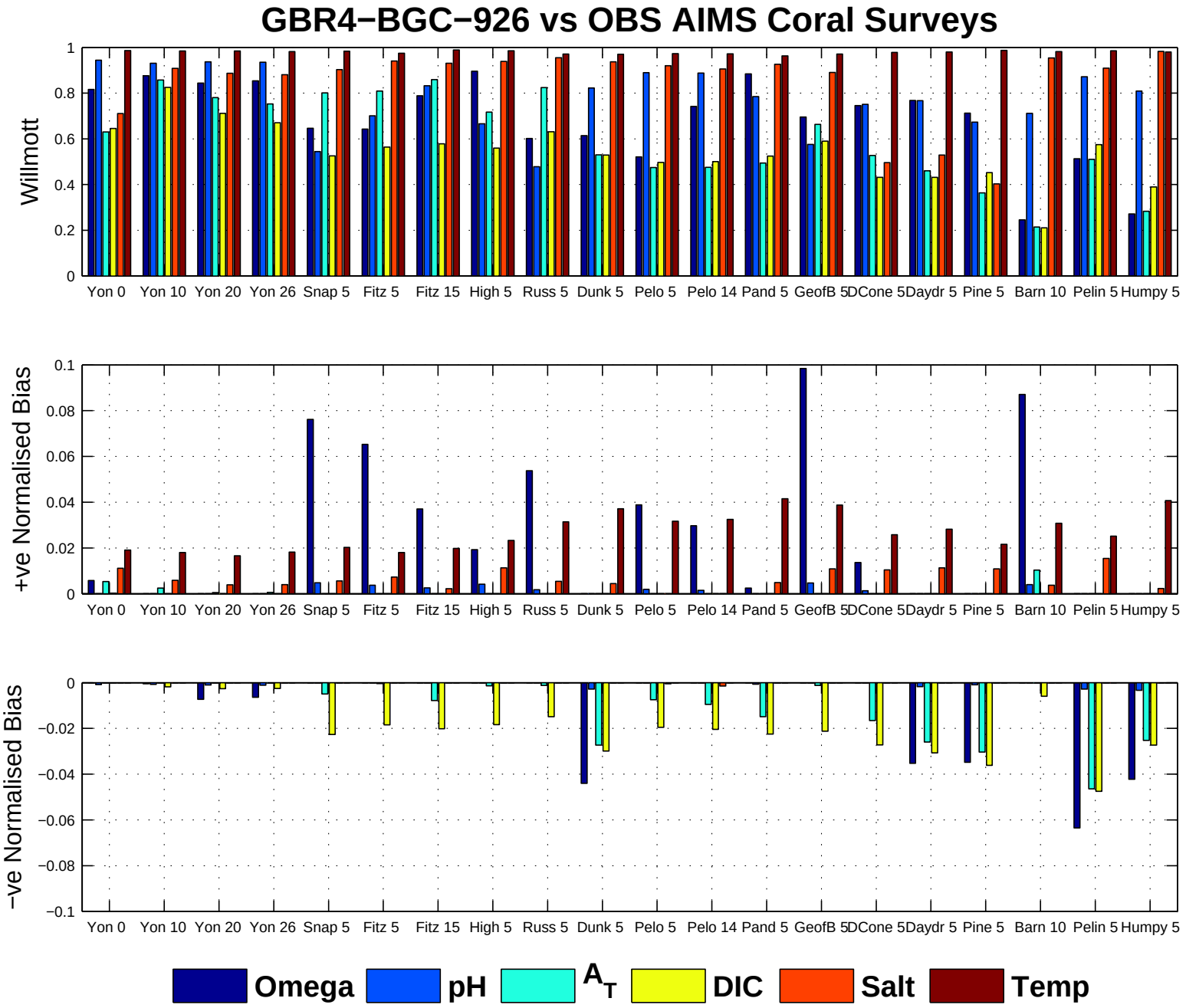


Figure 14: Statistical plots for the normalised metrics shown in the figures for the Coral Survey sites. Numbers at end of site name indicate depth

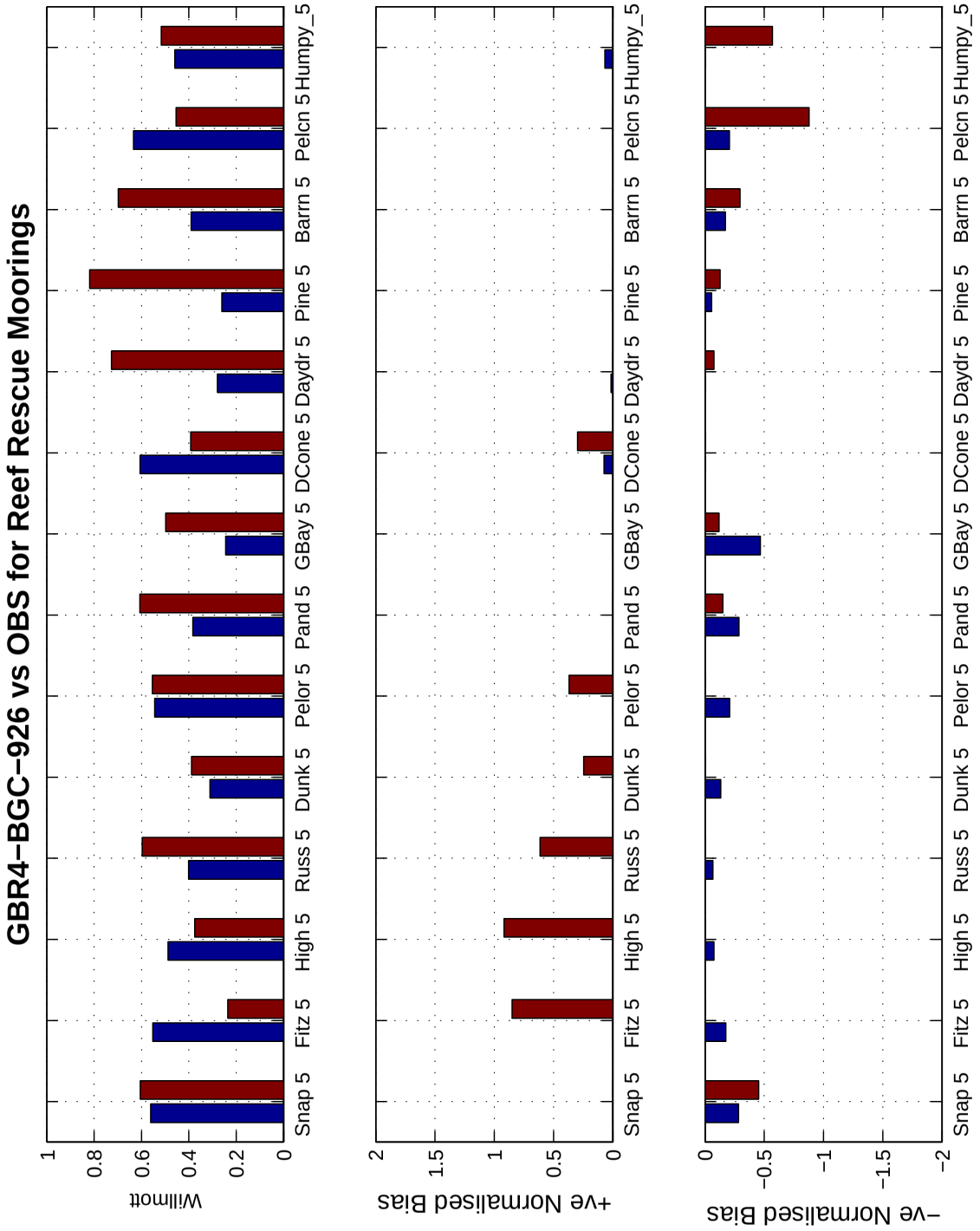


Figure 15: Statistical plots for the normalised metrics shown in the figures for the Reef Rescue sites for chlorophyll and TSS. Numbers at end of site name indicate depth

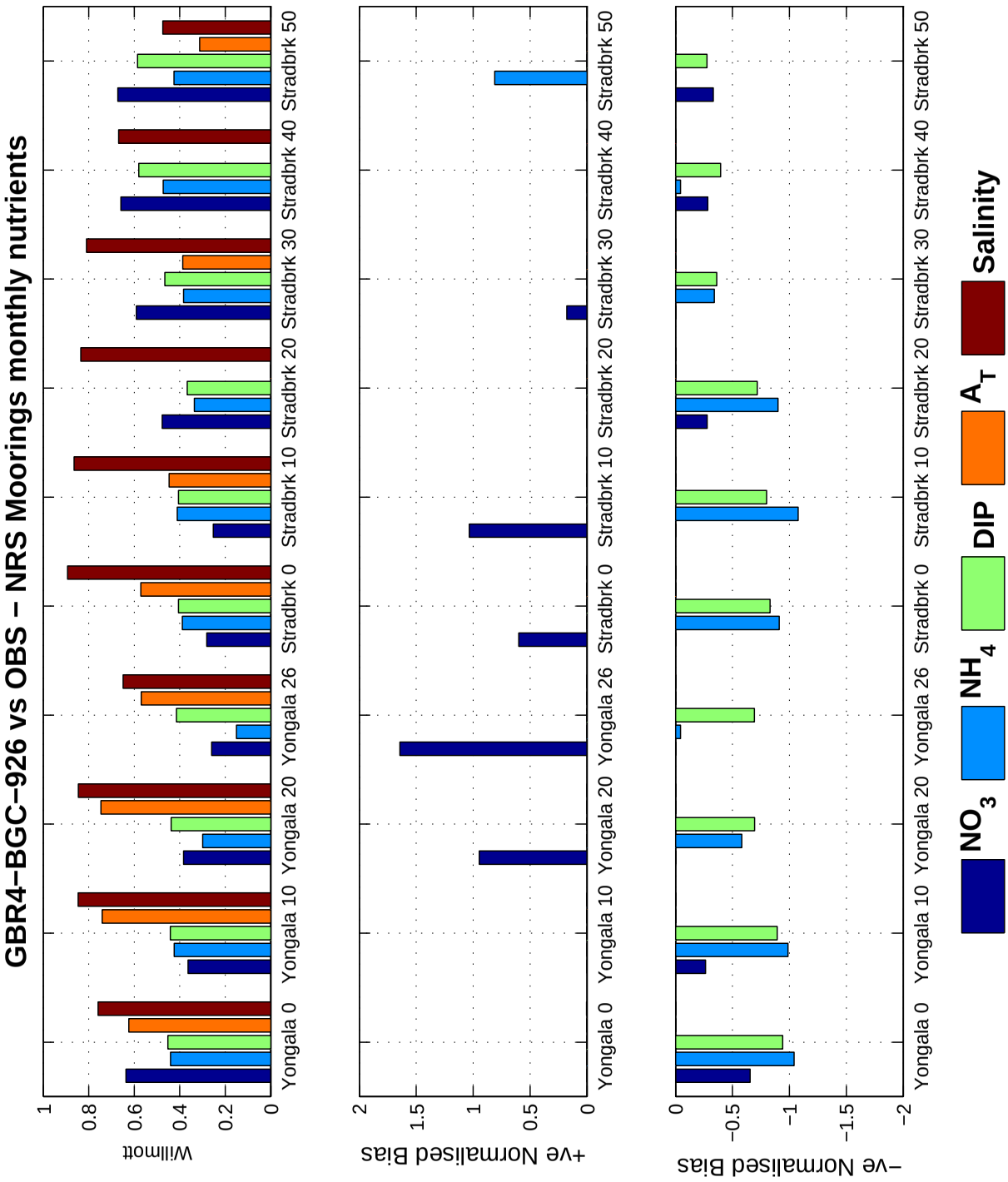


Figure 16: Statistical plots for the normalised metrics shown in the figures for the NRS moorings for chlorophyll and nutrients. Numbers at end of site name indicate depth

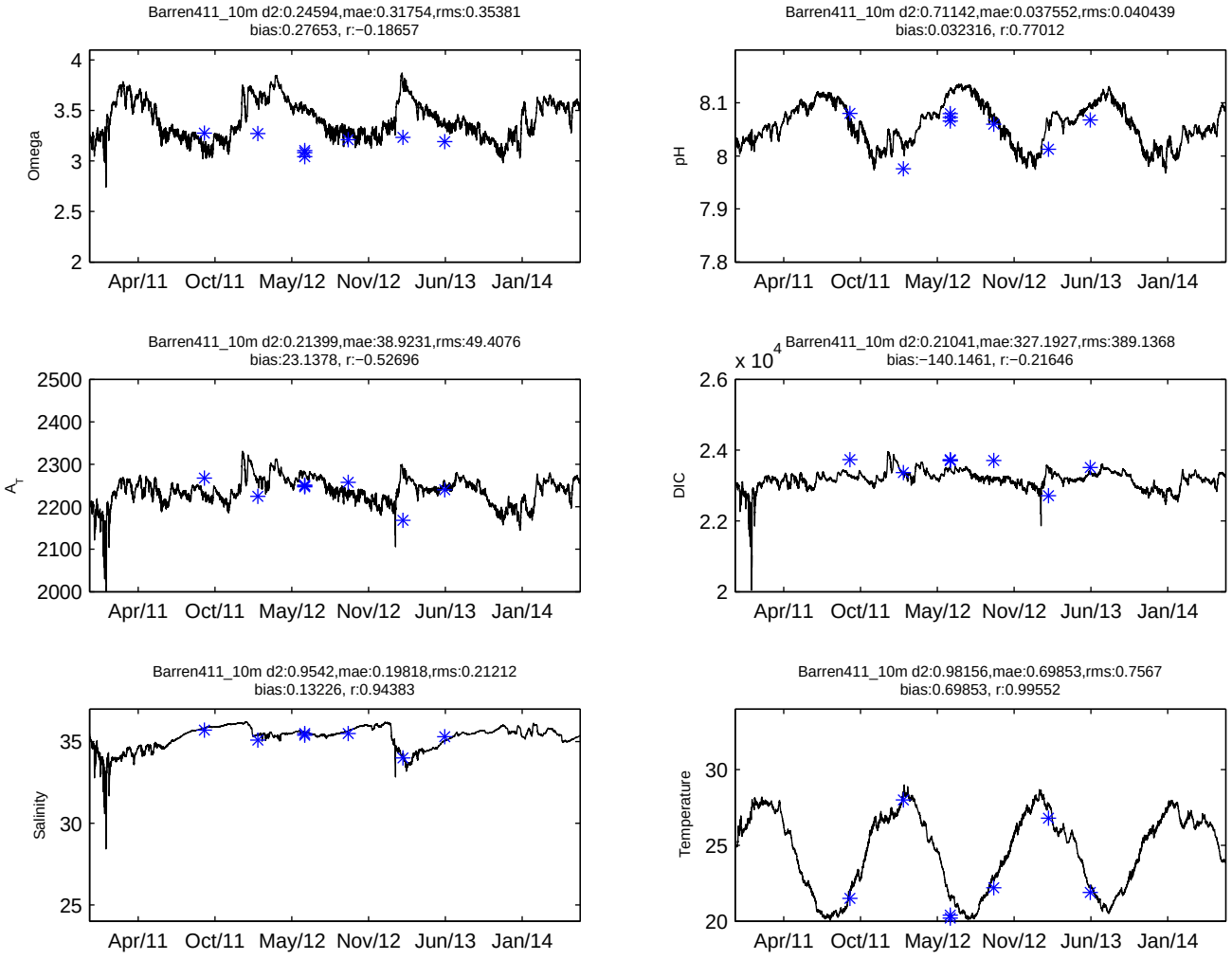


Figure 17: Barren Island Coral dataset (AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 10 m. Model grid deepest point at this site 24.26 m. Observation deepest point at this site 15.2 to 18.9 m.

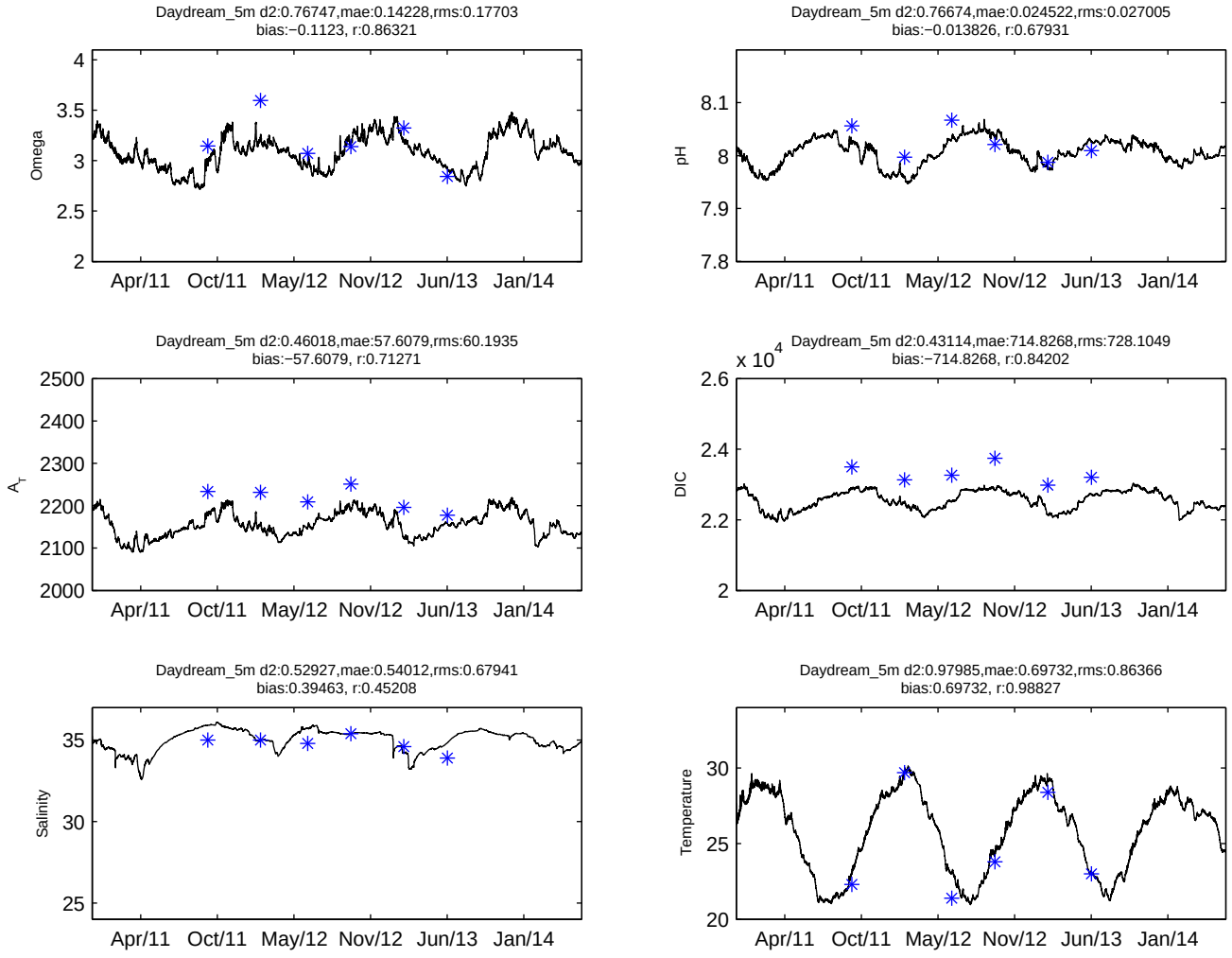


Figure 18: Daydream Island Coral dataset (AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 5 m. Model grid deepest point at this site 16.76 m. Observation deepest point at this site 23.6 to 25.9 m.

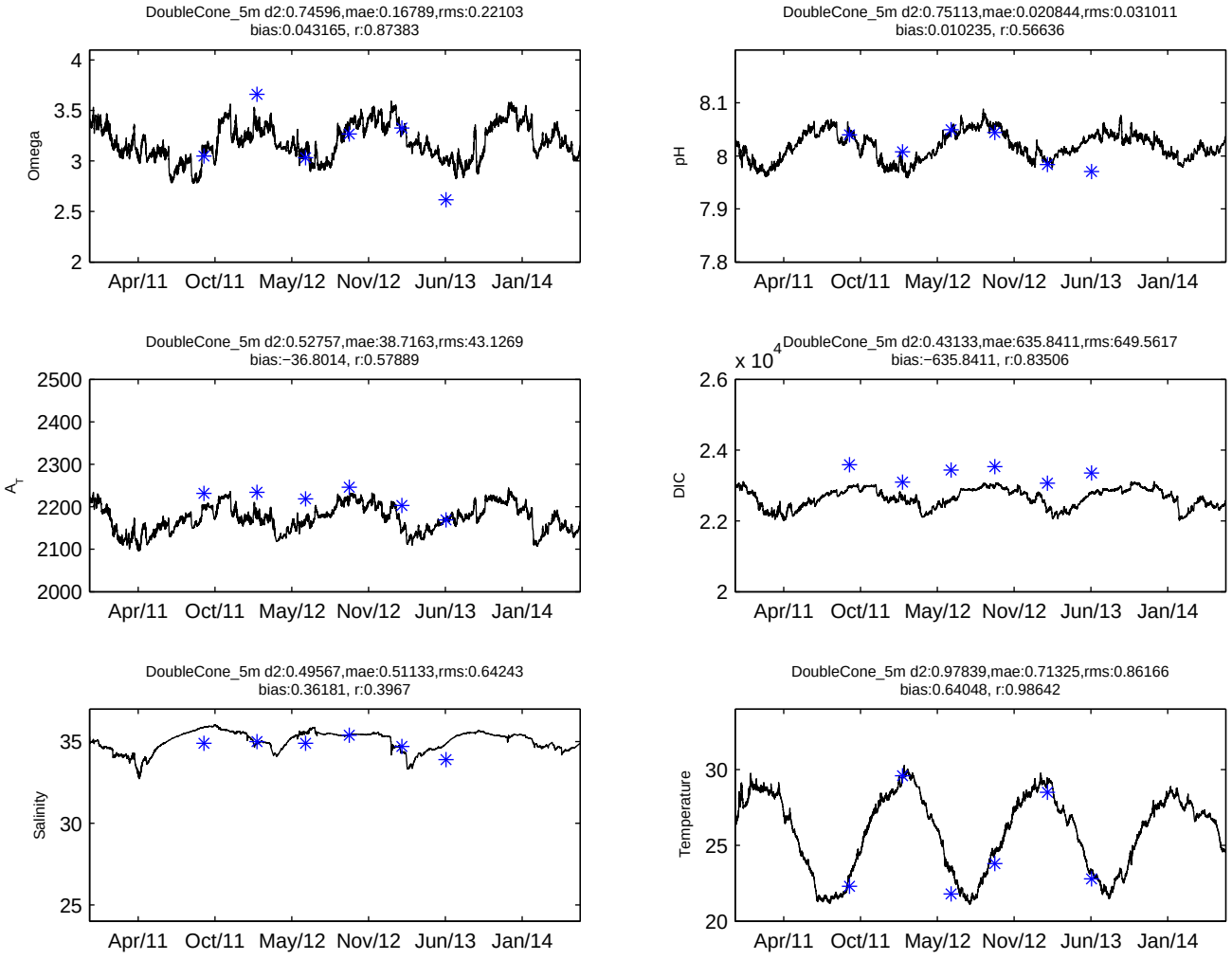


Figure 19: Double Cone Island Coral dataset (AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 5 m. Model grid deepest point at this site 17.03 m. Observation deepest point at this site 23.0 to 31.0 m.

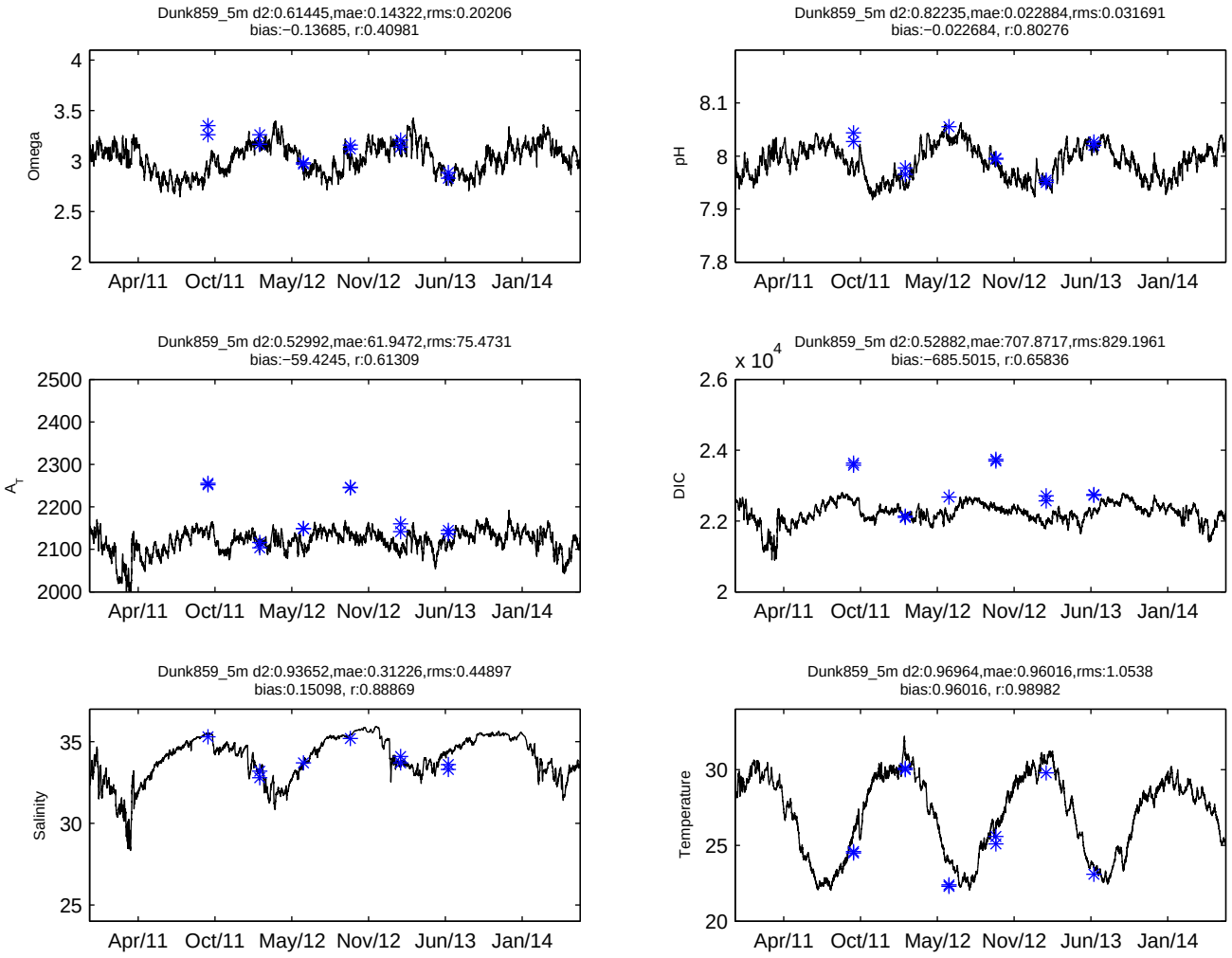


Figure 20: Dunk Island Coral dataset (AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 5 m. Model grid deepest point at this site 9.15 m. Observation deepest point at this site 9.0 to 10.4 m.

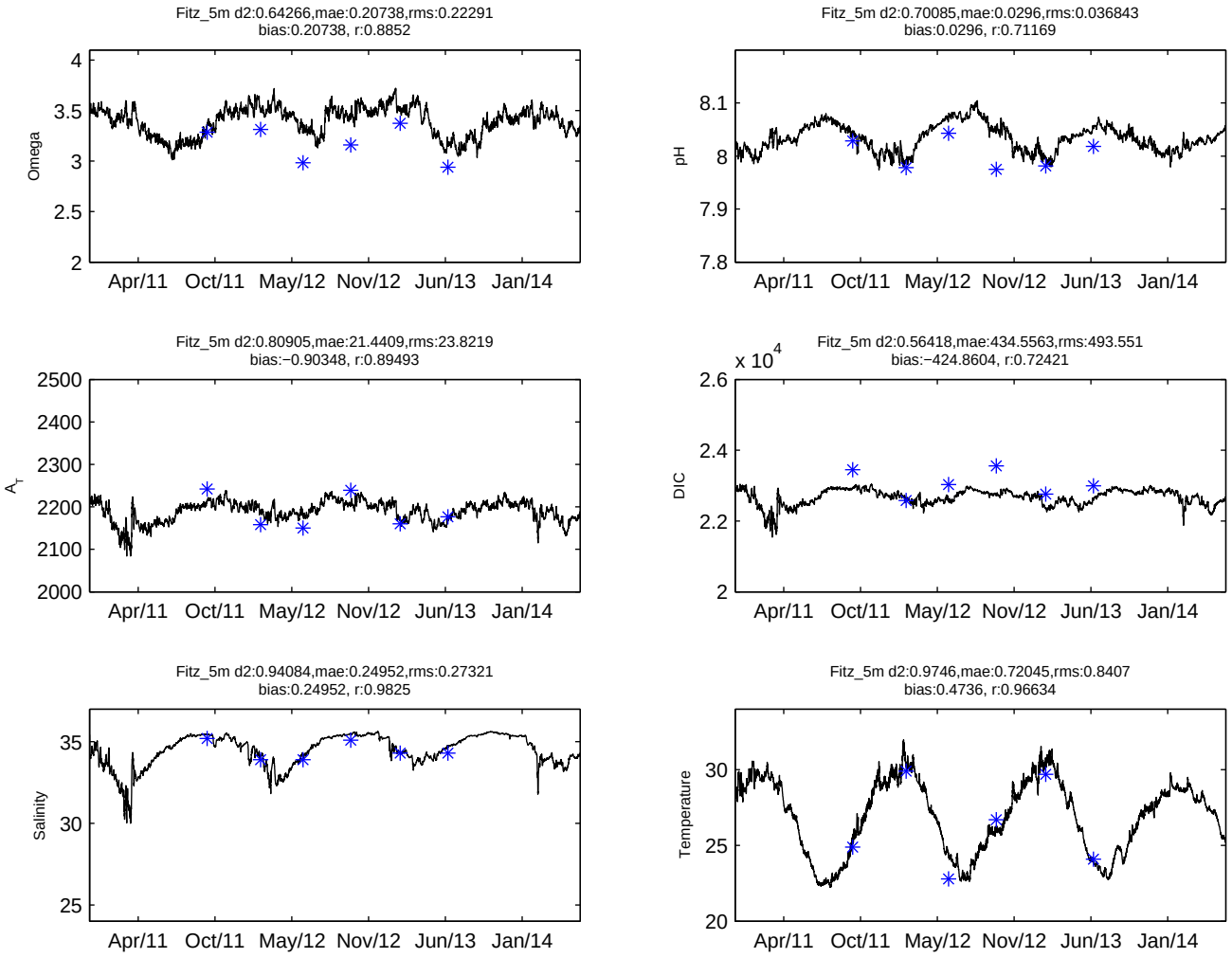


Figure 21: Fitzroy Reef Coral dataset (AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 5 m. Model grid deepest point at this site 27 m. Observation deepest point at this site 15.5 to17.2 m.

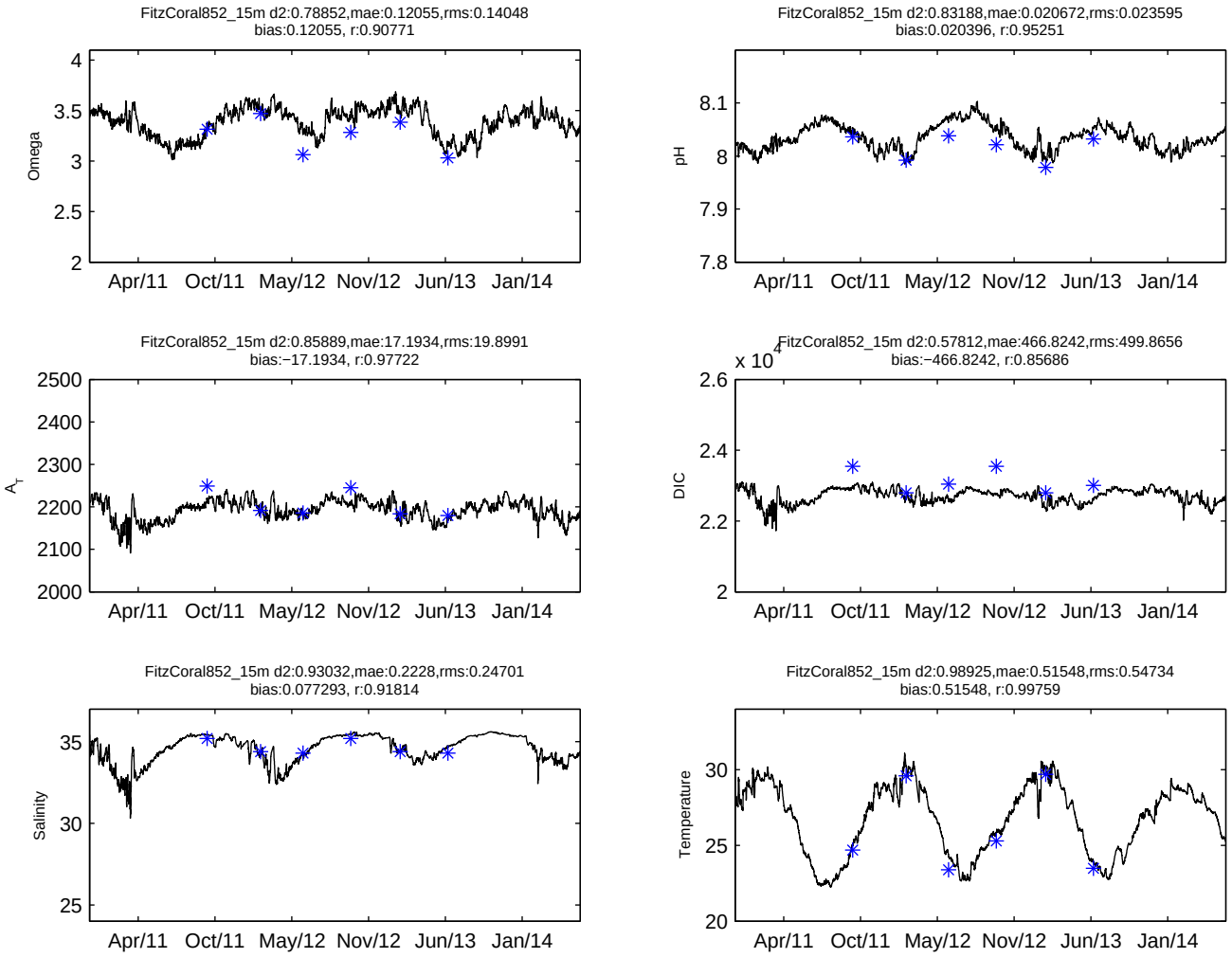


Figure 22: Fitzroy Reef Coral dataset (AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 15 m. Model grid deepest point at this site 27 m. Observation deepest point at this site 15.5 to17.2 m.

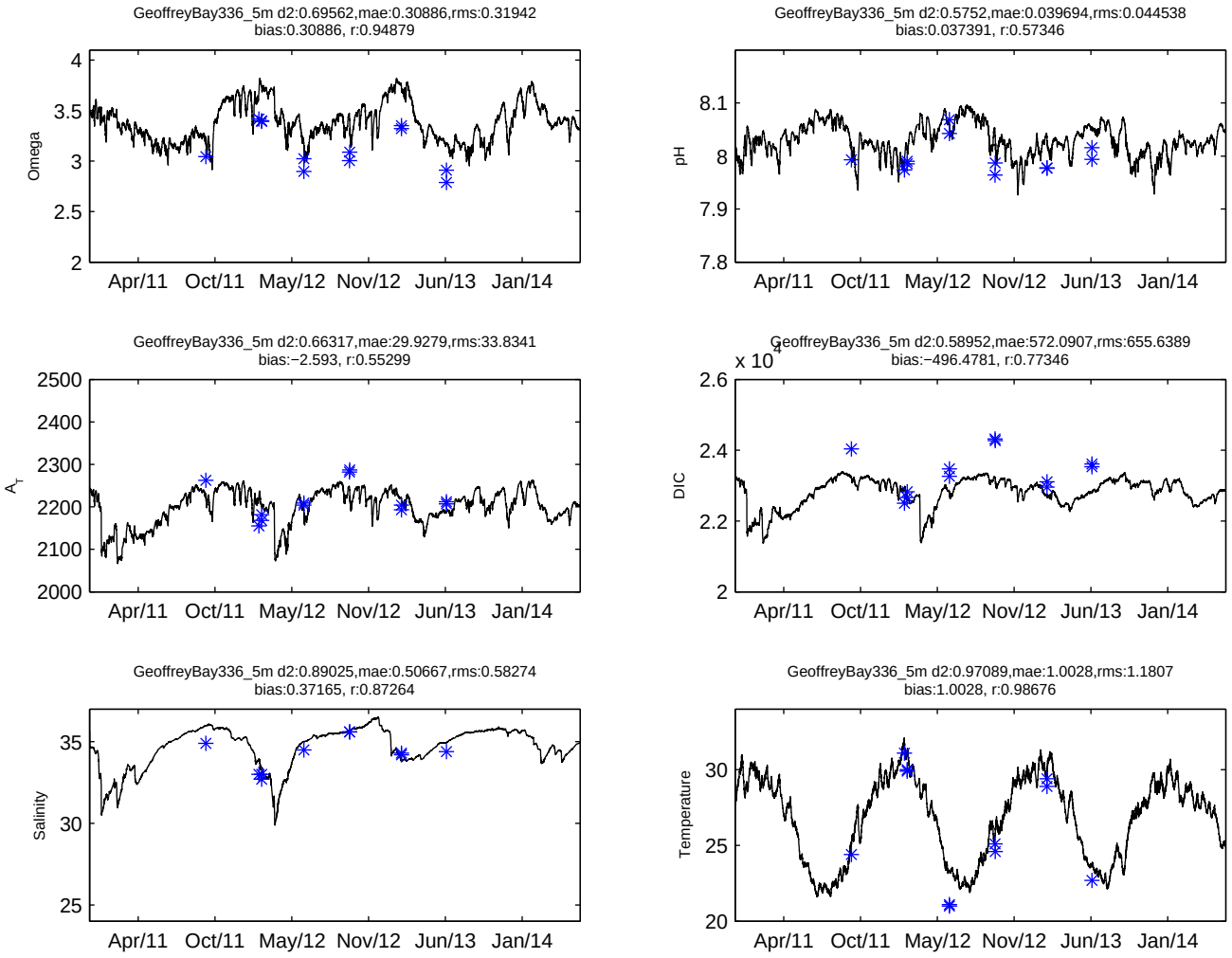


Figure 23: Geoffrey Bay Coral dataset (AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 5 m. Model grid deepest point at this site -10.42 m. Observation deepest point at this site 9.9 to 12 m.

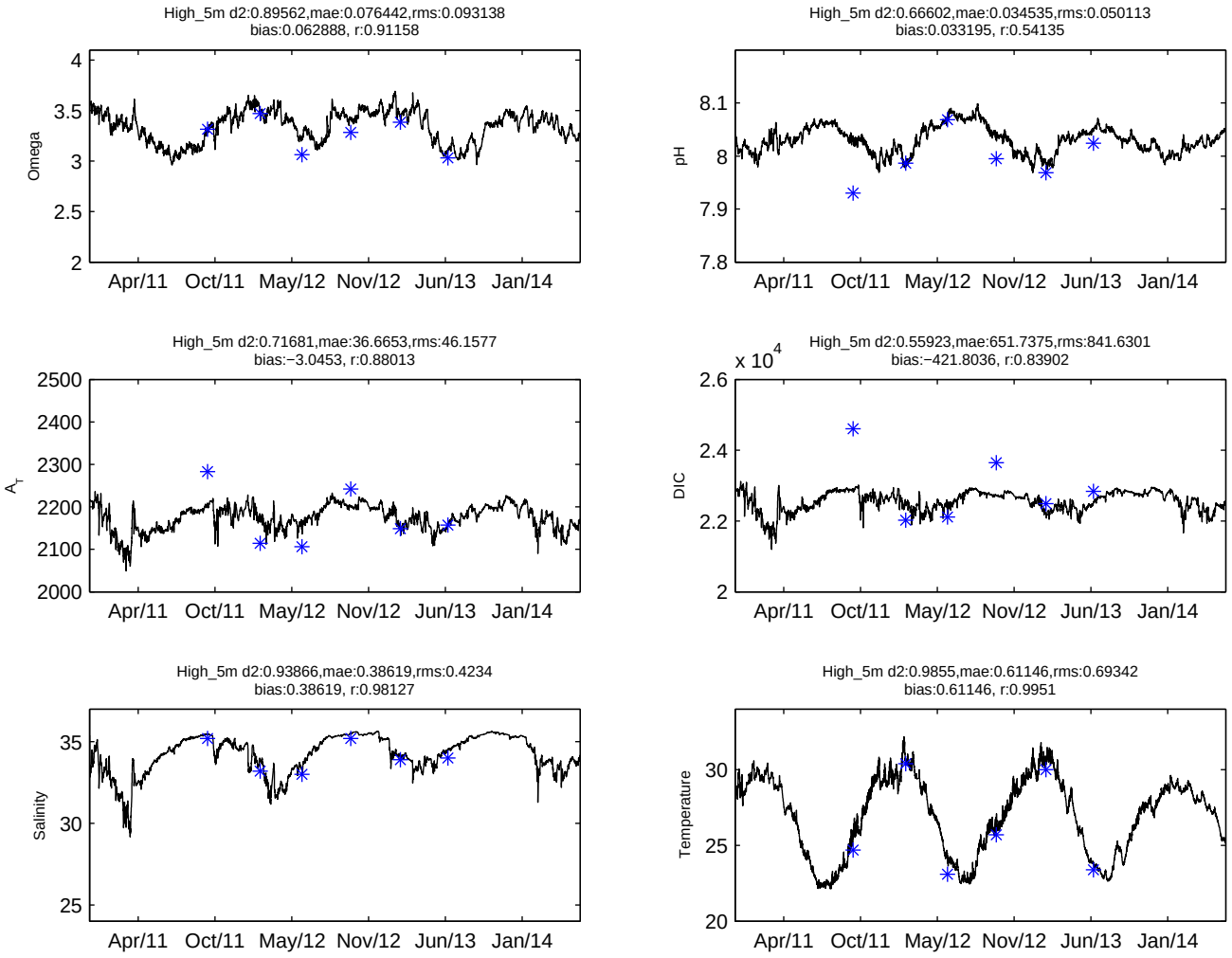


Figure 24: High Island Coral dataset (AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 5 m. Model grid deepest point at this site -17.64 m. Observation deepest point at this site 22.0 to 25.3 m.

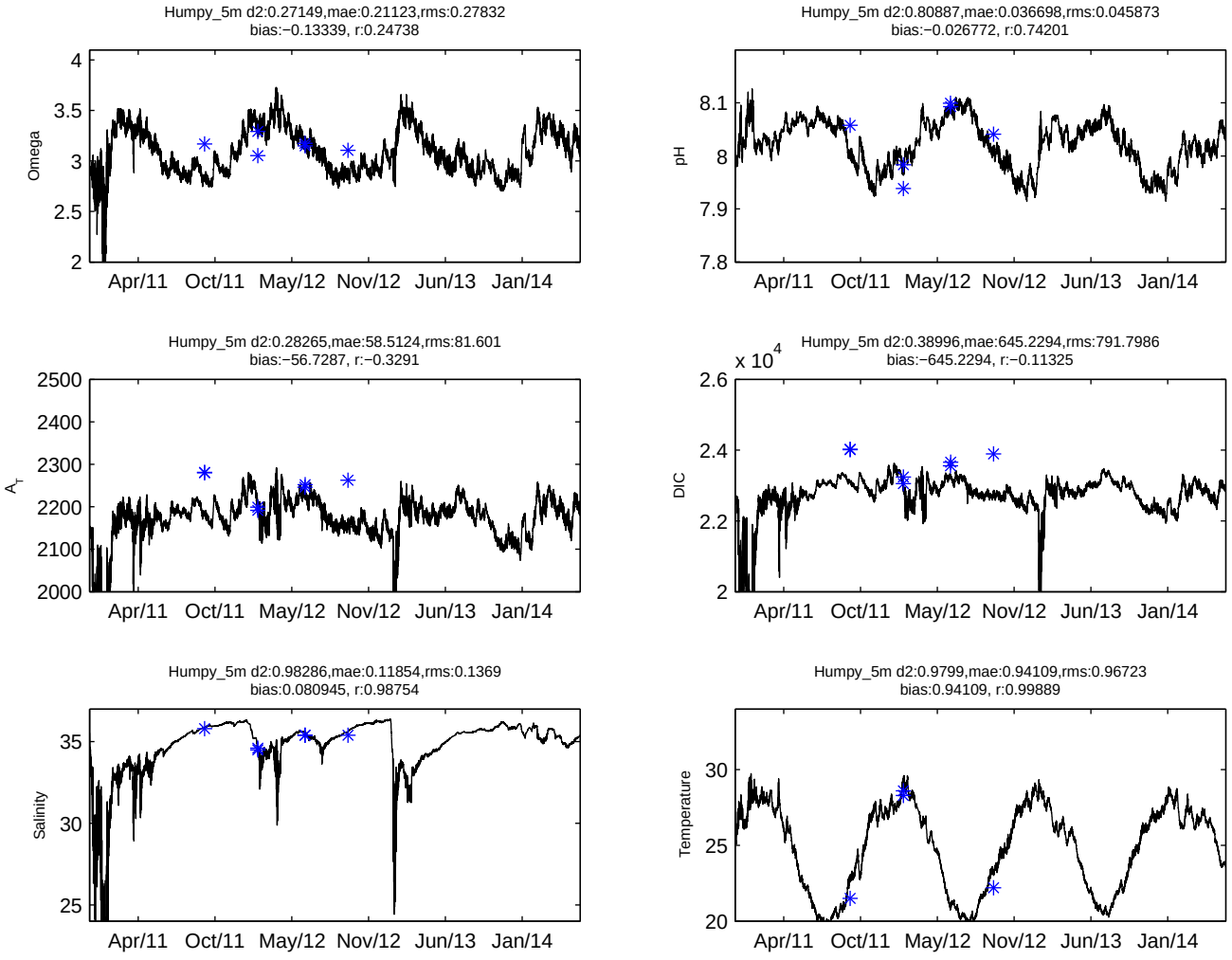


Figure 25: Humpy Island Coral dataset (AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 5 m. Model grid deepest point at this site -12.86 m. Observation deepest point at this site 12.6 to 19.5 m.

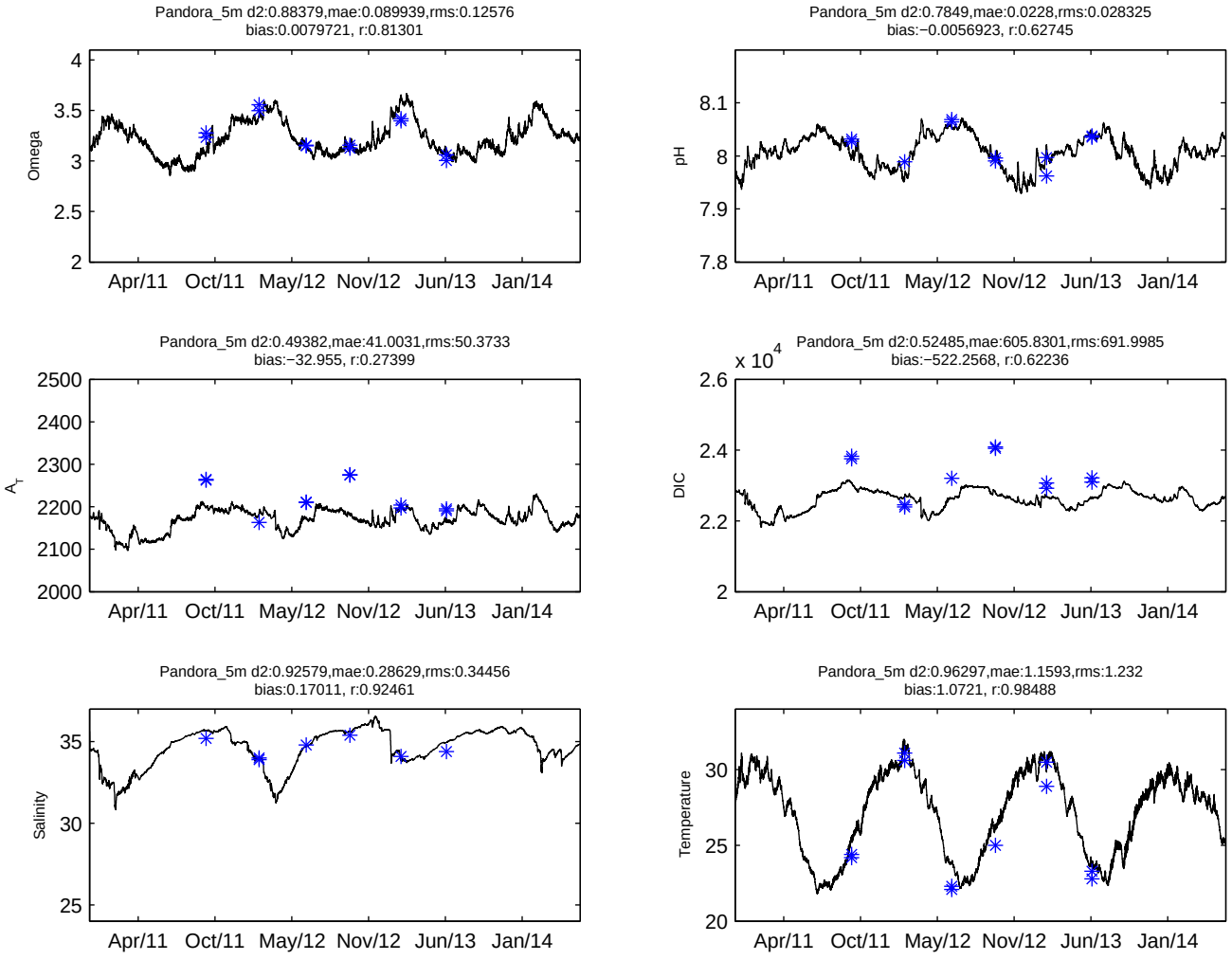


Figure 26: Pandora Island Coral dataset (AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 5 m. Model grid deepest point at this site -16.98 m. Observation deepest point at this site 12.9 to 13.9 m.

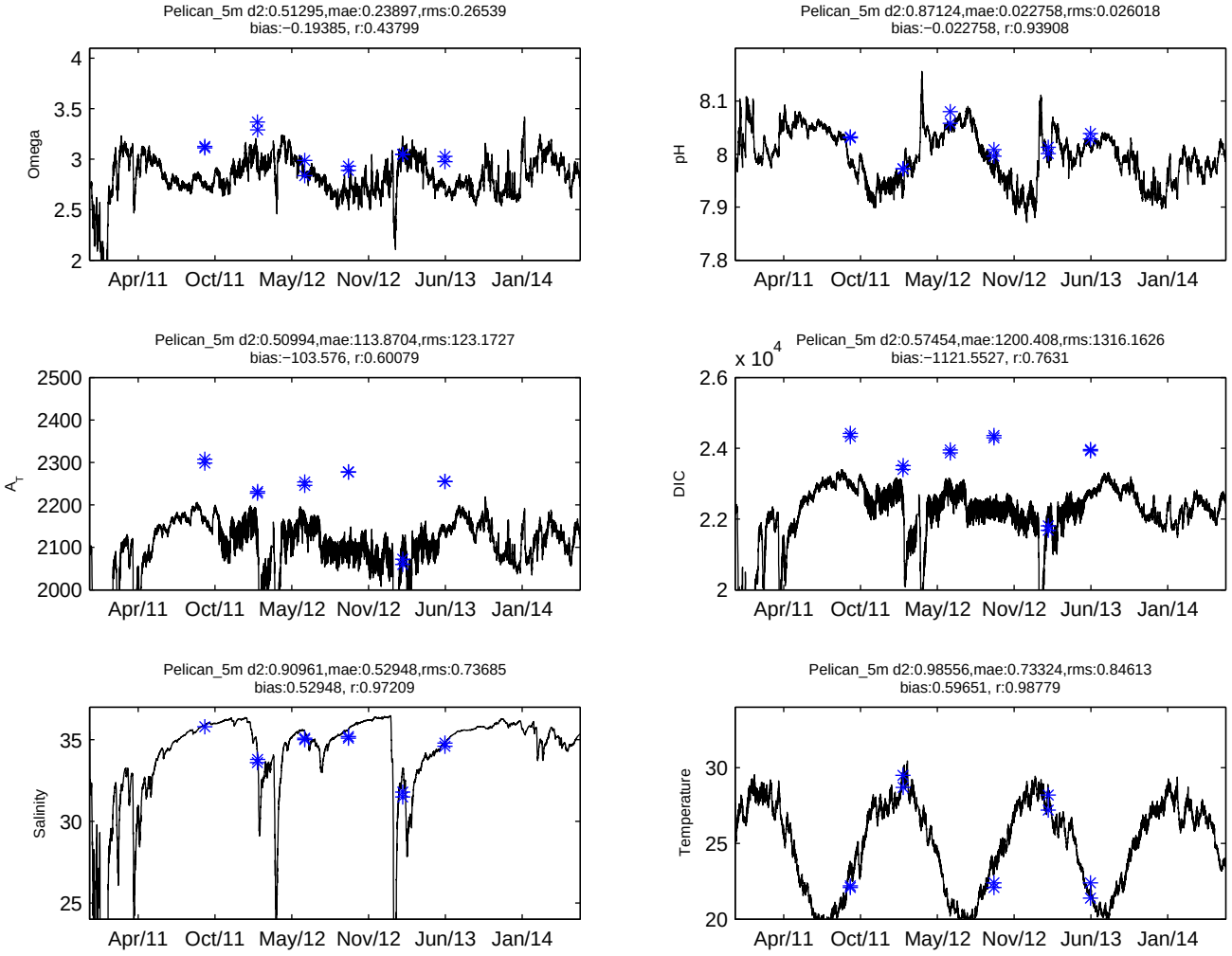


Figure 27: Pelican Island Coral dataset (AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 5 m. Model grid deepest point at this site -4.47 m. Observation deepest point at this site 8.8 to 9.7 m.

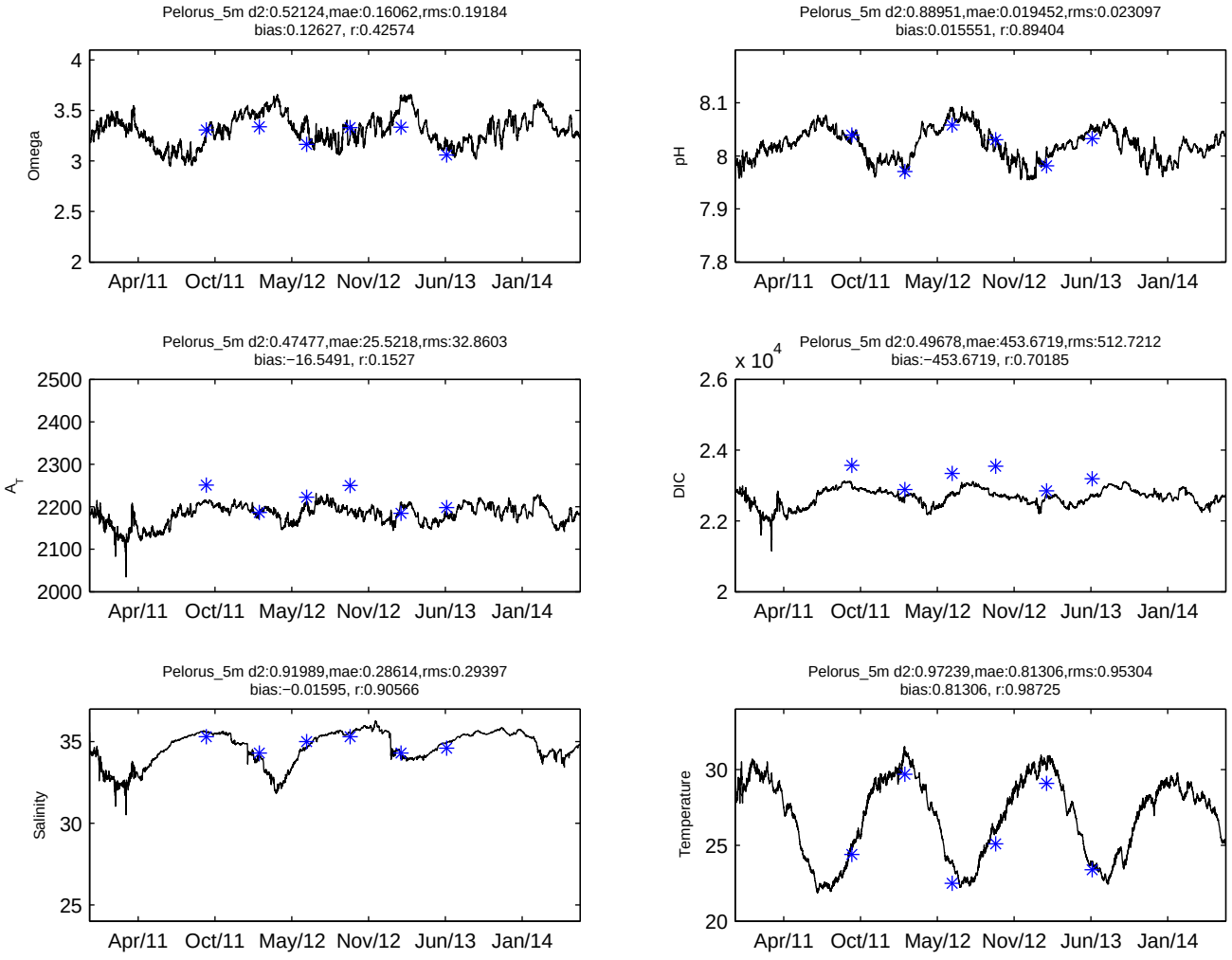


Figure 28: Pelorous/Orpheus Island Coral dataset (AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 5 m. Model grid deepest point at this site -24.64 m. Observation deepest point at this site 25.3 to 31.4 m.

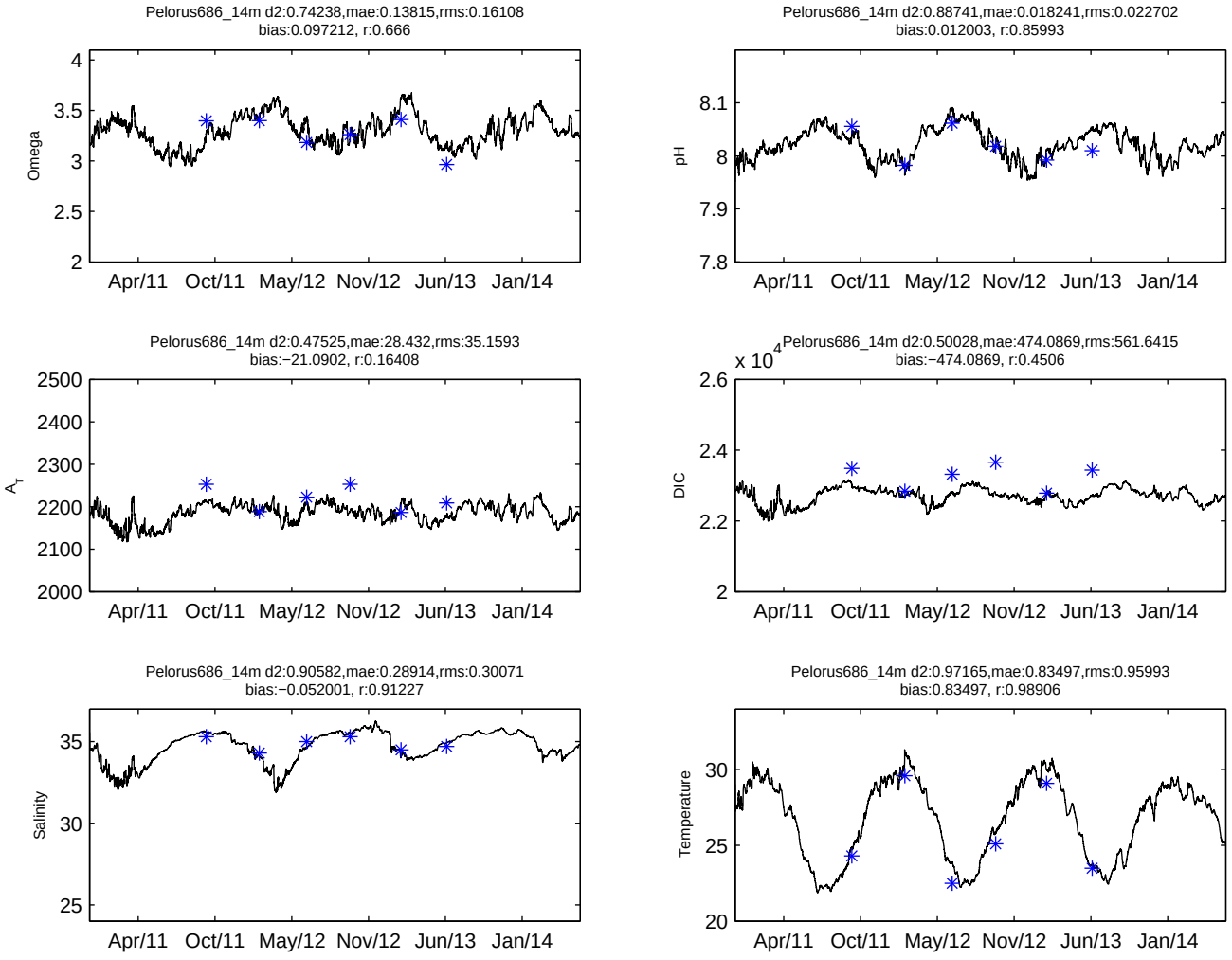


Figure 29: Pelorous/Orpheus Island Coral dataset (AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 14 m. Model grid deepest point at this site -24.64 m. Observation deepest point at this site 25.3 to 31.4 m.

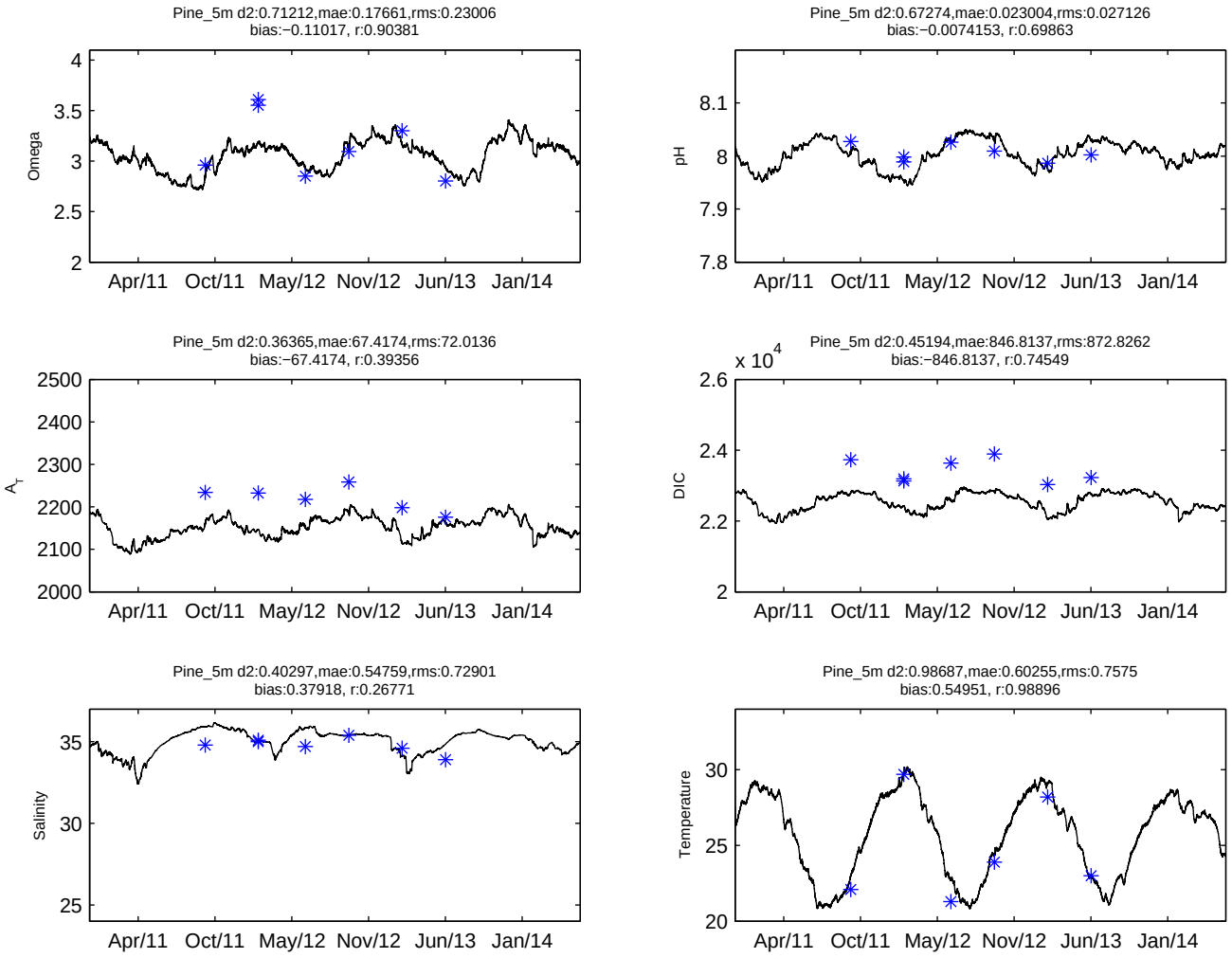


Figure 30: Pine Island Coral dataset (AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 5 m. Model grid deepest point at this site -18.14 m. Observation deepest point at this site 20.0 to 25.7 m.

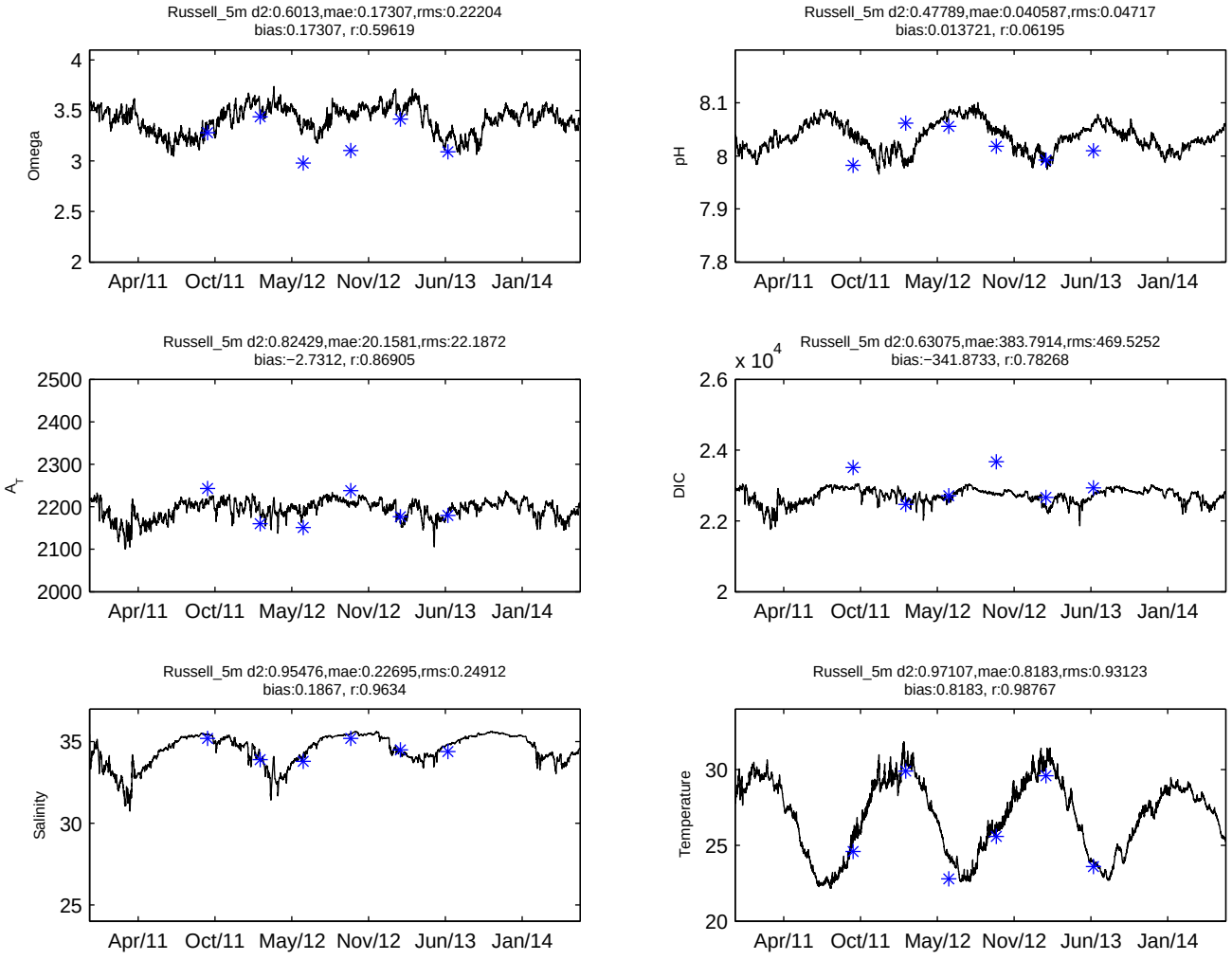


Figure 31: Russell Island Coral dataset (AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 5 m. Model grid deepest point at this site -19.94 m. Observation deepest point at this site 22.0 to 23.7 m.

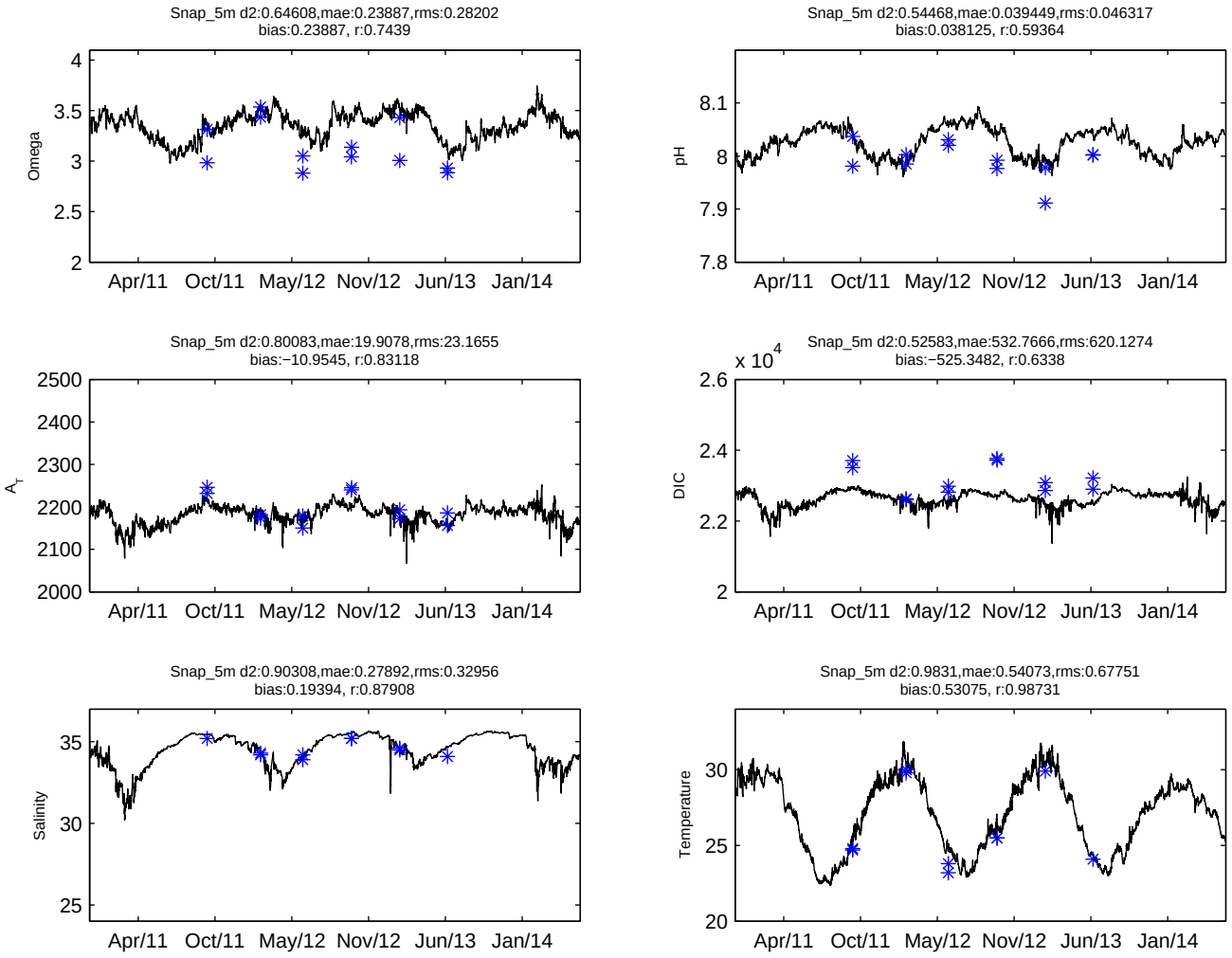


Figure 32: Snapper Island Coral dataset (AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 5 m. Model grid deepest point at this site -22.14 m. Observation deepest point at this site 8.0 to 11.2 m.

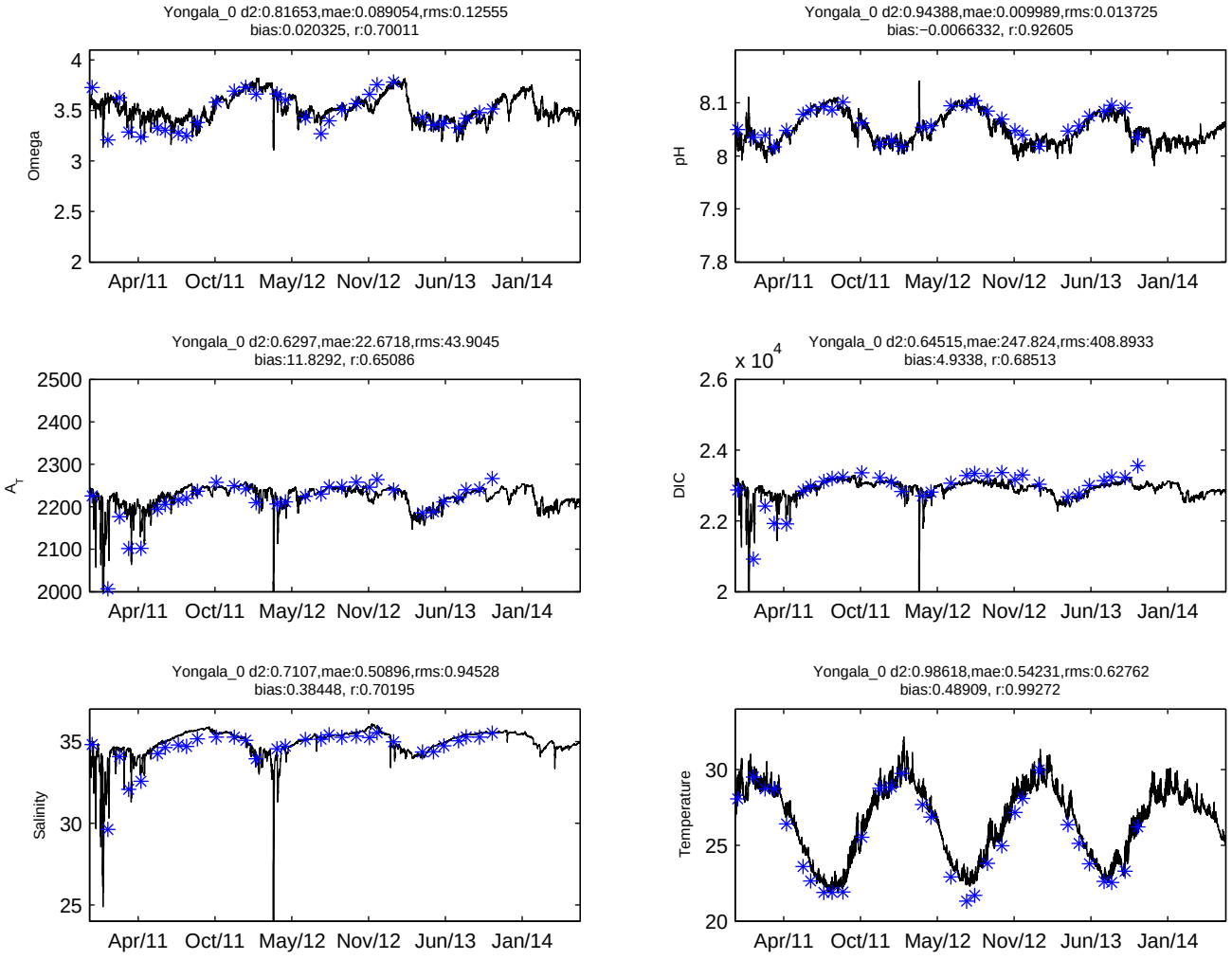


Figure 33: Yongala (NRSYON) Coral dataset (NRS/AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 0 m. Model grid deepest point at this site -28.62 m. Observation deepest point at this site 27 m.

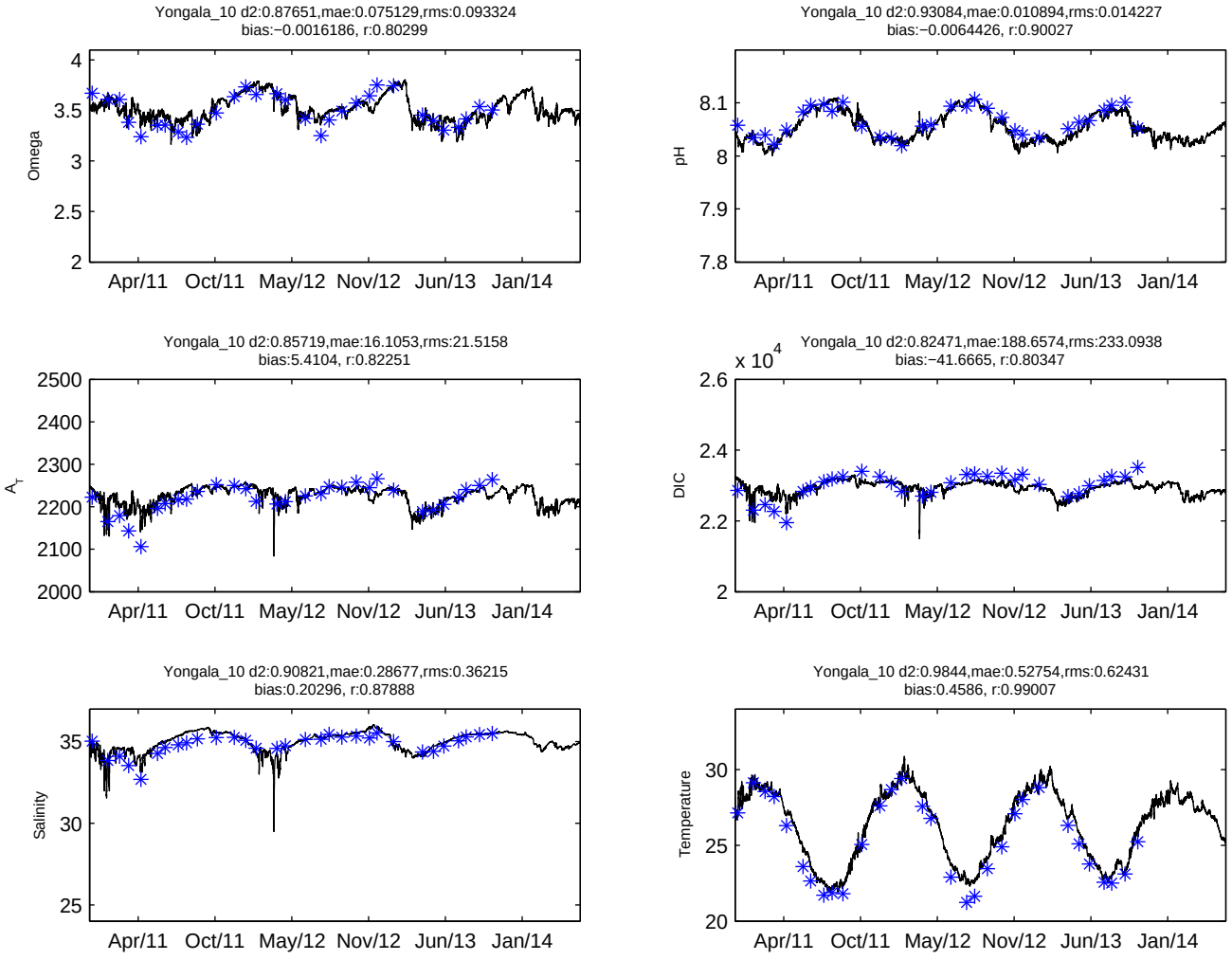


Figure 34: Yongala (NRSYON) Coral dataset (NRS/AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 10 m. Model grid deepest point at this site -28.62 m. Observation deepest point at this site 27 m.

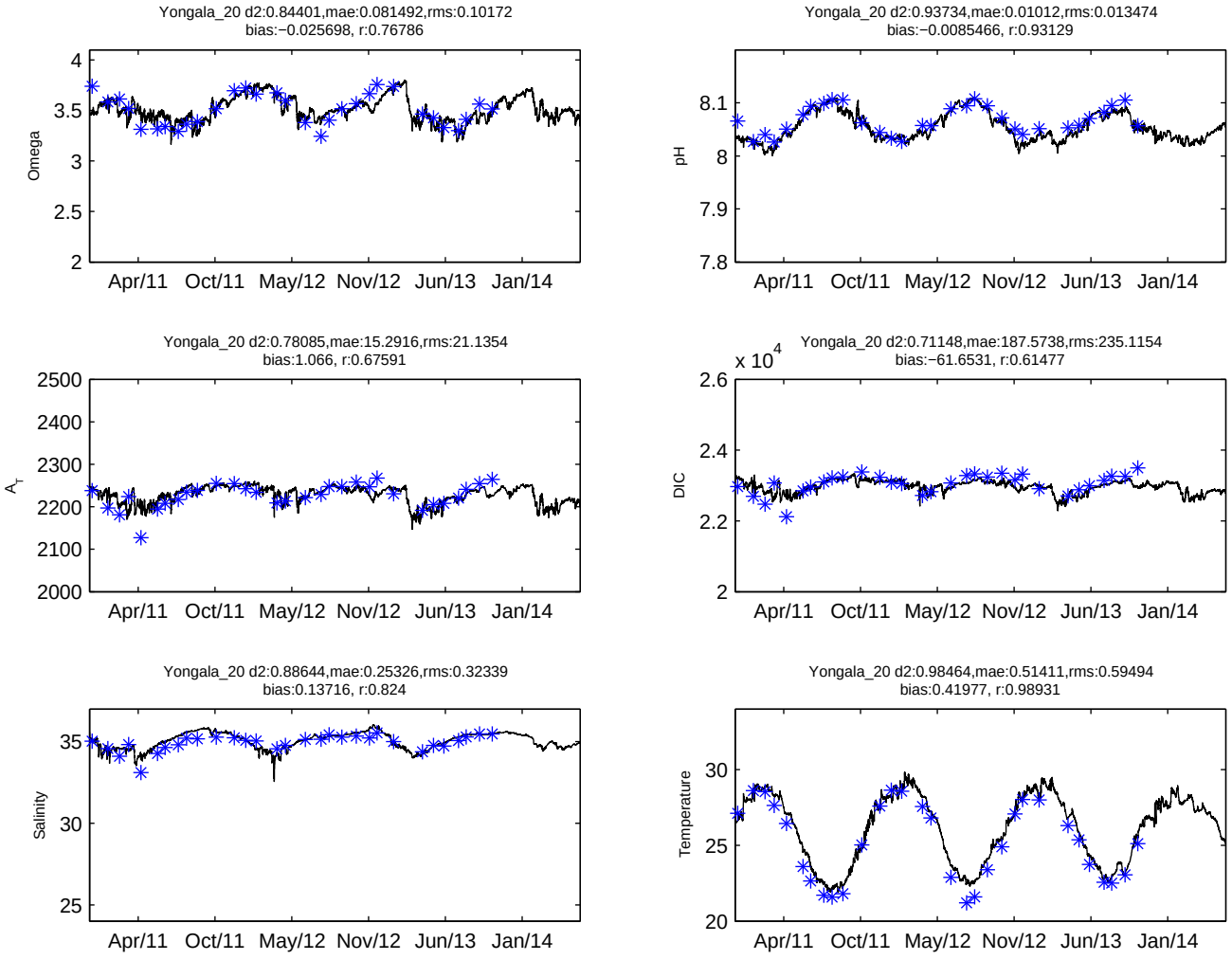


Figure 35: Yongala (NRSYON) Coral dataset (NRS/AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 20 m. Model grid deepest point at this site -28.62 m. Observation deepest point at this site 27 m.

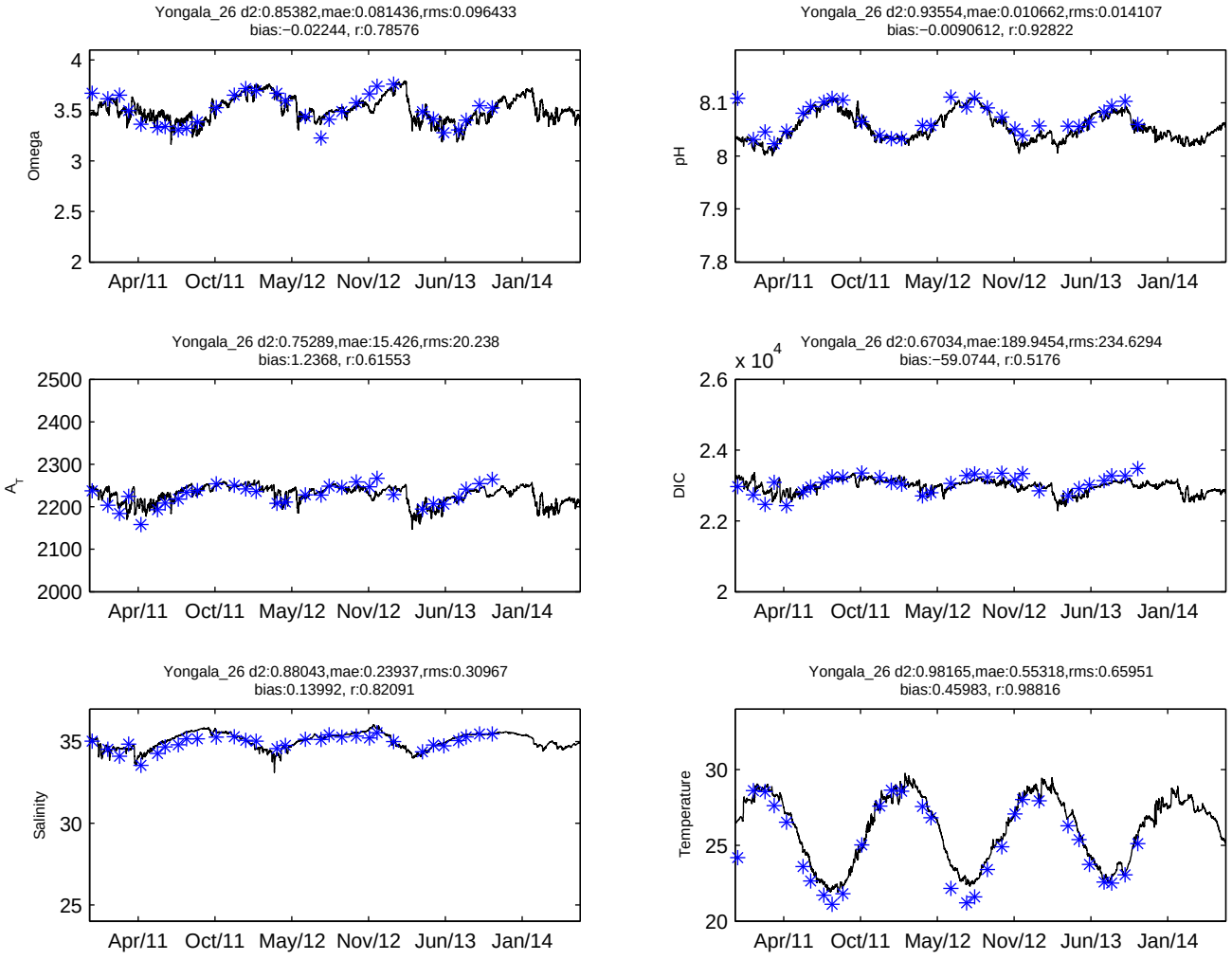


Figure 36: Yongala (NRSYON) Coral dataset (NRS/AIMS) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = Omega, pH, A_T, DIC, Salinity, Temperature. Field observation depth taken: 26 m. Model grid deepest point at this site -28.62 m. Observation deepest point at this site 27 m.

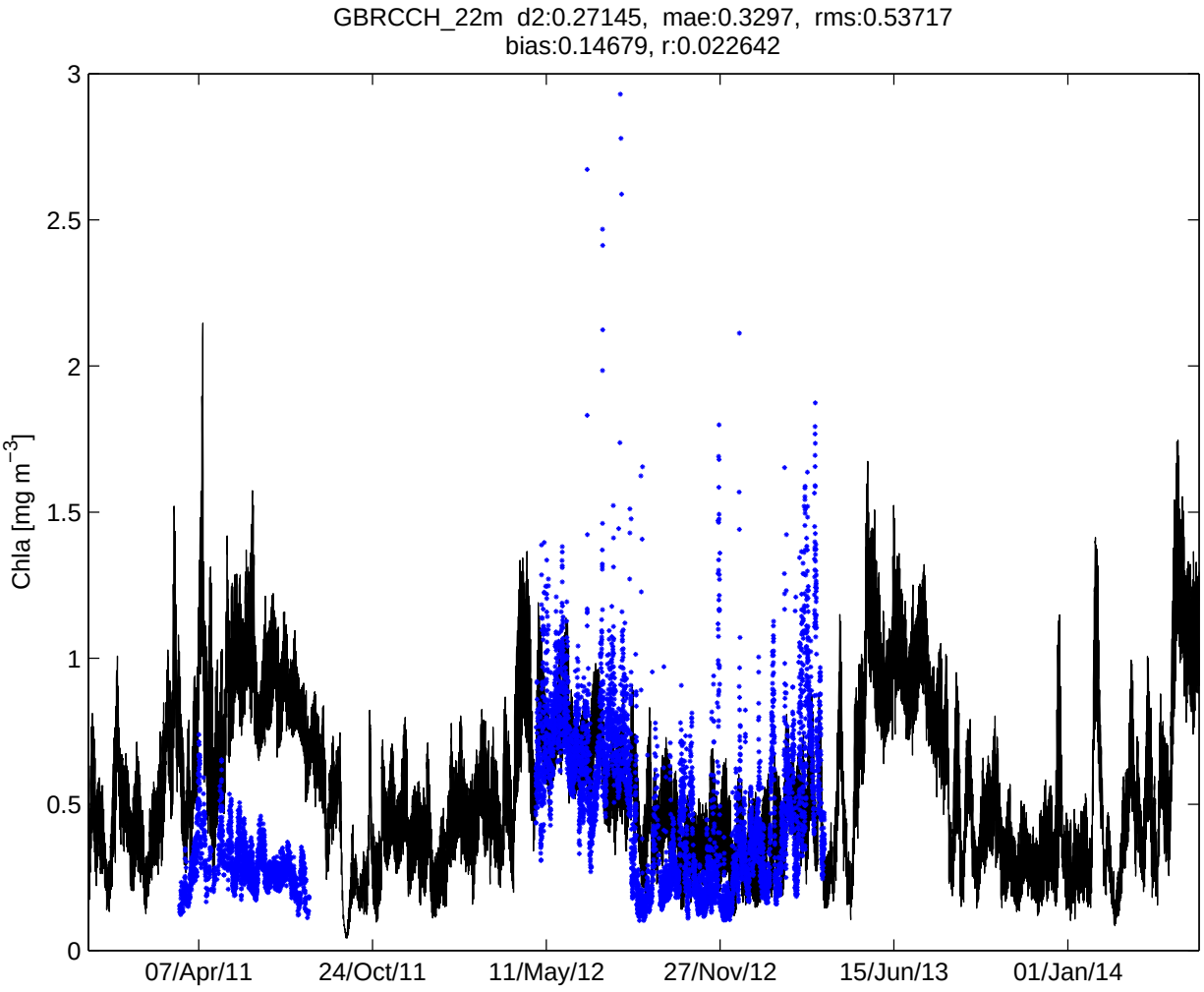


Figure 37: Capricorn Channel (GBRCCH) CHL IMOS Moorings CHL observations against GBR4 model: Observation (blue), model (black): Parameter/s = Chlorophyll fluorescence . Field observation depth taken: 22 m. Model grid deepest point at this site 91.17 m. Observation deepest point at this site 92 m.

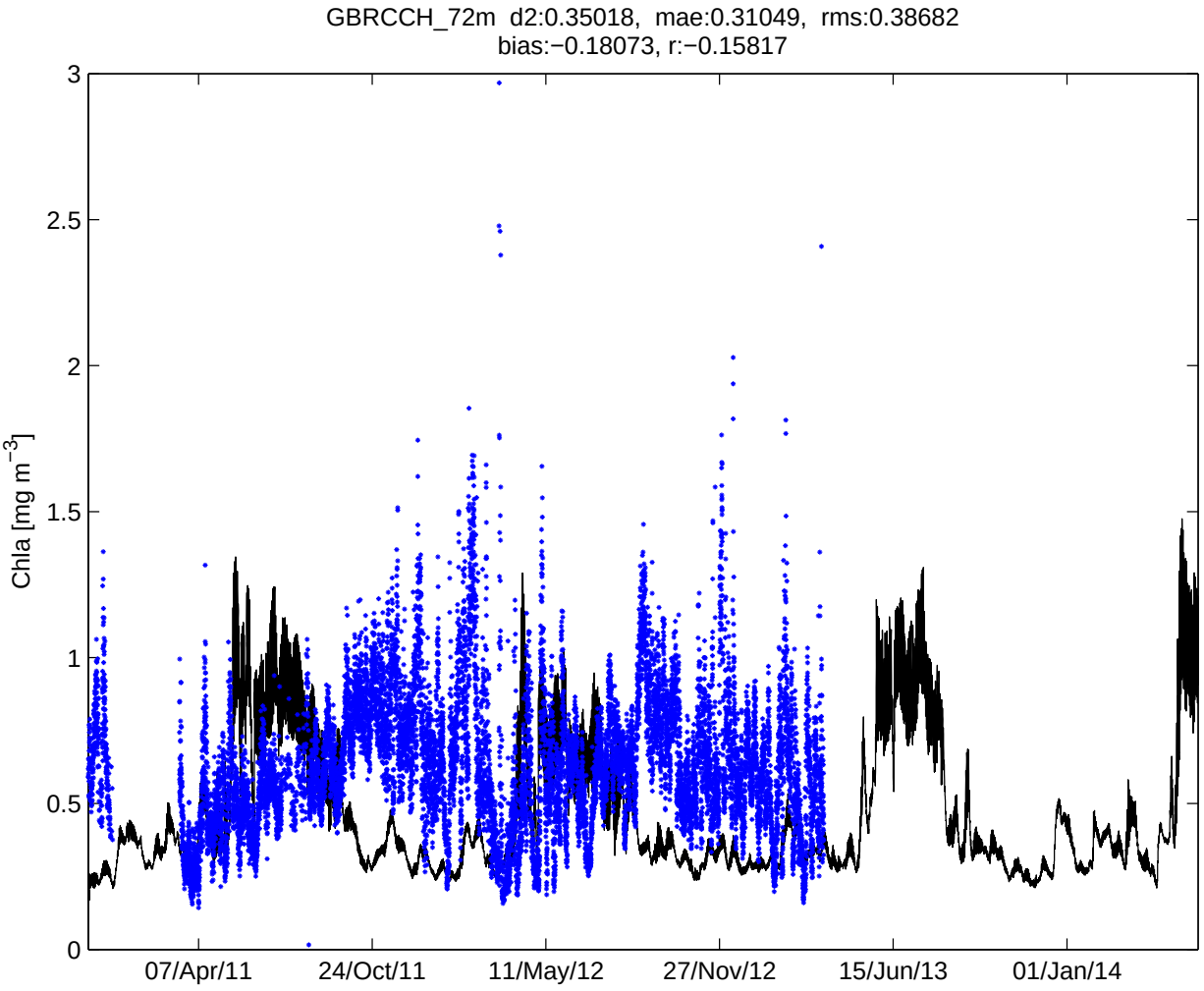


Figure 38: Capricorn Channel (GBRCCH) CHL IMOS Moorings CHL observations against GBR4 model: Observation (blue), model (black): Parameter/s = Chlorophyll fluorescence . Field observation depth taken: 72 m. Model grid deepest point at this site 91.17 m. Observation deepest point at this site 92 m.

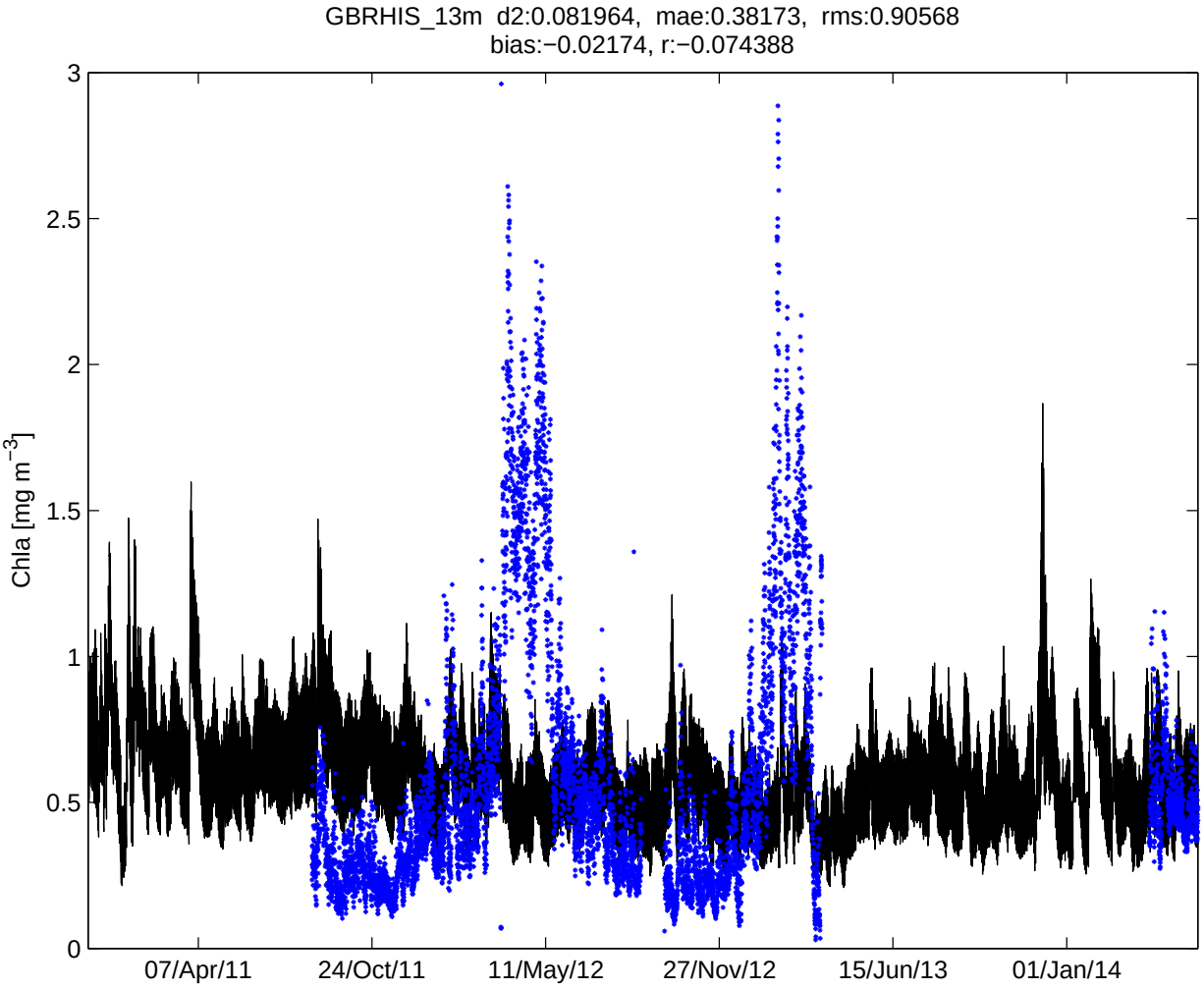


Figure 39: Heron Island South (GBRHIS) CHL IMOS Moorings CHL observations against GBR4 model: Observation (blue), model (black): Parameter/s = Chlorophyll fluorescence . Field observation depth taken: 13 m. Model grid deepest point at this site -47.01 m. Observation deepest point at this site 46 m.

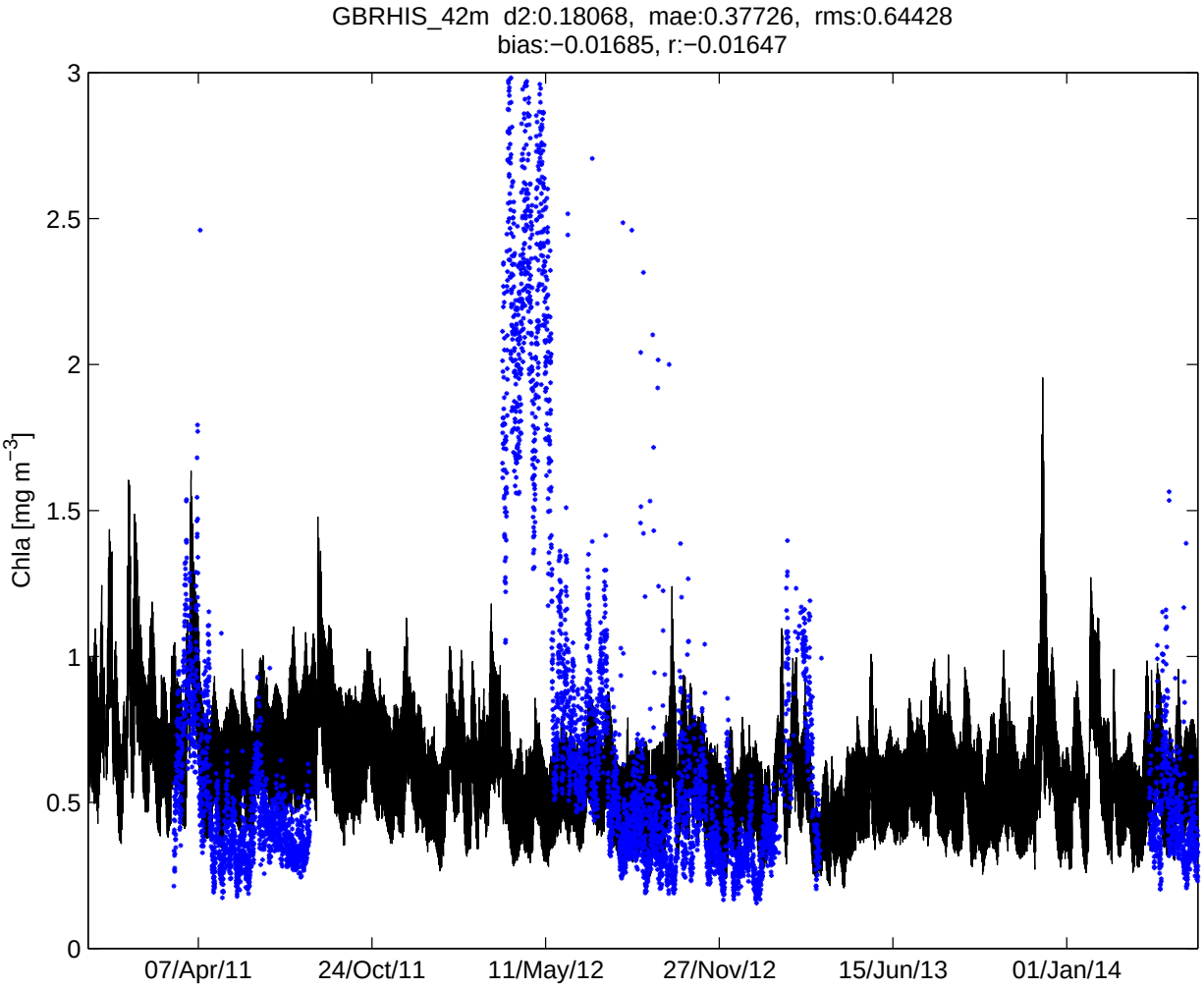


Figure 40: Heron Island South (GBRHIS) CHL IMOS Moorings CHL observations against GBR4 model: Observation (blue), model (black): Parameter/s = Chlorophyll fluorescence . Field observation depth taken: 42 m. Model grid deepest point at this site -47.01 m. Observation deepest point at this site 46 m.

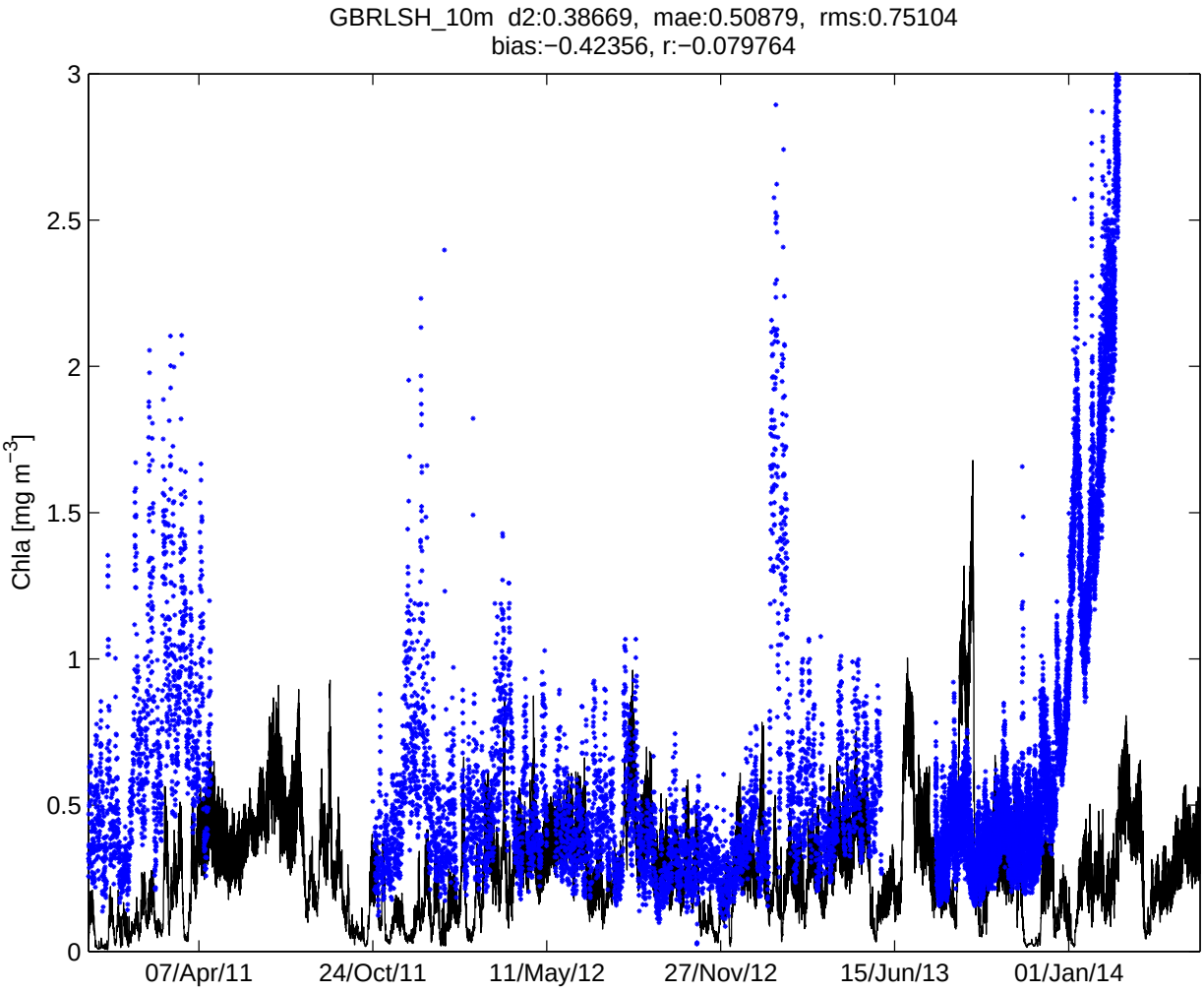


Figure 41: Lizard Shelf (GBRLSH) CHL IMOS Moorings CHL observations against GBR4 model: Observation (blue), model (black): Parameter/s = Chlorophyll fluorescence . Field observation depth taken: 10 m. Model grid deepest point at this site -30.32 m. Observation deepest point at this site 31 m.

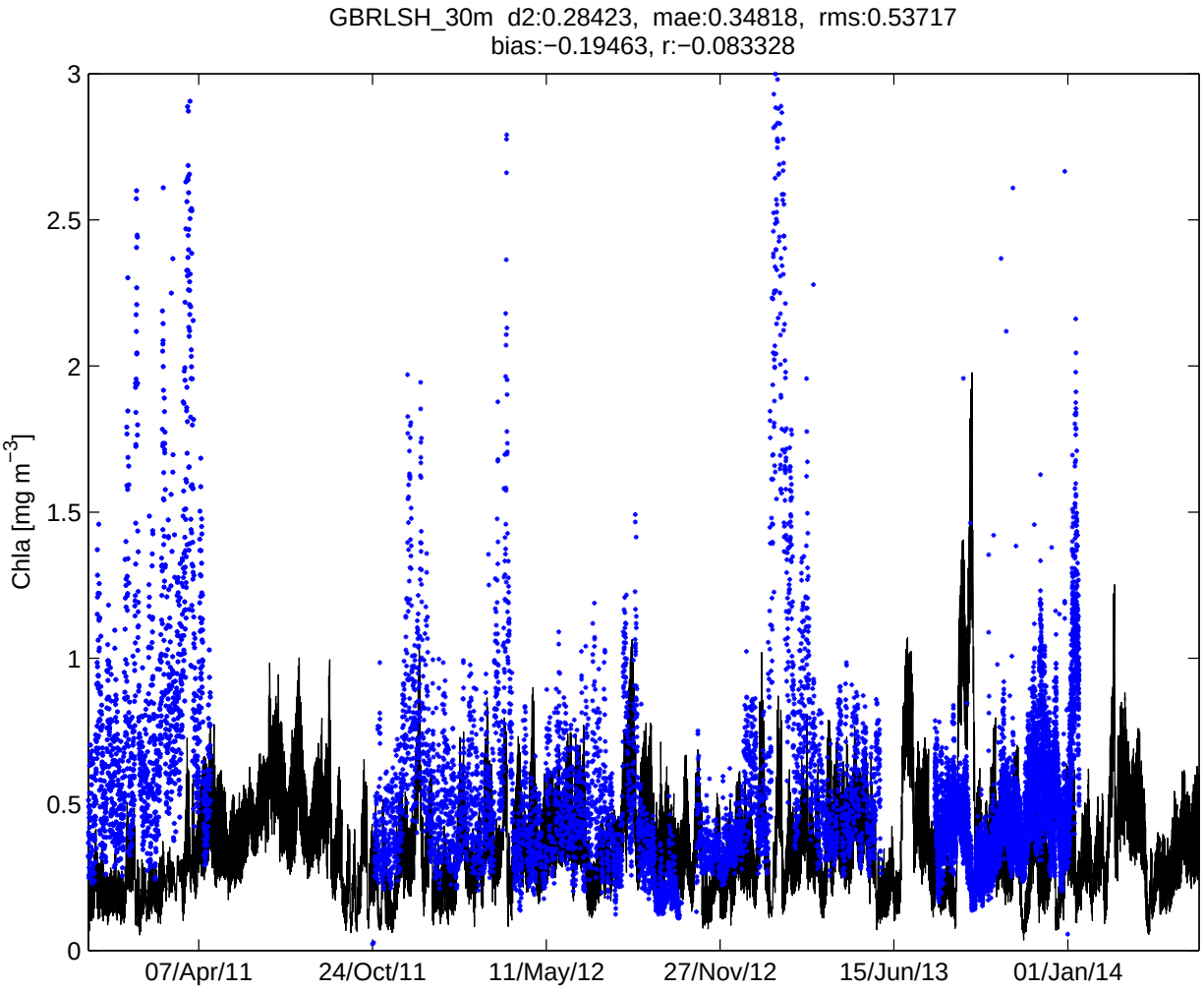


Figure 42: Lizard Shelf (GBRLSH) CHL IMOS Moorings CHL observations against GBR4 model: Observation (blue), model (black): Parameter/s = Chlorophyll fluorescence . Field observation depth taken: 30 m. Model grid deepest point at this site -30.32 m. Observation deepest point at this site 31 m.

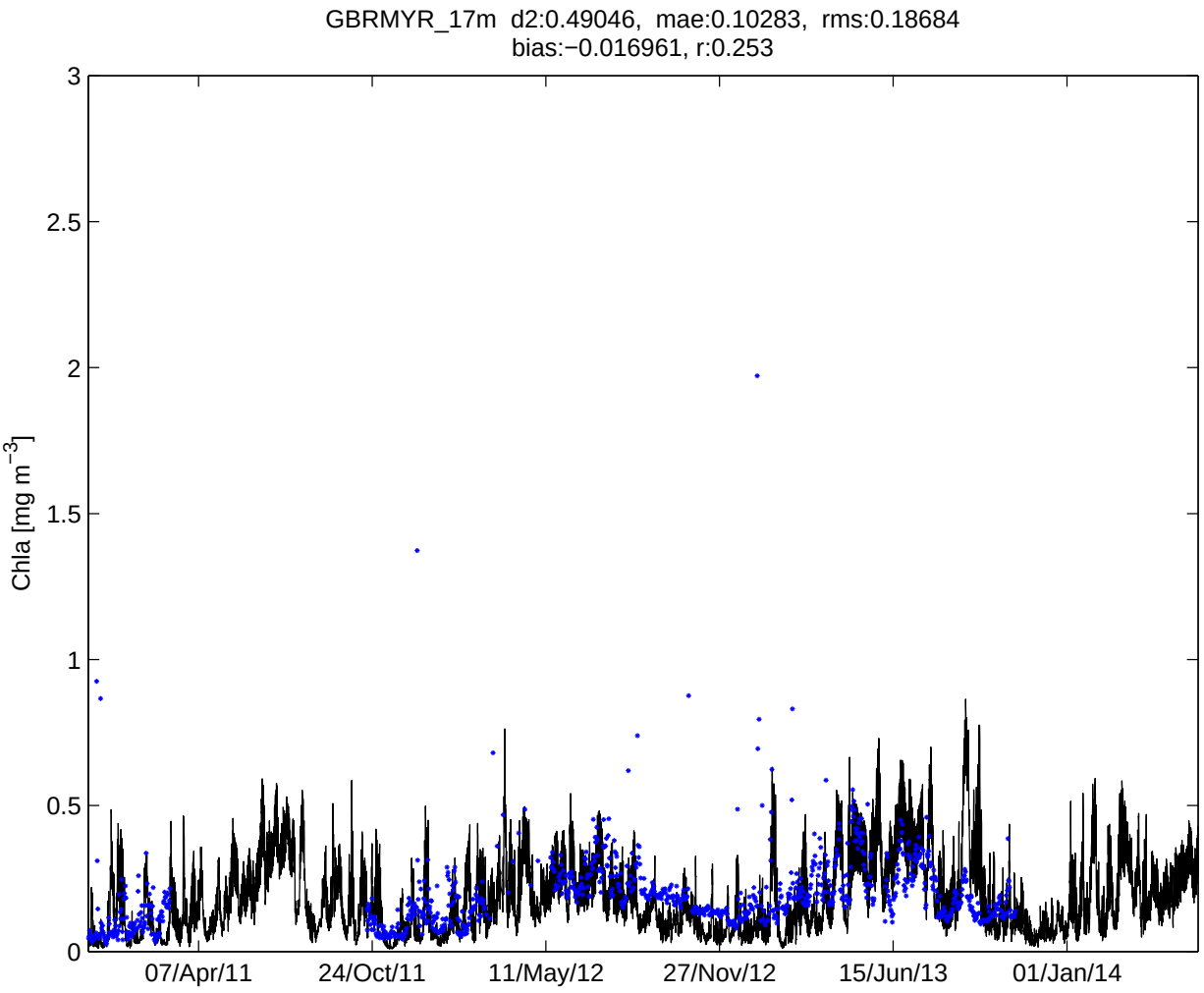


Figure 43: Myrmidon (GBRMYR) CHL IMOS Moorings CHL observations against GBR4 model: Observation (blue), model (black): Parameter/s = Chlorophyll fluorescence . Field observation depth taken: 17 m. Model grid deepest point at this site -220 m. Observation deepest point at this site 203 m.

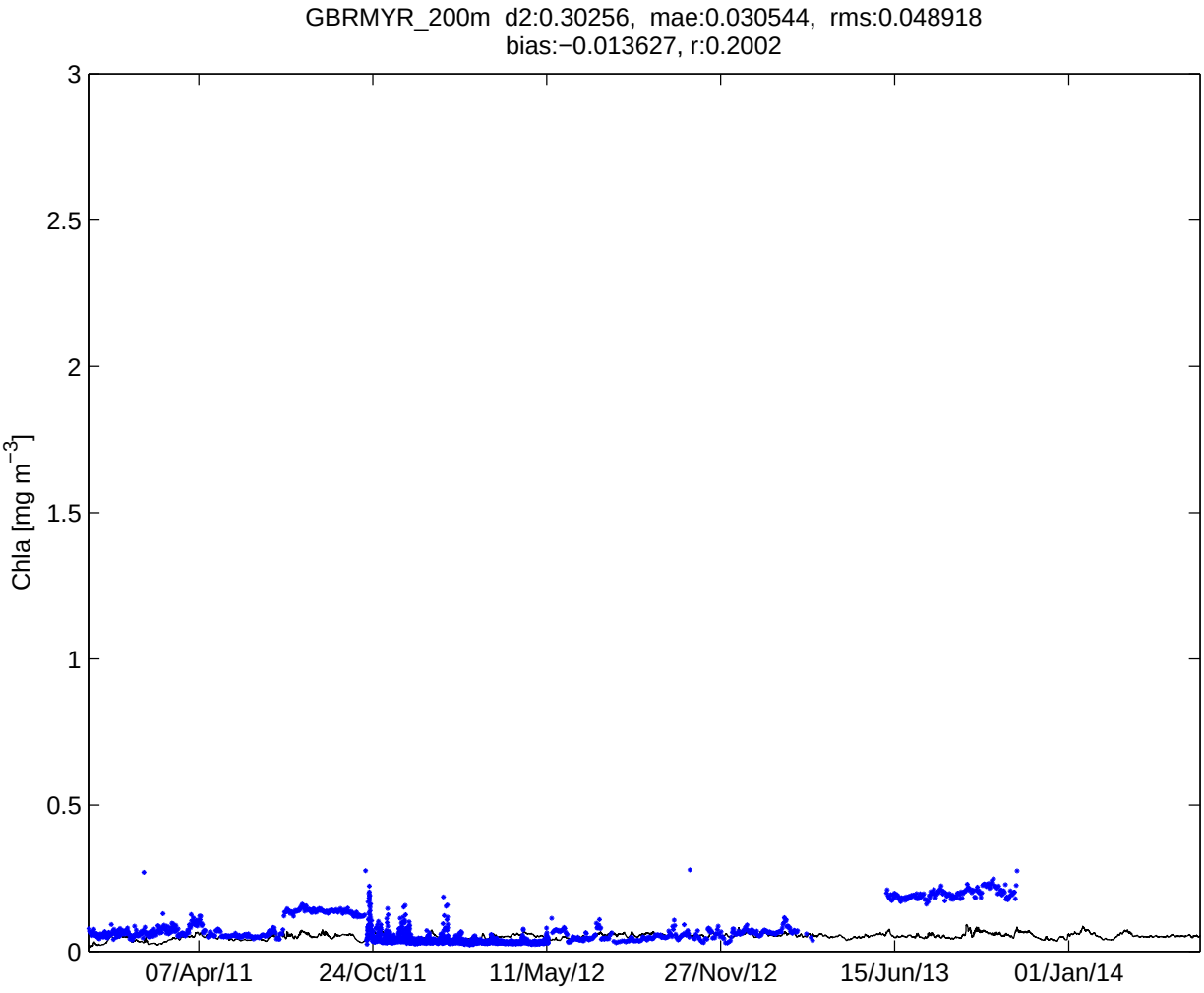


Figure 44: Myrmidon (GBRMYR) CHL IMOS Moorings CHL observations against GBR4 model: Observation (blue), model (black): Parameter/s = Chlorophyll fluorescence . Field observation depth taken: 200 m. Model grid deepest point at this site -220 m. Observation deepest point at this site 203 m.

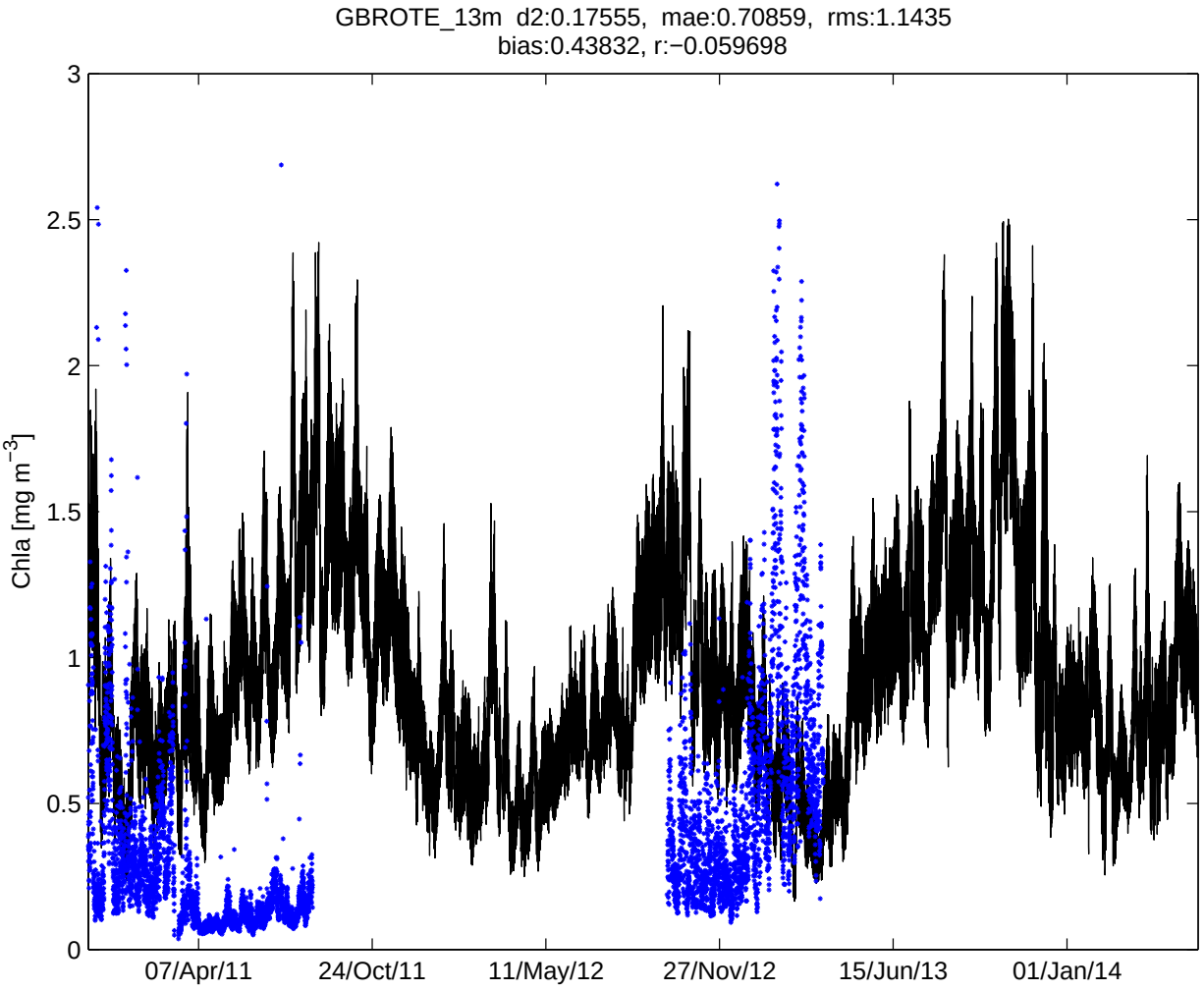


Figure 45: One Tree (GBROTE) CHL IMOS Moorings CHL observations against GBR4 model: Observation (blue), model (black): Parameter/s = Chlorophyll fluorescence . Field observation depth taken: 13 m. Model grid deepest point at this site -62.61 m. Observation deepest point at this site 58 m.

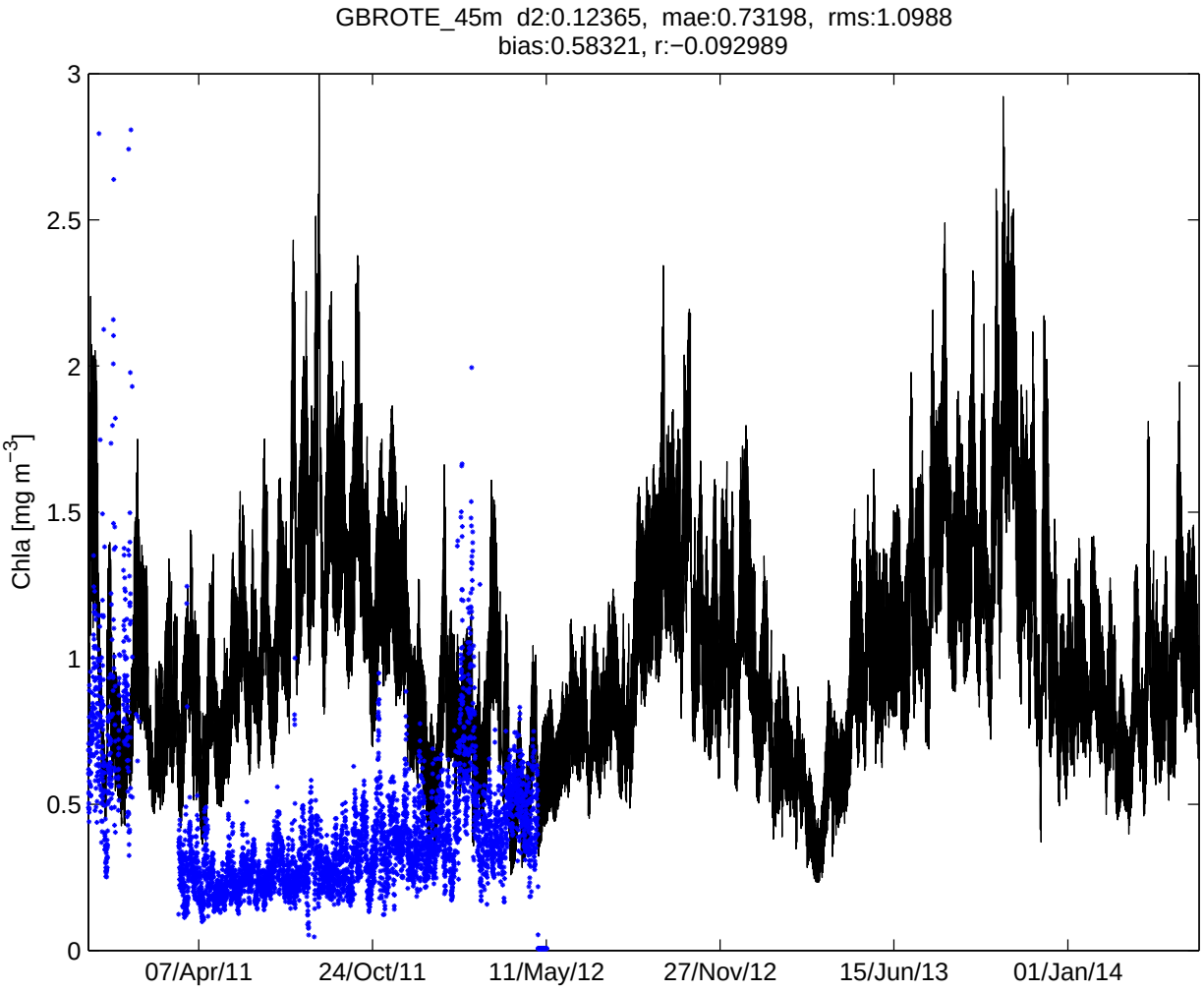


Figure 46: One Tree (GBROTE) CHL IMOS Moorings CHL observations against GBR4 model: Observation (blue), model (black): Parameter/s = Chlorophyll fluorescence . Field observation depth taken: 45 m. Model grid deepest point at this site -62.61 m. Observation deepest point at this site 58 m.

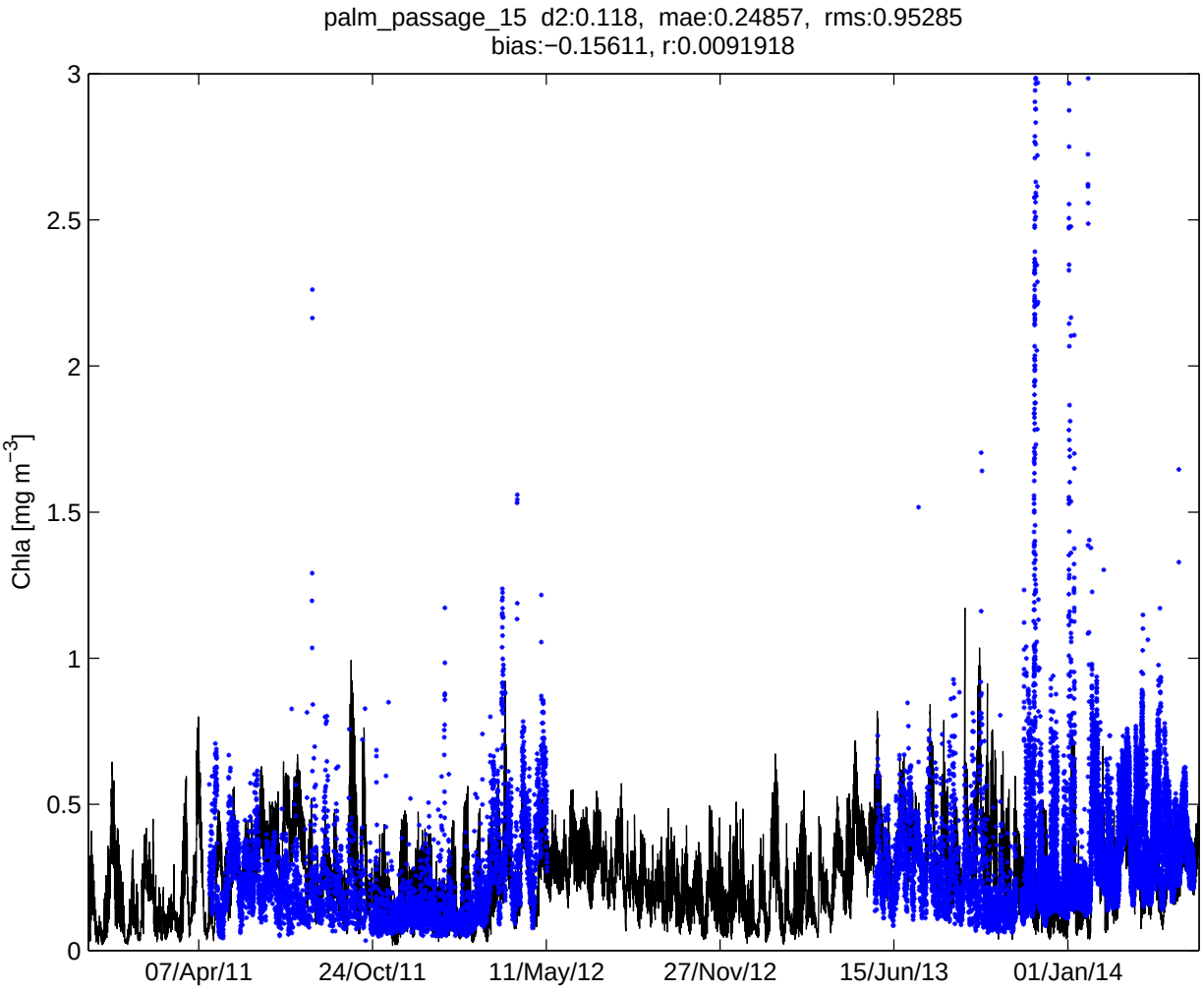


Figure 47: Palm Passage(GBRPPS) CHL IMOS Moorings CHL observations against GBR4 model: Observation (blue), model (black): Parameter/s = Chlorophyll fluorescence . Field observation depth taken: 15 m. Model grid deepest point at this site 71.9 m. Observation deepest point at this site 70 m.

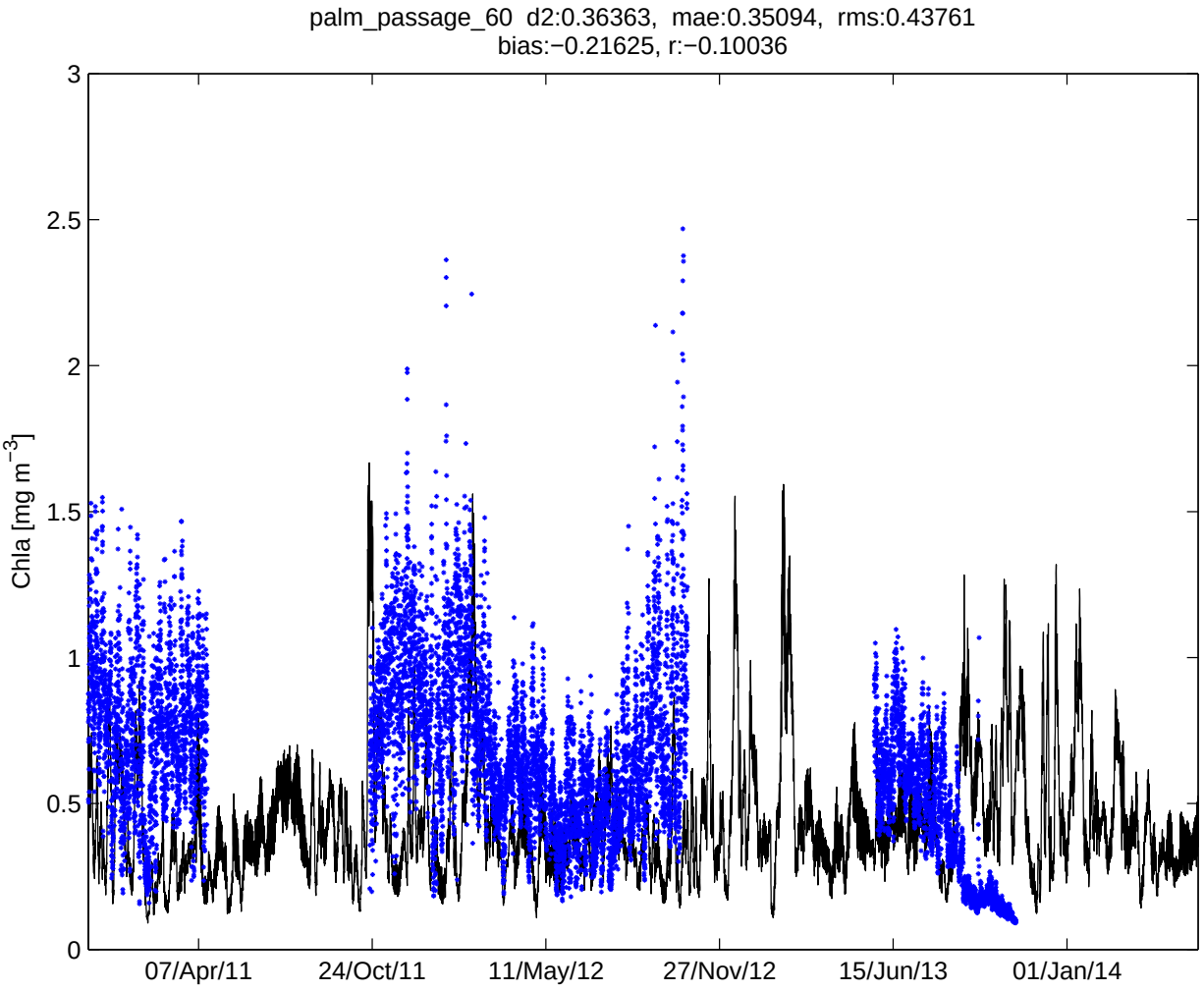


Figure 48: Palm Passage(GBRPPS) CHL IMOS Moorings CHL observations against GBR4 model: Observation (blue), model (black): Parameter/s = Chlorophyll fluorescence . Field observation depth taken: 60 m. Model grid deepest point at this site 71.9 m. Observation deepest point at this site 70 m.

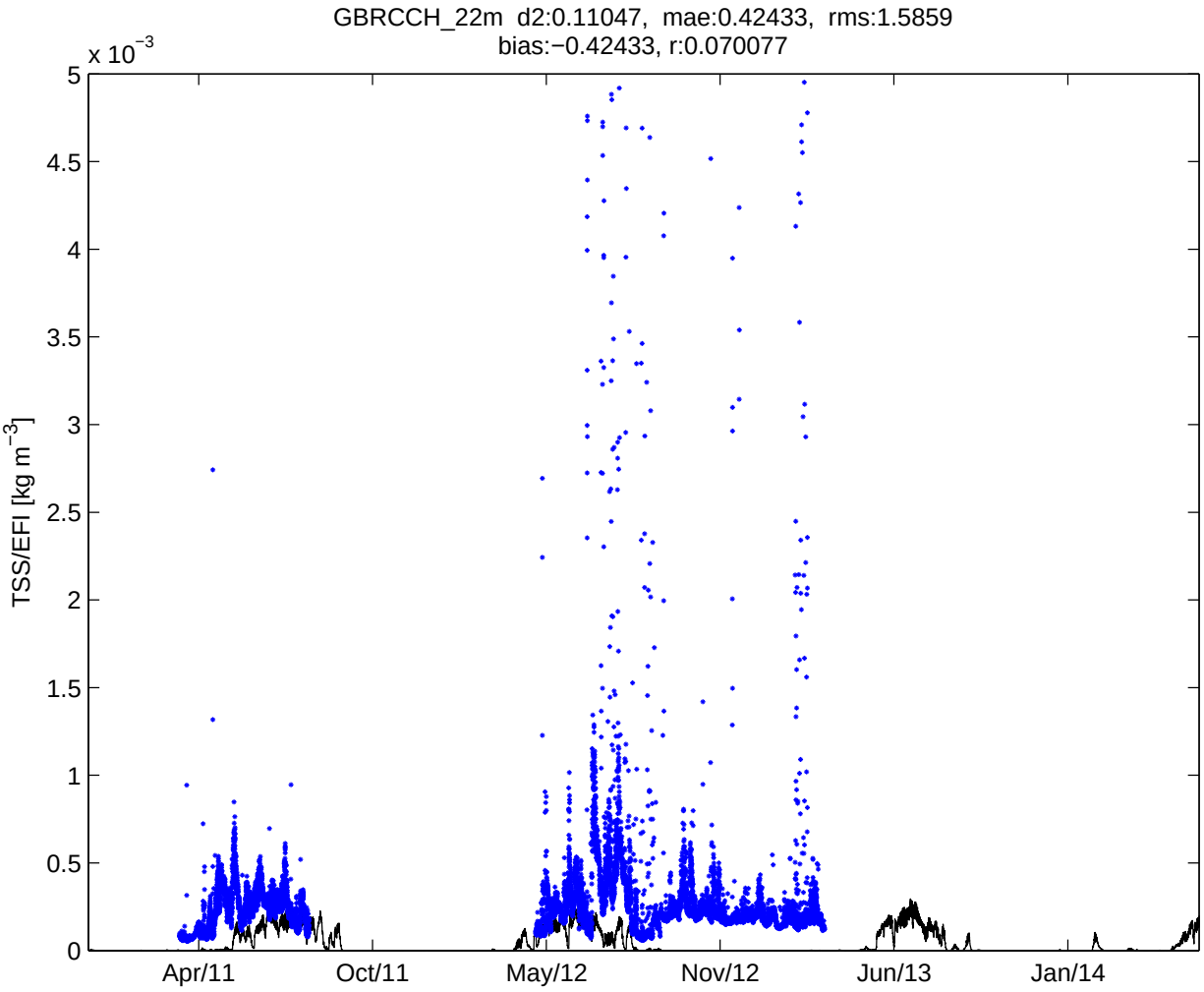


Figure 49: Capricorn Channel (GBRCCH) TSS IMOS Moorings TSS observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS. Field observation depth taken: 22 m. Model grid deepest point at this site 91.17 m. Observation deepest point at this site 92 m.

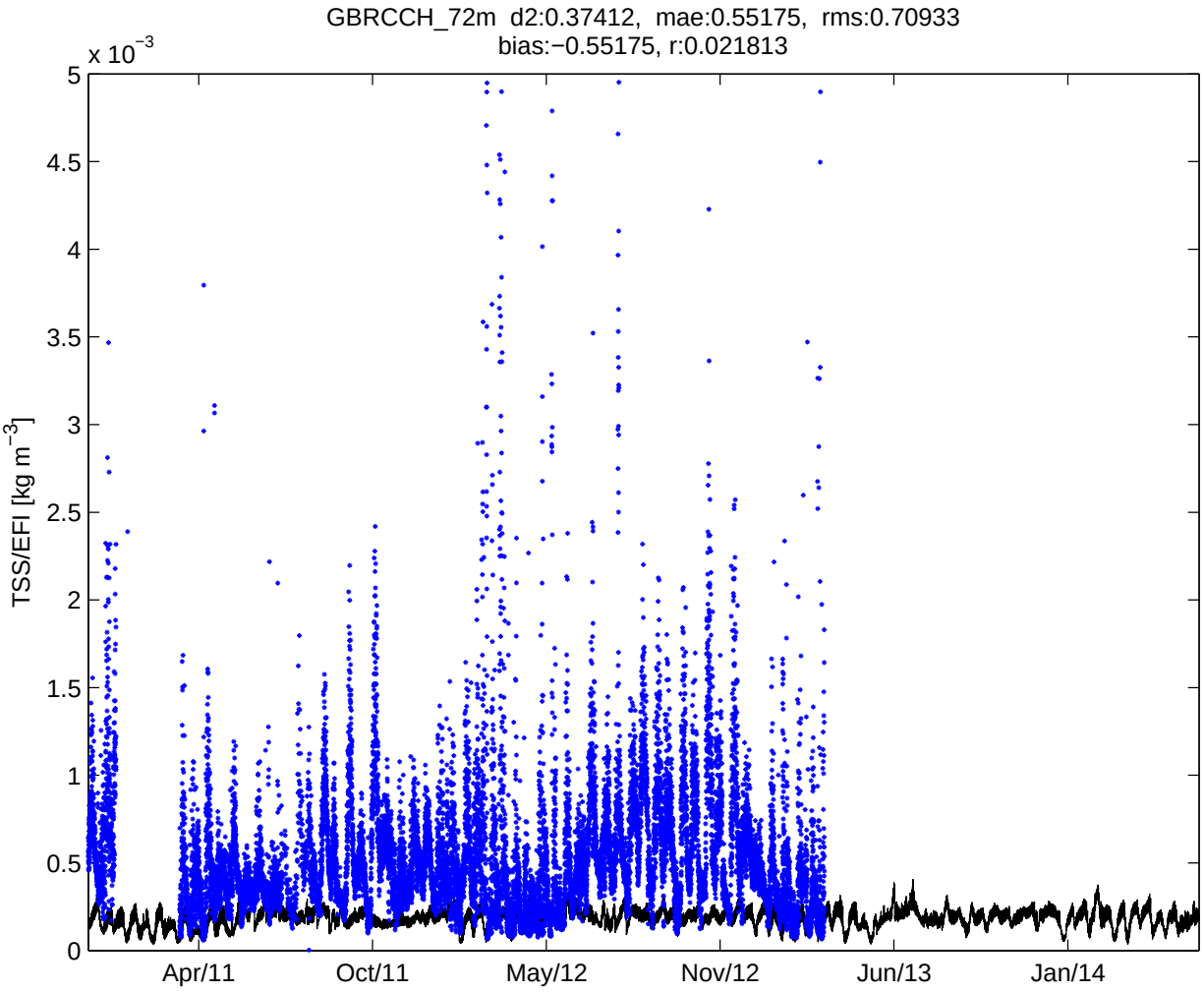


Figure 50: Capricorn Channel (GBRCCH) TSS IMOS Moorings TSS observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS. Field observation depth taken: 72 m. Model grid deepest point at this site 91.17 m. Observation deepest point at this site 92 m.

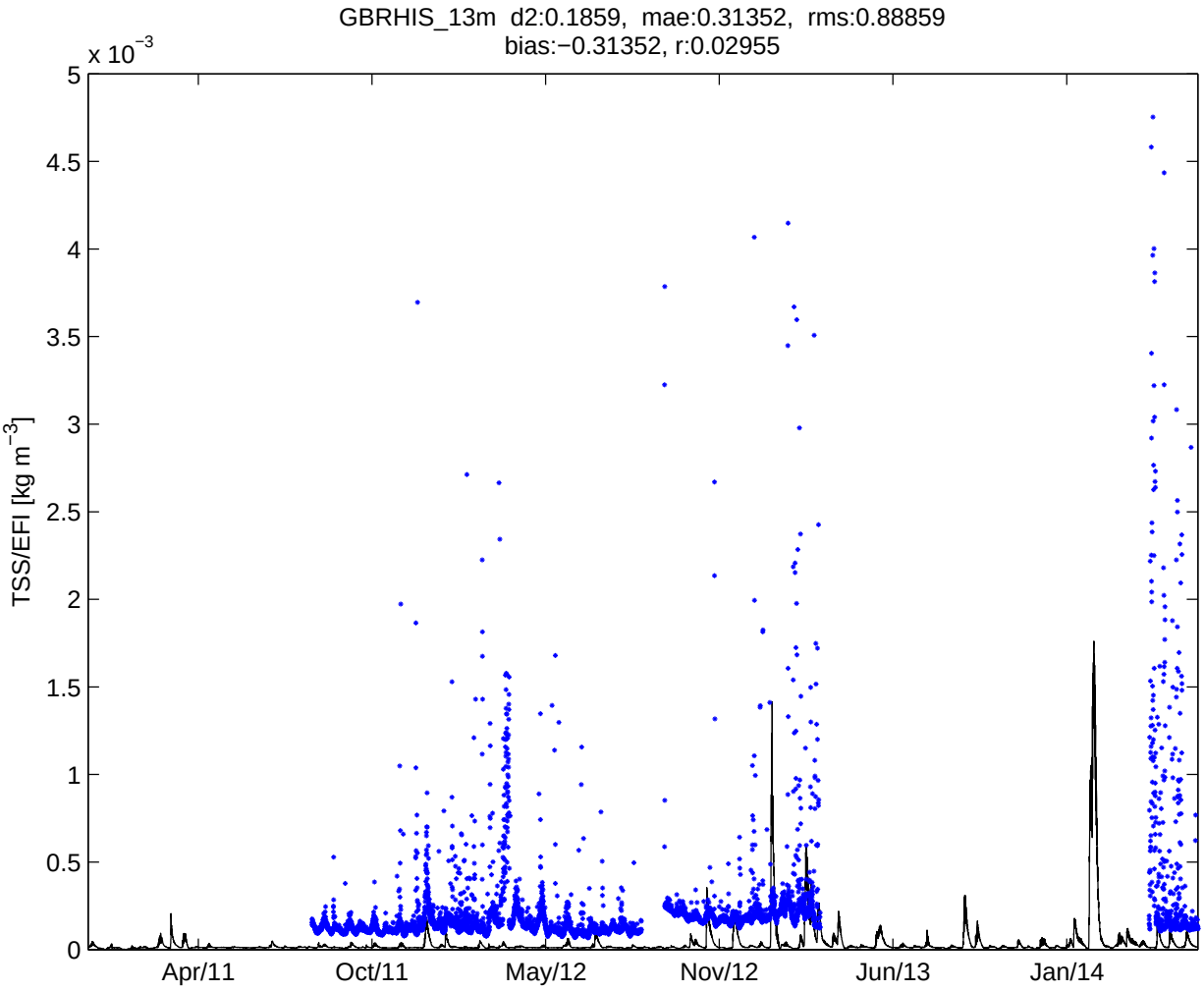


Figure 51: Heron Island South (GBRHIS) TSS IMOS Moorings TSS observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS. Field observation depth taken: 13 m. Model grid deepest point at this site -47.01 m. Observation deepest point at this site 46 m.

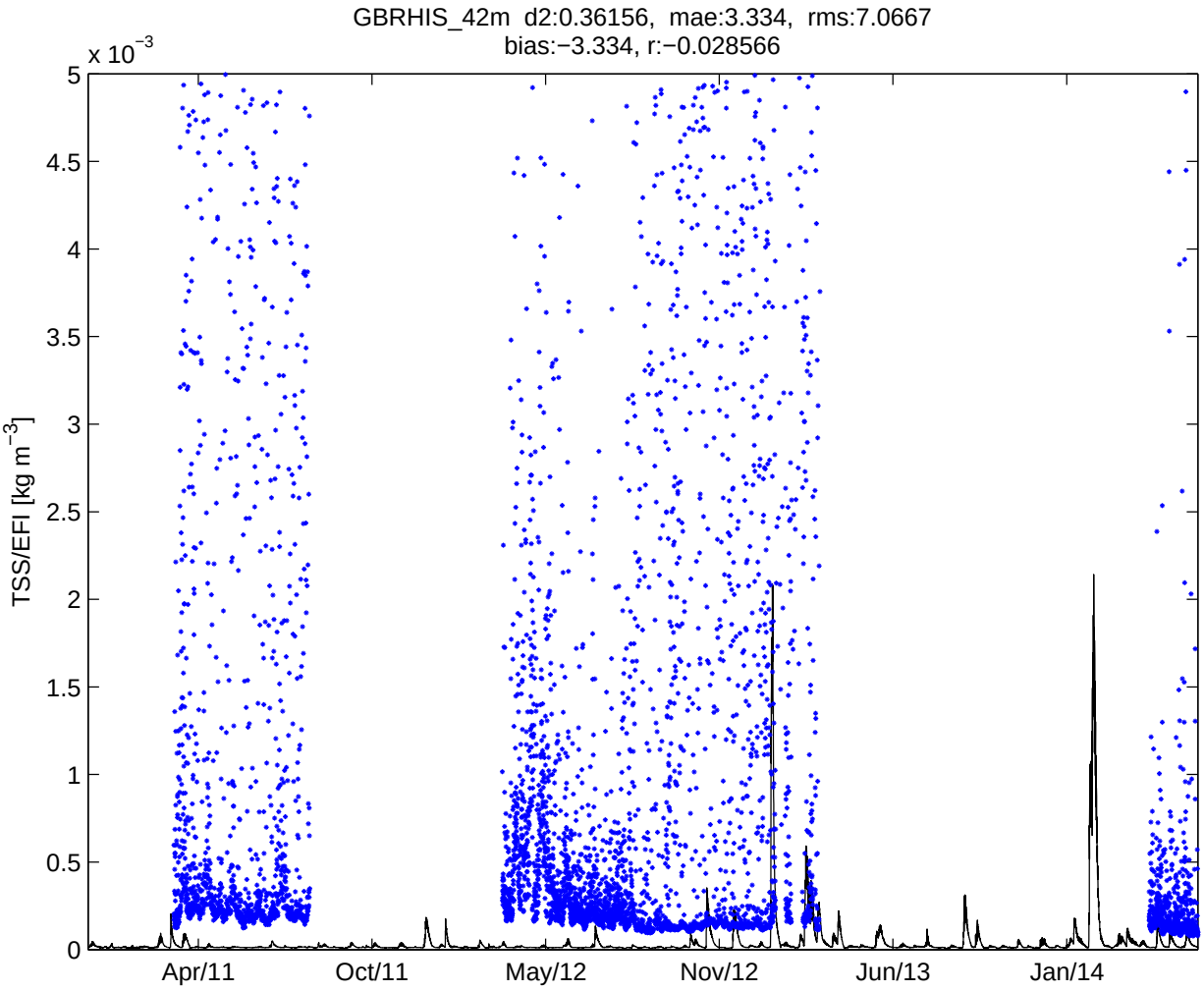


Figure 52: Heron Island South (GBRHIS) TSS IMOS Moorings TSS observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS. Field observation depth taken: 42 m. Model grid deepest point at this site -47.01 m. Observation deepest point at this site 46 m.

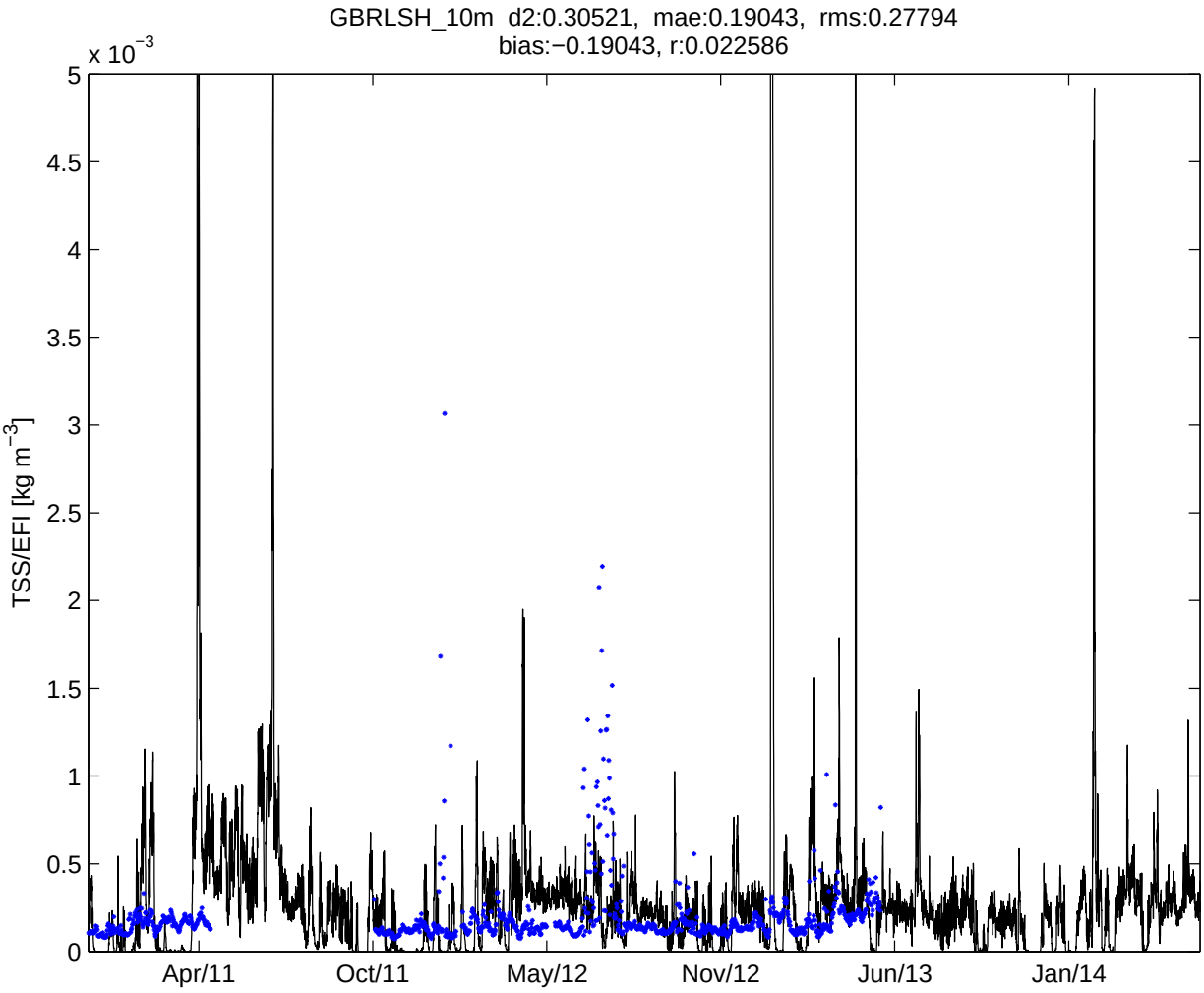


Figure 53: Lizard Shelf (GBRLSH) TSS IMOS Moorings TSS observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS. Field observation depth taken: 10 m. Model grid deepest point at this site -30.32 m. Observation deepest point at this site 31 m.

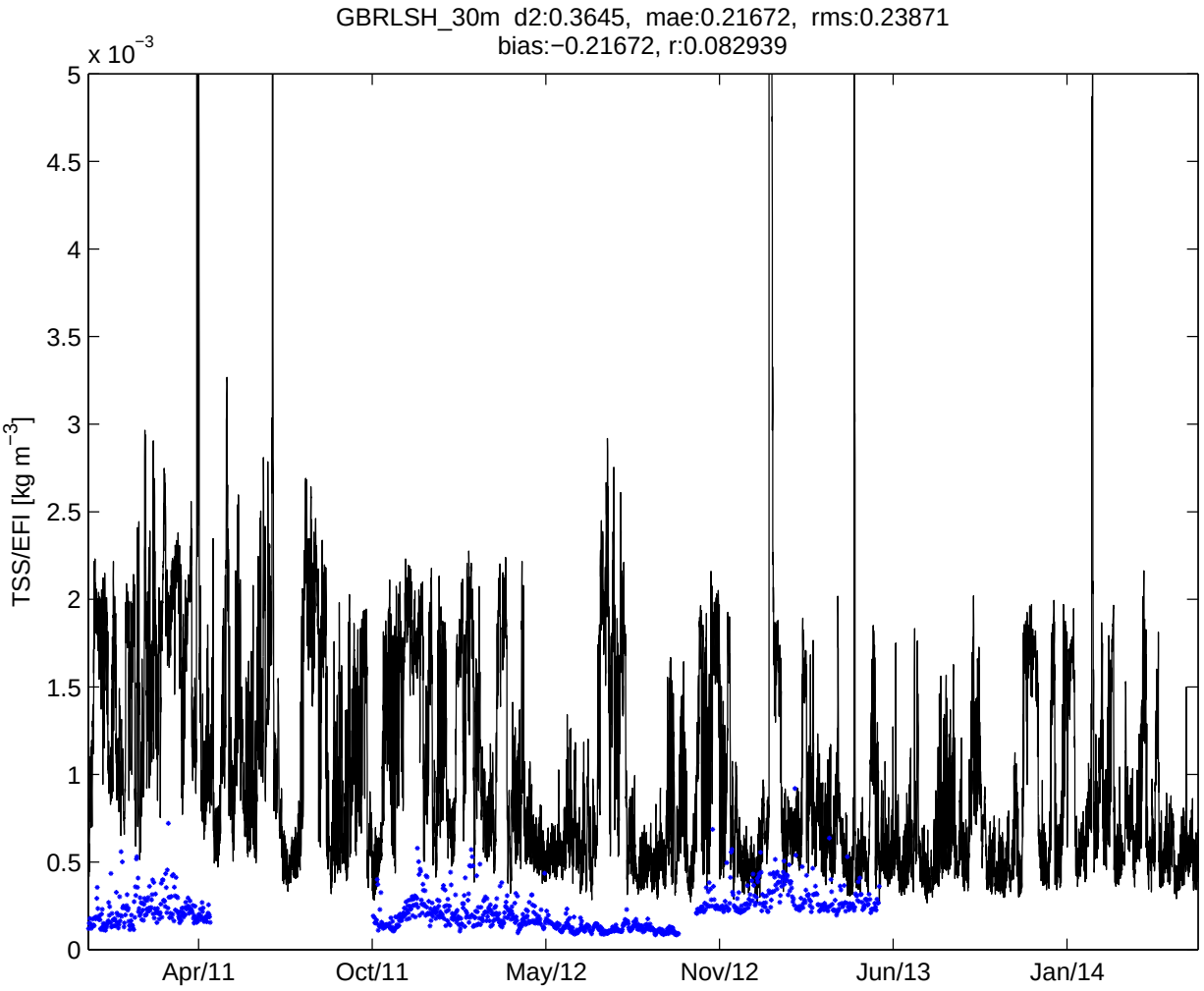


Figure 54: Lizard Shelf (GBRLSH) TSS IMOS Moorings TSS observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS. Field observation depth taken: 30 m. Model grid deepest point at this site -30.32 m. Observation deepest point at this site 31 m.

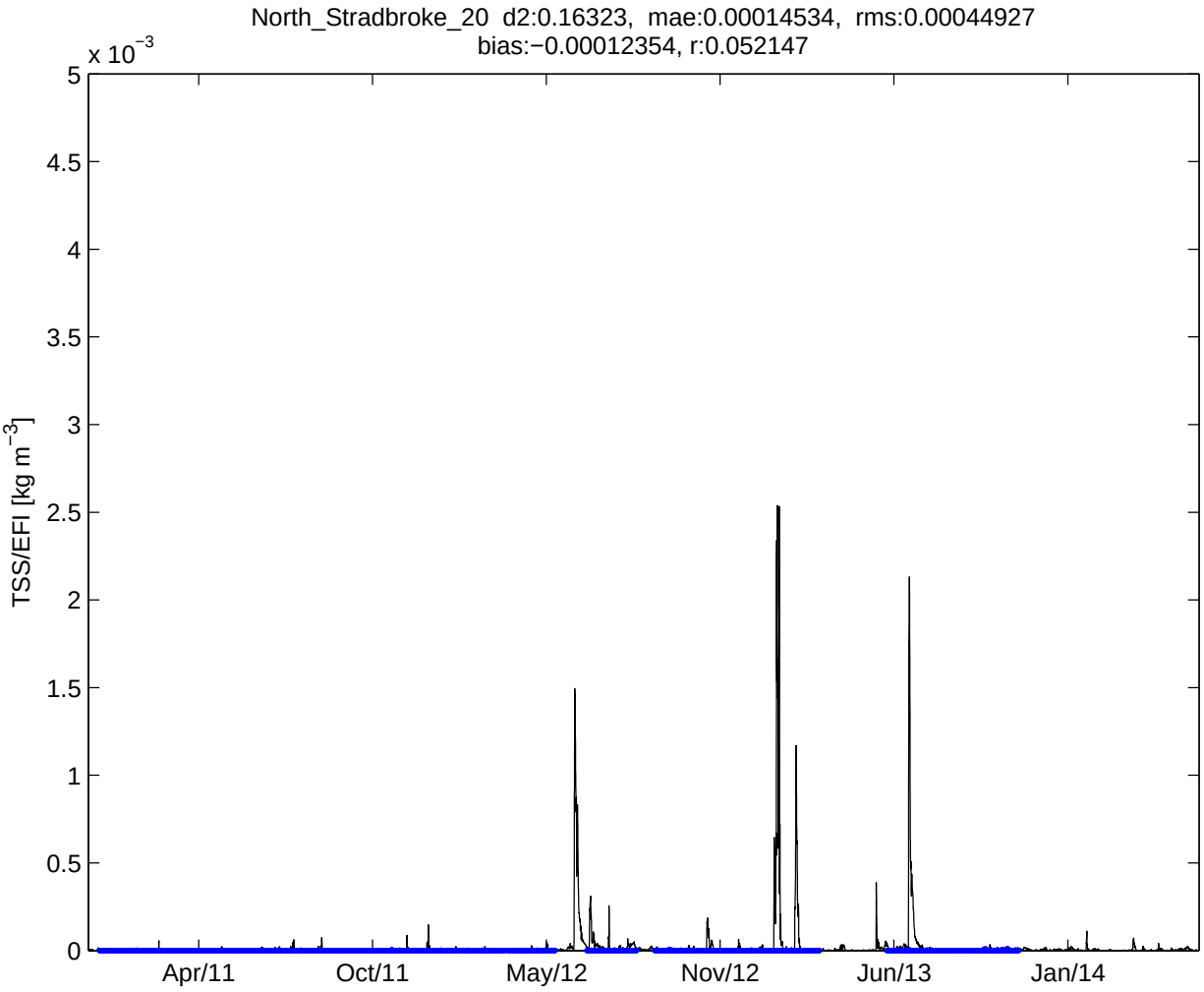


Figure 55: North Stradbroke (GBRNSI) TSS IMOS Moorings TSS observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS. Field observation depth taken: 20 m. Model grid deepest point at this site -66 m. Observation deepest point at this site 67 m.

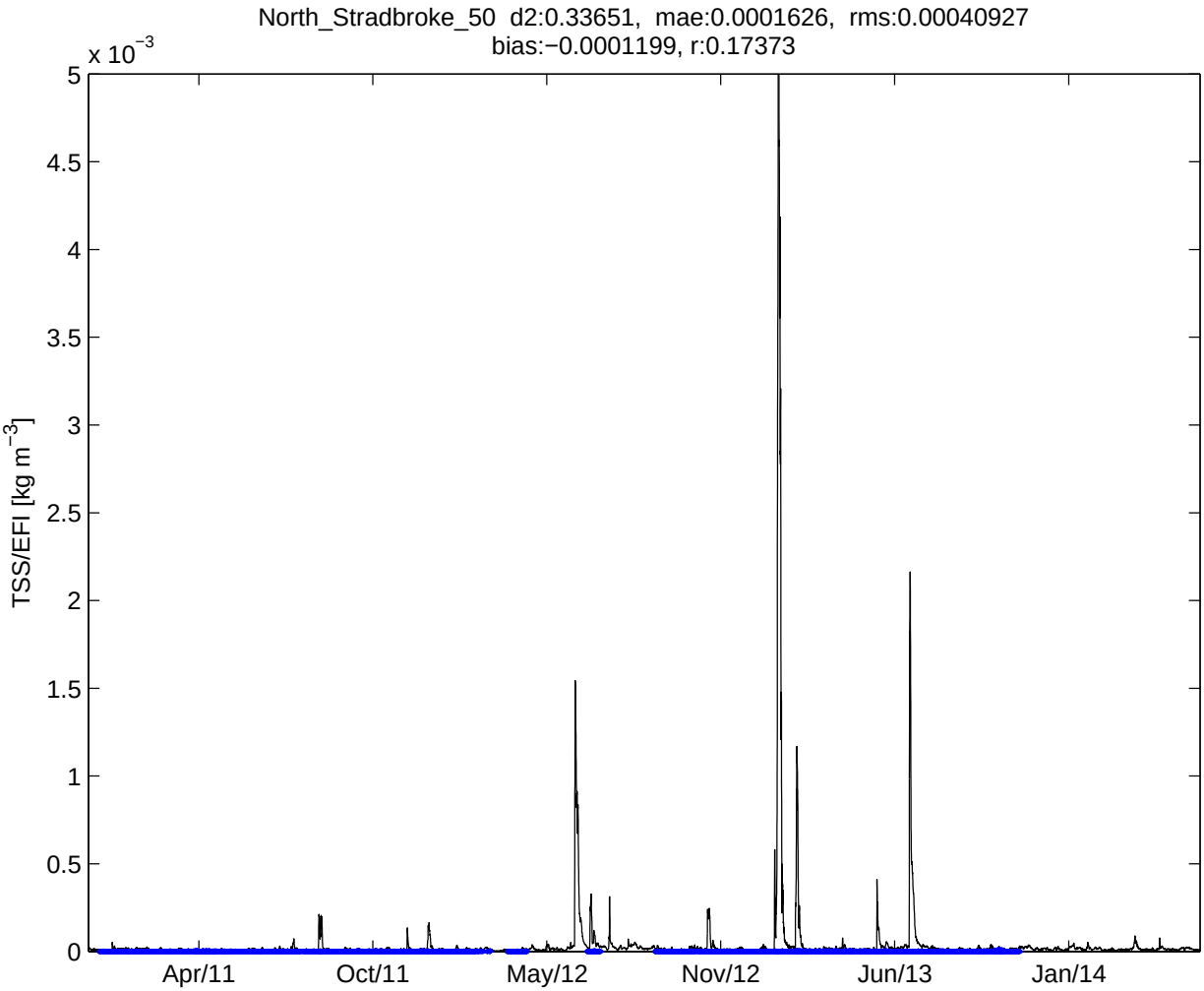


Figure 56: North Stradbroke (GBRNSI) TSS IMOS Moorings TSS observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS. Field observation depth taken: 50 m. Model grid deepest point at this site -66 m. Observation deepest point at this site 67 m.

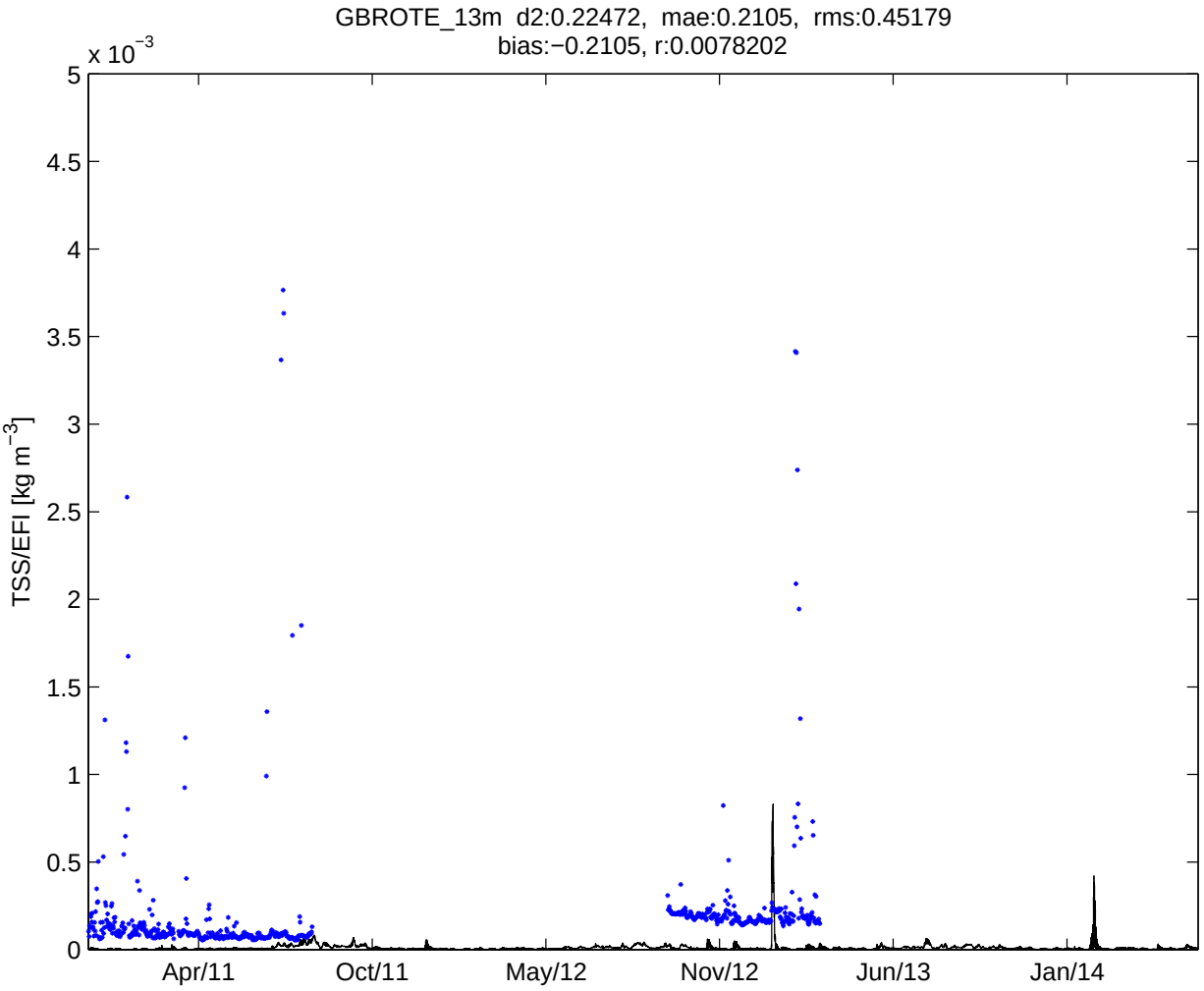


Figure 57: One Tree (GBROTE) TSS IMOS Moorings TSS observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS. Field observation depth taken: 13 m. Model grid deepest point at this site -62.61 m. Observation deepest point at this site 58 m.

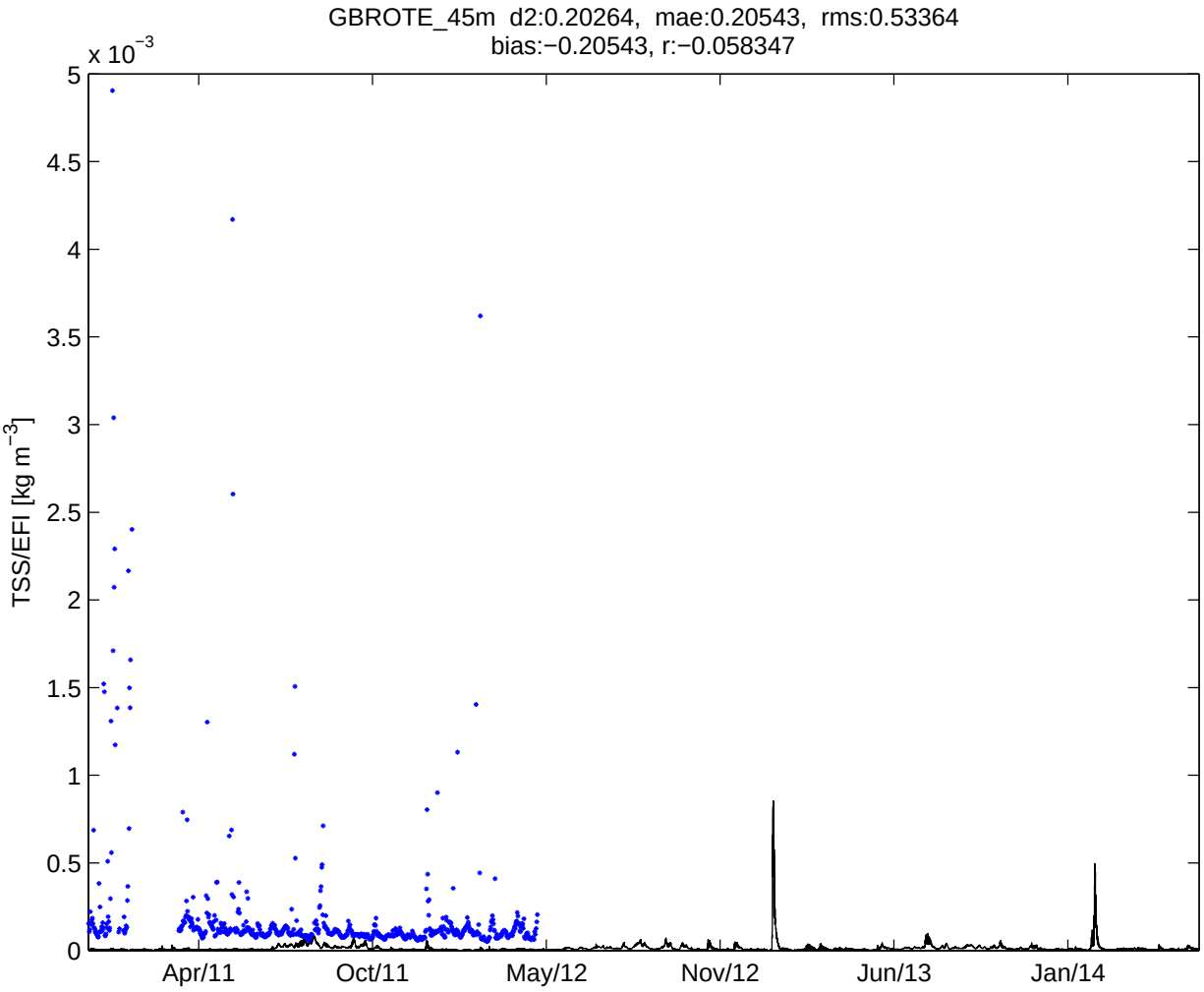


Figure 58: One Tree (GBROTE) TSS IMOS Moorings TSS observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS. Field observation depth taken: 45 m. Model grid deepest point at this site -62.61 m. Observation deepest point at this site 58 m.

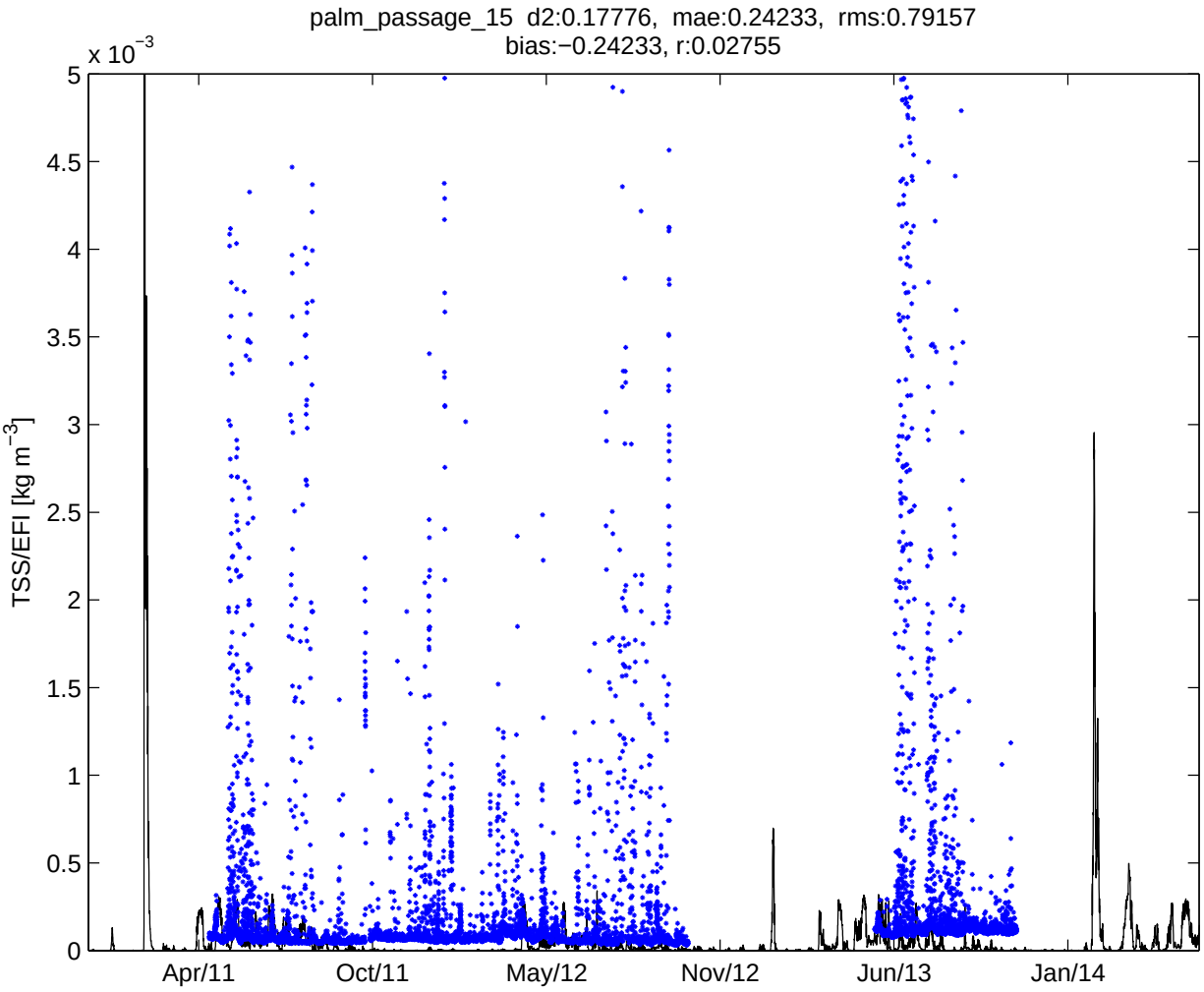


Figure 59: Palm Passage(GBRPPS) TSS IMOS Moorings TSS observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS. Field observation depth taken: 15 m. Model grid deepest point at this site 71.9 m. Observation deepest point at this site 70 m.

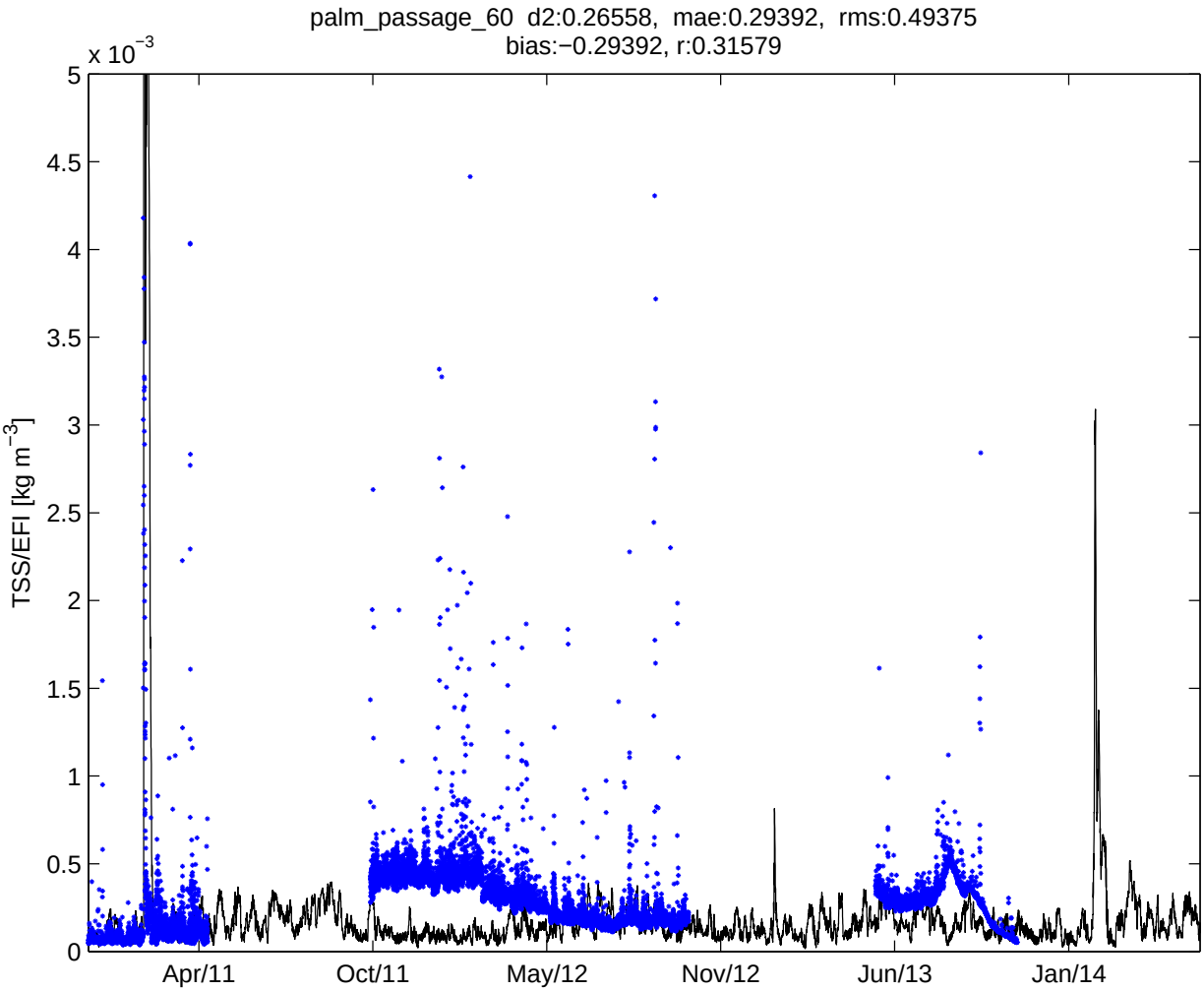


Figure 60: Palm Passage(GBRPPS) TSS IMOS Moorings TSS observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS. Field observation depth taken: 60 m. Model grid deepest point at this site 71.9 m. Observation deepest point at this site 70 m.

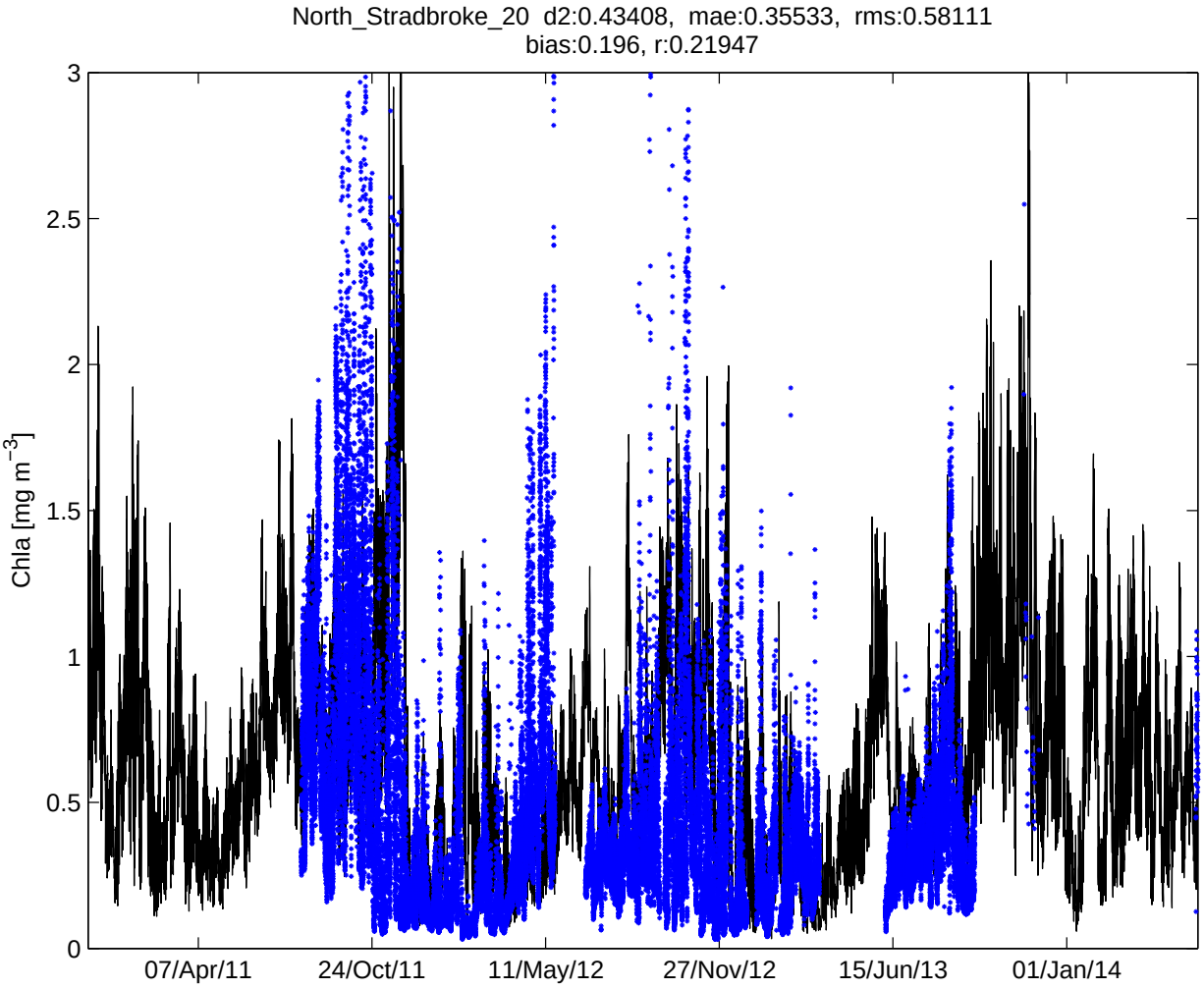


Figure 61: North Stradbroke (GBRNSI) CHL IMOS/NRS Moorings CHL observations against GBR4 model: Observation (blue), model (black): Parameter/s = Chlorophyll fluorescence . Field observation depth taken: 20 m. Model grid deepest point at this site -66 m. Observation deepest point at this site 67 m.

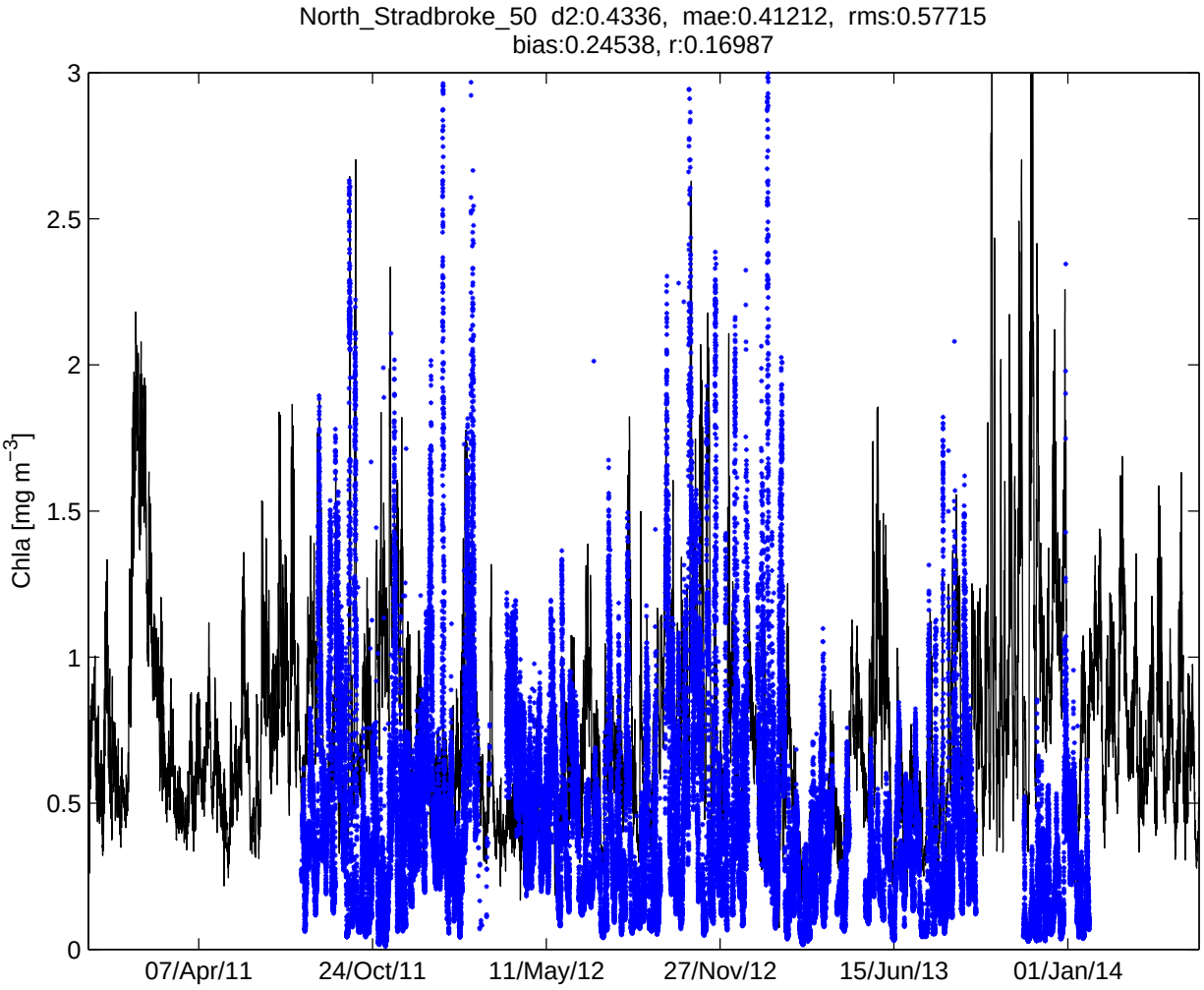


Figure 62: North Stradbroke (GBRNSI) CHL IMOS/NRS Moorings CHL observations against GBR4 model: Observation (blue), model (black): Parameter/s = Chlorophyll fluorescence . Field observation depth taken: 50 m. Model grid deepest point at this site -66 m. Observation deepest point at this site 67 m.

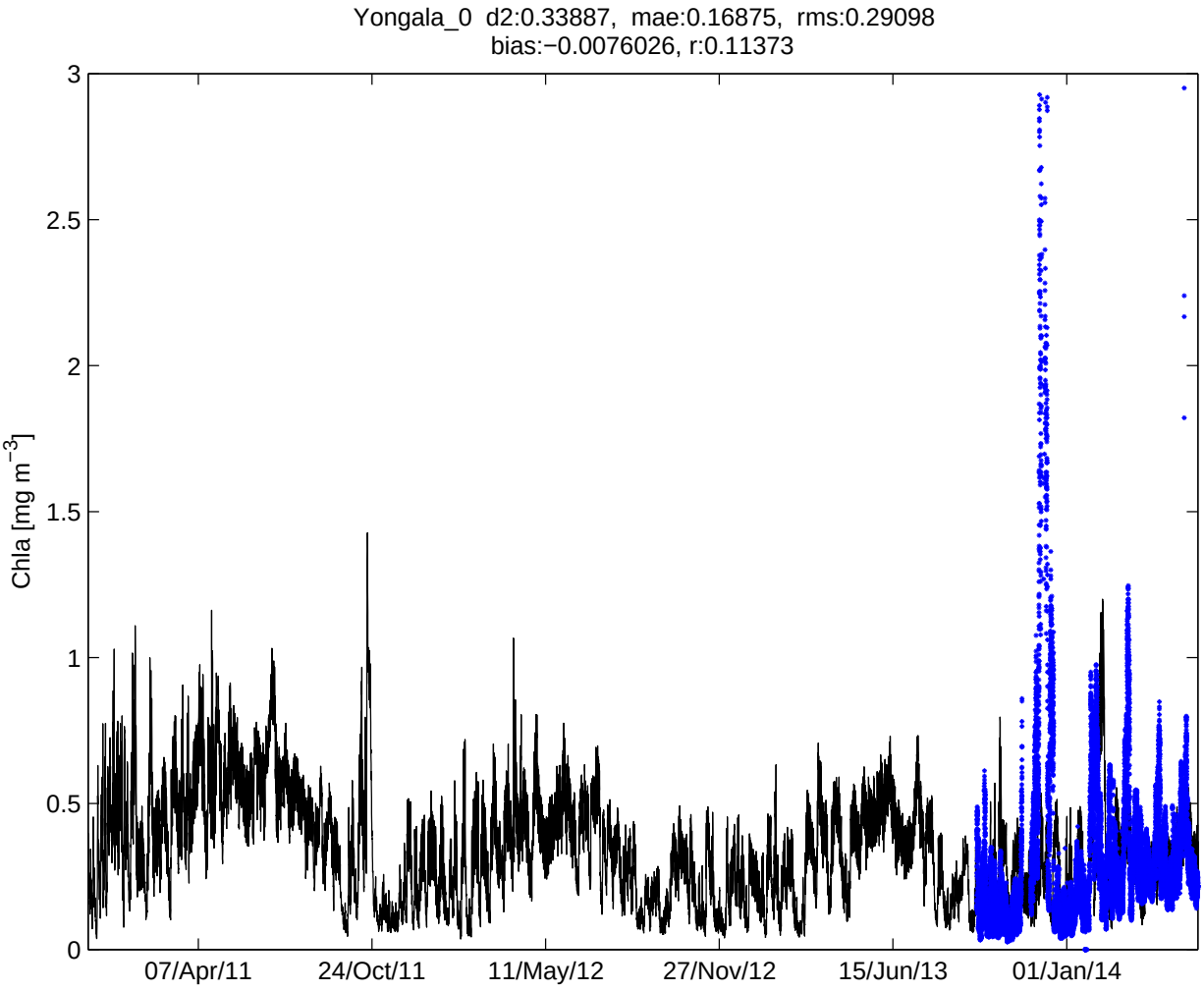


Figure 63: Yongala (NRSYON) CHL IMOS/NRS Moorings CHL observations against GBR4 model: Observation (blue), model (black): Parameter/s = Chlorophyll fluorescence . Field observation depth taken: 0 m. Model grid deepest point at this site -28.62 m. Observation deepest point at this site 27 m.

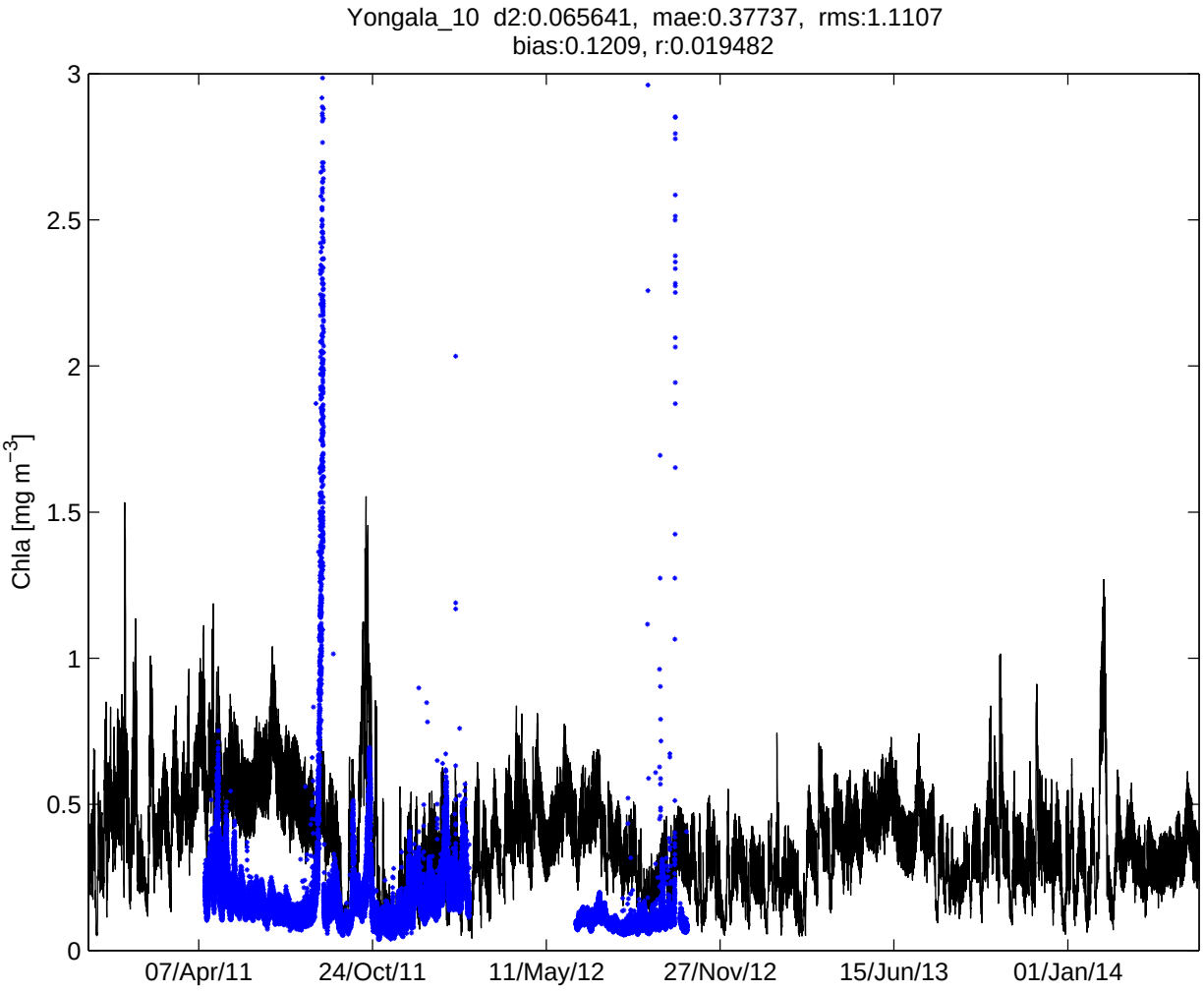


Figure 64: Yongala (NRSYON) CHL IMOS/NRS Moorings CHL observations against GBR4 model: Observation (blue), model (black): Parameter/s = Chlorophyll fluorescence . Field observation depth taken: 10 m. Model grid deepest point at this site -28.62 m. Observation deepest point at this site 27 m.

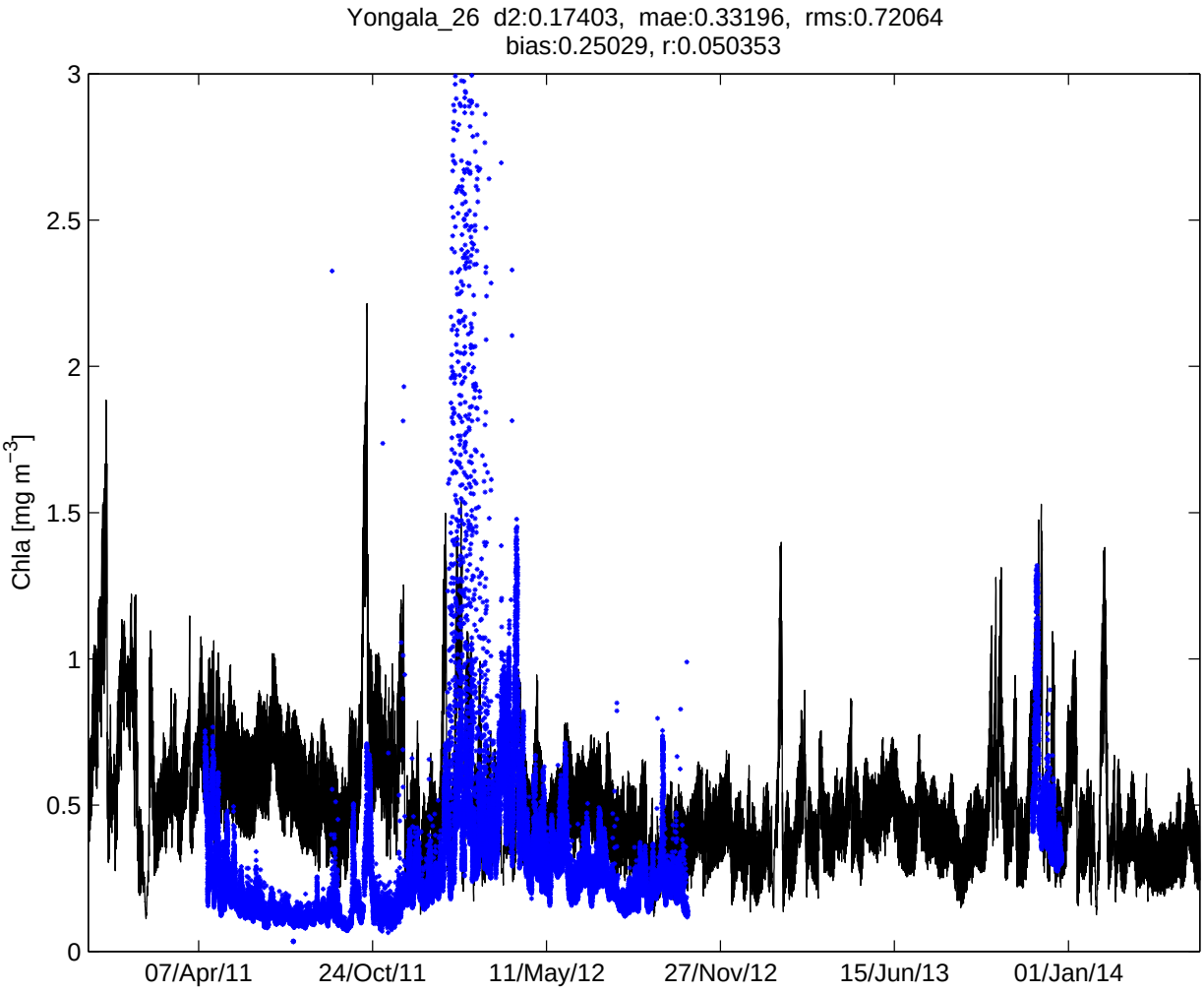


Figure 65: Yongala (NRSYON CHL IMOS/NRS Moorings CHL observations against GBR4 model: Observation (blue), model (black): Parameter/s = Chlorophyll fluorescence . Field observation depth taken: 26 m. Model grid deepest point at this site -28.62 m. Observation deepest point at this site 27 m.

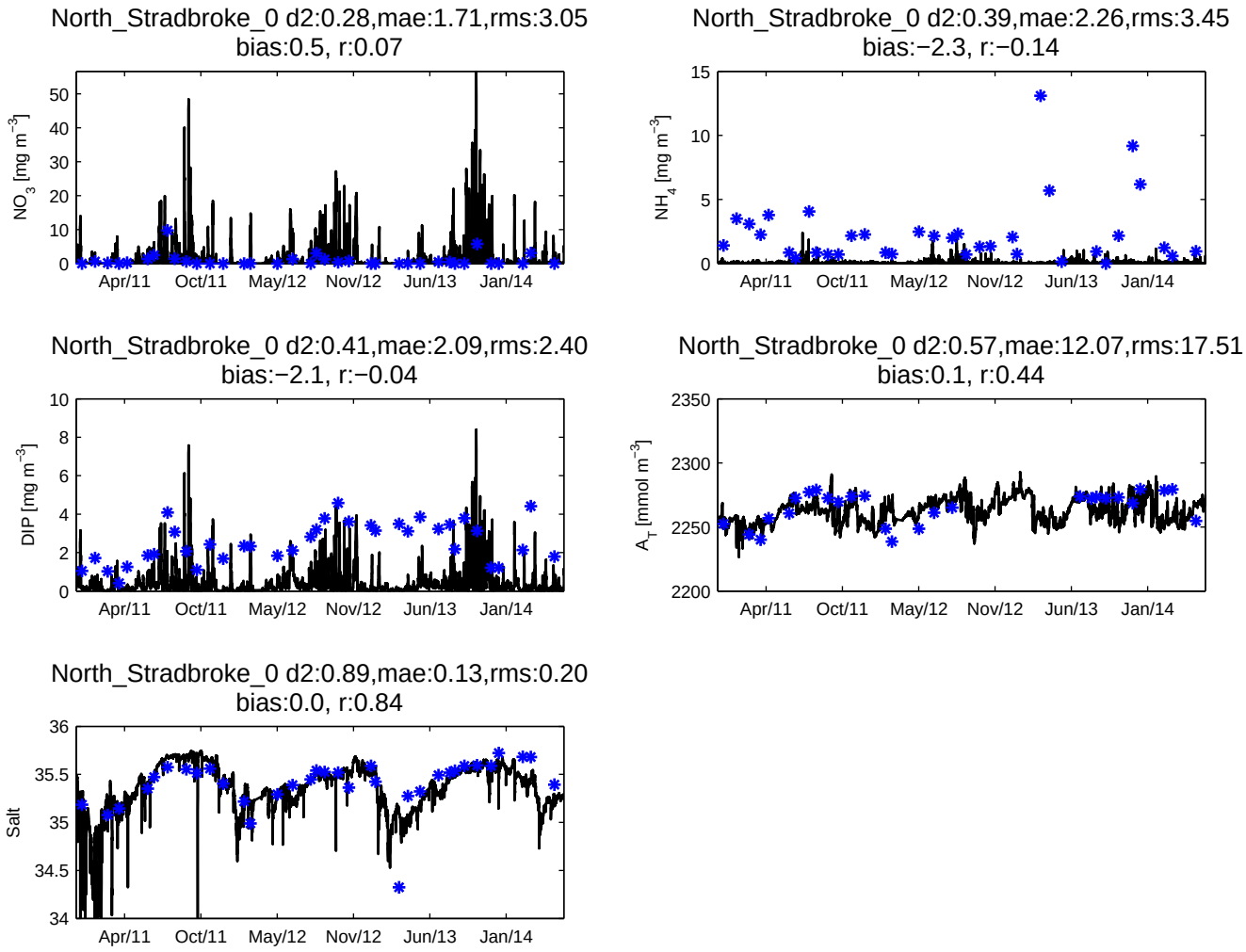


Figure 66: North Stradbroke (GBRNSI) IMOS/NRS Moorings Nutrients observations against GBR4 model: Observation (blue), model (black): Parameter/s = (NO_3, NH_4, DIP, A_T). Field observation depth taken: 0 m. Model grid deepest point at this site -66 m. Observation deepest point at this site 67 m.

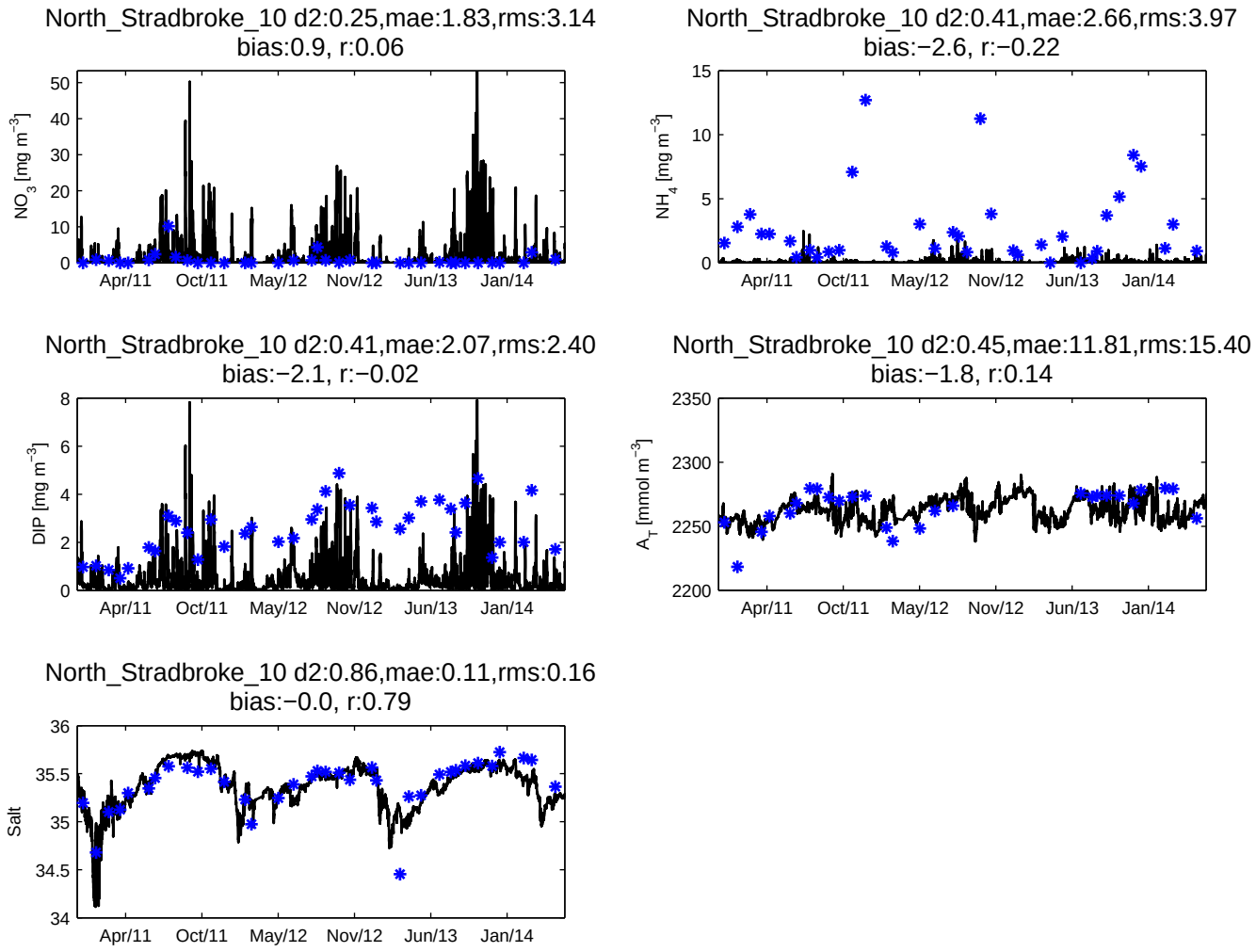


Figure 67: North Stradbroke (GBRNSI) IMOS/NRS Moorings Nutrients observations against GBR4 model: Observation (blue), model (black): Parameter/s = NO_3, NH_4, DIP, A_T. Field observation depth taken: 10 m. Model grid deepest point at this site -66 m. Observation deepest point at this site 67 m.

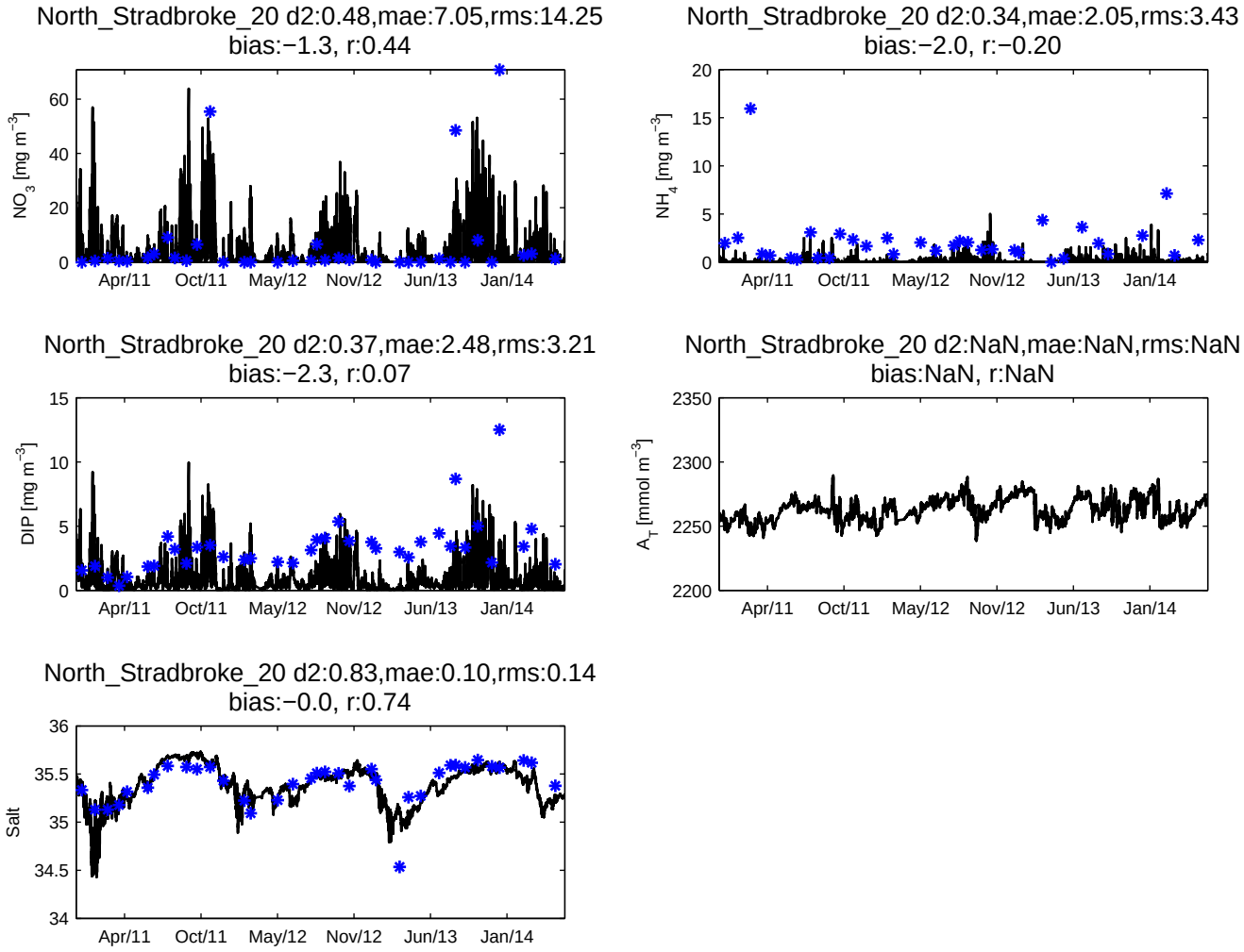


Figure 68: North Stradbroke (GBRNSI) IMOS/NRS Moorings Nutrients observations against GBR4 model: Observation (blue), model (black): Parameter/s = NO_3, NH_4, DIP, A_T. Field observation depth taken: 20 m. Model grid deepest point at this site -66 m. Observation deepest point at this site 67 m.

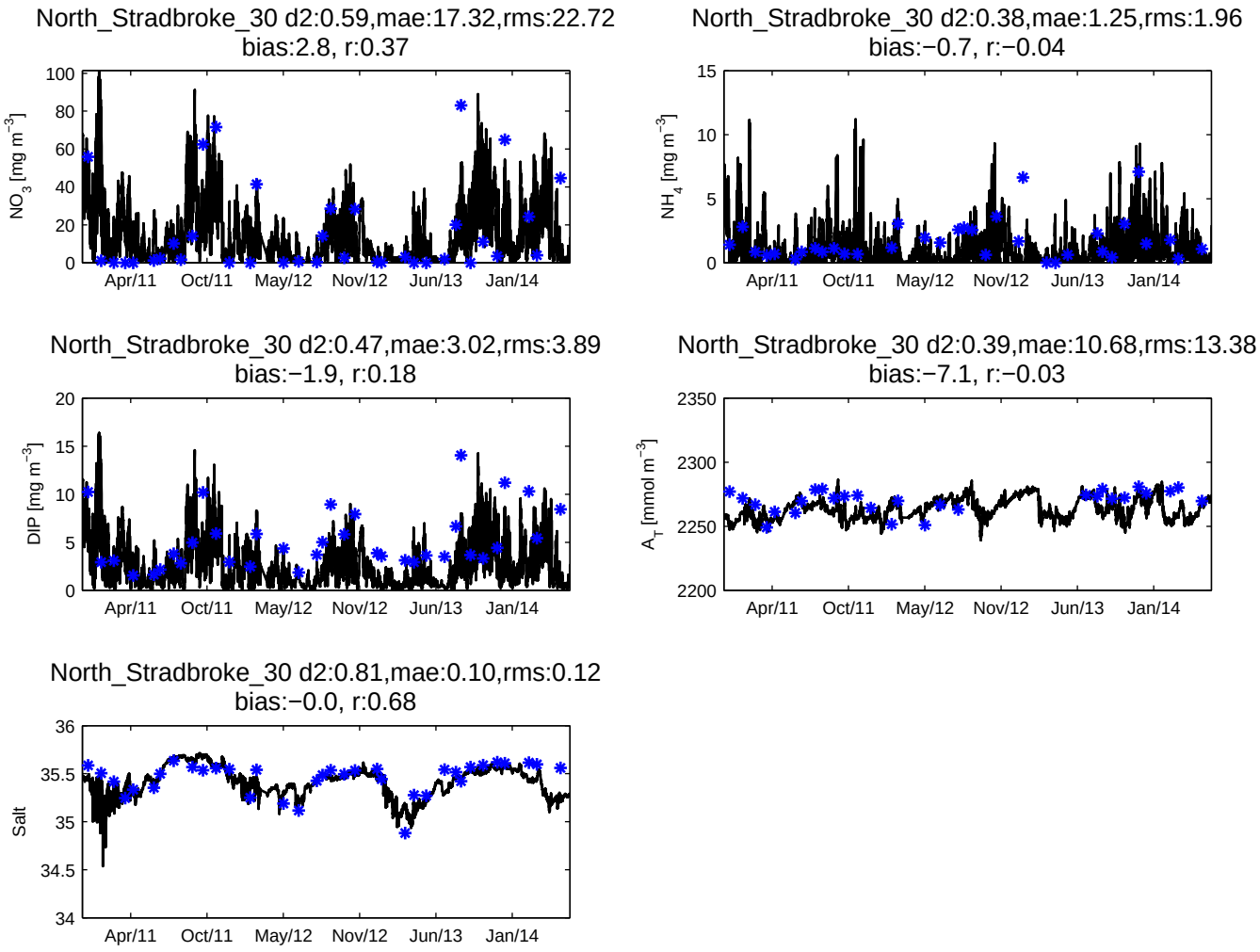


Figure 69: North Stradbroke (GBRNSI) IMOS/NRS Moorings Nutrients observations against GBR4 model: Observation (blue), model (black): Parameter/s = NO_3, NH_4, DIP, A_T. Field observation depth taken: 30 m. Model grid deepest point at this site -66 m. Observation deepest point at this site 67 m.

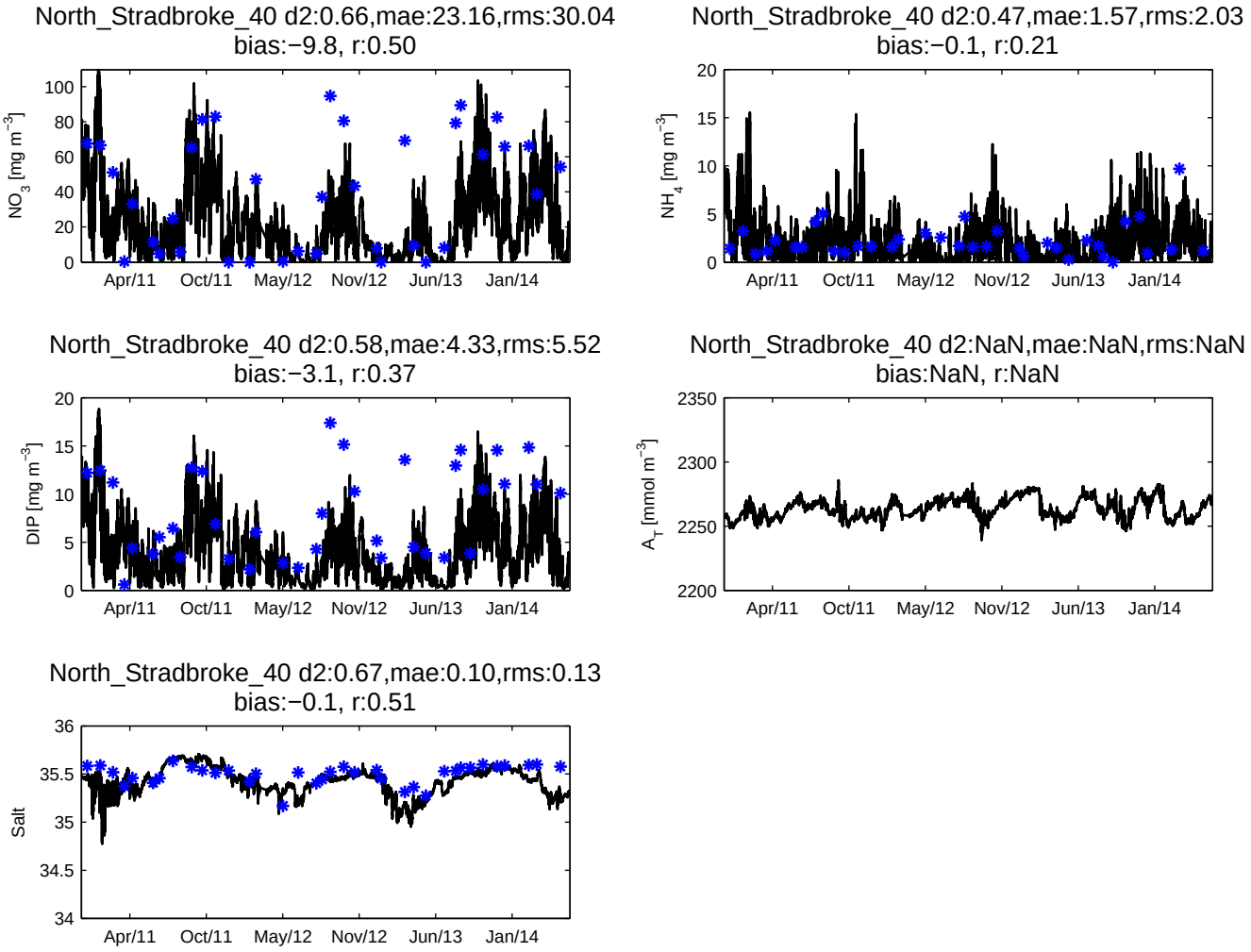


Figure 70: North Stradbroke (GBRNSI) IMOS/NRS Moorings Nutrients observations against GBR4 model: Observation (blue), model (black): Parameter/s = NO_3, NH_4, DIP, A_T. Field observation depth taken: 40 m. Model grid deepest point at this site -66 m. Observation deepest point at this site 67 m.

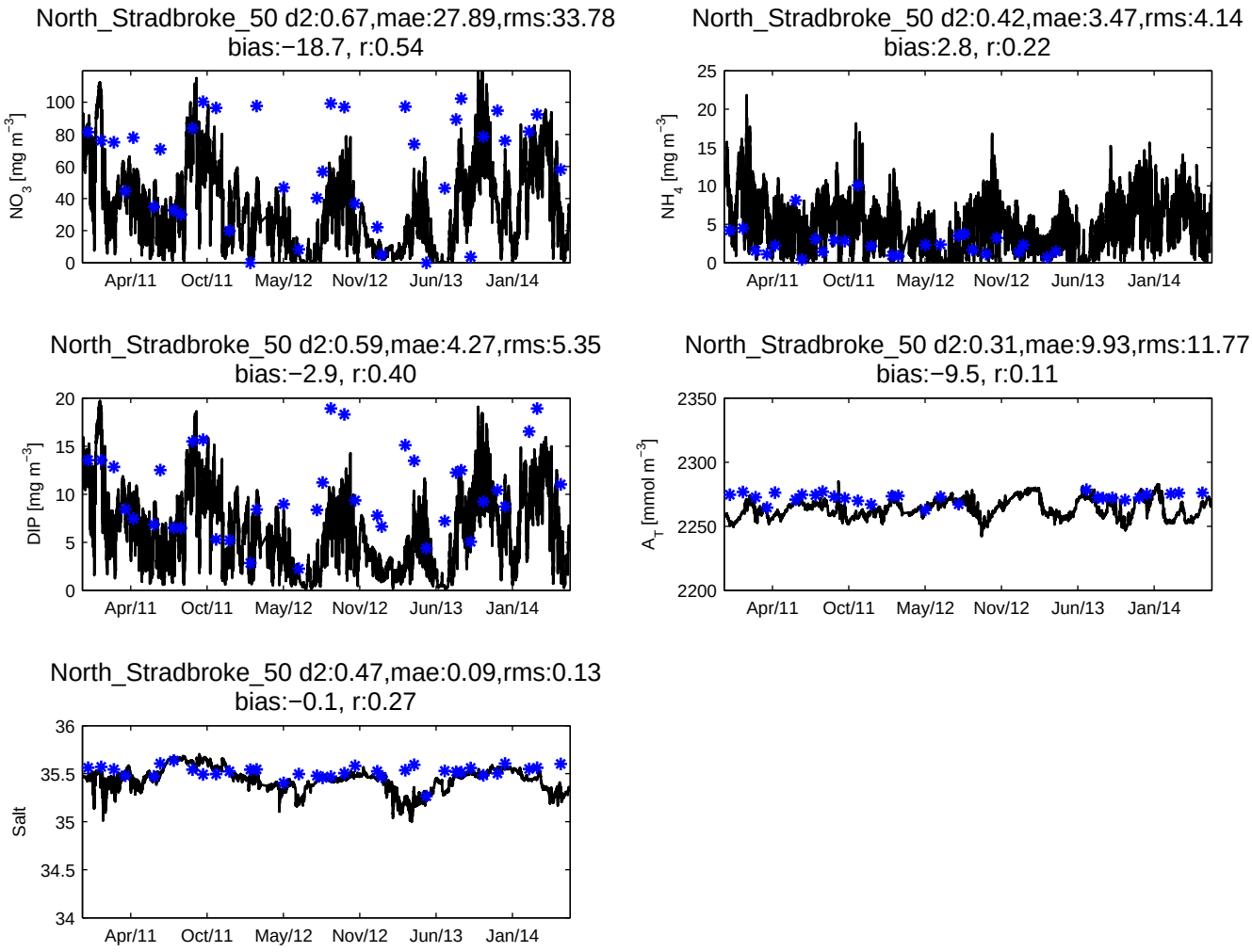


Figure 71: North Stradbroke (GBRNSI) IMOS/NRS Moorings Nutrients observations against GBR4 model: Observation (blue), model (black): Parameter/s = NO_3, NH_4, DIP, A_T. Field observation depth taken: 50 m. Model grid deepest point at this site -66 m. Observation deepest point at this site 67 m.

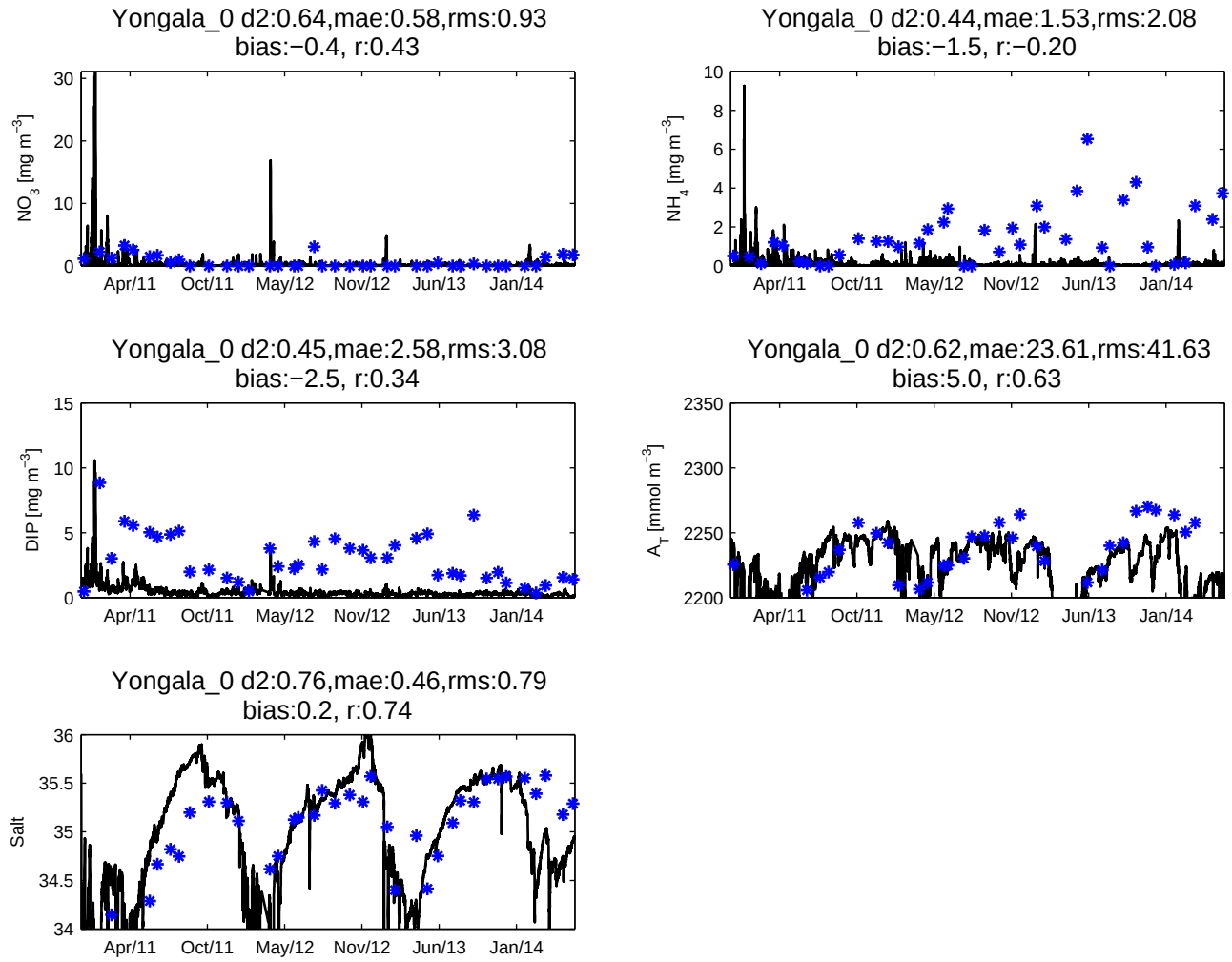


Figure 72: Yongala (NRSYON) IMOS/NRS Moorings Nutrients observations against GBR4 model: Observation (blue), model (black): Parameter/s = (NO_3, NH_4, DIP, A_T). Field observation depth taken: 0 m. Model grid deepest point at this site -28.62 m. Observation deepest point at this site 27 m.

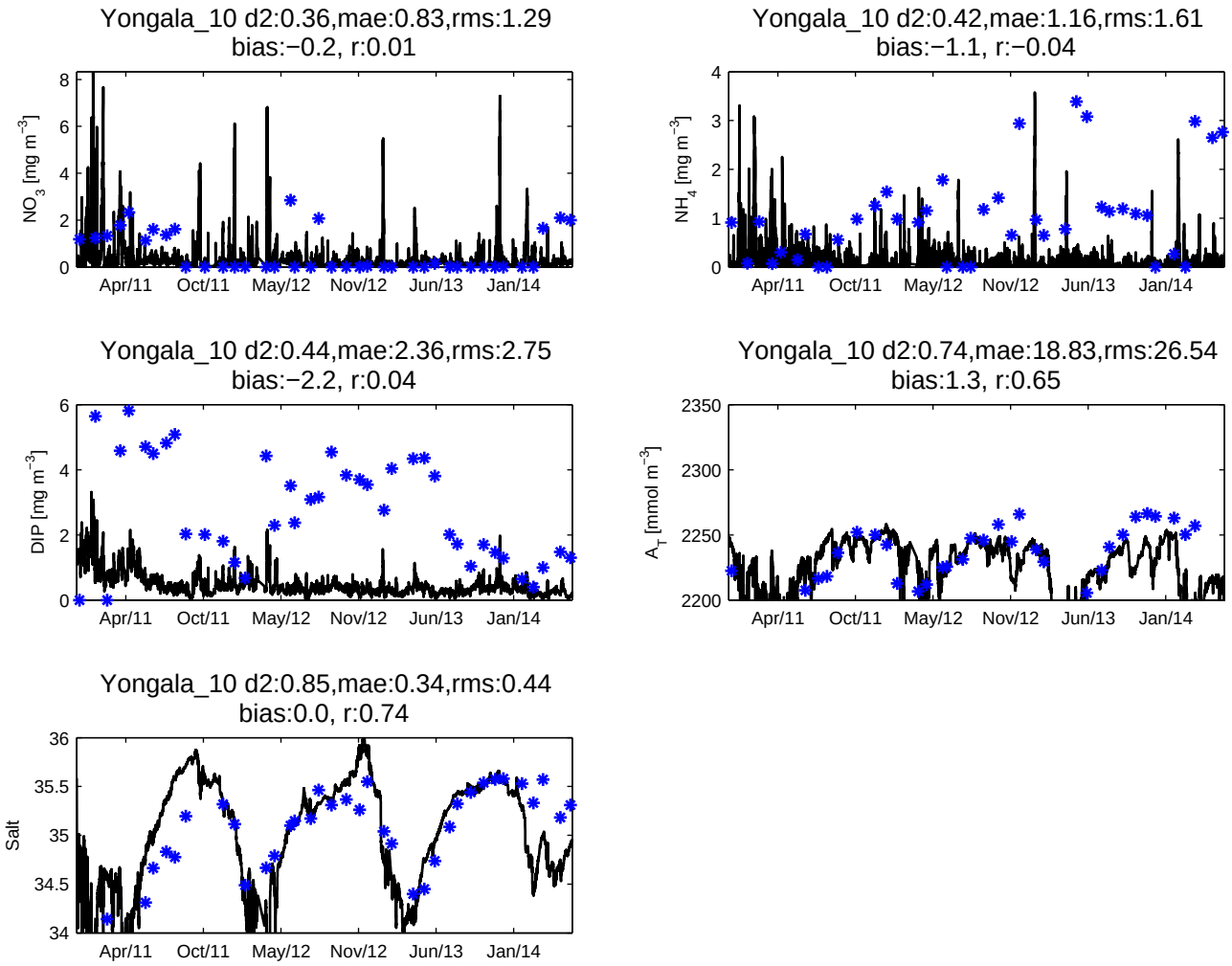


Figure 73: Yongala (NRSYON) IMOS/NRS Moorings Nutrients observations against GBR4 model: Observation (blue), model (black): Parameter/s = (NO_3, NH_4, DIP, A_T). Field observation depth taken: 10 m. Model grid deepest point at this site -28.62 m. Observation deepest point at this site 27 m.

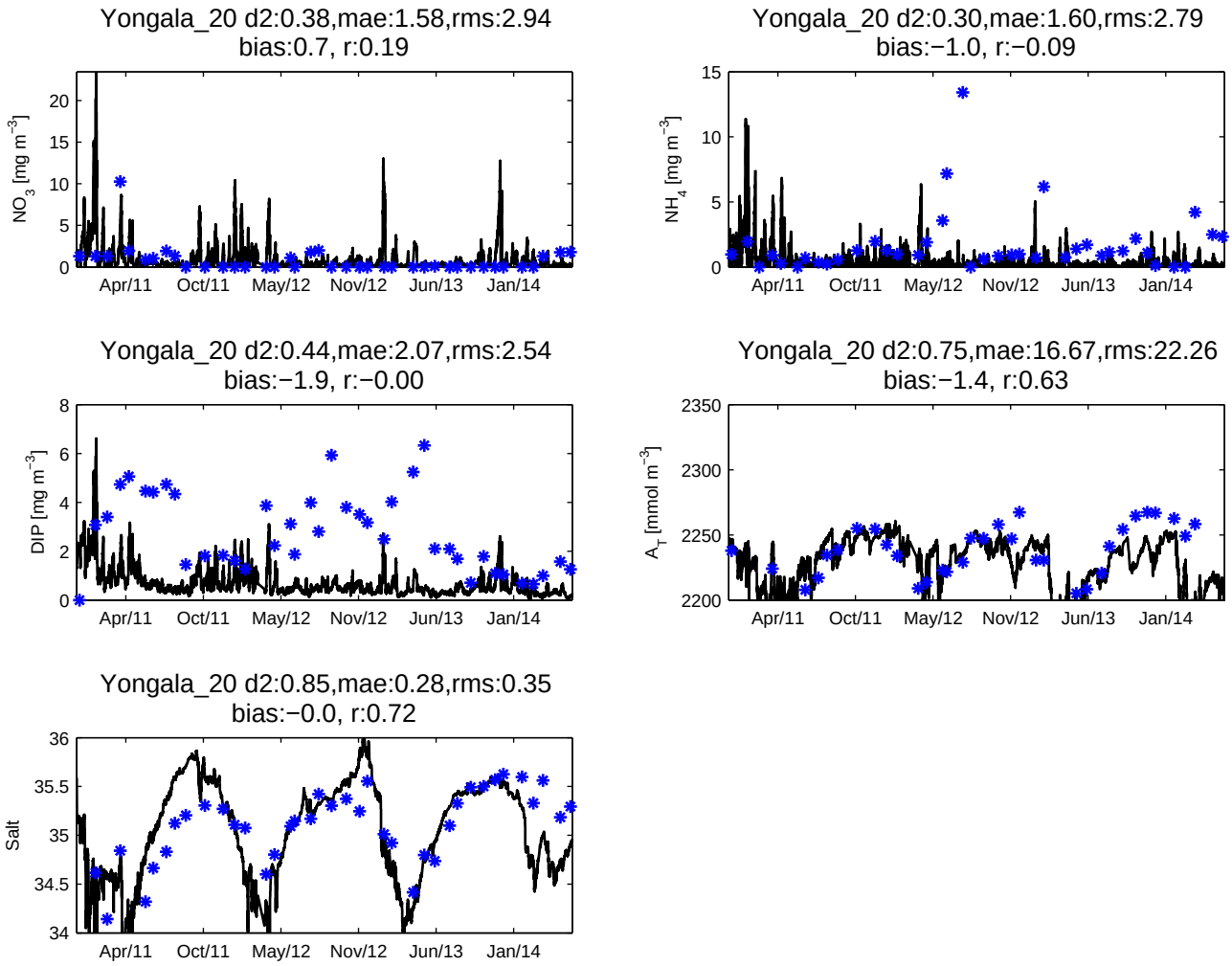


Figure 74: Yongala (NRSYON) IMOS/NRS Moorings Nutrients observations against GBR4 model: Observation (blue), model (black): Parameter/s = (NO_3, NH_4, DIP, A_T). Field observation depth taken: 20 m. Model grid deepest point at this site -28.62 m. Observation deepest point at this site 27 m.

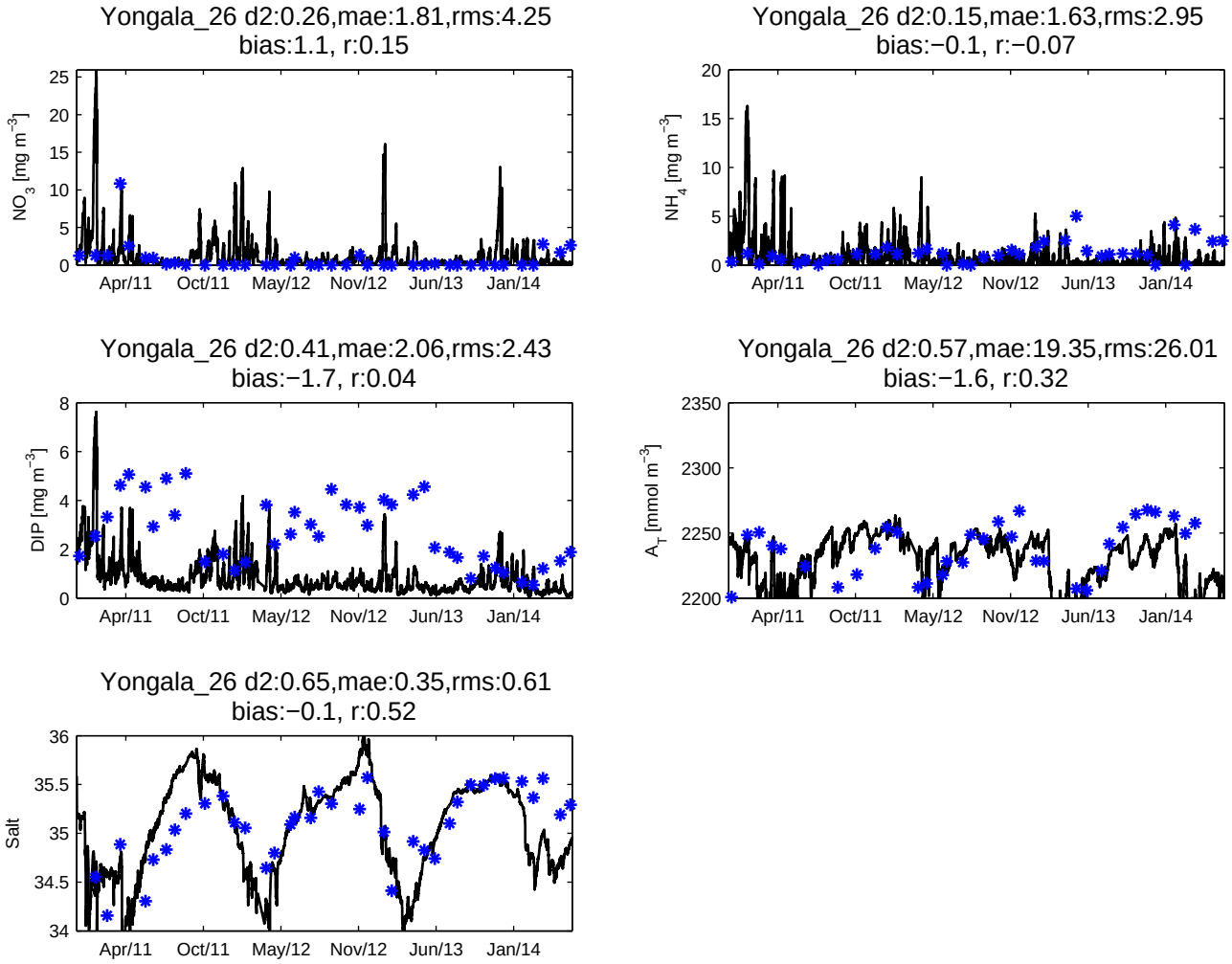


Figure 75: Yongala (NRSYON) IMOS/NRS Moorings Nutrients observations against GBR4 model: Observation (blue), model (black): Parameter/s = (NO_3, NH_4, DIP, A_T). Field observation depth taken: 26 m. Model grid deepest point at this site -28.62 m. Observation deepest point at this site 27 m.

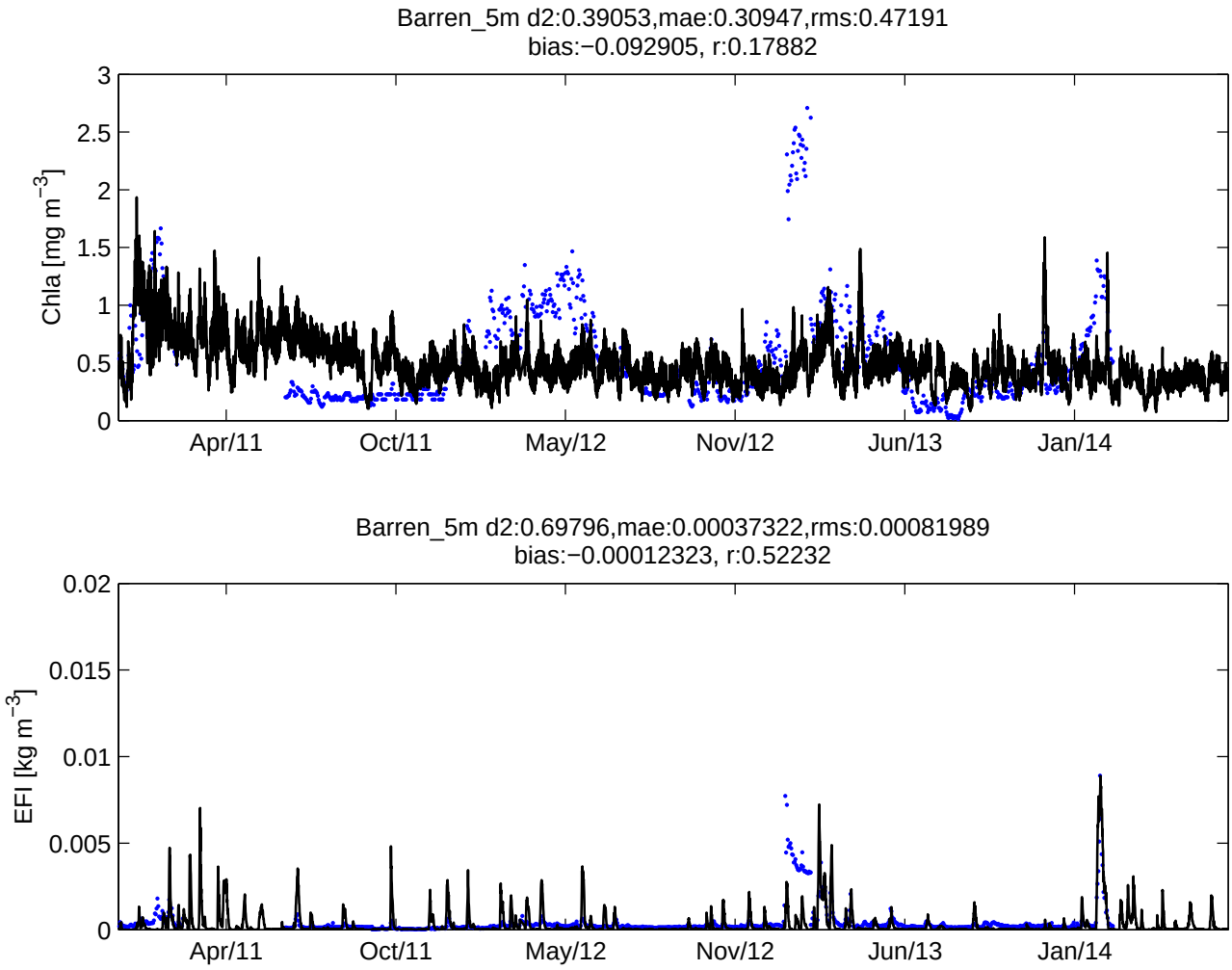


Figure 76: Barren Island Reef Rescue moorings (AIMS) observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS and Chlorophyll (fluorescence) . Field observation depth taken: 5 m. Model grid deepest point at this site 24.26 m. Observation deepest point at this site 15.2 to 18.9 m.

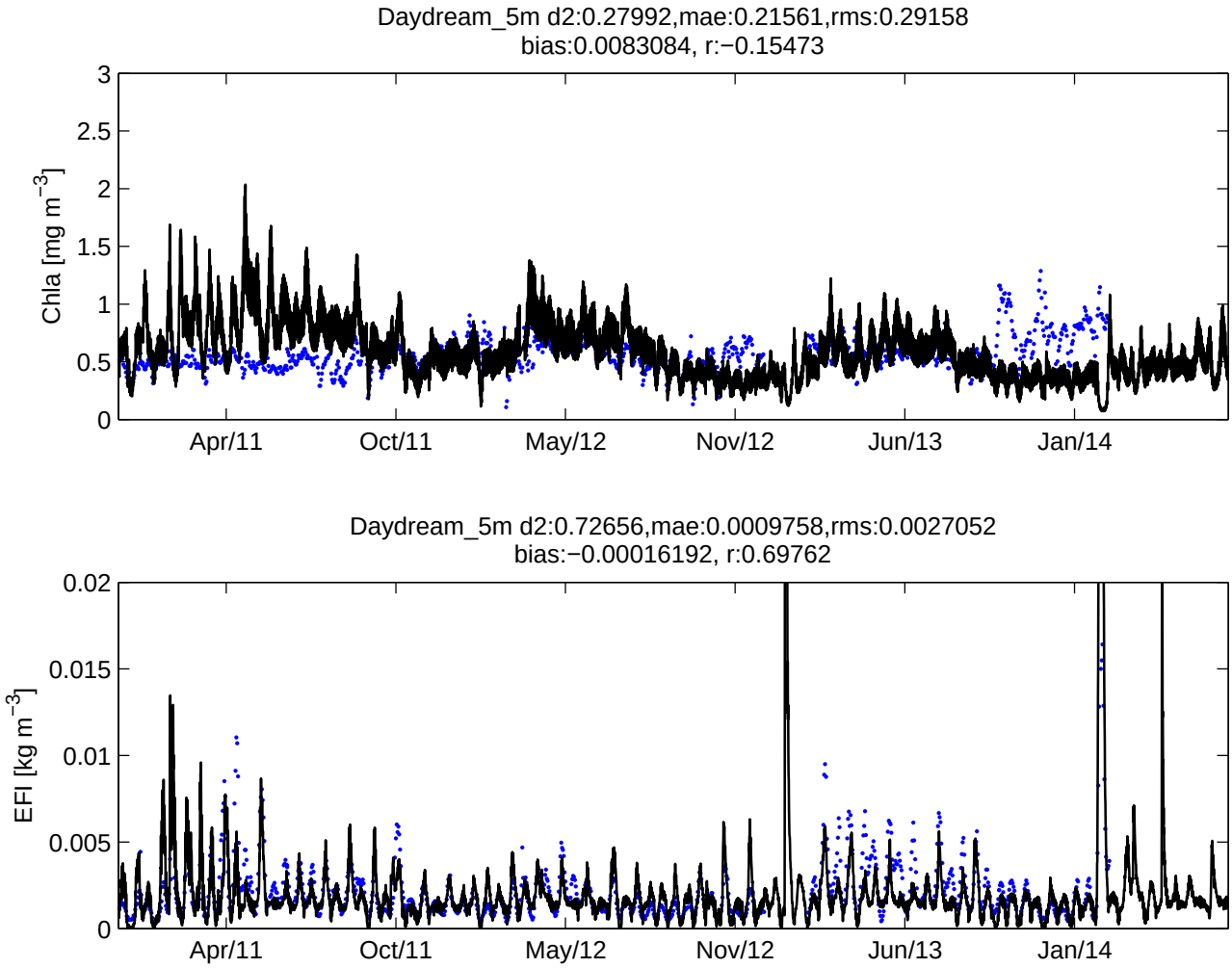


Figure 77: Daydream Island Reef Rescue moorings (AIMS) observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS and Chlorophyll (fluorescence) . Field observation depth taken: 5 m. Model grid deepest point at this site 16.76 m. Observation deepest point at this site 23.6 to 25.9 m.

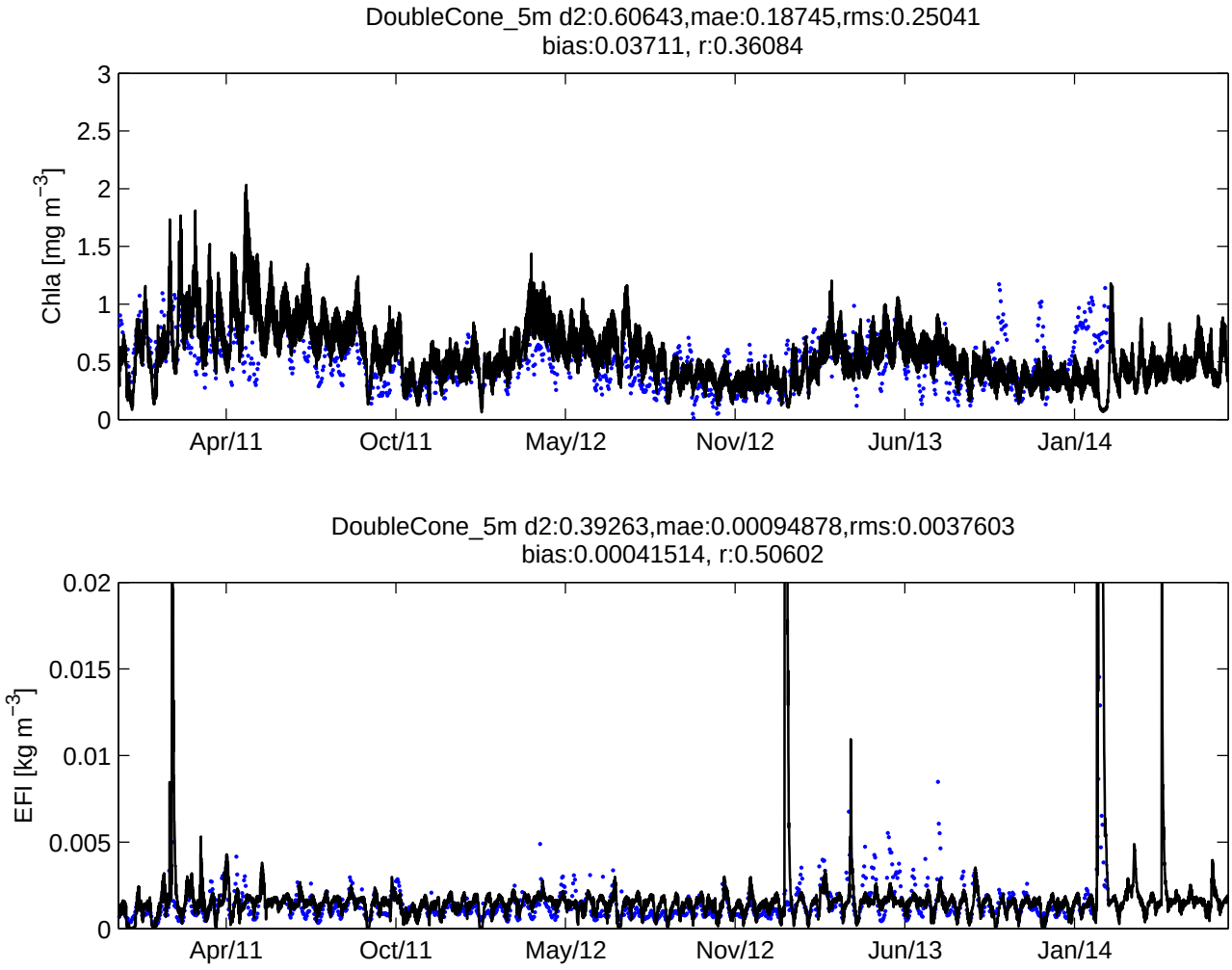


Figure 78: Double Cone Island Reef Rescue moorings (AIMS) observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS and Chlorophyll (fluorescence) . Field observation depth taken: 5 m. Model grid deepest point at this site 17.03 m. Observation deepest point at this site 23.0 to 31.0 m.

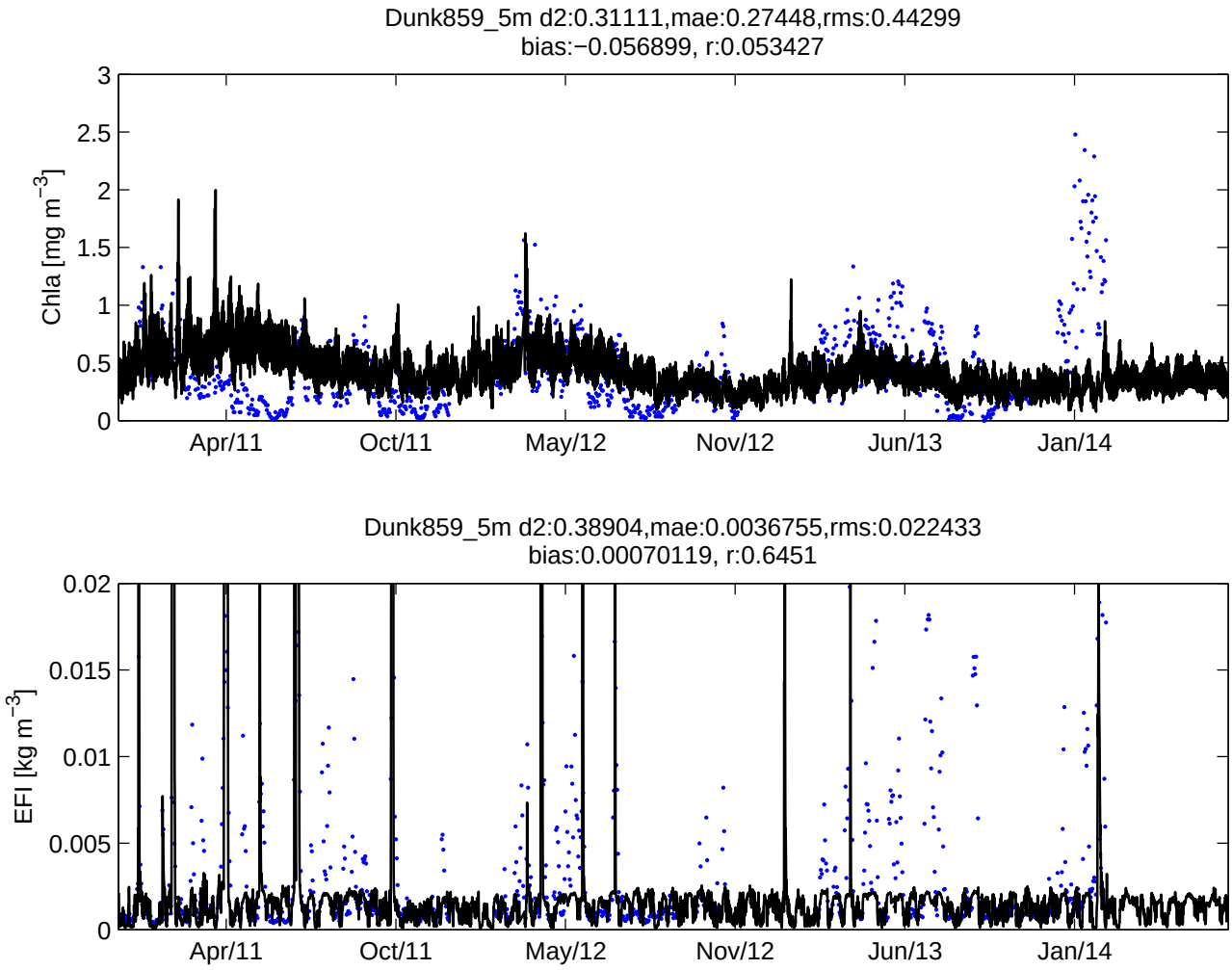


Figure 79: Dunk Island Reef Rescue moorings (AIMS) observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS and Chlorophyll (fluorescence) . Field observation depth taken: 5 m. Model grid deepest point at this site 9.15 m. Observation deepest point at this site 9.0 to 10.4 m.

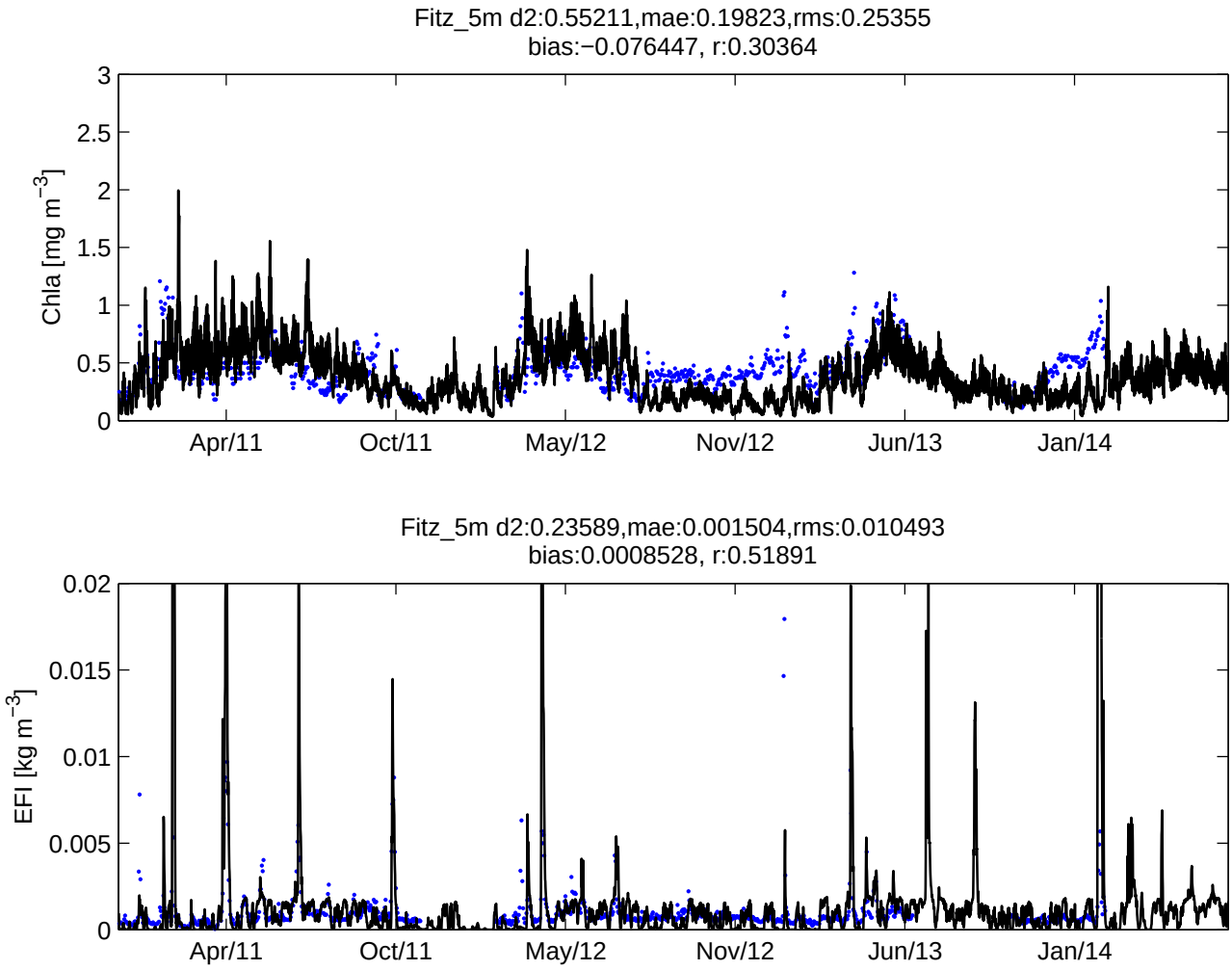


Figure 80: Fitzroy Reef Reef Rescue moorings (AIMS) observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS and Chlorophyll (fluorescence) . Field observation depth taken: 5 m. Model grid deepest point at this site 27 m. Observation deepest point at this site 15.5 to17.2 m.

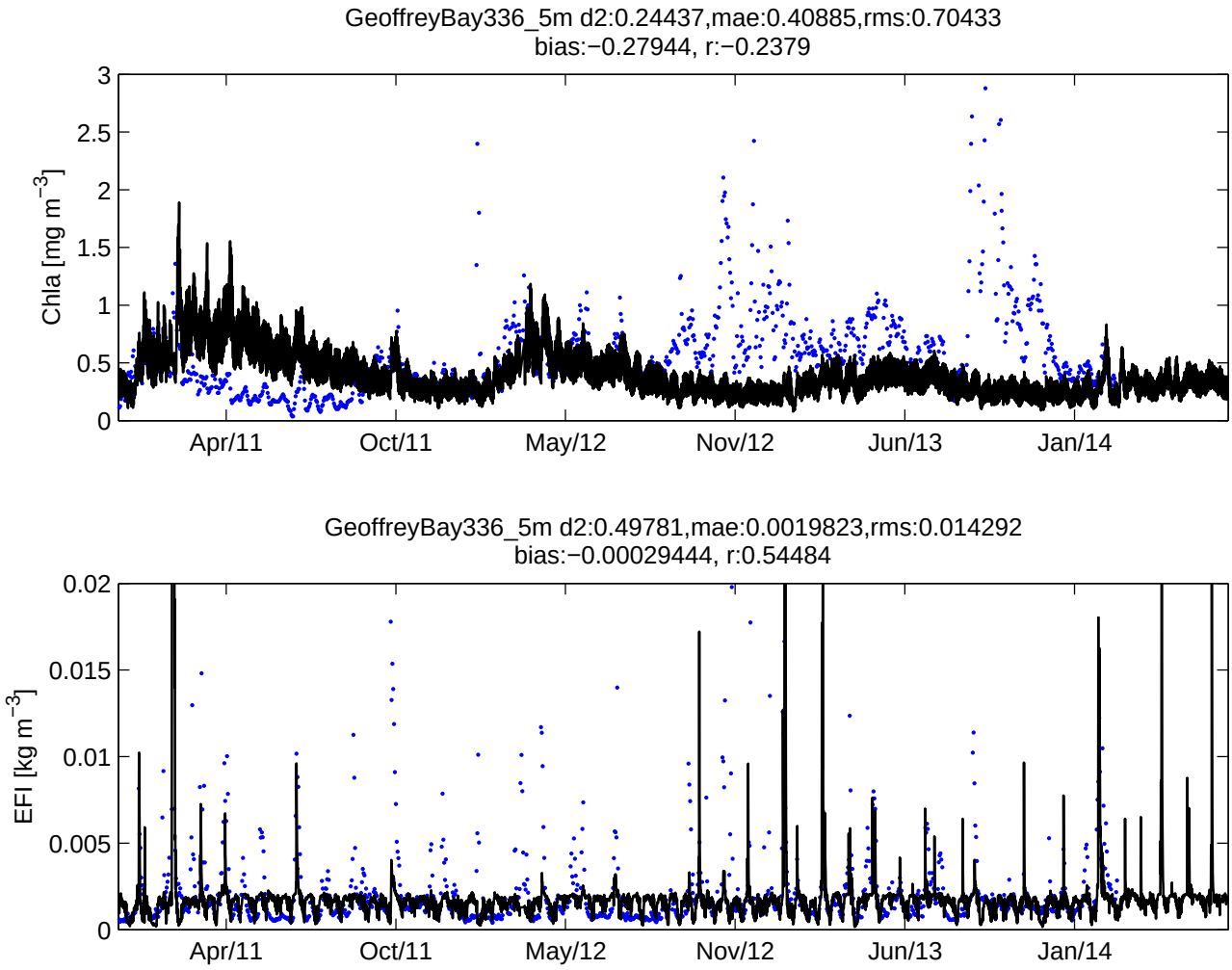


Figure 81: Geoffrey Bay Reef Rescue moorings (AIMS) observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS and Chlorophyll (fluorescence) . Field observation depth taken: 5 m. Model grid deepest point at this site -10.42 m. Observation deepest point at this site 9.9 to 12 m.

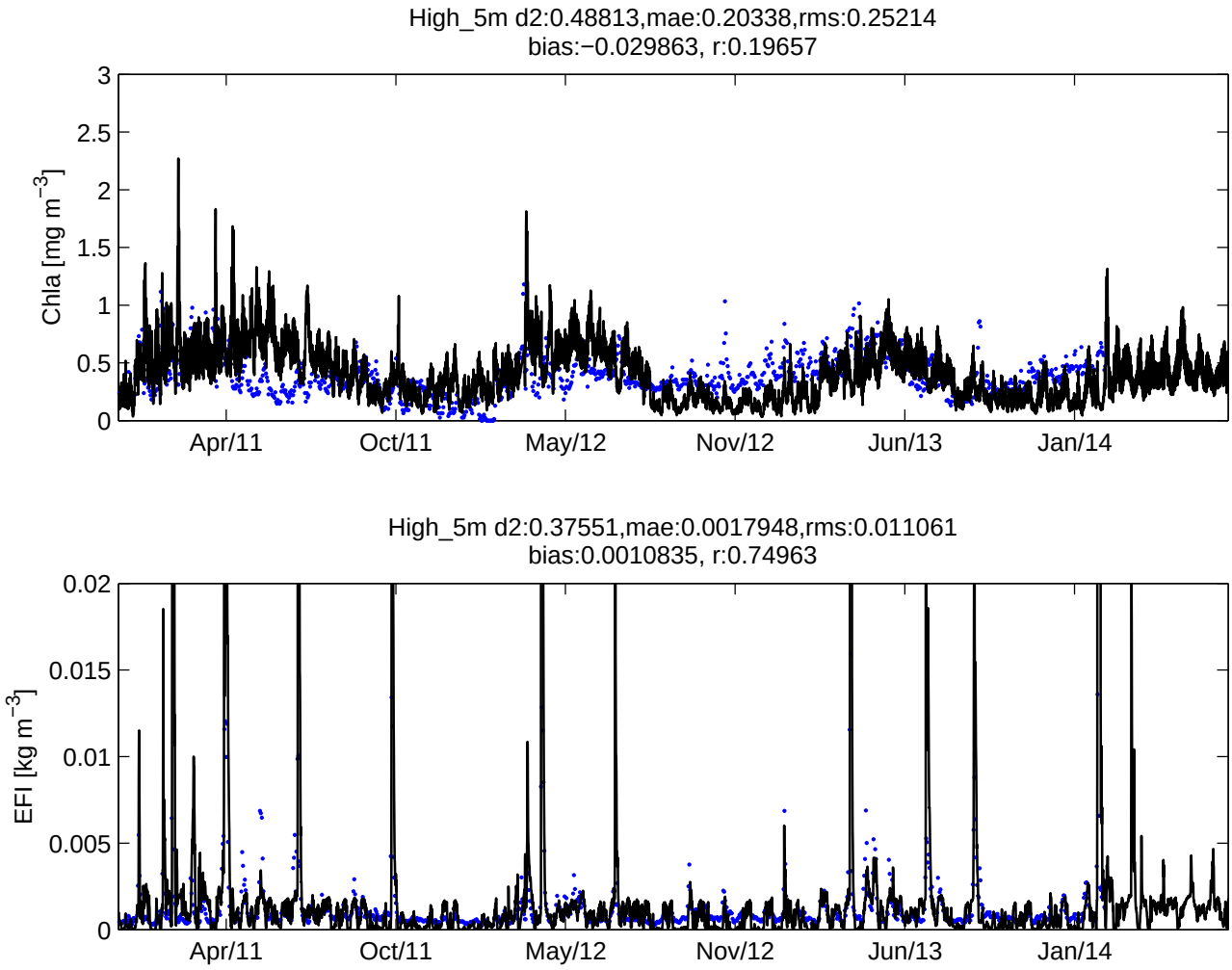


Figure 82: High Island Reef Rescue moorings (AIMS) observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS and Chlorophyll (fluorescence) . Field observation depth taken: 5 m. Model grid deepest point at this site -17.64 m. Observation deepest point at this site 22.0 to 25.3 m.

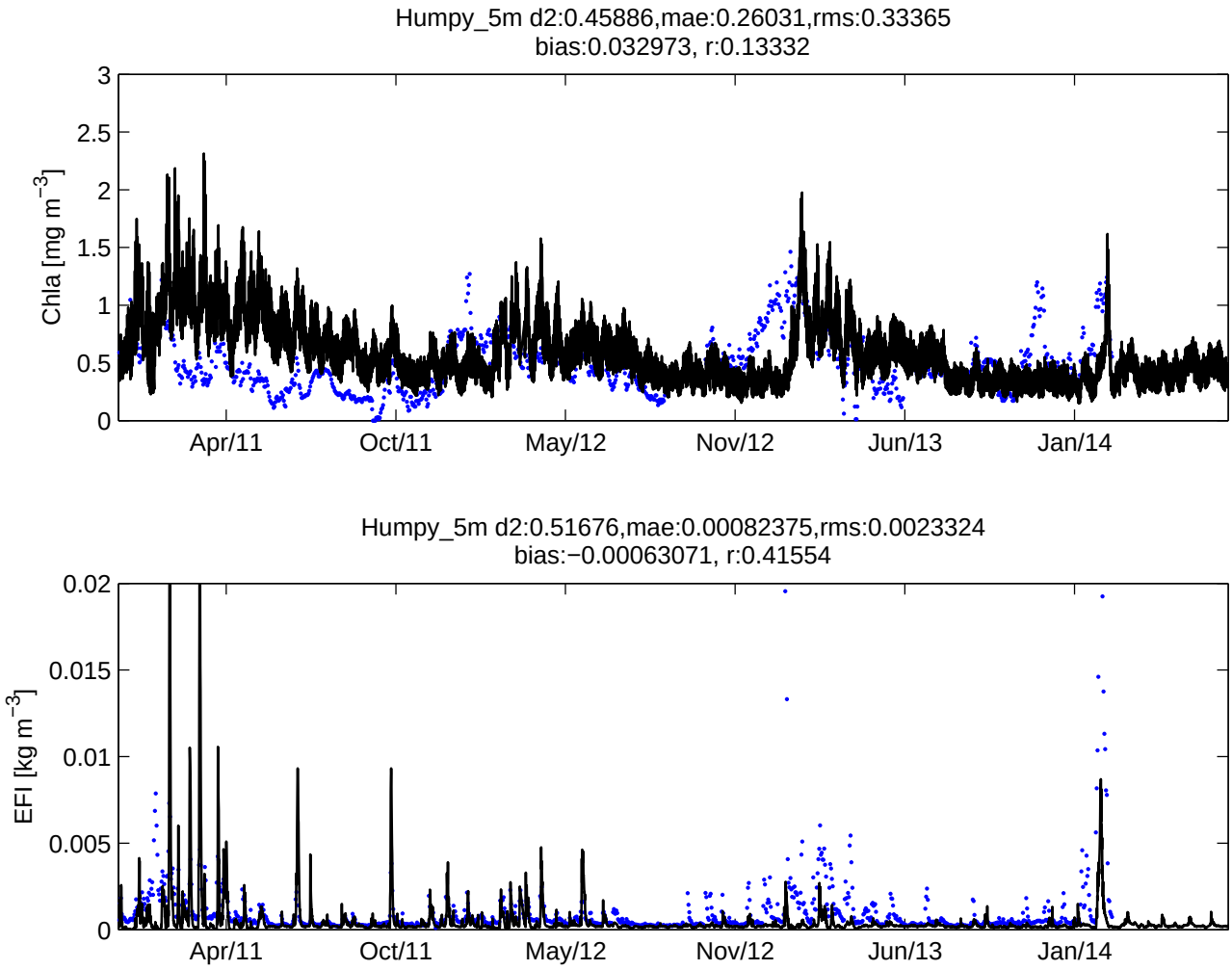


Figure 83: Humpy Island Reef Rescue moorings (AIMS) observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS and Chlorophyll (fluorescence) . Field observation depth taken: 5 m. Model grid deepest point at this site -12.86 m. Observation deepest point at this site 12.6 to 19.5 m.

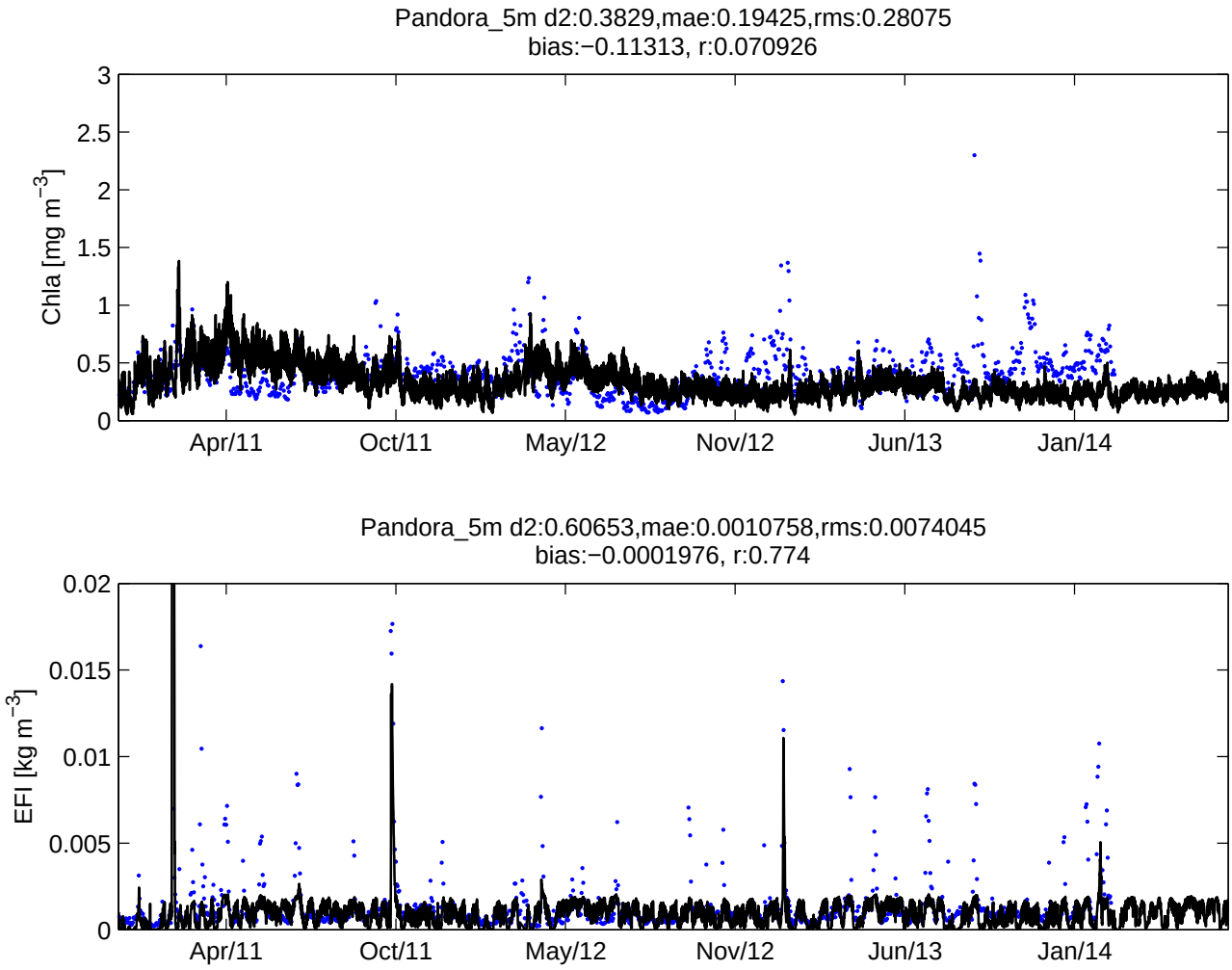


Figure 84: Pandora Island Reef Rescue moorings (AIMS) observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS and Chlorophyll (fluorescence) . Field observation depth taken: 5 m. Model grid deepest point at this site -16.98 m. Observation deepest point at this site 12.9 to 13.9 m.

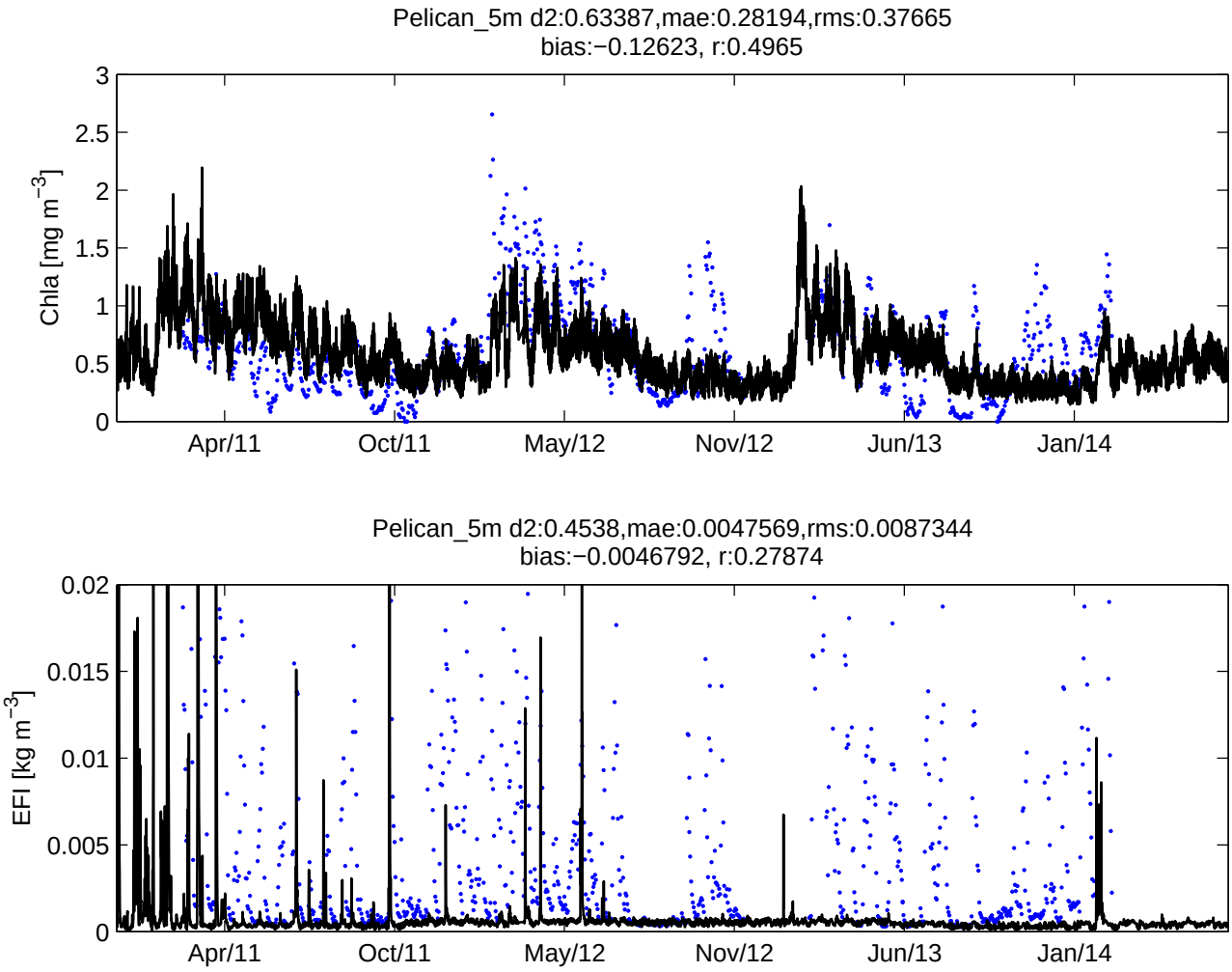


Figure 85: Pelican Island Reef Rescue moorings (AIMS) observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS and Chlorophyll (fluorescence) . Field observation depth taken: 5 m. Model grid deepest point at this site -4.47 m. Observation deepest point at this site 8.8 to 9.7 m.

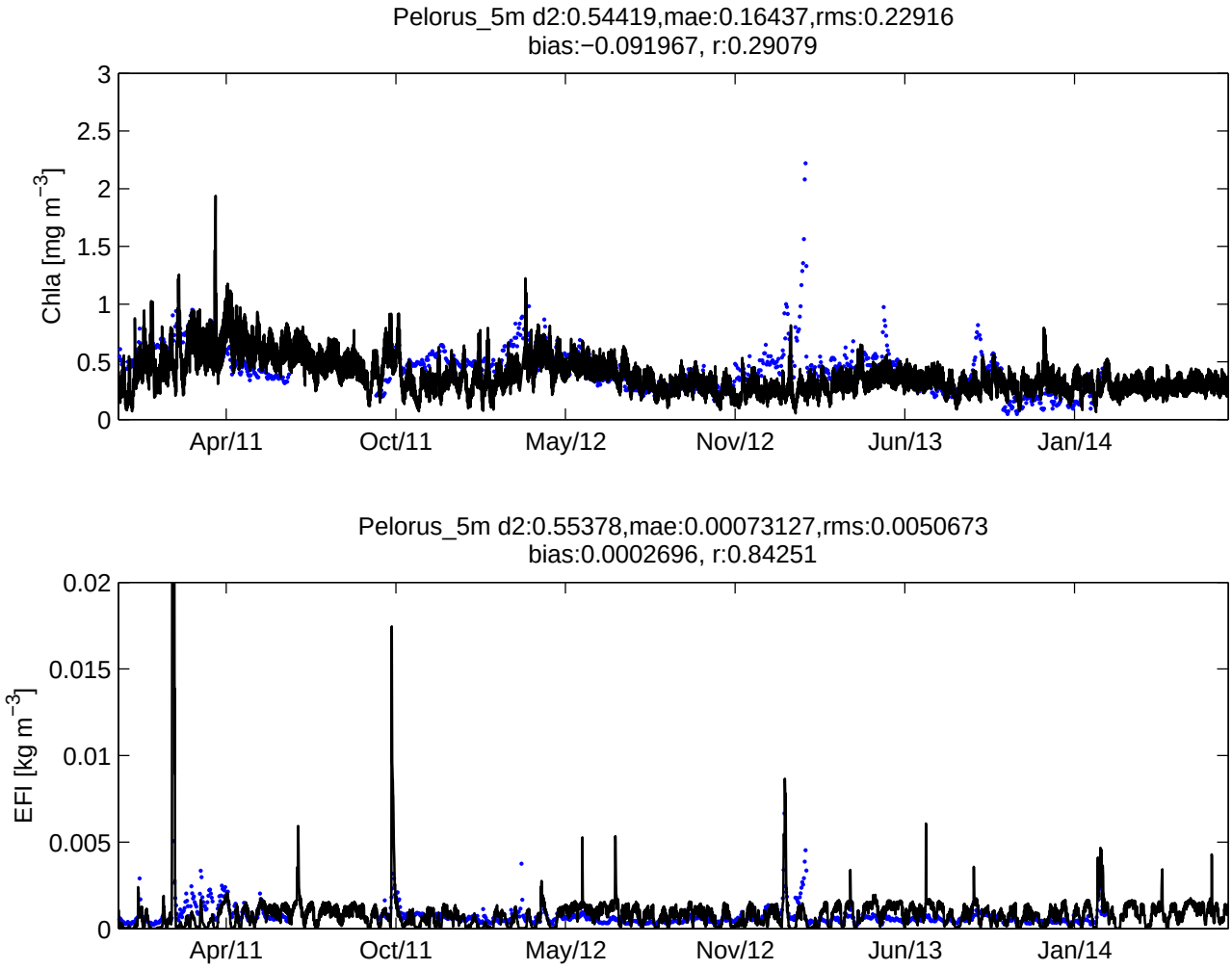


Figure 86: Pelorous/Orpheus Island Reef Rescue moorings (AIMS) observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS and Chlorophyll (fluorescence) . Field observation depth taken: 5 m. Model grid deepest point at this site -24.64 m. Observation deepest point at this site 25.3 to 31.4 m.

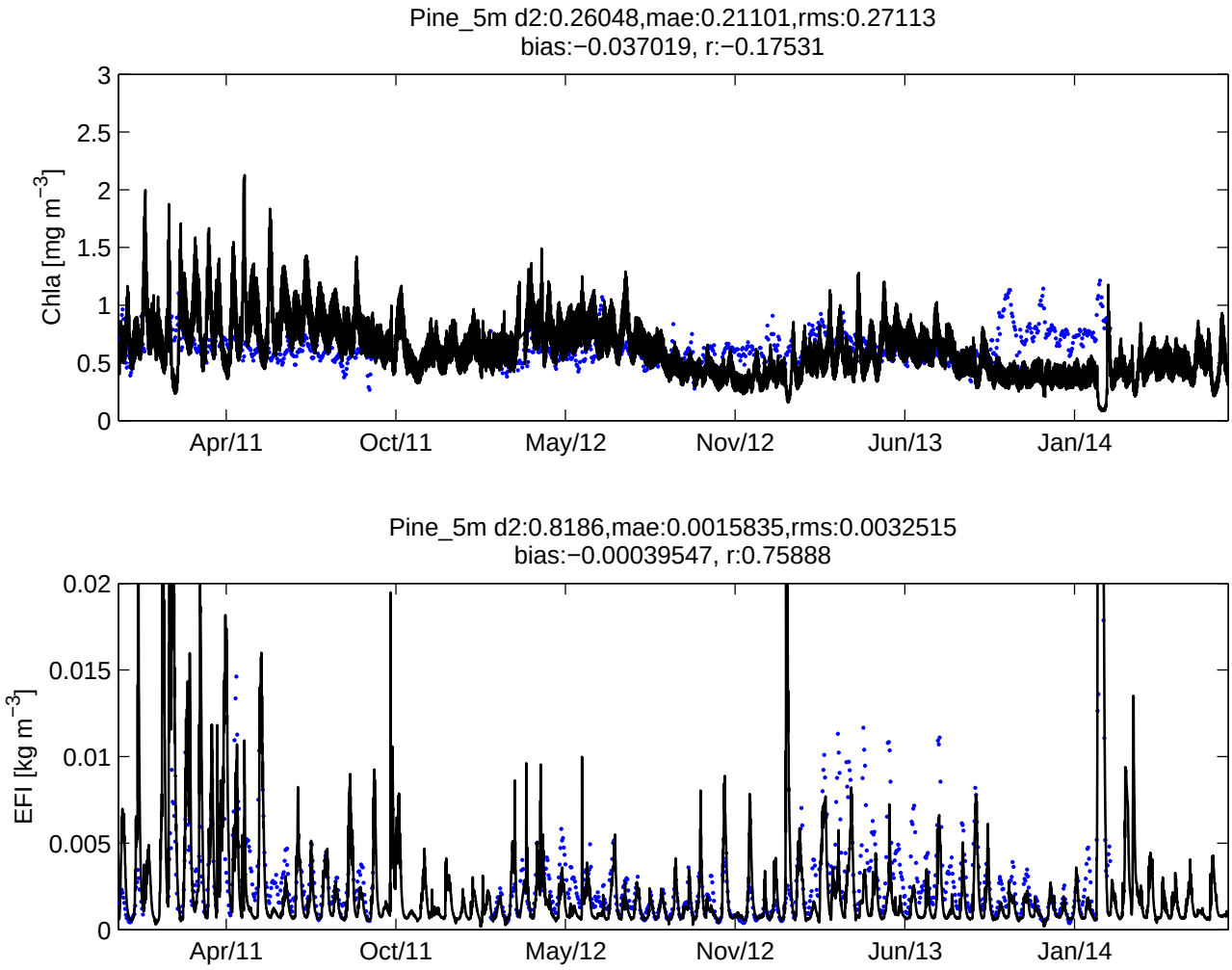


Figure 87: Pine Island Reef Rescue moorings (AIMS) observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS and Chlorophyll (fluorescence) . Field observation depth taken: 5 m. Model grid deepest point at this site -18.14 m. Observation deepest point at this site 20.0 to 25.7 m.

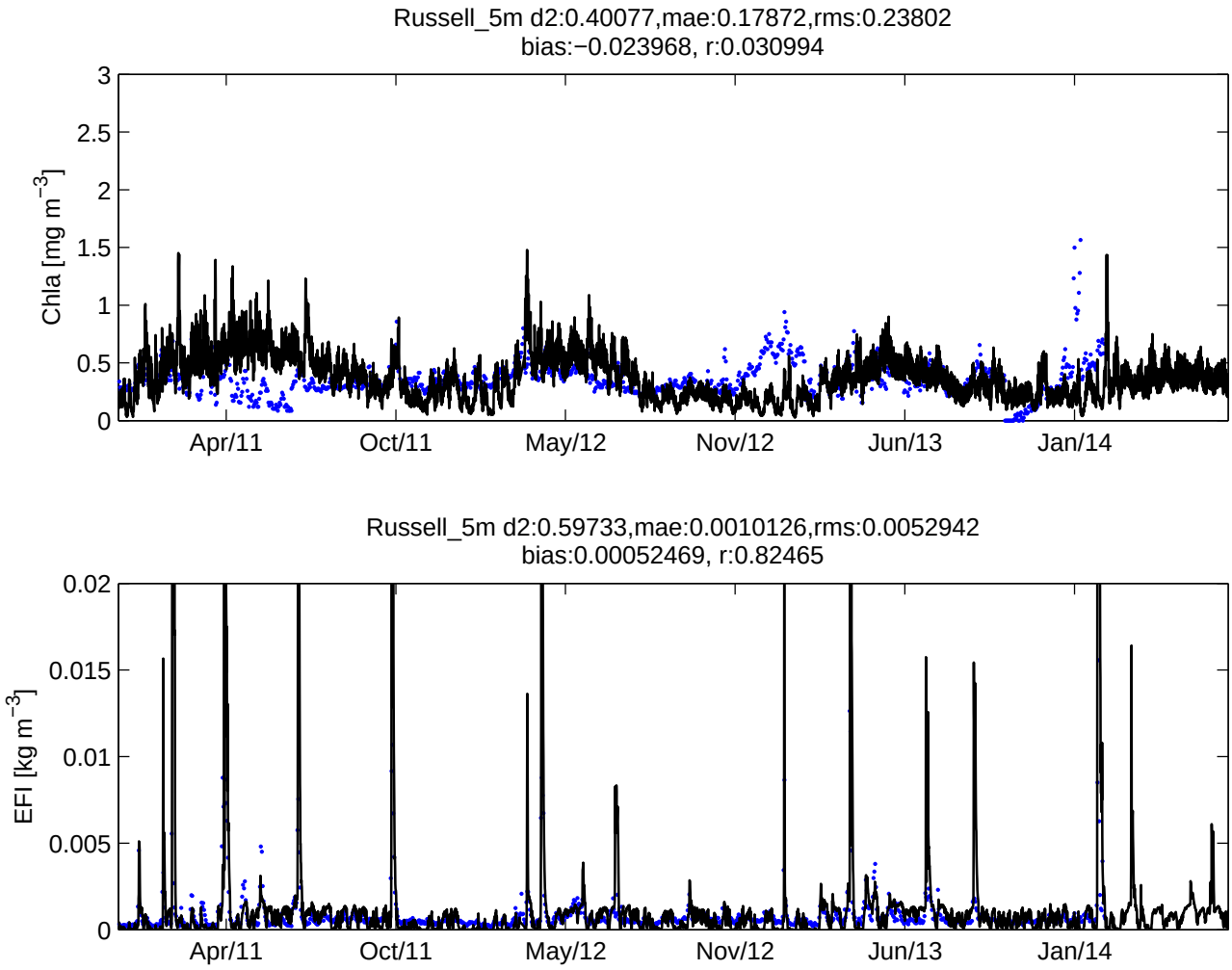


Figure 88: Russell Island Reef Rescue moorings (AIMS) observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS and Chlorophyll (fluorescence) . Field observation depth taken: 5 m. Model grid deepest point at this site -19.94 m. Observation deepest point at this site 22.0 to 23.7 m.

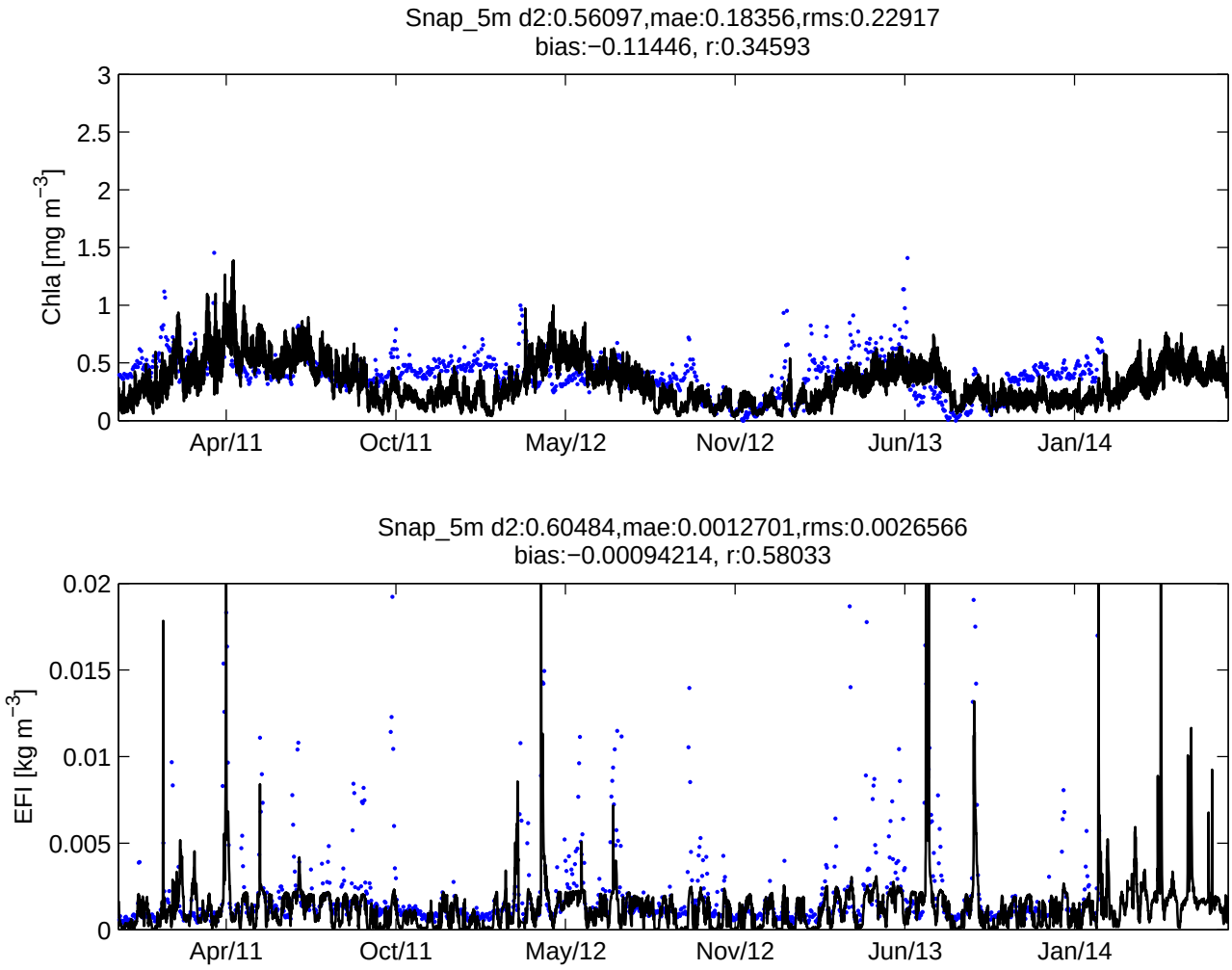


Figure 89: Snapper Island Reef Rescue moorings (AIMS) observations against GBR4 model: Observation (blue), model (black): Parameter/s = TSS and Chlorophyll (fluorescence) . Field observation depth taken: 5 m. Model grid deepest point at this site -22.14 m. Observation deepest point at this site 8.0 to 11.2 m.

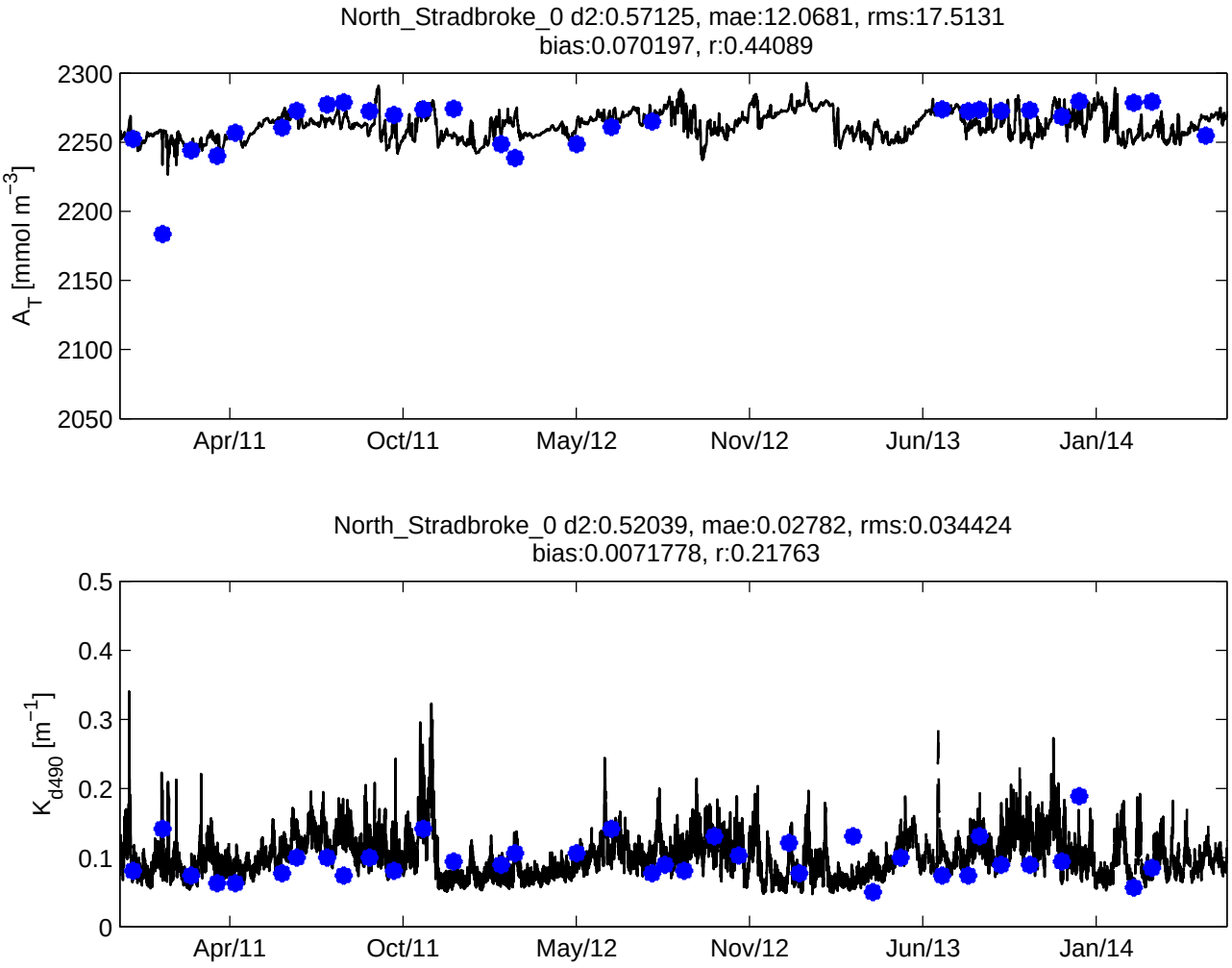


Figure 90: North Stradbroke (GBRNSI) IMOS/NRS Moorings observations against GBR4 model: Observation (blue), model (black): Parameter/s = Vertical attentuation of light at 490 nm, $K_{d,490}$ and alkalinity, A_T. Field observation depth taken: 0 m. Model grid deepest point at this site -66 m. Observation deepest point at this site 67 m.

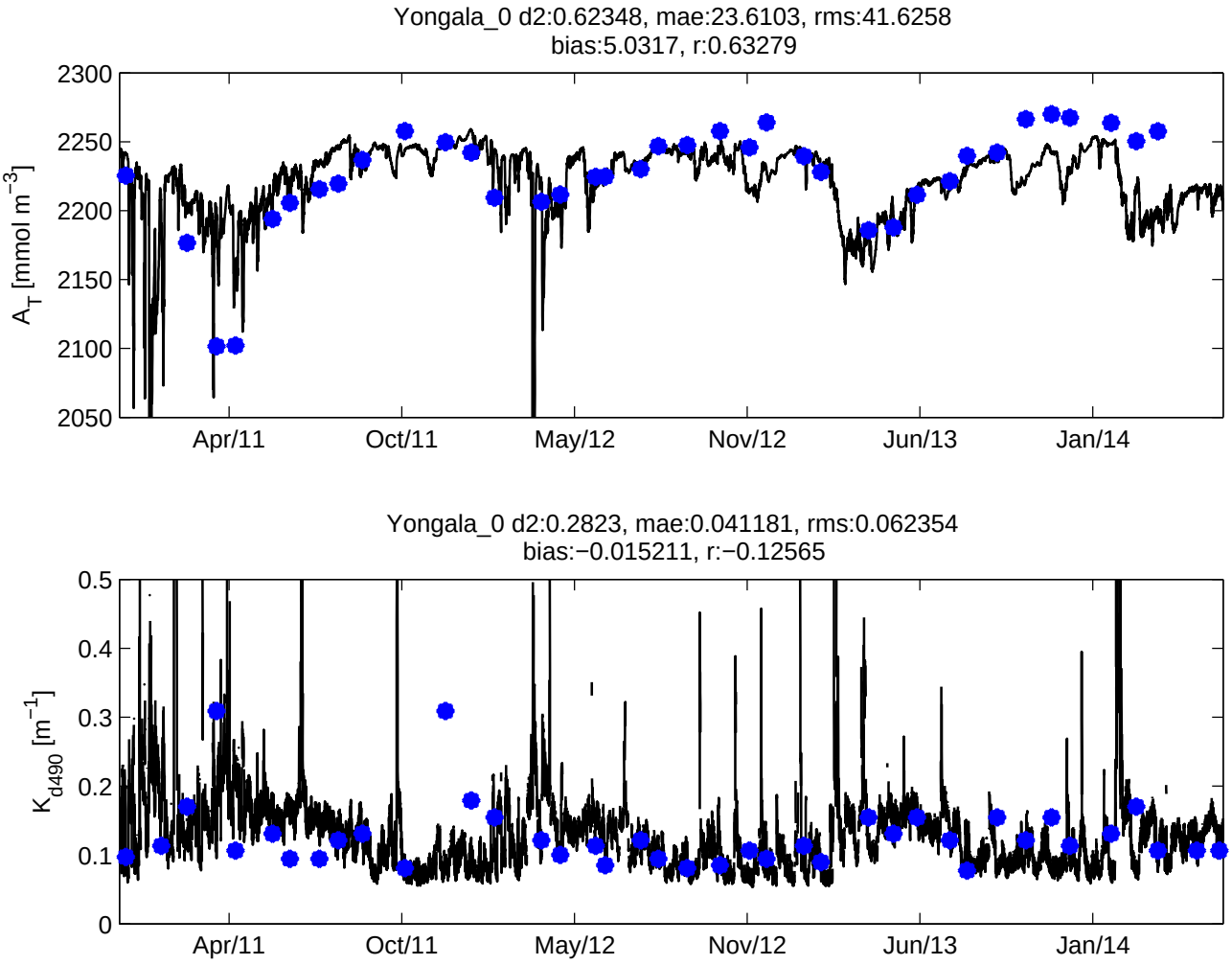


Figure 91: Yongala (NRSYON) IMOS/NRS Moorings observations against GBR4 model: Observation (blue), model (black): Parameter/s = Vertical attentuation of light at 490 nm, $K_{d,490}$ and alkalinity, A_T. Field observation depth taken: 0 m. Model grid deepest point at this site -28.62 m. Observation deepest point at this site 27 m.

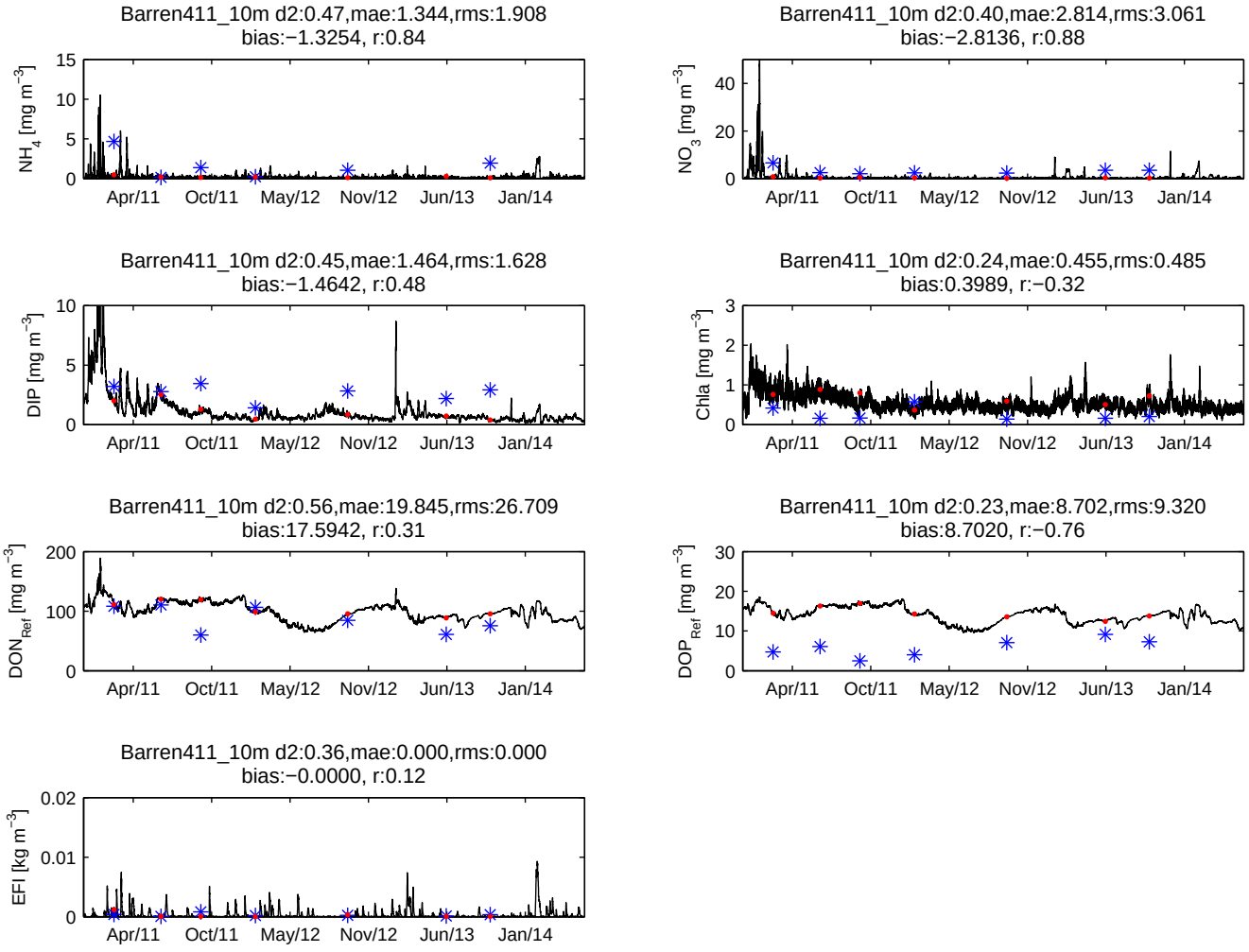


Figure 92: Barren Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 10 m. Model grid deepest point at this site 24.26 m. Observation deepest point at this site 15.2 to 18.9 m.

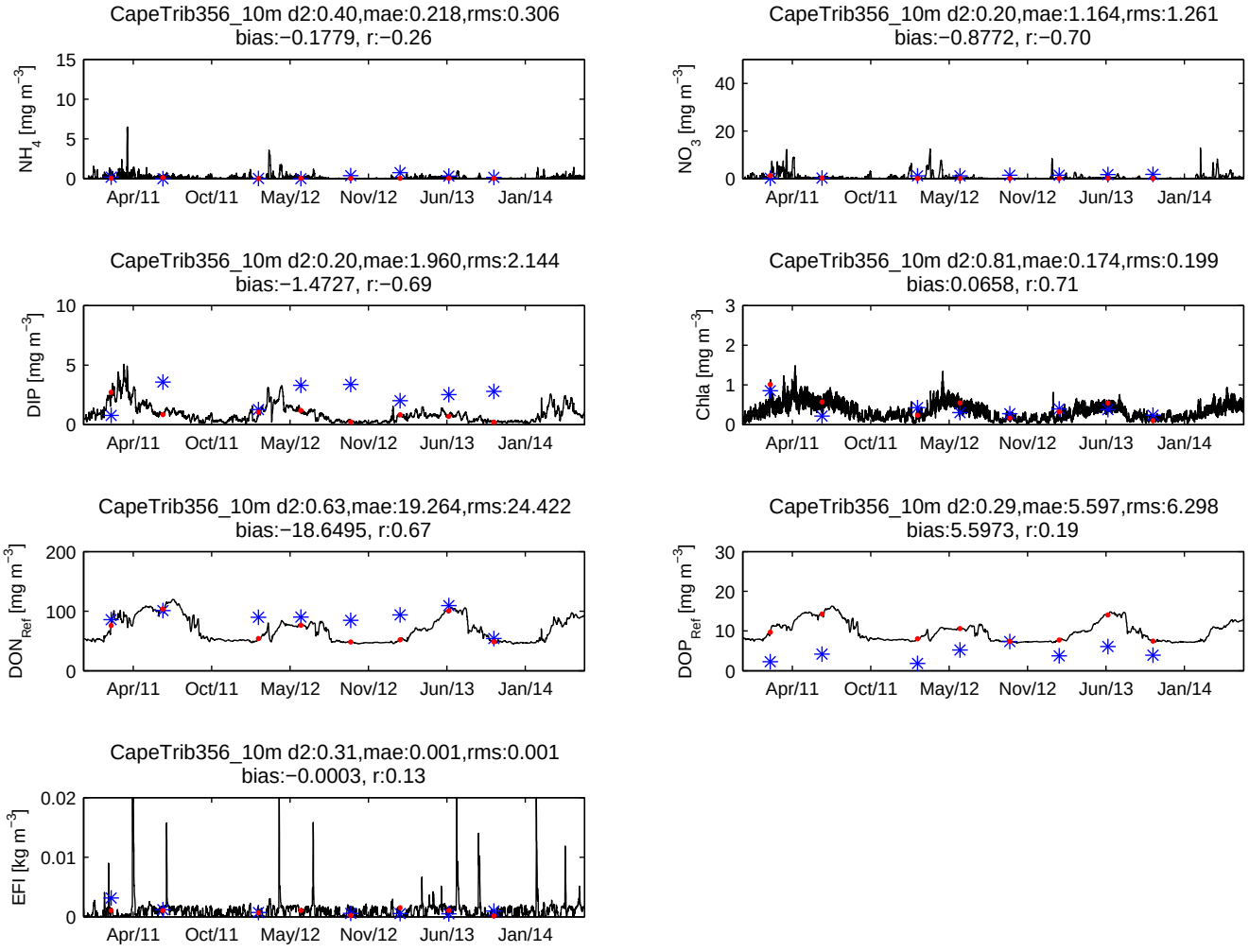


Figure 93: Cape Tribulation AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 10 m. Model grid deepest point at this site 20.5 m. Observation deepest point at this site 17.0 to 20.1 m.

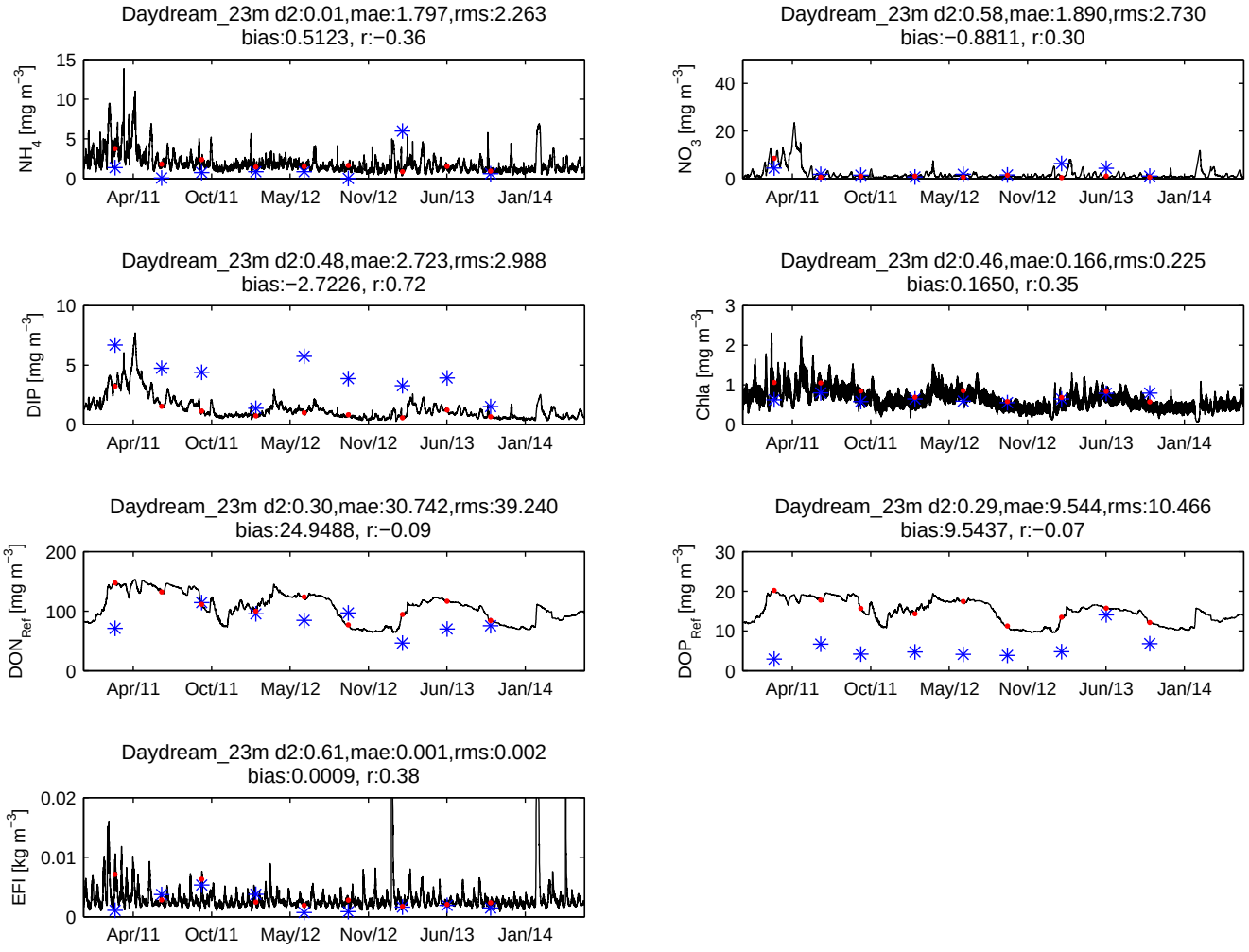


Figure 94: Daydream Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 23 m. Model grid deepest point at this site 16.76 m. Observation deepest point at this site 23.6 to 25.9 m.

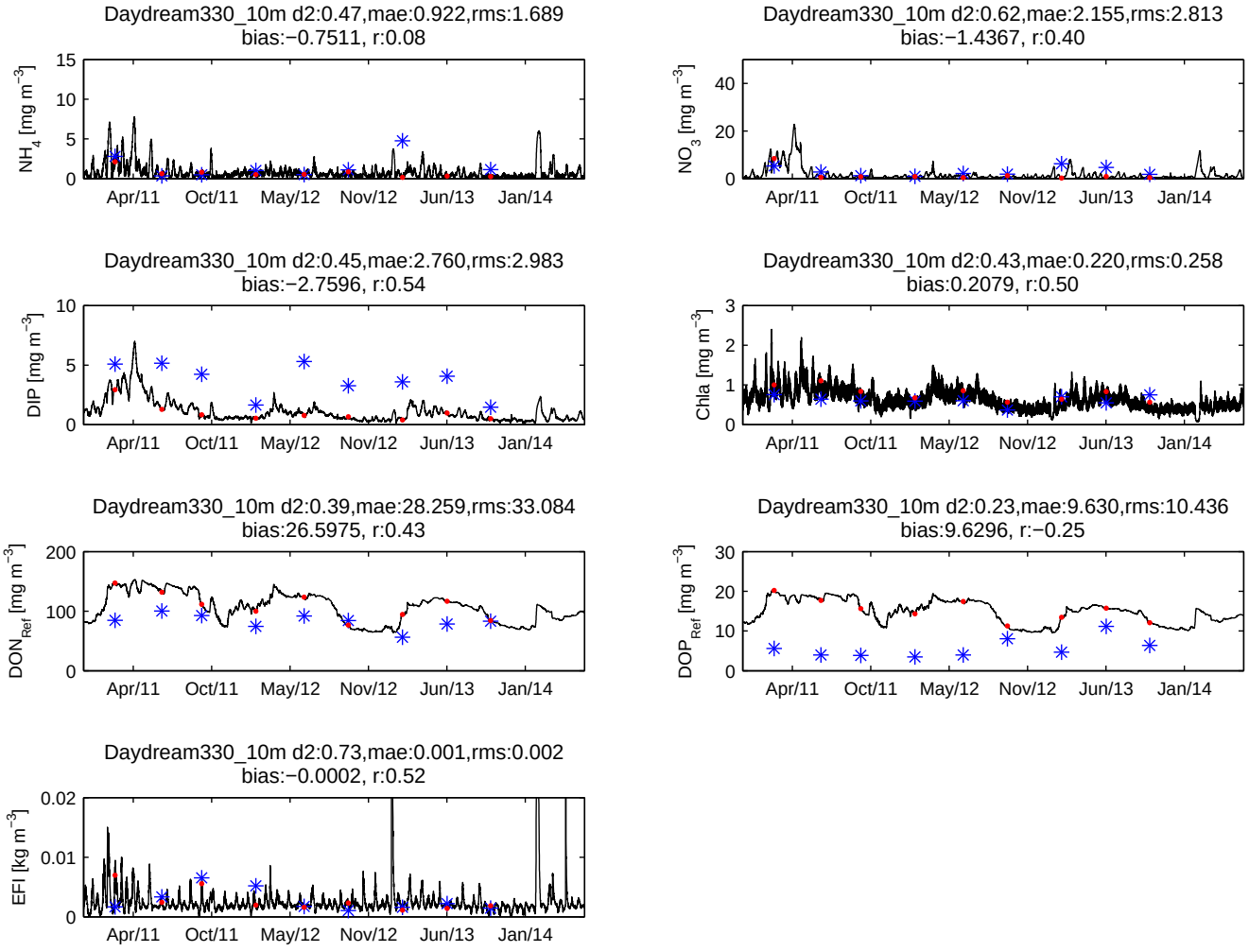


Figure 95: Daydream Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 10 m. Model grid deepest point at this site 16.76 m. Observation deepest point at this site 23.6 to 25.9 m.

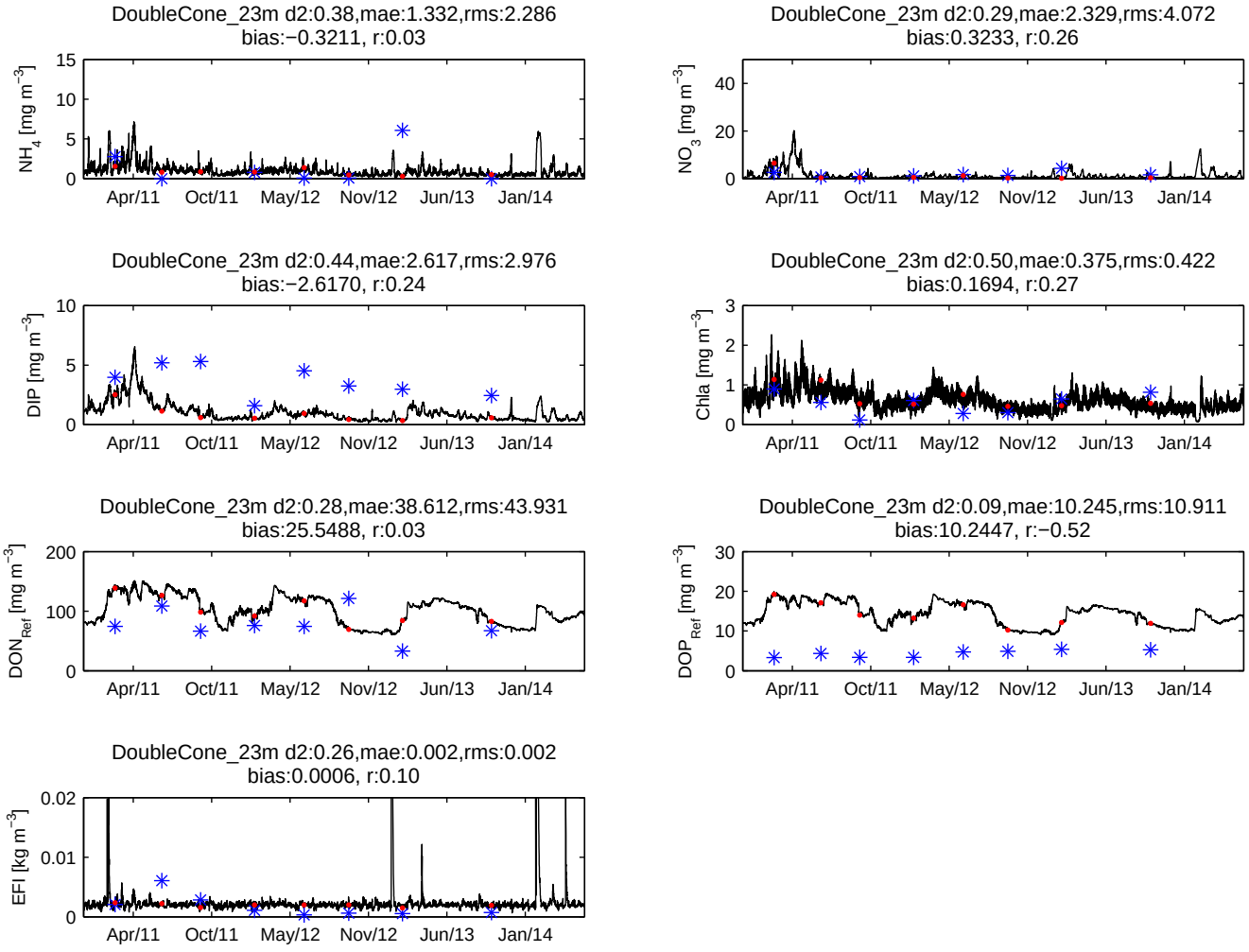


Figure 96: Double Cone Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 23 m. Model grid deepest point at this site 17.03 m. Observation deepest point at this site 23.0 to 31.0 m.

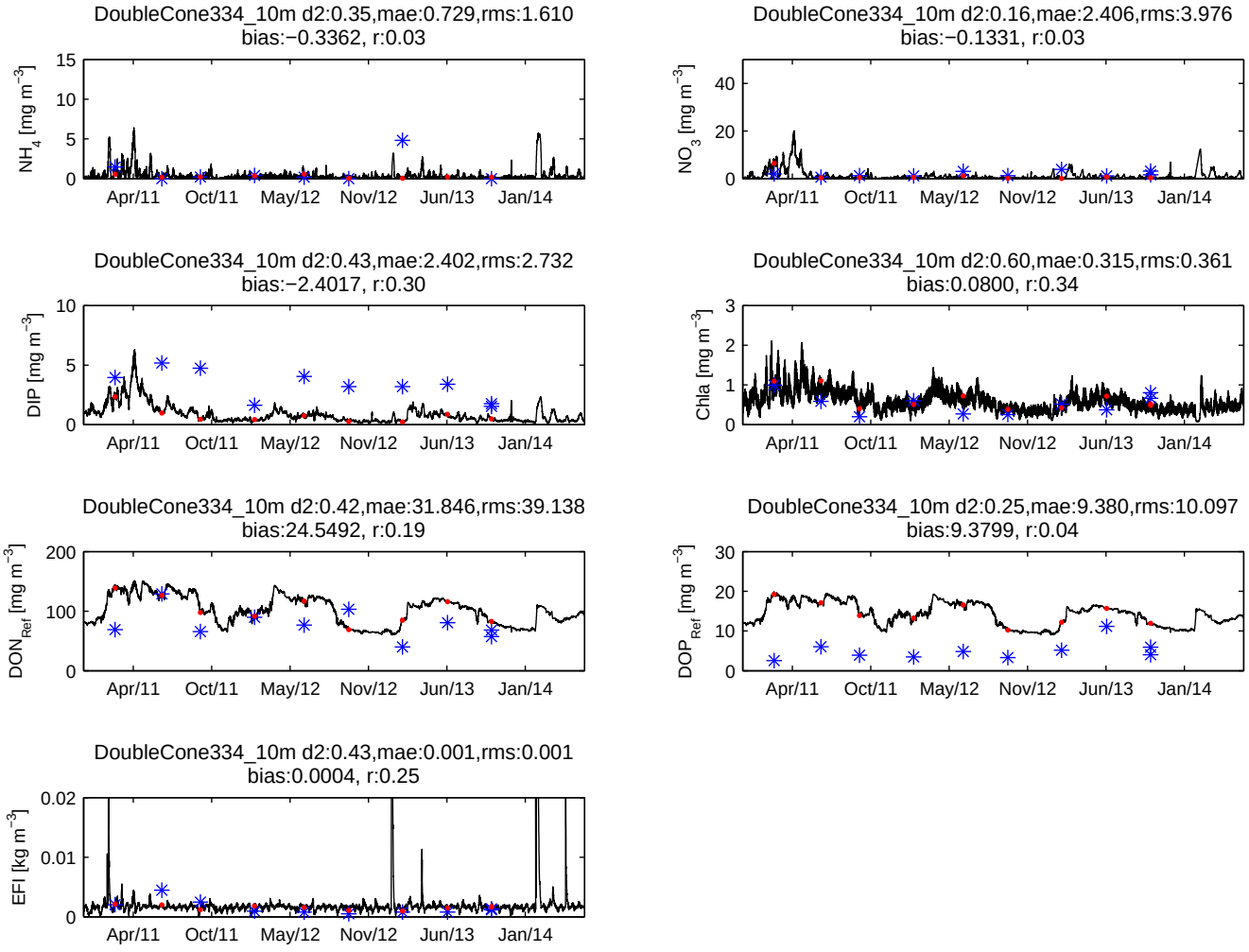


Figure 97: Double Cone Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 10 m. Model grid deepest point at this site 17.03 m. Observation deepest point at this site 23.0 to 31.0 m.

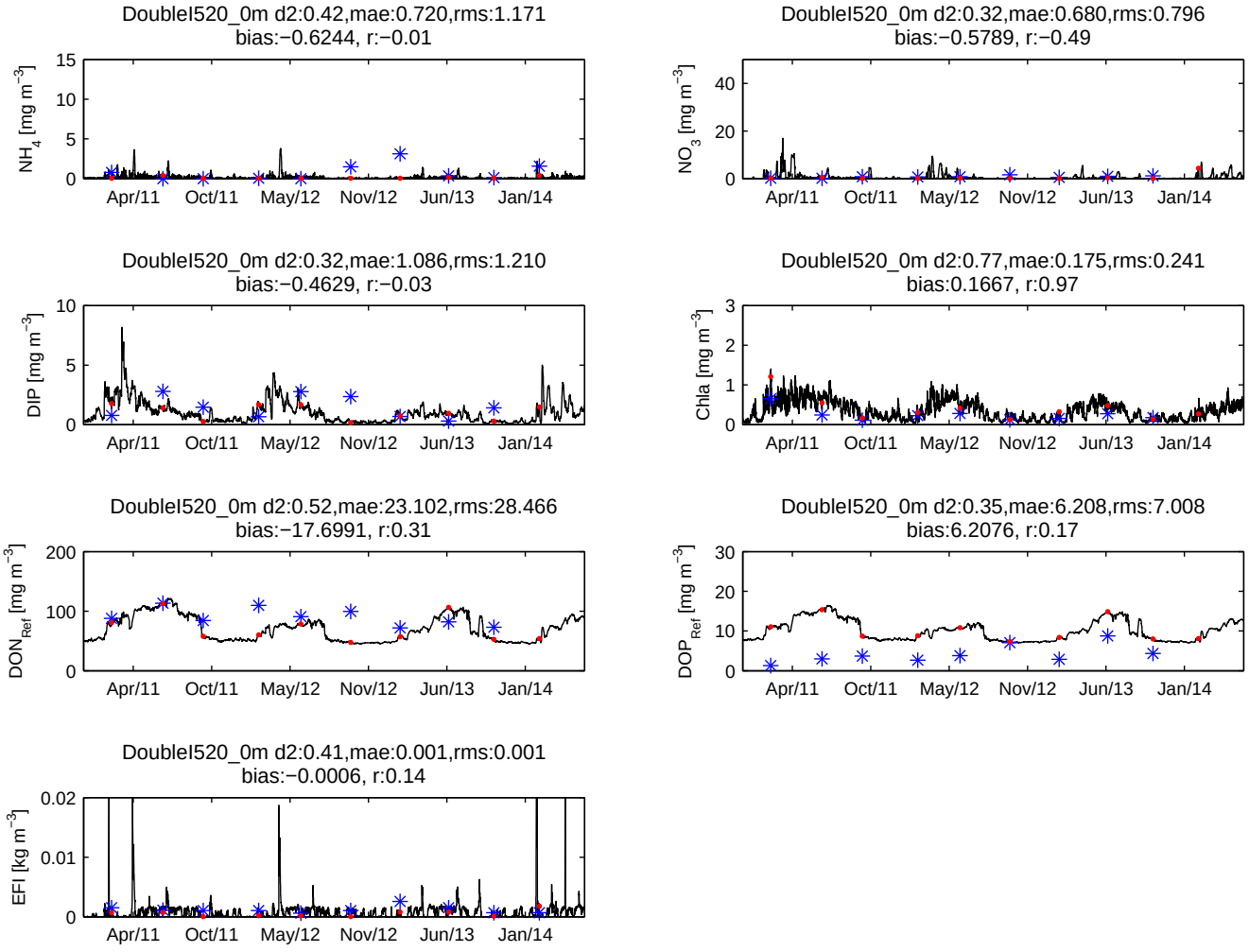


Figure 98: Double Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 0 m. Model grid deepest point at this site 22.05 m. Observation deepest point at this site 20.7 to 21.5 m.

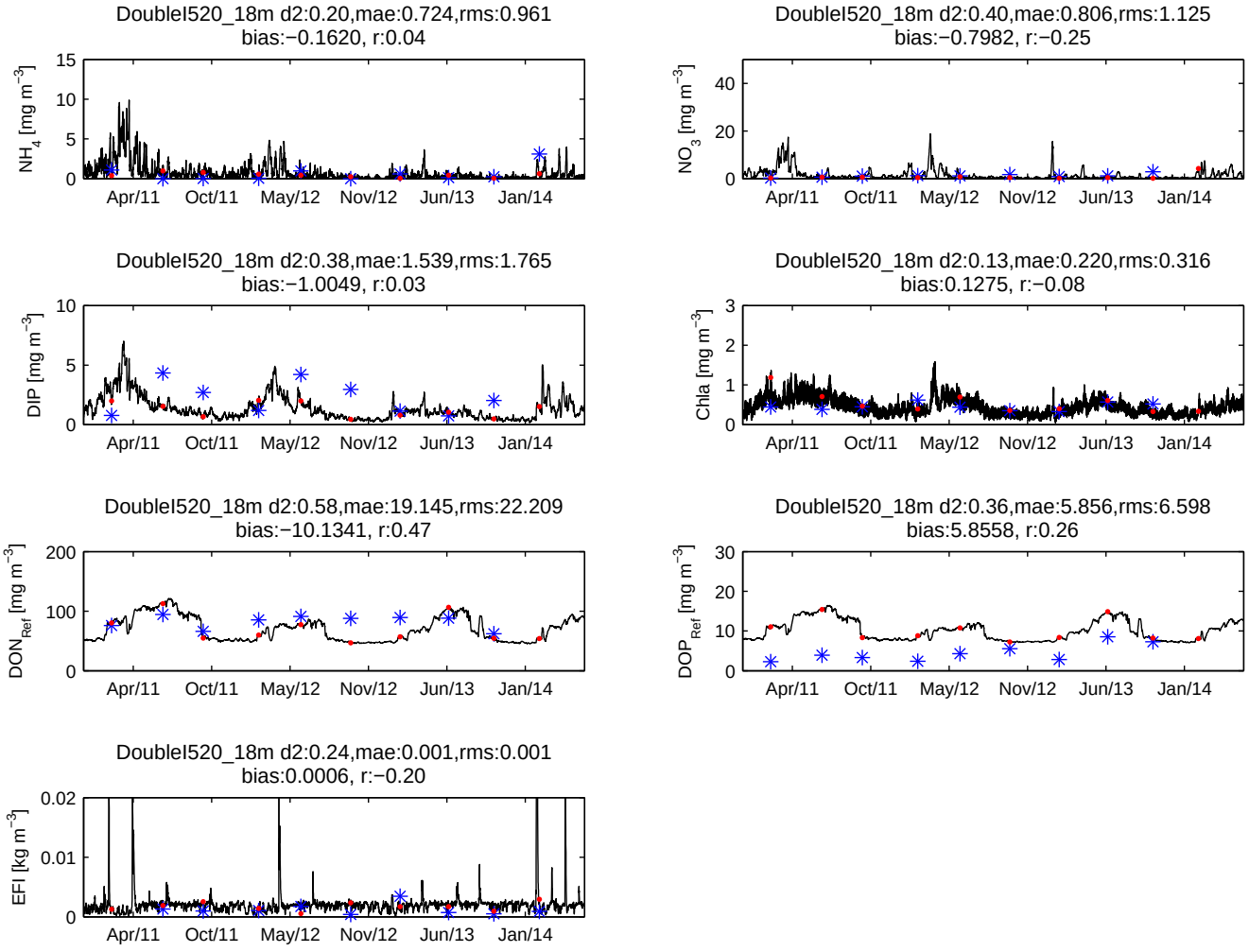


Figure 99: Double Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 18 m. Model grid deepest point at this site 22.05 m. Observation deepest point at this site 20.7 to 21.5 m.

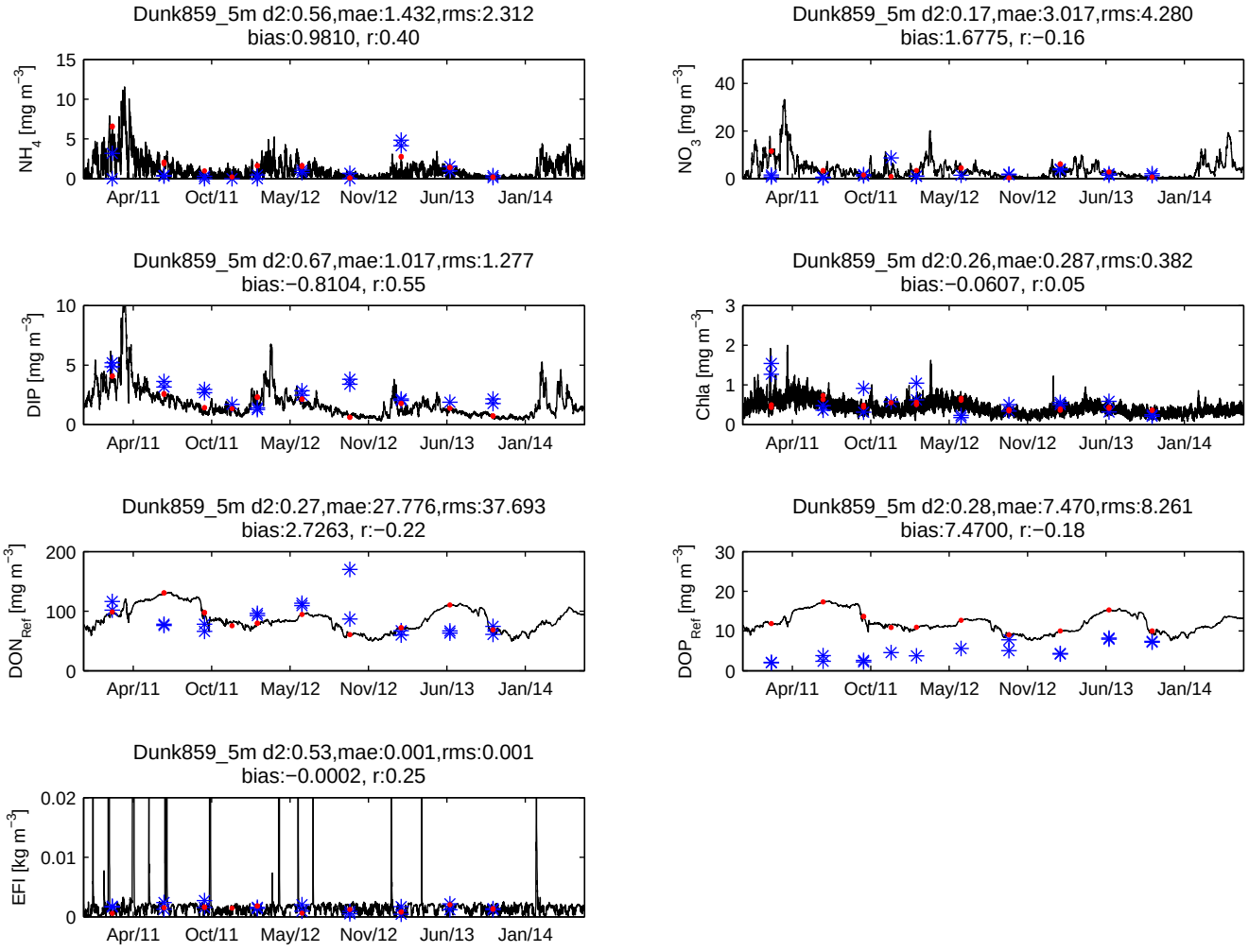


Figure 100: Dunk Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 5 m. Model grid deepest point at this site 9.15 m. Observation deepest point at this site 9.0 to 10.4 m.

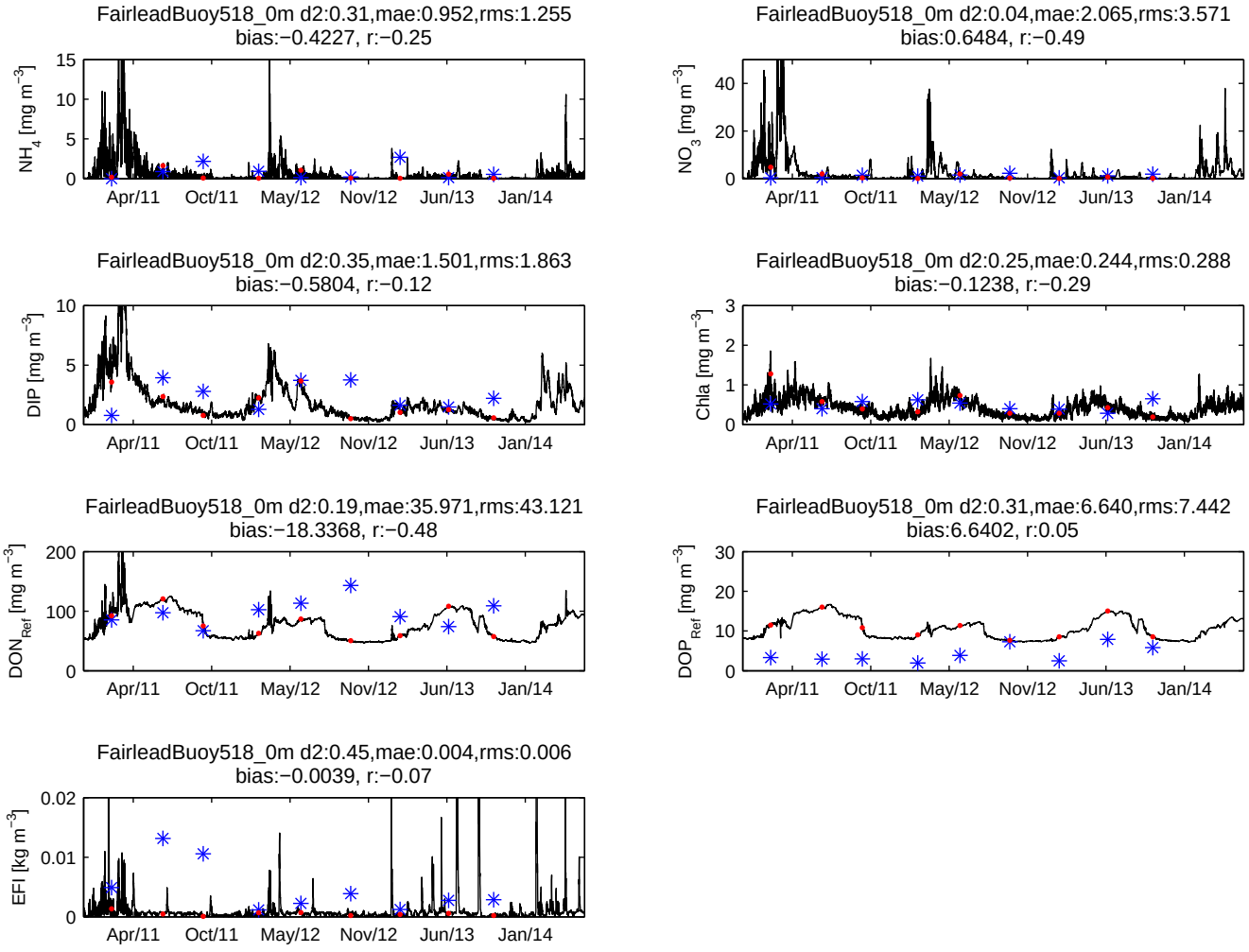


Figure 101: Fairlead buoy AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 0 m. Model grid deepest point at this site 9.63 m. Observation deepest point at this site 7.0 to 10.0 m.

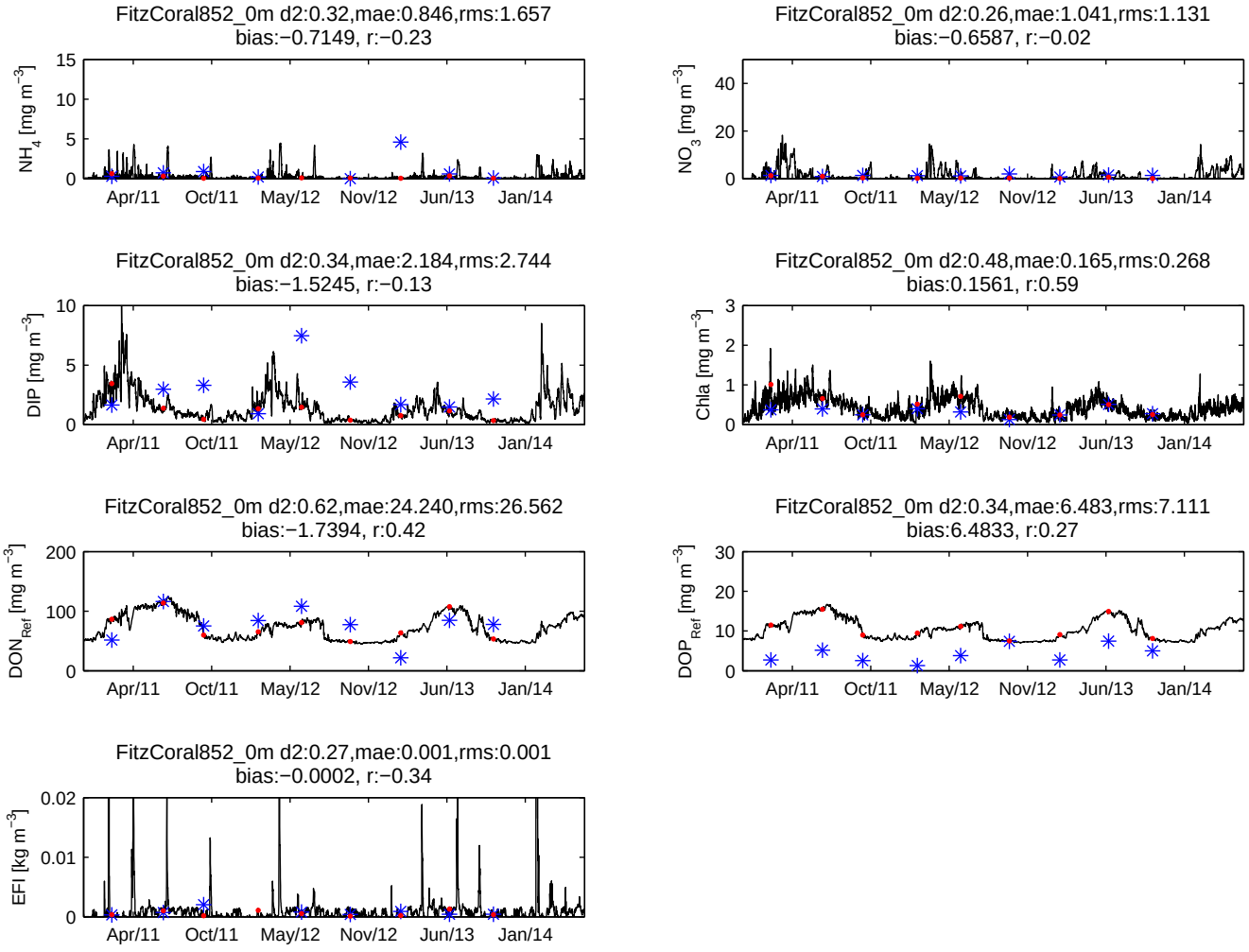


Figure 102: Fitzroy Reef AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 0 m. Model grid deepest point at this site 27 m. Observation deepest point at this site 15.5 to17.2 m.

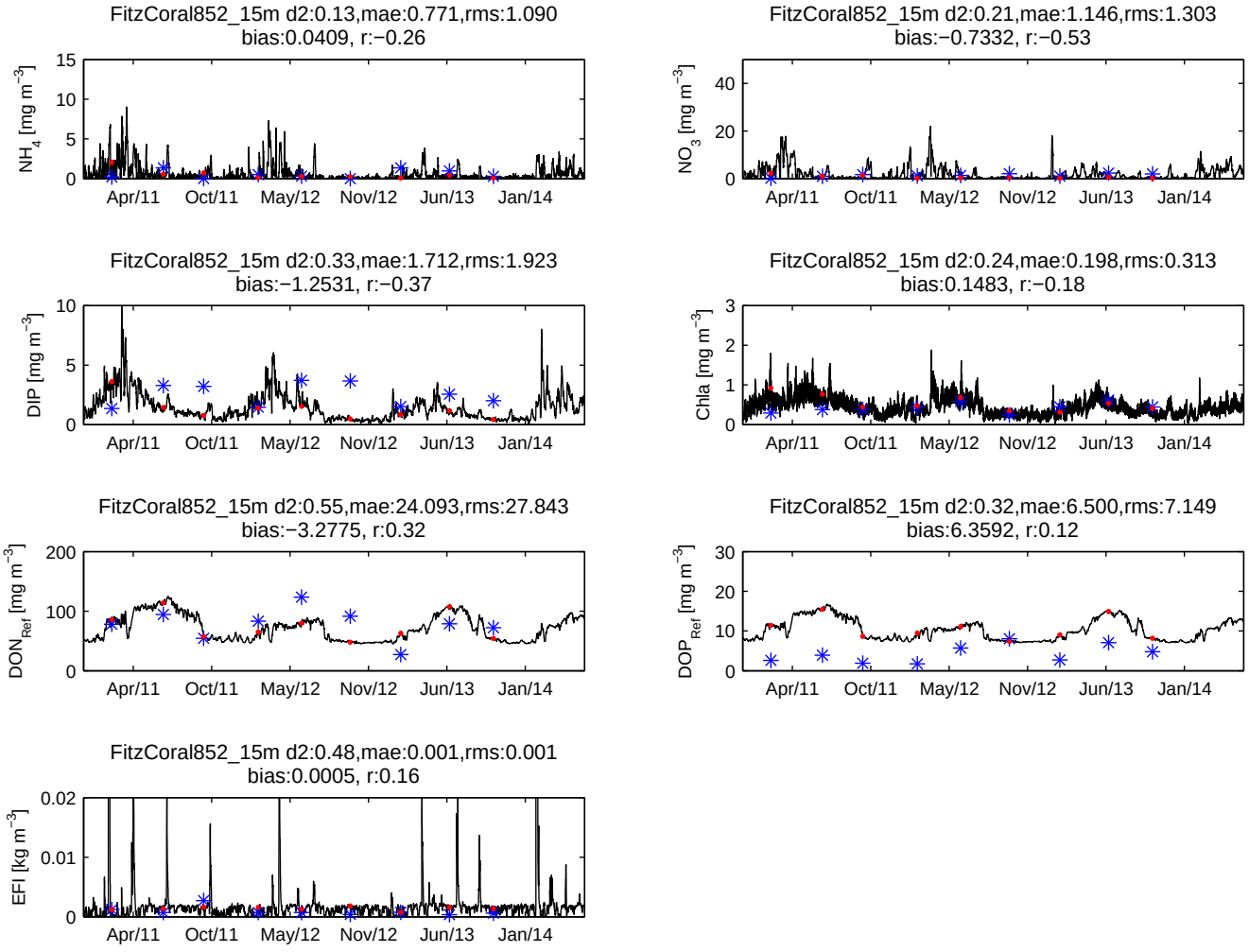


Figure 103: Fitzroy Reef AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 15 m. Model grid deepest point at this site 27 m. Observation deepest point at this site 15.5 to17.2 m.

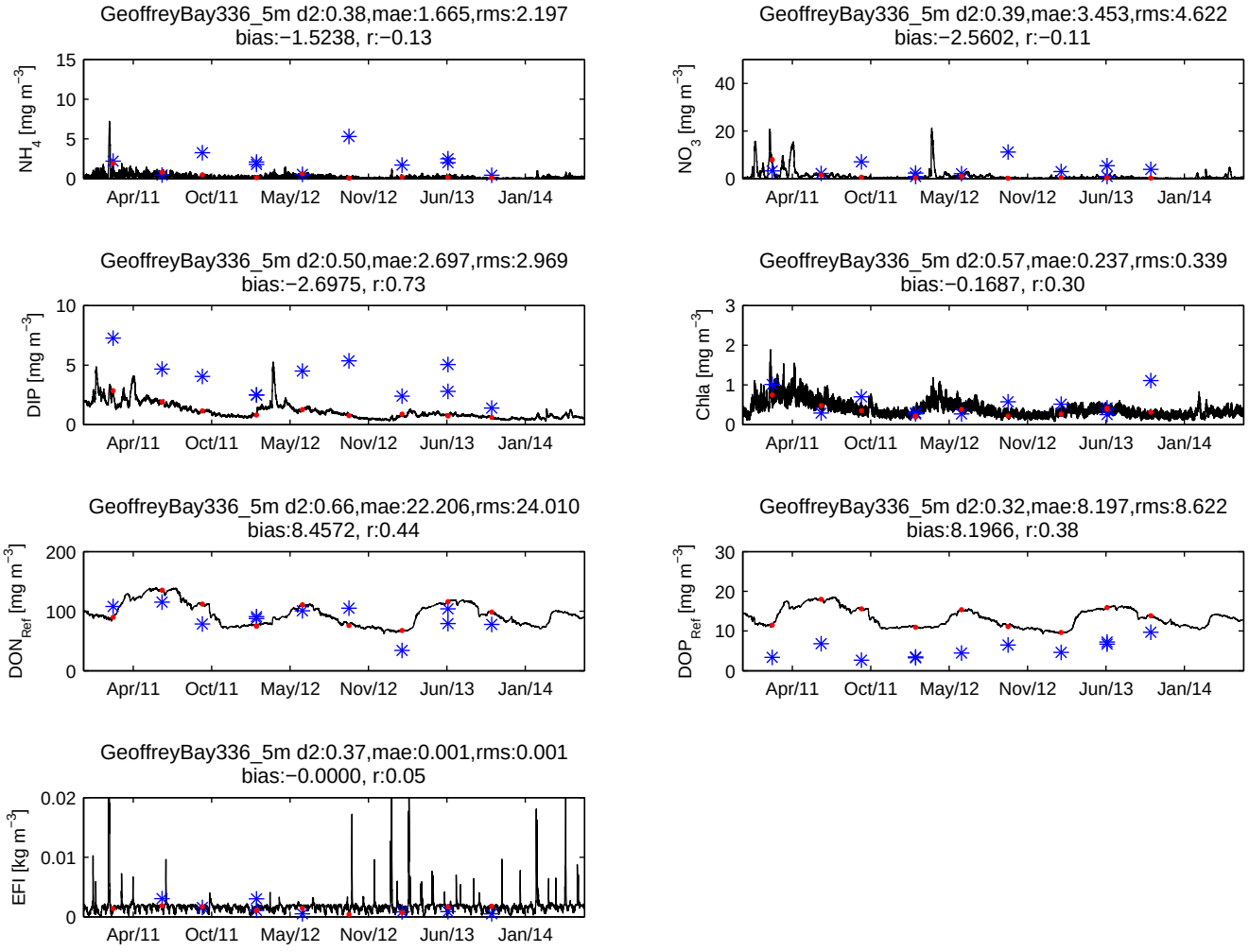


Figure 104: Geoffrey Bay AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 5 m. Model grid deepest point at this site -10.42 m. Observation deepest point at this site 9.9 to 12 m.

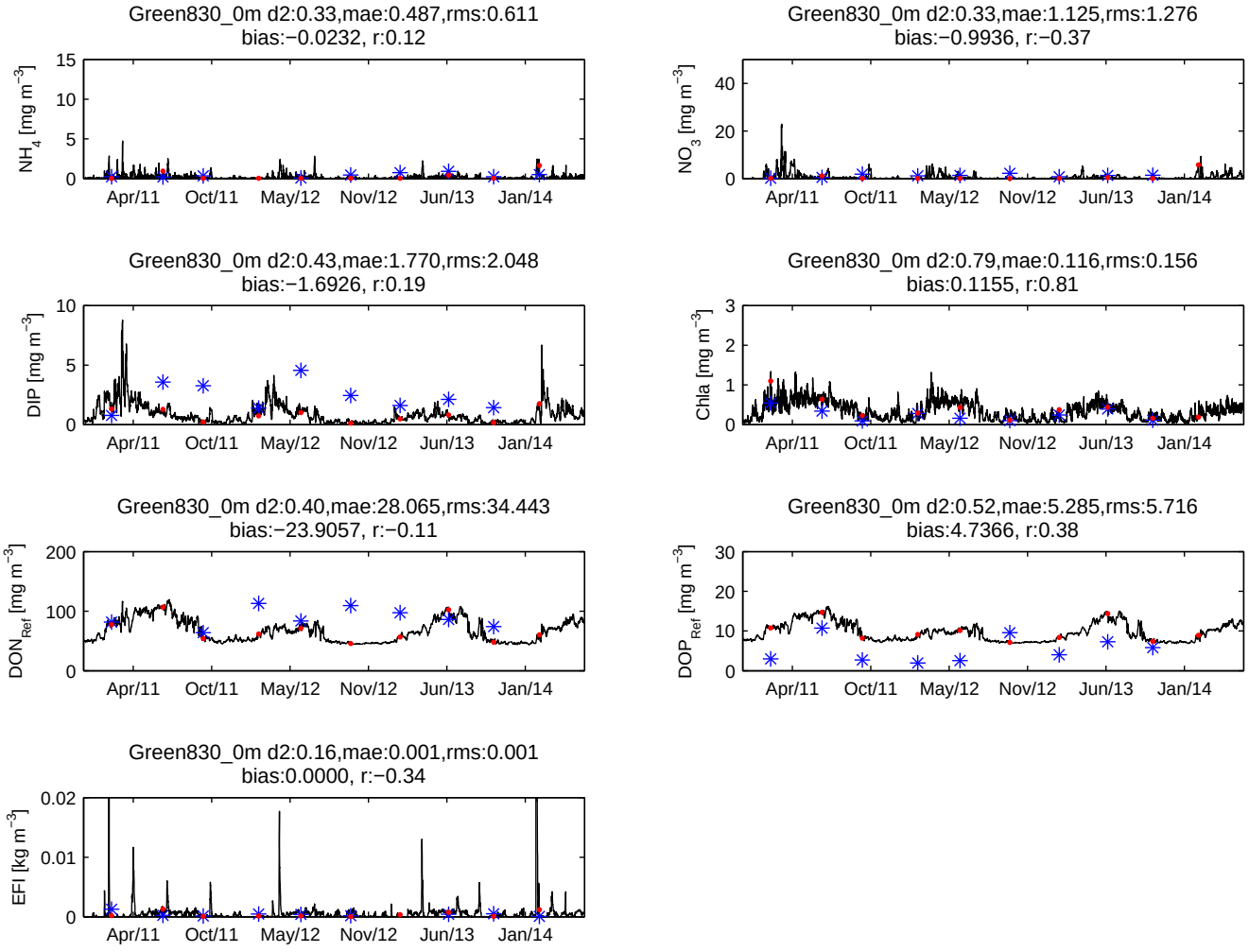


Figure 105: Green Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 0 m. Model grid deepest point at this site -34.66 m. Observation deepest point at this site 38.0 to 39.5 m.

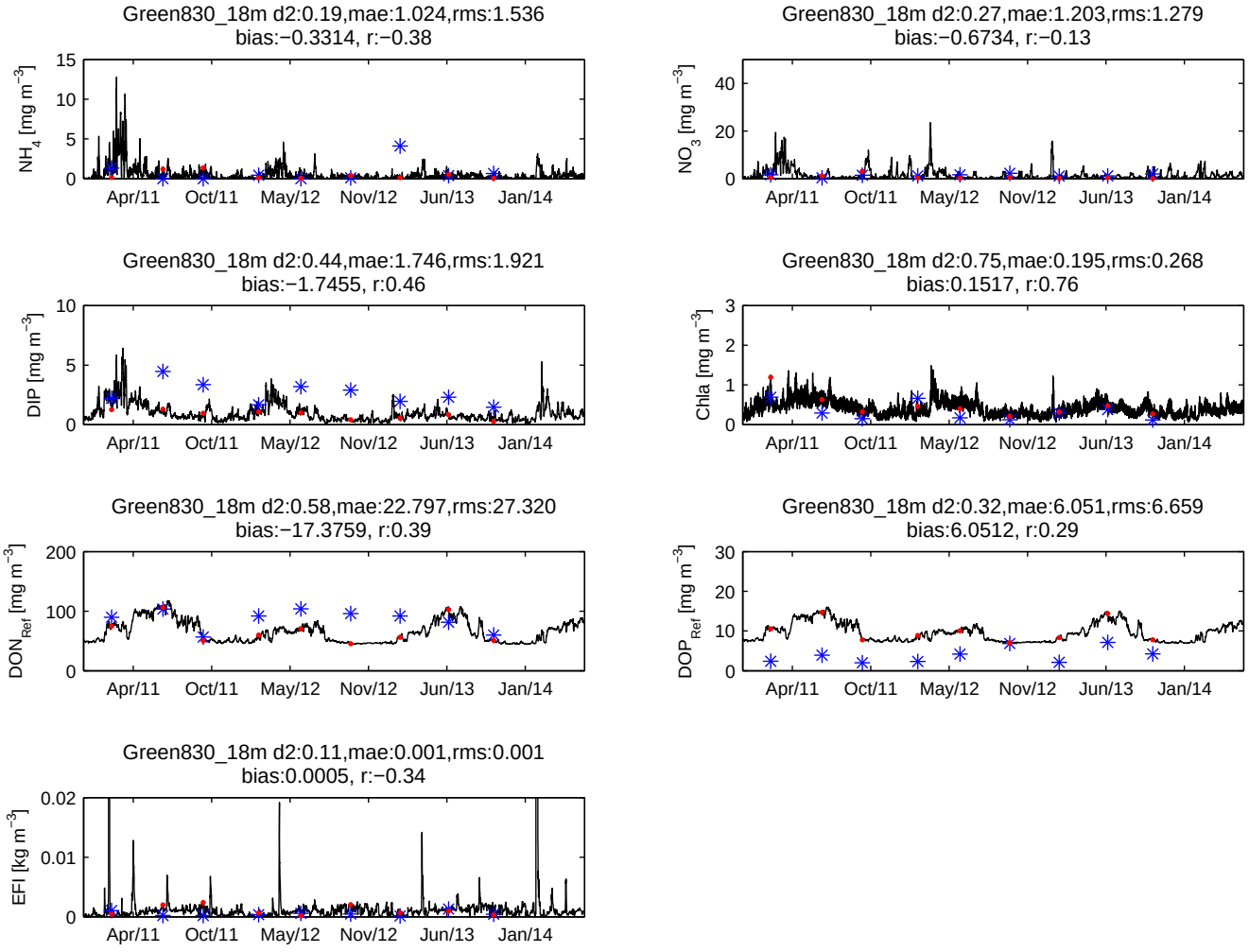


Figure 106: Green Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 18 m. Model grid deepest point at this site -34.66 m. Observation deepest point at this site 38.0 to 39.5 m.

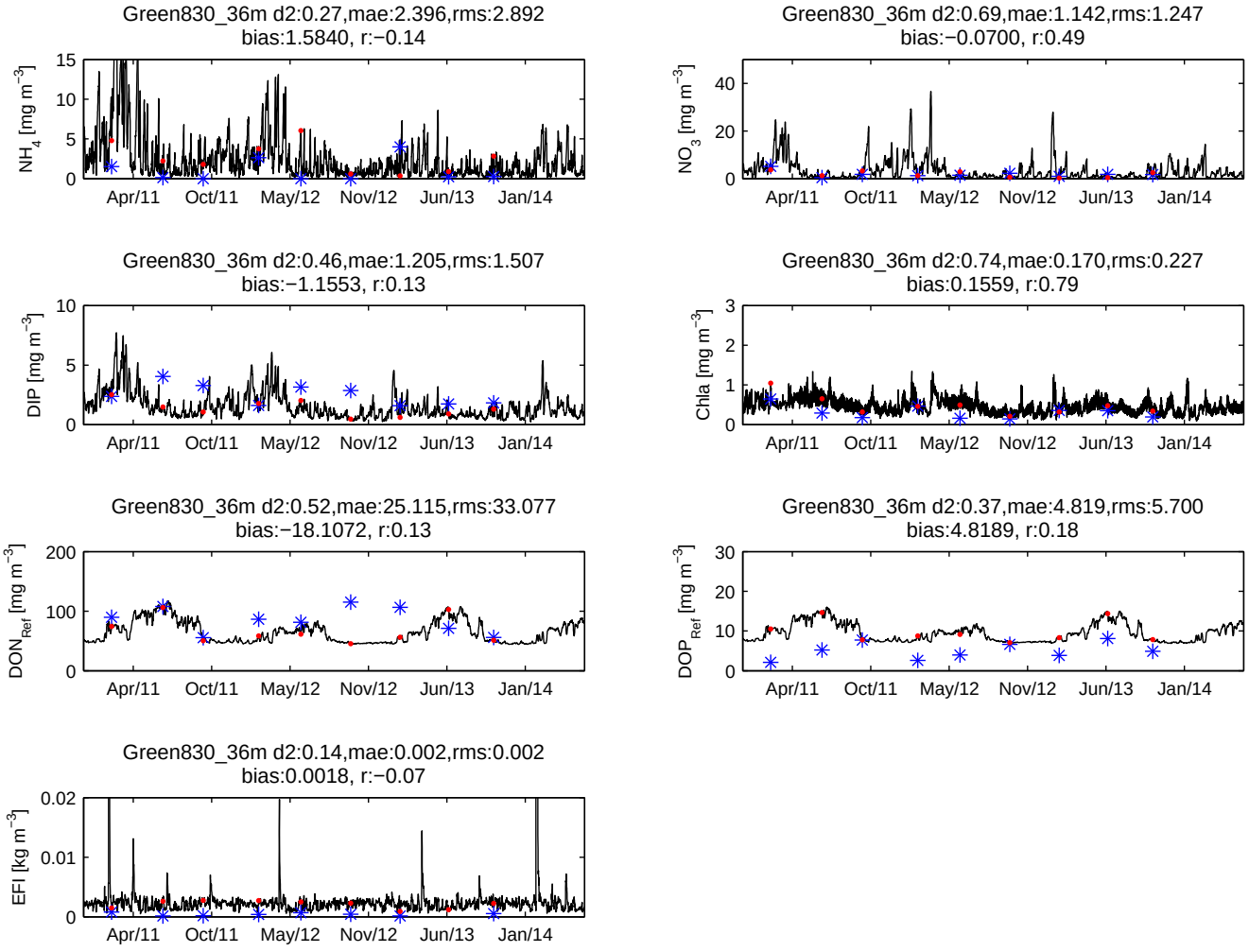


Figure 107: Green Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 36 m. Model grid deepest point at this site -34.66 m. Observation deepest point at this site 38.0 to 39.5 m.

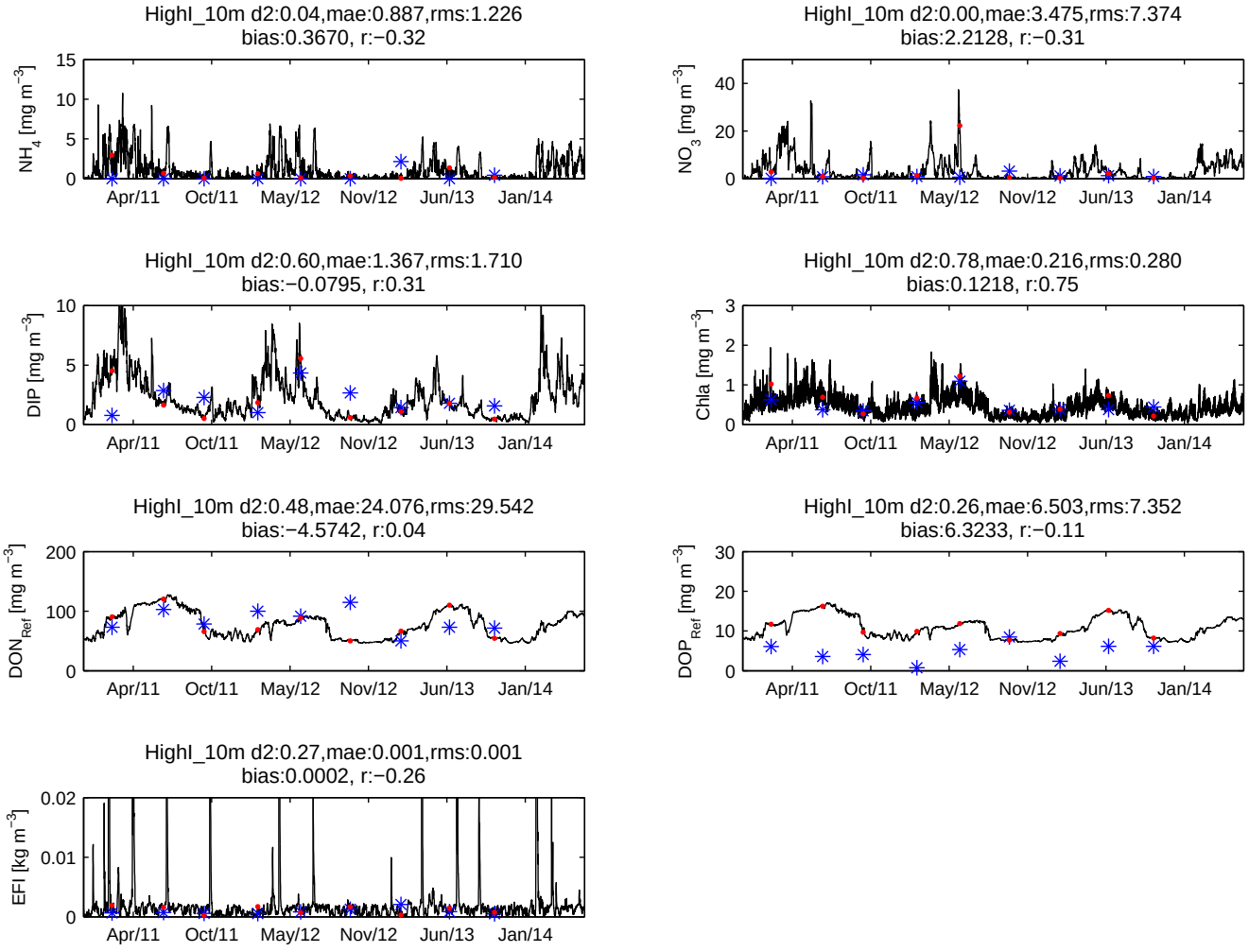


Figure 108: High Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 10 m. Model grid deepest point at this site -17.64 m. Observation deepest point at this site 22.0 to 25.3 m.

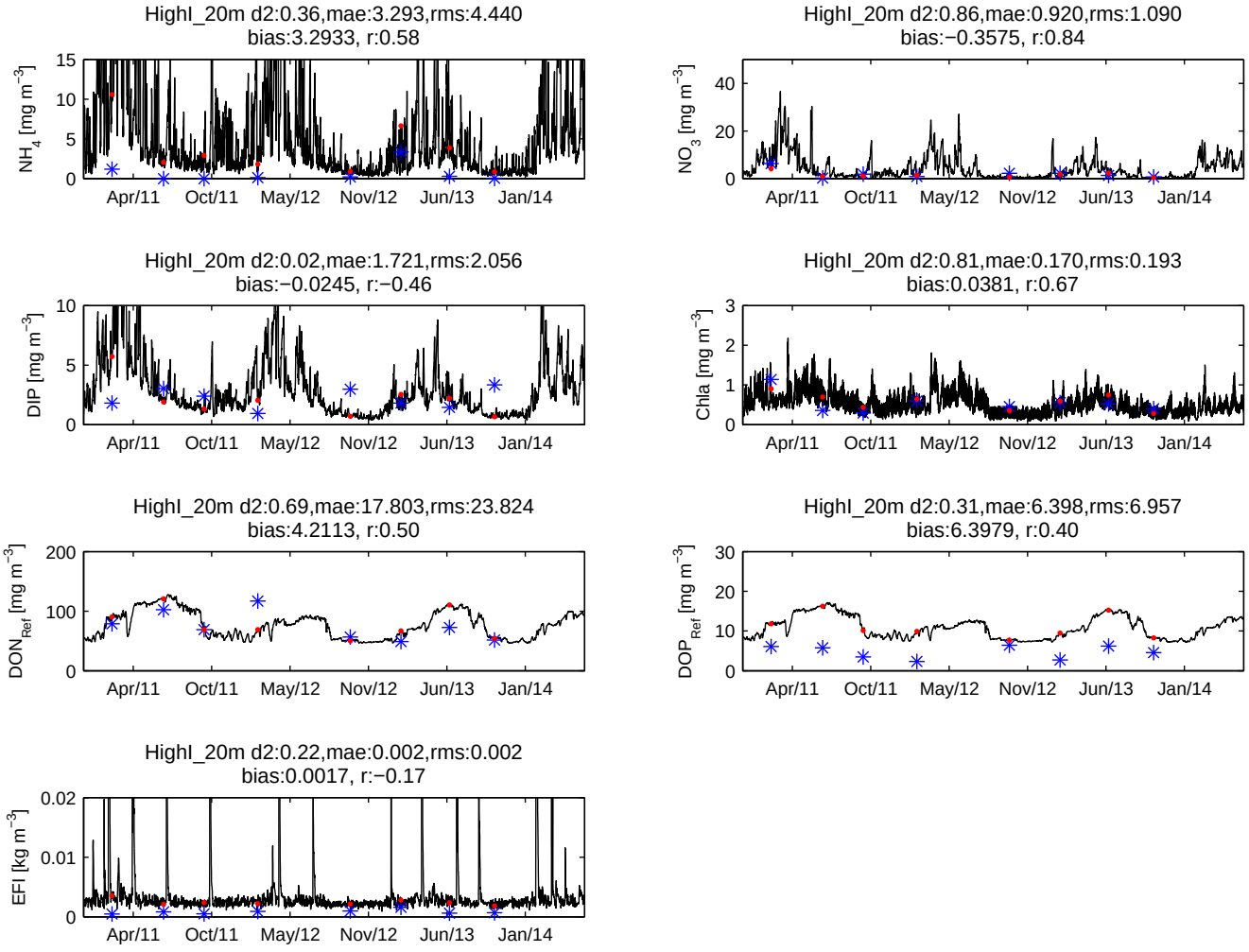


Figure 109: High Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 20 m. Model grid deepest point at this site -17.64 m. Observation deepest point at this site 22.0 to 25.3 m.

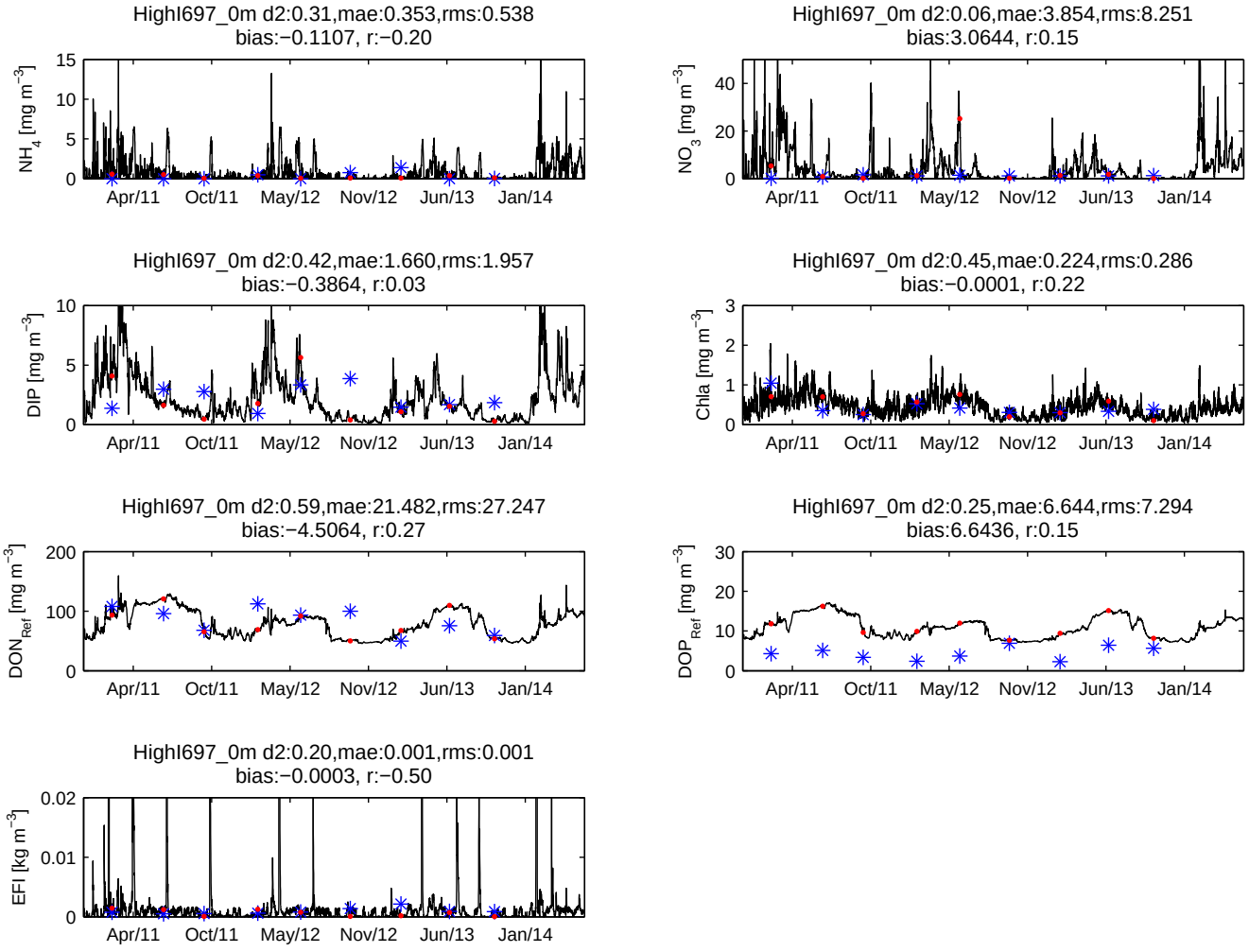


Figure 110: High Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 0 m. Model grid deepest point at this site -17.64 m. Observation deepest point at this site 22.0 to 25.3 m.

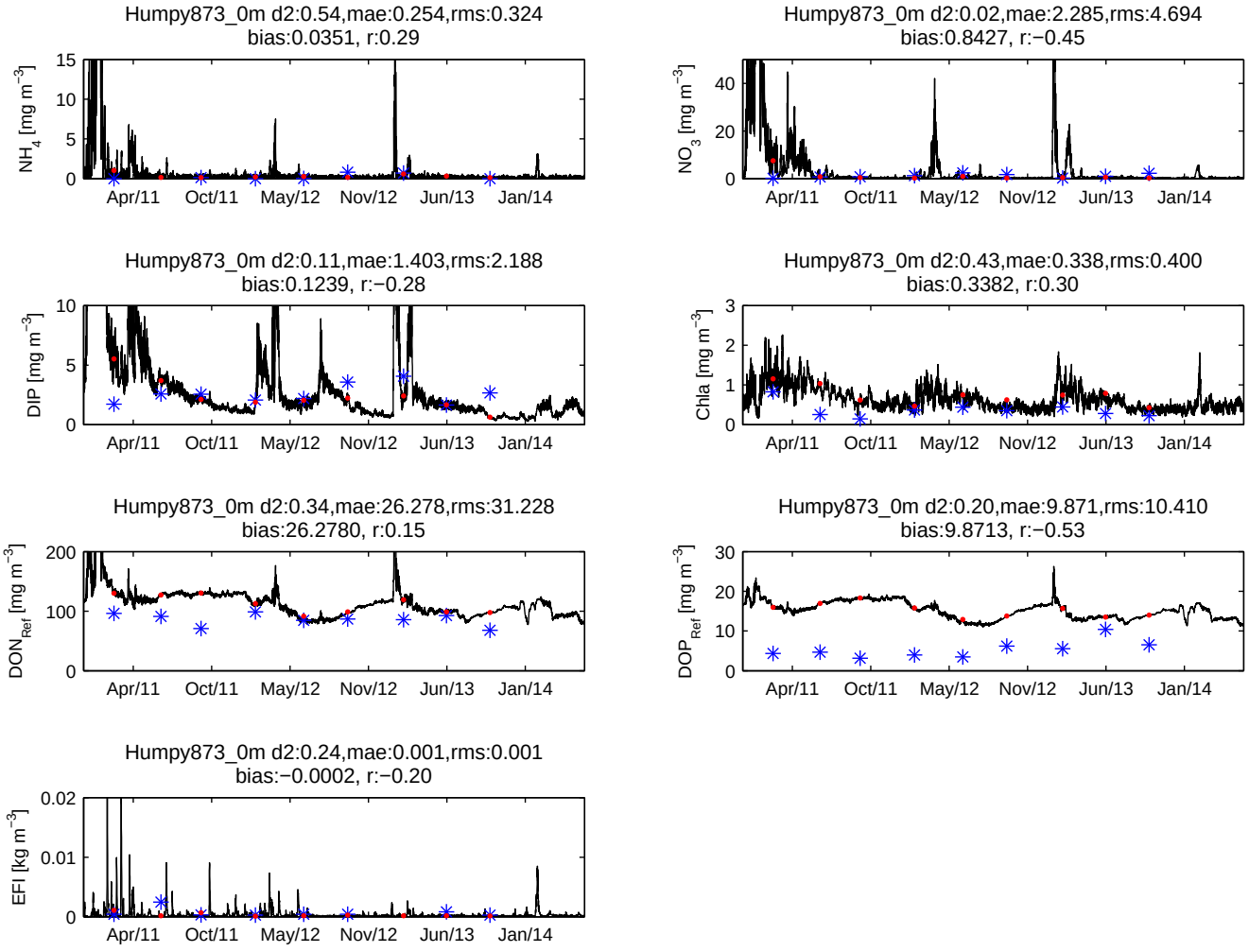


Figure 111: Humpy Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 0 m. Model grid deepest point at this site -12.86 m. Observation deepest point at this site 12.6 to 19.5 m.

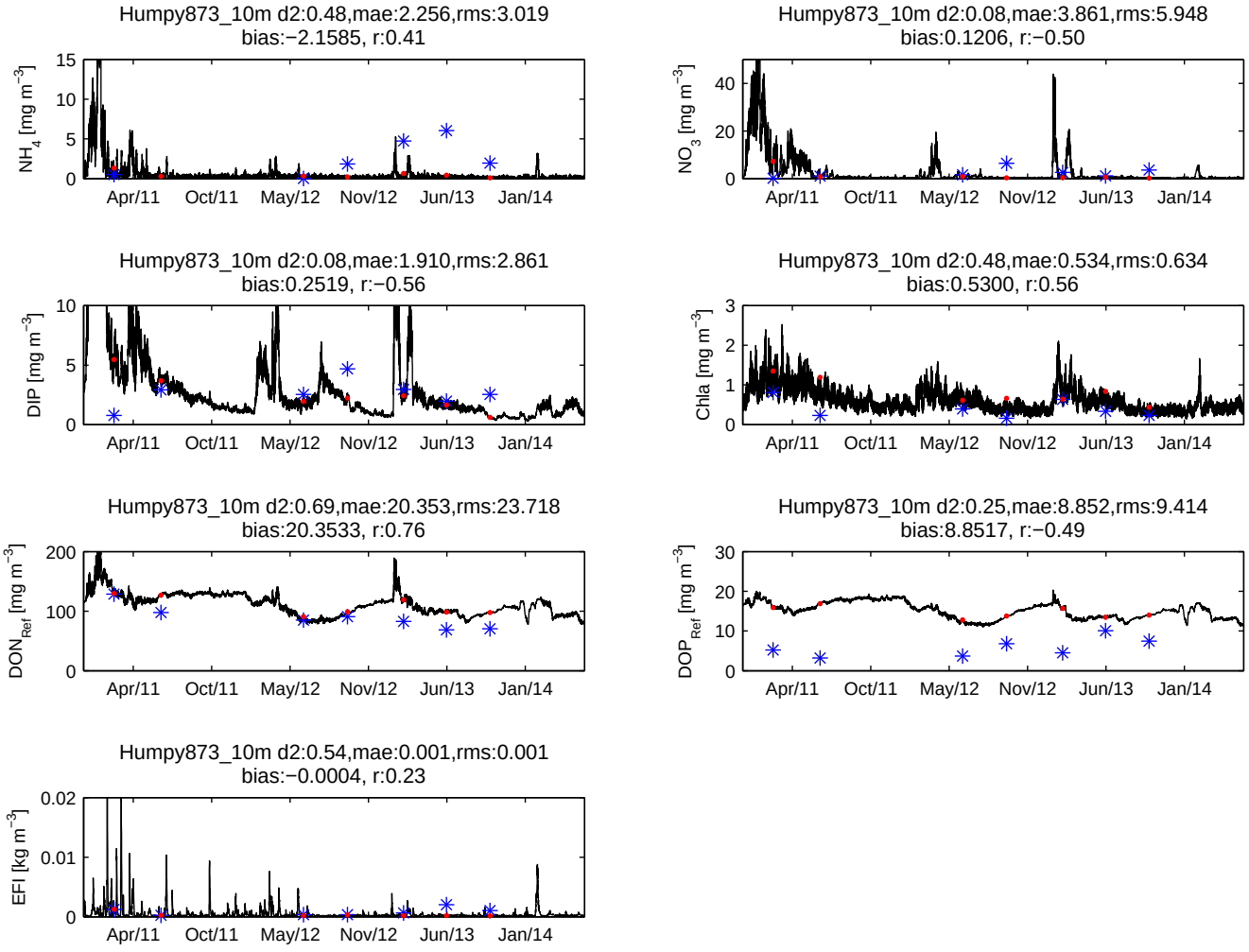


Figure 112: Humpy Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 10 m. Model grid deepest point at this site -12.86 m. Observation deepest point at this site 12.6 to 19.5 m.

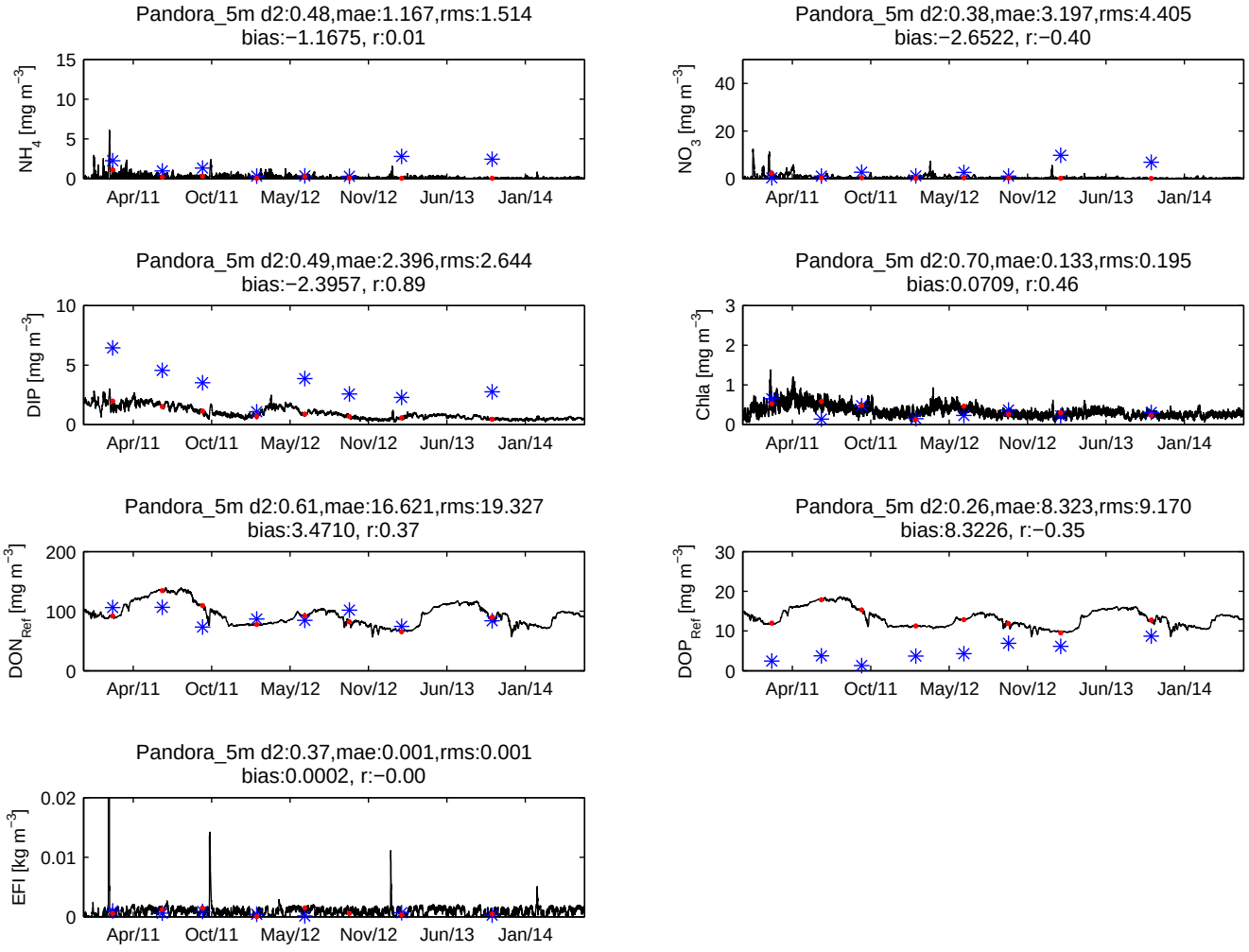


Figure 113: Pandora Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 5 m. Model grid deepest point at this site -16.98 m. Observation deepest point at this site 12.9 to 13.9 m.

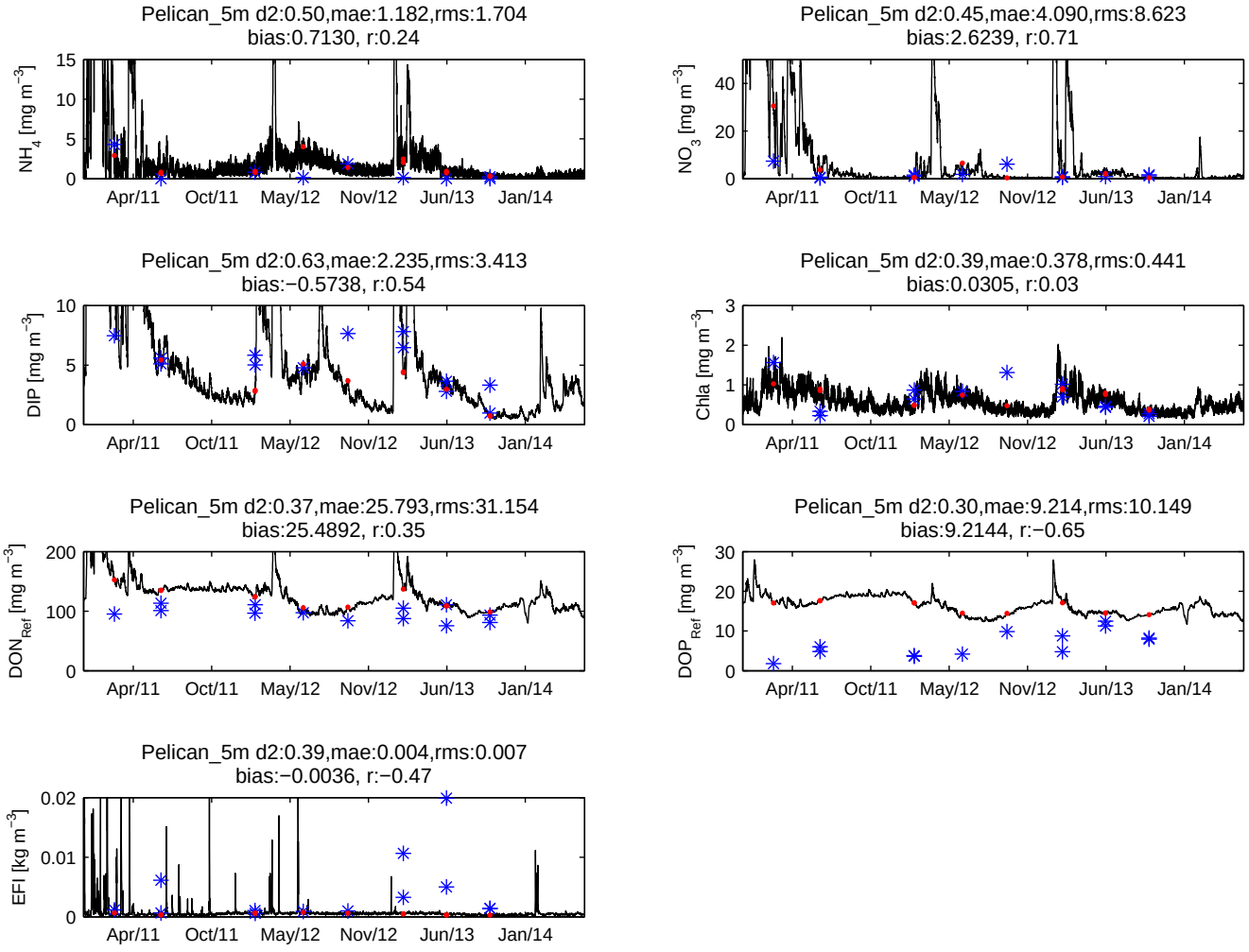


Figure 114: Pelican Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 5 m. Model grid deepest point at this site -4.47 m. Observation deepest point at this site 8.8 to 9.7 m.

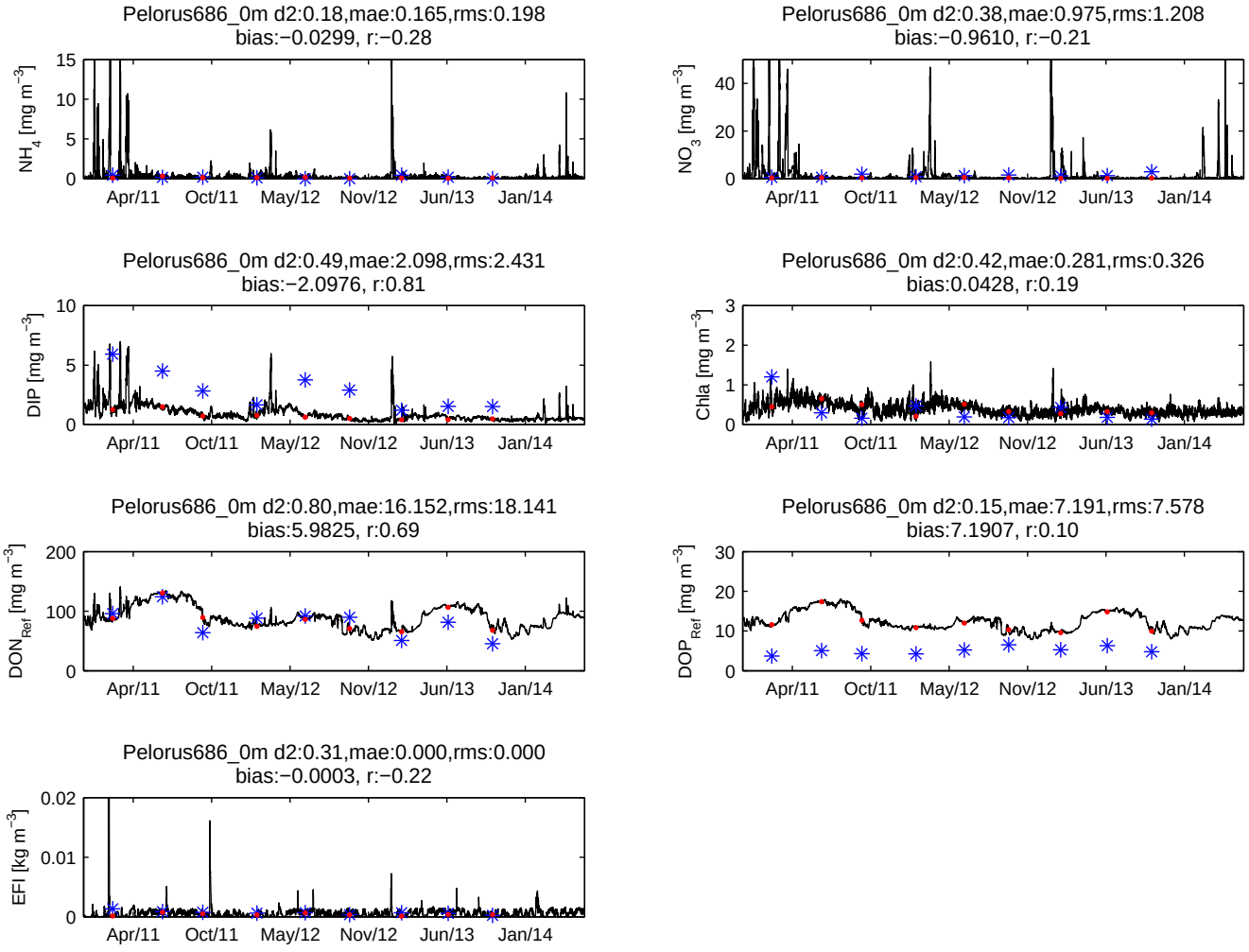


Figure 115: Pelorous/Orpheus Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 0 m. Model grid deepest point at this site -24.64 m. Observation deepest point at this site 25.3 to 31.4 m.

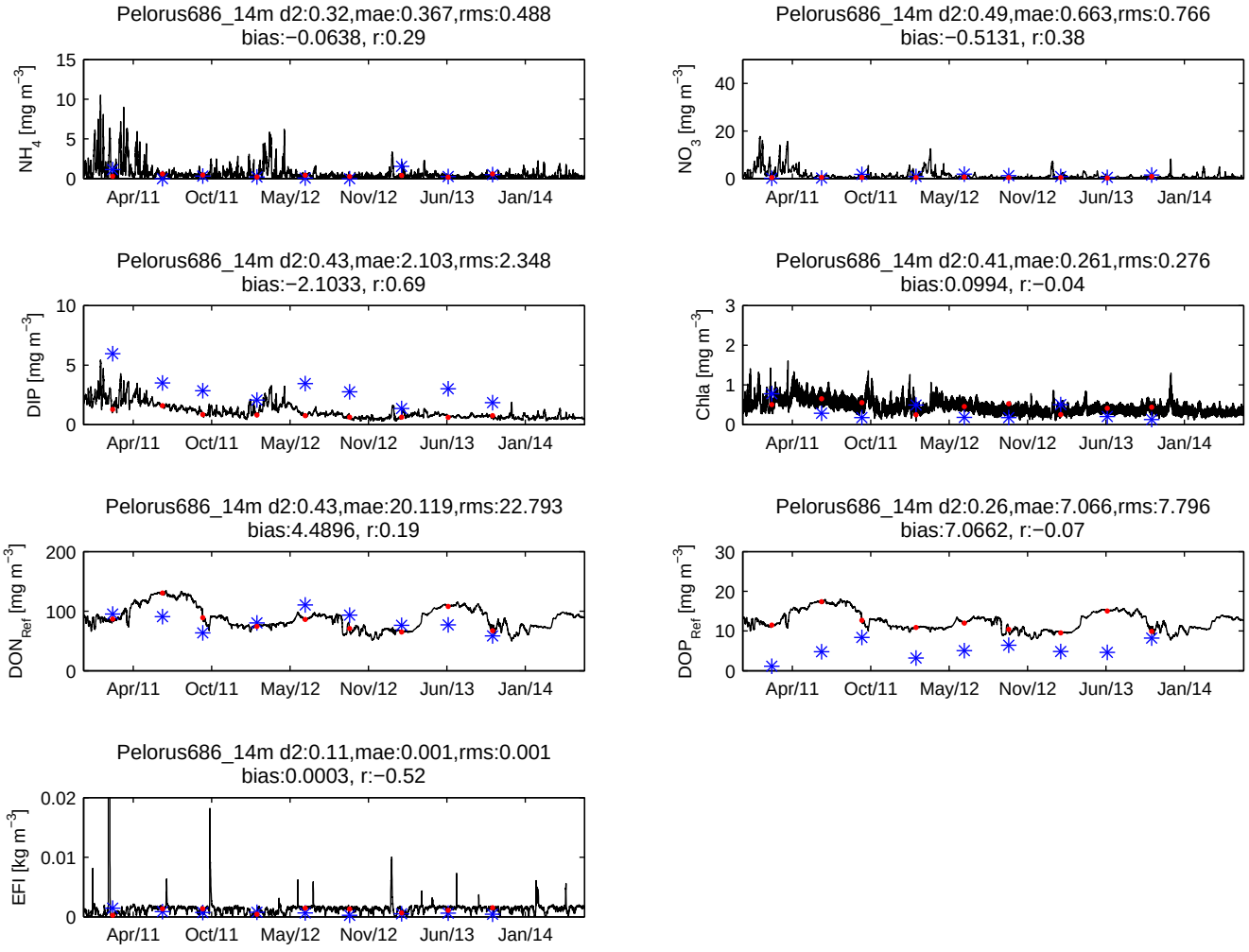


Figure 116: Pelorous/Orpheus Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 14 m. Model grid deepest point at this site -24.64 m. Observation deepest point at this site 25.3 to 31.4 m.

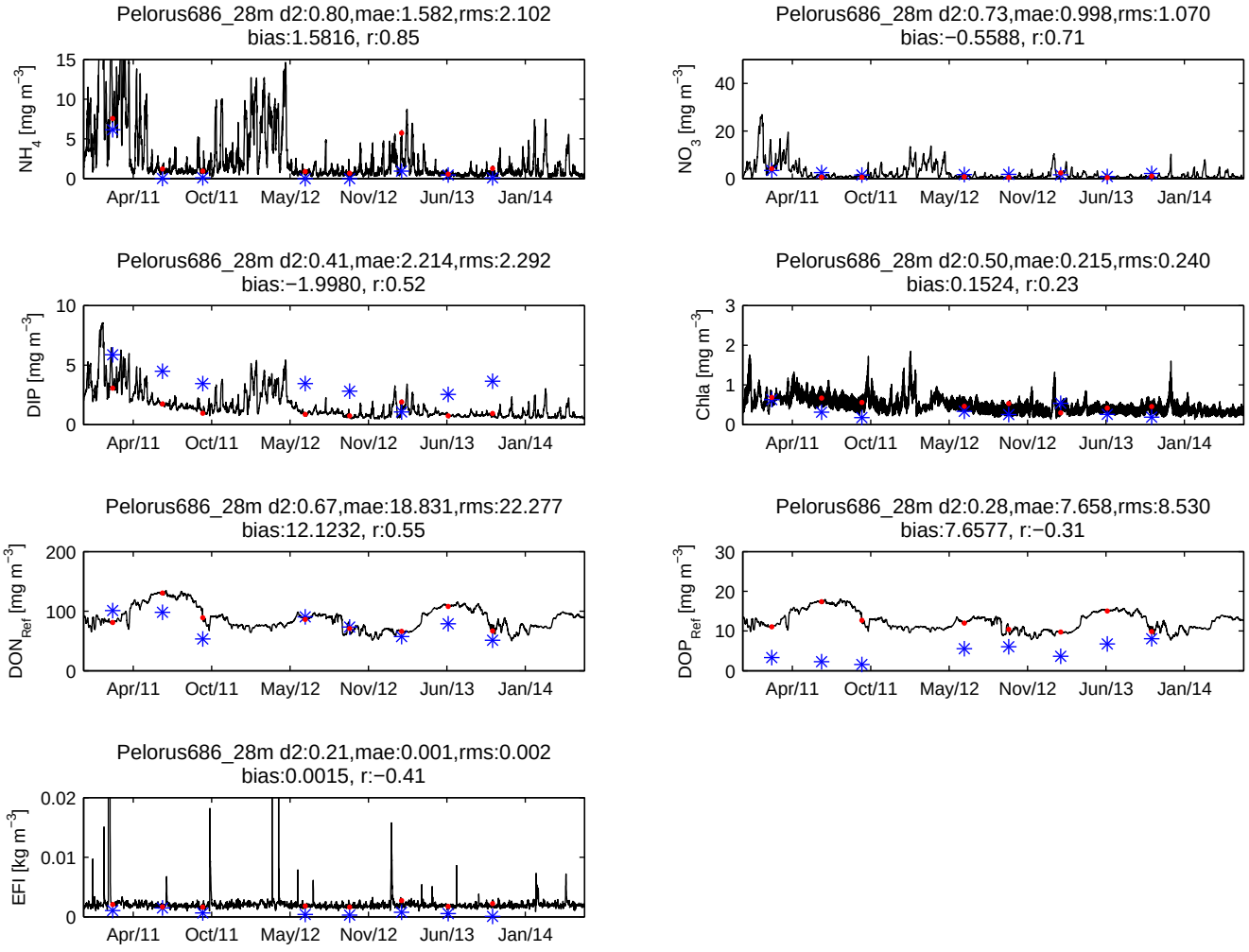


Figure 117: Pelorous/Orpheus Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 28 m. Model grid deepest point at this site -24.64 m. Observation deepest point at this site 25.3 to 31.4 m.

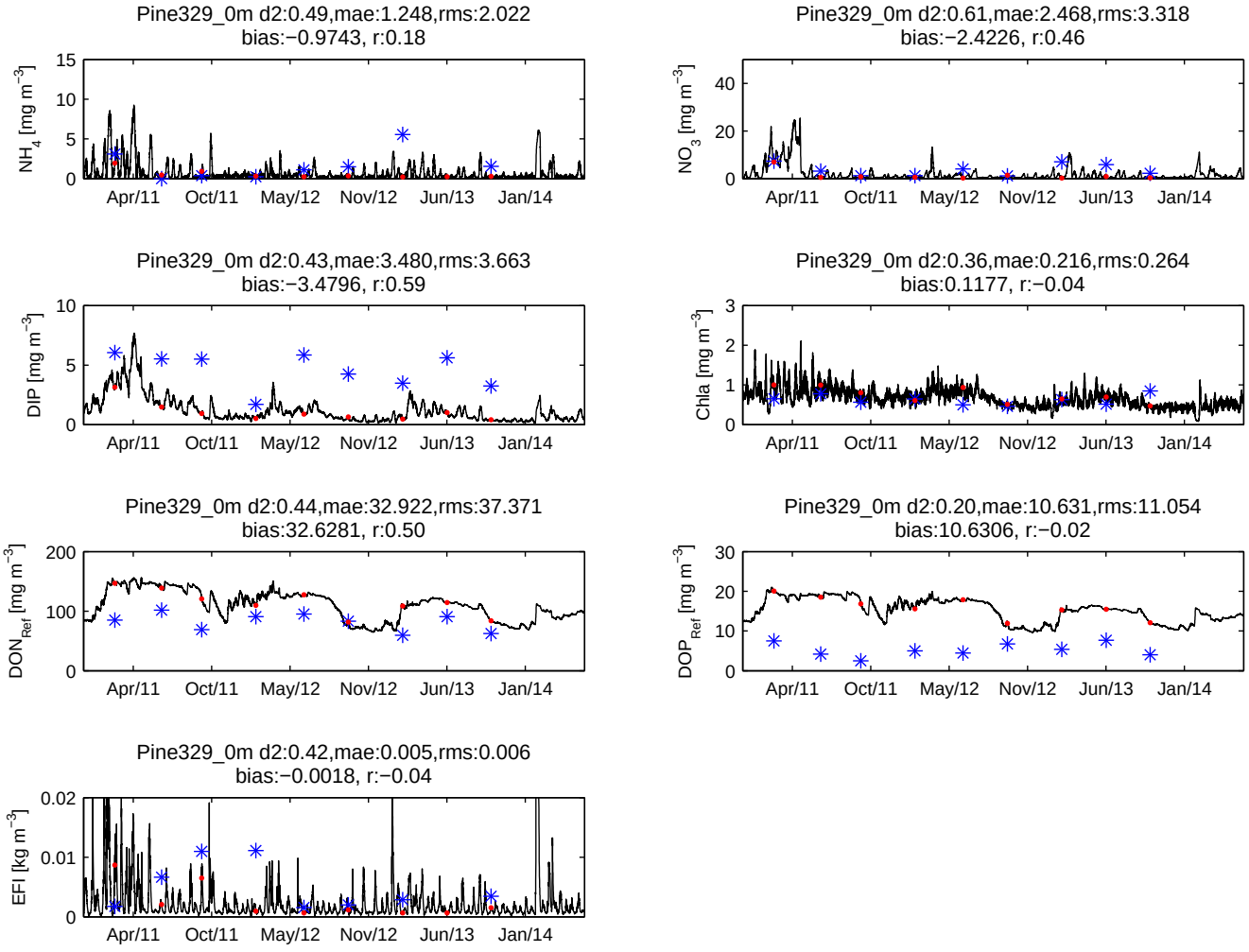


Figure 118: Pine Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 0 m. Model grid deepest point at this site -18.14 m. Observation deepest point at this site 20.0 to 25.7 m.

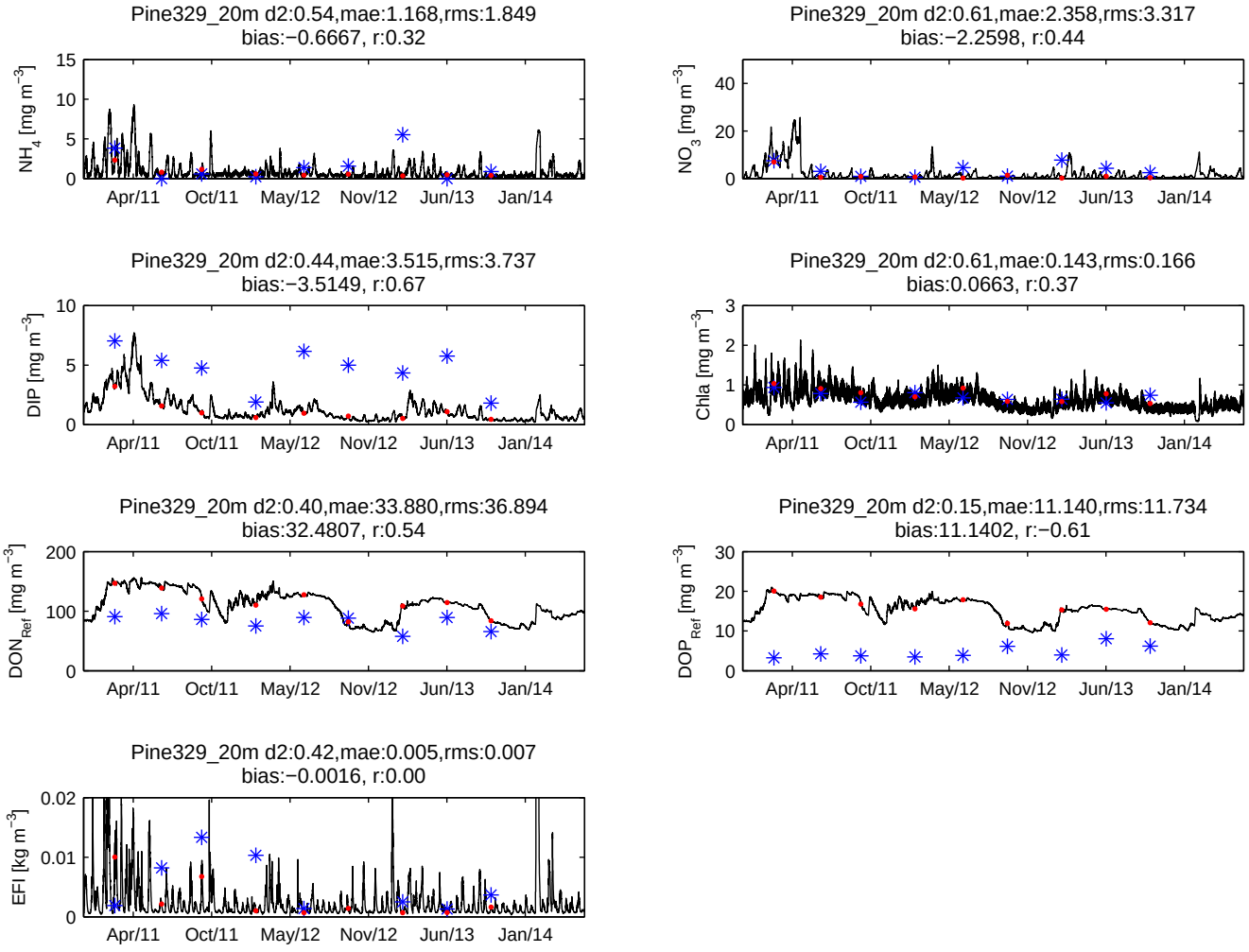


Figure 119: Pine Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 20 m. Model grid deepest point at this site -18.14 m. Observation deepest point at this site 20.0 to 25.7 m.

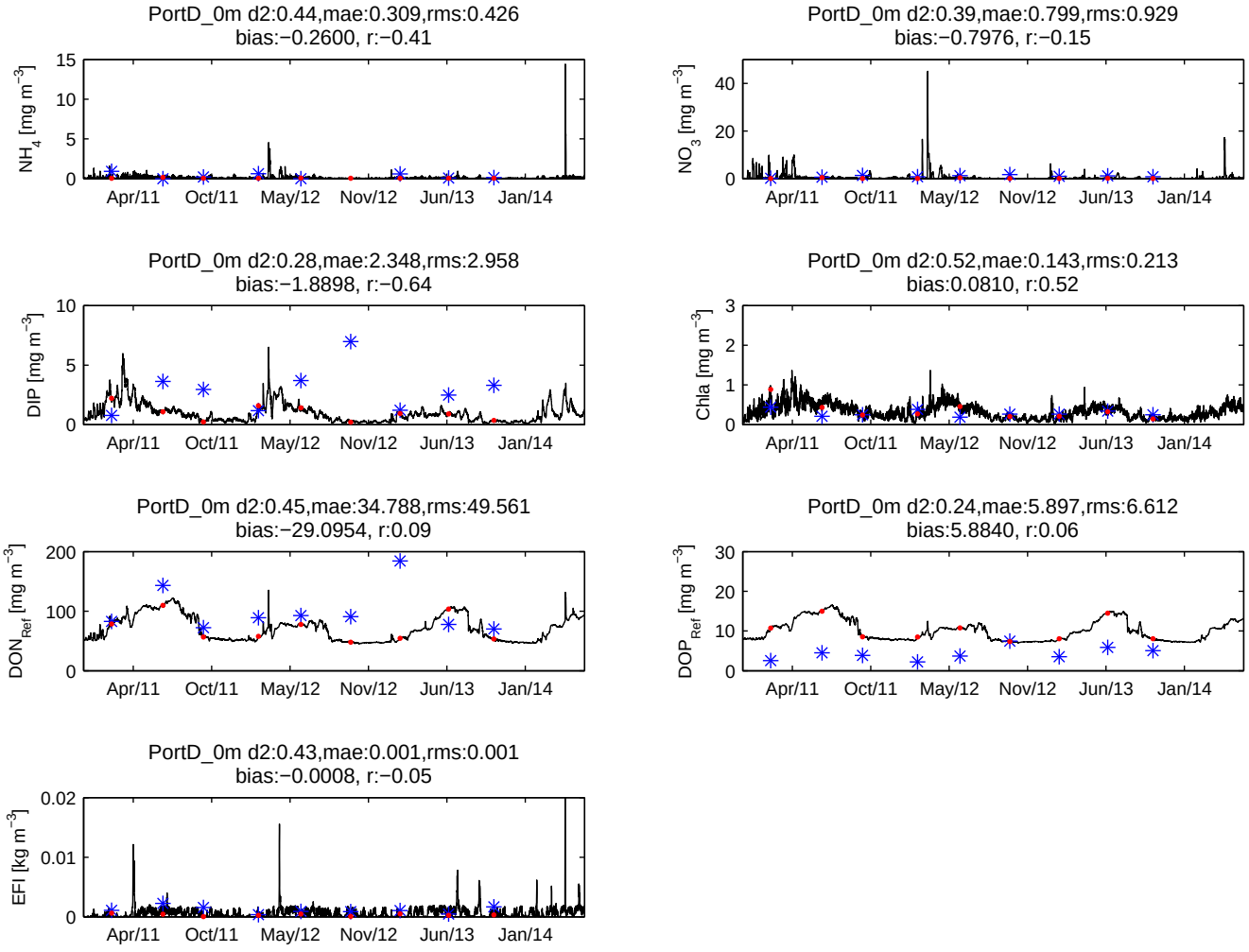


Figure 120: Port Douglas AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 0 m. Model grid deepest point at this site -18.44 m. Observation deepest point at this site 15.2 to 17.1 m.

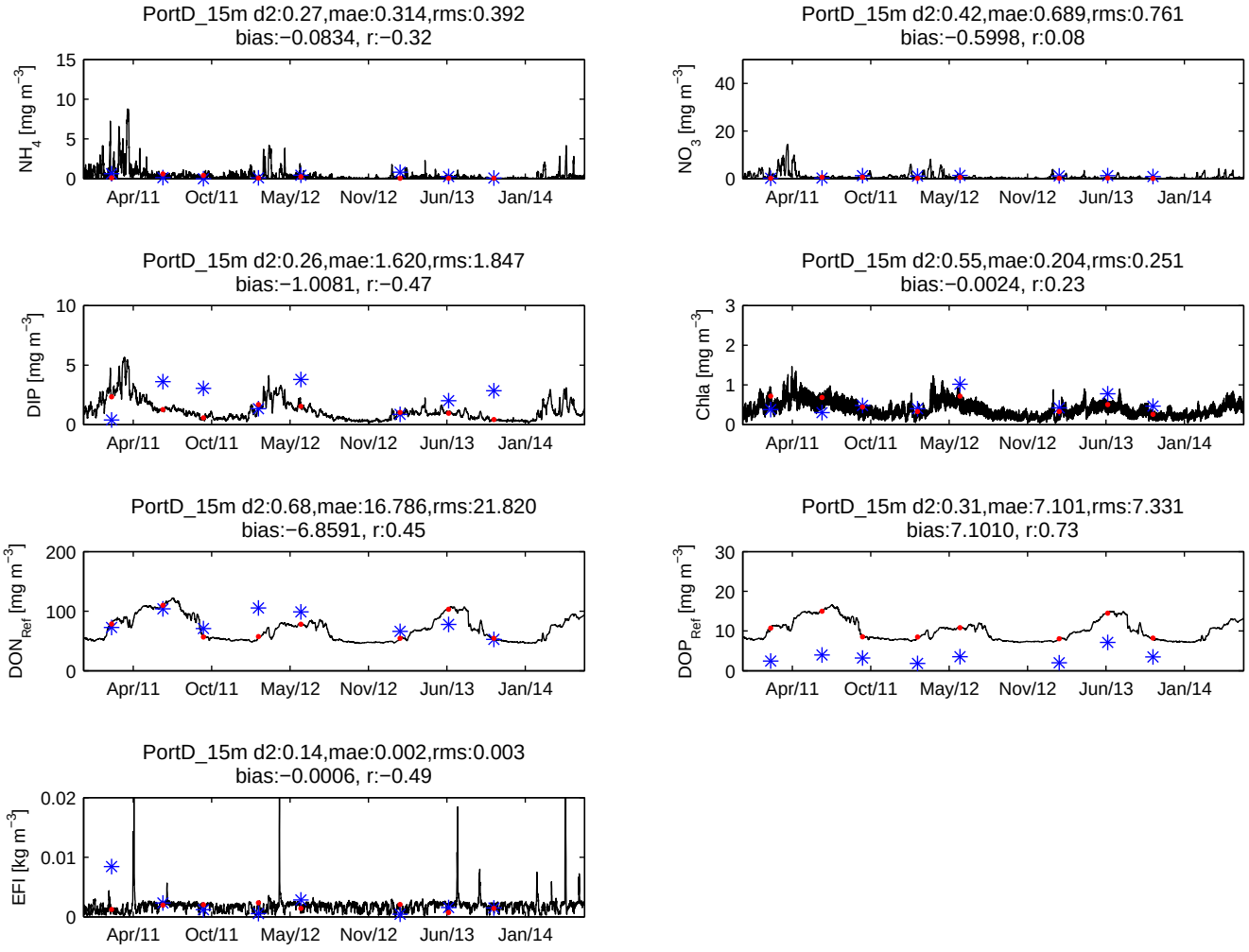


Figure 121: Port Douglas AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 15 m. Model grid deepest point at this site -18.44 m. Observation deepest point at this site 15.2 to 17.1 m.

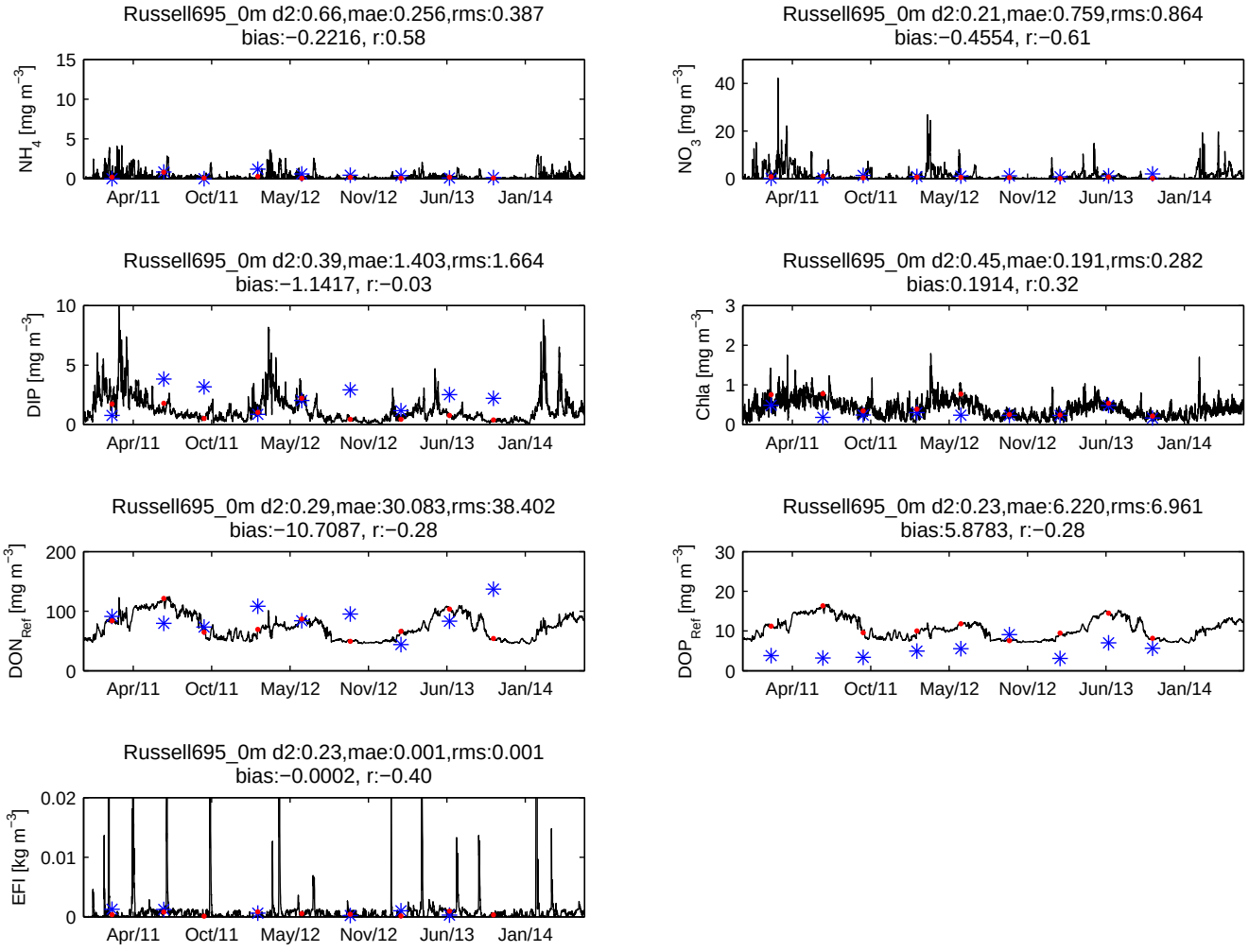


Figure 122: Russell Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 0 m. Model grid deepest point at this site -19.94 m. Observation deepest point at this site 22.0 to 23.7 m.

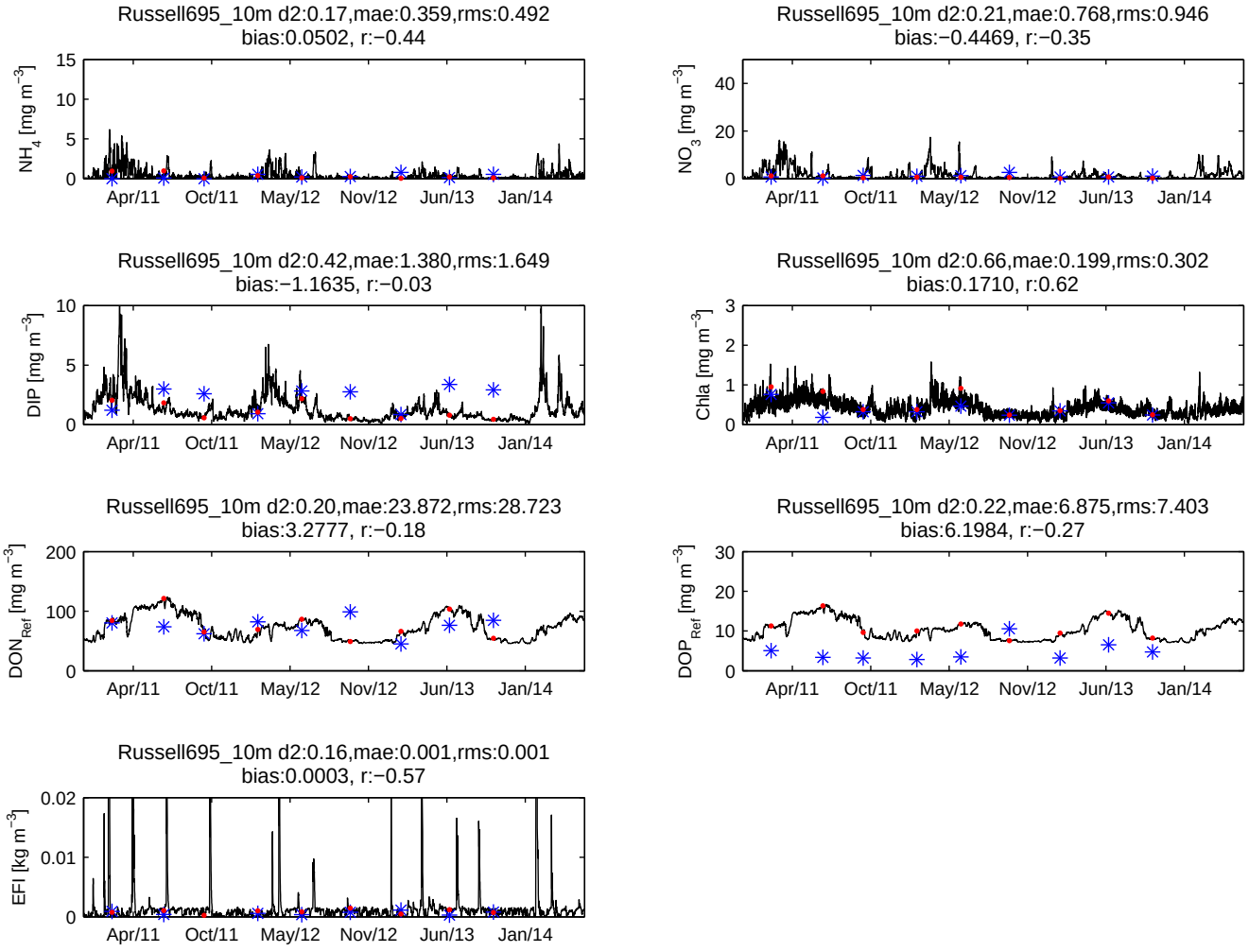


Figure 123: Russell Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 10 m. Model grid deepest point at this site -19.94 m. Observation deepest point at this site 22.0 to 23.7 m.

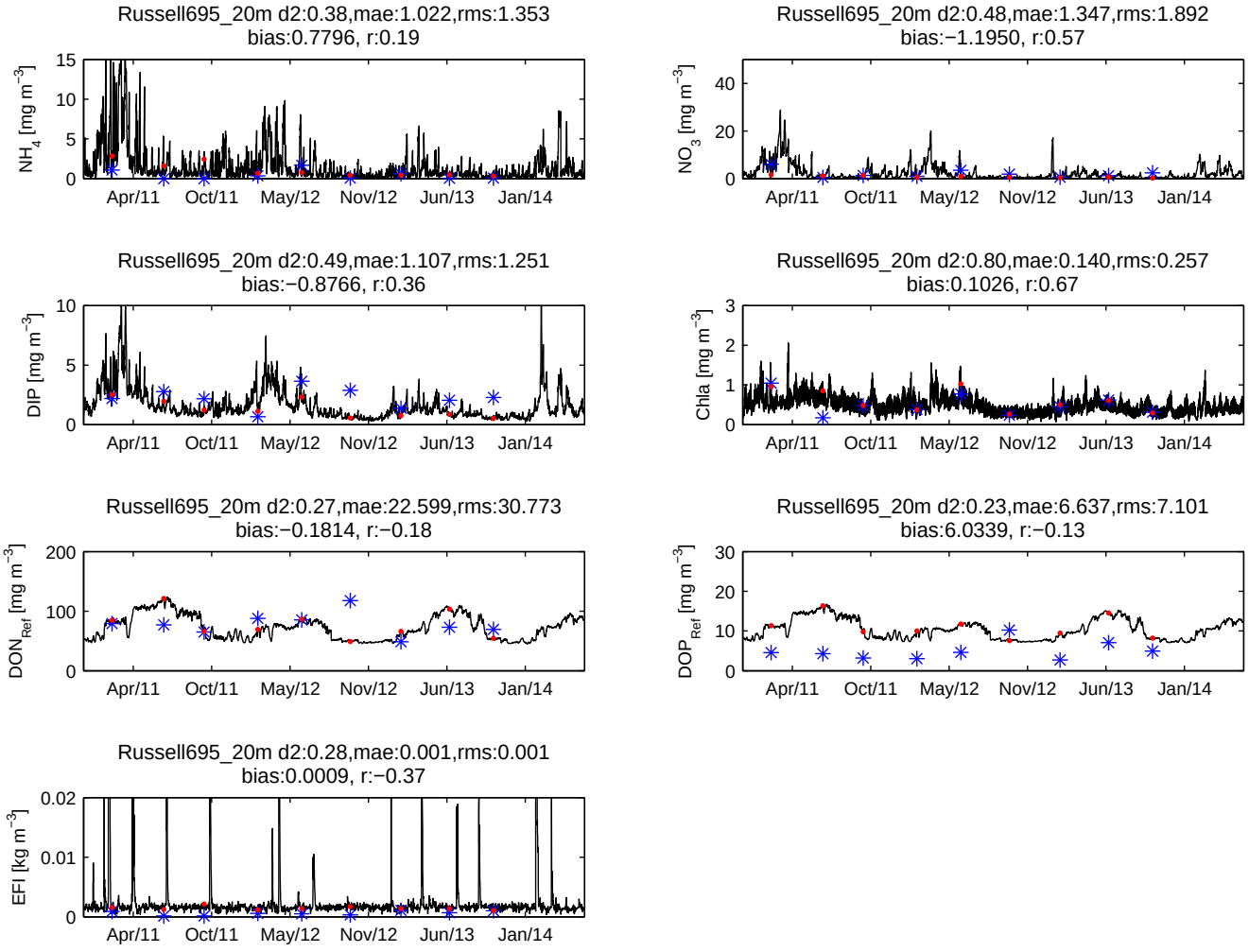


Figure 124: Russell Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 20 m. Model grid deepest point at this site -19.94 m. Observation deepest point at this site 22.0 to 23.7 m.

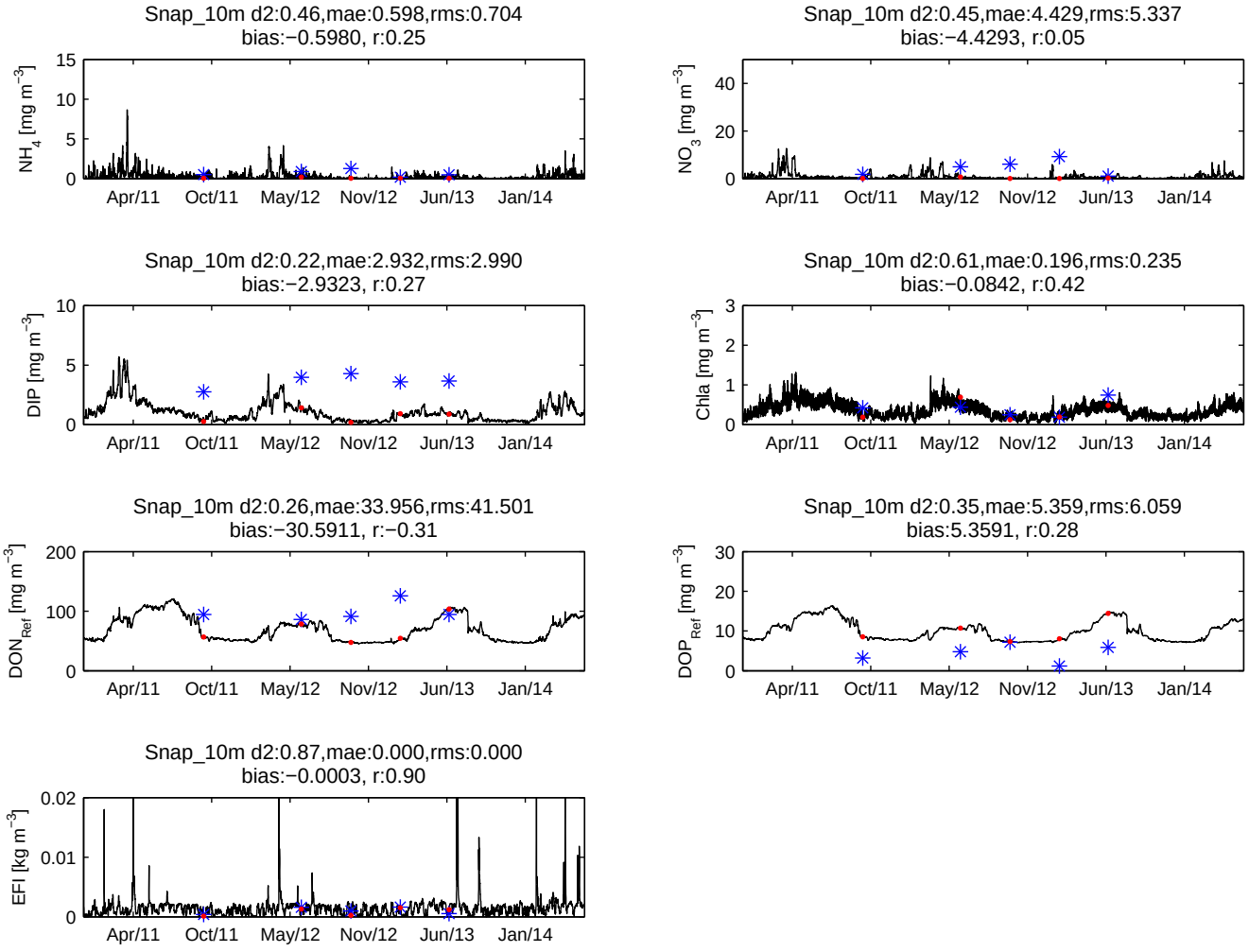


Figure 125: Snapper Island AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 10 m. Model grid deepest point at this site -22.14 m. Observation deepest point at this site 8.0 to 11.2 m.

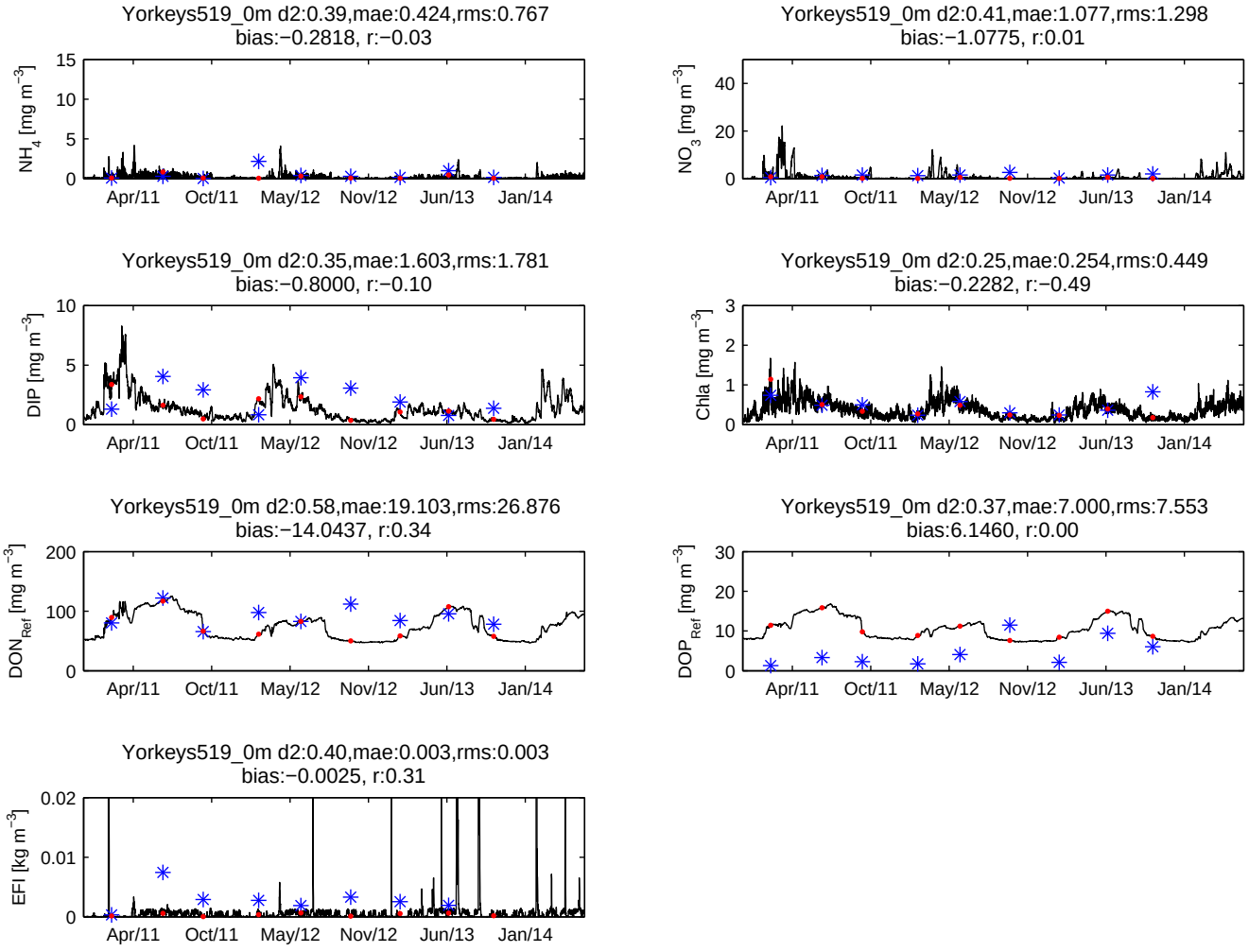


Figure 126: Yorkeys Knob AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 0 m. Model grid deepest point at this site -10.5 m. Observation deepest point at this site 10.6 to 11.9 m.

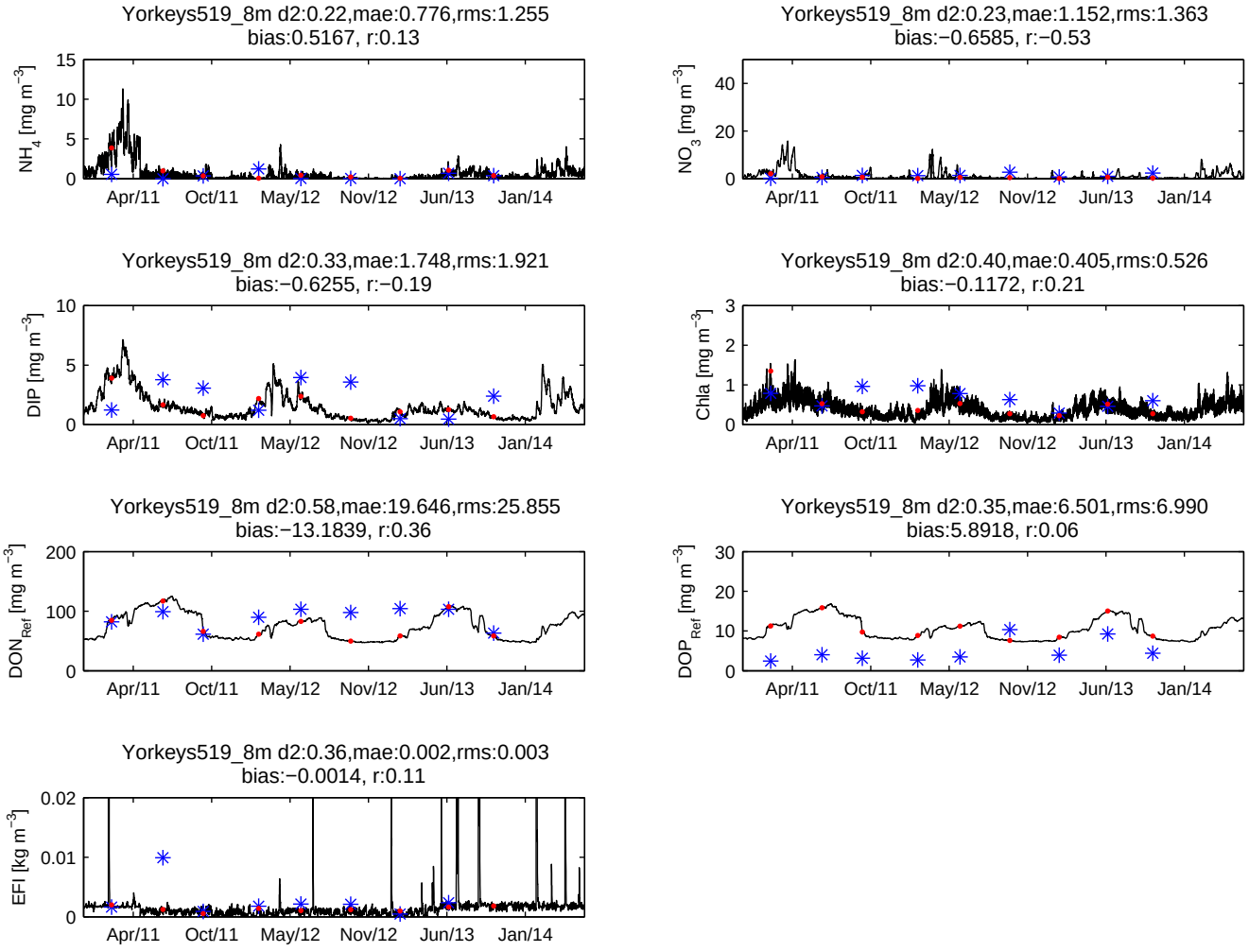


Figure 127: Yorkeys Knob AIMS Water Quality Monitoring (WQM) observations against GBR4 model: Observations (blue stars), model (black line) and timepoint on model where observation falls (red circles): Parameter/s = NH_4, NO_3, DIP, Chlorophyll a, DON_{refr}, DOP_{refr}, EFI_{model}/NTU_{obs}. Field observation depth taken: 8 m. Model grid deepest point at this site -10.5 m. Observation deepest point at this site 10.6 to 11.10 m.

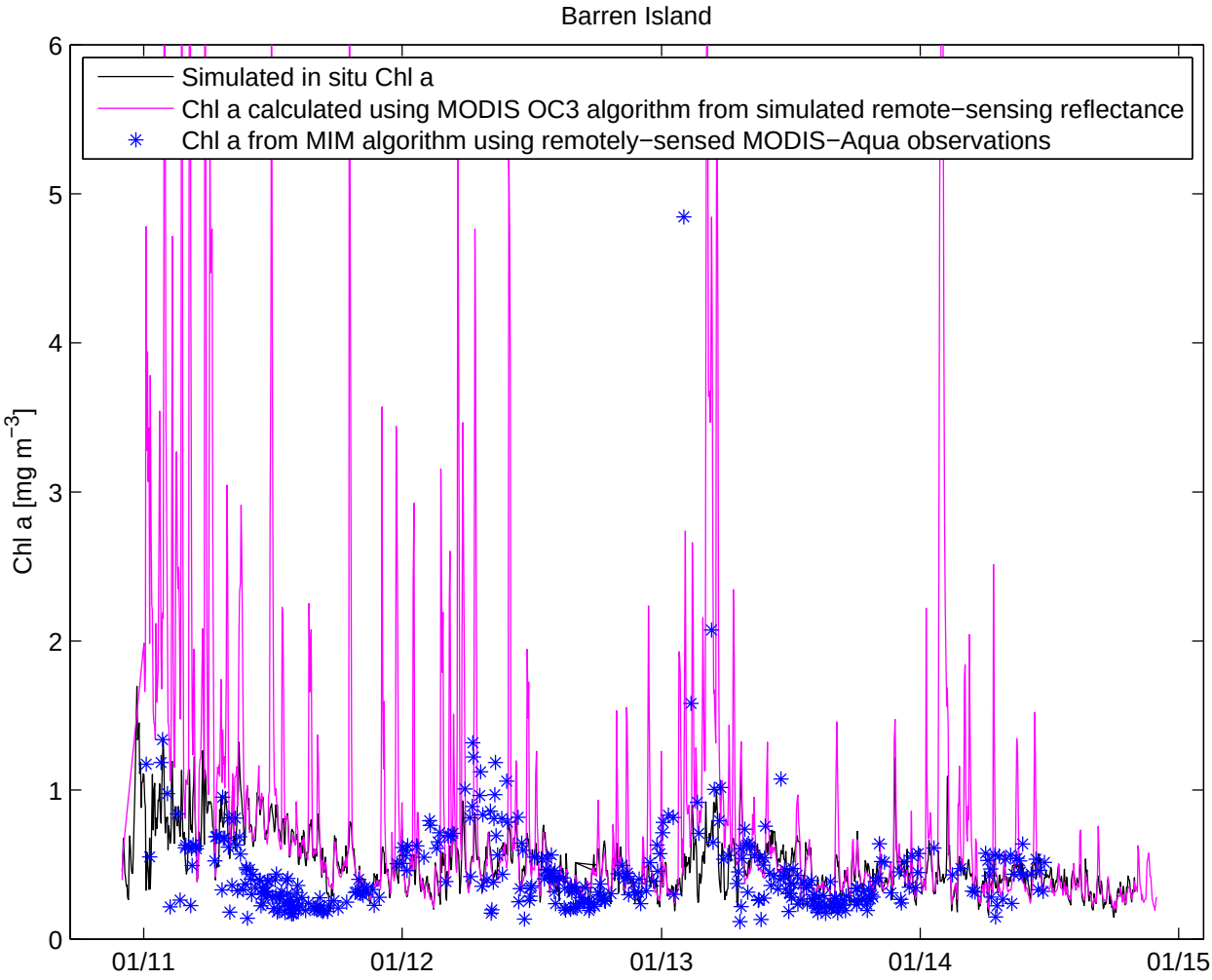


Figure 128: Barren Island Remote sensing comparisons Simulated *insitu* Chl *a* (black), Chl *a* calculated using MODIS OC3 algorithm from simulated remote-sensing reflectance (pink), Chl *a* from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars), : Parameter/s = Chlorophyll *a*. Field observation depth taken: 0 m. Model grid deepest point at this site 24.26 m. Observation deepest point at this site 15.2 to 18.9 m.

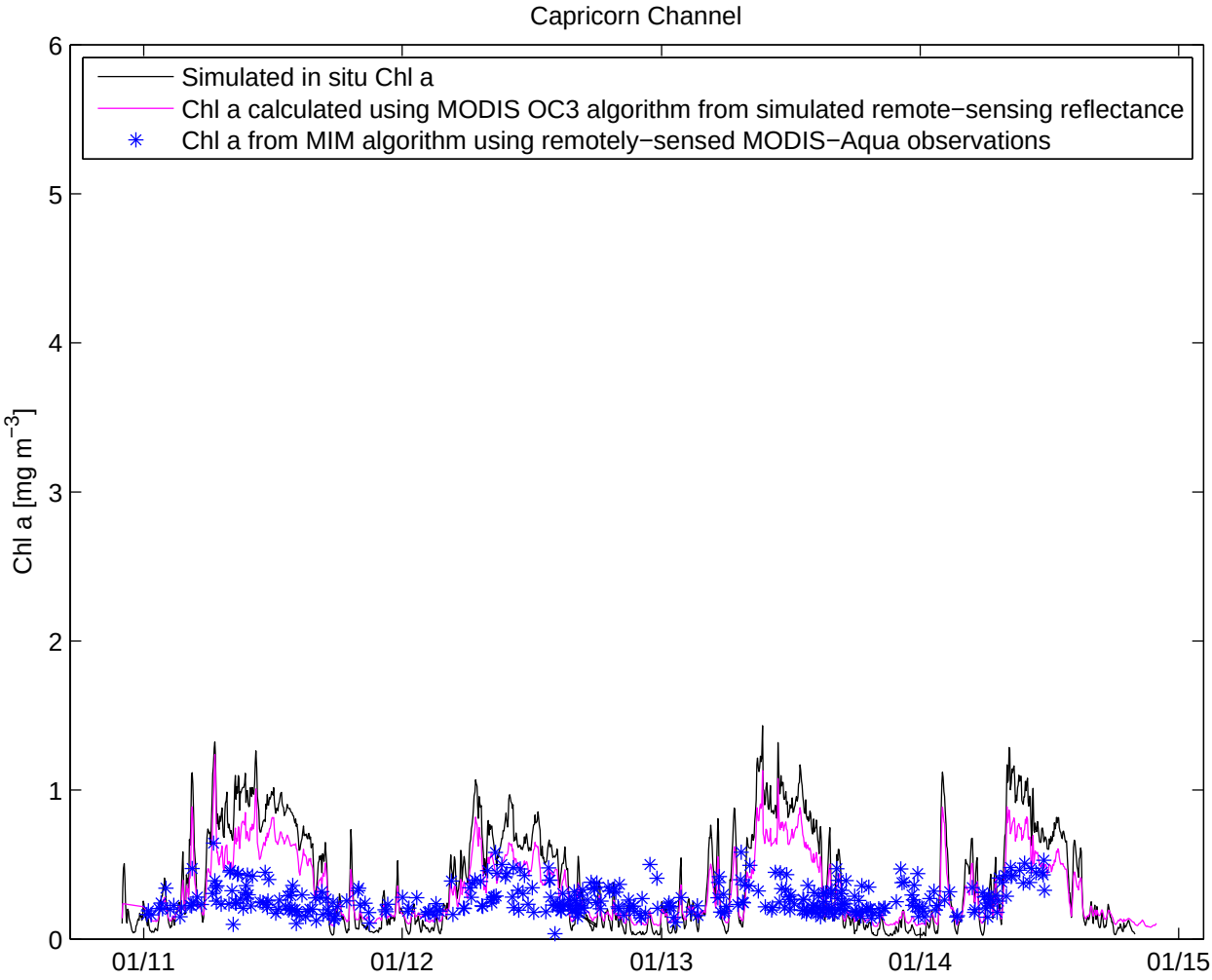


Figure 129: Capricorn Channel (GBRCCH) Remote sensing comparisons Simulated *insitu* Chl *a* (black), Chl *a* calculated using MODIS OC3 algorithm from simulated remote-sensing reflectance (pink), Chl *a* from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars), : Parameter/s = Chlorophyll *a*. Field observation depth taken: 0 m. Model grid deepest point at this site 91.17 m. Observation deepest point at this site 92 m.

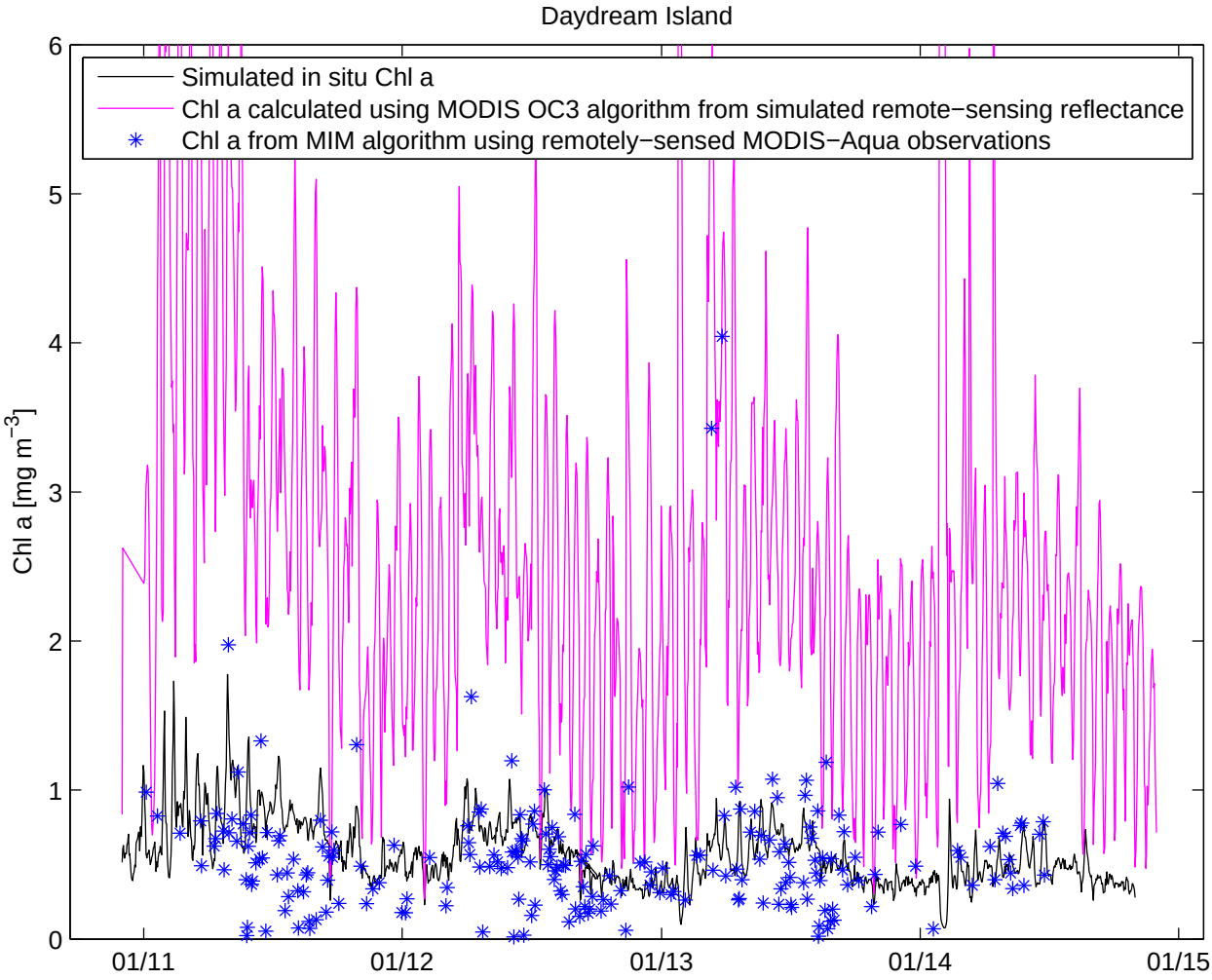


Figure 130: Daydream Island Remote sensing comparisons Simulated *insitu* Chl *a* (black), Chl *a* calculated using MODIS OC3 algorithm from simulated remote-sensing reflectance (pink), Chl *a* from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars), : Parameter/s = Chlorophyll *a*. Field observation depth taken: 0 m. Model grid deepest point at this site 16.76 m. Observation deepest point at this site 23.6 to 25.9 m.

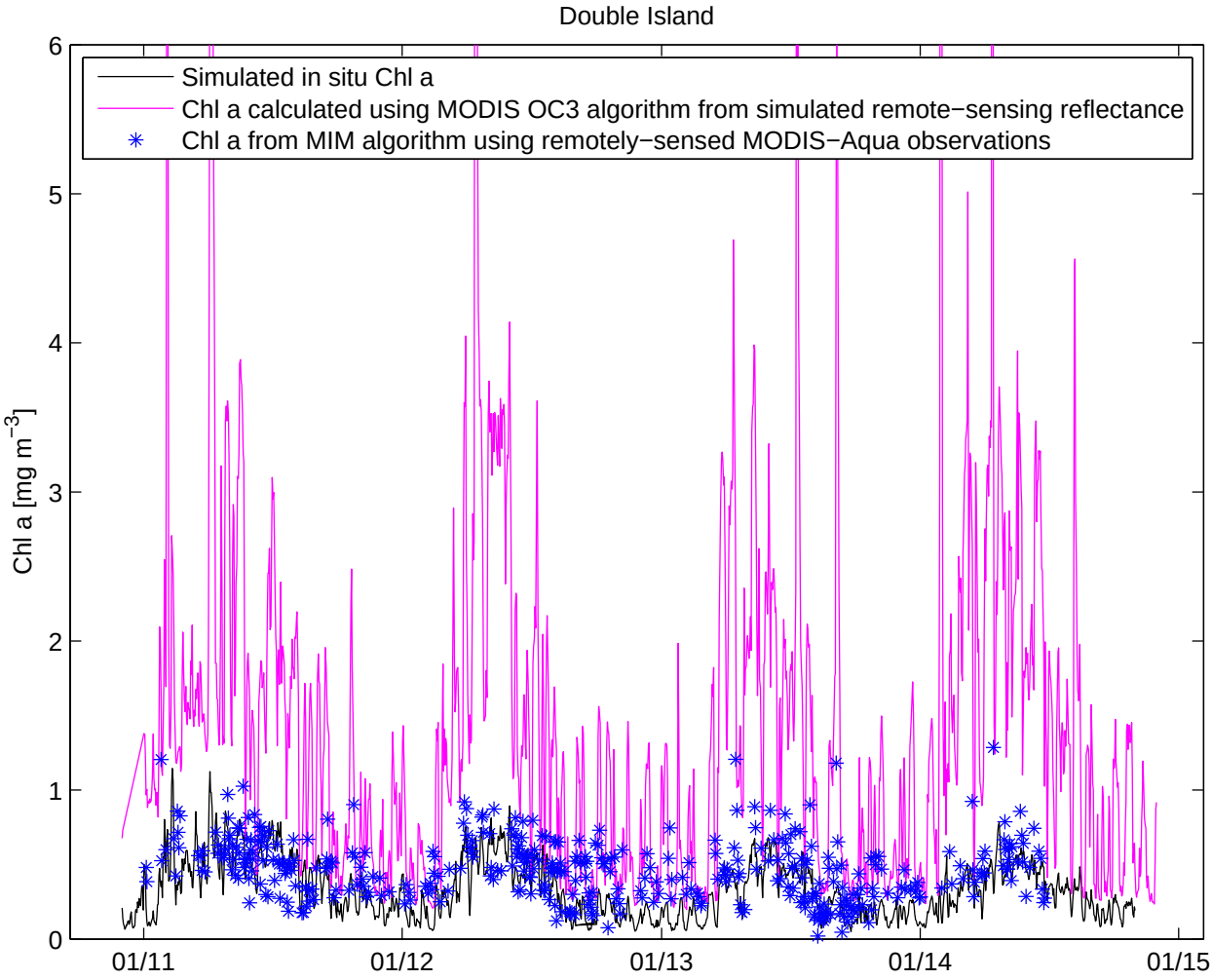


Figure 131: Double Cone Island Remote sensing comparisons Simulated *insitu* Chl *a* (black), Chl *a* calculated using MODIS OC3 algorithm from simulated remote-sensing reflectance (pink), Chl *a* from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars), : Parameter/s = Chlorophyll *a*. Field observation depth taken: 0 m. Model grid deepest point at this site 17.03 m. Observation deepest point at this site 23.0 to 31.0 m.

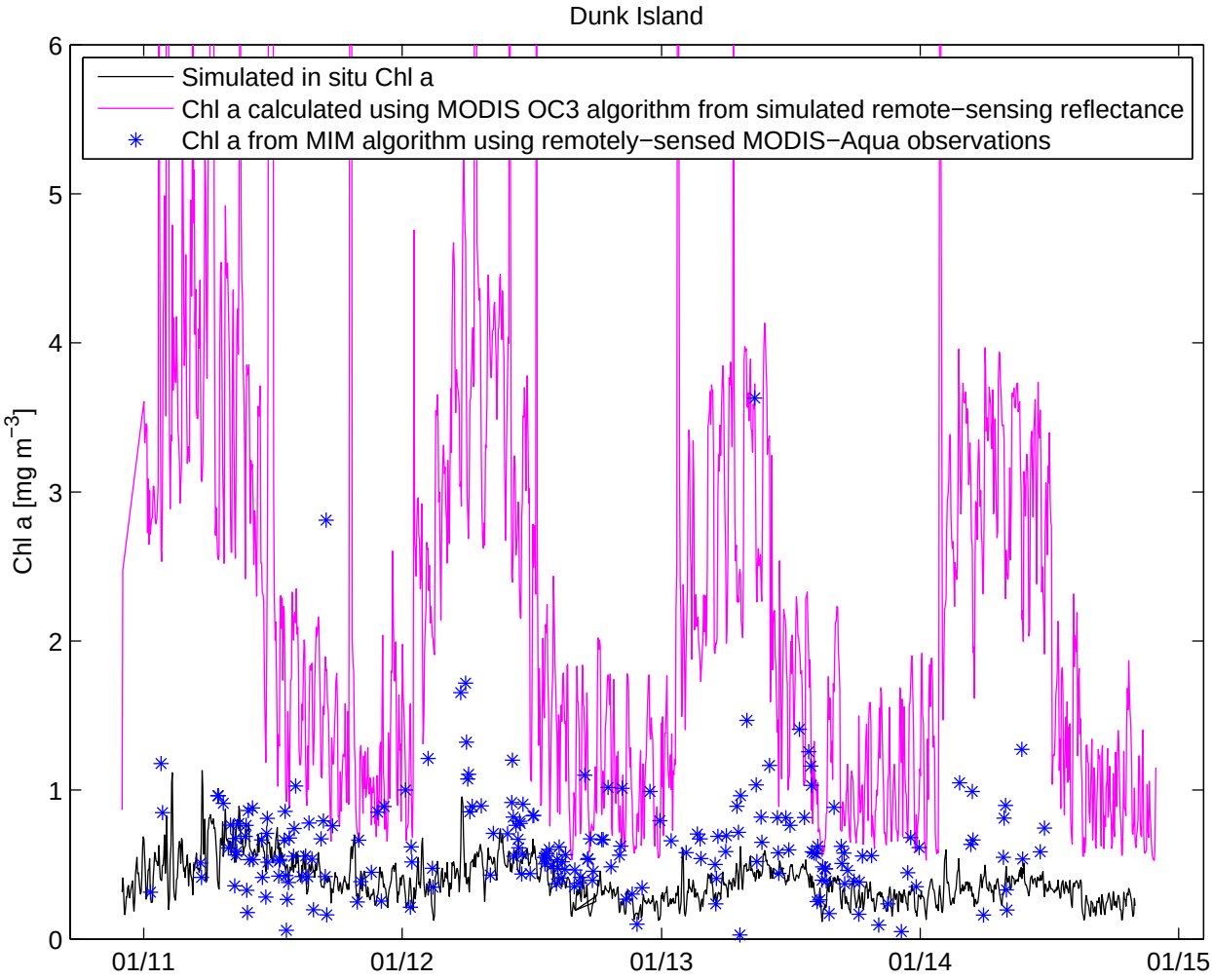


Figure 132: Dunk Island Remote sensing comparisons Simulated *insitu* Chl *a* (black), Chl *a* calculated using MODIS OC3 algorithm from simulated remote-sensing reflectance (pink), Chl *a* from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars), : Parameter/s = Chlorophyll *a*. Field observation depth taken: 0 m. Model grid deepest point at this site 9.15 m. Observation deepest point at this site 9.0 to 10.4 m.

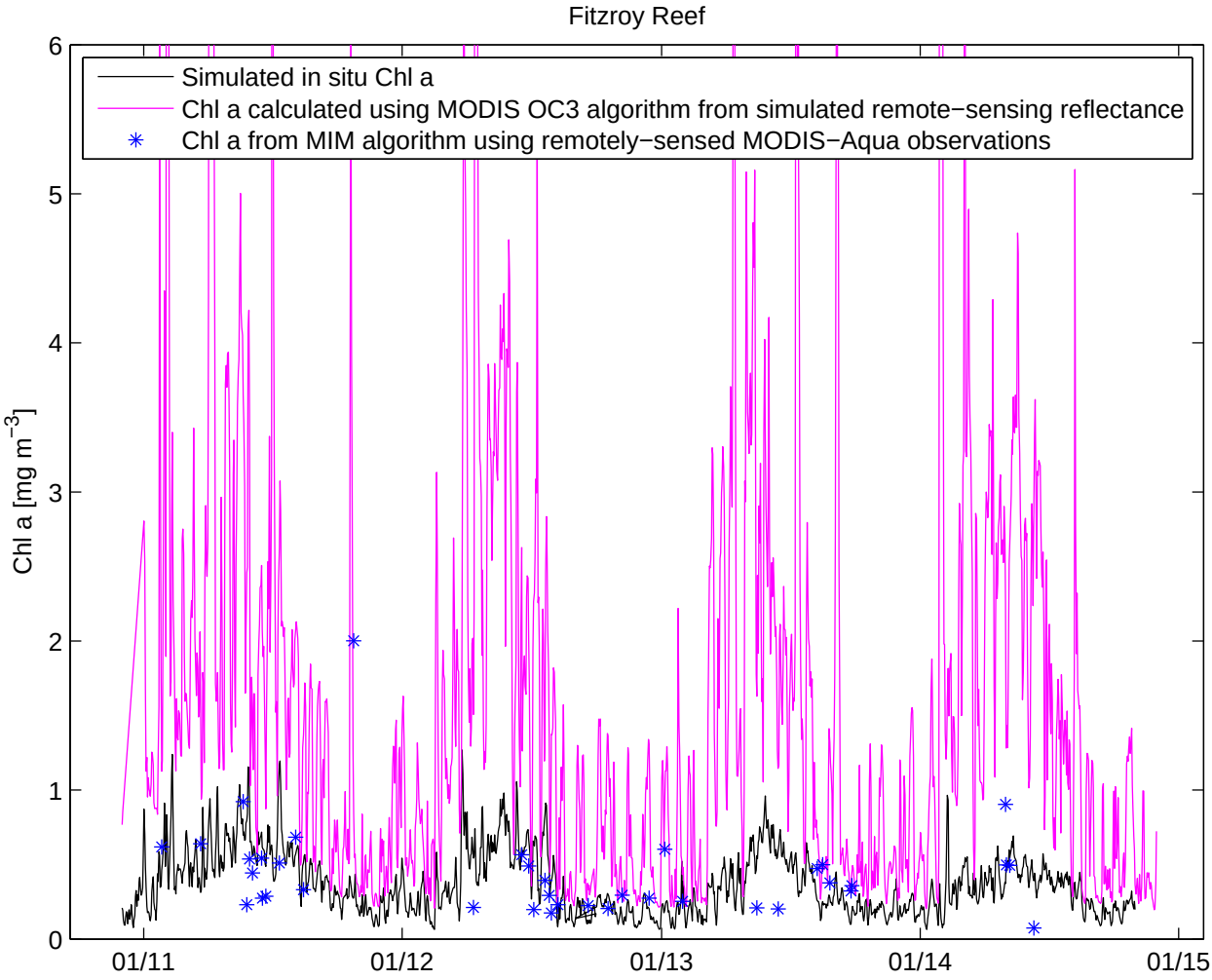


Figure 133: Fitzroy Reef Remote sensing comparisons Simulated *insitu* Chl *a* (black), Chl *a* calculated using MODIS OC3 algorithm from simulated remote-sensing reflectance (pink), Chl *a* from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars), : Parameter/s = Chlorophyll *a*. Field observation depth taken: 0 m. Model grid deepest point at this site 27 m. Observation deepest point at this site 15.5 to17.2 m.

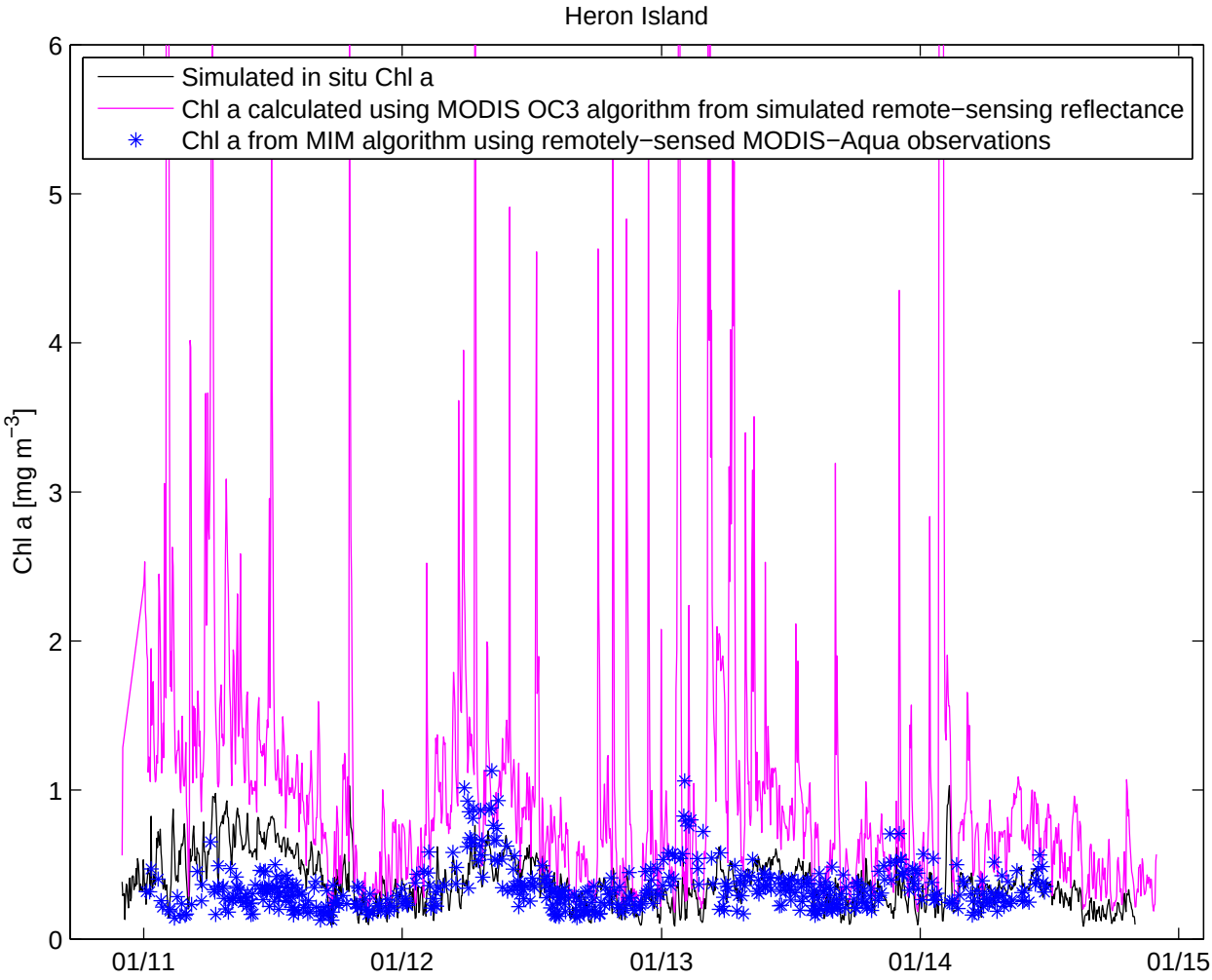


Figure 134: Heron Island South (GBRHIS) Remote sensing comparisons Simulated *insitu* Chl *a* (black), Chl *a* calculated using MODIS OC3 algorithm from simulated remote-sensing reflectance (pink), Chl *a* from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars), : Parameter/s = Chlorophyll *a*. Field observation depth taken: 0 m. Model grid deepest point at this site -47.01 m. Observation deepest point at this site 46 m.

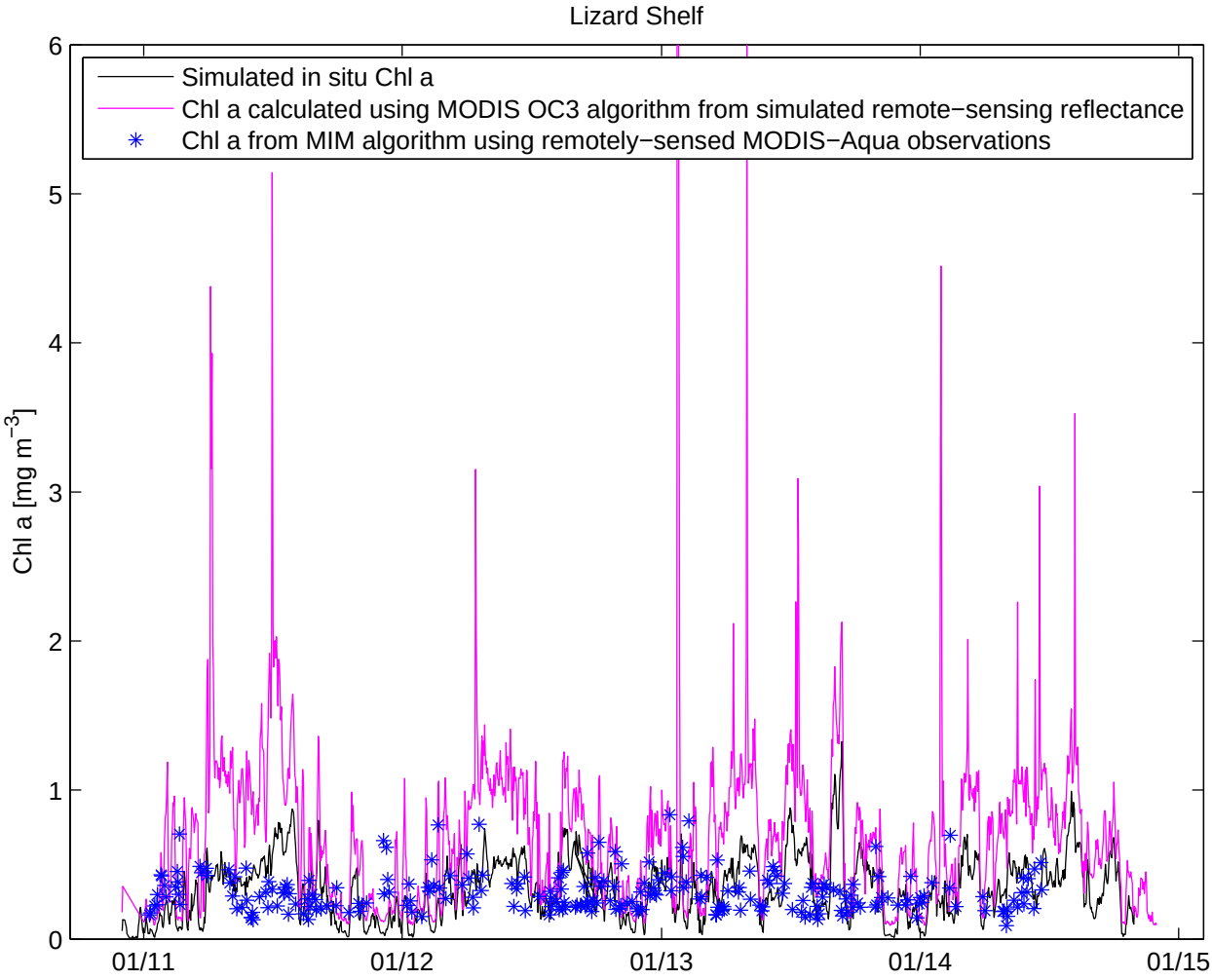


Figure 135: Lizard Shelf (GBRLSH) Remote sensing comparisons Simulated *insitu* Chl *a* (black), Chl *a* calculated using MODIS OC3 algorithm from simulated remote-sensing reflectance (pink), Chl *a* from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars), : Parameter/s = Chlorophyll *a*. Field observation depth taken: 0 m. Model grid deepest point at this site -30.32 m. Observation deepest point at this site 31 m.

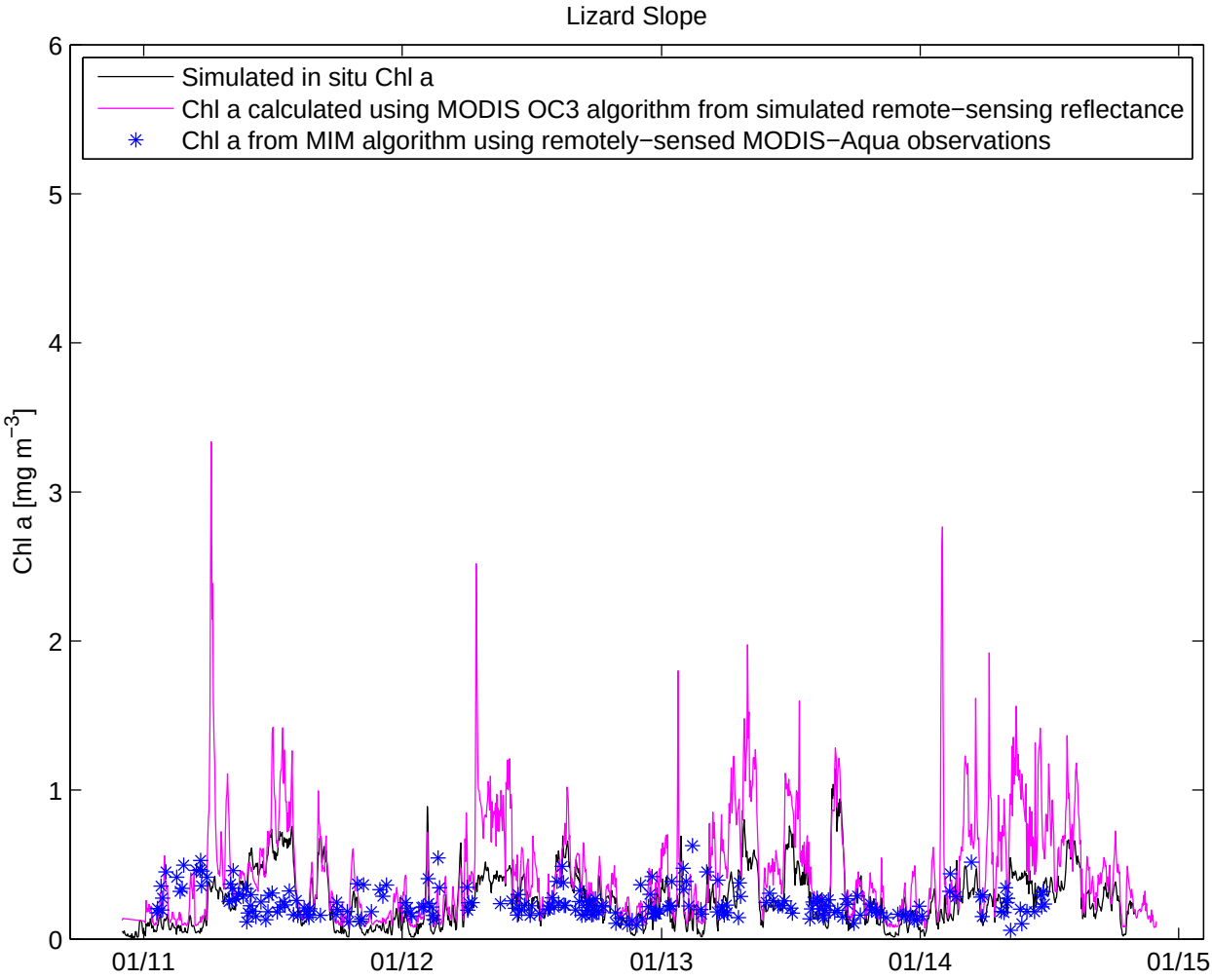


Figure 136: Lizard Slope(GBRLSL) Remote sensing comparisons Simulated *insitu* Chl *a* (black), Chl *a* calculated using MODIS OC3 algorithm from simulated remote-sensing reflectance (pink), Chl *a* from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars), : Parameter/s = Chlorophyll *a*. Field observation depth taken: 0 m. Model grid deepest point at this site -37.66 m. Observation deepest point at this site 350 m.

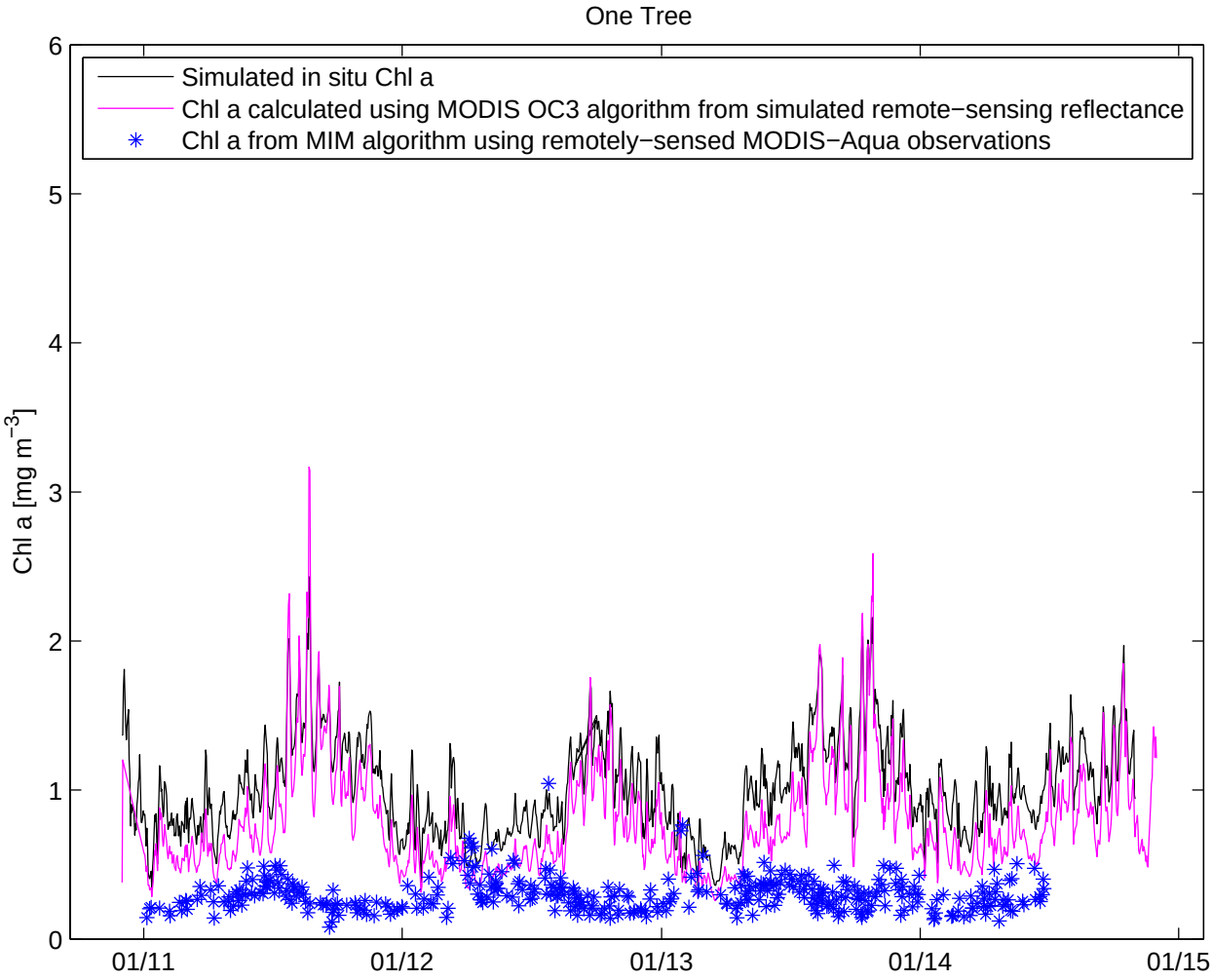


Figure 137: One Tree (GBROTE) Remote sensing comparisons Simulated *insitu* Chl *a* (black), Chl *a* calculated using MODIS OC3 algorithm from simulated remote-sensing reflectance (pink), Chl *a* from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars), : Parameter/s = Chlorophyll *a*. Field observation depth taken: 0 m. Model grid deepest point at this site -62.61 m. Observation deepest point at this site 58 m.

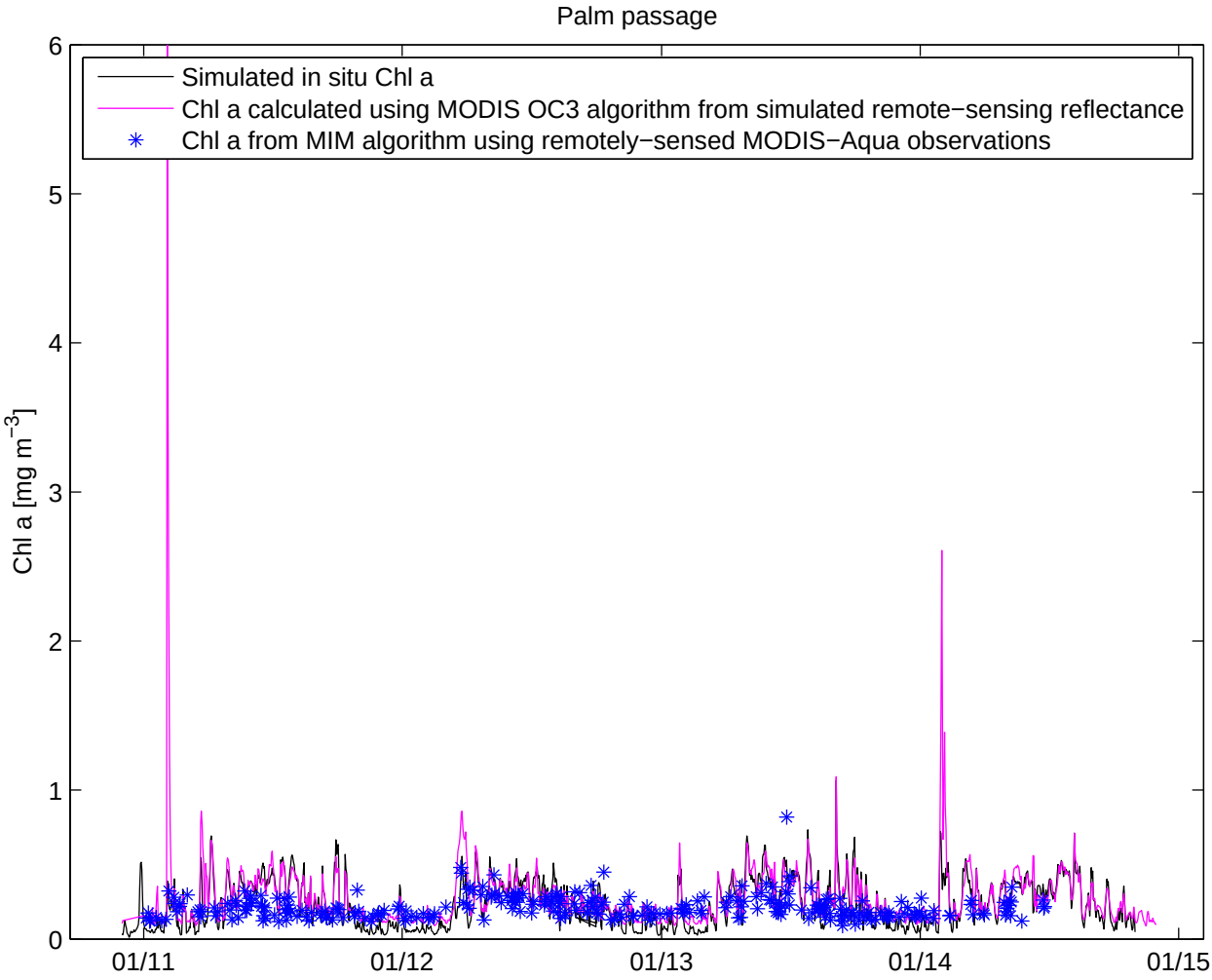


Figure 138: Palm Passage(GBRPPS) Remote sensing comparisons Simulated *insitu* Chl *a* (black), Chl *a* calculated using MODIS OC3 algorithm from simulated remote-sensing reflectance (pink), Chl *a* from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars), : Parameter/s = Chlorophyll *a*. Field observation depth taken: 0 m. Model grid deepest point at this site 71.9 m. Observation deepest point at this site 70 m.

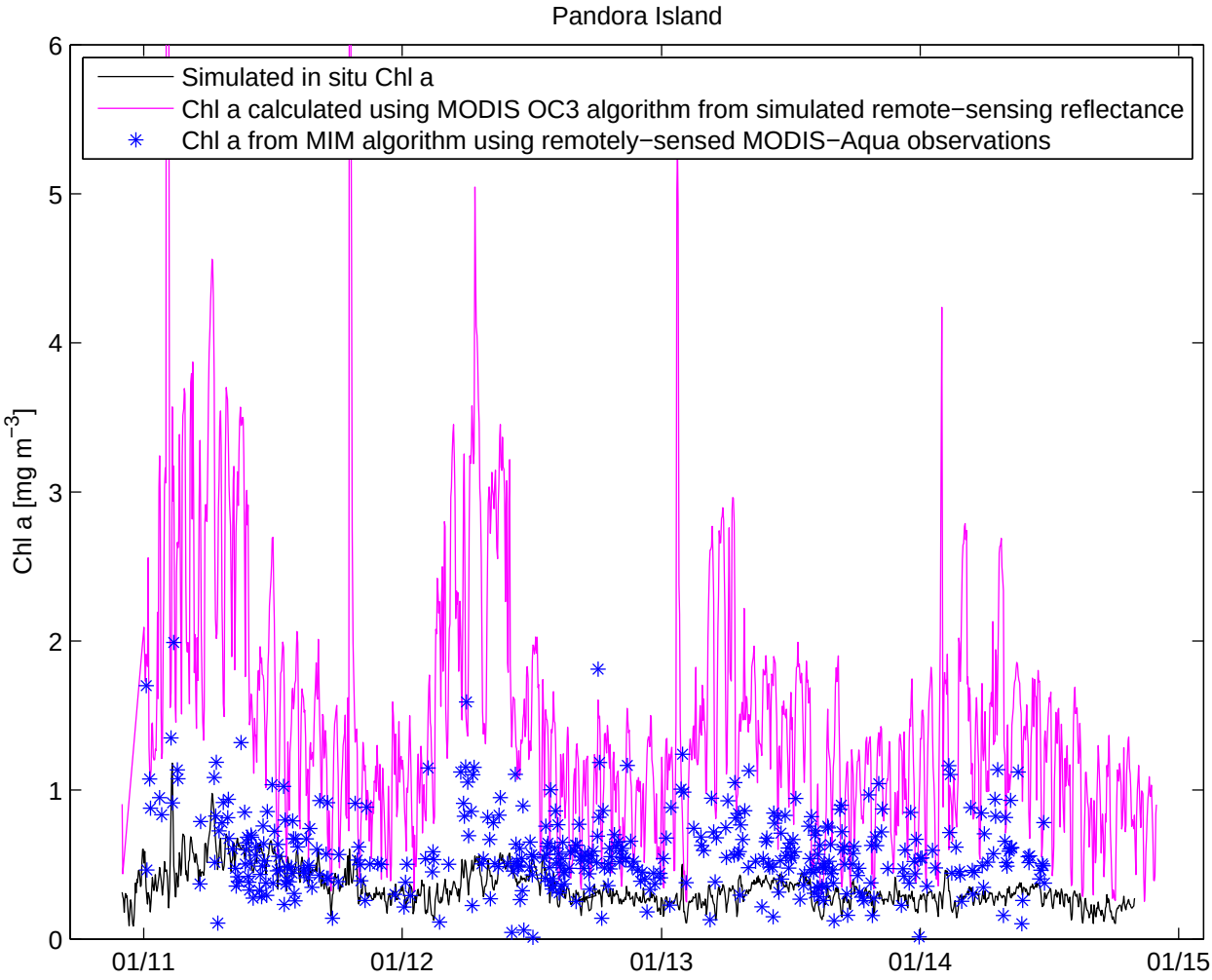


Figure 139: Pandora Island Remote sensing comparisons Simulated *insitu* Chl *a* (black), Chl *a* calculated using MODIS OC3 algorithm from simulated remote-sensing reflectance (pink), Chl *a* from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars), : Parameter/s = Chlorophyll *a*. Field observation depth taken: 0 m. Model grid deepest point at this site -16.98 m. Observation deepest point at this site 12.9 to 13.9 m.

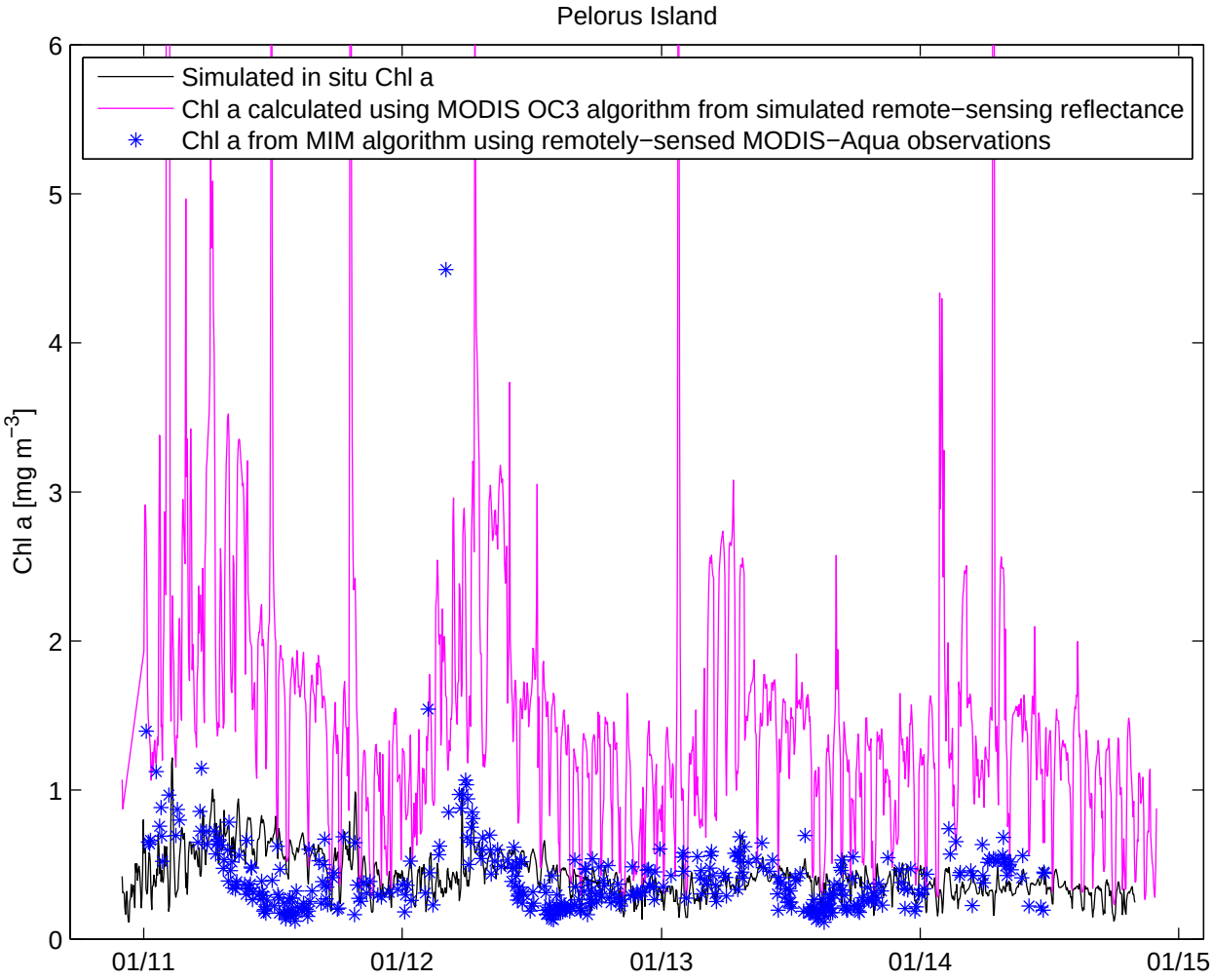


Figure 140: Pelorous/Orpheus Island Remote sensing comparisons Simulated *insitu* Chl *a* (black), Chl *a* calculated using MODIS OC3 algorithm from simulated remote-sensing reflectance (pink), Chl *a* from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars), : Parameter/s = Chlorophyll *a*. Field observation depth taken: 0 m. Model grid deepest point at this site -24.64 m. Observation deepest point at this site 25.3 to 31.4 m.

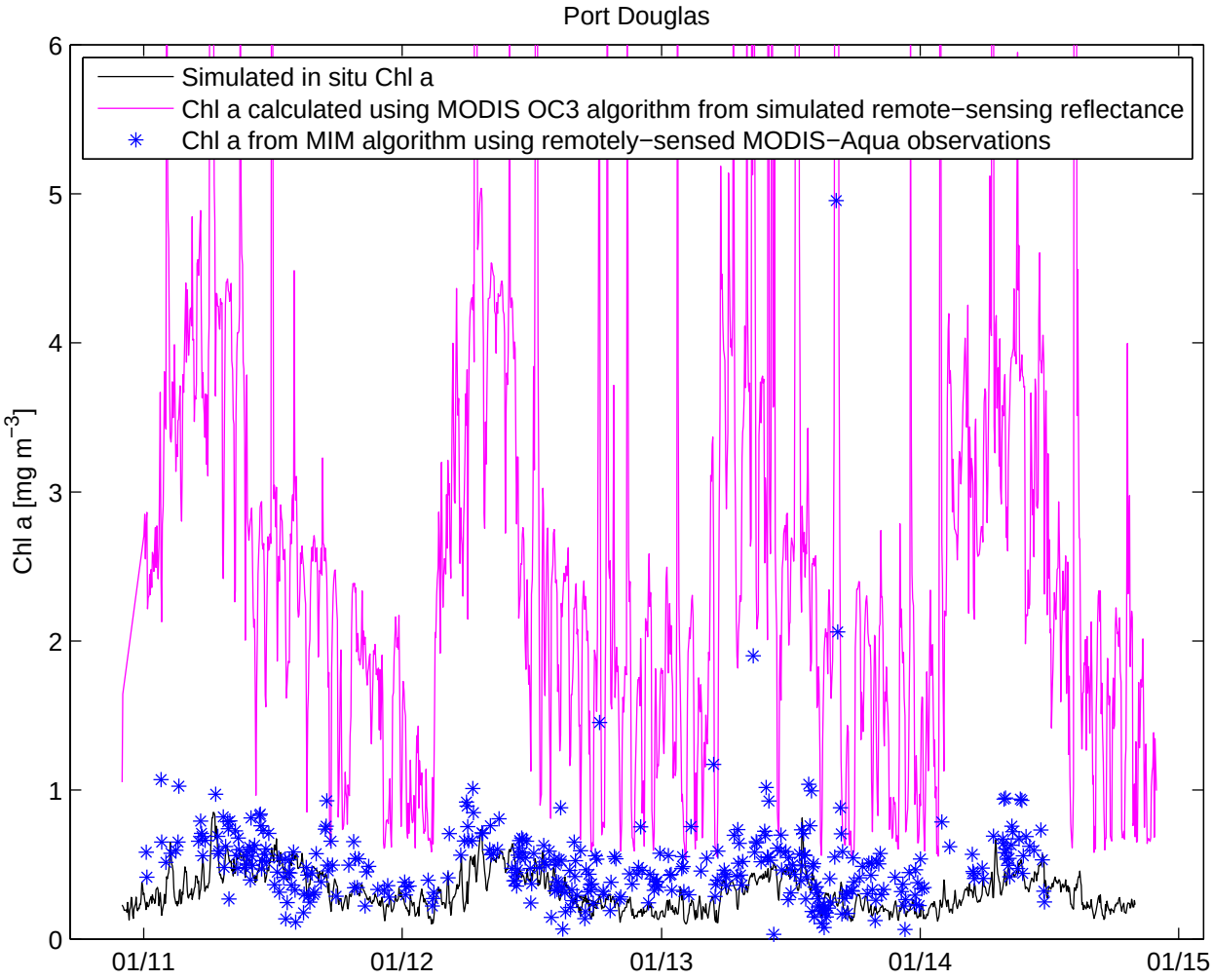


Figure 141: Port Douglas Remote sensing comparisons Simulated *insitu* Chl *a* (black), Chl *a* calculated using MODIS OC3 algorithm from simulated remote-sensing reflectance (pink), Chl *a* from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars), : Parameter/s = Chlorophyll *a*. Field observation depth taken: 0 m. Model grid deepest point at this site -18.44 m. Observation deepest point at this site 15.2 to 17.1 m.

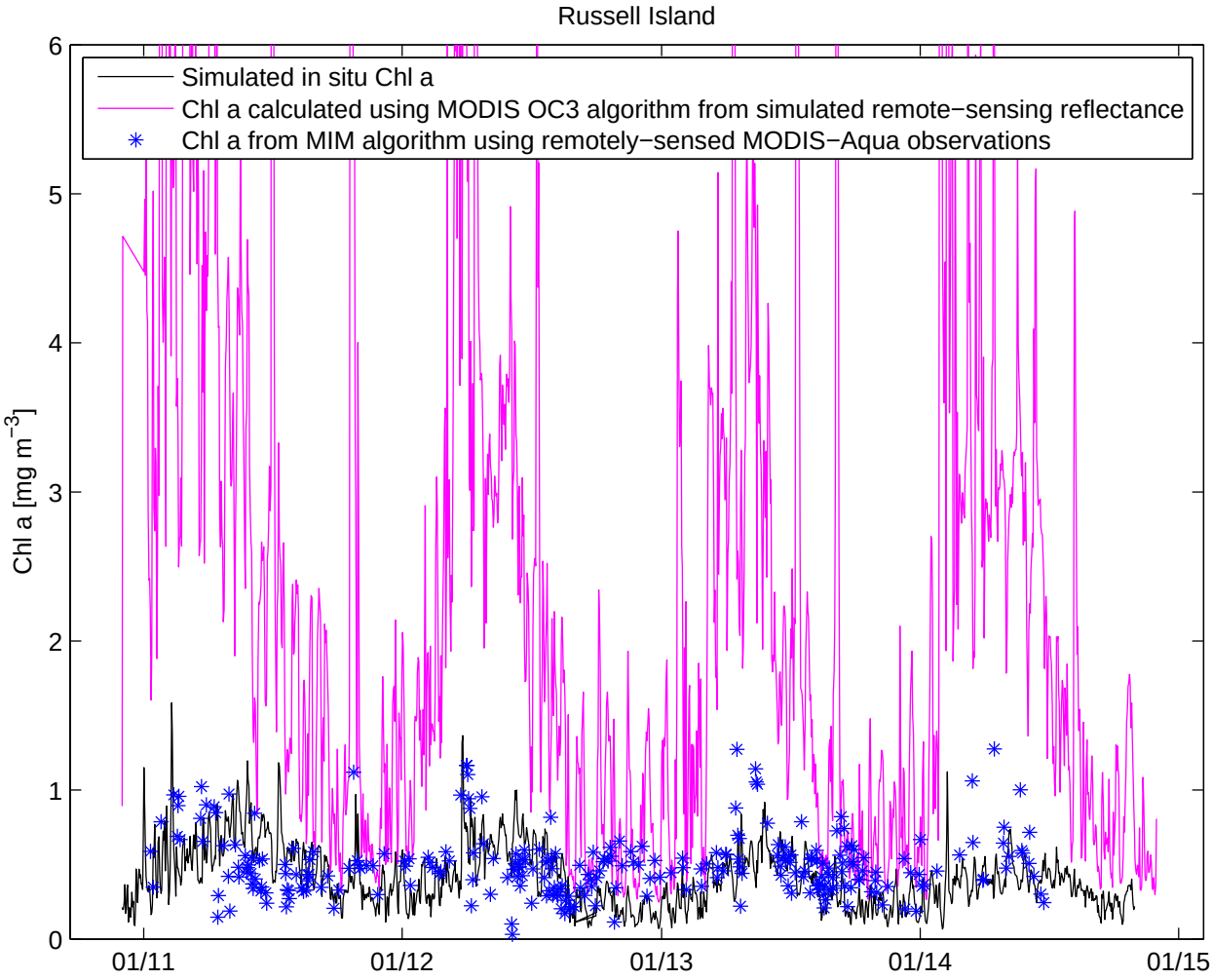


Figure 142: Russell Island Remote sensing comparisons Simulated *insitu* Chl *a* (black), Chl *a* calculated using MODIS OC3 algorithm from simulated remote-sensing reflectance (pink), Chl *a* from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars), : Parameter/s = Chlorophyll *a*. Field observation depth taken: 0 m. Model grid deepest point at this site -19.94 m. Observation deepest point at this site 22.0 to 23.7 m.

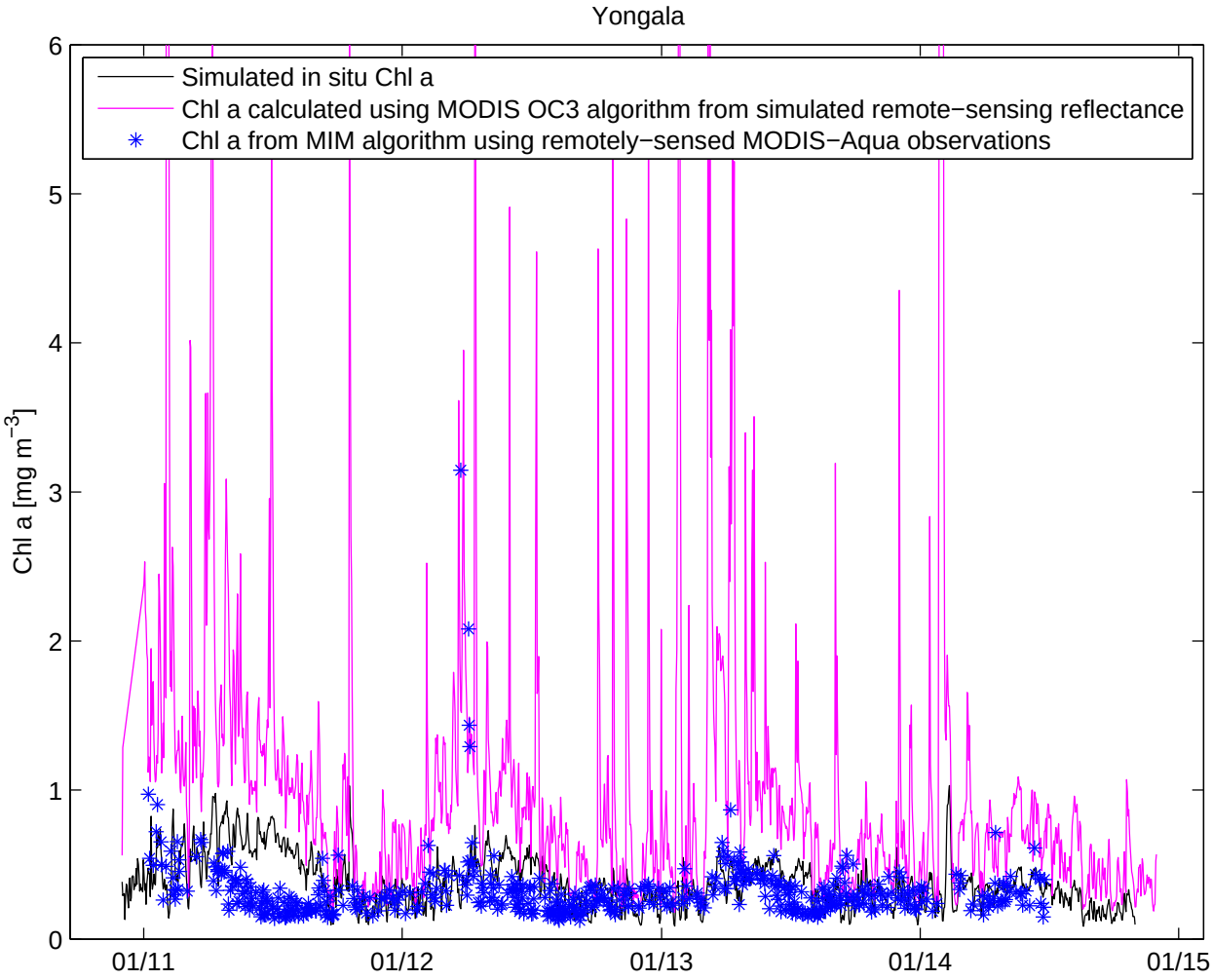


Figure 143: Yongala (NRSYON) Remote sensing comparisons Simulated *insitu* Chl *a* (black), Chl *a* calculated using MODIS OC3 algorithm from simulated remote-sensing reflectance (pink), Chl *a* from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars), : Parameter/s = Chlorophyll *a*. Field observation depth taken: 0 m. Model grid deepest point at this site -28.62 m. Observation deepest point at this site 27 m.

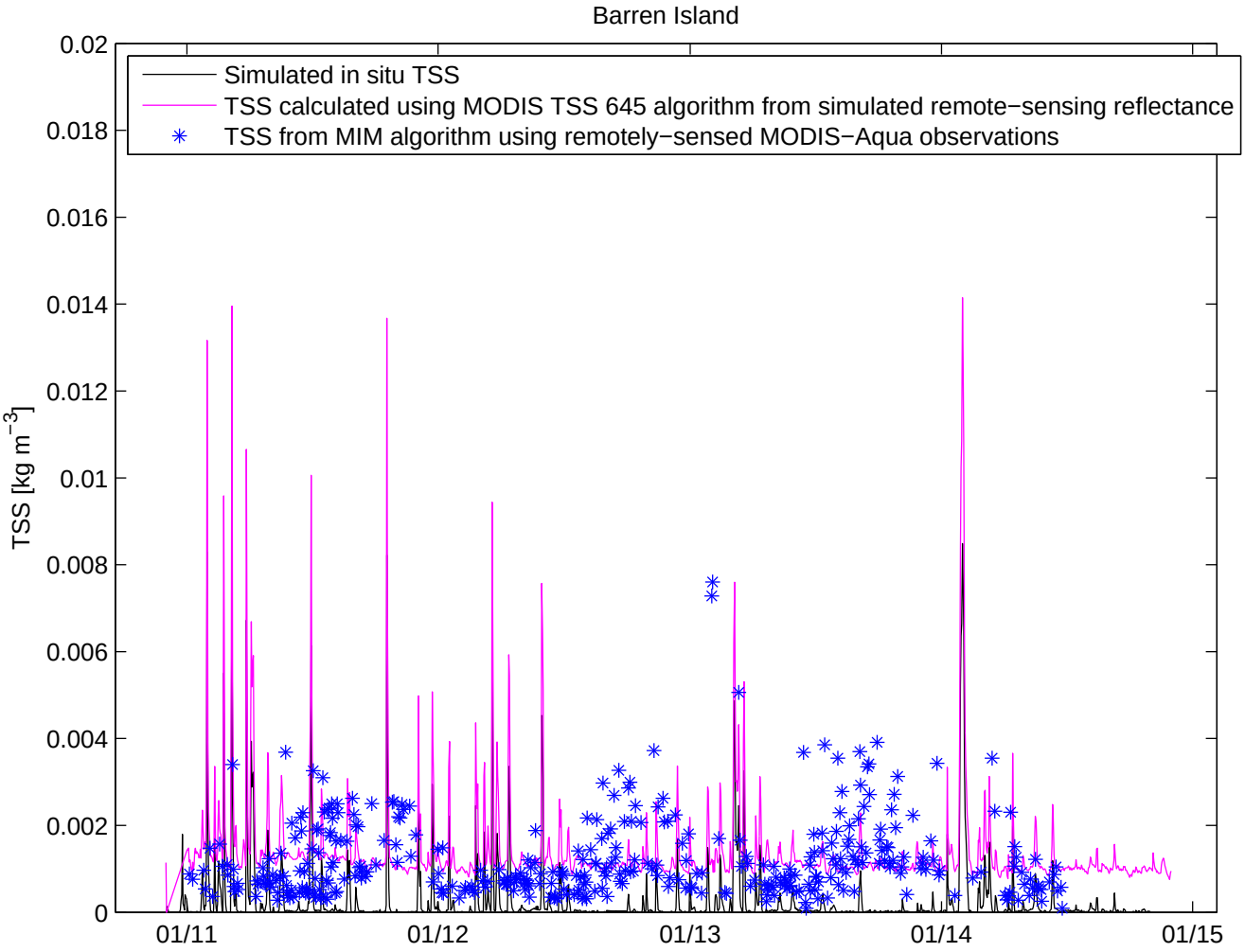


Figure 144: Barren Island Remote sensing comparisons Simulated *insitu* TSS (black), TSS calculated using MODIS TSS 645 algorithm from simulated remote-sensing reflectance (pink), TSS from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars): Parameter/s = TSS. Field observation depth taken: 0 m. Model grid deepest point at this site 24.26 m. Observation deepest point at this site 15.2 to 18.9 m.

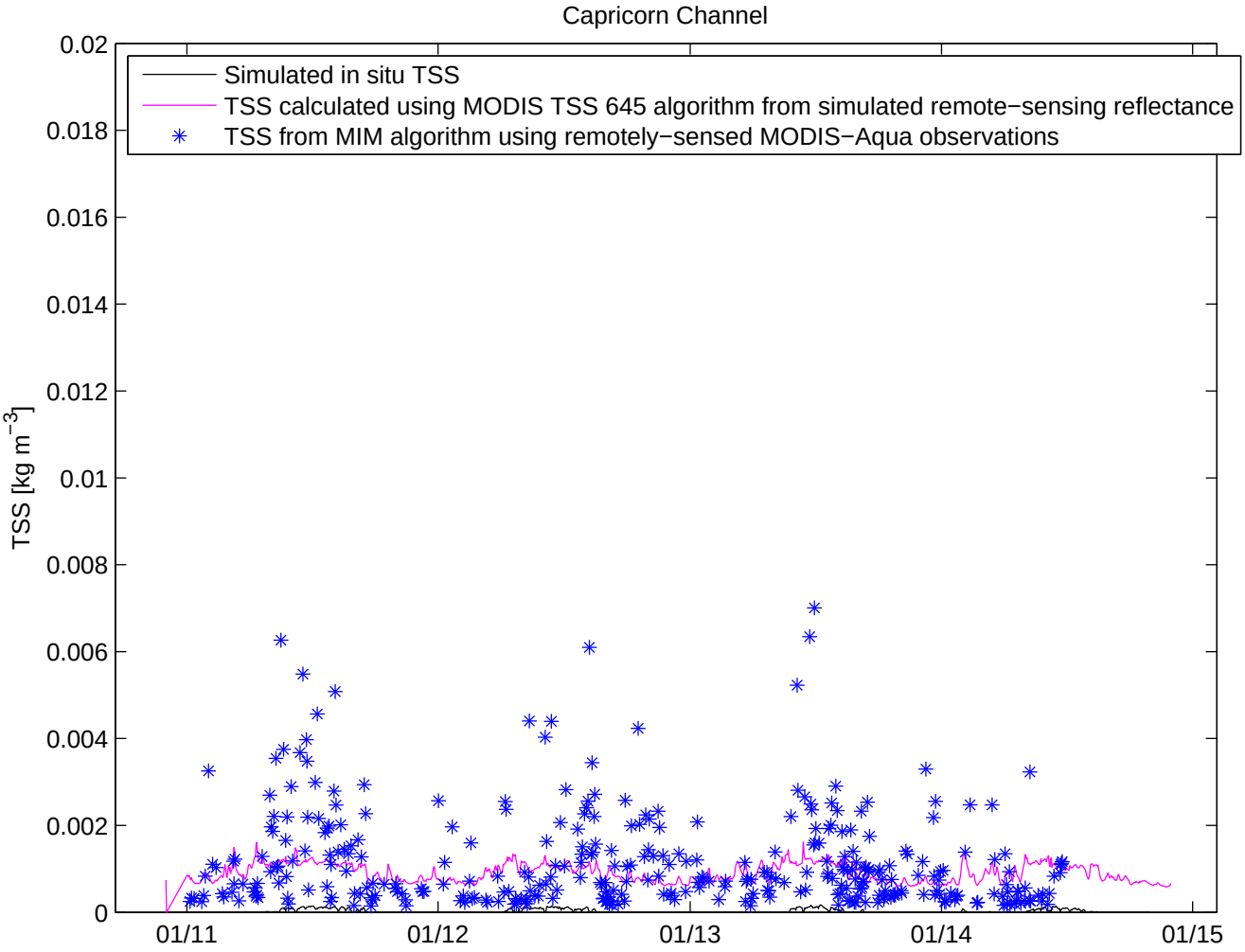


Figure 145: Capricorn Channel (GBRCCH) Remote sensing comparisons Simulated *insitu* TSS (black), TSS calculated using MODIS TSS 645 algorithm from simulated remote-sensing reflectance (pink), TSS from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars): Parameter/s = TSS. Field observation depth taken: 0 m. Model grid deepest point at this site 91.17 m. Observation deepest point at this site 92 m.

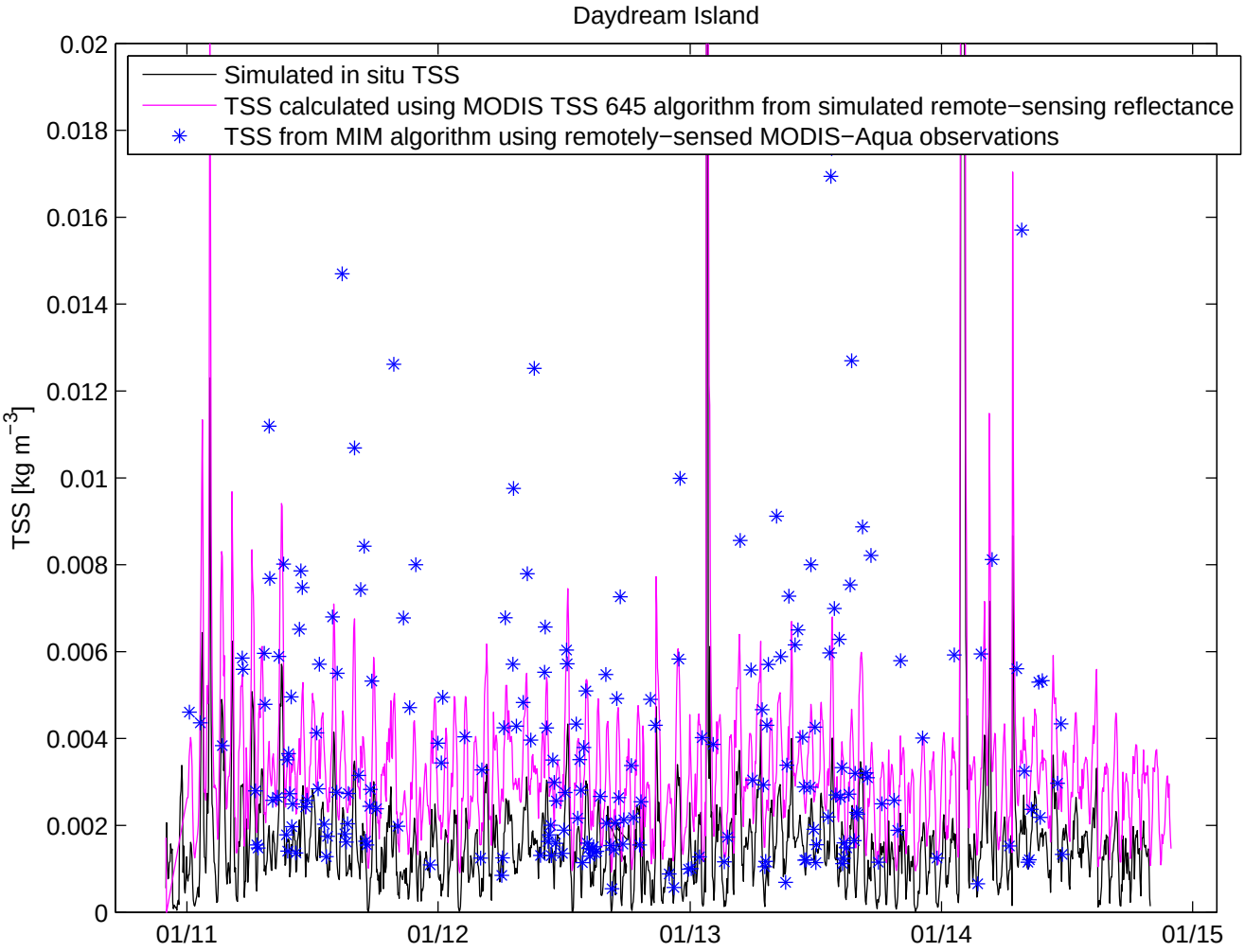


Figure 146: Daydream Island Remote sensing comparisons Simulated *insitu* TSS (black), TSS calculated using MODIS TSS 645 algorithm from simulated remote-sensing reflectance (pink), TSS from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars): Parameter/s = TSS. Field observation depth taken: 0 m. Model grid deepest point at this site 16.76 m. Observation deepest point at this site 23.6 to 25.9 m.

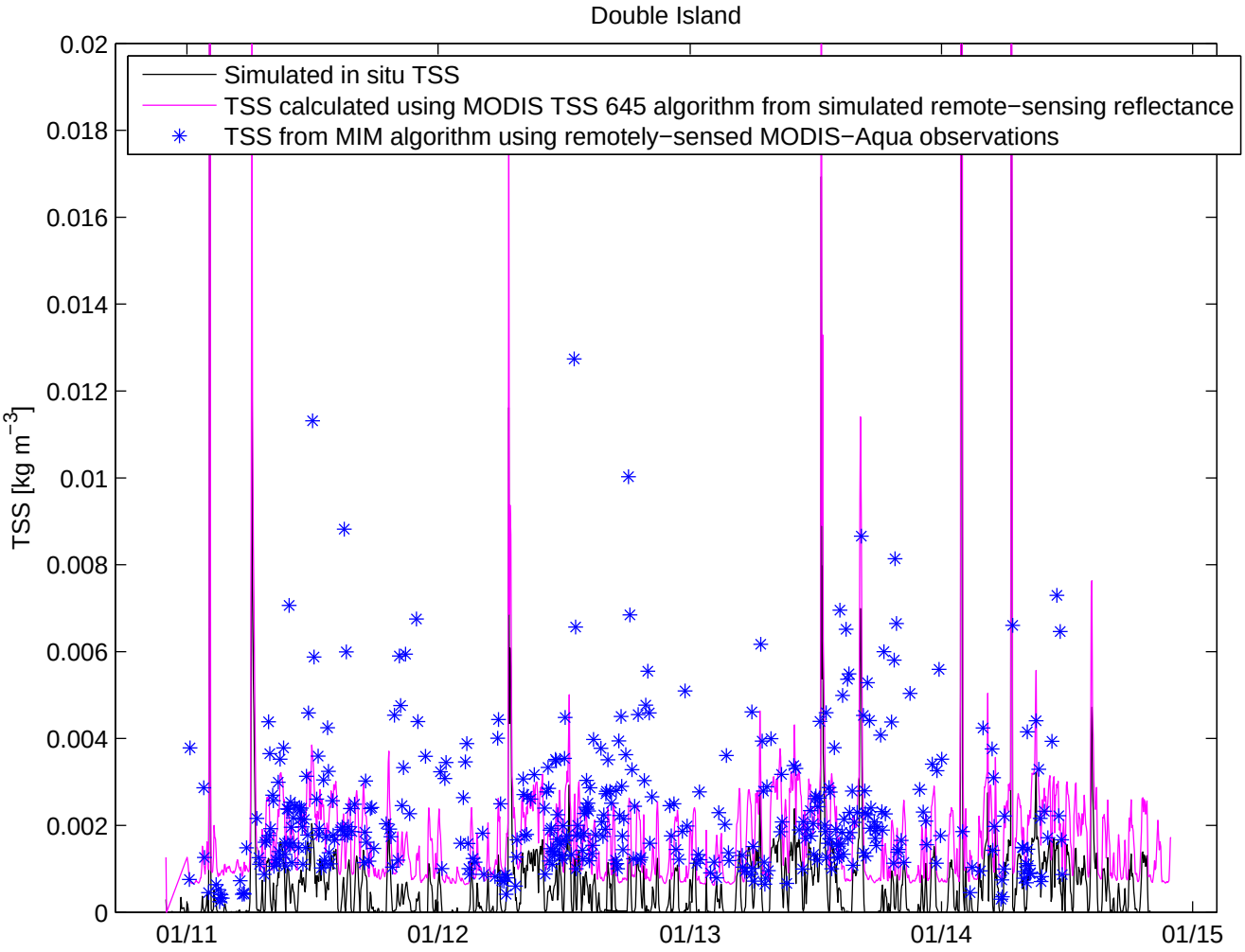


Figure 147: Double Cone Island Remote sensing comparisons Simulated *insitu* TSS (black), TSS calculated using MODIS TSS 645 algorithm from simulated remote-sensing reflectance (pink), TSS from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars): Parameter/s = TSS. Field observation depth taken: 0 m. Model grid deepest point at this site 17.03 m. Observation deepest point at this site 23.0 to 31.0 m.

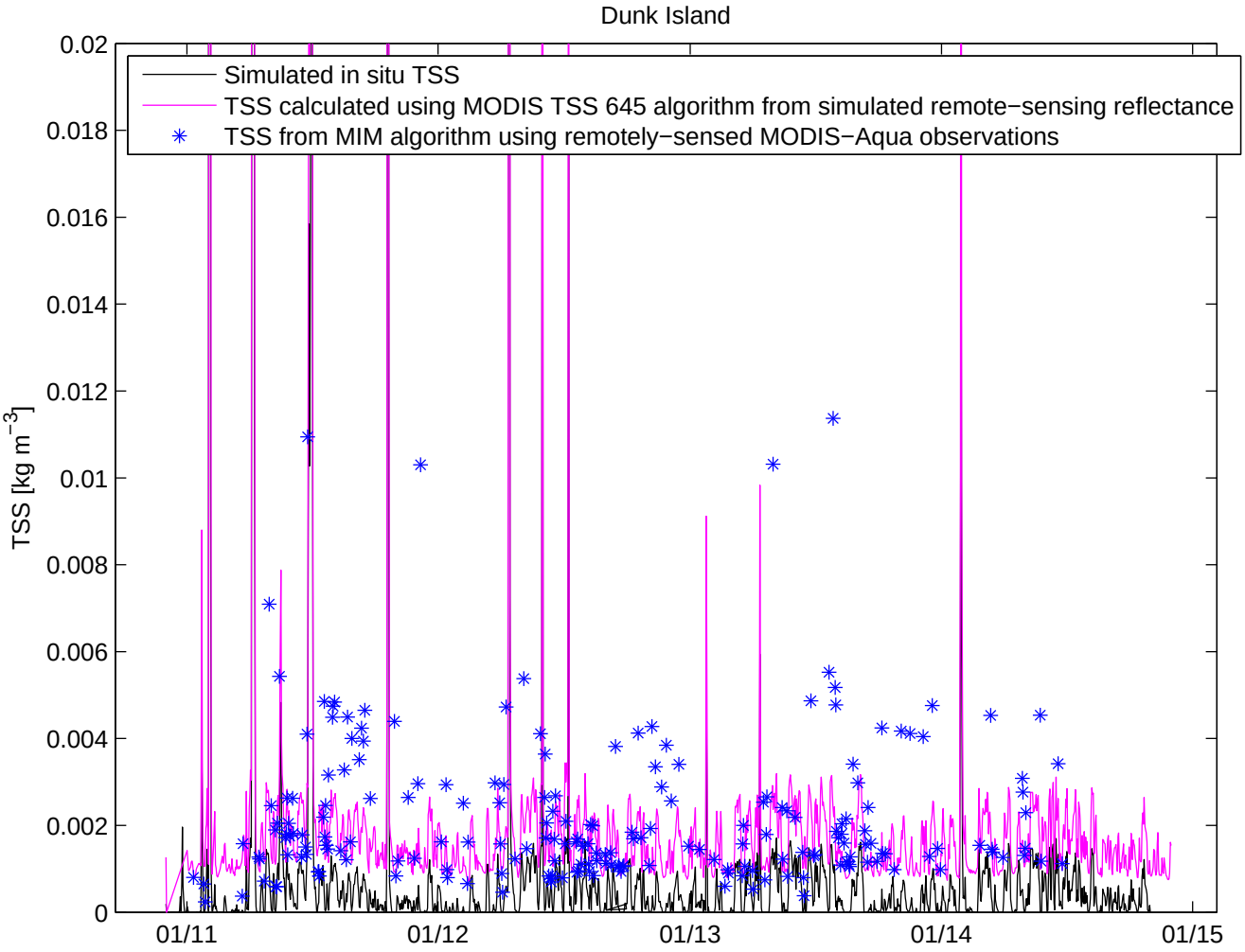


Figure 148: Dunk Island Remote sensing comparisons Simulated *insitu* TSS (black), TSS calculated using MODIS TSS 645 algorithm from simulated remote-sensing reflectance (pink), TSS from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars): Parameter/s = TSS. Field observation depth taken: 0 m. Model grid deepest point at this site 9.15 m. Observation deepest point at this site 9.0 to 10.4 m.

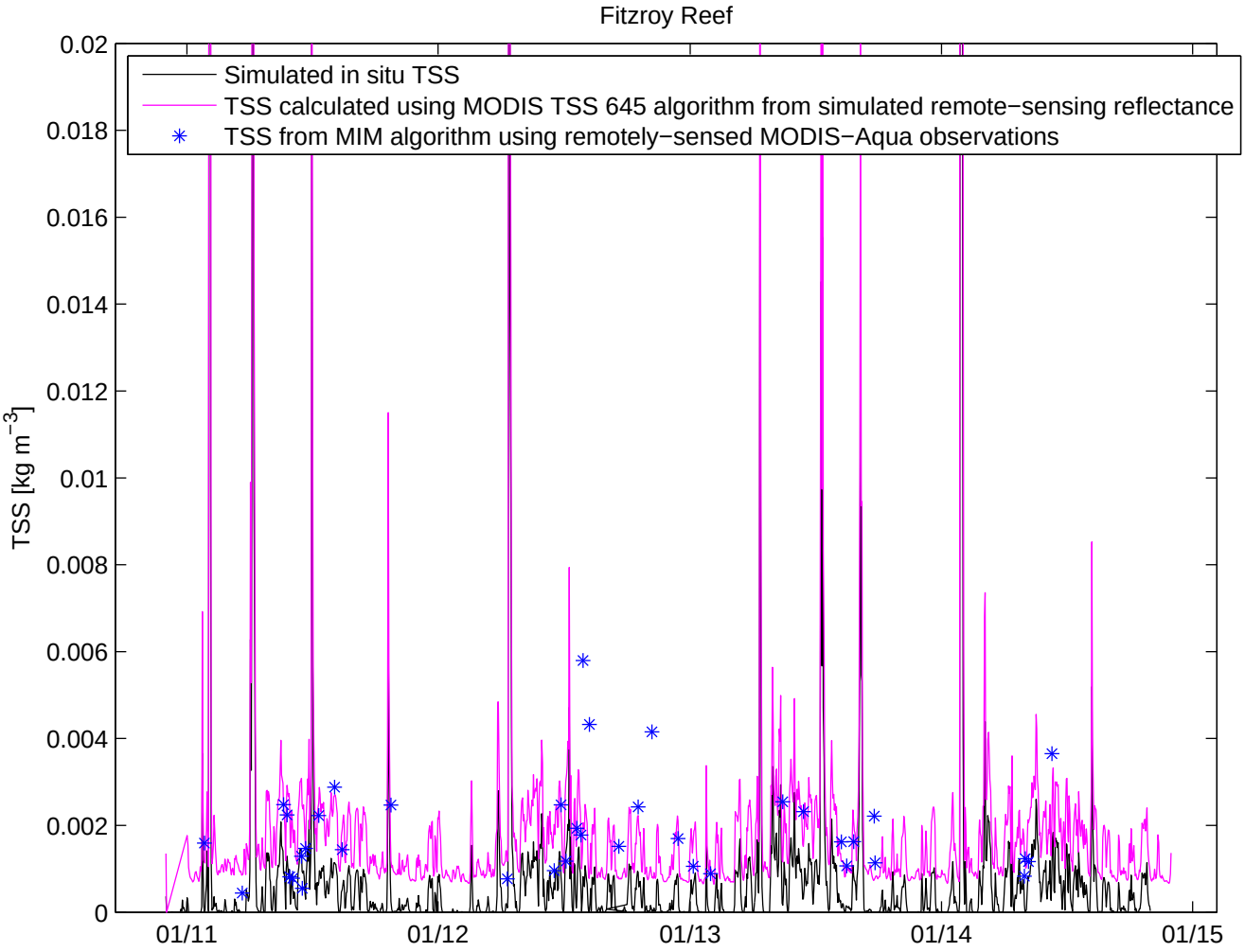


Figure 149: Fitzroy Reef Remote sensing comparisons Simulated *insitu* TSS (black), TSS calculated using MODIS TSS 645 algorithm from simulated remote-sensing reflectance (pink), TSS from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars): Parameter/s = TSS. Field observation depth taken: 0 m. Model grid deepest point at this site 27 m. Observation deepest point at this site 15.5 to17.2 m.

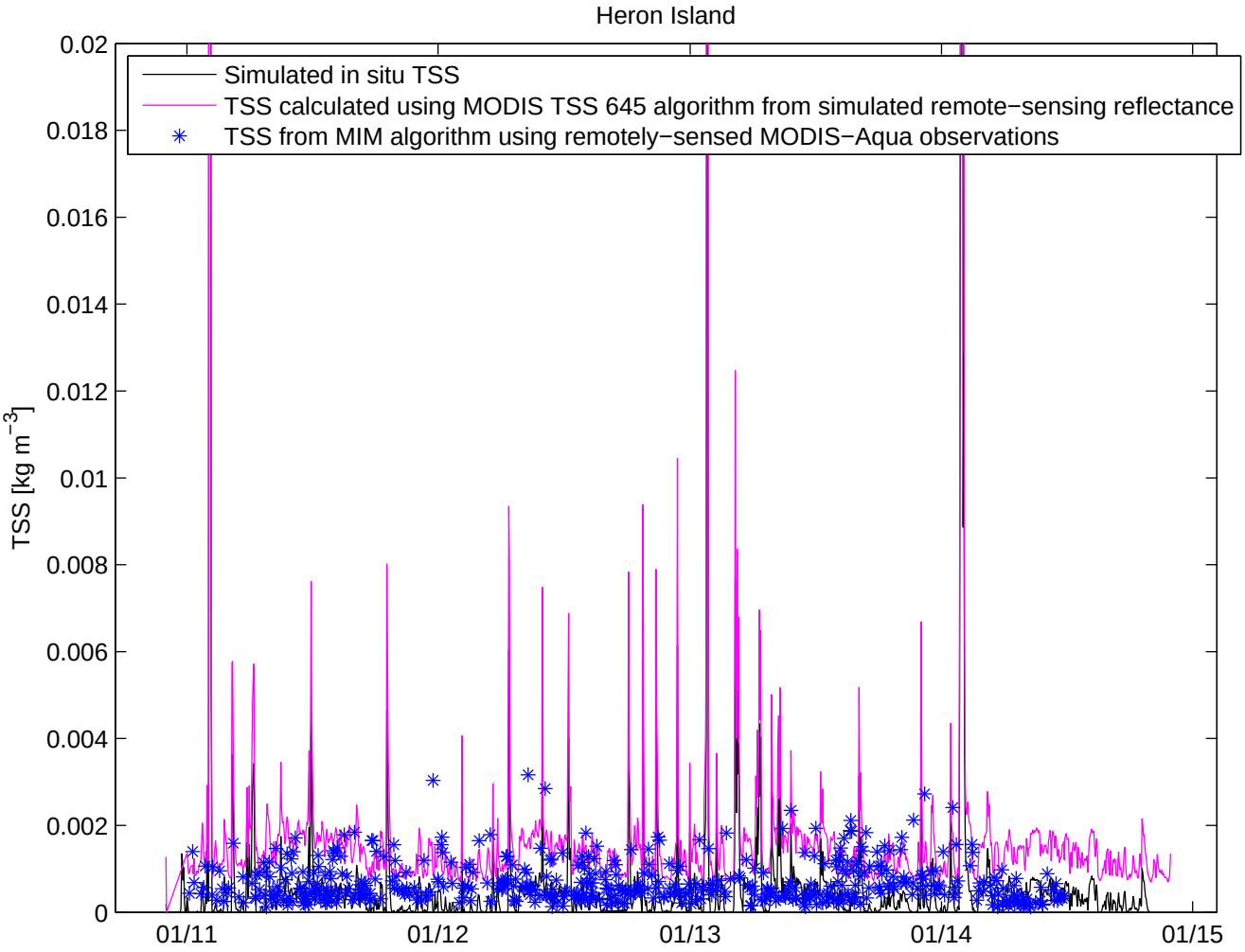


Figure 150: Heron Island South (GBRHIS) Remote sensing comparisons Simulated *insitu* TSS (black), TSS calculated using MODIS TSS 645 algorithm from simulated remote-sensing reflectance (pink), TSS from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars): Parameter/s = TSS. Field observation depth taken: 0 m. Model grid deepest point at this site -47.01 m. Observation deepest point at this site 46 m.

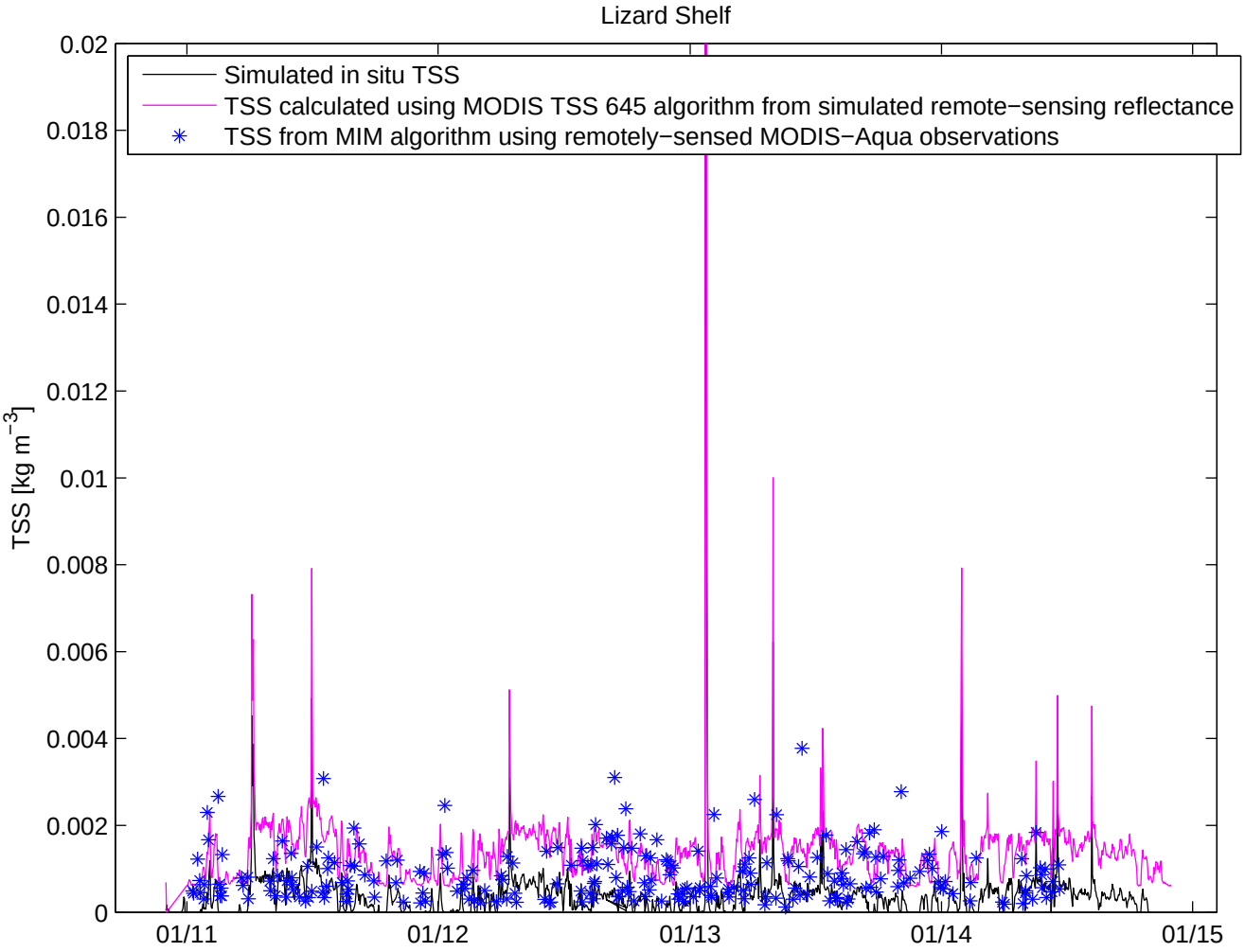


Figure 151: Lizard Shelf (GBRLSH) Remote sensing comparisons Simulated *insitu* TSS (black), TSS calculated using MODIS TSS 645 algorithm from simulated remote-sensing reflectance (pink), TSS from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars): Parameter/s = TSS. Field observation depth taken: 0 m. Model grid deepest point at this site -30.32 m. Observation deepest point at this site 31 m.

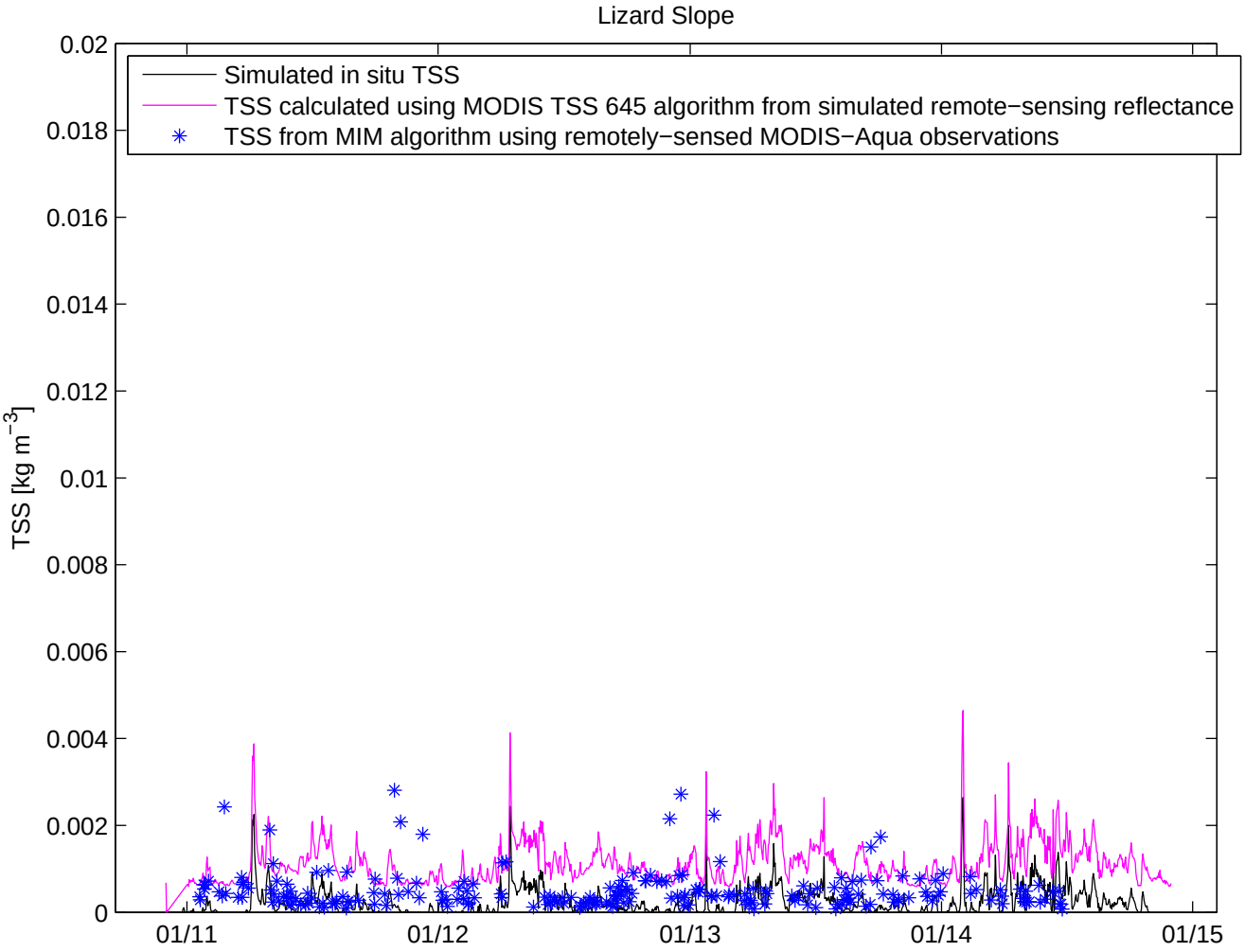


Figure 152: Lizard Slope(GBRLSL) Remote sensing comparisons Simulated *insitu* TSS (black), TSS calculated using MODIS TSS 645 algorithm from simulated remote-sensing reflectance (pink), TSS from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars): Parameter/s = TSS. Field observation depth taken: 0 m. Model grid deepest point at this site -37.66 m. Observation deepest point at this site 350 m.

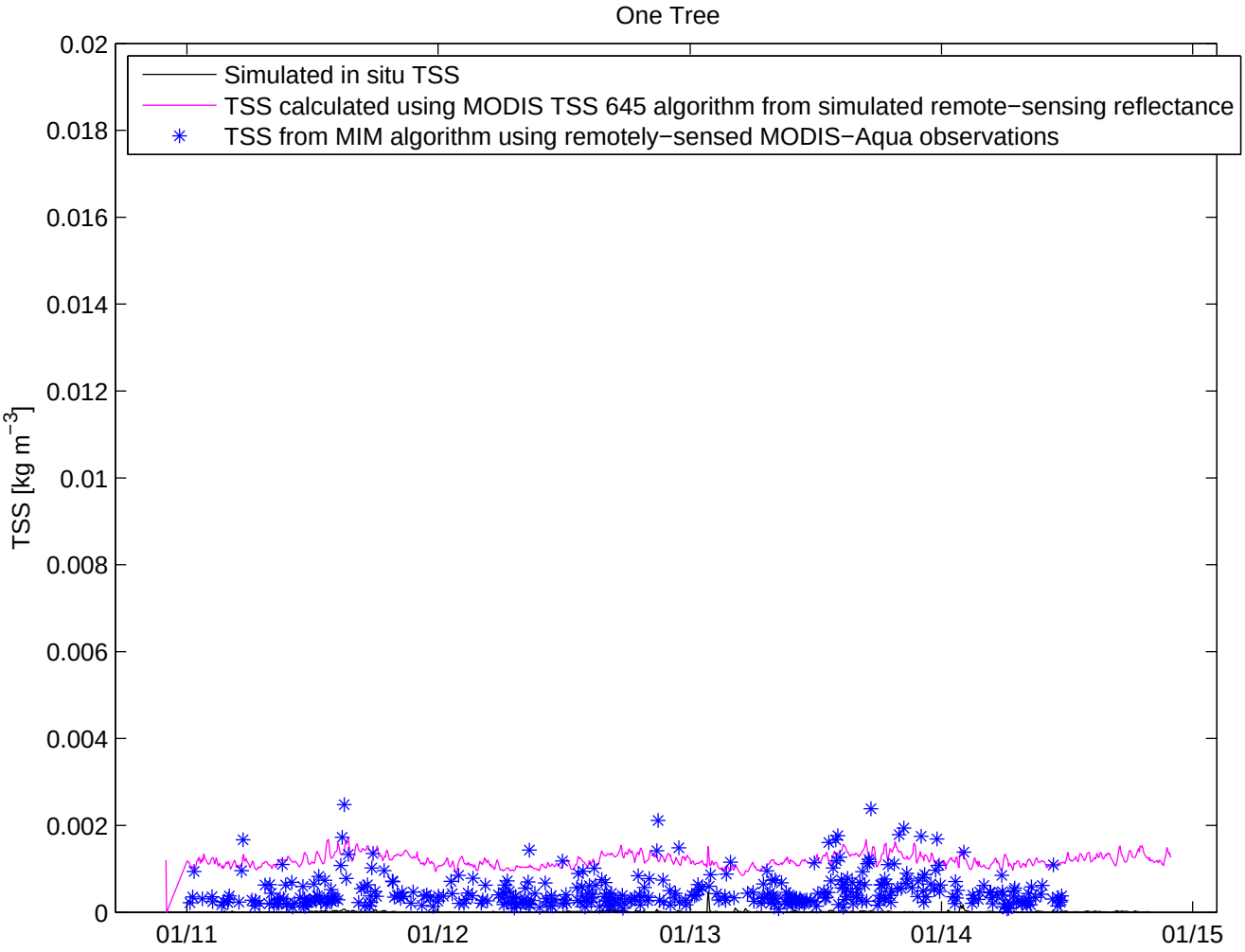


Figure 153: One Tree (GBROTE) Remote sensing comparisons Simulated *insitu* TSS (black), TSS calculated using MODIS TSS 645 algorithm from simulated remote-sensing reflectance (pink), TSS from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars): Parameter/s = TSS. Field observation depth taken: 0 m. Model grid deepest point at this site -62.61 m. Observation deepest point at this site 58 m.

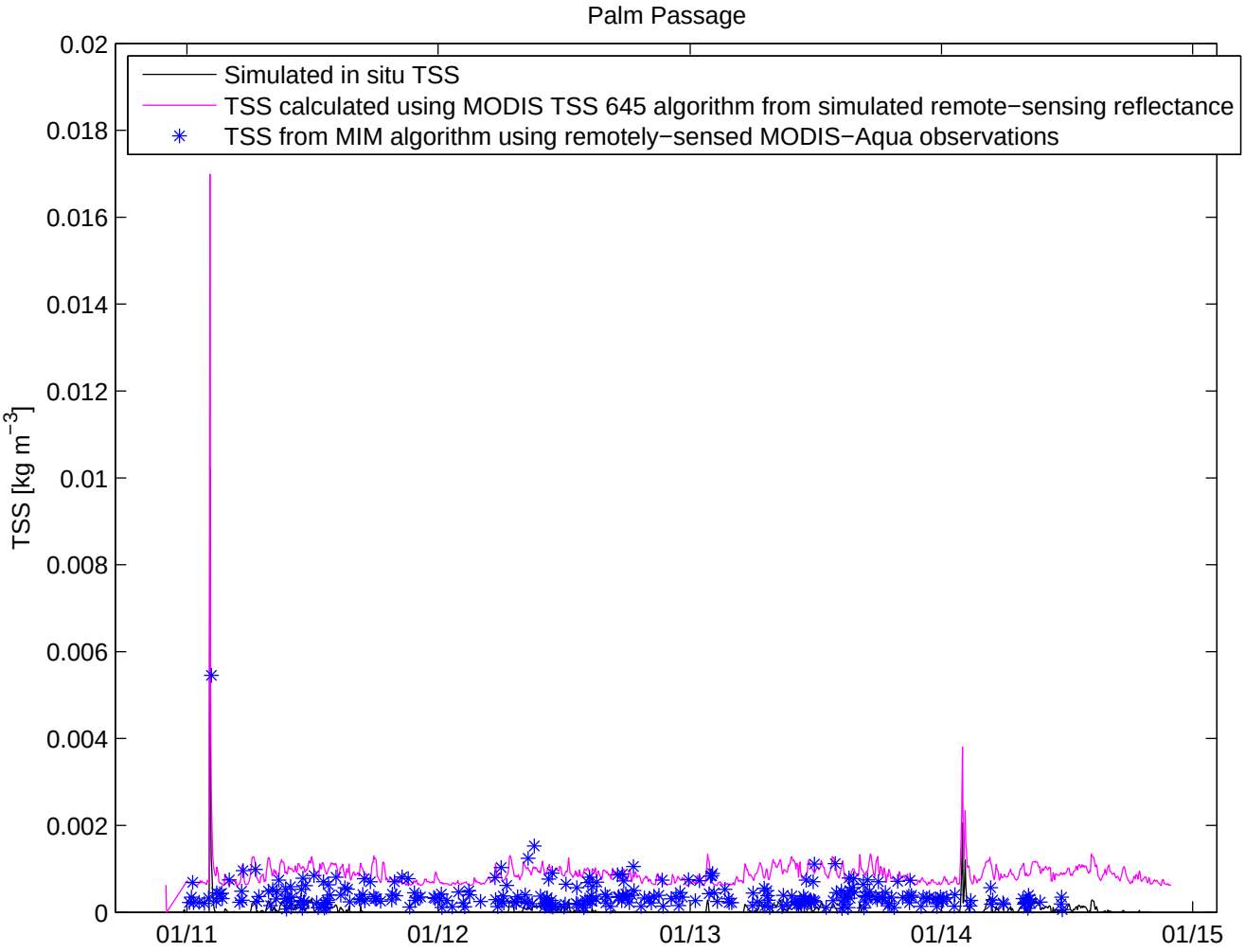


Figure 154: Palm Passage(GBRPPS) Remote sensing comparisons Simulated *insitu* TSS (black), TSS calculated using MODIS TSS 645 algorithm from simulated remote-sensing reflectance (pink), TSS from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars): Parameter/s = TSS. Field observation depth taken: 0 m. Model grid deepest point at this site 71.9 m. Observation deepest point at this site 70 m.

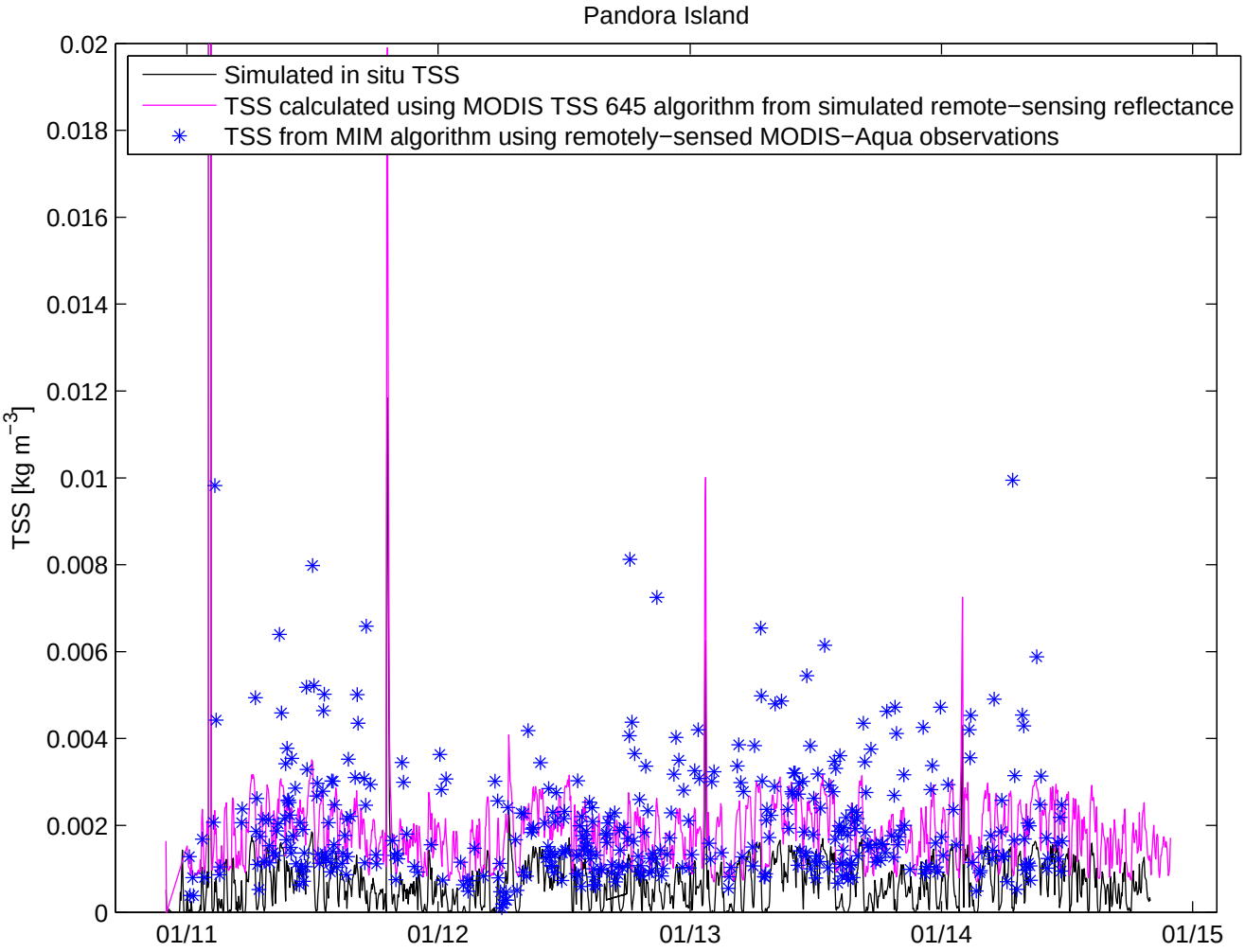


Figure 155: Pandora Island Remote sensing comparisons Simulated *insitu* TSS (black), TSS calculated using MODIS TSS 645 algorithm from simulated remote-sensing reflectance (pink), TSS from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars): Parameter/s = TSS. Field observation depth taken: 0 m. Model grid deepest point at this site -16.98 m. Observation deepest point at this site 12.9 to 13.9 m.

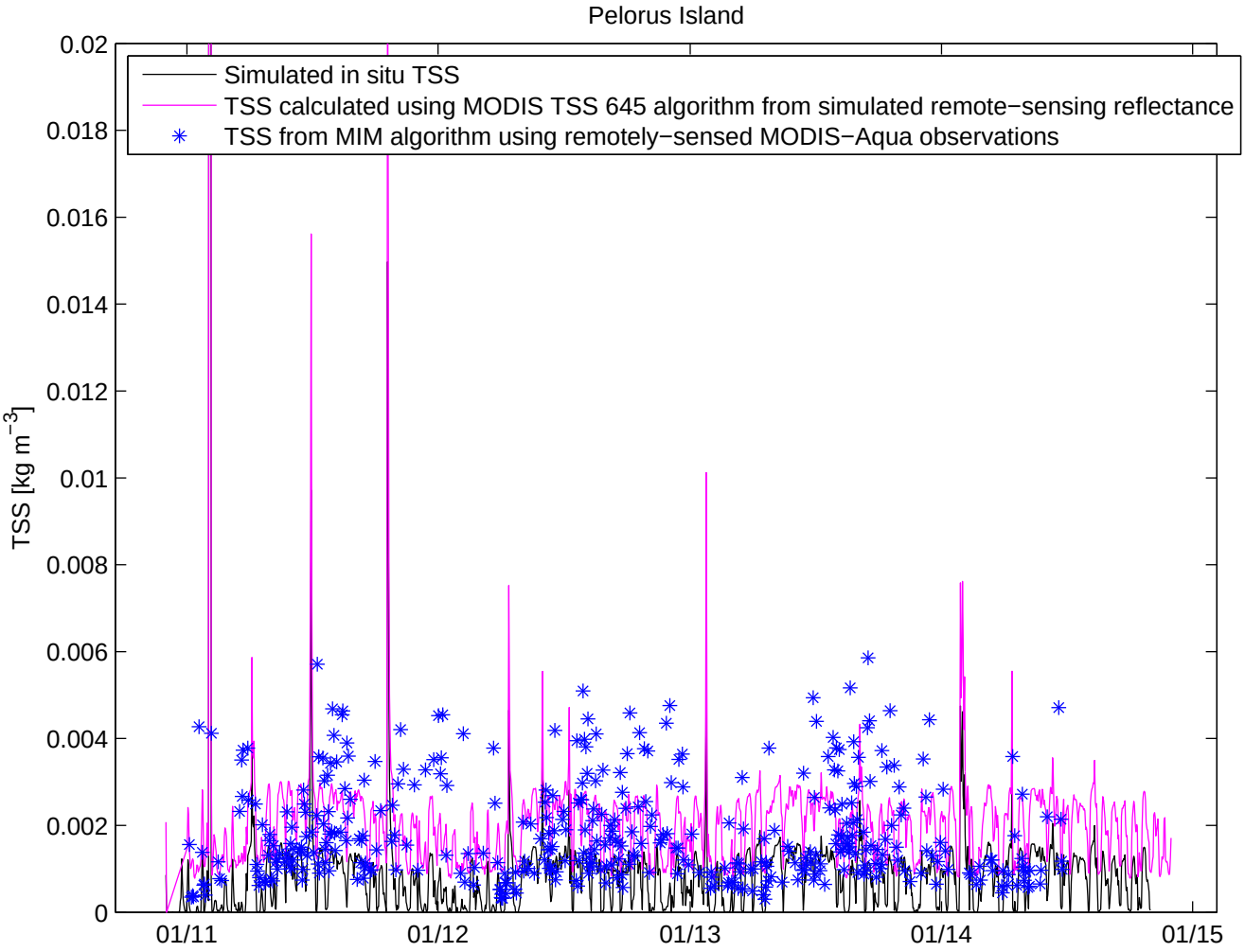


Figure 156: Pelorous/Orpheus Island Remote sensing comparisons Simulated *insitu* TSS (black), TSS calculated using MODIS TSS 645 algorithm from simulated remote-sensing reflectance (pink), TSS from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars): Parameter/s = TSS. Field observation depth taken: 0 m. Model grid deepest point at this site -24.64 m. Observation deepest point at this site 25.3 to 31.4 m.

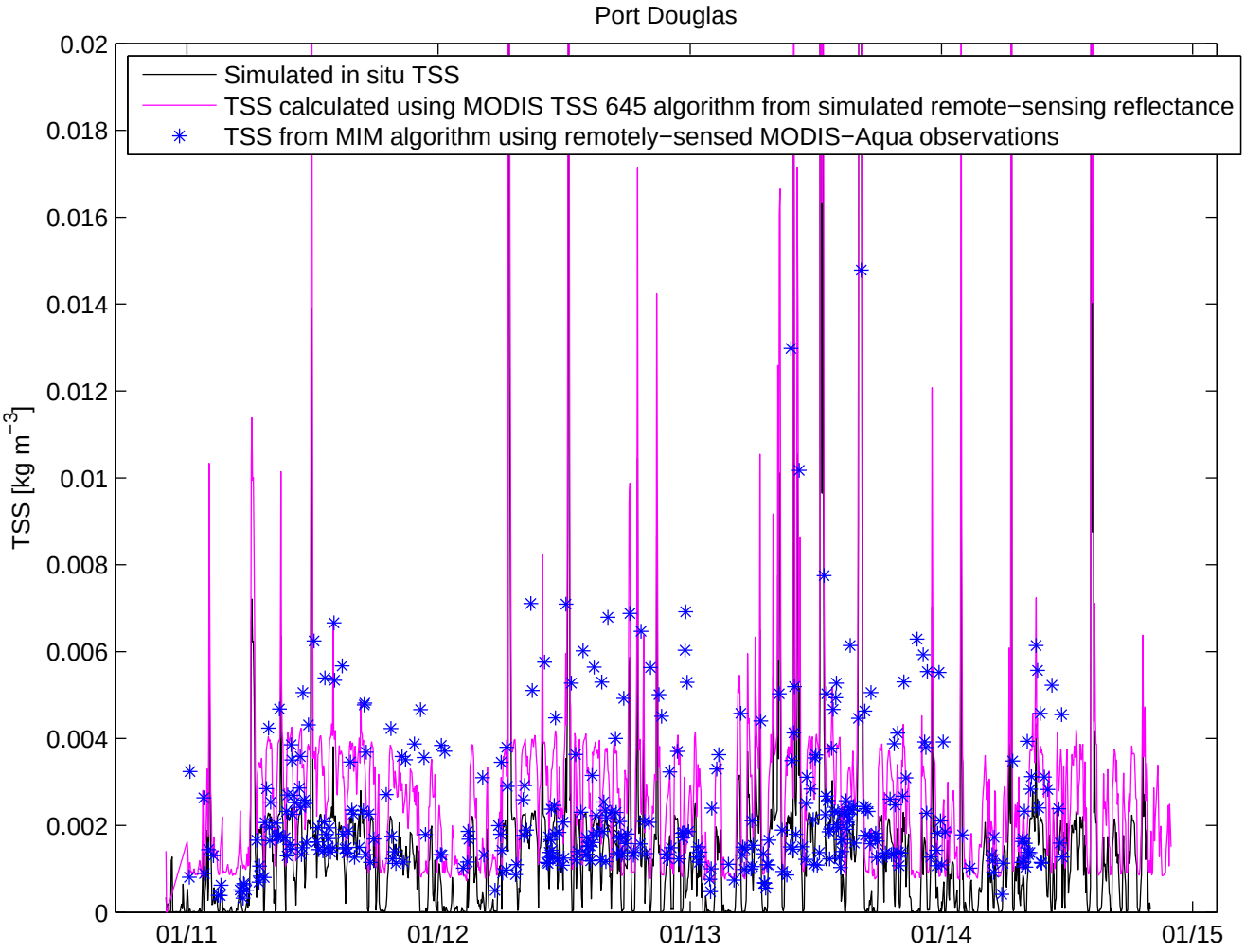


Figure 157: Port Douglas Remote sensing comparisons Simulated *insitu* TSS (black), TSS calculated using MODIS TSS 645 algorithm from simulated remote-sensing reflectance (pink), TSS from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars): Parameter/s = TSS. Field observation depth taken: 0 m. Model grid deepest point at this site -18.44 m. Observation deepest point at this site 15.2 to 17.1 m.

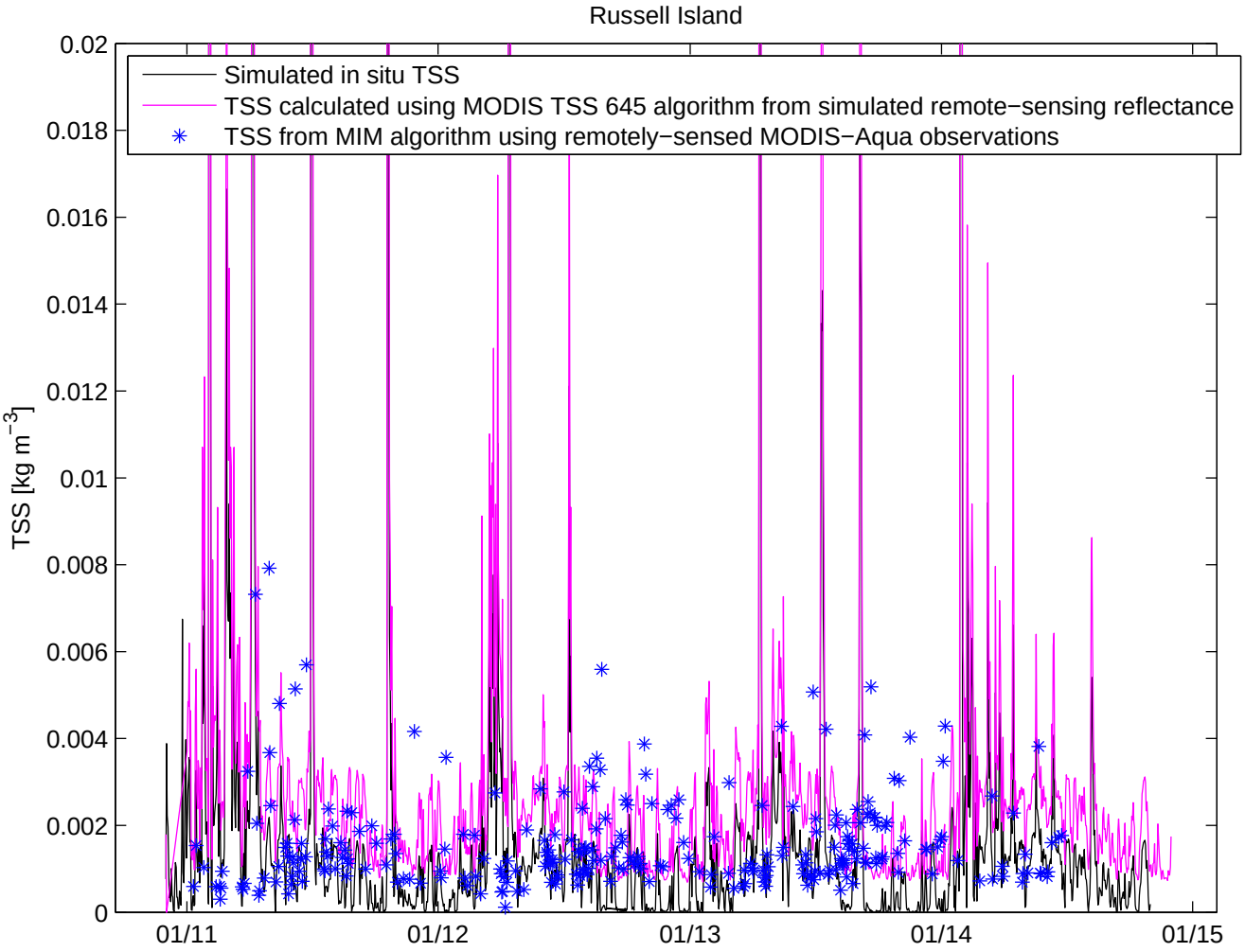


Figure 158: Russell Island Remote sensing comparisons Simulated *insitu* TSS (black), TSS calculated using MODIS TSS 645 algorithm from simulated remote-sensing reflectance (pink), TSS from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars): Parameter/s = TSS. Field observation depth taken: 0 m. Model grid deepest point at this site -19.94 m. Observation deepest point at this site 22.0 to 23.7 m.

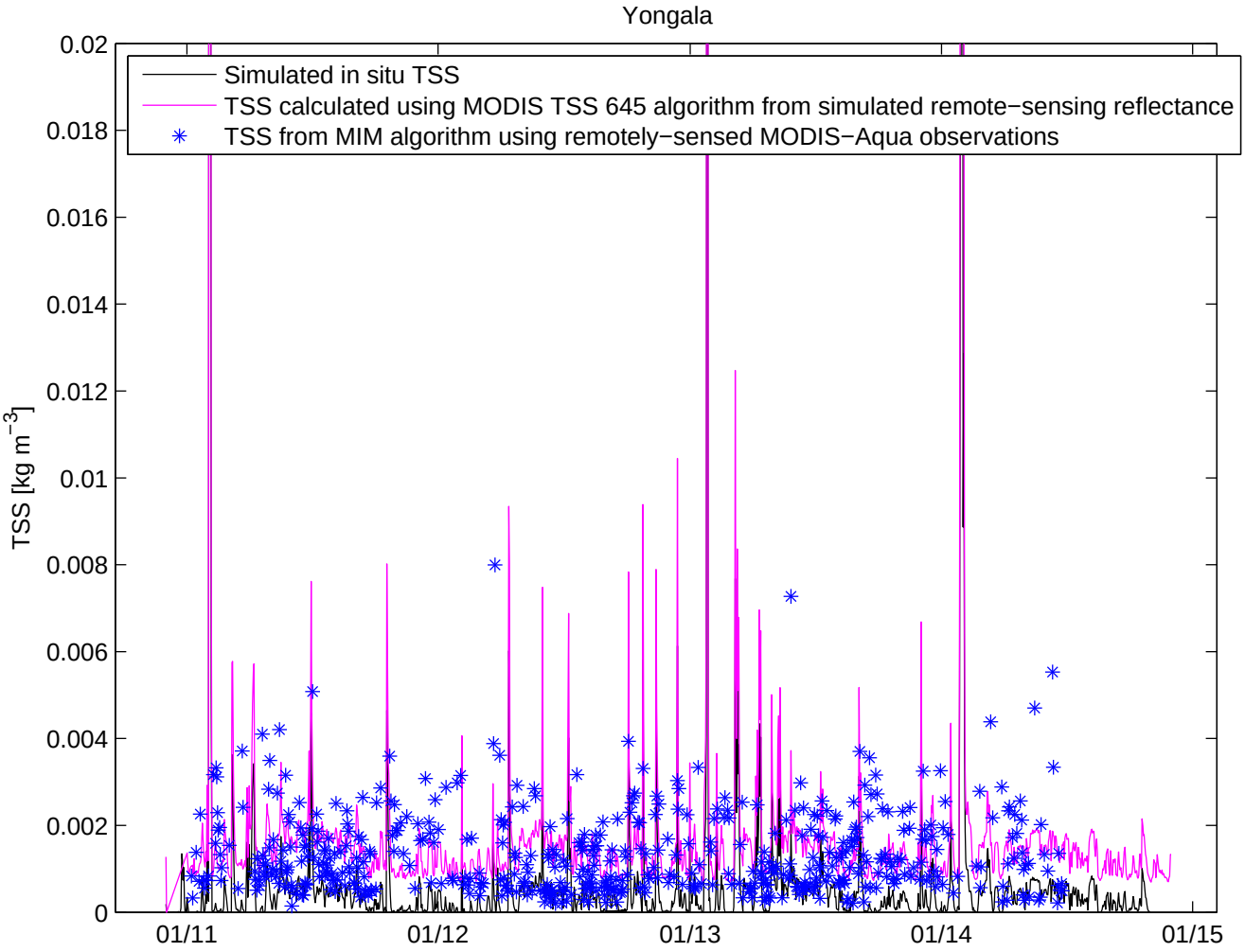


Figure 159: Yongala (NRSYON) Remote sensing comparisons Simulated *insitu* TSS (black), TSS calculated using MODIS TSS 645 algorithm from simulated remote-sensing reflectance (pink), TSS from MIM algorithm using remotely-sensed MODIS-Aqua observations (blue stars): Parameter/s = TSS. Field observation depth taken: 0 m. Model grid deepest point at this site -28.62 m. Observation deepest point at this site 27 m.