Figure S1 Among the factors that could influence the discrepancy between observations and model predictions, mixing behavior as mixed-layer depth (MLD) and maximal depth were selected. The assumption is, that inaccuracies in both measurements and model results differ for shallow, well-mixed areas, than for stratified areas. In addition, the distance from the coast was chosen under the assumption that the near-shore processes are more dynamic and are less well reproduced by the model. Measurement depth was selected as potentially influencing factor of the bias, as hydrodynamic and biogeochemical processes in certain water layers have different dynamics, e.g., the area of the halocline and/or thermocline as well as near-bottom water layers which could influence the accuracy of both measurements and model values. Thereby, month and basin were included as non-numerical factors by applying the correction factors for each basin across each month. The figure shows the bias of oxygen concentrations [mg/l] depending on the factors separately for near-bottom measurements (squares) and profile data (dots).

Table S1 Error statistics to assess model-data misfits of the multiannual mean near-bottom oxygen concentrations (2010-2019) for the corrected model results either based on near-bottom oxygen values (Bottom values), oxygen profiles (Profiles) or both data sources (All data). Pearson's Rank correlation coefficient (r), Root Mean Squared Error (RMSE), Average Error (AE), Modelling Efficiency (ME).

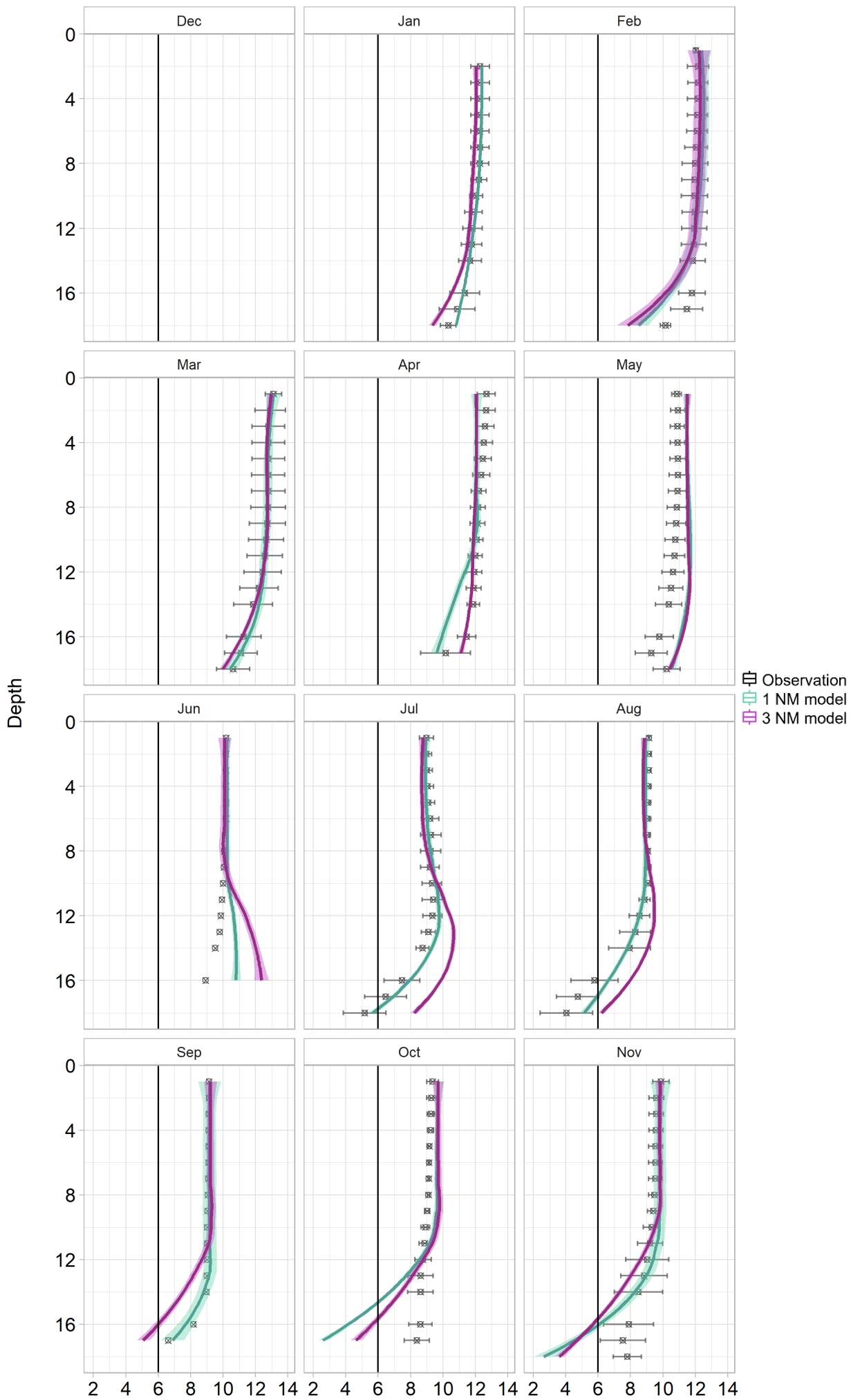
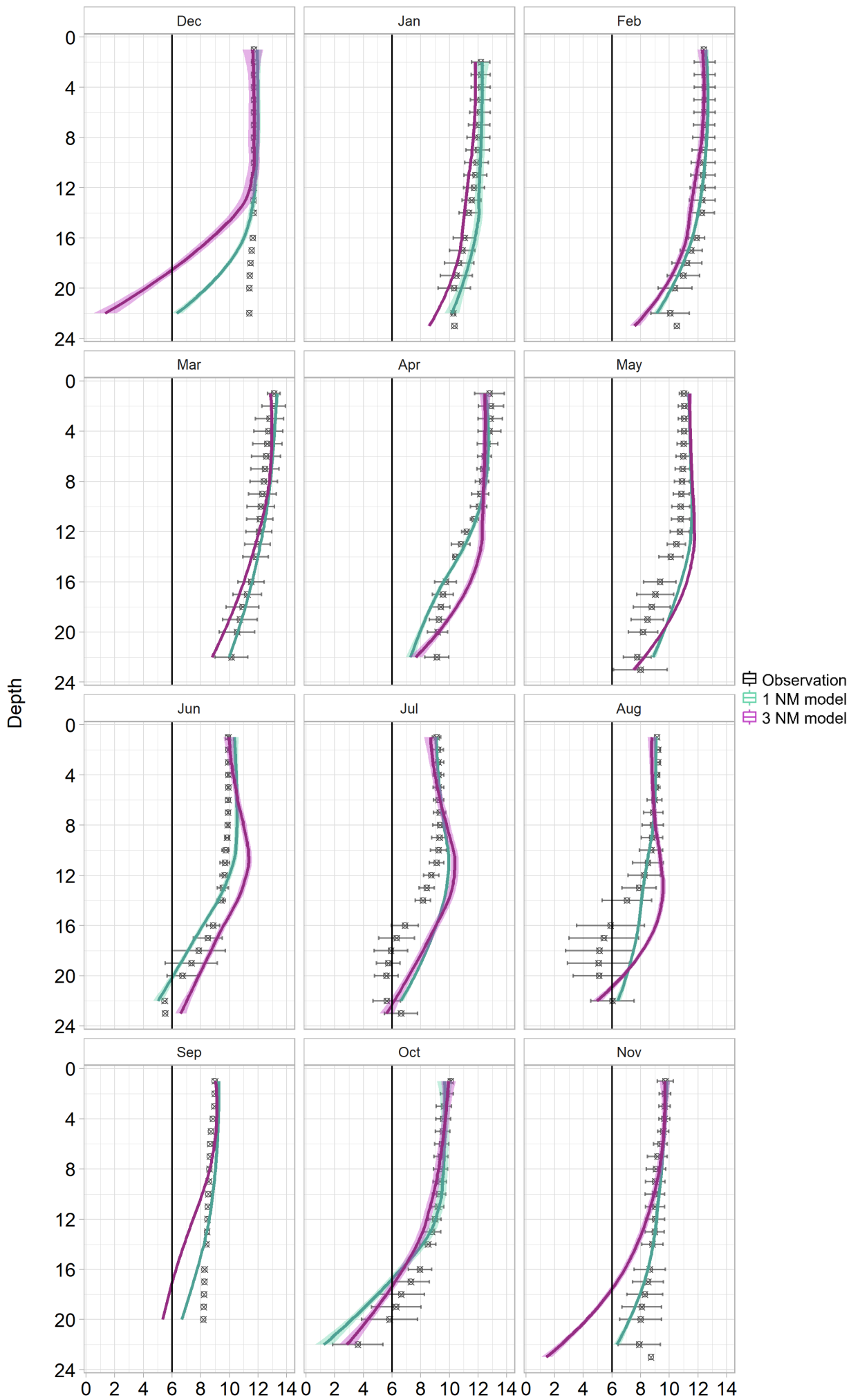
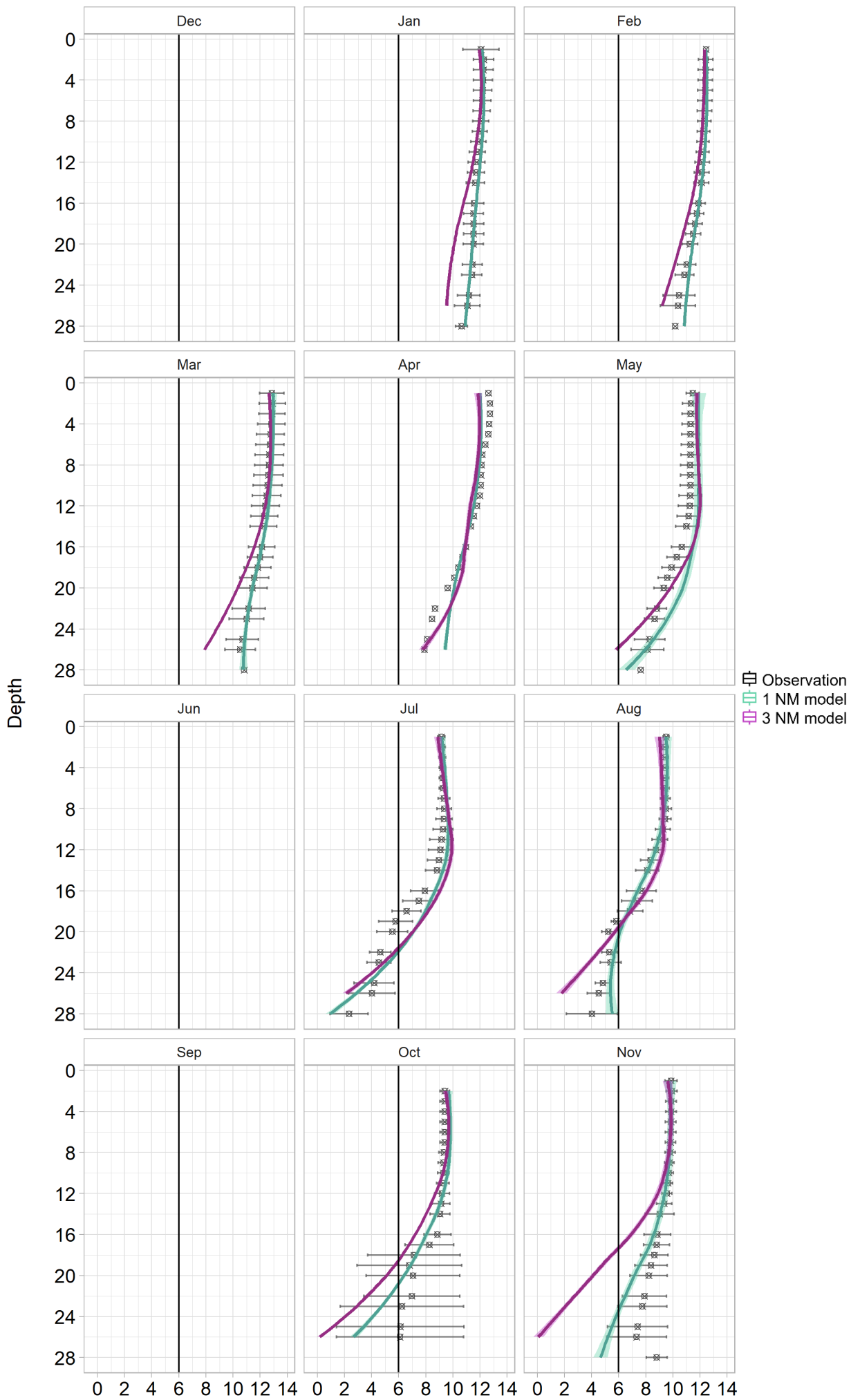
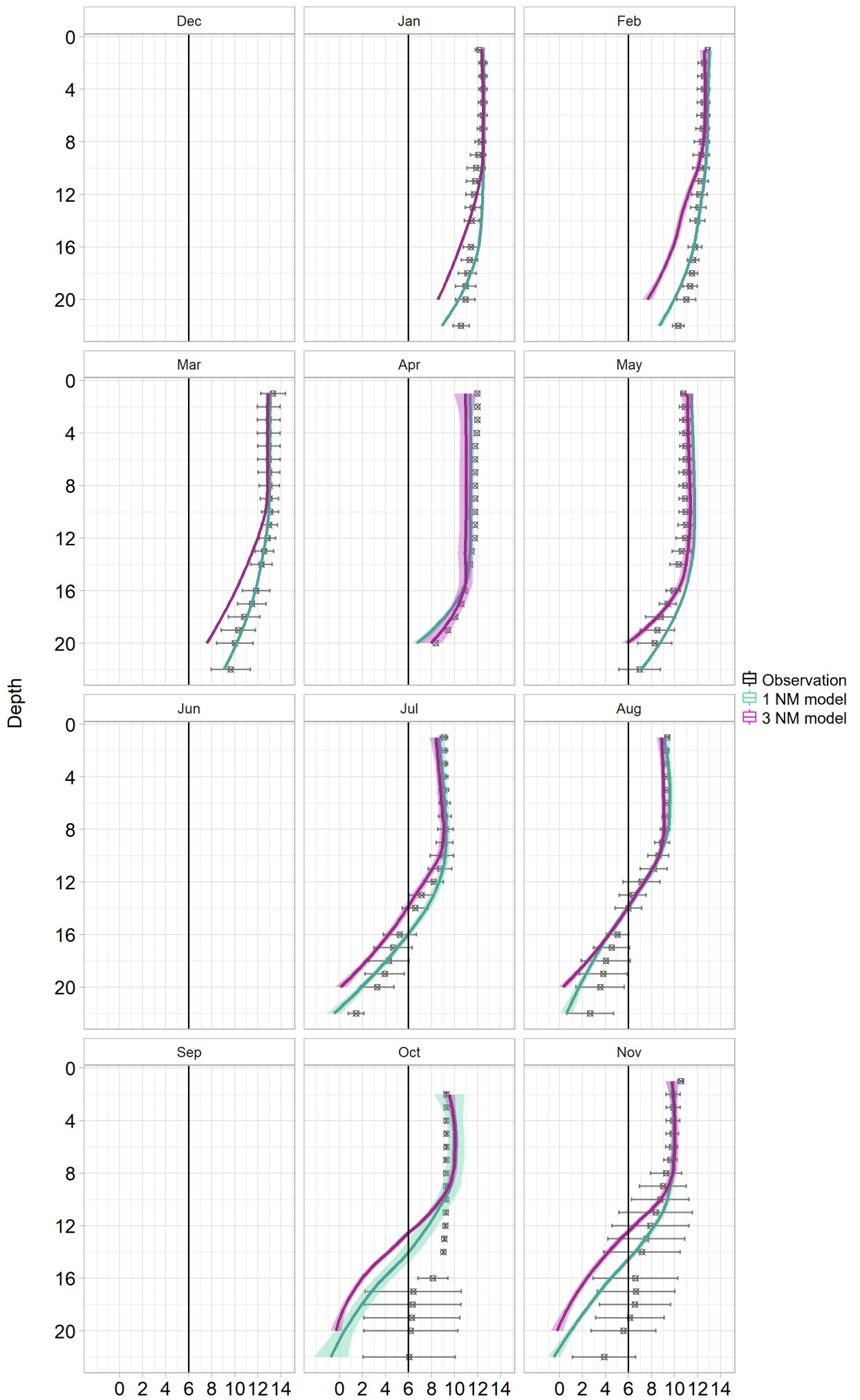
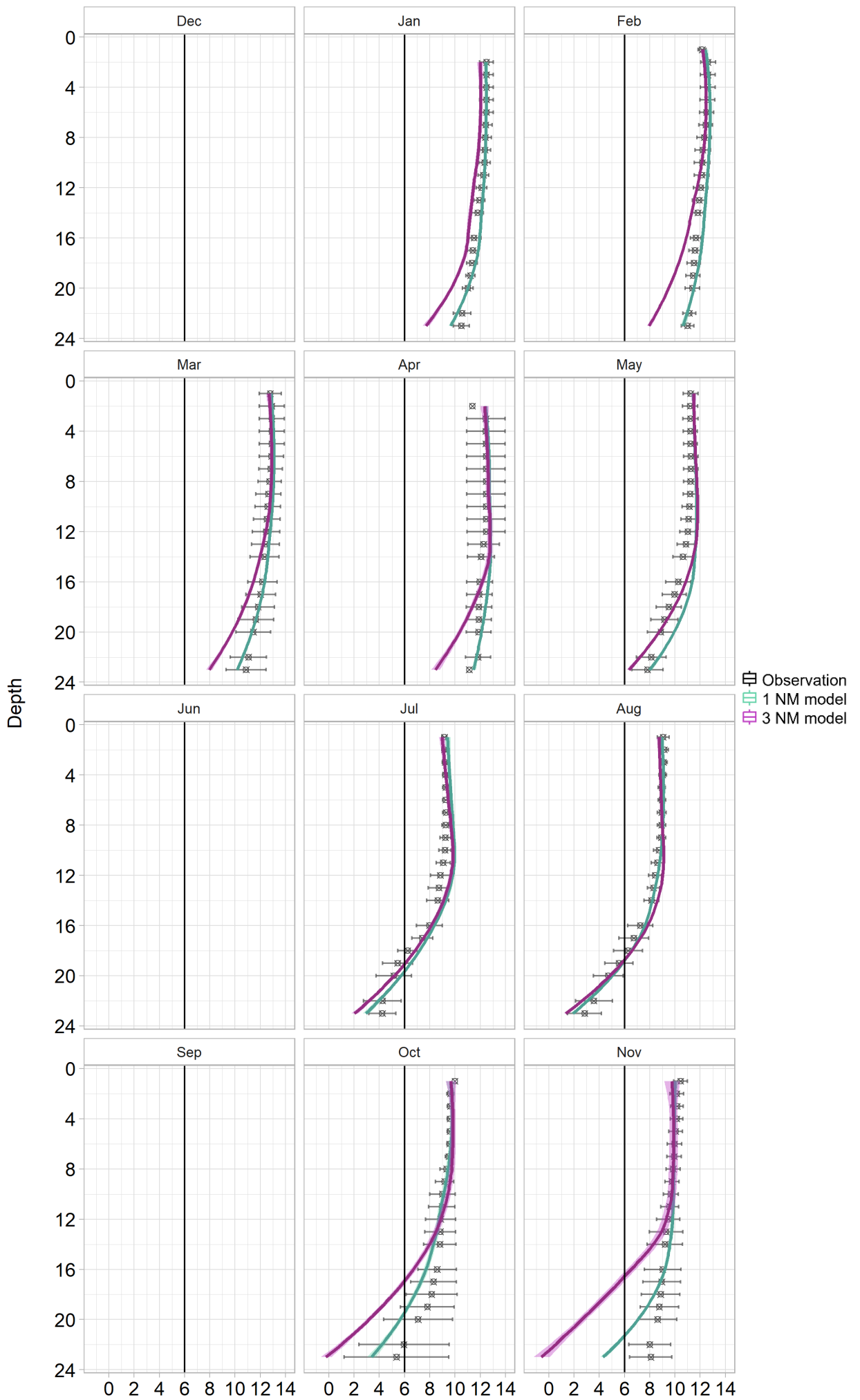
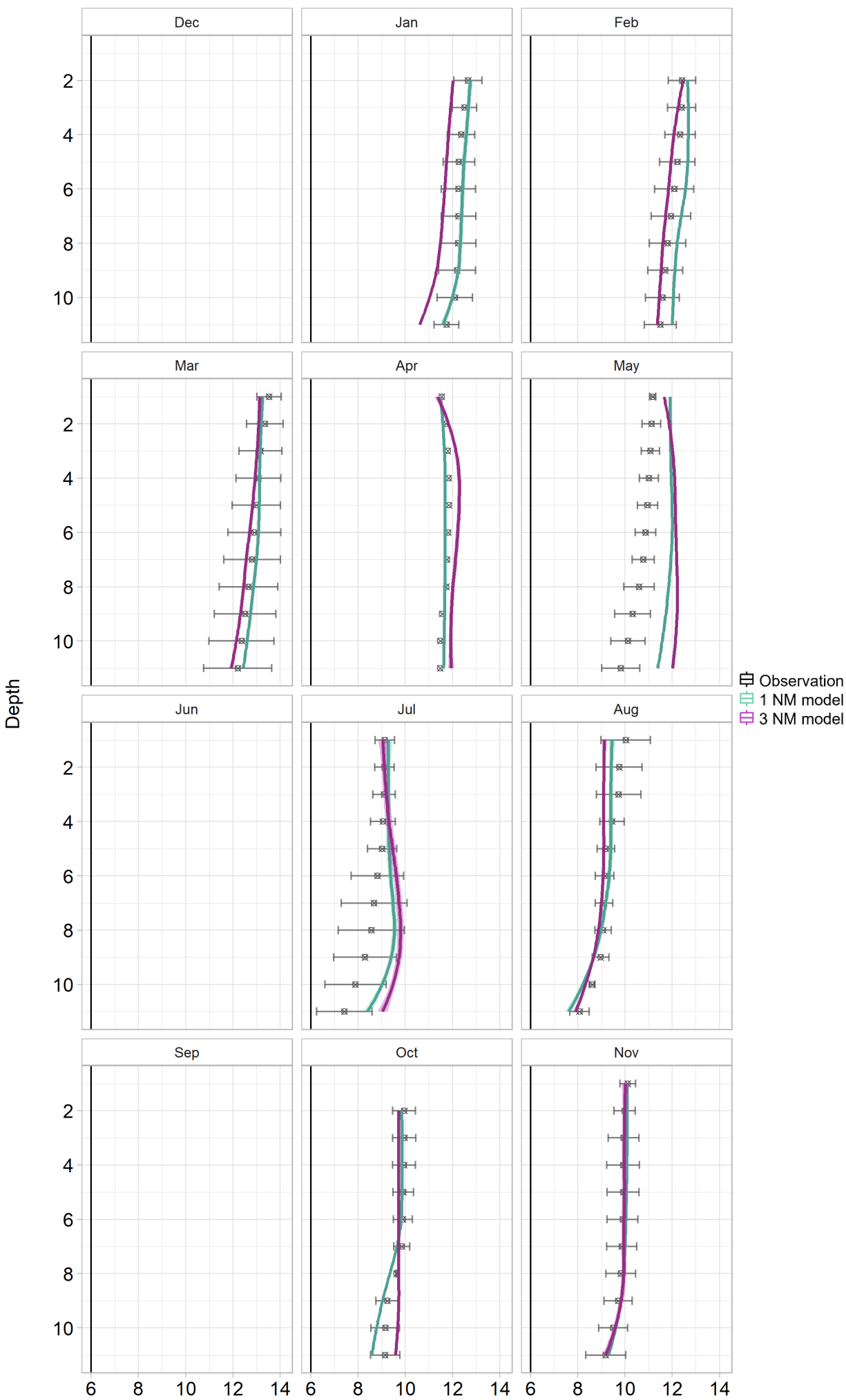
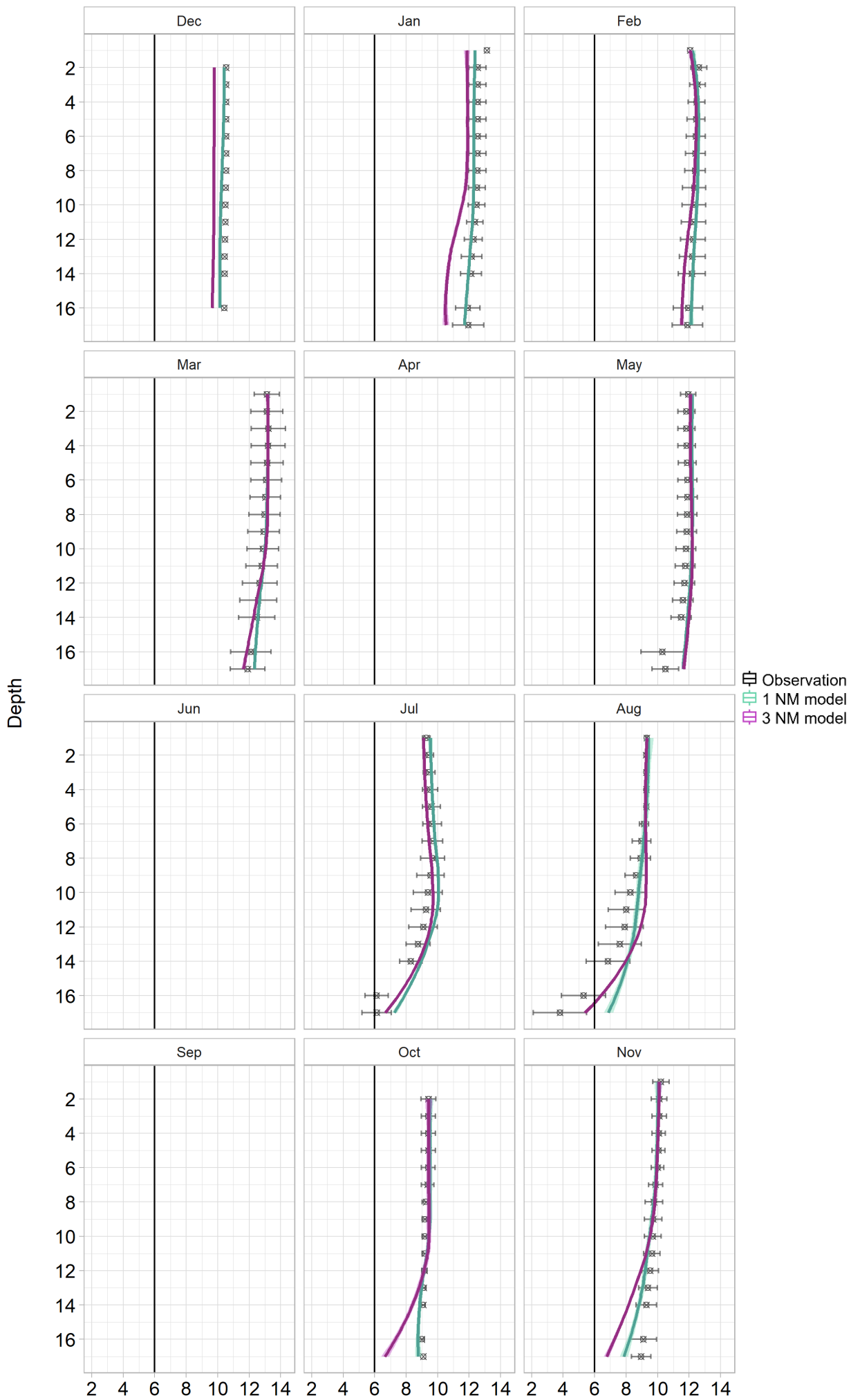
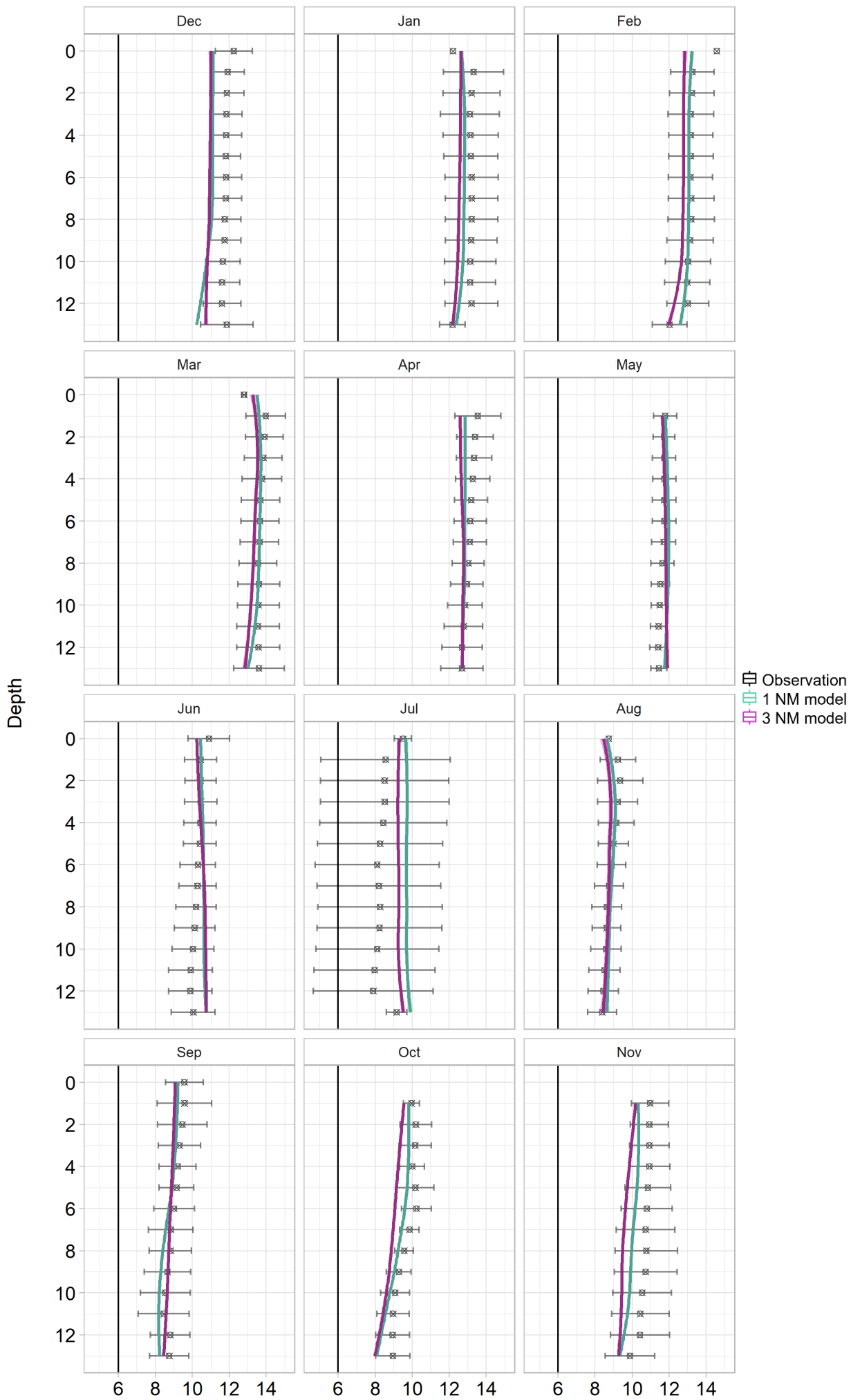
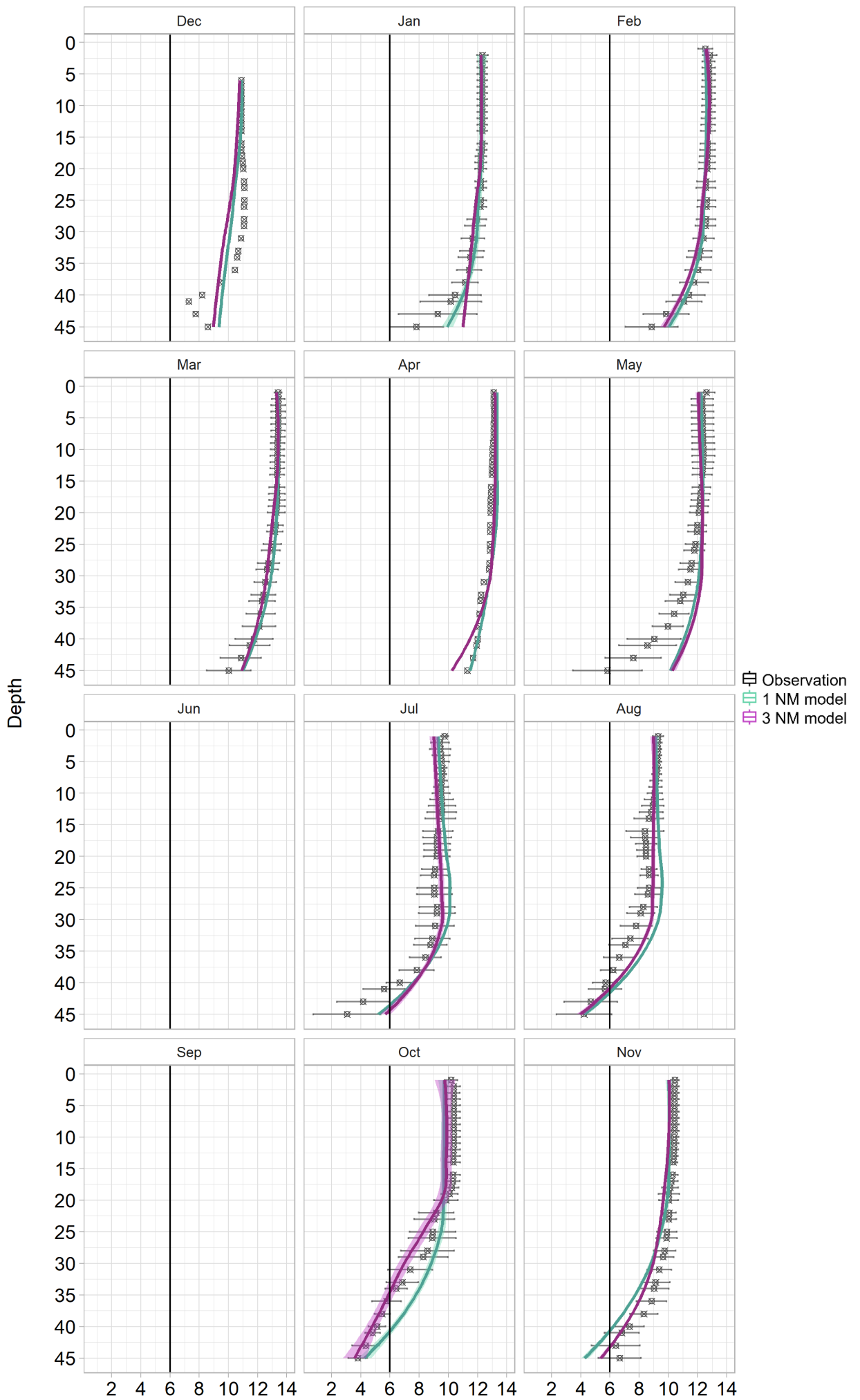
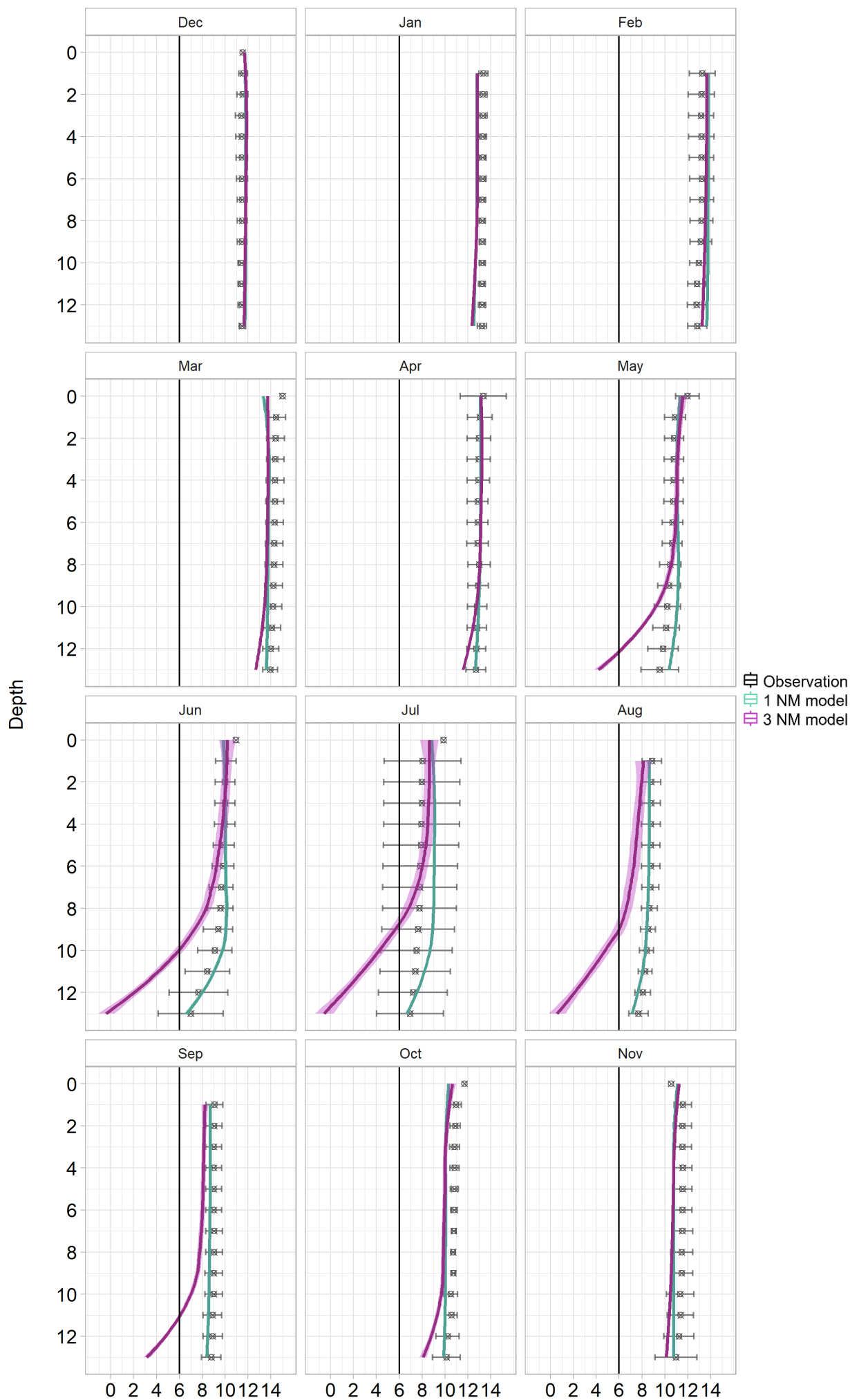
Basin	Station	Correction	r	RMSE	AE	ME
Kiel Bay	TF0360	None	0.67	2.66	-0.93	-0.15
		All data	0.73	2.75	-1.53	-0.23
		Bottom values	0.73	2.65	-1.70	-0.14
		Profiles	0.68	2.96	-0.65	-0.43
	TF0010	None	0.77	2.59	-0.80	0.16
		All data	0.81	2.38	-1.08	0.29
		Bottom values	0.79	2.63	-1.59	0.13
		Profiles	0.76	2.26	-0.46	0.36
	TF0361	None	0.66	2.14	-0.28	0.21
		All data	0.71	1.95	-0.58	0.34
		Bottom values	0.68	2.00	-0.55	0.30
		Profiles	0.73	2.00	-0.37	0.30
Bay of Mecklenburg	TF0022	None	0.83	2.91	-1.45	0.35
		All data	0.82	2.43	-1.15	0.55
		Bottom values	0.82	2.50	-1.19	0.52
		Profiles	0.81	2.43	-1.01	0.54
	TFO5	None	0.85	1.20	0.61	0.61
		All data	0.89	0.89	-0.03	0.79
		Bottom values	0.88	0.98	-0.29	0.74
		Profiles	0.89	0.95	0.07	0.76
	TF0012	None	0.73	3.48	-2.03	-0.21
		All data	0.74	2.88	-1.51	0.17
		Bottom values	0.77	3.03	-1.92	0.09
		Profiles	0.71	2.92	-1.31	0.15
Arkona Basin	O9	None	0.76	1.53	0.03	0.58
		All data	0.82	1.42	-0.47	0.64
		Bottom values	0.78	1.73	-0.89	0.46
		Profiles	0.82	1.36	-0.04	0.67
	TF0113	None	0.65	2.90	-0.05	0.11
		All data	0.72	2.42	-0.90	0.38
		Bottom values	0.70	2.43	-0.88	0.37

Basin	Station	Correction	r	RMSE	AE	ME
		Profiles	0.70	2.31	-0.14	0.43
		None	0.83	1.47	0.48	0.64
	TF0002	All data	0.87	1.22	-0.03	0.75
		Bottom values	0.84	1.54	-0.76	0.60
		Profiles	0.87	1.23	0.27	0.74
		None	0.76	3.74	-2.04	-0.53
	OB2	All data	0.73	3.56	-1.90	-0.39
		Bottom values	0.66	3.70	-2.30	-0.50
		Profiles	0.72	3.50	-1.83	-0.34
		None	0.81	1.67	0.00	0.69
Pomeranian Bay	OB4	All data	0.79	1.91	-0.30	0.60
		Bottom values	0.71	2.26	-1.06	0.44
		Profiles	0.76	2.72	0.97	0.18
		None	0.84	2.29	-0.81	0.38
	O14	All data	0.79	2.14	-0.75	0.46
		Bottom values	0.75	2.54	-1.34	0.24
		Profiles	0.56	2.02	-0.35	0.52

Table S2 Error statistics to assess model-data misfits of the multiannual mean of oxygen profiles (2010-2019) for the corrected model results either based on near-bottom oxygen values (Bottom values), oxygen profiles (Profiles) or both data sources (All data). Pearson's Rank correlation coefficient (r), Root Mean Squared Error (RMSE), Average Error (AE), Modelling Efficiency (ME).

Basin	Station	Correction	r	RMSE	AE	ME
		None	0.82	1.16	0.15	0.59
	TF0360	All data	0.85	1.13	-0.22	0.61
		Bottom values	0.71	1.66	-0.62	0.16
		Profiles	0.69	2.22	0.52	-0.50
		None	0.89	1.12	0.12	0.74
Kiel Bay	TF0010	All data	0.91	0.98	-0.10	0.79
		Bottom values	0.80	1.99	-0.34	0.15
		Profiles	0.91	1.00	-0.07	0.79
		None	0.87	1.27	0.32	0.62
	TF0361	All data	0.89	1.14	0.24	0.69
		Bottom values	0.79	1.80	0.11	0.24
		Profiles	0.88	1.23	0.29	0.64
		None	0.86	1.64	-0.03	0.61
	TF0022	All data	0.87	1.47	-0.20	0.68
		Bottom values	0.79	2.15	-0.26	0.33
		Profiles	0.87	1.47	-0.19	0.69
		None	0.91	0.82	0.34	0.77
Bay of Mecklenburg	TFO5	All data	0.95	0.64	-0.11	0.86
		Bottom values	0.93	0.95	-0.56	0.69
		Profiles	0.93	0.70	-0.01	0.83
		None	0.85	1.21	0.21	0.69
	TF0012	All data	0.88	1.09	0.01	0.75
		Bottom values	0.67	2.08	-0.33	0.09

		Profiles	0.87	1.11	-0.06	0.74
Arkona Basin	**O9**	**None**	0.74	1.35	-0.01	0.64
		All data	0.79	1.30	-0.24	0.67
		Bottom values	0.72	1.78	-1.00	0.38
		Profiles	0.79	1.27	0.08	0.68
	TF0113	**None**	0.90	1.00	0.16	0.79
		All data	0.91	0.94	-0.18	0.81
		Bottom values	0.69	2.41	-1.35	-0.24
		Profiles	0.92	0.90	0.18	0.83
	TF0002	**None**	0.93	0.68	0.17	0.86
		All data	0.94	0.67	-0.23	0.86
		Bottom values	0.86	1.54	-1.22	0.27
		Profiles	0.94	0.60	0.05	0.89
Pomeranian Bay	**OB2**	**None**	0.73	2.17	-0.73	0.30
		All data	0.67	2.18	-0.57	0.29
		Bottom values	0.63	2.48	-1.25	0.08
		Profiles	0.70	2.13	-0.54	0.32
	OB4	**None**	0.78	1.44	-0.19	0.68
		All data	0.75	1.48	-0.09	0.65
		Bottom values	0.68	2.04	-1.07	0.35
		Profiles	0.78	1.47	0.15	0.66
	O14	**None**	0.79	1.32	0.07	0.71
		All data	0.72	1.59	-0.23	0.58
		Bottom values	0.74	2.09	-1.36	0.28
		Profiles	0.54	2.35	0.93	0.09

TF0360 - Depth profiles; multiannual monthly mean oxygen conc. (2010-2019)

TF0361 - Depth profiles; multiannual monthly mean oxygen conc. (2010-2019)

TF0010 - Depth profiles; multiannual monthly mean oxygen conc. (2010-2019)

TF0022 - Depth profiles; multiannual monthly mean oxygen conc. (2010-2019)

TF0012 - Depth profiles; multiannual monthly mean oxygen conc. (2010-2019)

TFO5 - Depth profiles; multiannual monthly mean oxygen conc. (2010-2019)

TF0002 - Depth profiles; multiannual monthly mean oxygen conc. (2010-2019)

O9 - Depth profiles; multiannual monthly mean oxygen conc. (2010-2019)

TF0113 - Depth profiles; multiannual monthly mean oxygen conc. (2010-2019)

O14 - Depth profiles; multiannual monthly mean oxygen conc. (2010-2019)

OB4 - Depth profiles; multiannual monthly mean oxygen conc. (2010-2019)

OB2 - Depth profiles; multiannual monthly mean oxygen conc. (2010-2019)

Legend:
- Observation
- 1 NM model
- 3 NM model

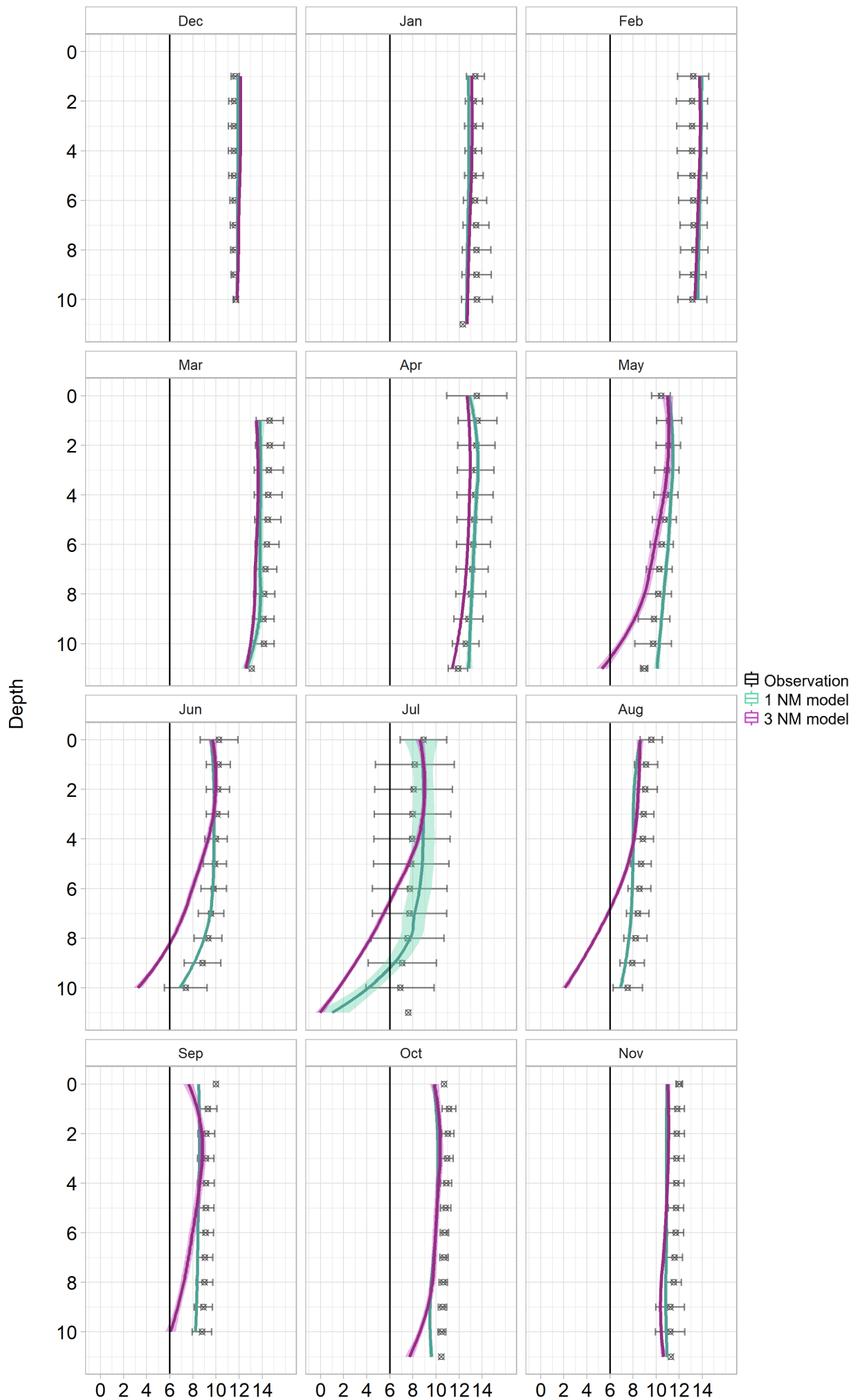
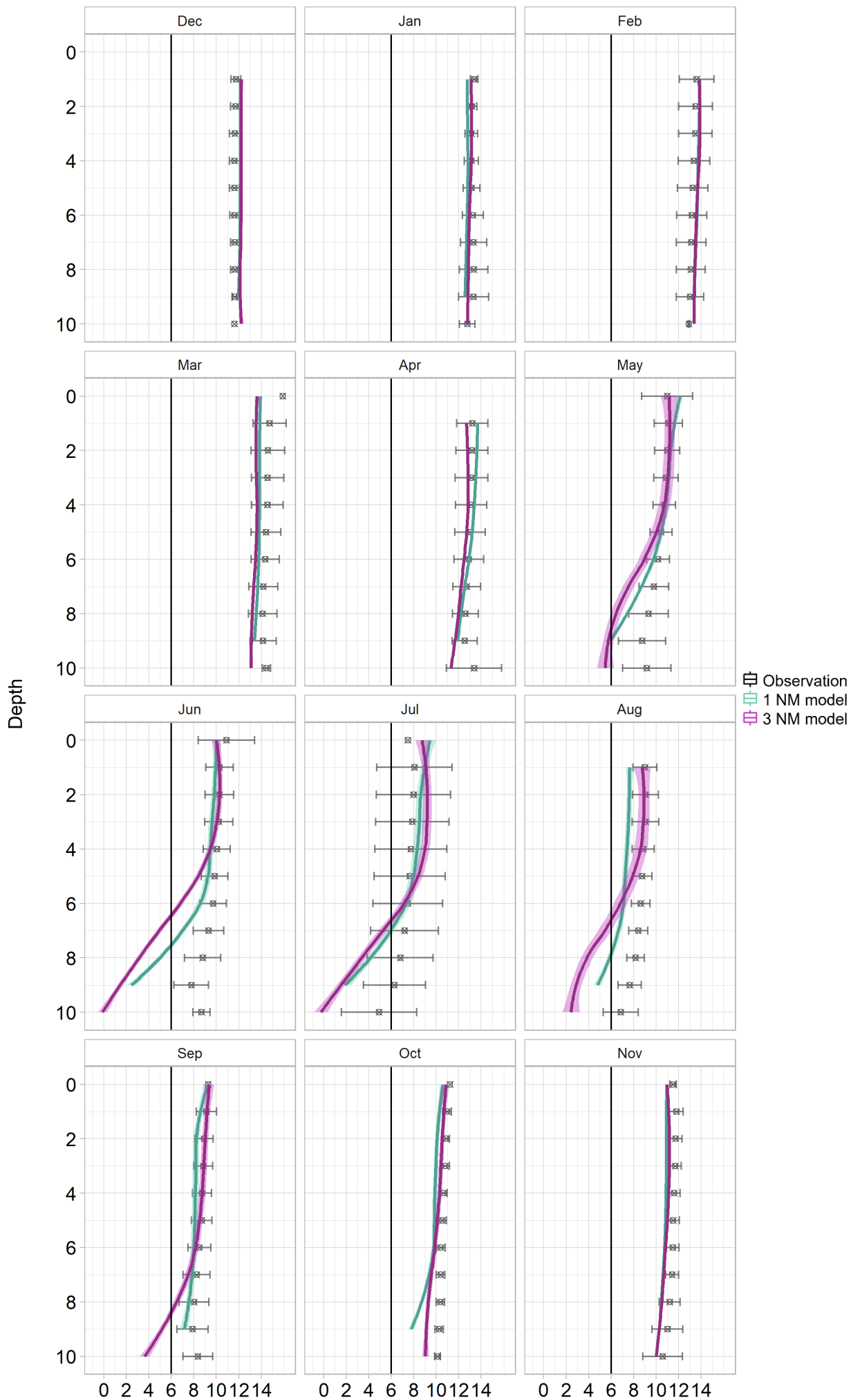



Figure S2 Comparison of monthly averaged oxygen depth profiles (2010-2019) from observations (black) and model predictions with two different spatial resolutions (3NM purple, 1NM turquoise). The black line indicates uppermost critical oxygen threshold of 6 mg/l used in oxygen assessments within the Baltic Sea (HELCOM 2023).

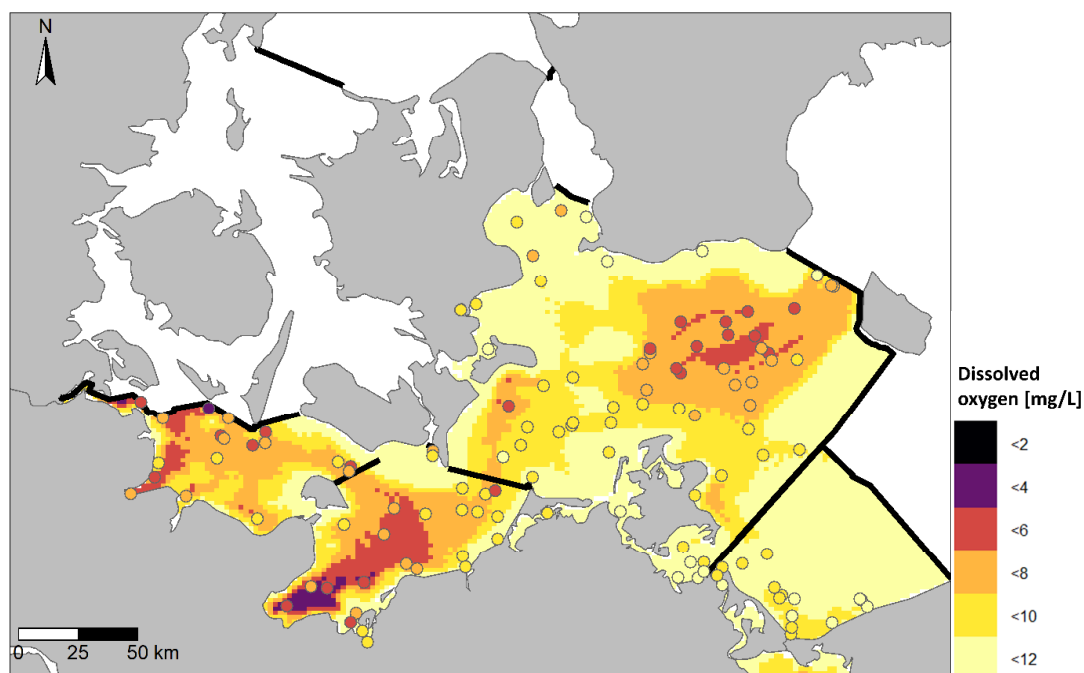



Figure S3 Multiannual mean near-bottom oxygen concentrations (2011-2016) from observations (circles) and model predictions with a spatial resolution of 1NM. Black lines indicate sub-basin divisions.

Table S3 Error statistics to assess model-data misfits of the multiannual mean near-bottom oxygen concentrations (2011-2016) for the 1NM model resolutions. Pearson's correlation coefficient (r), Root Mean Squared Error (RMSE), Average Error (AE). Number of available stations per sub-basins in brackets.

Error statistic	r	RMSE	AE	ME
Kiel Bay (23)	0.16	1.96	0.60	-0.22
Bay of Mecklenburg (27)	0.52	2.14	-0.01	-1.19
Arkona Basin (110)	0.72	1.30	0.30	0.37
Pomeranian Bay (15)	0.26	0.85	0.16	-0.19
SW Baltic Sea (175)	0.68	1.52	0.26	0.30