

Table S1. Maxima, minima, amplitude and variability of the seasonal cycle of all the input variables.

Zone	Station	Depth	Temperature (°C)				Salinity				Phosphate ($\mu\text{mol kg}^{-1}$)				Nitrate ($\mu\text{mol kg}^{-1}$)				Silicate ($\mu\text{mol kg}^{-1}$)				Oxygen ($\mu\text{mol kg}^{-1}$)			
			Max	Min	Amplitude	Variability	Max	Min	Amplitude	Variability	Max	Min	Amplitude	Variability	Max	Min	Amplitude	Variability	Max	Min	Amplitude	Variability	Max	Min	Amplitude	Variability
Inner	V3	0-5 m	18.0	12.7	5.3	1.3 ± 0.3	35.3	33.4	1.9	1.1 ± 0.4	0.94	0.43	0.51	0.22 ± 0.02	8.9	1.1	7.8	2.2 ± 0.8	11.5	3.6	7.8	3.4 ± 0.8	261.9	208.0	53.8	23.2 ± 2.7
		5-10 m	16.8	13.1	3.7	1.3 ± 0.3	35.4	34.5	0.9	0.6 ± 0.2	1.01	0.51	0.50	0.21 ± 0.02	8.1	2.1	6.1	2.3 ± 0.4	9.0	2.8	6.2	2.6 ± 0.5	253.7	195.5	58.3	21.3 ± 4.0
		10-15 m	16.0	13.2	2.8	1.2 ± 0.3	35.5	34.7	0.7	0.5 ± 0.1	1.01	0.59	0.42	0.21 ± 0.03	7.7	2.7	5.0	2.4 ± 0.3	8.5	3.2	5.3	2.5 ± 0.5	247.8	188.7	59.1	19.9 ± 3.8
		0-5 m	17.7	12.8	4.9	1.2 ± 0.3	35.4	34.1	1.3	0.8 ± 0.3	0.90	0.37	0.54	0.19 ± 0.04	8.5	1.0	7.5	2.3 ± 0.7	9.6	2.1	7.5	2.8 ± 0.8	265.6	212.9	52.7	22.3 ± 6.0
	V4	5-10 m	16.4	13.1	3.3	1.3 ± 0.3	35.5	34.9	0.6	0.5 ± 0.1	0.90	0.43	0.46	0.19 ± 0.03	7.9	1.8	6.1	2.4 ± 0.4	7.8	2.1	5.7	2.3 ± 0.5	258.9	204.7	54.2	21.0 ± 5.9
		10-15 m	15.4	13.2	2.2	1.2 ± 0.3	35.6	35.1	0.5	0.4 ± 0.1	0.90	0.49	0.41	0.20 ± 0.03	7.4	3.0	4.4	2.7 ± 0.3	7.1	2.8	4.3	2.3 ± 0.3	250.9	192.9	58.0	20.7 ± 5.3
		0-5 m	17.8	12.8	5.0	1.2 ± 0.3	35.4	34.2	1.2	0.7 ± 0.3	0.80	0.31	0.49	0.18 ± 0.04	8.3	0.7	7.6	2.2 ± 0.7	8.8	1.3	7.5	2.4 ± 0.8	271.8	221.5	50.3	20.7 ± 6.3
	V2	5-10 m	16.2	13.0	3.2	1.2 ± 0.3	35.5	34.8	0.7	0.5 ± 0.1	0.78	0.35	0.43	0.19 ± 0.04	7.8	1.3	6.5	2.4 ± 0.5	7.3	1.5	5.8	2.1 ± 0.6	265.2	215.2	50.0	20.5 ± 6.2
		10-15 m	15.5	13.2	2.3	1.1 ± 0.2	35.6	35.1	0.5	0.4 ± 0.1	0.76	0.43	0.34	0.20 ± 0.04	7.4	2.5	4.8	2.7 ± 0.4	6.4	2.1	4.3	2.2 ± 0.3	255.2	205.7	49.5	20.8 ± 6.6
Outer/Middle	V7	0-5 m	17.0	12.9	4.1	1.3 ± 0.4	35.5	34.9	0.6	0.5 ± 0.1	0.62	0.23	0.40	0.17 ± 0.03	7.6	0.6	7.0	2.5 ± 0.7	6.6	0.7	5.9	1.8 ± 0.7	280.4	231.9	48.5	21.4 ± 6.2
		5-10 m	15.7	13.0	2.7	1.1 ± 0.3	35.6	35.2	0.4	0.4 ± 0.1	0.57	0.29	0.28	0.20 ± 0.05	7.3	1.7	5.6	2.9 ± 0.5	5.7	1.1	4.6	1.7 ± 0.5	265.4	232.7	32.7	23.2 ± 8.8
		10-15 m	15.4	13.0	2.4	1.0 ± 0.3	35.6	35.3	0.3	0.3 ± 0.1	0.56	0.36	0.20	0.20 ± 0.05	7.1	2.7	4.4	3.0 ± 0.5	5.3	1.6	3.7	1.8 ± 0.4	260.9	218.1	42.8	23.6 ± 9.1
		0-5 m	17.1	12.8	4.3	1.1 ± 0.3	35.5	34.7	0.8	0.6 ± 0.2	0.57	0.22	0.36	0.16 ± 0.03	6.0	0.4	5.7	1.6 ± 0.6	5.7	0.7	5.0	1.5 ± 0.6	283.5	238.2	45.3	17.7 ± 4.4
	V1	5-10 m	15.9	13.0	2.9	1.1 ± 0.3	35.6	34.9	0.7	0.5 ± 0.1	0.54	0.21	0.33	0.16 ± 0.04	7.2	0.8	6.4	2.2 ± 0.6	5.3	0.7	4.6	1.5 ± 0.5	272.4	234.5	37.9	18.2 ± 6.3
		10-15 m	15.4	13.1	2.3	1.1 ± 0.2	35.6	35.1	0.6	0.3 ± 0.1	0.53	0.31	0.22	0.19 ± 0.05	7.0	1.8	5.1	2.7 ± 0.4	5.1	1.2	3.8	1.7 ± 0.4	261.4	231.2	30.2	20.7 ± 8.2
		0-5 m	16.8	12.8	3.9	1.1 ± 0.3	35.5	34.9	0.6	0.5 ± 0.1	0.46	0.18	0.28	0.14 ± 0.02	5.0	0.3	4.8	1.5 ± 0.5	4.1	0.5	3.7	1.3 ± 0.5	291.7	242.8	48.9	16.6 ± 4.0
	V6	5-10 m	15.8	13.0	2.9	1.1 ± 0.2	35.6	35.0	0.6	0.4 ± 0.1	0.47	0.20	0.27	0.15 ± 0.03	6.2	0.7	5.4	2.1 ± 0.5	4.3	0.7	3.6	1.3 ± 0.4	276.7	237.6	39.2	17.7 ± 5.0
		10-15 m	15.3	13.1	2.2	1.0 ± 0.2	35.7	35.1	0.5	0.3 ± 0.1	0.47	0.27	0.20	0.18 ± 0.03	6.5	1.8	4.7	2.7 ± 0.3	4.2	1.1	3.1	1.5 ± 0.3	263.5	233.0	30.5	20.2 ± 7.5
	V5	0-5 m	16.6	12.9	3.7	1.1 ± 0.3	35.5	35.0	0.6	0.5 ± 0.1	0.43	0.18	0.25	0.13 ± 0.02	5.6	0.4	5.2	1.7 ± 0.7	4.1	0.6	3.5	1.3 ± 0.5	291.0	243.9	47.1	18.1 ± 4.2
		5-10 m	15.8	13.0	2.8	1.1 ± 0.3	35.6	35.1	0.5	0.4 ± 0.1	0.44	0.20	0.24	0.14 ± 0.02	6.3	1.0	5.3	2.2 ± 0.5	3.7	0.7	3.0	1.2 ± 0.3	277.4	237.4	40.1	18.4 ± 4.8
		10-15 m	15.1	13.1	2.0	1.0 ± 0.2	35.7	35.3	0.4	0.3 ± 0.1	0.45	0.27	0.18	0.17 ± 0.03	6.2	2.0	4.2	2.5 ± 0.4	3.6	1.1	2.5	1.3 ± 0.2	263.0	232.8	30.2	19.5 ± 5.3

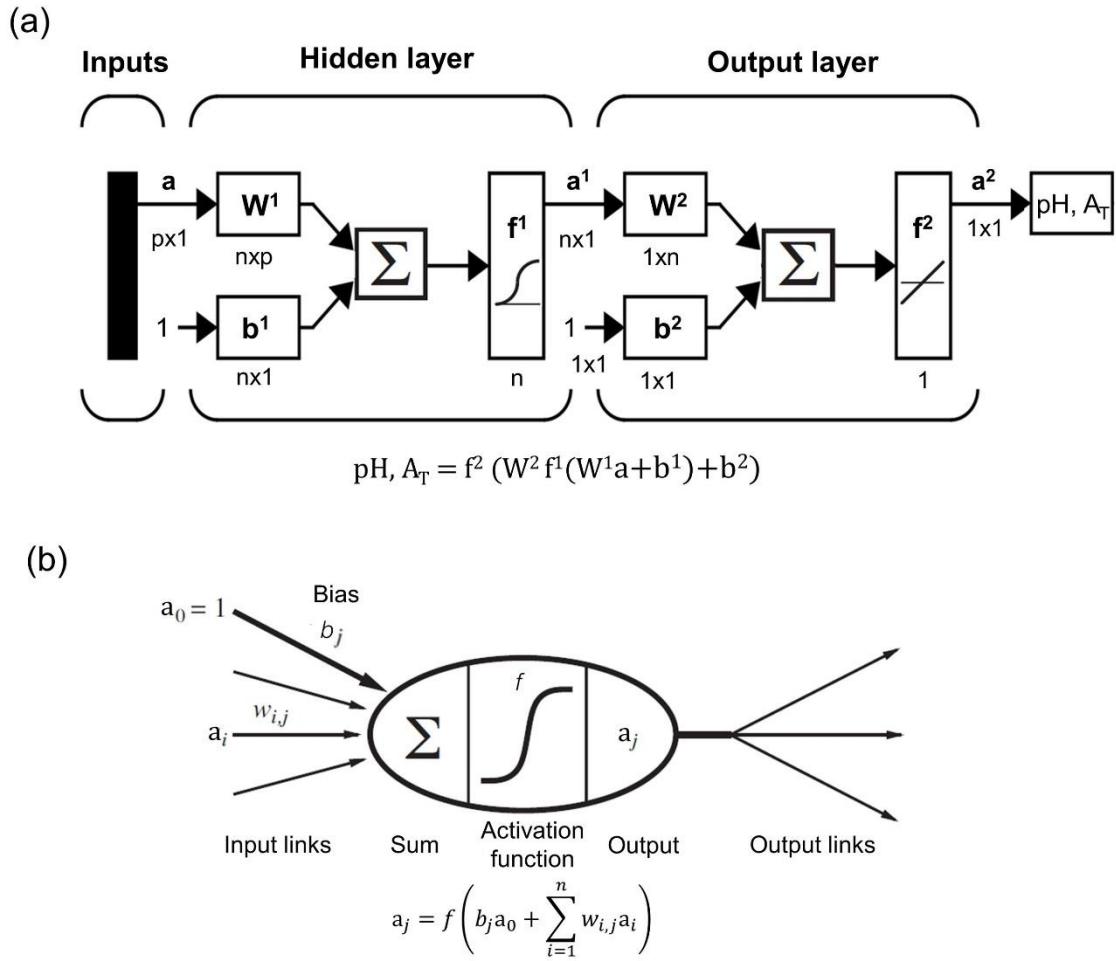


Figure S1. (a) Architecture of the neural networks used in the present study. The notation is in agreement with Hagan et al. (2014). p : number of input variables; \mathbf{a} : input vectors; \mathbf{W}^l : weight matrix; \mathbf{b}^l : bias matrix; Σ : sum; f^l : activation function; \mathbf{a}^l : output matrix. Dimensions of the matrices are for an individual sample. Modified from Hagan et al. (2014). (b) Neuron. a_i : inputs to each neuron; $w_{i,j}$: weights of each input to each neuron. Modified from Russell and Norvig (2010).

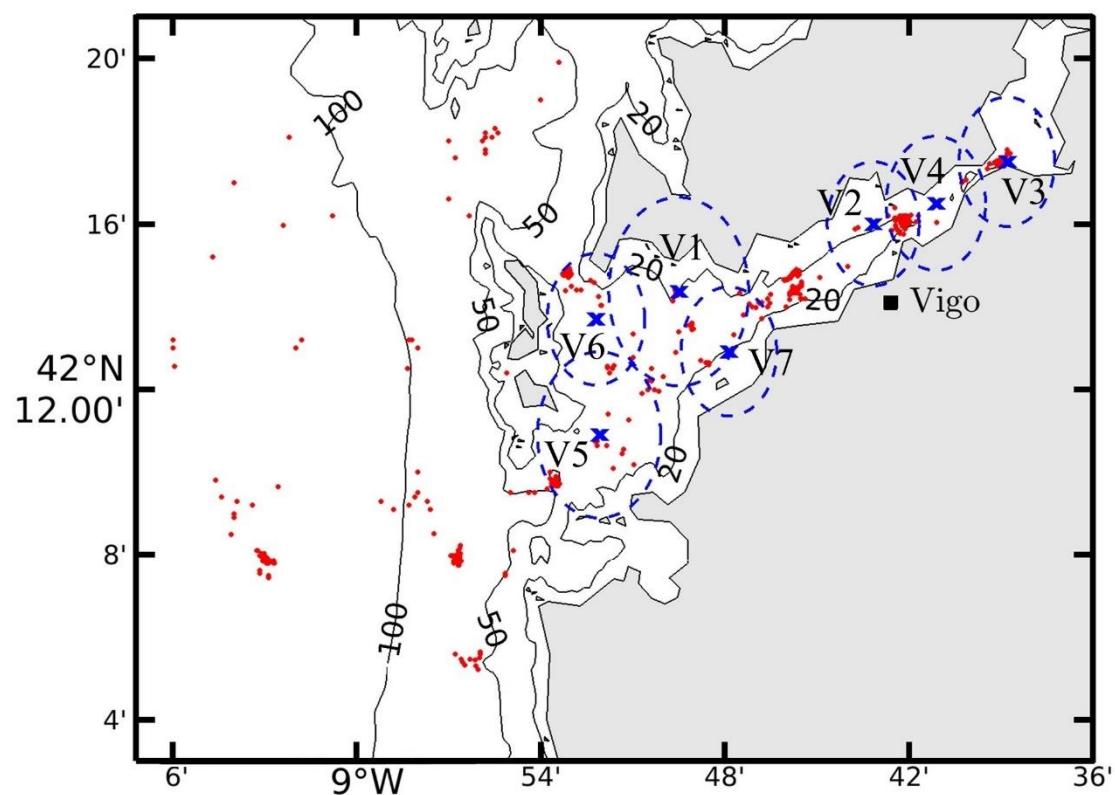


Figure S2. Validation area for each time series.

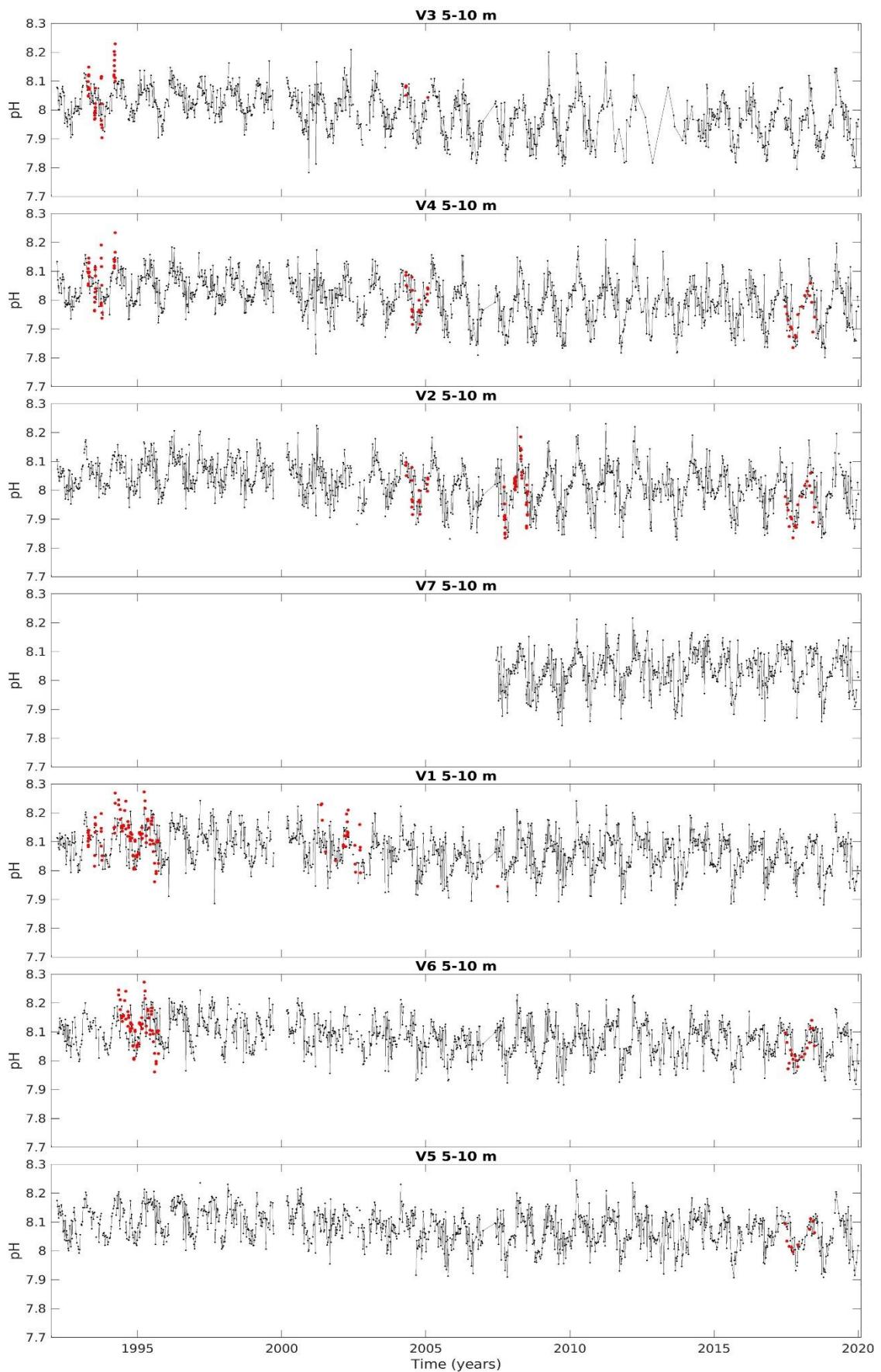


Figure S3. pH time series in the 5-10 m range. Red dots: validation points from IIM-database.

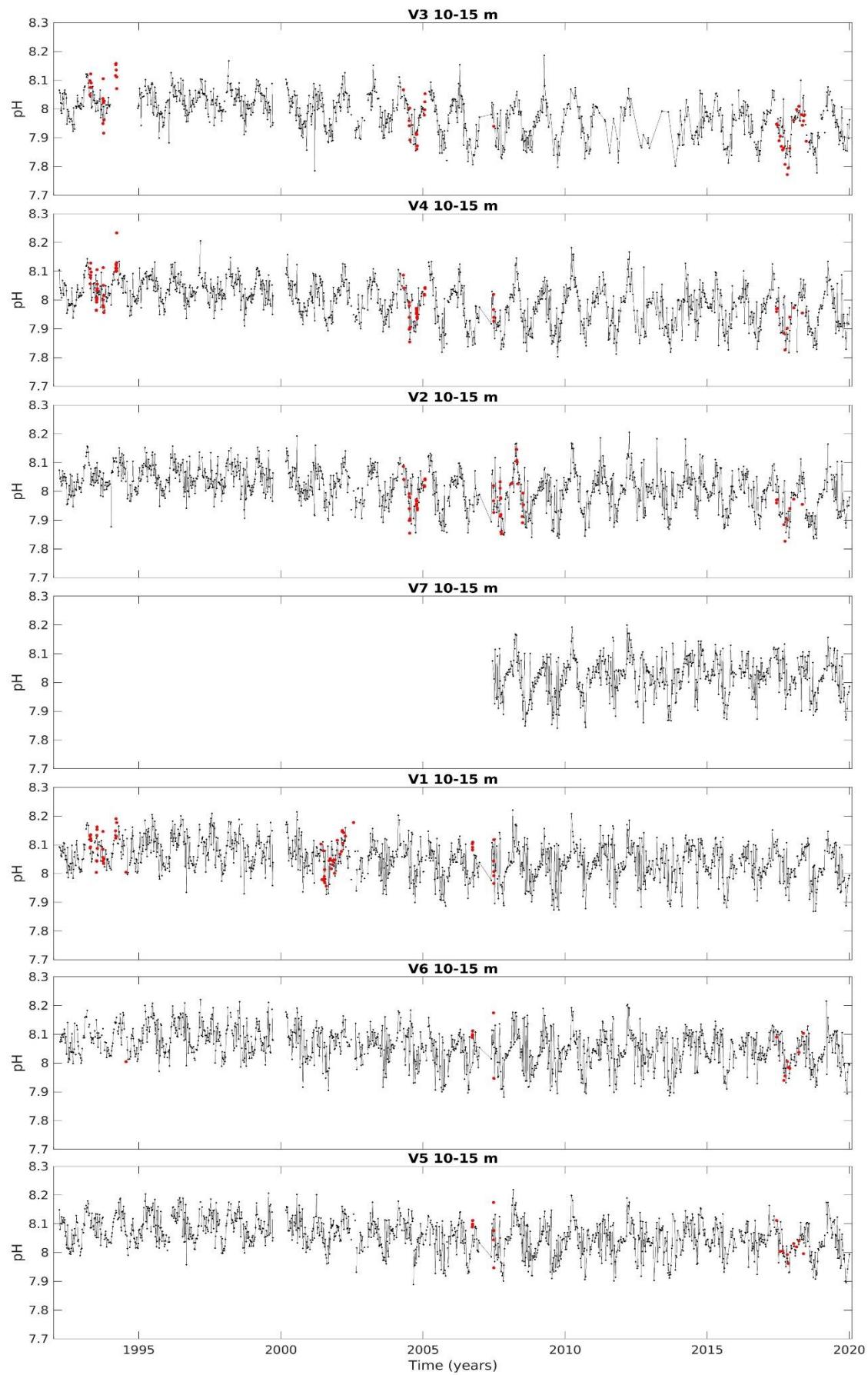


Figure S4. pH time series in the 10-15 m range. Red dots: validation points from IIM-database.

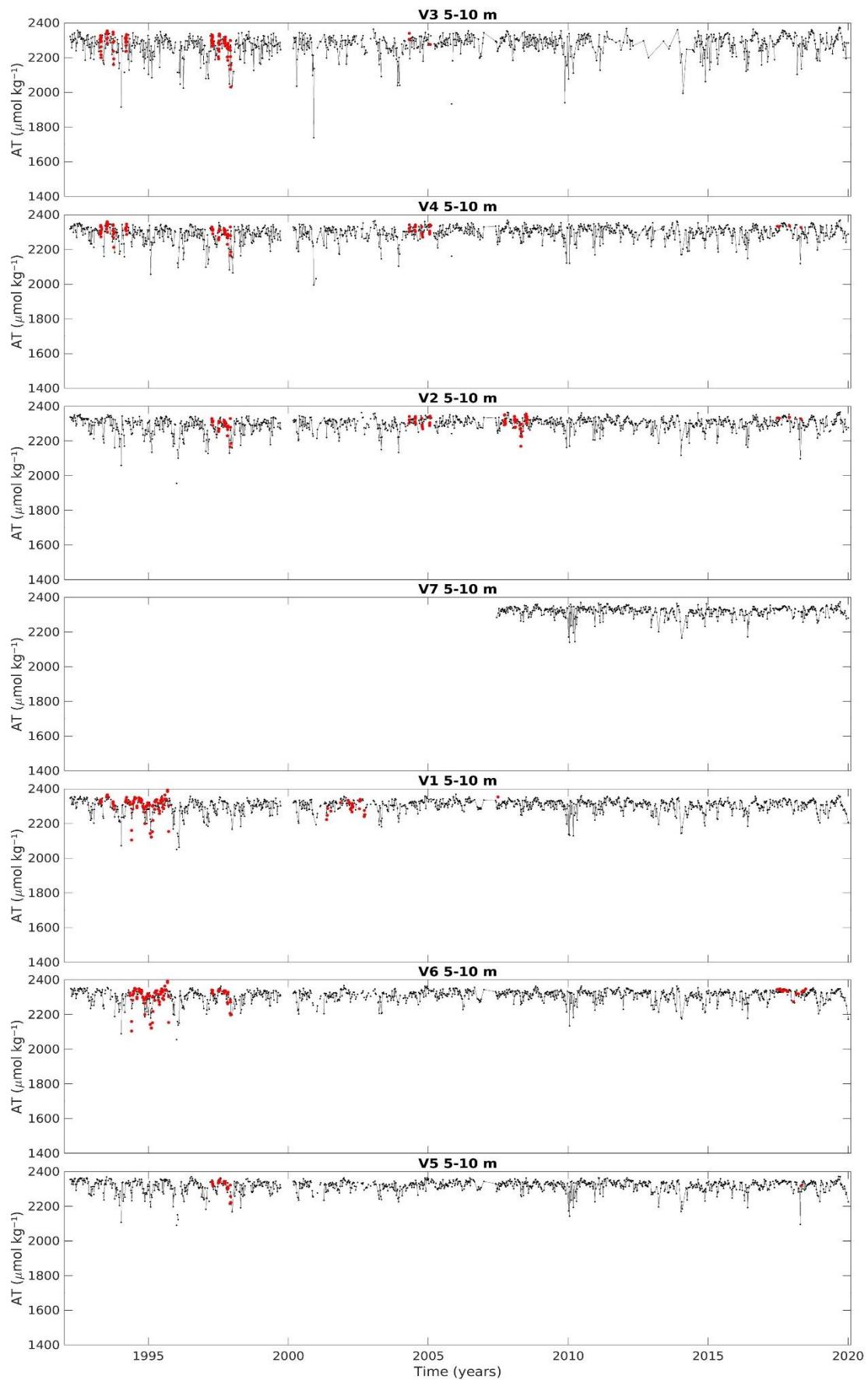


Figure S5. AT time series in the 5-10 m range. Red dots: validation points from IIM-database.

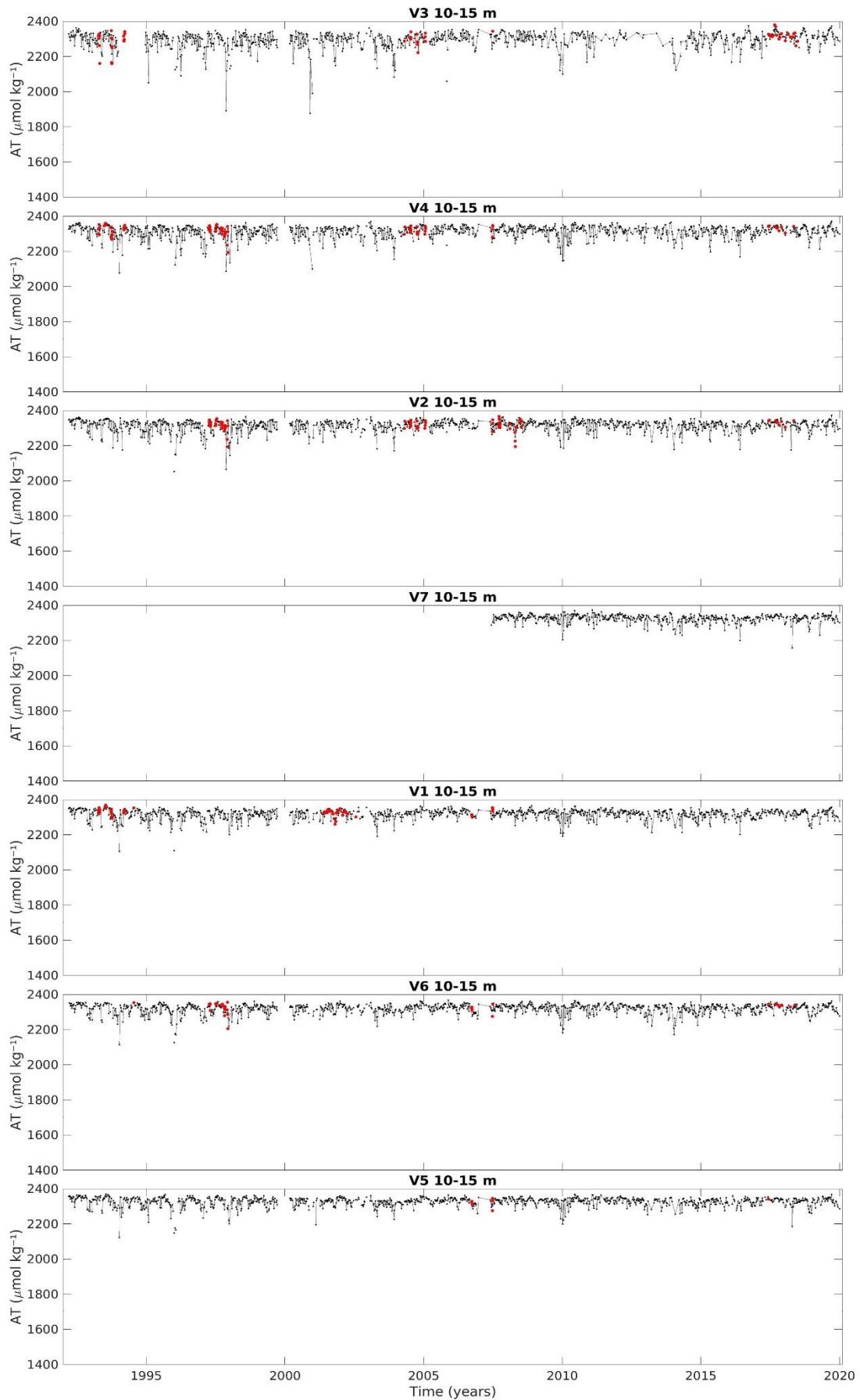


Figure S6. At time series in the 10-15 m range. Red dots: validation points from IIM-database.

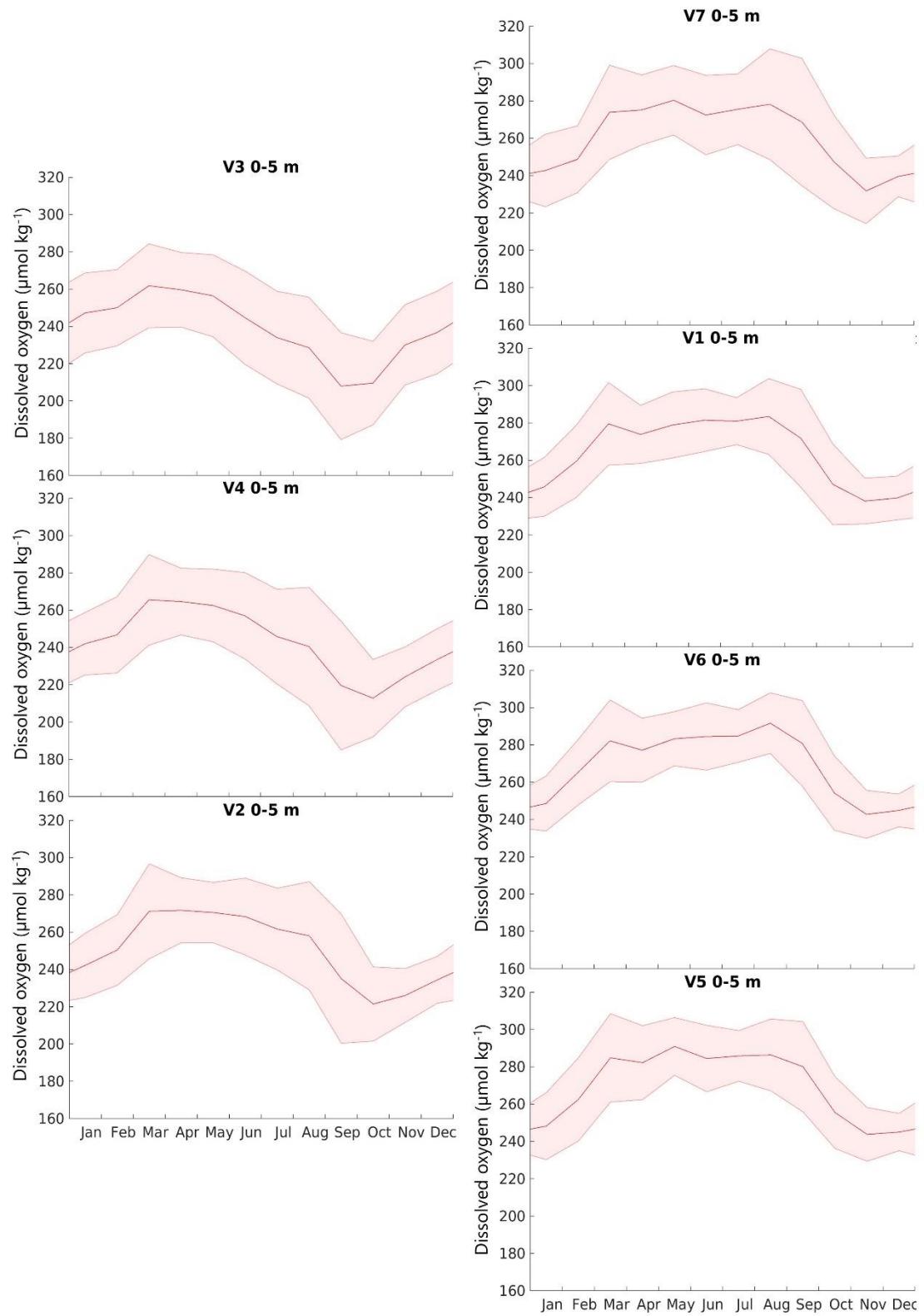


Figure S7. Seasonal cycle of dissolved oxygen in the 0-5 m range. Shadow area represents one standard deviation from the mean of the full time series for each month.

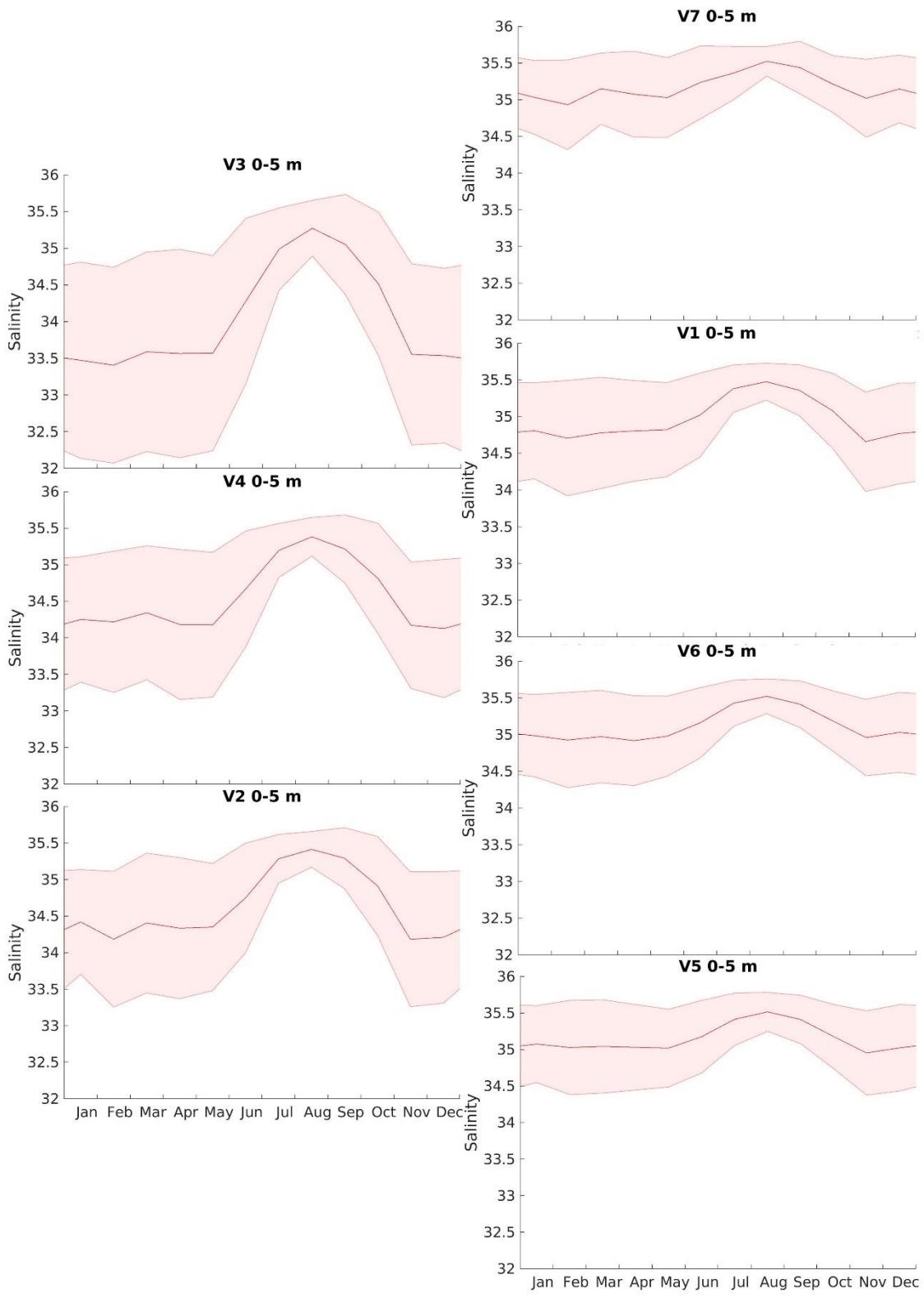


Figure S8. Seasonal cycle of salinity in the 0-5 m range. Shadow area represents one standard deviation from the mean of the full time series for each month.

References

Hagan, M. T., Demuth, H. B., Beale, M. H., and De Jesus, O.: Neural network design, ISBN 978-0971732117, available at: <http://hagan.okstate.edu/nnd.html> (last access: 26 July 2018), 2014.

Russell, S. J. and Norvig, P.: Artificial intelligence: a modern approach, Prentice Hall, 2010.