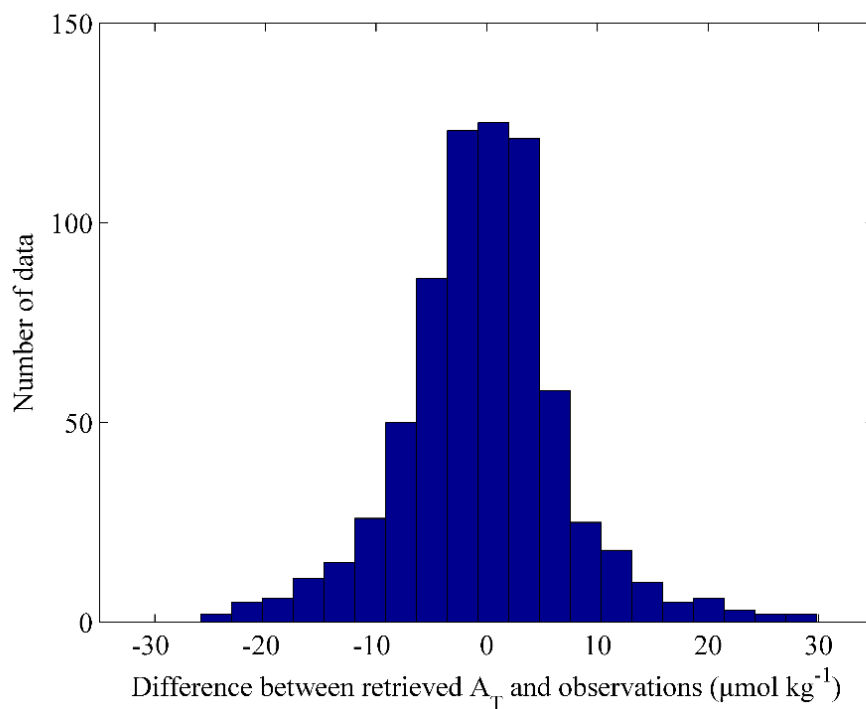


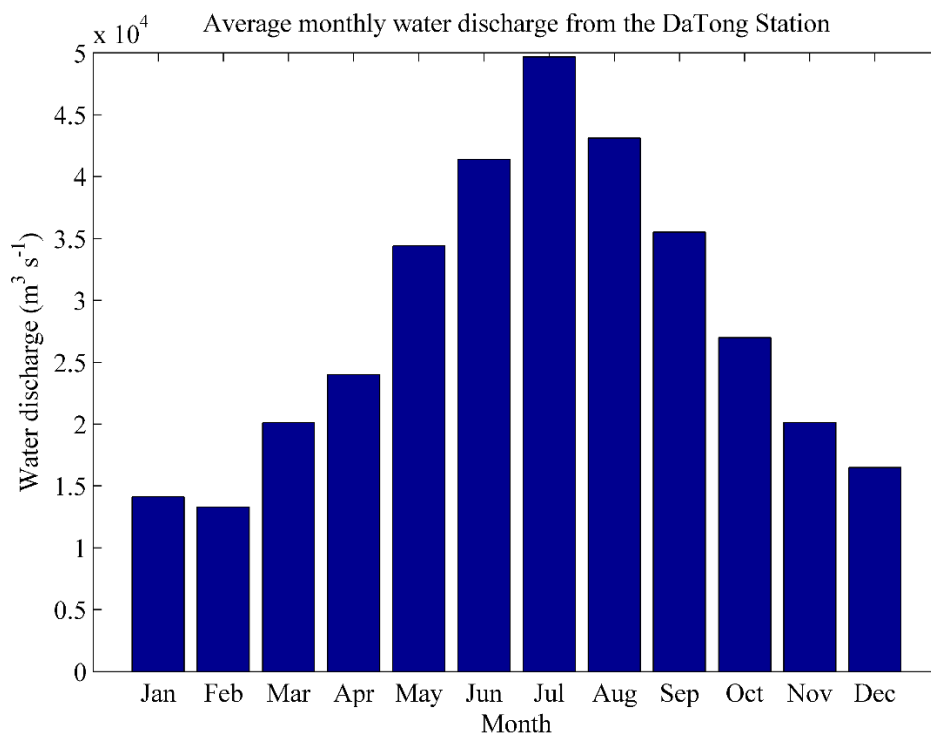
Supplementary Material

1 Supplementary Figures and Tables

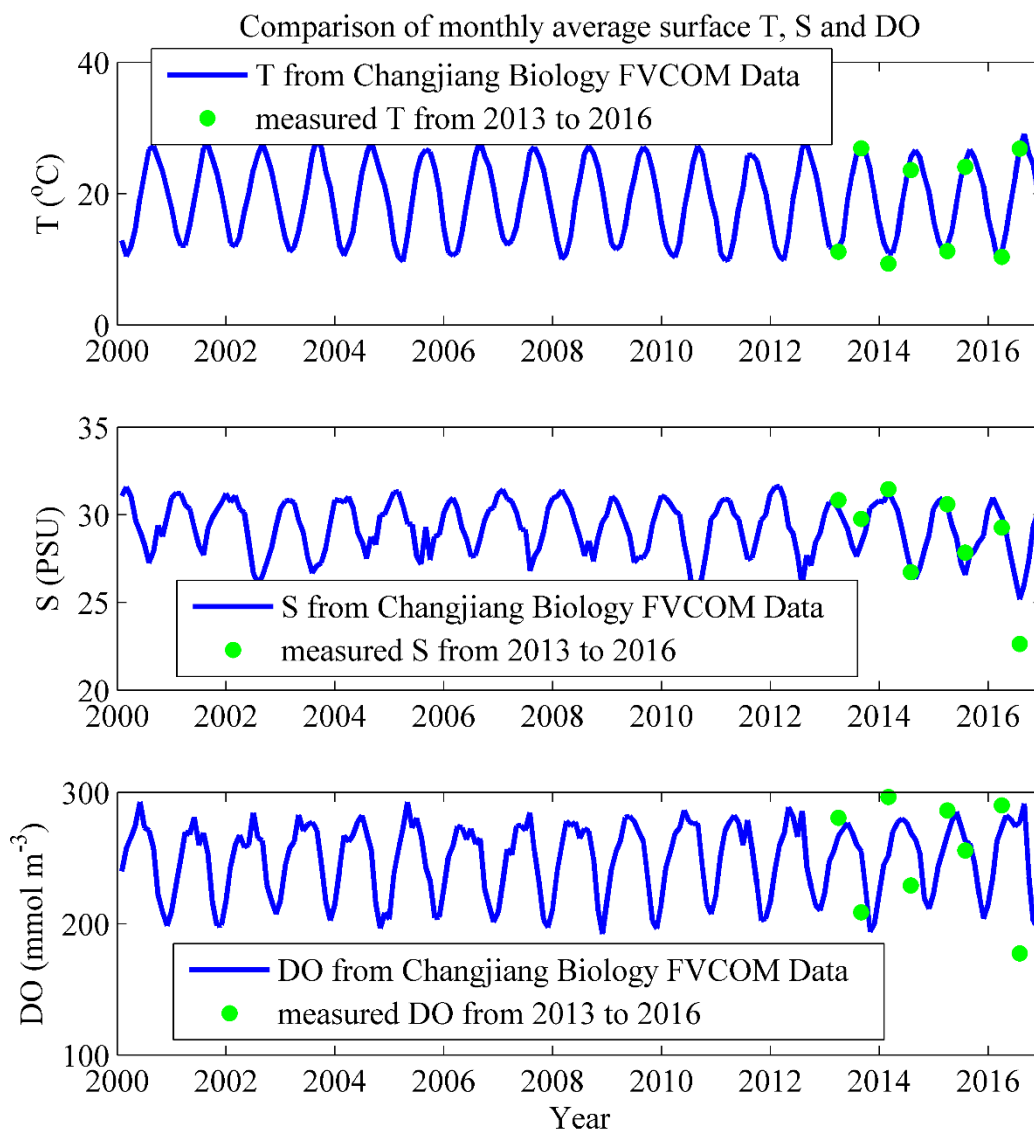
1.1 Supplementary Figures



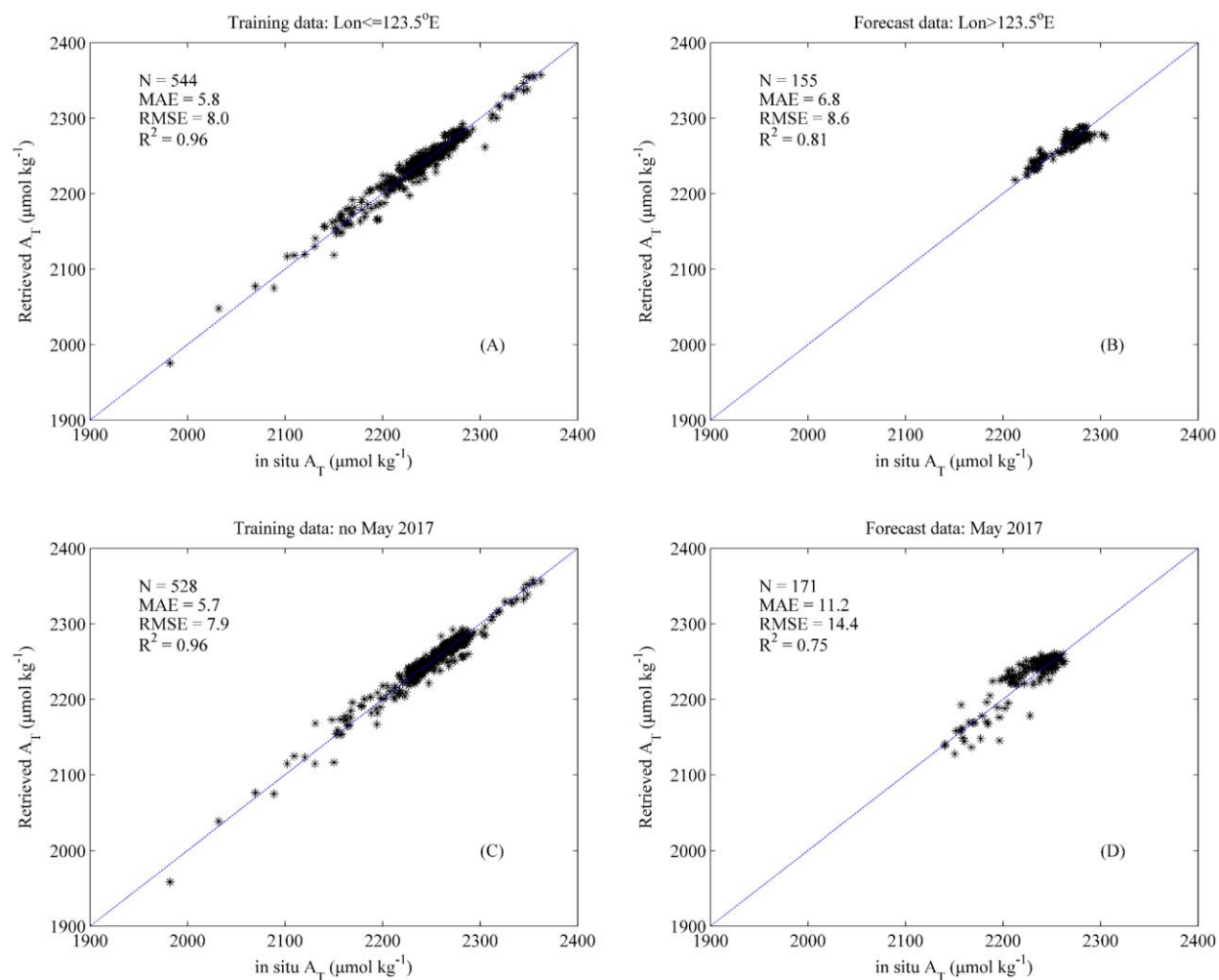
Supplementary Figure 1. Normal distribution of the differences between total alkalinity estimated by the ANN model minus the observations for all cruises data.



Supplementary Figure 2. Average monthly water discharge of the Changjiang River (Datong station, data derived from the Hydrological Information Center of China, <http://www.hydroinfo.gov.cn/>). The blue bar displays the long-term (2002–2017) average values.



Supplementary Figure 3. Comparison of monthly average surface temperature, salinity and dissolved oxygen on the ECS shelf. Blue line represents simulated value from Changjiang Biology FVCOM Data; green point represents measured value for 8 cruises from 2013 to 2016.



Supplementary Figure 4. Performance of model extrapolation for longitude ($>123.5^\circ\text{E}$) and month (May 2017). (A) Training data for longitude $\leq 123.5^\circ\text{E}$; (B) Forecast data for longitude $> 123.5^\circ\text{E}$; (C) Training data for 4 cruises without May 2017; (D) Forecast data for May 2017 cruise. The 1:1 line is shown in each plot as visual reference. N represents the number of data points. Three statistics are the mean absolute error (MAE), the root mean squared error (RMSE), and the coefficient of determination (R^2).