

# Supplementary Materials

March 4, 2025

## A The impacts of parameter on the performance of SMO-STANet

### A.1 The impacts of parameter $n\_heads$ on the performance of SMO-STANet

We have conducted experiments to evaluate the impacts of parameter  $n\_heads$  on the performance of SMO-STANet to determine their optimal values. According to the Figure 1, we set  $n\_heads$  to 8 to achieve the optimal performance.

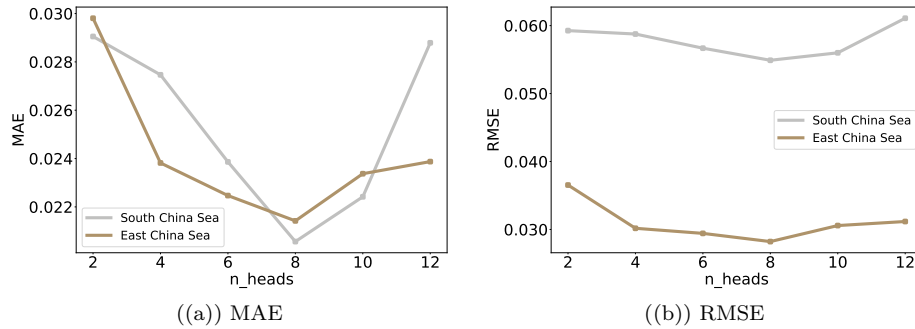


Figure 1: The results of SMO-STANet while varying the hyper-parameter  $n\_heads$ .

### A.2 The impacts of parameter decay\_factor $\eta$ on the performance of SMO-STANet

We have conducted experiments to evaluate the impacts of parameter decay\_factor  $\eta$  on the performance of SMO-STANet to determine their optimal values. According to the Figure 2, we set  $\eta$  to 1.5 and 1.0 for East China Sea dataset and South China Sea dataset, respectively, to achieve the optimal performance.

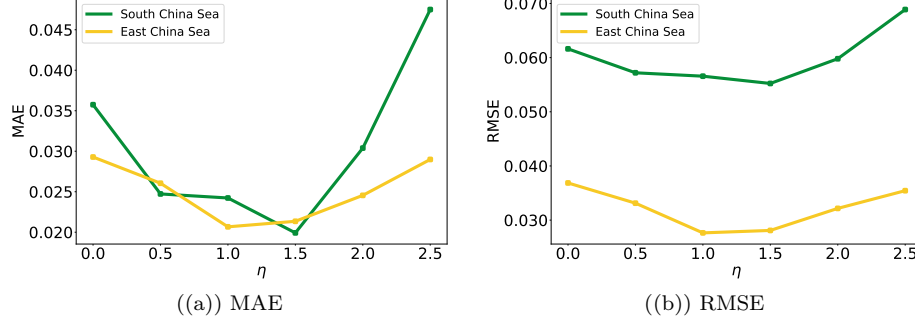


Figure 2: The results of SMO-STANet while varying the hyper-parameter  $\eta$  in the scaled loss function.

### A.3 The impacts of parameter `seq_len` on the performance of SMO-STANet

We have conducted experiments to evaluate the impacts of parameter `seq_len` on the performance of SMO-STANet to determine their optimal values. According to the Figure 3, we set `seq_len` to 32 to achieve the optimal performance.

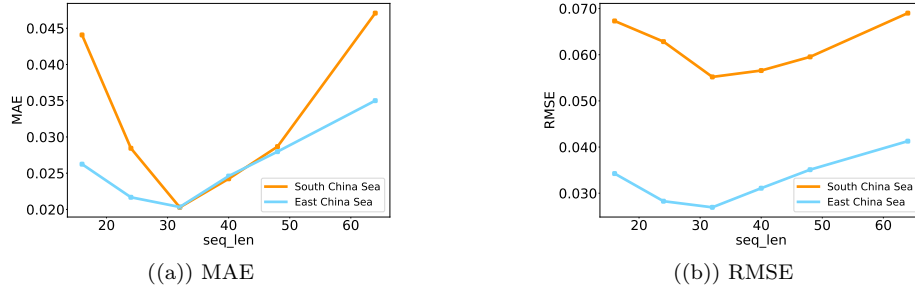


Figure 3: The results of SMO-STANet while varying the sequence length `seq_len`.

### A.4 The impacts of parameter `pred_len` on the performance of SMO-STANet

As illustrated in Figure 4, we have analyzed how the variations in `pred_len` influence the predictive performance of SMO-STANet. Based on the results, we can see that when `seq_len` is constant, the prediction performance becomes worse as `pred_len` becomes longer.

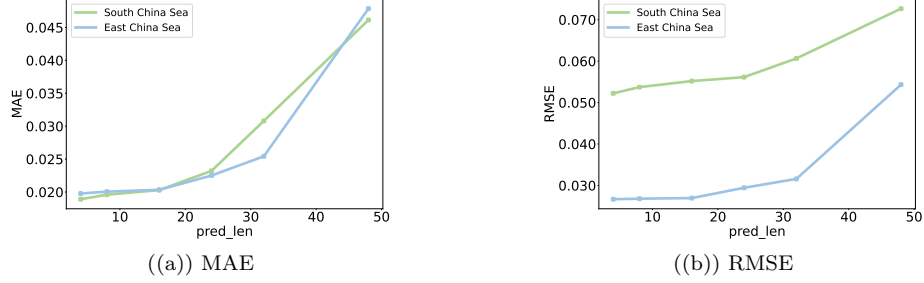


Figure 4: The results of SMO-STANet while varying the prediction length  $pred\_len$ .

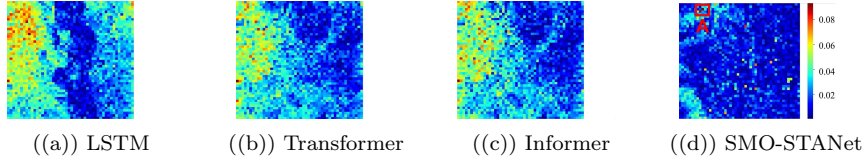


Figure 5: The MAE visualization of Chl-a prediction in the East China Sea on June 6, 2022.

## B Visualization of the performance of SMO-STANet

Figures 5 and 6 visualize the MAE distributions of different Chl-a prediction methods in the two study areas.

The visualization reveals that MAE of SMO-STANet is obviously smaller than the other three baseline methods, which indicates the superiority of SMO-STANet. Notably, SMO-STANet does not perform well in some small areas include the highlighted region A in the East China Sea, and highlighted regions B in the South China Sea. Our findings indicate that these regions are influenced by the Kuroshio warm current, resulting in large fluctuations in Chl-a, ultimately degrading prediction performance.

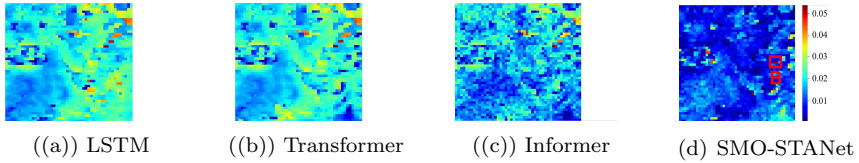


Figure 6: The MAE visualization of Chl-a prediction in the South China Sea on June 18, 2022.