

<><> Time Stamp <><>

Code started: 09/10/2022 - 19:24:42

Total Run Time: 15.995 s

<><> Bore Information <><>

Bore ID: GW075025.1.1

Region: Coastal

Bore Coordinates: (-33.932117, 151.228967)

Agency: WaterNSW

Drilled Date: 20/07/1998

Bore Depth: 24.2 m

Drilled Depth: 25.5 m

Reference Elevation: 8.5 m

Time Series Reference Elevation: 24.17 m

Land Surface Elevation: 8.5 m

Silo Grid Point Coordinates: (-33.95, 151.25)

<><> Model Output <><>

Averaged Period: 30 day(s)

Output: Average Standing Water Level (m) in 1 period(s) time

<><> Model Inputs <><>

Data Range: 07/04/2000 - 17/04/2021

Train Set Size: 80.0%

Test Set Size: 20.0%

Input Timesteps: Current period + 2 preceeding period(s)

Input Variables:

Average Standing Water Level (m)

Average Absolute Root Zone Soil Moisture (0-100cm) (%)

Average Absolute Upper Layer Soil Moisture (0-10cm) (%)

Average Absolute Deep Drainage (below 6m) (mm)

Average Evapotranspiration - Morton's Areal Actual Evapotranspiration (mm)

Average Absolute Deep Layer Soil Moisture (1-6m) (%)

<><> Data Quality <><>

Interpolation Method: Spline

Quality Code: A, Number: 4765, Percentage: 61.67%

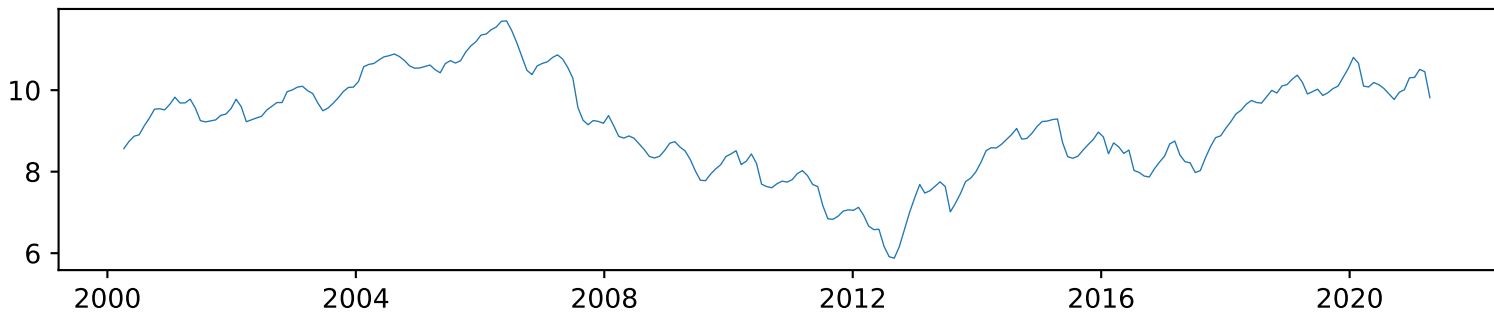
Quality Code: B, Number: 1575, Percentage: 20.39%

Quality Code: C, Number: 628, Percentage: 8.13%

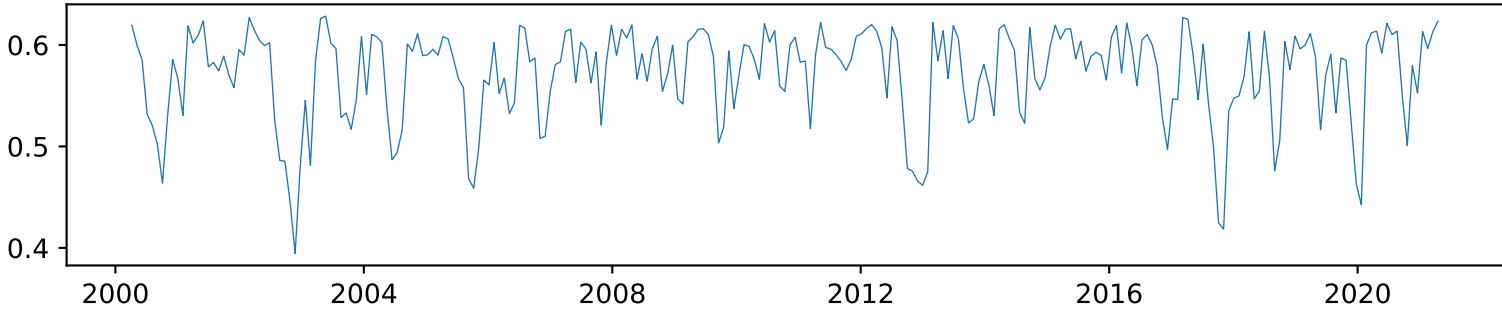
Quality Code: E, Number: 695, Percentage: 9.0%

Quality Code: I, Number: 63, Percentage: 0.82%

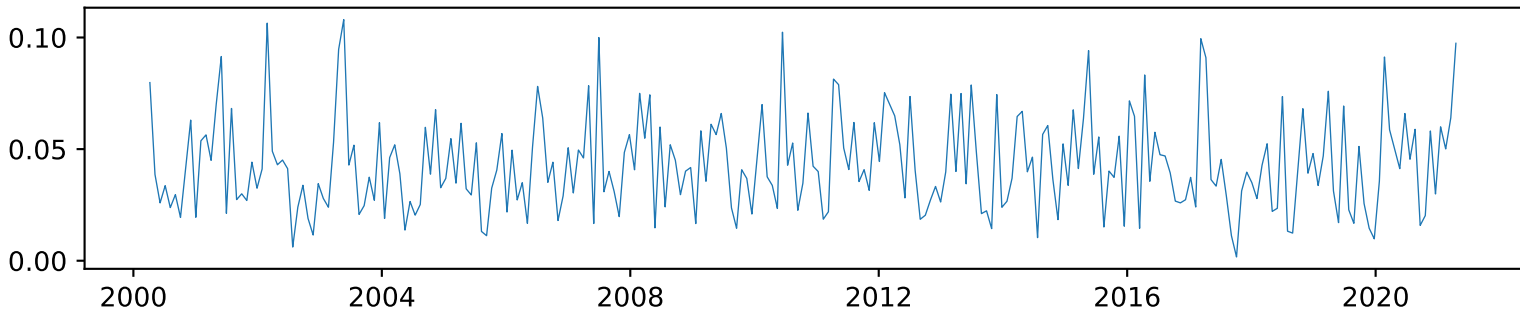
Average Standing Water Level (m)



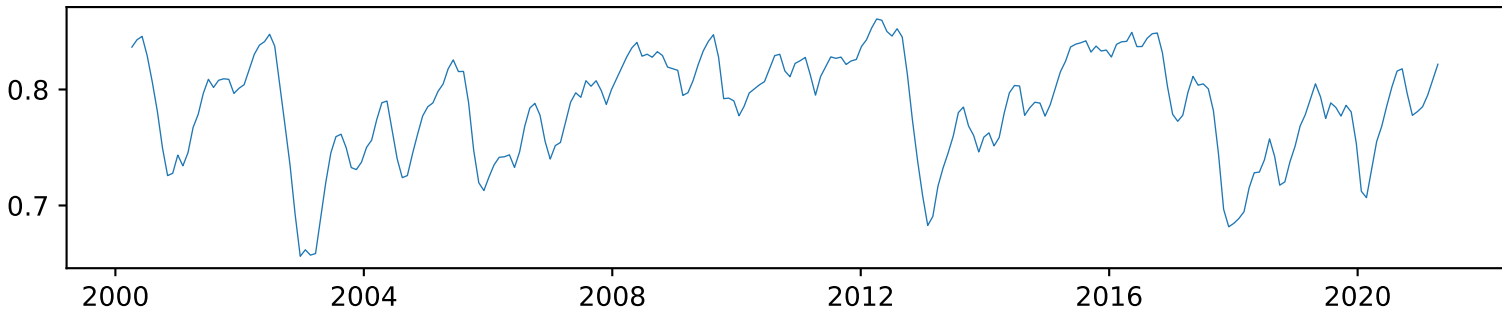
Average Absolute Root Zone Soil Moisture (0-100cm) (%)



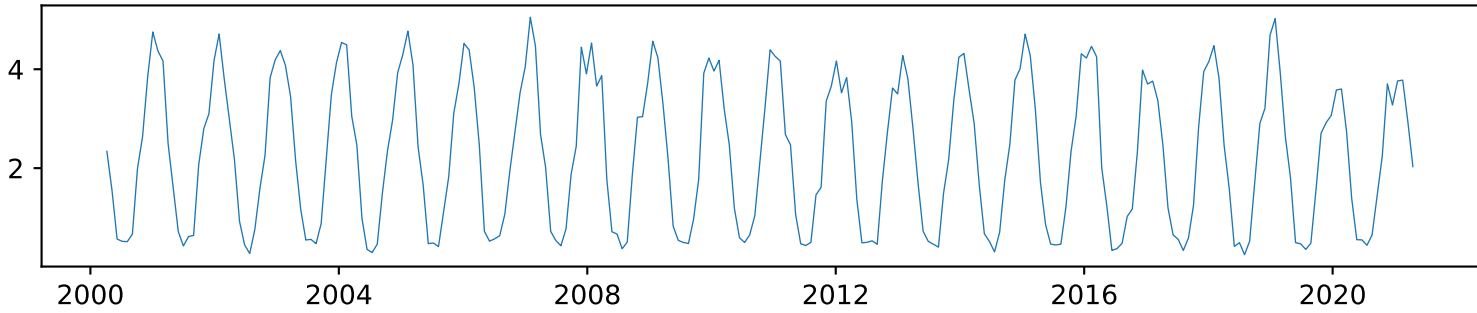
Average Absolute Upper Layer Soil Moisture (0-10cm) (%)



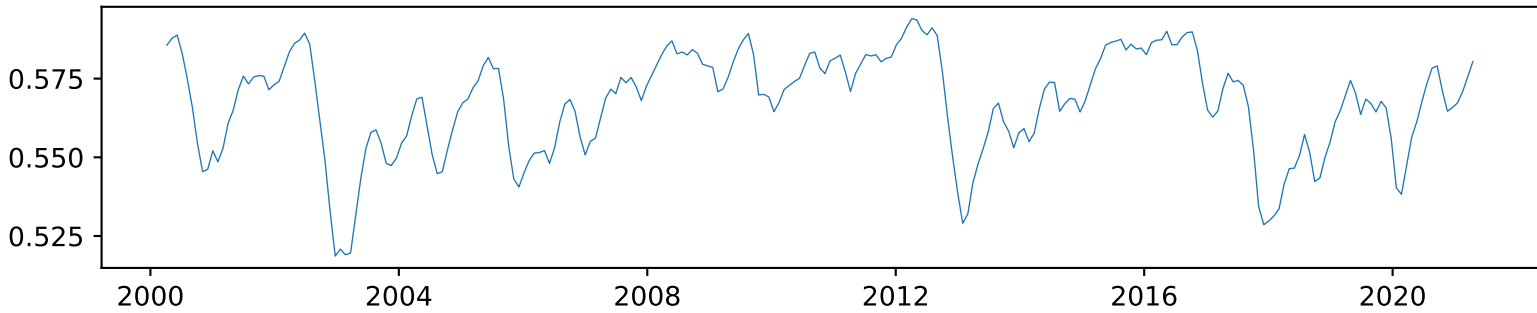
Average Absolute Deep Drainage (below 6m) (mm)



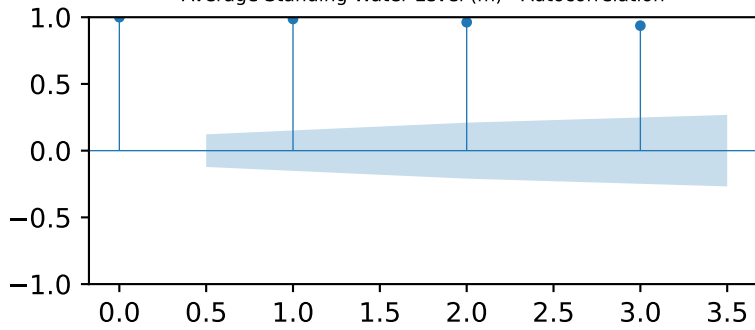
Average Evapotranspiration - Morton's Areal Actual Evapotranspiration (mm)



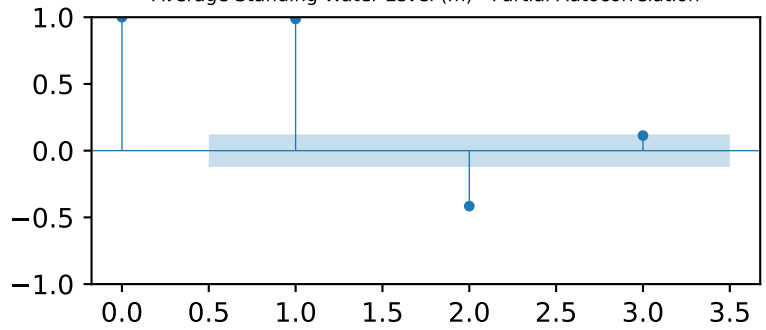
Average Absolute Deep Layer Soil Moisture (1-6m) (%)



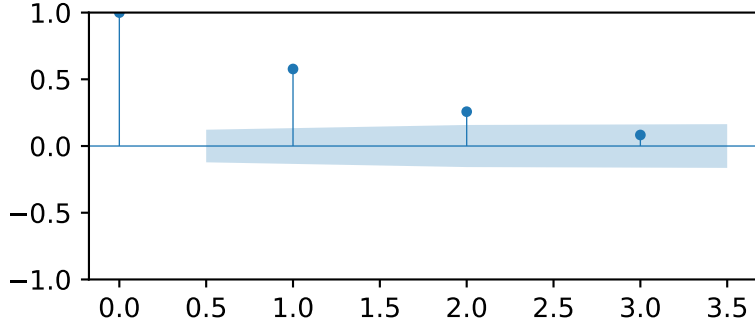
Average Standing Water Level (m) - Autocorrelation



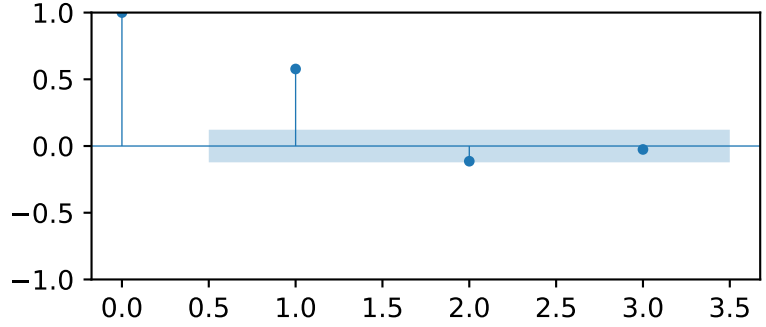
Average Standing Water Level (m) - Partial Autocorrelation



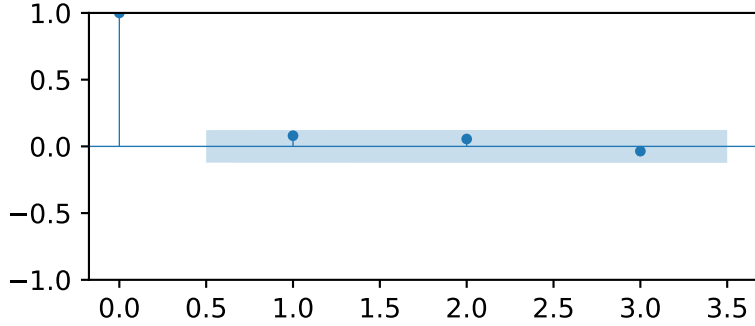
Average Absolute Root Zone Soil Moisture (0-100cm) (%) - Autocorrelation



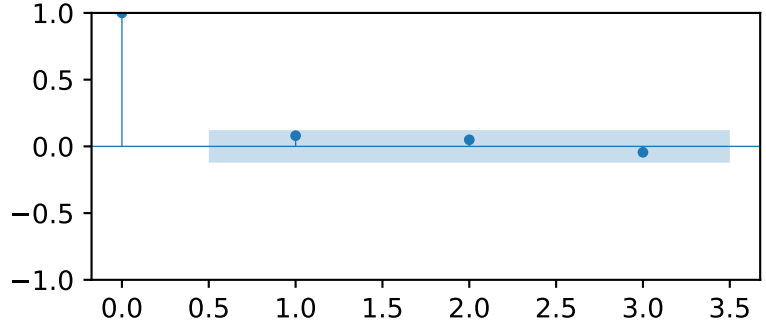
Average Absolute Root Zone Soil Moisture (0-100cm) (%) - Partial Autocorrelation



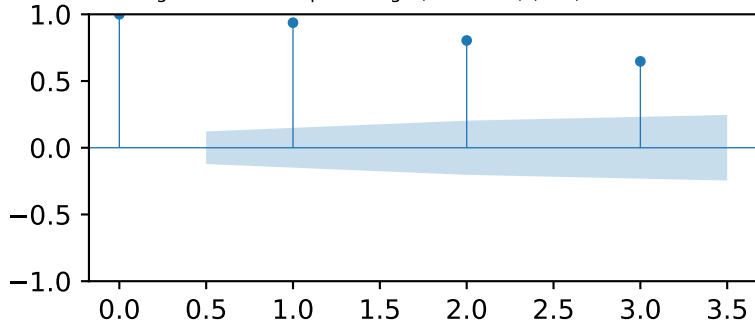
Average Absolute Upper Layer Soil Moisture (0-10cm) (%) - Autocorrelation



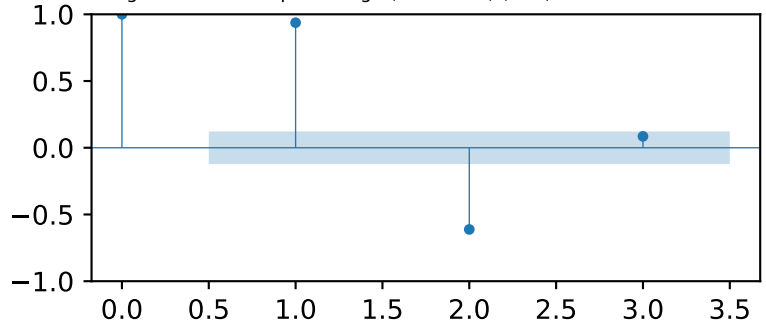
Average Absolute Upper Layer Soil Moisture (0-10cm) (%) - Partial Autocorrelation



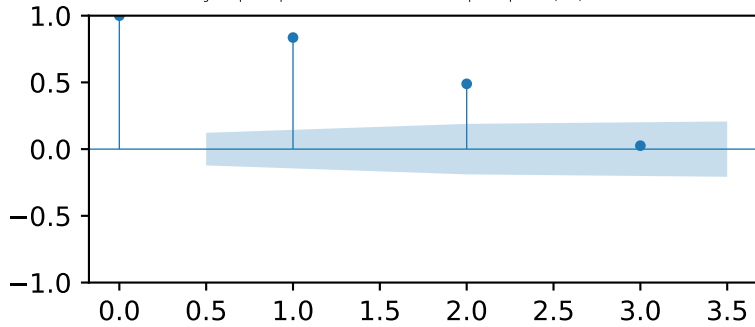
Average Absolute Deep Drainage (below 6m) (mm) - Autocorrelation



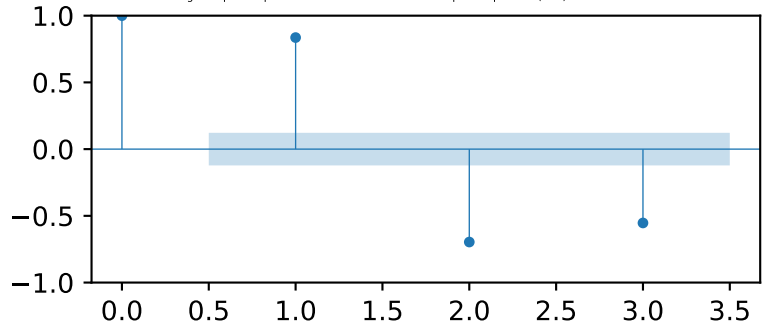
Average Absolute Deep Drainage (below 6m) (mm) - Partial Autocorrelation



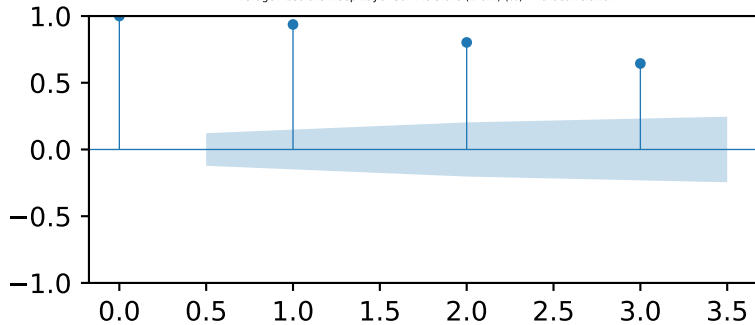
Average Evapotranspiration - Morton's Areal Actual Evapotranspiration (mm) - Autocorrelation



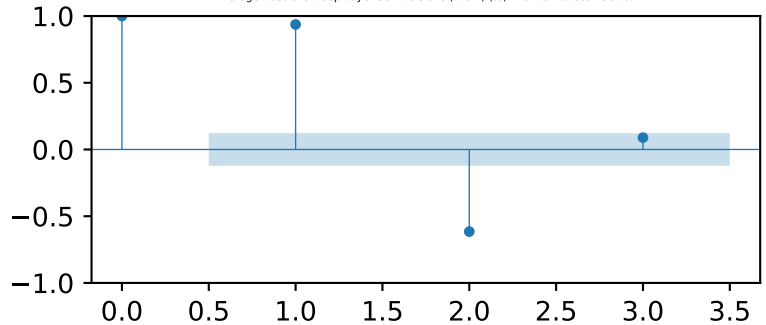
Average Evapotranspiration - Morton's Areal Actual Evapotranspiration (mm) - Partial Autocorrelation



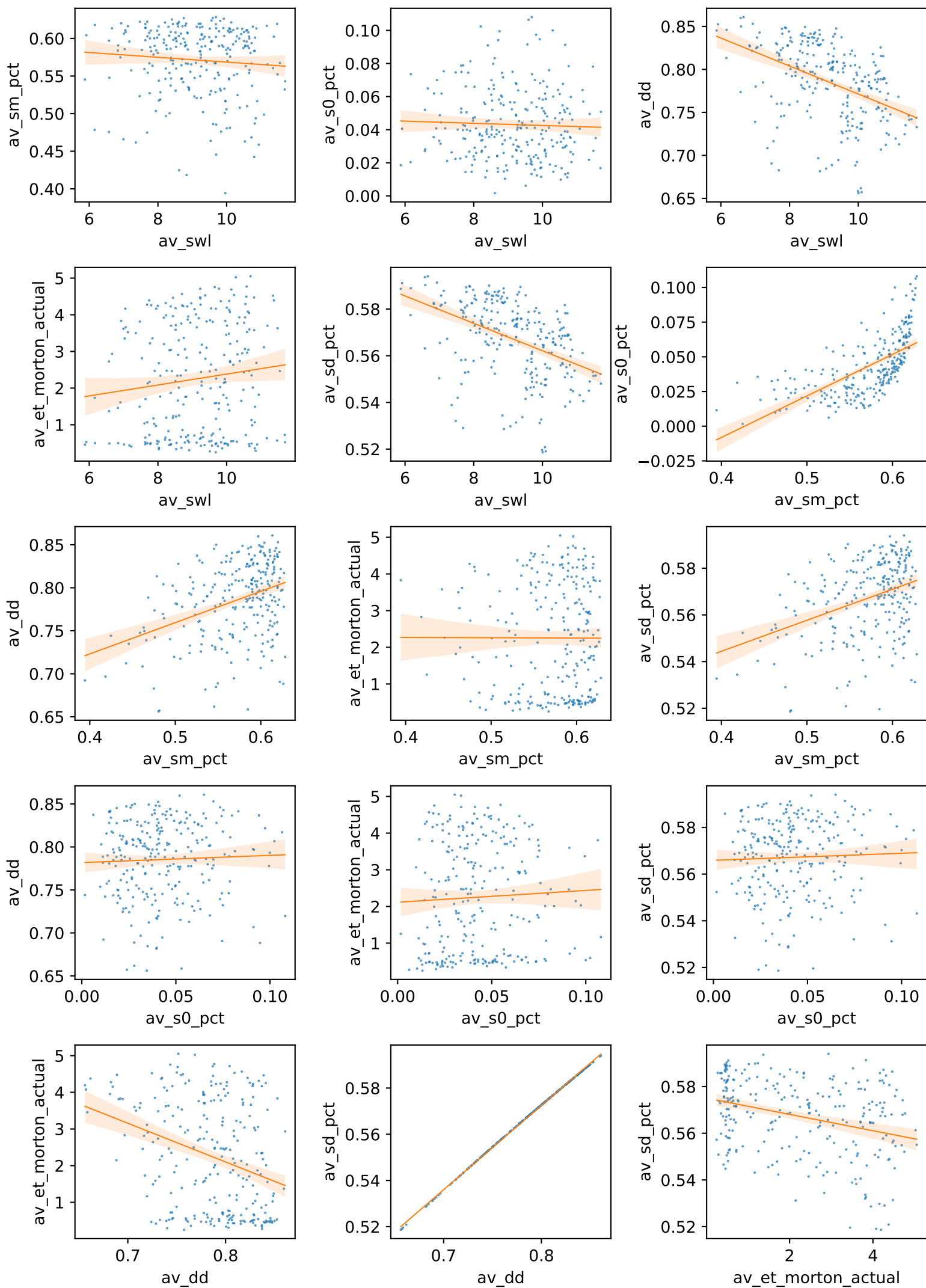
Average Absolute Deep Layer Soil Moisture (1-6m) (%) - Autocorrelation



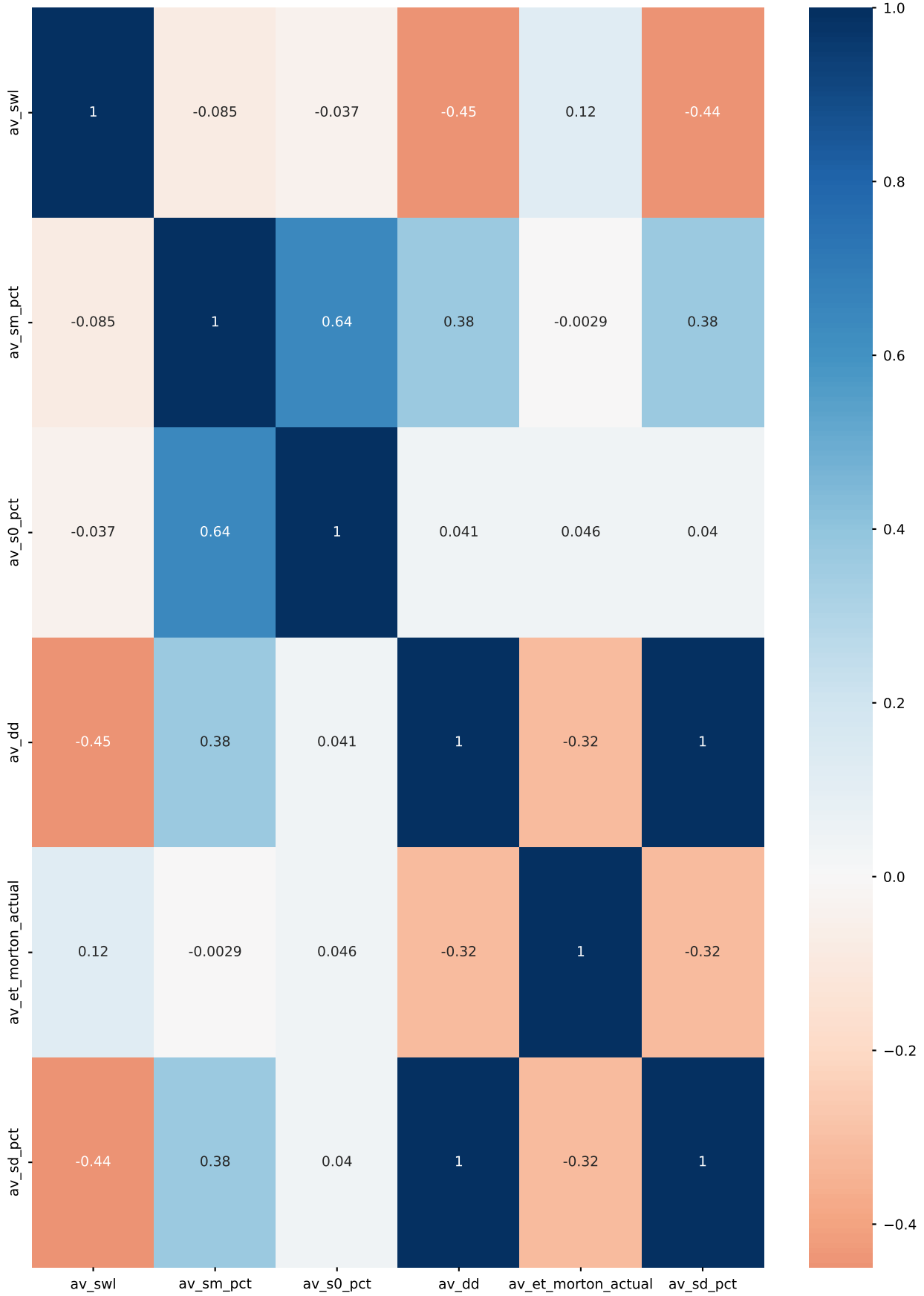
Average Absolute Deep Layer Soil Moisture (1-6m) (%) - Partial Autocorrelation



Input Variable Correlation



Input Variable Correlation Heatmap



<><> TensorFlow Keras LSTM Model <><>

Optimiser: adam  
Loss: mse  
Number of Epochs: 100  
Percentage of Training Data for Validation: 20.0%  
Time Series Order: Chronological  
Verbose: Off

<><> Model Architecture <><>

Input Shape (Samples, Timesteps, Features): (203, 3, 6)  
LSTM Layers: 1  
LSTM Cells per Layer: 64  
Fully Connected Hidden Layers: 2  
Fully Connected Hidden Neurons per Layer: 32  
Fully Connected Output Neurons: 1  
LSTM Dropout Rate: 20.0%  
LSTM Recurrent Dropout Rate: 20.0%

Model: "sequential\_20"

Layer (type)	Output Shape	Param #
=====		
lstm_20 (LSTM)	(None, 64)	18176
dense_60 (Dense)	(None, 32)	2080
dense_61 (Dense)	(None, 32)	1056
dense_62 (Dense)	(None, 1)	33
=====		
Total params: 21,345		
Trainable params: 21,345		
Non-trainable params: 0		

<><> Training Loss <><>

Epoch: 10,    Loss: 0.035274356603622437  
Epoch: 20,    Loss: 0.0315014123916626  
Epoch: 30,    Loss: 0.021791180595755577  
Epoch: 40,    Loss: 0.02080833911895752  
Epoch: 50,    Loss: 0.017660968005657196  
Epoch: 60,    Loss: 0.016931619495153427  
Epoch: 70,    Loss: 0.013716905377805233  
Epoch: 80,    Loss: 0.014012116007506847  
Epoch: 90,    Loss: 0.011355993337929249  
Epoch: 100,   Loss: 0.011517470702528954

<><> Validation Loss <><>

Epoch: 10, Loss: 0.00816439650952816  
Epoch: 20, Loss: 0.0036029317416250706  
Epoch: 30, Loss: 0.0013299272395670414  
Epoch: 40, Loss: 0.0015522305620834231  
Epoch: 50, Loss: 0.001996266655623913  
Epoch: 60, Loss: 0.0013930542627349496  
Epoch: 70, Loss: 0.0013720366405323148  
Epoch: 80, Loss: 0.0011367573169991374  
Epoch: 90, Loss: 0.0010987333953380585  
Epoch: 100, Loss: 0.001989677082747221

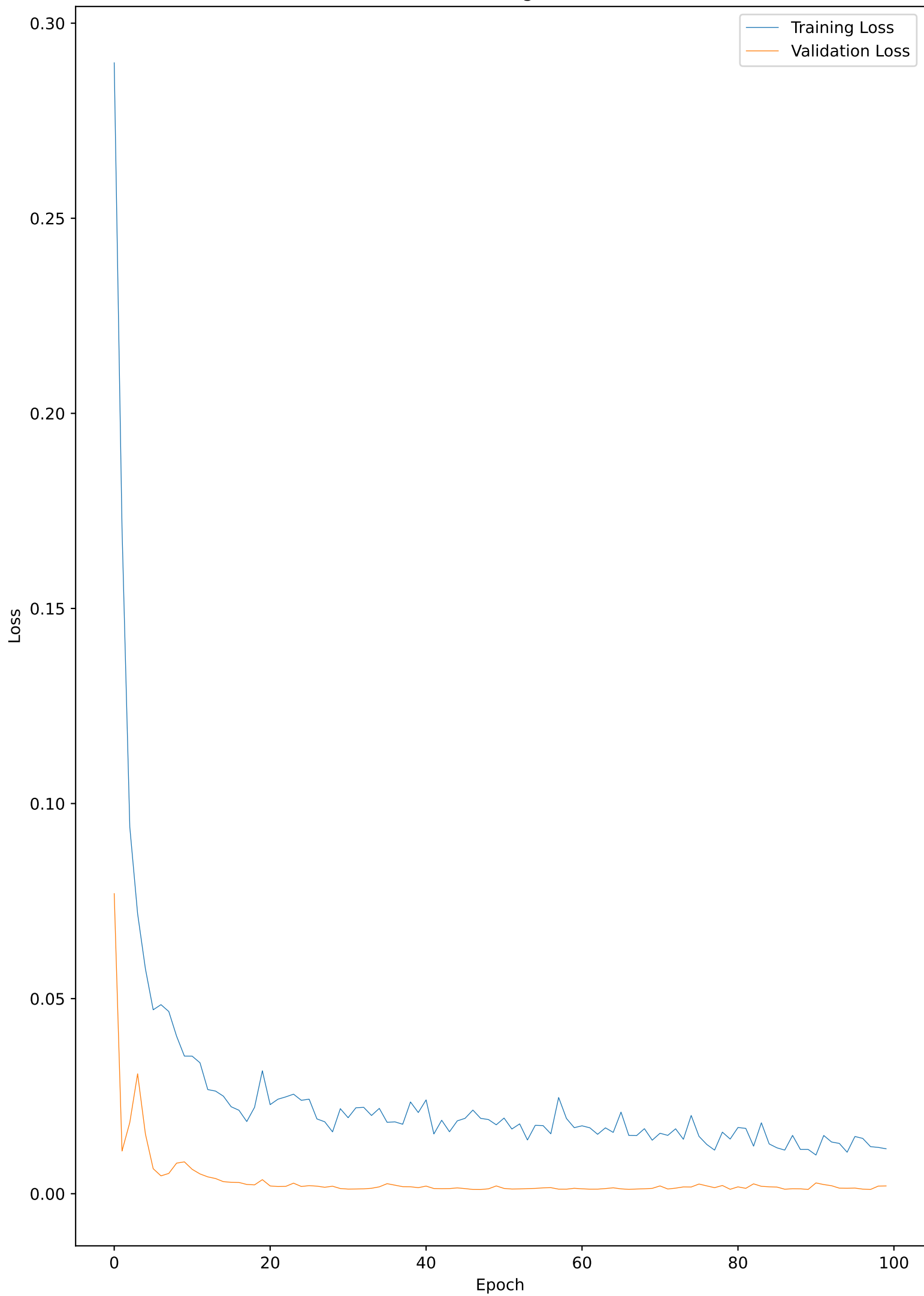
<><> Training Set Scores <><>

Train Root Mean Squared Error: 0.05223  
Train Mean Squared Error: 0.00273  
Train Normalised Root Mean Squared Error: 0.05223  
Train Coefficient of Determination: 0.94425  
Train Normalised Nash Sutcliffe Efficiency: 0.9472  
Train Mean Absolute Error: 0.04136  
Train Pearson's Correlation Coefficient: 0.98347  
Train Index of Agreement: 0.98418  
Train Kling-Gupta Efficiency: 0.871  
Train Mean Bias Error: -0.02461  
Train Mean Absolute Percentage Error: 0.0263

<><> Test Set Scores <><>

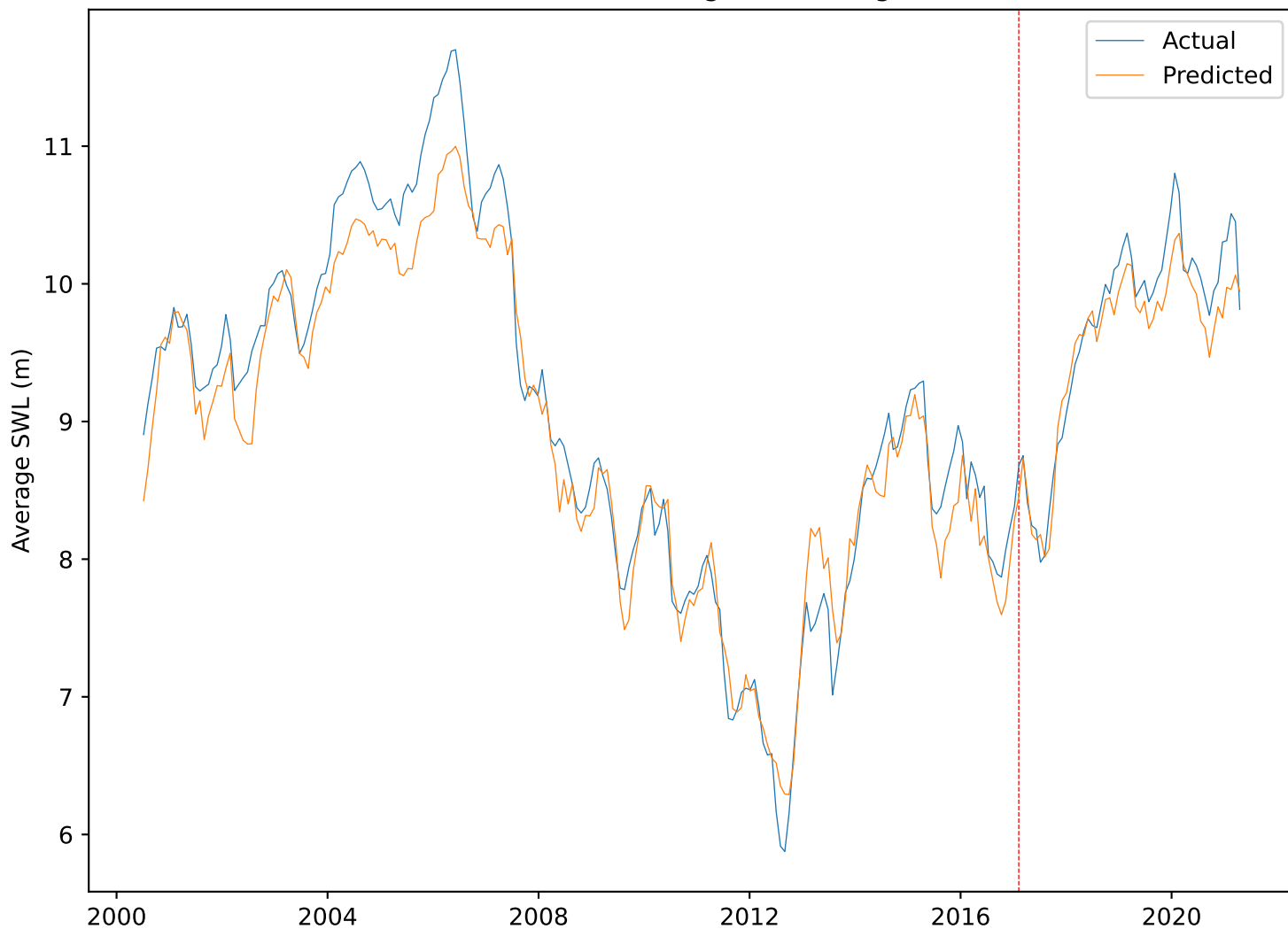
Test Root Mean Squared Error: 0.0405  
Test Mean Squared Error: 0.00164  
Test Normalised Root Mean Squared Error: 0.08349  
Test Coefficient of Determination: 0.89158  
Test Normalised Nash Sutcliffe Efficiency: 0.90219  
Test Mean Absolute Error: 0.0334  
Test Pearson's Correlation Coefficient: 0.96852  
Test Index of Agreement: 0.96876  
Test Kling-Gupta Efficiency: 0.85812  
Test Mean Bias Error: -0.02334  
Test Mean Absolute Percentage Error: 0.01968

LSTM Learning Curves

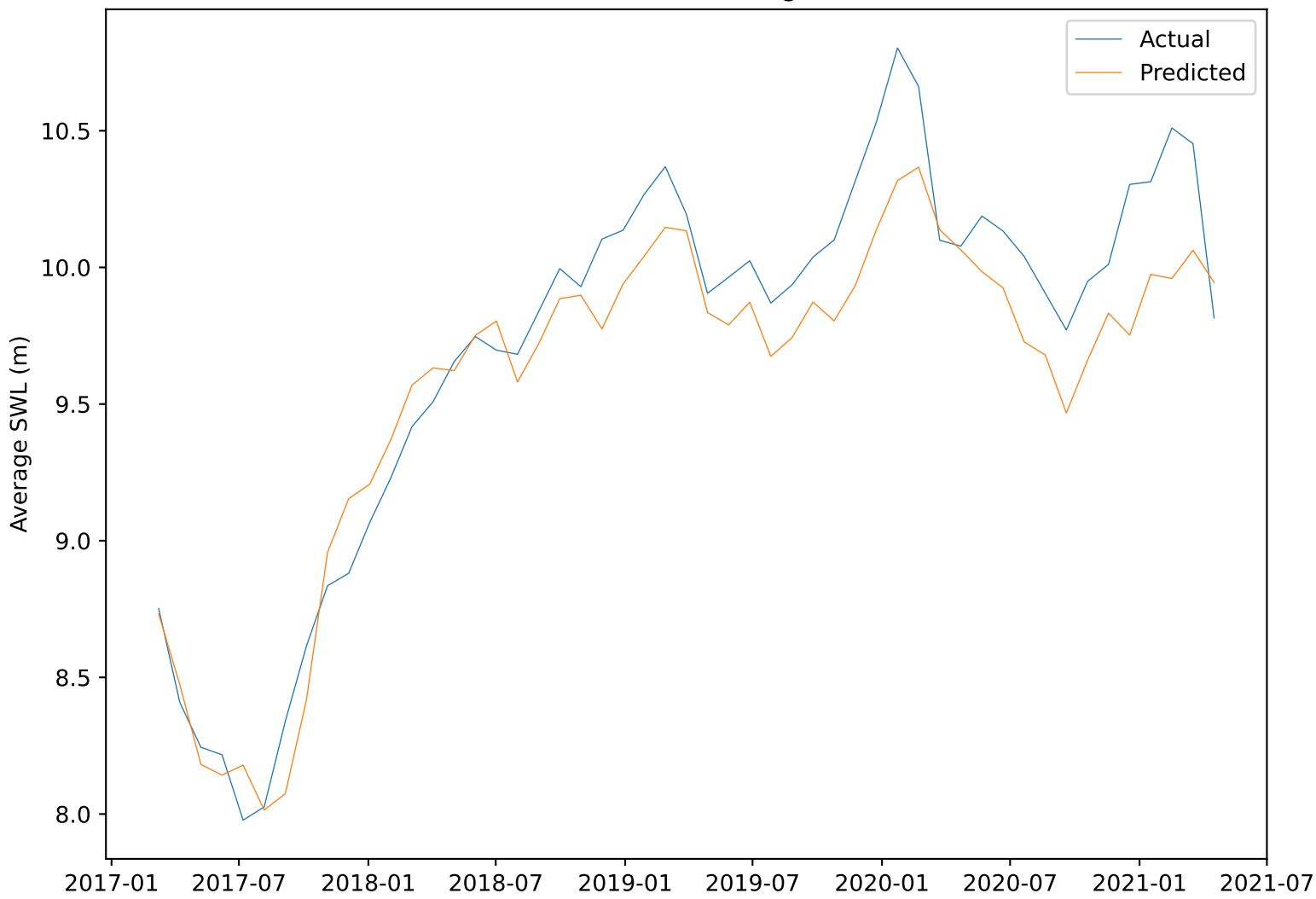




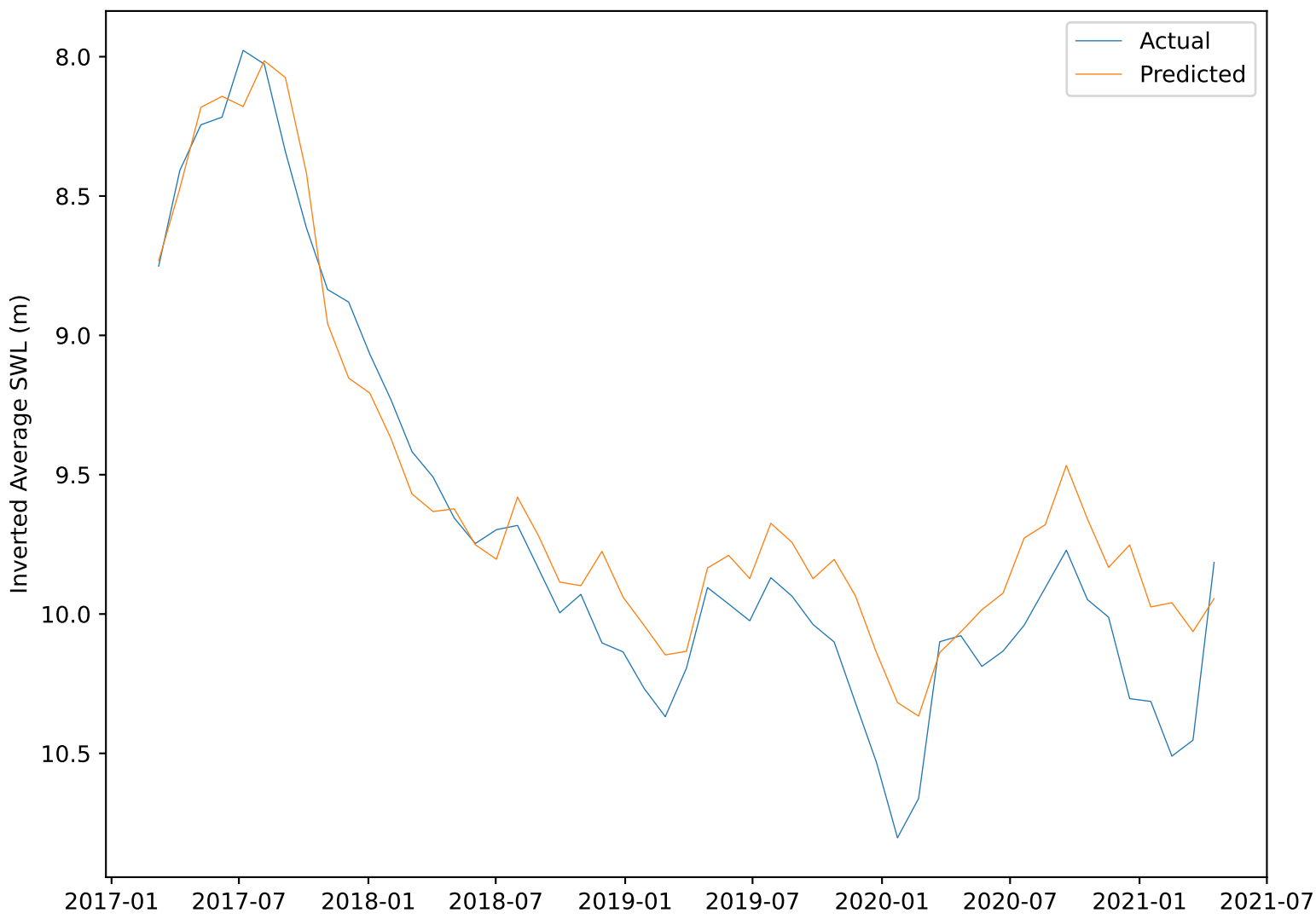
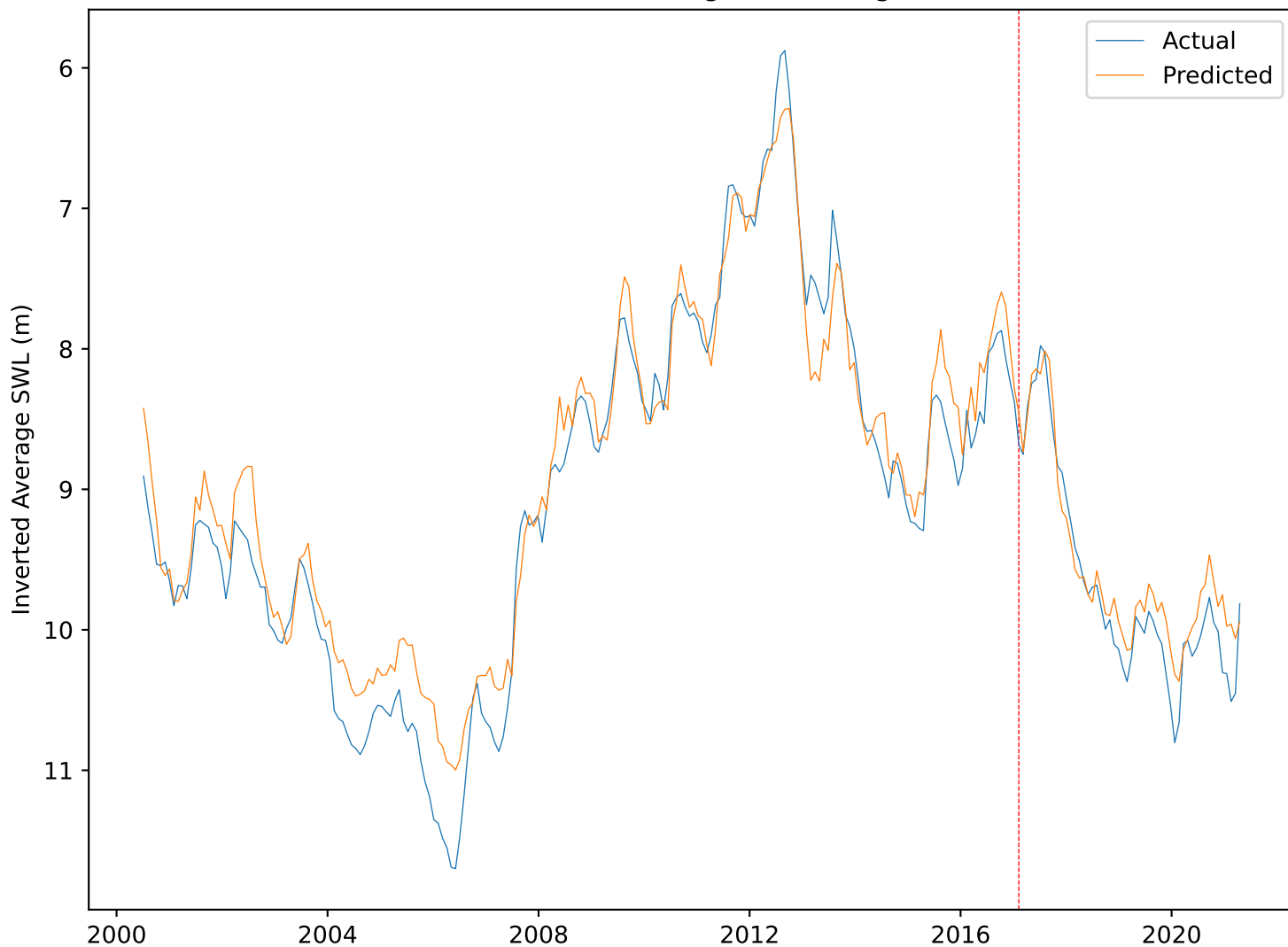
# LSTM Model: Training and Testing Sets



## LSTM Model: Testing Set



LSTM Model: Training and Testing Sets



<><> Scikit Learn SVR Model <><>

Kernel Function: rbf  
Kernel Coefficient: scale  
Epsilon: 0.1  
Stopping Criterion Tolerance: 1e-05  
Regularisation Parameter: 1.0  
Shrinking: True  
Time Series Order: Chronological  
Verbose: Off

<><> Model Architecture <><>

Number of Support Vectors: 26  
Input/Support Vector Size: 18

<><> 5-Fold Cross Validation Mean Training Loss <><>

Epoch: 10,	Loss: 0.002082817861608958
Epoch: 20,	Loss: 0.002532830696526749
Epoch: 30,	Loss: 0.003637429450888892
Epoch: 40,	Loss: 0.005064765630846782
Epoch: 50,	Loss: 0.005026847539975412
Epoch: 60,	Loss: 0.00463636753194459
Epoch: 70,	Loss: 0.004117808919399804
Epoch: 80,	Loss: 0.003836372128260012
Epoch: 90,	Loss: 0.0036554586221144193
Epoch: 100,	Loss: 0.003582342859121924

<><> 5-Fold Cross Validation Mean Validation Loss <><>

Epoch: 10,	Loss: 0.05766848657837981
Epoch: 20,	Loss: 0.06578325478345169
Epoch: 30,	Loss: 0.06251018858623666
Epoch: 40,	Loss: 0.06161097582223202
Epoch: 50,	Loss: 0.06232558392948971
Epoch: 60,	Loss: 0.0507787883129817
Epoch: 70,	Loss: 0.030149945607059147
Epoch: 80,	Loss: 0.023433401858271117
Epoch: 90,	Loss: 0.023476870812265564
Epoch: 100,	Loss: 0.022306445246000763

<><> Training Set Scores <><>

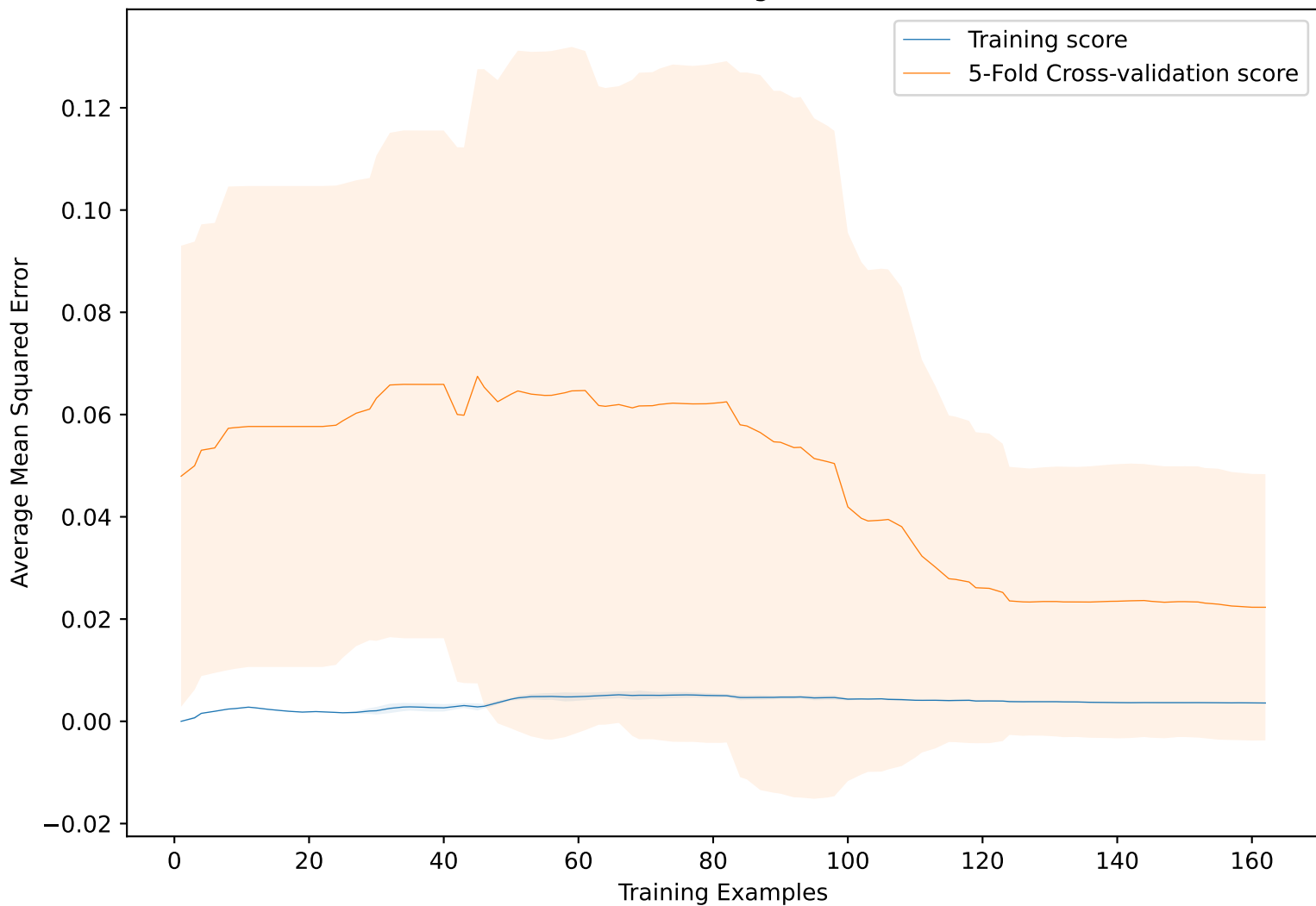
Train Root Mean Squared Error: 0.05669  
Train Mean Squared Error: 0.00321  
Train Normalised Root Mean Squared Error: 0.05669  
Train Coefficient of Determination: 0.93432  
Train Normalised Nash Sutcliffe Efficiency: 0.93837

Train Mean Absolute Error: 0.04662  
Train Pearson's Correlation Coefficient: 0.97472  
Train Index of Agreement: 0.98077  
Train Kling-Gupta Efficiency: 0.85483  
Train Mean Bias Error: -0.01045  
Train Mean Absolute Percentage Error: 0.03091

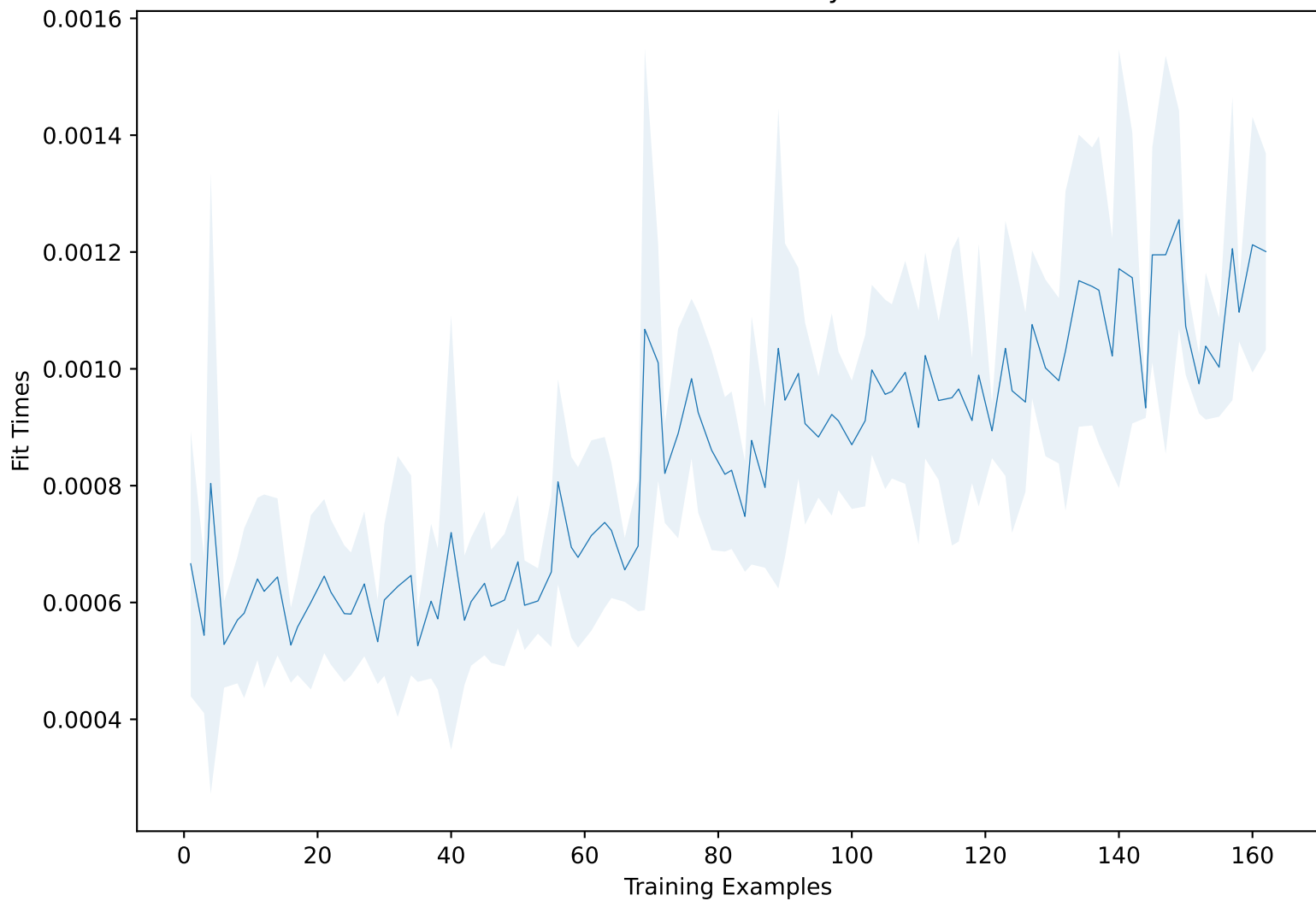
<><> Test Set Scores <><>

Test Root Mean Squared Error: 0.02913  
Test Mean Squared Error: 0.00085  
Test Normalised Root Mean Squared Error: 0.06006  
Test Coefficient of Determination: 0.9439  
Test Normalised Nash Sutcliffe Efficiency: 0.94688  
Test Mean Absolute Error: 0.02348  
Test Pearson's Correlation Coefficient: 0.98094  
Test Index of Agreement: 0.98411  
Test Kling-Gupta Efficiency: 0.88153  
Test Mean Bias Error: -0.01168  
Test Mean Absolute Percentage Error: 0.01416

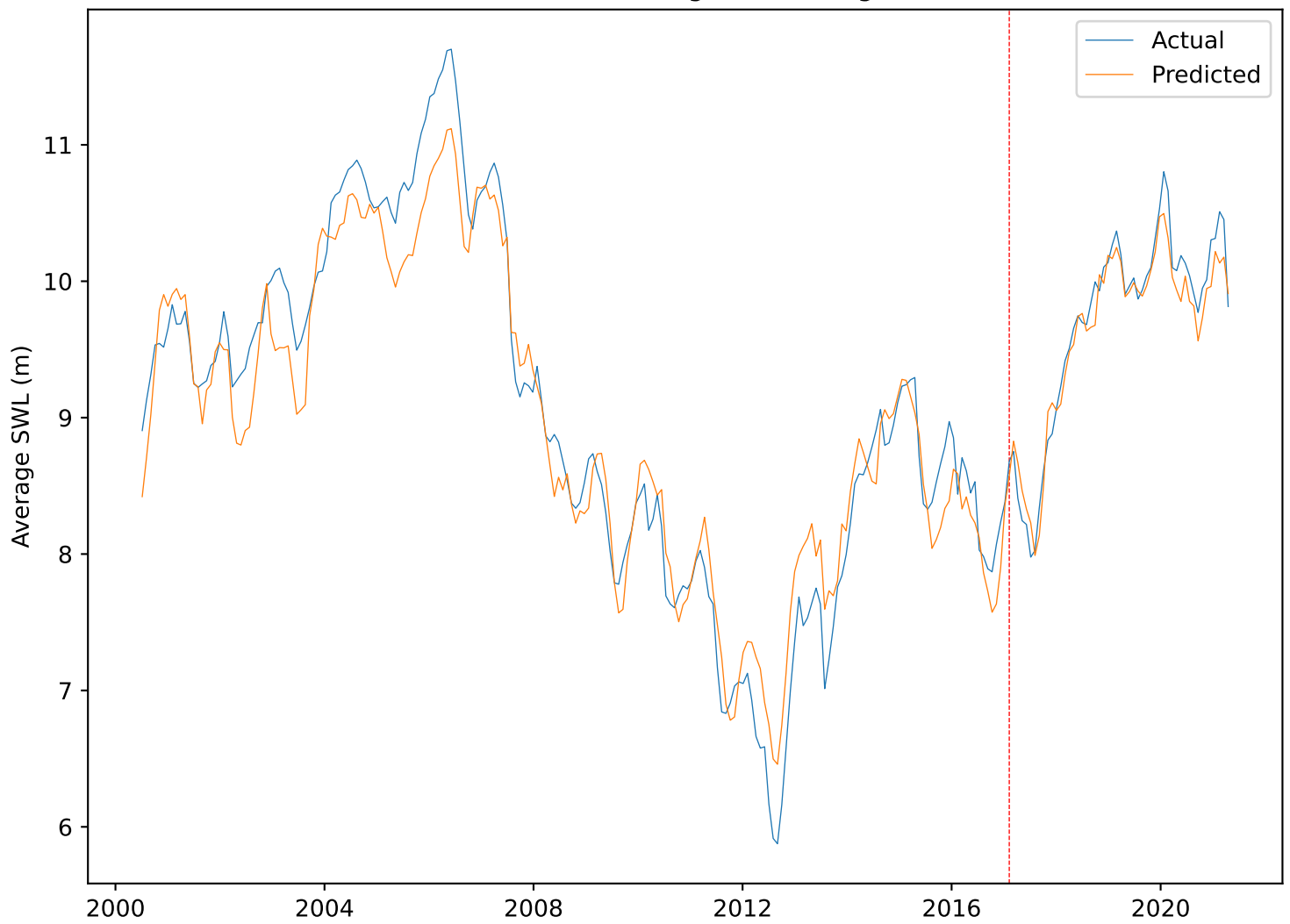
SVR Learning Curve



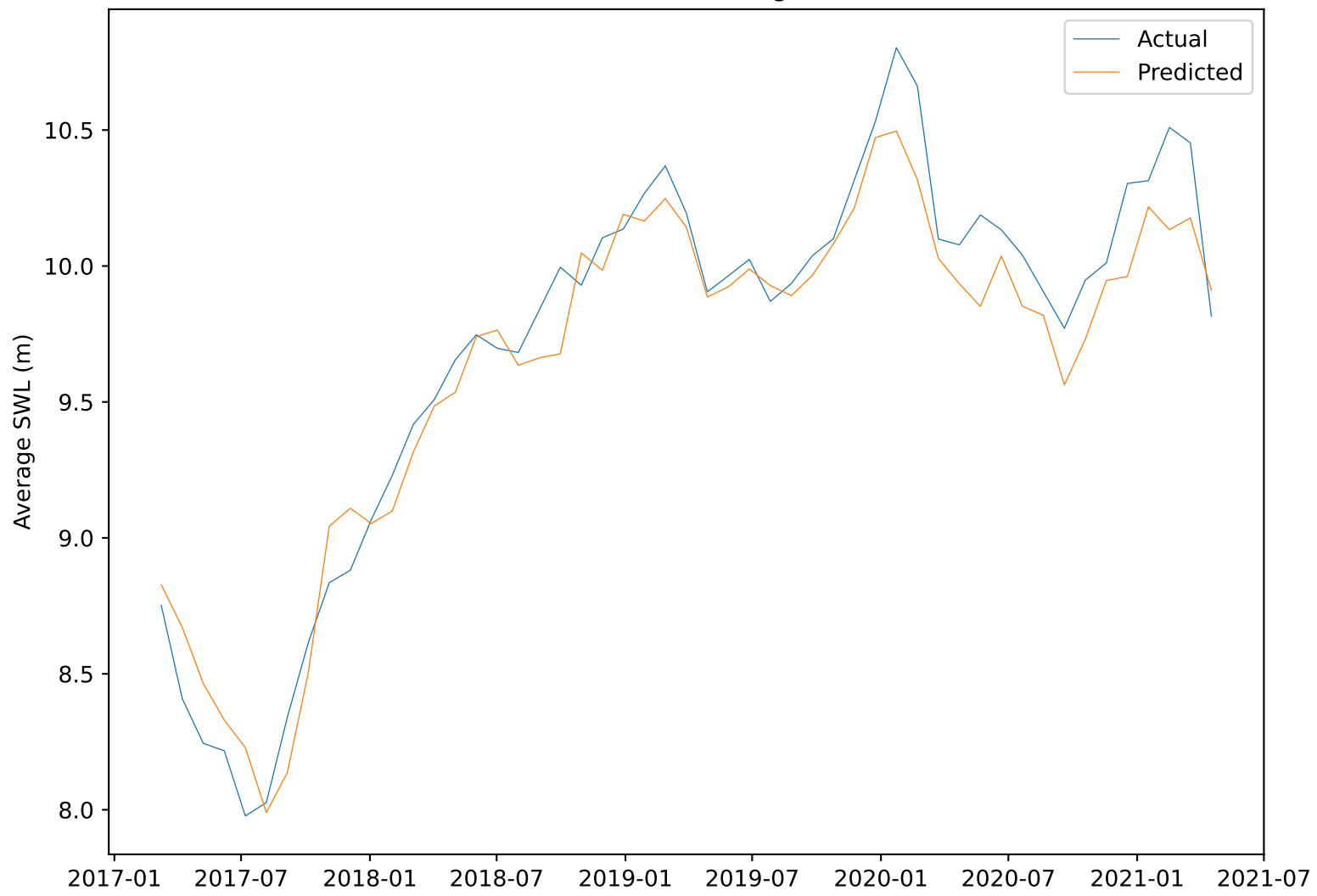
Model Scalability



SVR Model: Training and Testing Sets



SVR Model: Testing Set



SVR Model: Training and Testing Sets

