

<><> Time Stamp <><>

Code started: 09/10/2022 - 16:39:46

Total Run Time: 17.118 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 Absolute Lower Layer Soil Moisture (10-100cm) (%)

<><> 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%

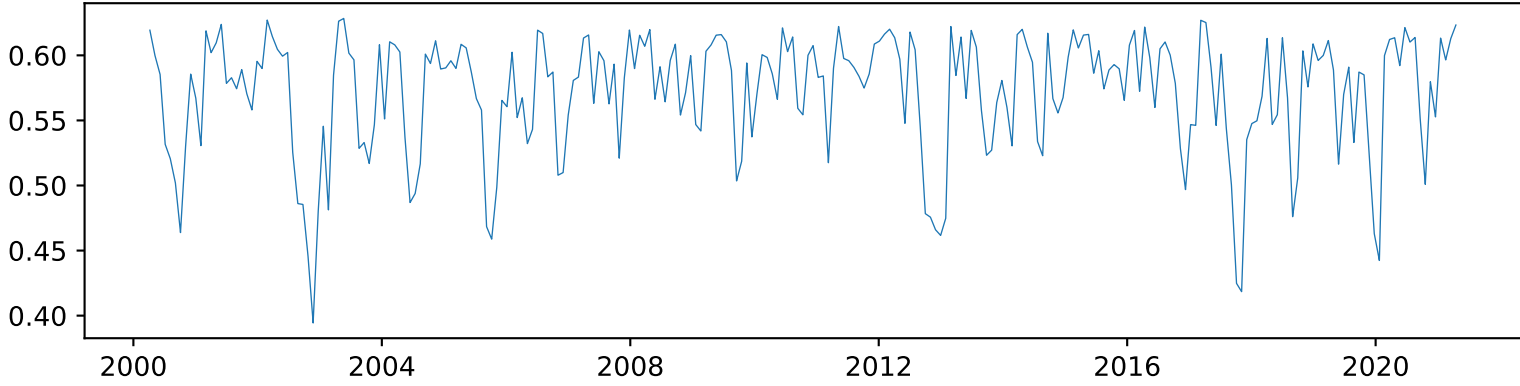
Quality Code: E, Number: 695, Percentage: 9.0%

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

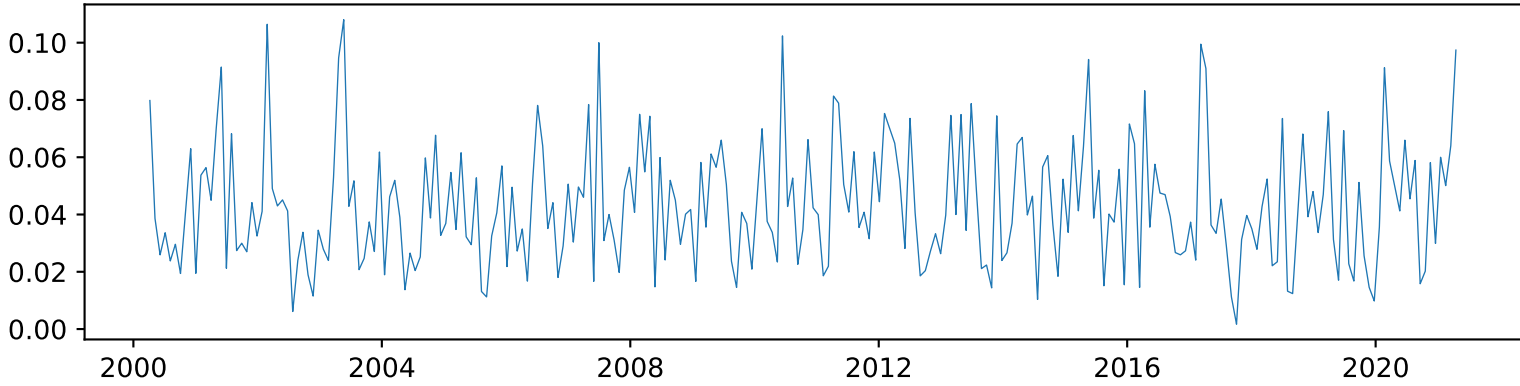
Average Standing Water Level (m)



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



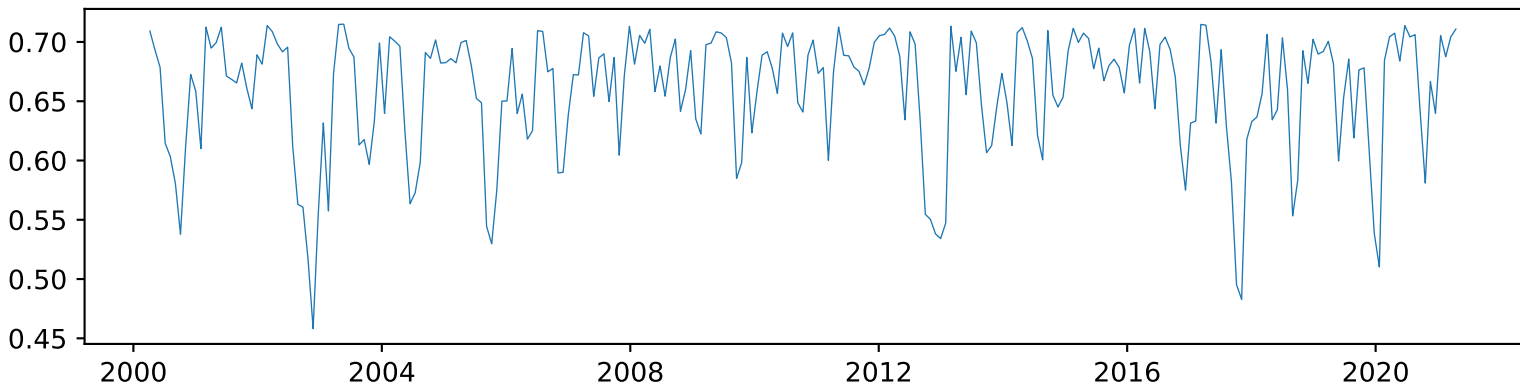
Average Absolute Upper Layer Soil Moisture (0-10cm) (%)



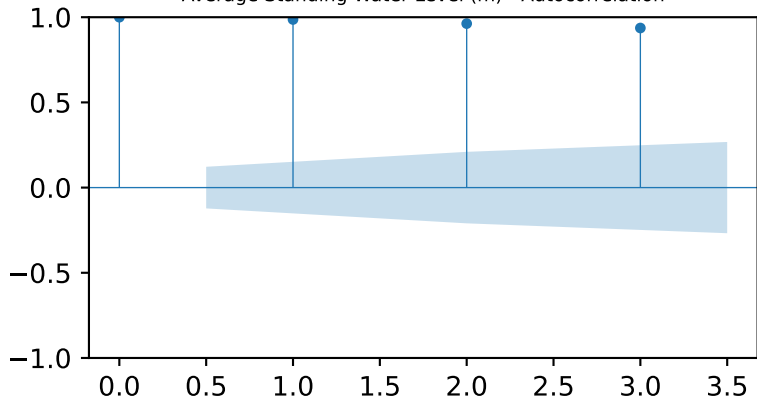
Average Absolute Deep Drainage (below 6m) (mm)



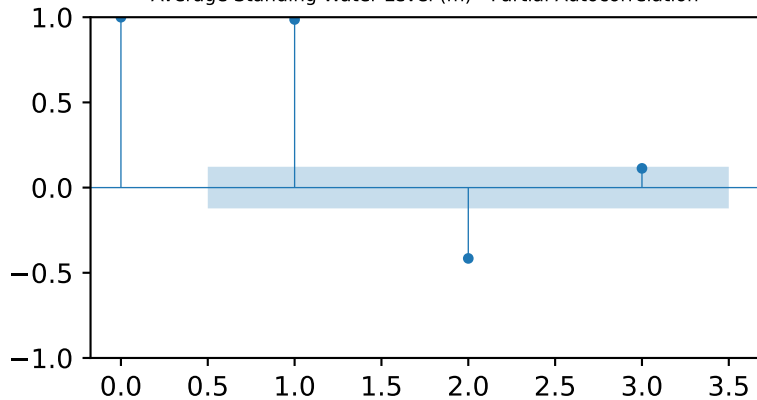
Average Absolute Lower Layer Soil Moisture (10-100cm) (%)



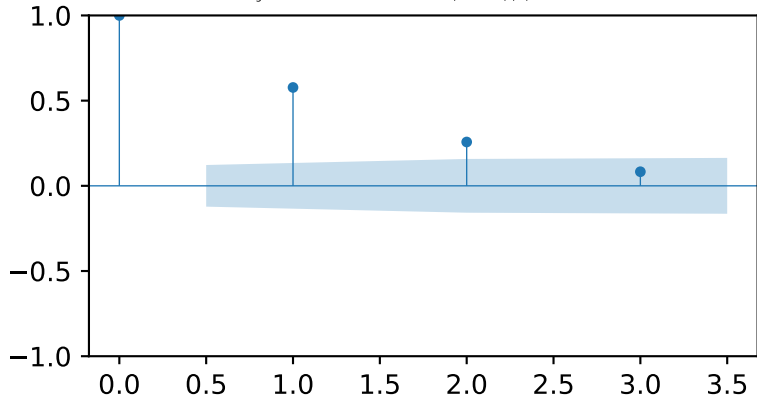
Average Standing Water Level (m) - Autocorrelation



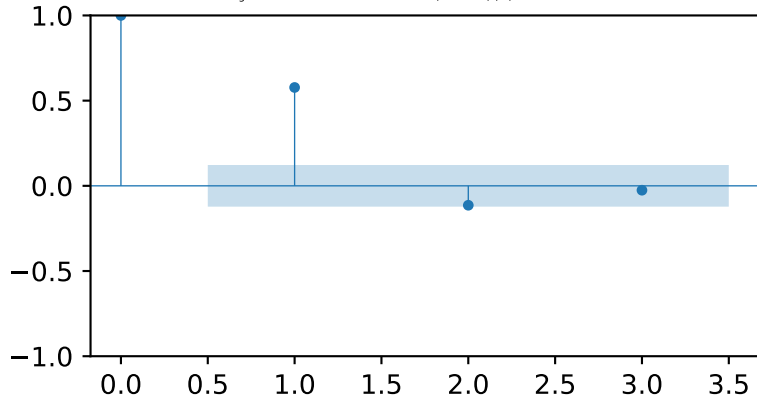
Average Standing Water Level (m) - Partial Autocorrelation



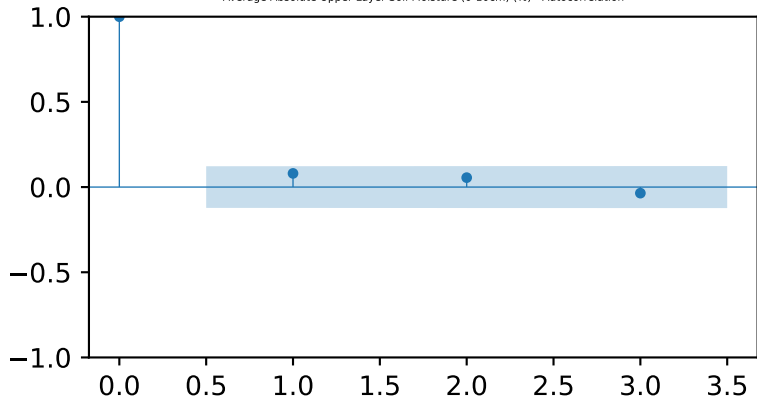
Average Absolute Root Zone Soil Moisture (0-100cm) (%) - Autocorrelation



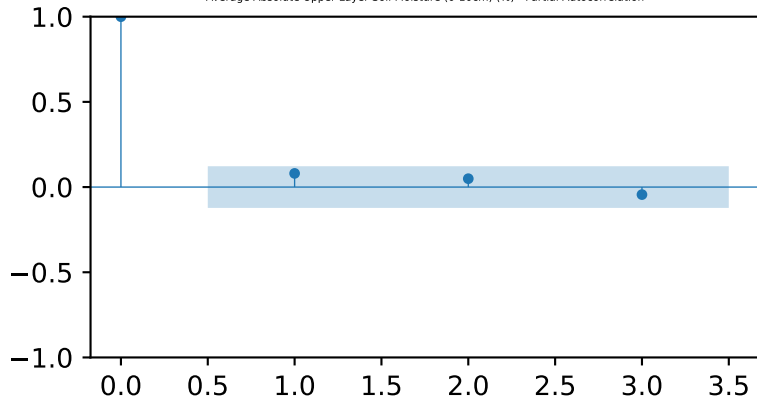
Average Absolute Root Zone Soil Moisture (0-100cm) (%) - Partial Autocorrelation



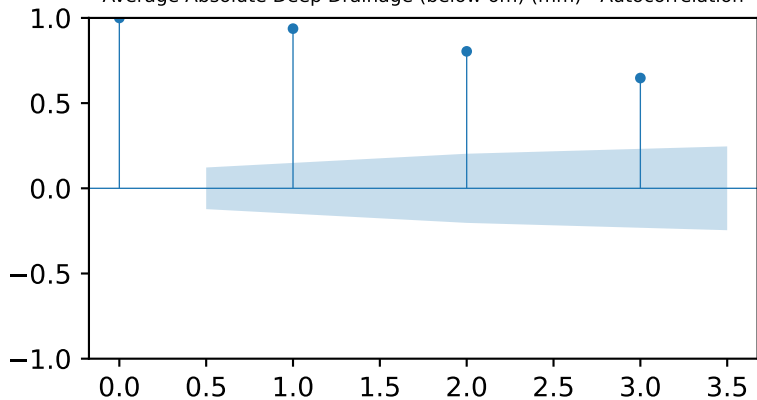
Average Absolute Upper Layer Soil Moisture (0-10cm) (%) - Autocorrelation



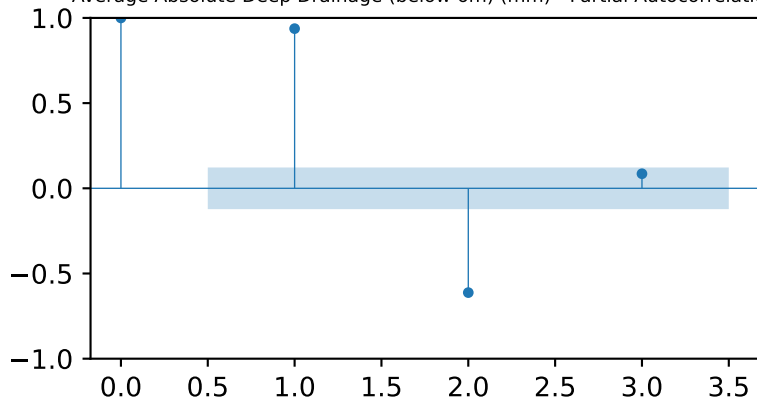
Average Absolute Upper Layer Soil Moisture (0-10cm) (%) - Partial Autocorrelation



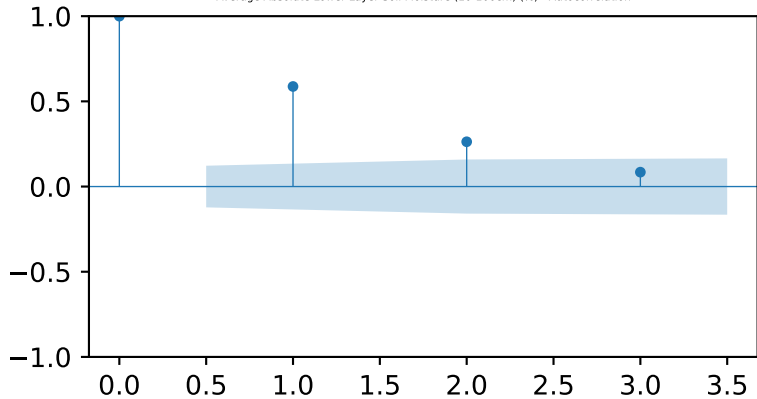
Average Absolute Deep Drainage (below 6m) (mm) - Autocorrelation



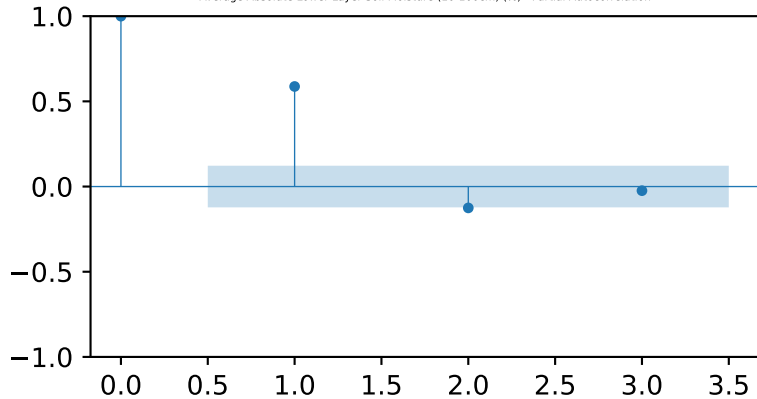
Average Absolute Deep Drainage (below 6m) (mm) - Partial Autocorrelation



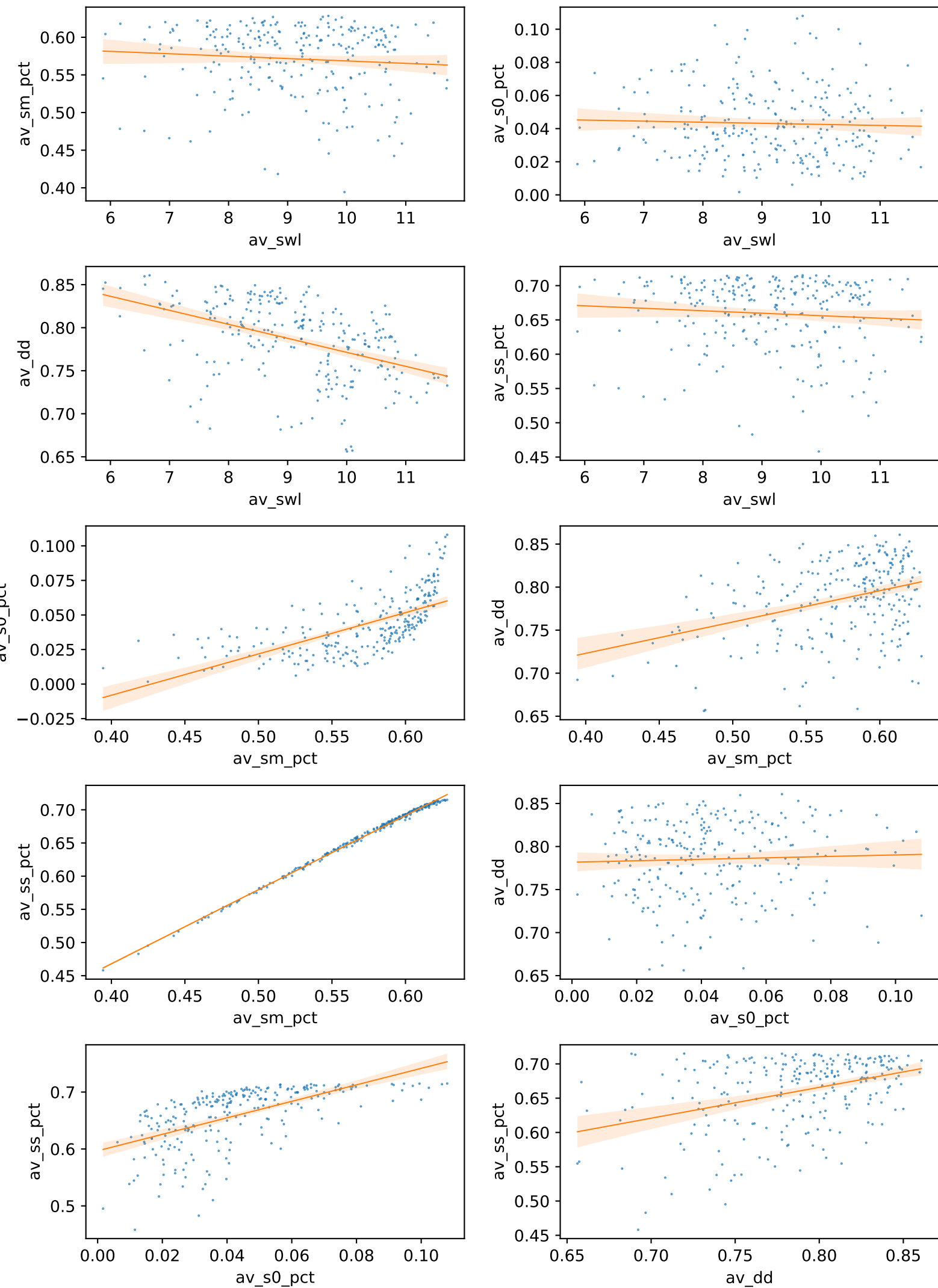
Average Absolute Lower Layer Soil Moisture (10-100cm) (%) - Autocorrelation



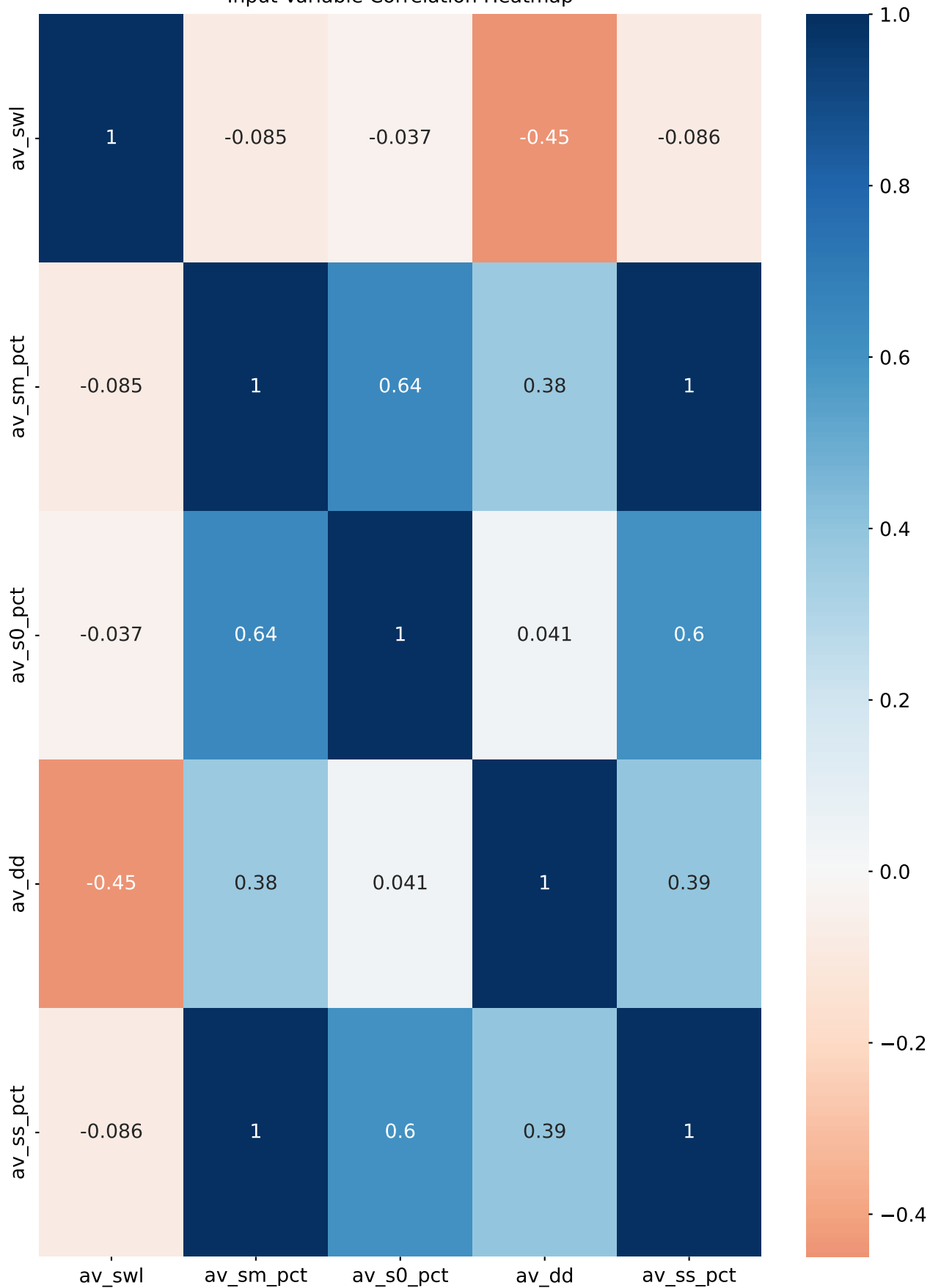
Average Absolute Lower Layer Soil Moisture (10-100cm) (%) - Partial Autocorrelation



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, 5)  
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\_35"

Layer (type)	Output Shape	Param #
=====		
lstm_35 (LSTM)	(None, 64)	17920
dense_105 (Dense)	(None, 32)	2080
dense_106 (Dense)	(None, 32)	1056
dense_107 (Dense)	(None, 1)	33
=====		
Total params: 21,089		
Trainable params: 21,089		
Non-trainable params: 0		
=====		

<><> Training Loss <><>

Epoch: 10,    Loss: 0.04034193232655525  
Epoch: 20,    Loss: 0.019753076136112213  
Epoch: 30,    Loss: 0.019578836858272552  
Epoch: 40,    Loss: 0.016382750123739243  
Epoch: 50,    Loss: 0.021208928897976875  
Epoch: 60,    Loss: 0.016281522810459137  
Epoch: 70,    Loss: 0.017626050859689713  
Epoch: 80,    Loss: 0.01615346409380436  
Epoch: 90,    Loss: 0.014022188261151314  
Epoch: 100,   Loss: 0.011251519434154034

<><> Validation Loss <><>

Epoch: 10, Loss: 0.004585034679621458  
Epoch: 20, Loss: 0.005553011316806078  
Epoch: 30, Loss: 0.0012112959520891309  
Epoch: 40, Loss: 0.0012010602513328195  
Epoch: 50, Loss: 0.0011221495224162936  
Epoch: 60, Loss: 0.0011158585548400879  
Epoch: 70, Loss: 0.0011326142121106386  
Epoch: 80, Loss: 0.0024936411064118147  
Epoch: 90, Loss: 0.0016451732954010367  
Epoch: 100, Loss: 0.00119327986612916

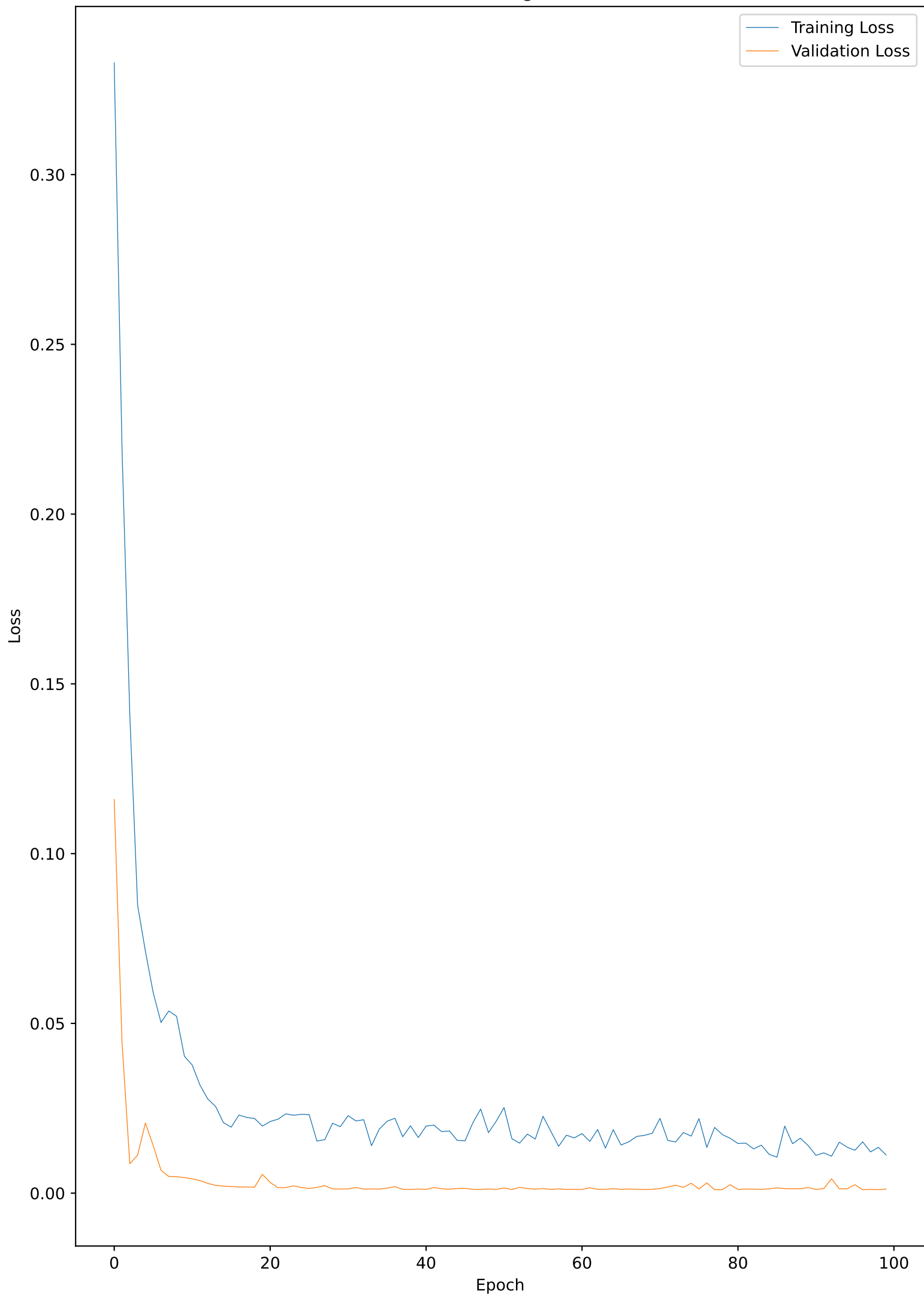
<><> Training Set Scores <><>

Train Root Mean Squared Error: 0.04585  
Train Mean Squared Error: 0.0021  
Train Normalised Root Mean Squared Error: 0.04585  
Train Coefficient of Determination: 0.95704  
Train Normalised Nash Sutcliffe Efficiency: 0.95881  
Train Mean Absolute Error: 0.03581  
Train Pearson's Correlation Coefficient: 0.98439  
Train Index of Agreement: 0.98782  
Train Kling-Gupta Efficiency: 0.88179  
Train Mean Bias Error: -0.00978  
Train Mean Absolute Percentage Error: 0.02321

<><> Test Set Scores <><>

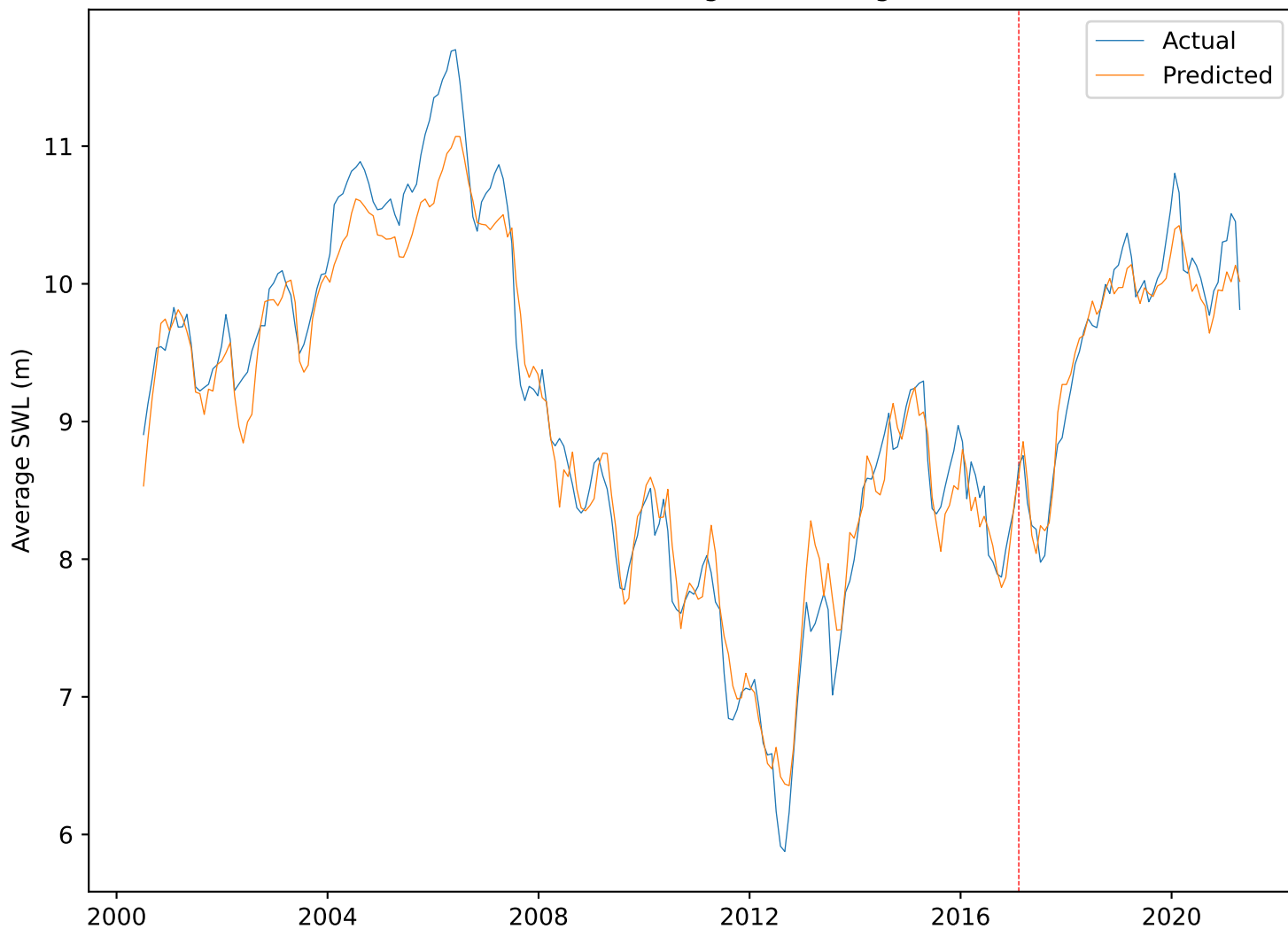
Test Root Mean Squared Error: 0.03338  
Test Mean Squared Error: 0.00111  
Test Normalised Root Mean Squared Error: 0.06881  
Test Coefficient of Determination: 0.92637  
Test Normalised Nash Sutcliffe Efficiency: 0.93142  
Test Mean Absolute Error: 0.02739  
Test Pearson's Correlation Coefficient: 0.97058  
Test Index of Agreement: 0.97861  
Test Kling-Gupta Efficiency: 0.86378  
Test Mean Bias Error: -0.00876  
Test Mean Absolute Percentage Error: 0.01639

LSTM Learning Curves

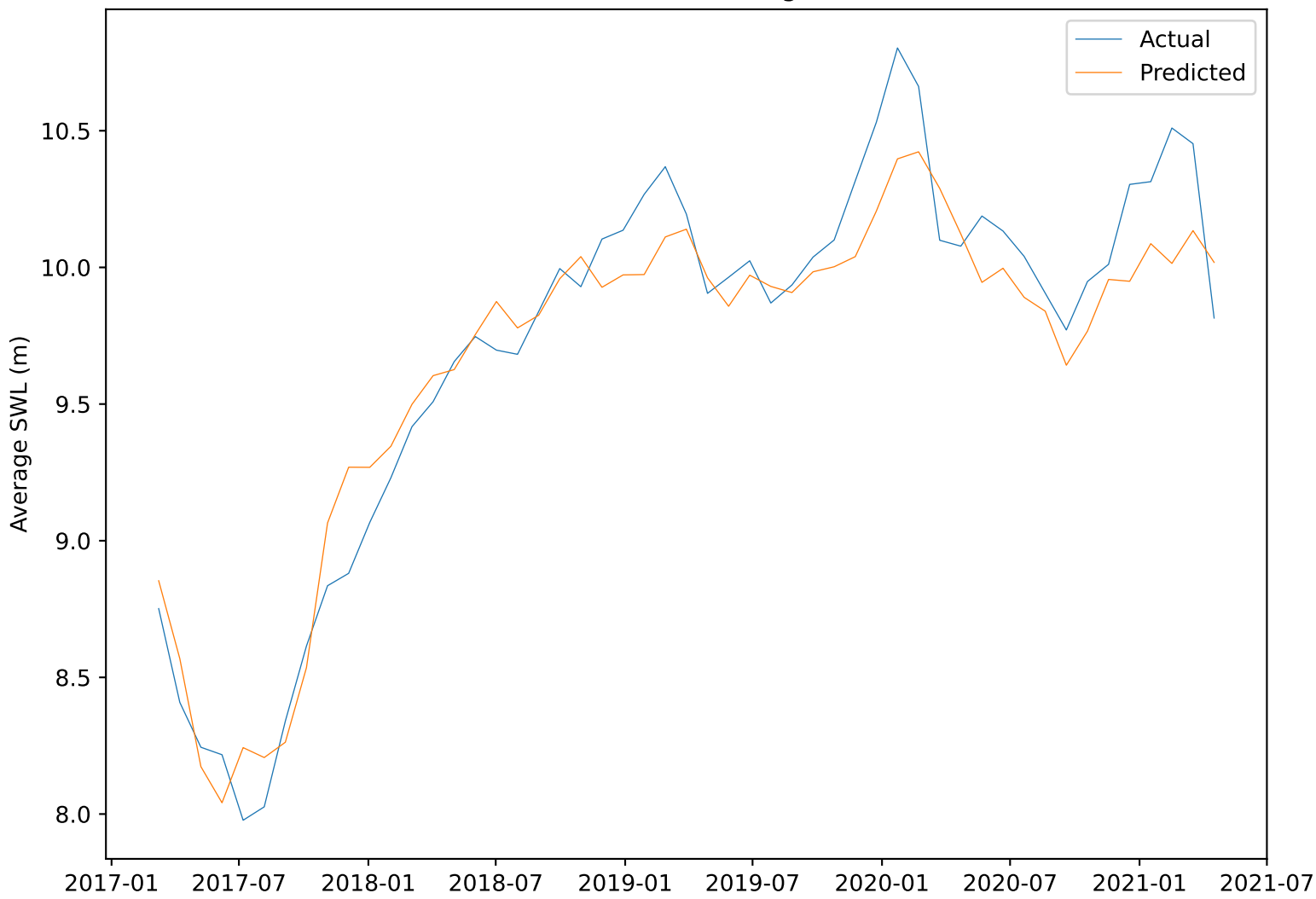




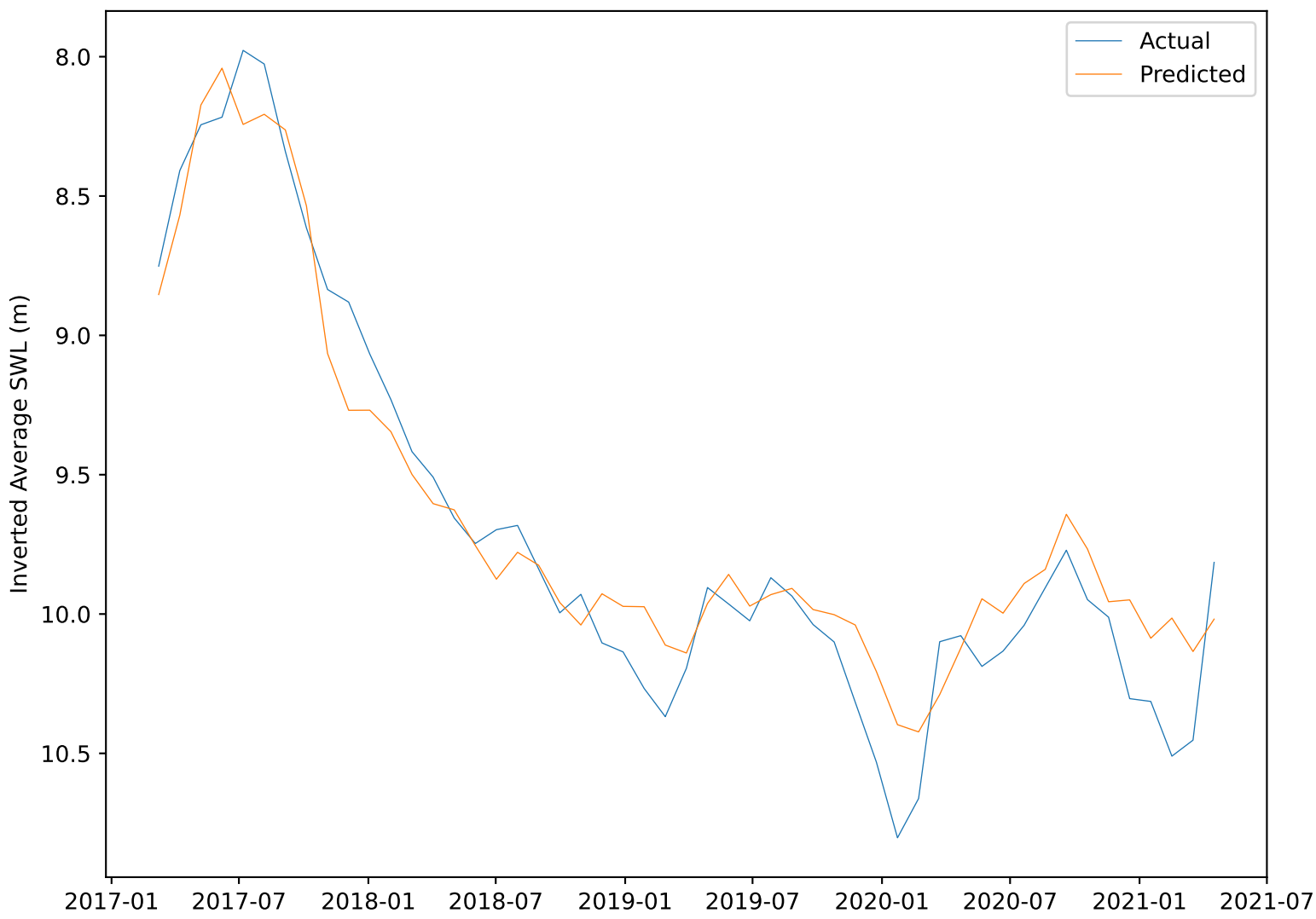
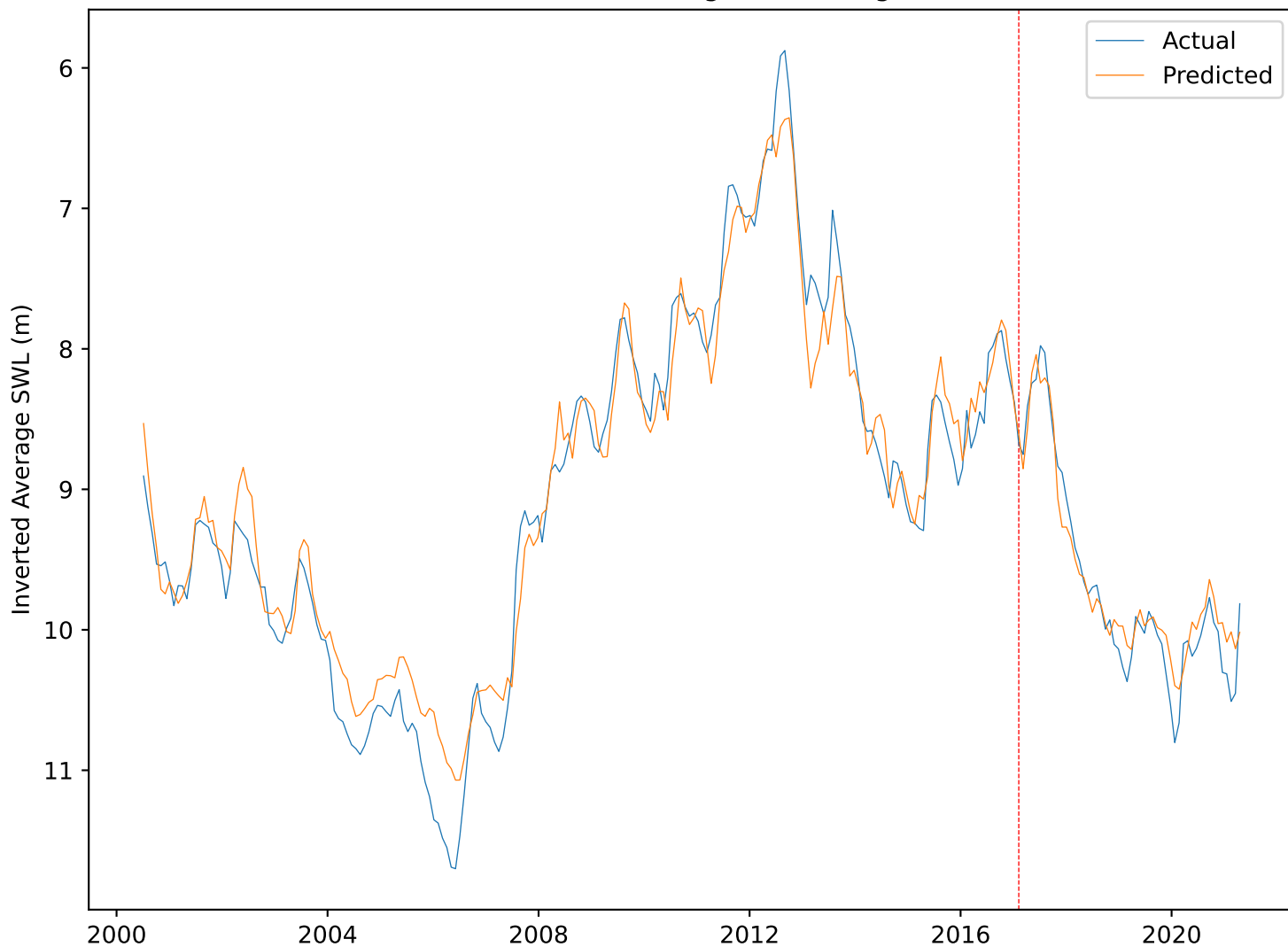
# LSTM Model: Training and Testing Sets



## 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: 23  
Input/Support Vector Size: 15

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

Epoch: 10,	Loss: 0.002082817861608958
Epoch: 20,	Loss: 0.0025816637679063276
Epoch: 30,	Loss: 0.003752805776197263
Epoch: 40,	Loss: 0.004606345575939026
Epoch: 50,	Loss: 0.004487746792444732
Epoch: 60,	Loss: 0.004007719253425821
Epoch: 70,	Loss: 0.003635547081787603
Epoch: 80,	Loss: 0.003448795545357574
Epoch: 90,	Loss: 0.0033432311227071542
Epoch: 100,	Loss: 0.0032583448706020707

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

Epoch: 10,	Loss: 0.05766848657837981
Epoch: 20,	Loss: 0.06548390013629501
Epoch: 30,	Loss: 0.05742734238335985
Epoch: 40,	Loss: 0.05878082971434597
Epoch: 50,	Loss: 0.06138535680101713
Epoch: 60,	Loss: 0.05067357506651662
Epoch: 70,	Loss: 0.0294323649560101
Epoch: 80,	Loss: 0.021072964048716173
Epoch: 90,	Loss: 0.021289440171868425
Epoch: 100,	Loss: 0.021019889660233777

<><> Training Set Scores <><>

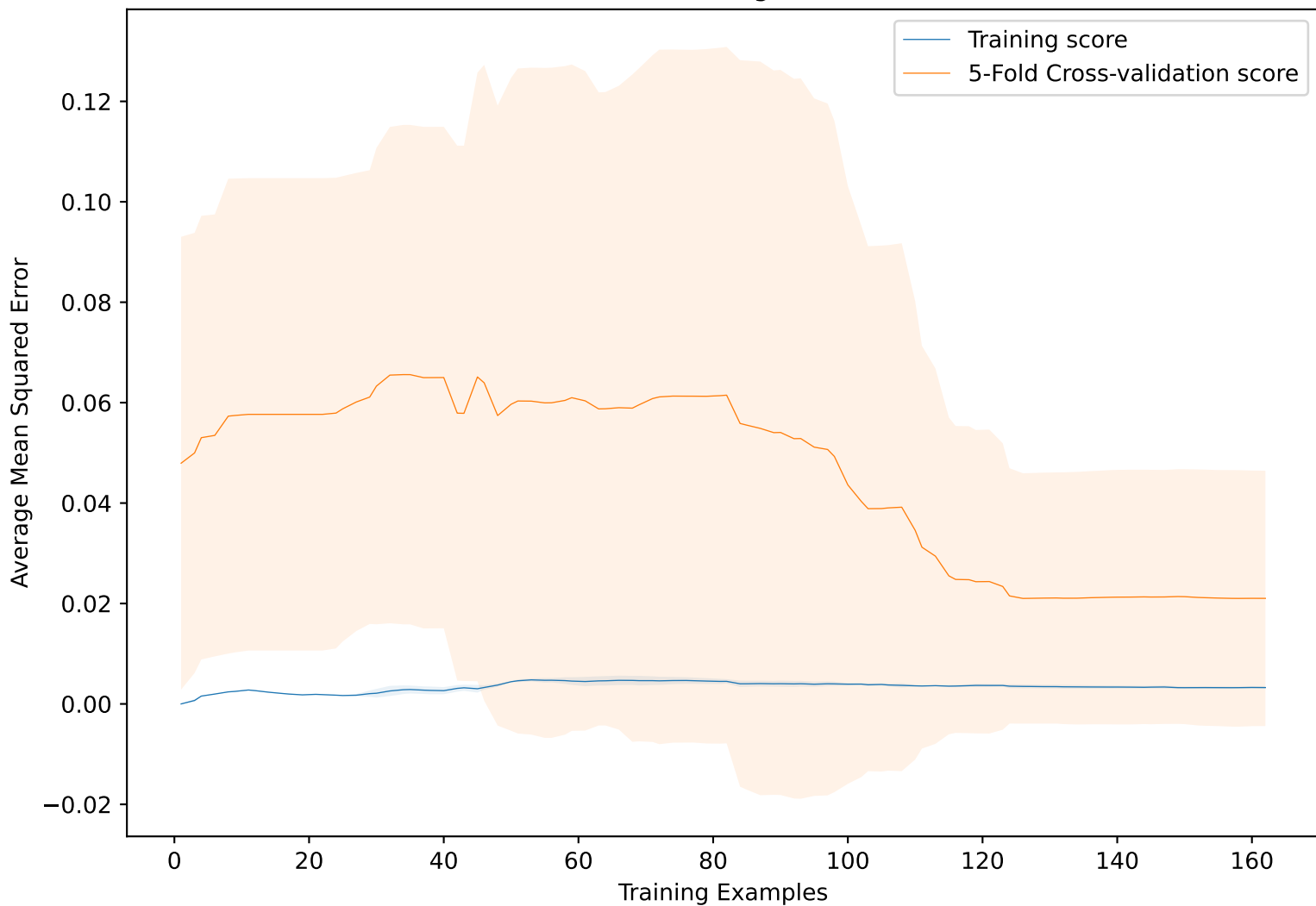
Train Root Mean Squared Error: 0.05512  
Train Mean Squared Error: 0.00304  
Train Normalised Root Mean Squared Error: 0.05512  
Train Coefficient of Determination: 0.93791  
Train Normalised Nash Sutcliffe Efficiency: 0.94154

Train Mean Absolute Error: 0.04549  
Train Pearson's Correlation Coefficient: 0.97129  
Train Index of Agreement: 0.98296  
Train Kling-Gupta Efficiency: 0.91327  
Train Mean Bias Error: -0.01212  
Train Mean Absolute Percentage Error: 0.03029

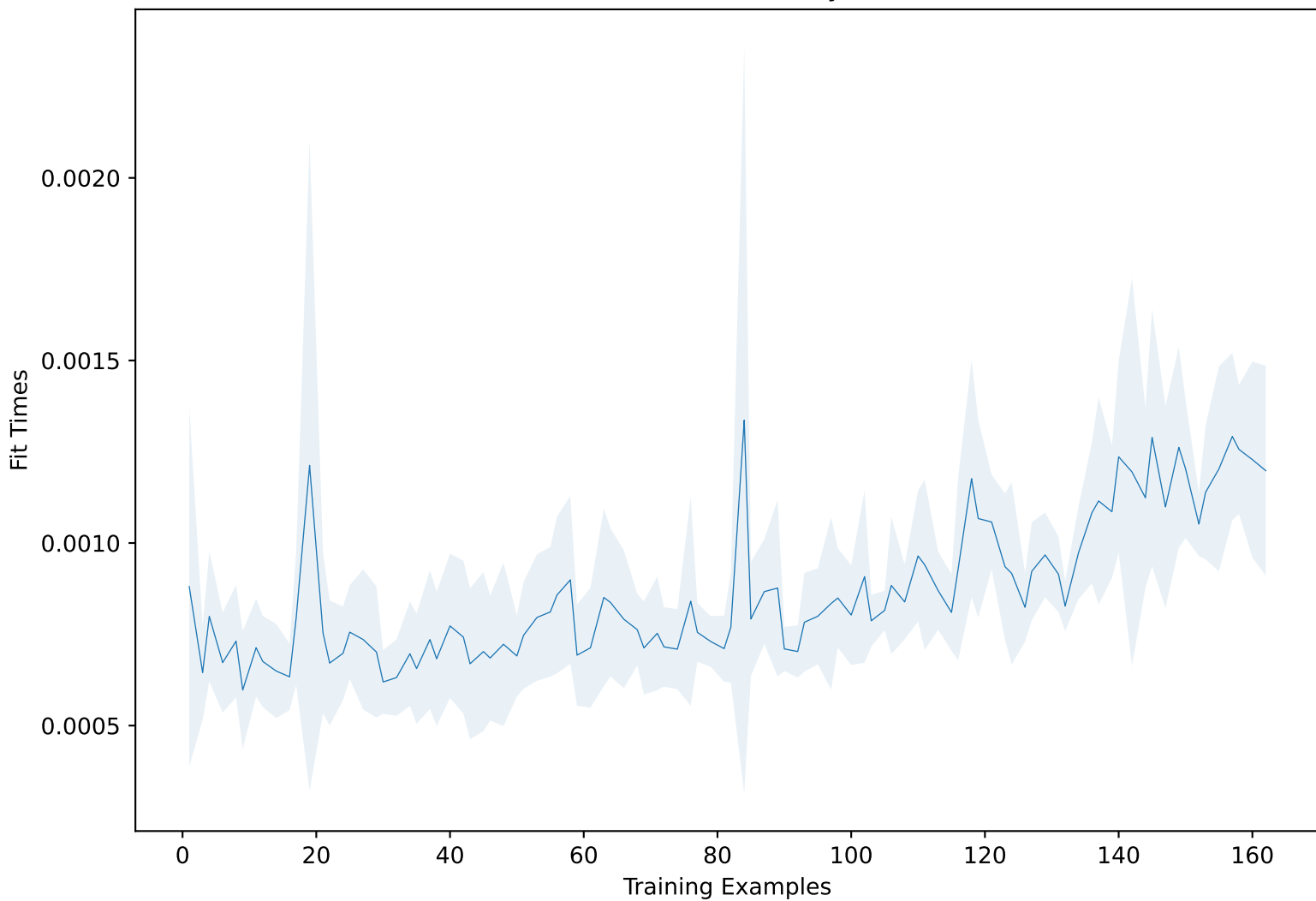
<><> Test Set Scores <><>

Test Root Mean Squared Error: 0.03297  
Test Mean Squared Error: 0.00109  
Test Normalised Root Mean Squared Error: 0.06796  
Test Coefficient of Determination: 0.92817  
Test Normalised Nash Sutcliffe Efficiency: 0.93299  
Test Mean Absolute Error: 0.02558  
Test Pearson's Correlation Coefficient: 0.96647  
Test Index of Agreement: 0.98065  
Test Kling-Gupta Efficiency: 0.92838  
Test Mean Bias Error: -0.00877  
Test Mean Absolute Percentage Error: 0.01527

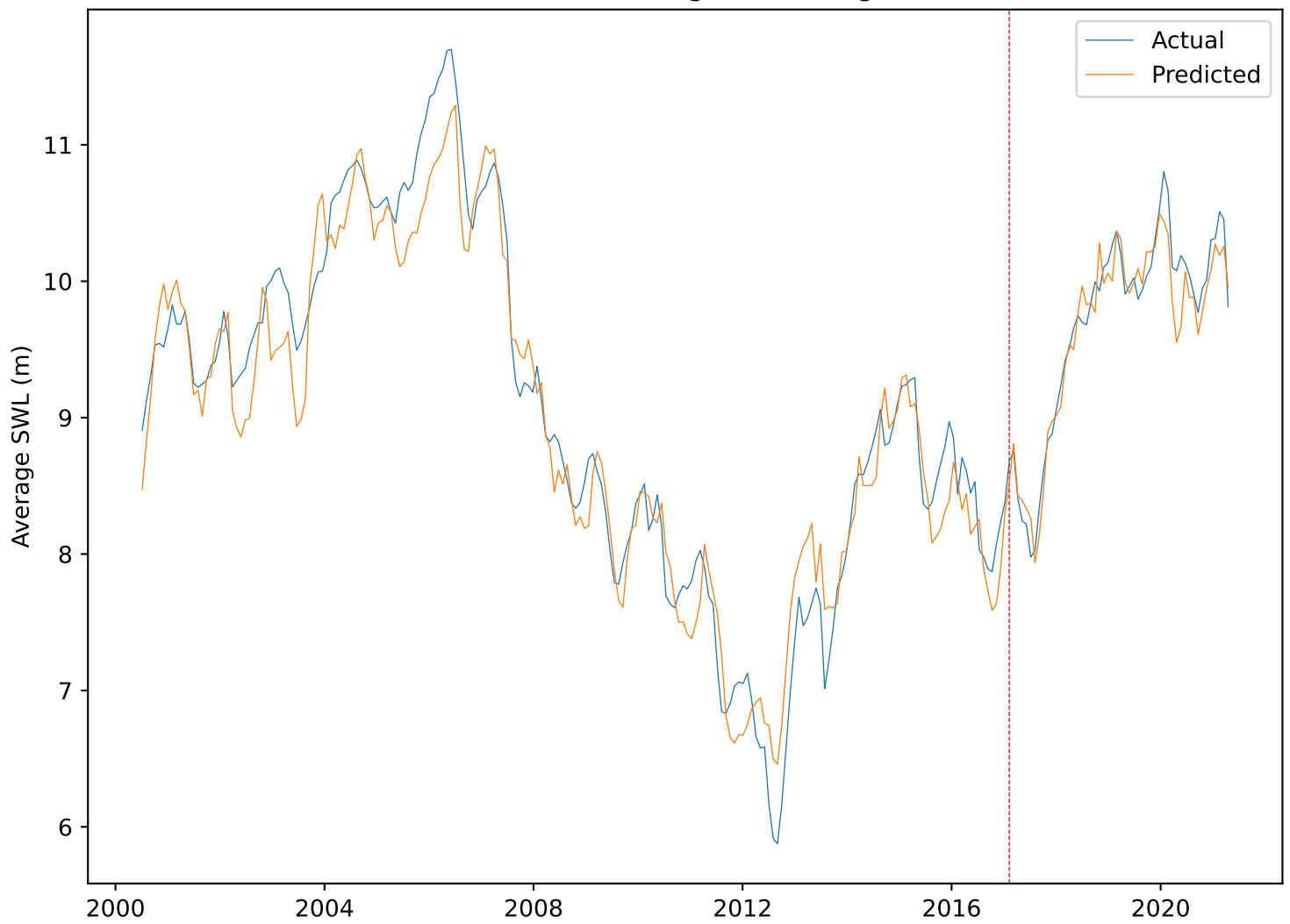
SVR Learning Curve



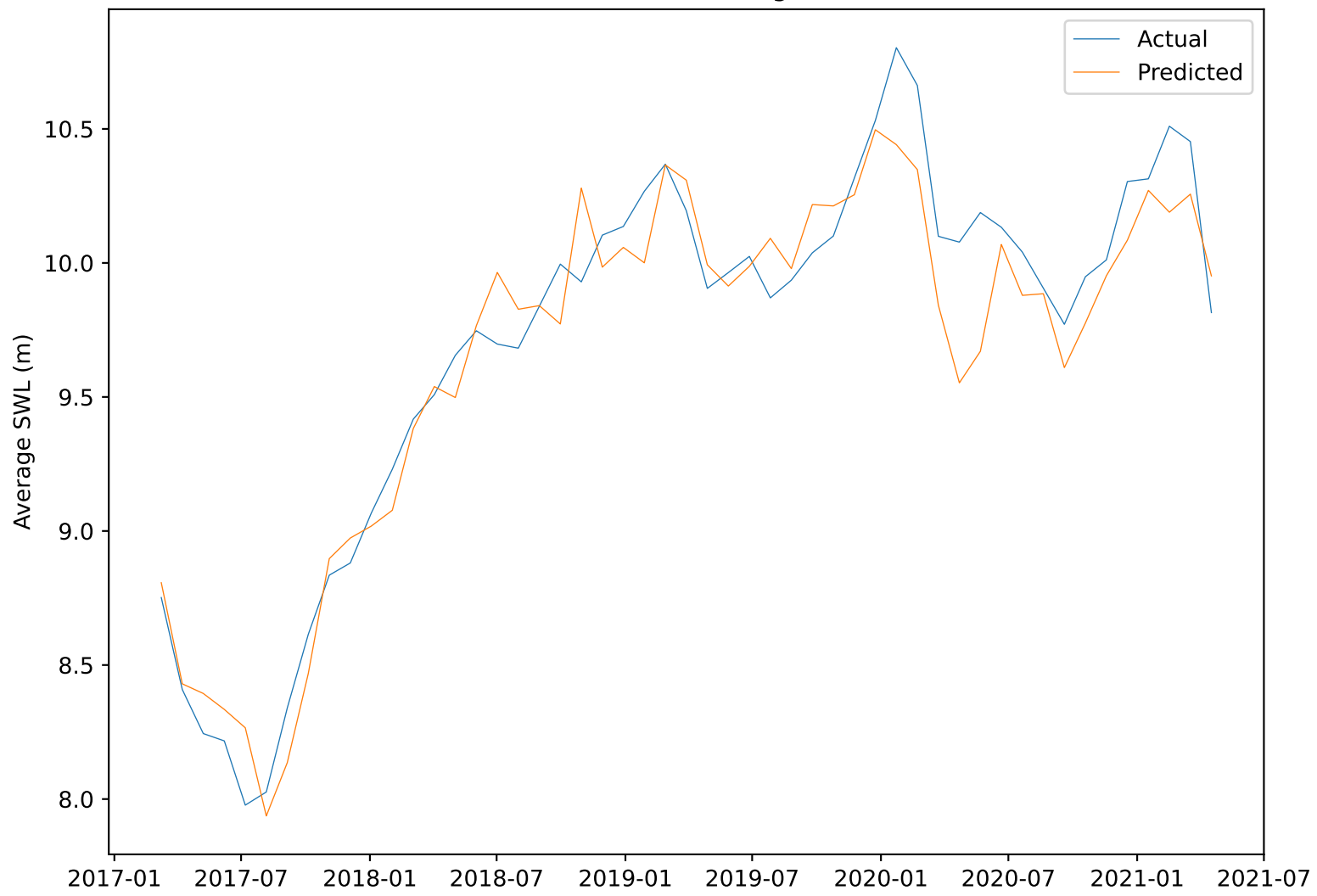
Model Scalability



SVR Model: Training and Testing Sets



SVR Model: Testing Set



SVR Model: Training and Testing Sets

