

<><> Time Stamp <><>

Code started: 09/10/2022 - 16:41:19

Total Run Time: 12.125 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%

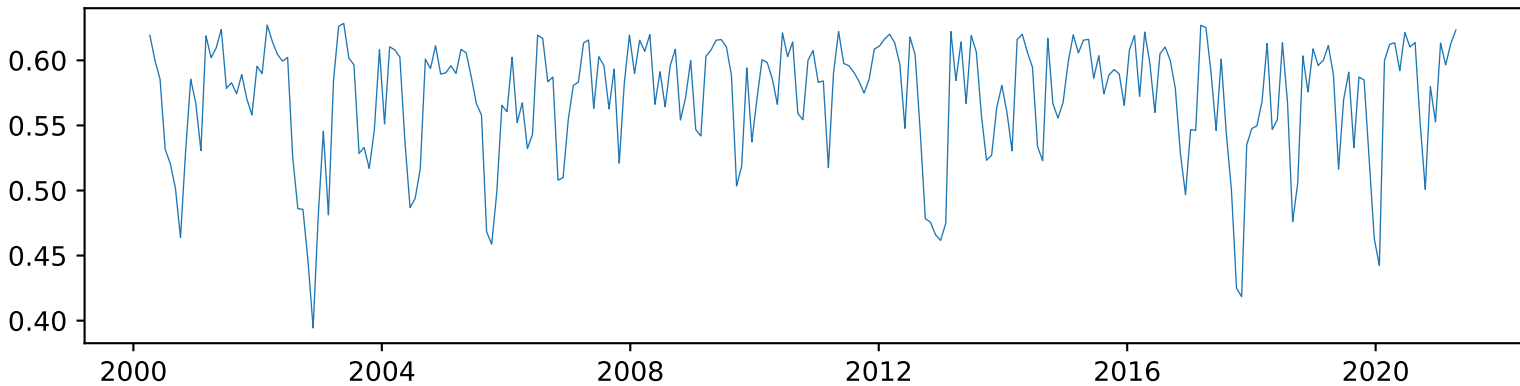
Quality Code: E, Number: 695, Percentage: 9.0%

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

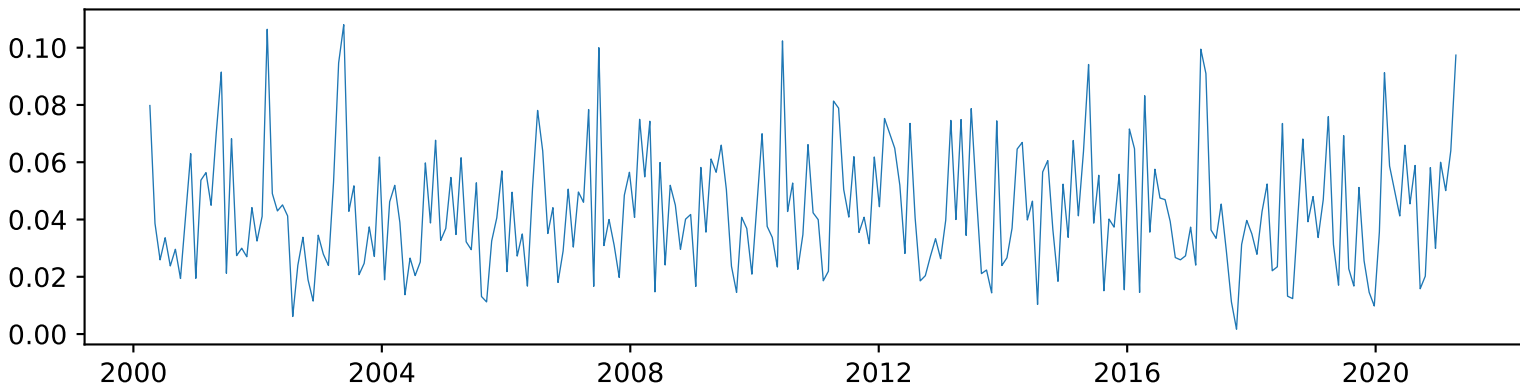
Average Standing Water Level (m)



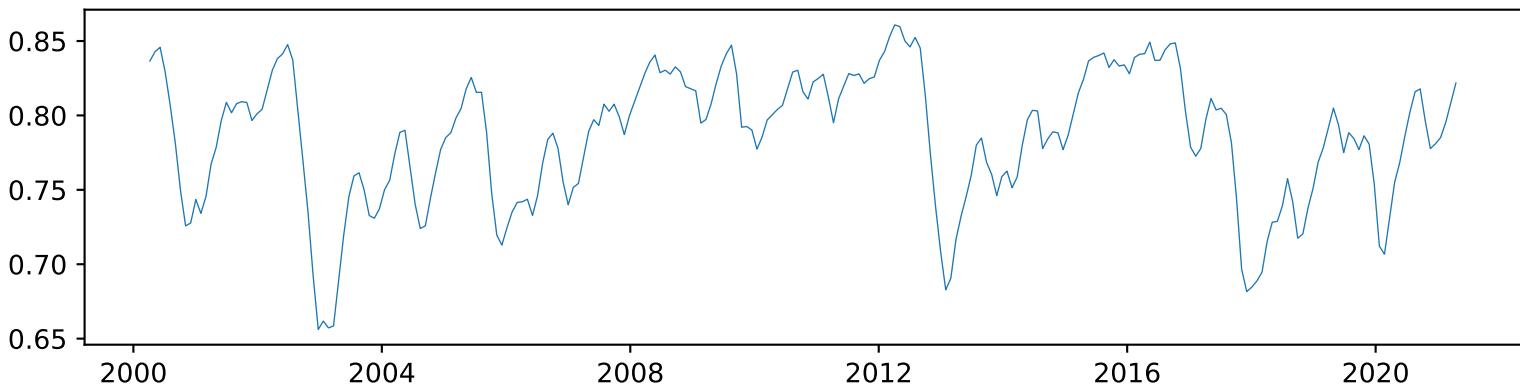
Average Absolute Root Zone Soil Moisture (0-100cm) (%)



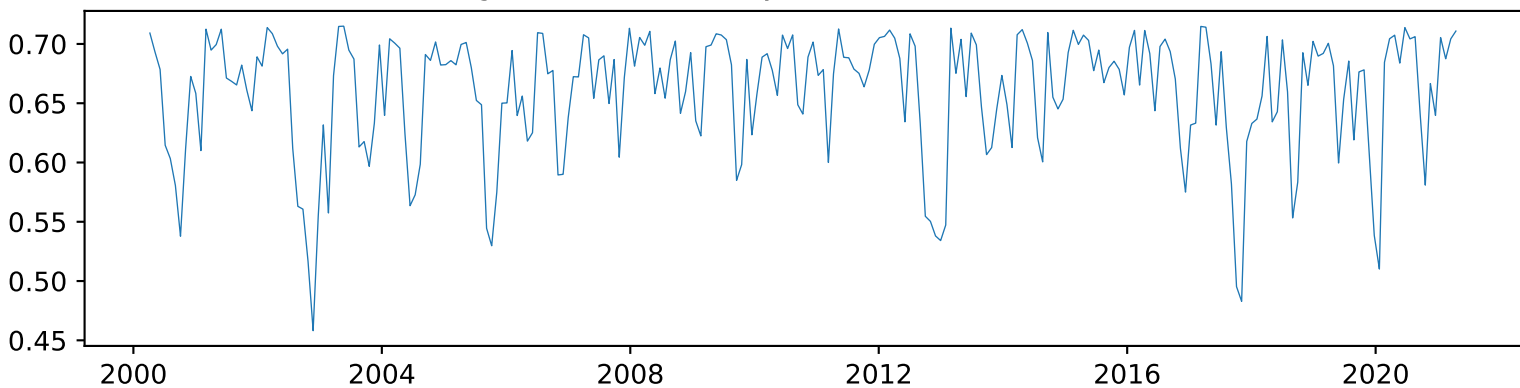
Average Absolute Upper Layer Soil Moisture (0-10cm) (%)



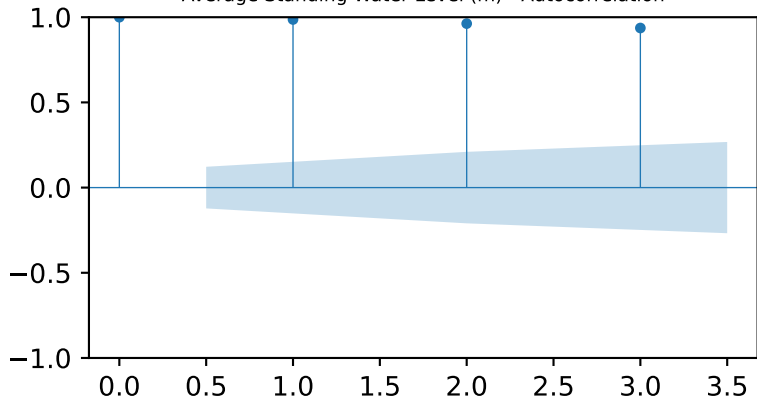
Average Absolute Deep Drainage (below 6m) (mm)



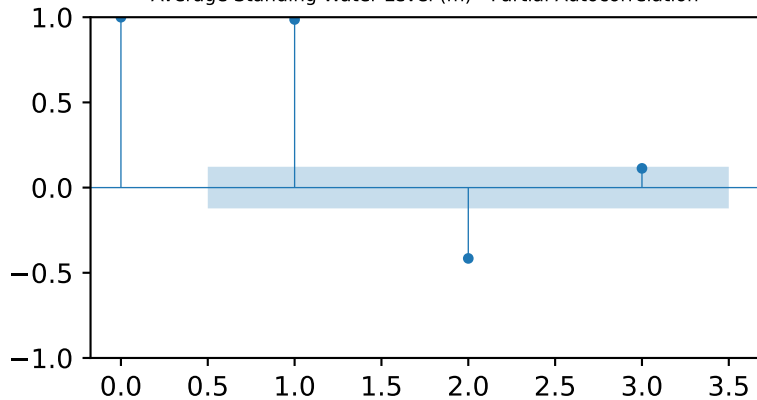
Average Absolute Lower Layer Soil Moisture (10-100cm) (%)



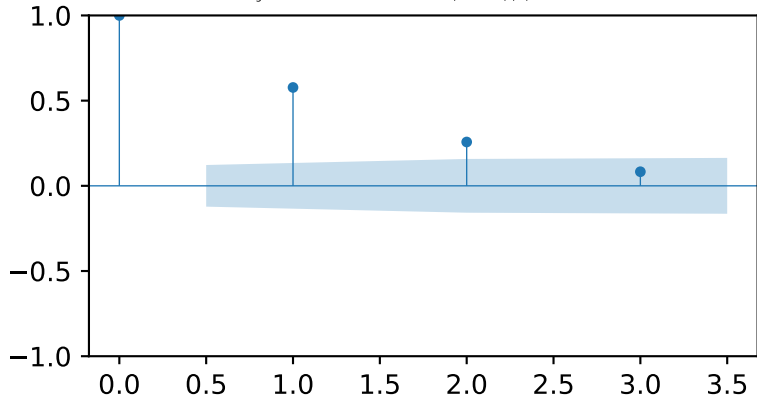
Average Standing Water Level (m) - Autocorrelation



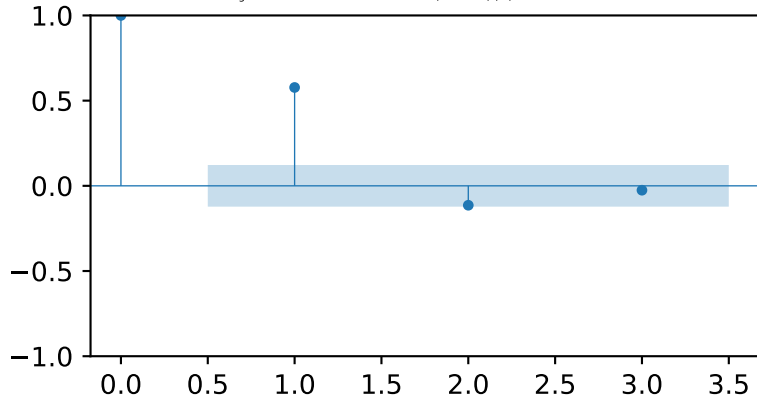
Average Standing Water Level (m) - Partial Autocorrelation



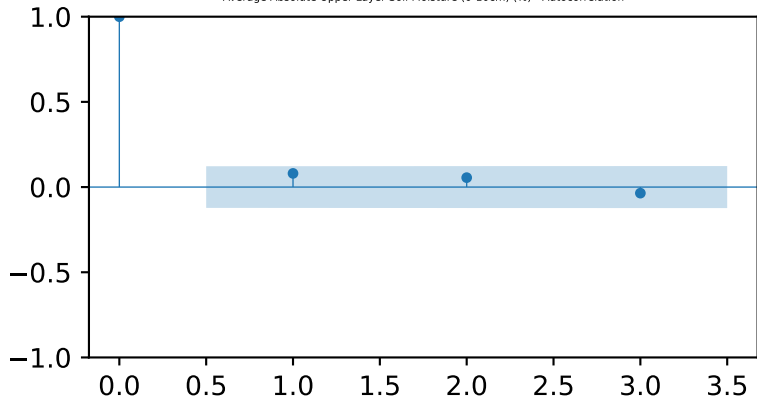
Average Absolute Root Zone Soil Moisture (0-100cm) (%) - Autocorrelation



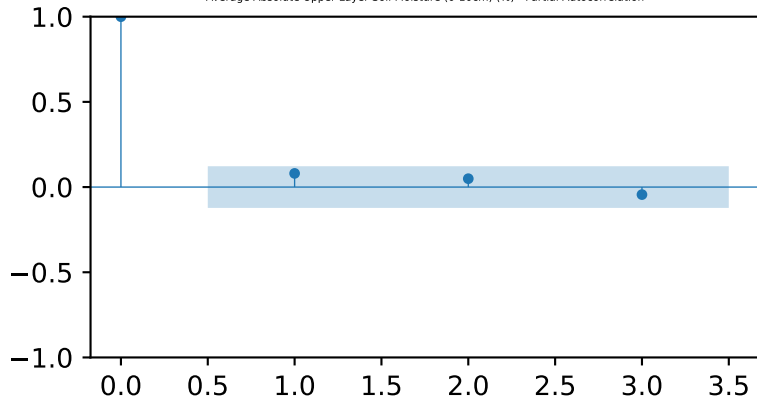
Average Absolute Root Zone Soil Moisture (0-100cm) (%) - Partial Autocorrelation



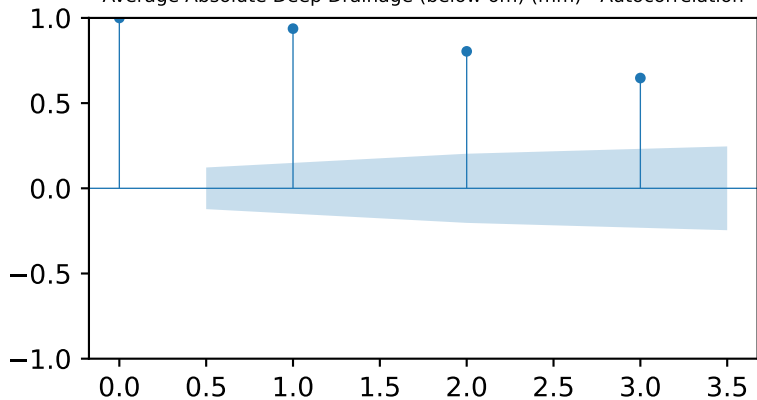
Average Absolute Upper Layer Soil Moisture (0-10cm) (%) - Autocorrelation



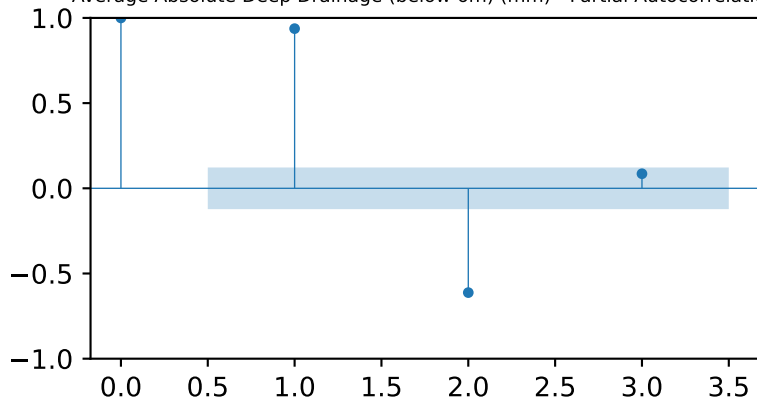
Average Absolute Upper Layer Soil Moisture (0-10cm) (%) - Partial Autocorrelation



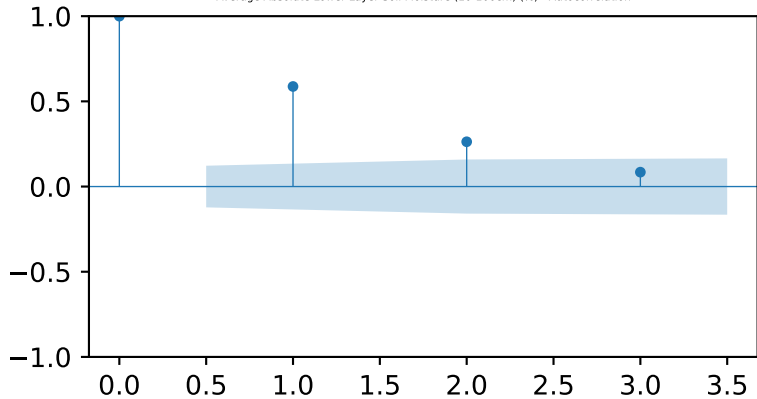
Average Absolute Deep Drainage (below 6m) (mm) - Autocorrelation



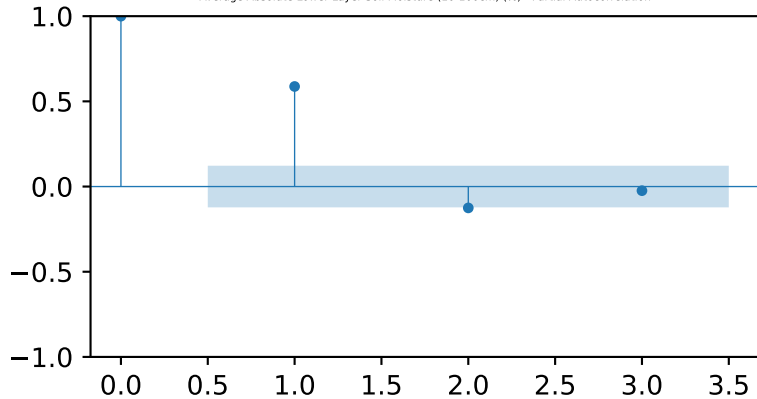
Average Absolute Deep Drainage (below 6m) (mm) - Partial Autocorrelation



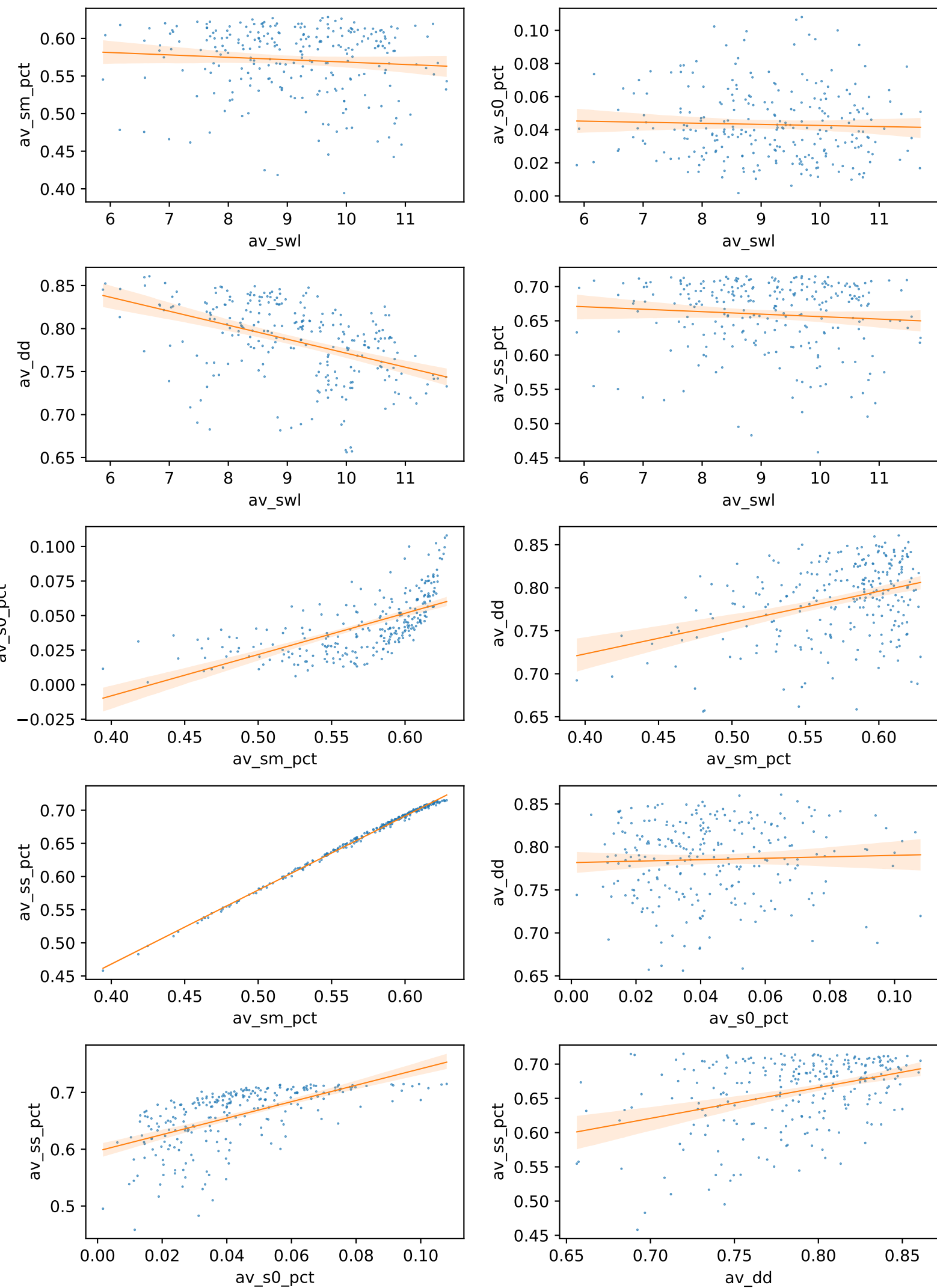
Average Absolute Lower Layer Soil Moisture (10-100cm) (%) - Autocorrelation



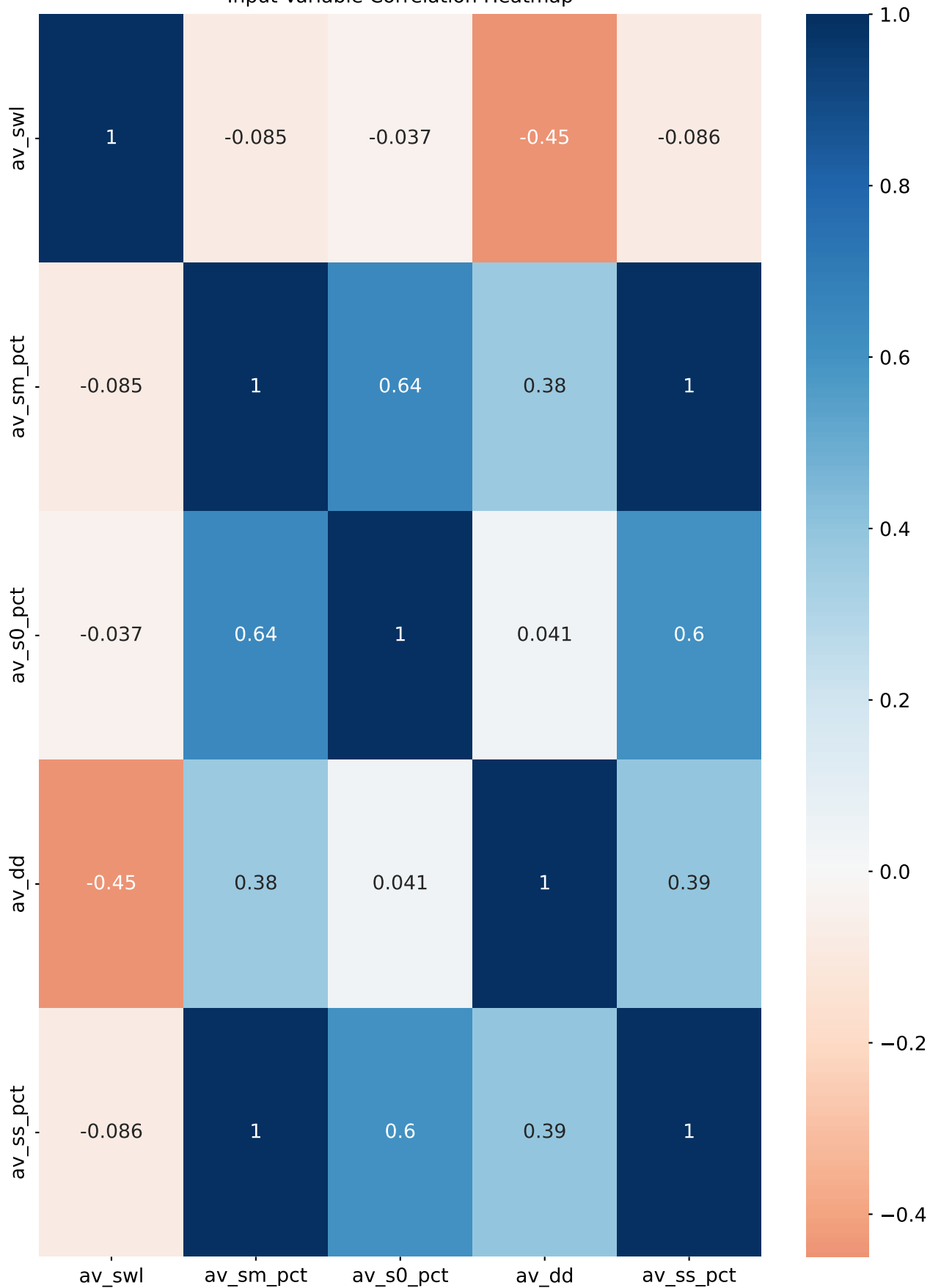
Average Absolute Lower Layer Soil Moisture (10-100cm) (%) - Partial Autocorrelation



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_38"

Layer (type)	Output Shape	Param #
=====		
lstm_38 (LSTM)	(None, 64)	17920
dense_114 (Dense)	(None, 32)	2080
dense_115 (Dense)	(None, 32)	1056
dense_116 (Dense)	(None, 1)	33
=====		
Total params: 21,089		
Trainable params: 21,089		
Non-trainable params: 0		

<><> Training Loss <><>

Epoch: 10, Loss: 0.03160390257835388
Epoch: 20, Loss: 0.022110307589173317
Epoch: 30, Loss: 0.017414147034287453
Epoch: 40, Loss: 0.01830211840569973
Epoch: 50, Loss: 0.017439575865864754
Epoch: 60, Loss: 0.01897648349404335
Epoch: 70, Loss: 0.01947251707315445
Epoch: 80, Loss: 0.018604325130581856
Epoch: 90, Loss: 0.015132158994674683
Epoch: 100, Loss: 0.012323240749537945

<><> Validation Loss <><>

Epoch: 10, Loss: 0.0038667211774736643
Epoch: 20, Loss: 0.0015621933853253722
Epoch: 30, Loss: 0.0018540783785283566
Epoch: 40, Loss: 0.0011310798581689596
Epoch: 50, Loss: 0.001220142119564116
Epoch: 60, Loss: 0.0011543078580871224
Epoch: 70, Loss: 0.0011493255151435733
Epoch: 80, Loss: 0.0011207724455744028
Epoch: 90, Loss: 0.004412585403770208
Epoch: 100, Loss: 0.0009172692080028355

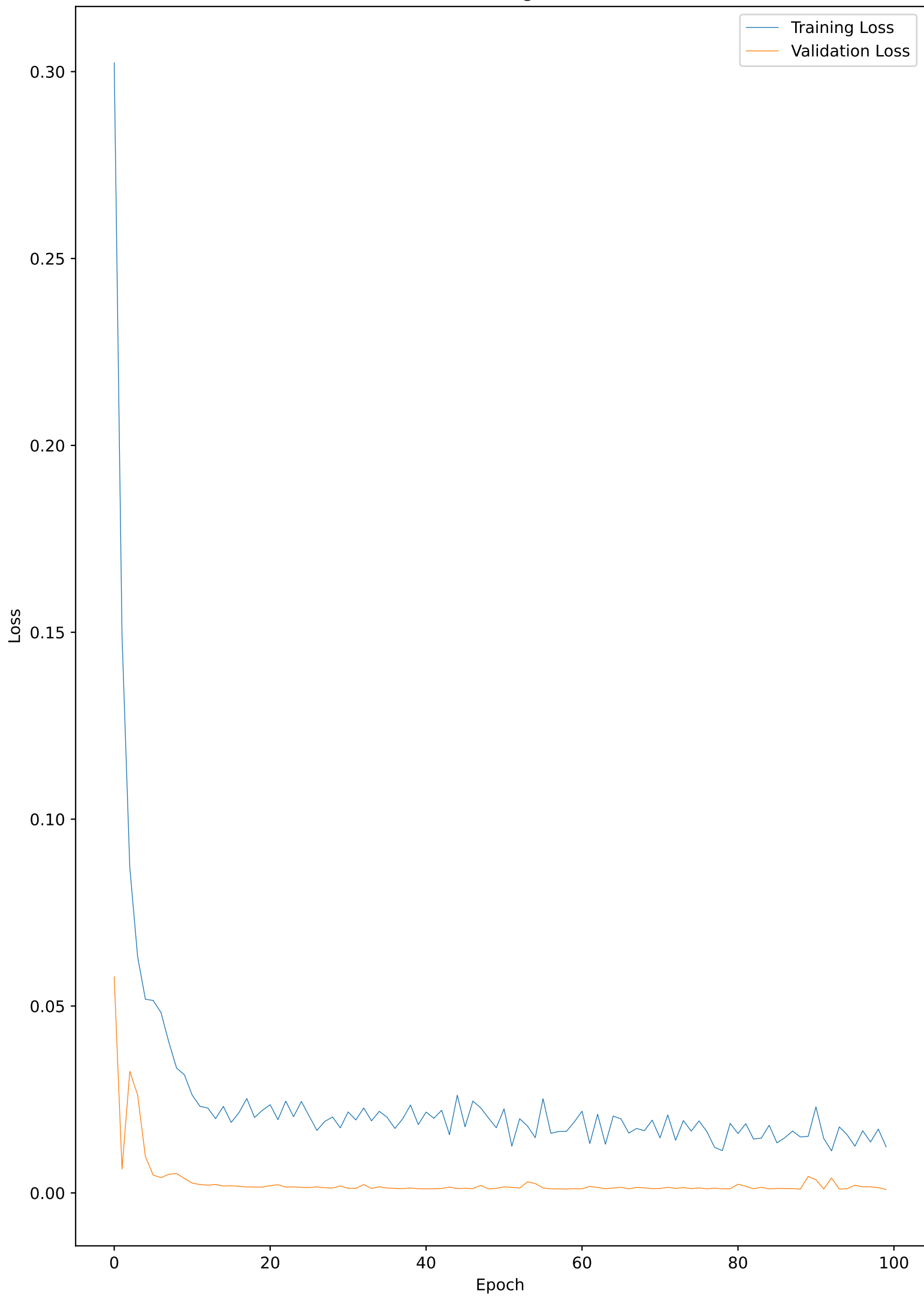
<><> Training Set Scores <><>

Train Root Mean Squared Error: 0.05043
Train Mean Squared Error: 0.00254
Train Normalised Root Mean Squared Error: 0.05043
Train Coefficient of Determination: 0.94804
Train Normalised Nash Sutcliffe Efficiency: 0.9506
Train Mean Absolute Error: 0.03956
Train Pearson's Correlation Coefficient: 0.98724
Train Index of Agreement: 0.98429
Train Kling-Gupta Efficiency: 0.82383
Train Mean Bias Error: -0.00192
Train Mean Absolute Percentage Error: 0.02621

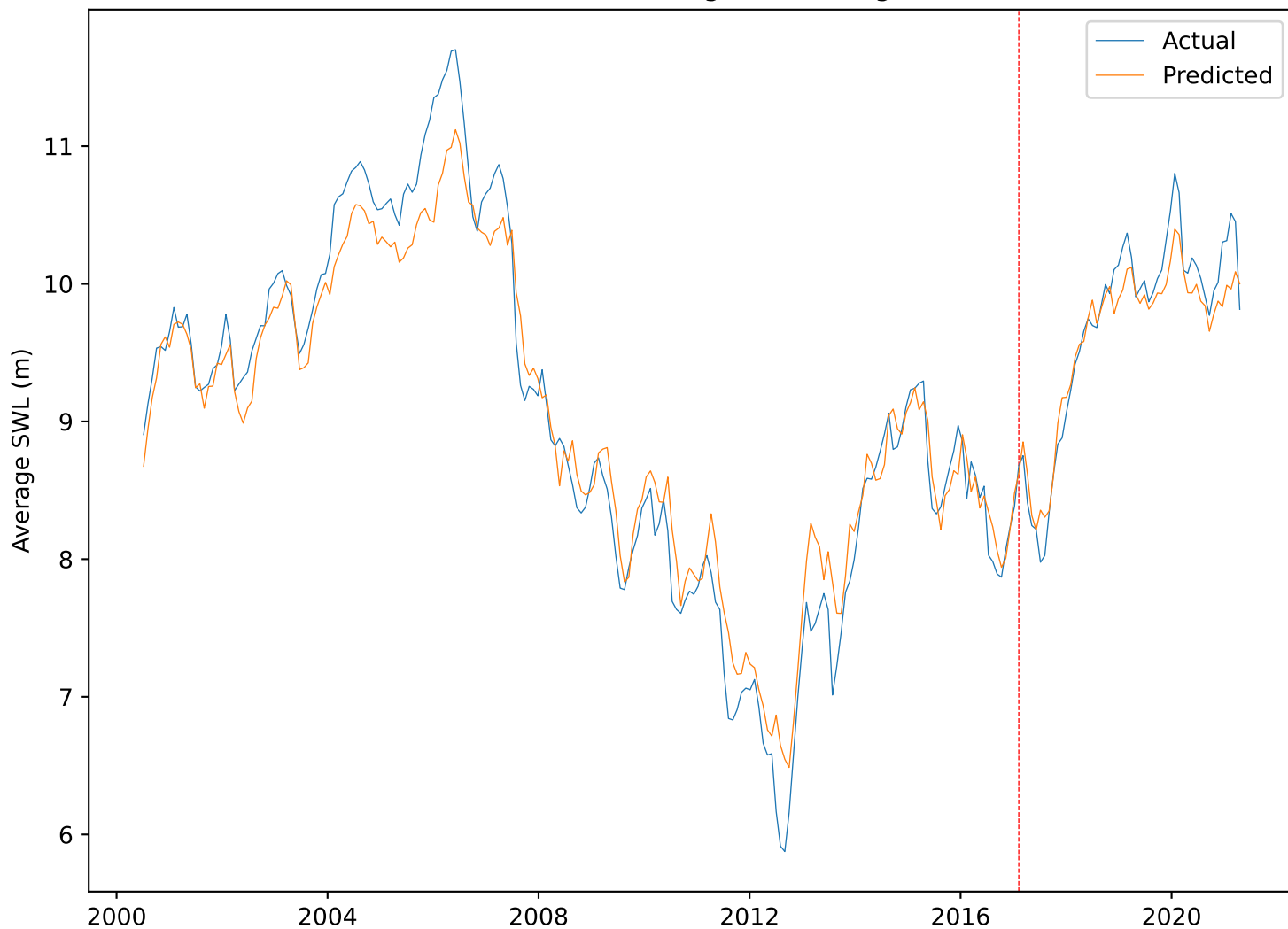
<><> Test Set Scores <><>

Test Root Mean Squared Error: 0.0368
Test Mean Squared Error: 0.00135
Test Normalised Root Mean Squared Error: 0.07586
Test Coefficient of Determination: 0.91049
Test Normalised Nash Sutcliffe Efficiency: 0.91785
Test Mean Absolute Error: 0.02868
Test Pearson's Correlation Coefficient: 0.97661
Test Index of Agreement: 0.9722
Test Kling-Gupta Efficiency: 0.79868
Test Mean Bias Error: -0.01375
Test Mean Absolute Percentage Error: 0.01701

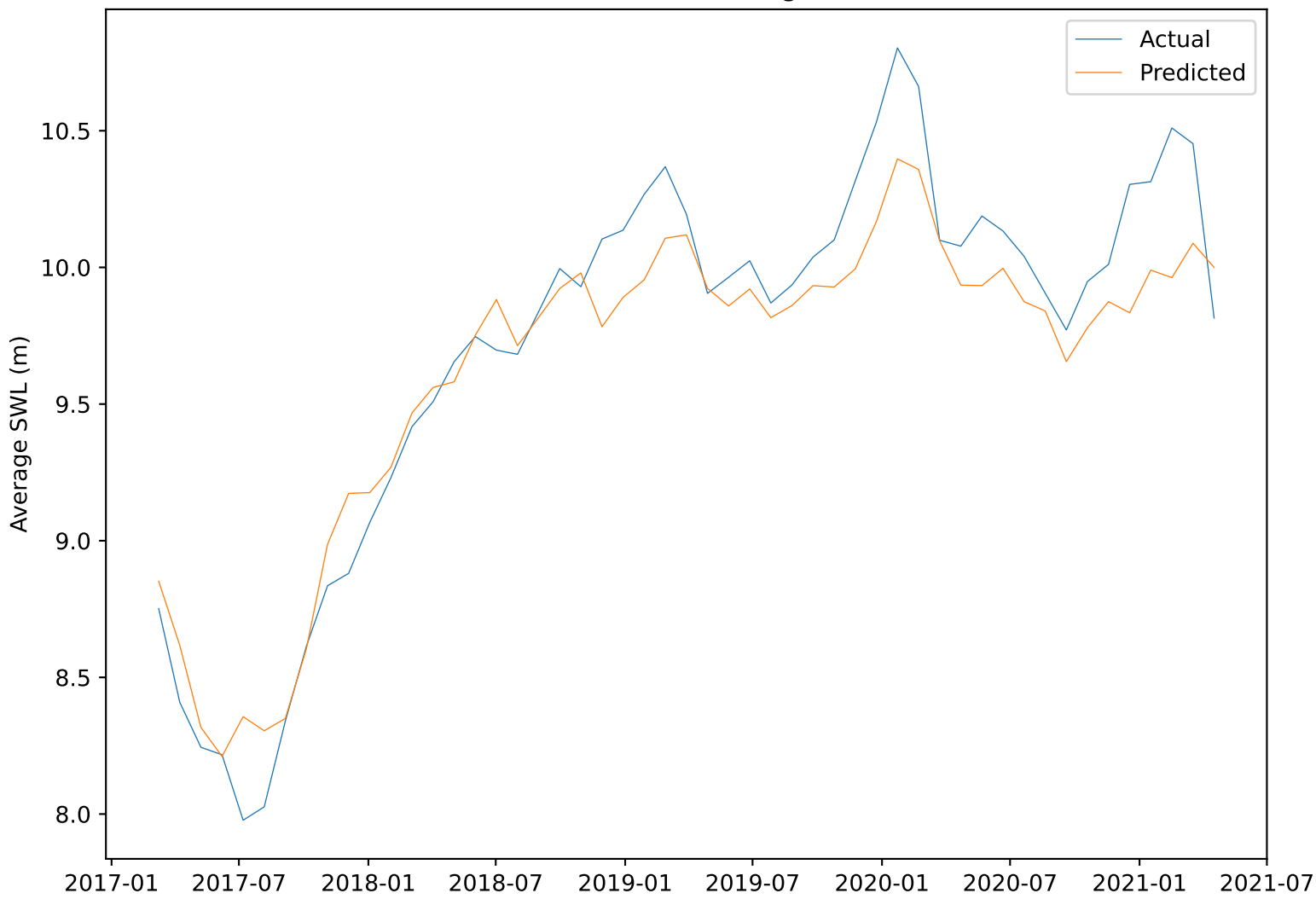
LSTM Learning Curves



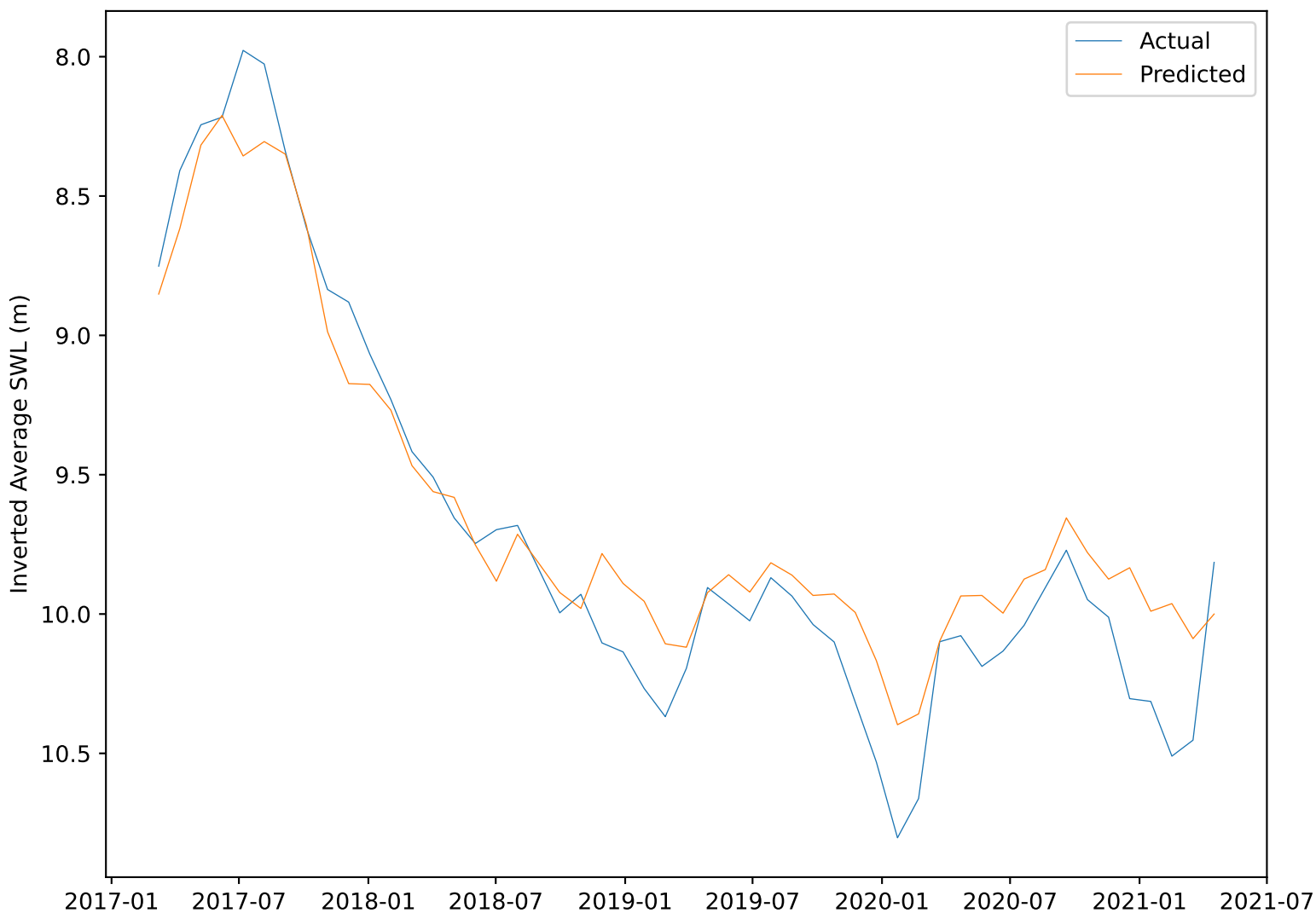
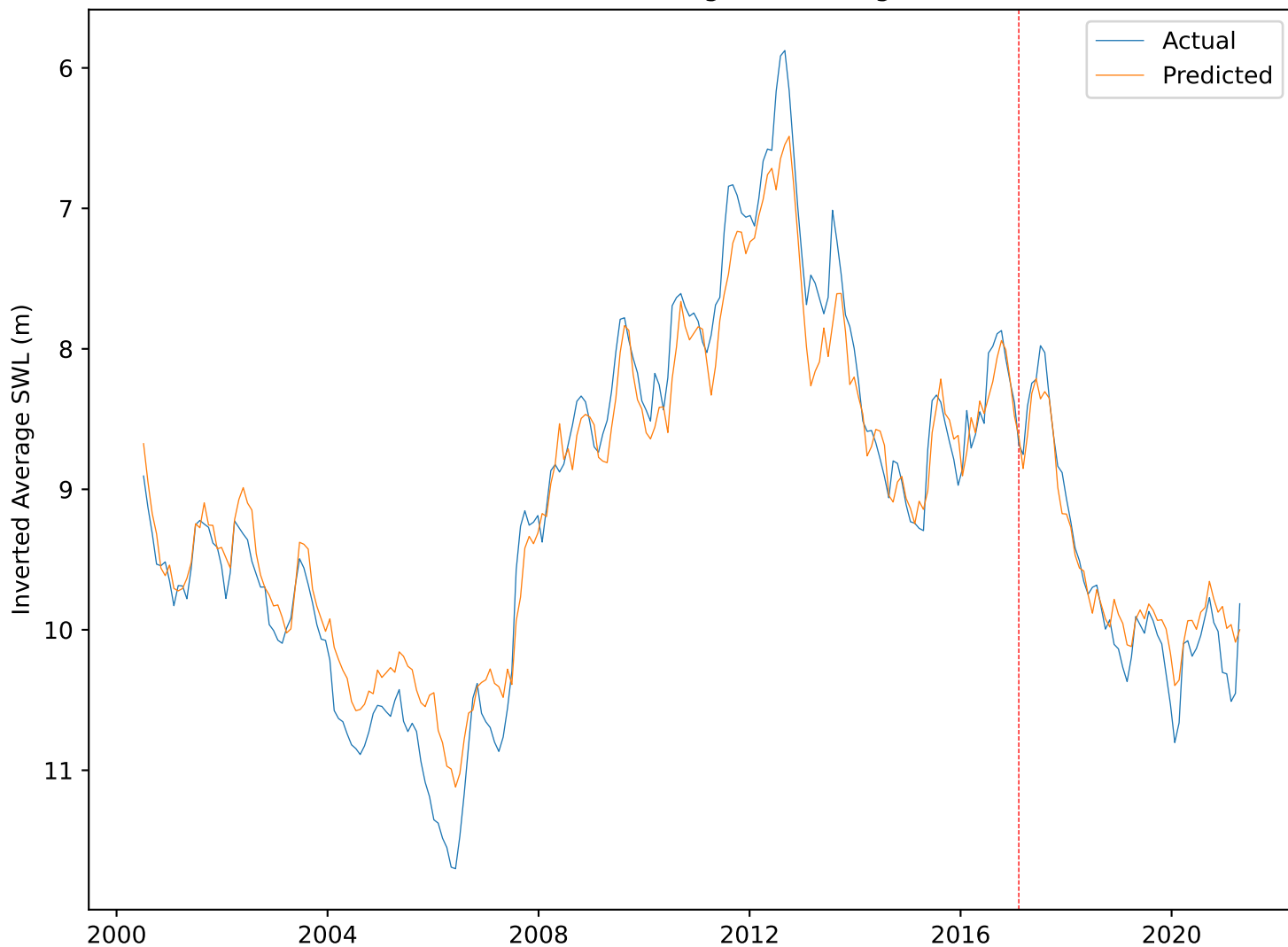
LSTM Model: Training and Testing Sets



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 <><>

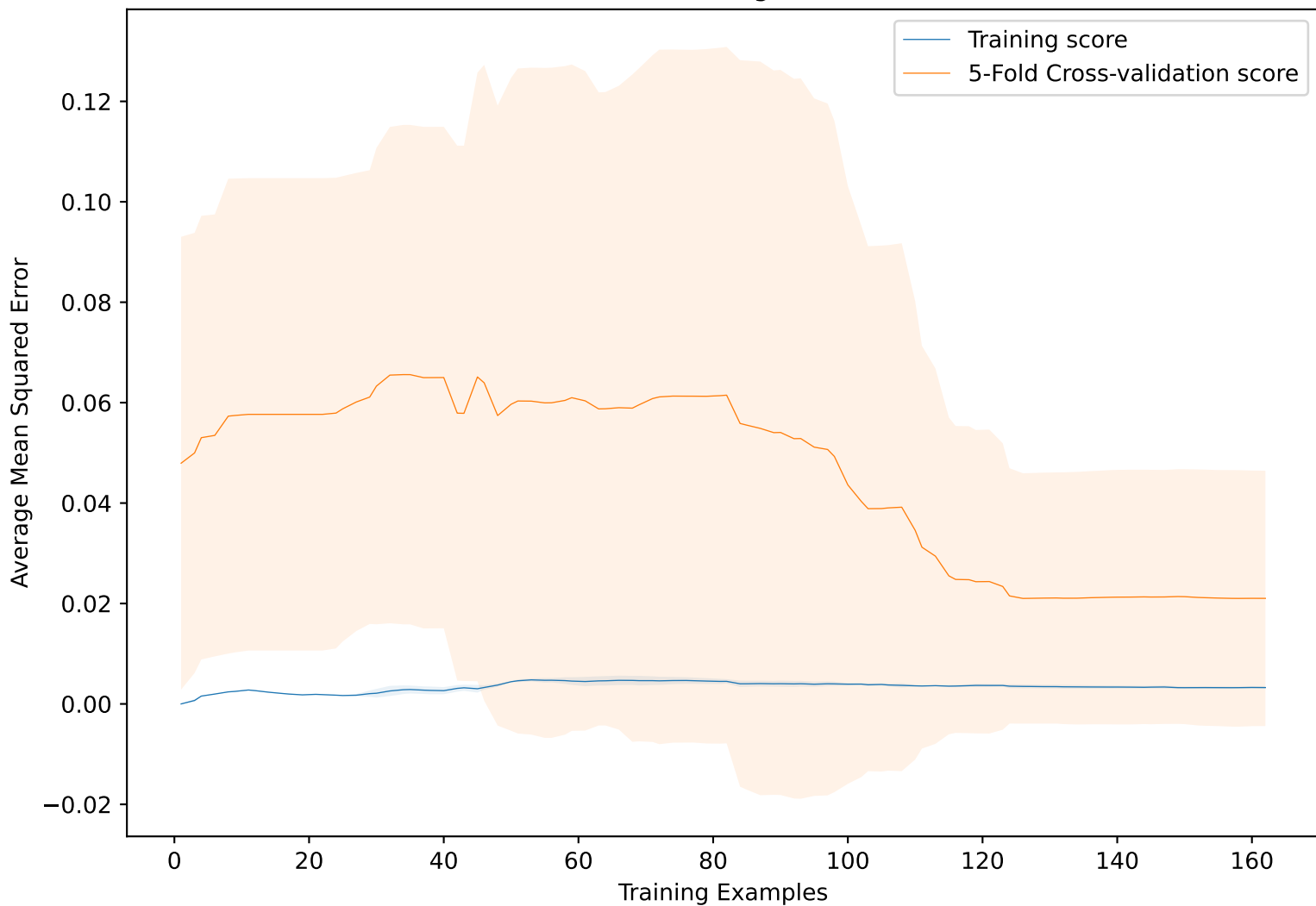
Train Root Mean Squared Error: 0.05512
Train Mean Squared Error: 0.00304
Train Normalised Root Mean Squared Error: 0.05512
Train Coefficient of Determination: 0.93791
Train Normalised Nash Sutcliffe Efficiency: 0.94154

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

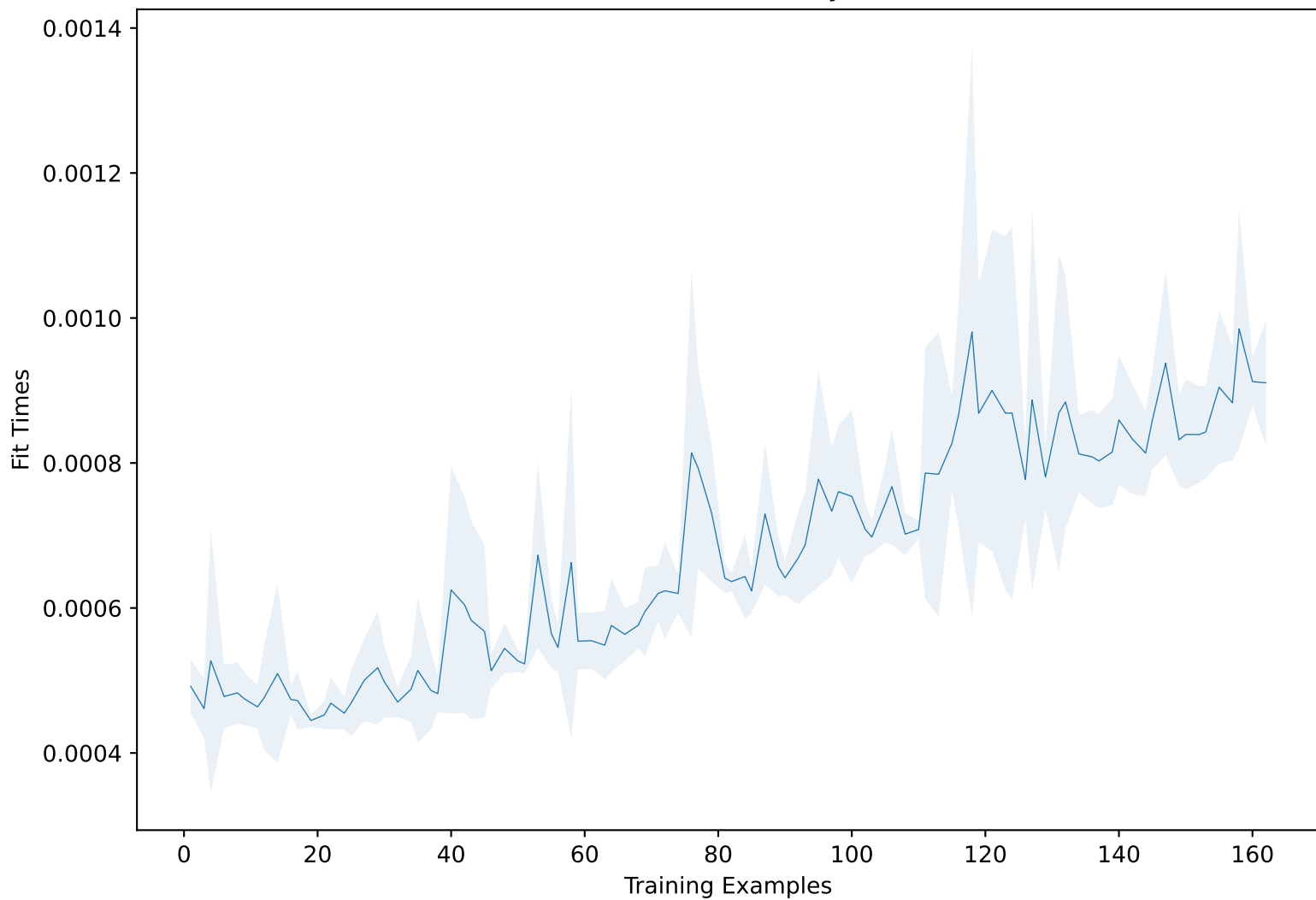
<><> Test Set Scores <><>

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

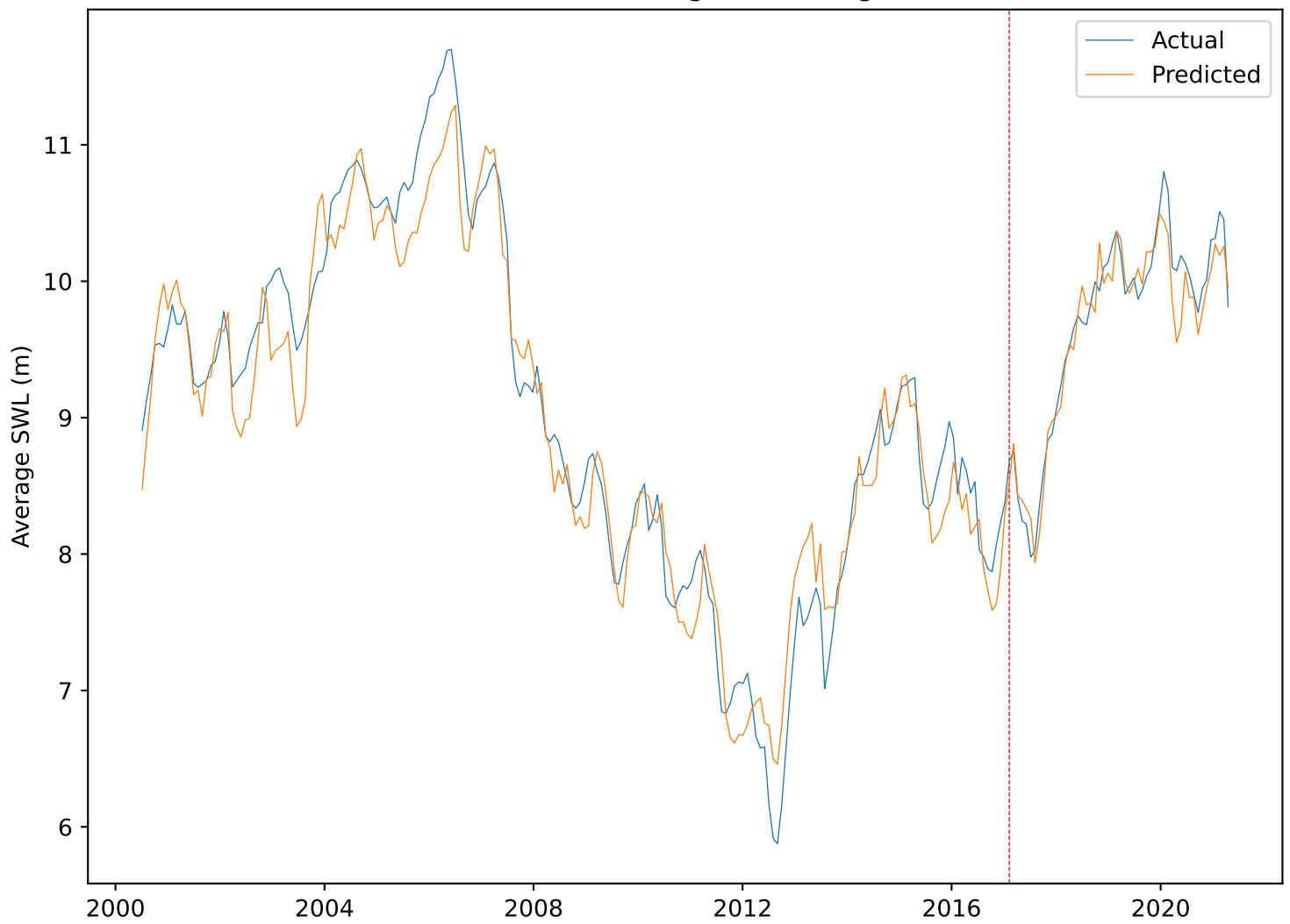
SVR Learning Curve



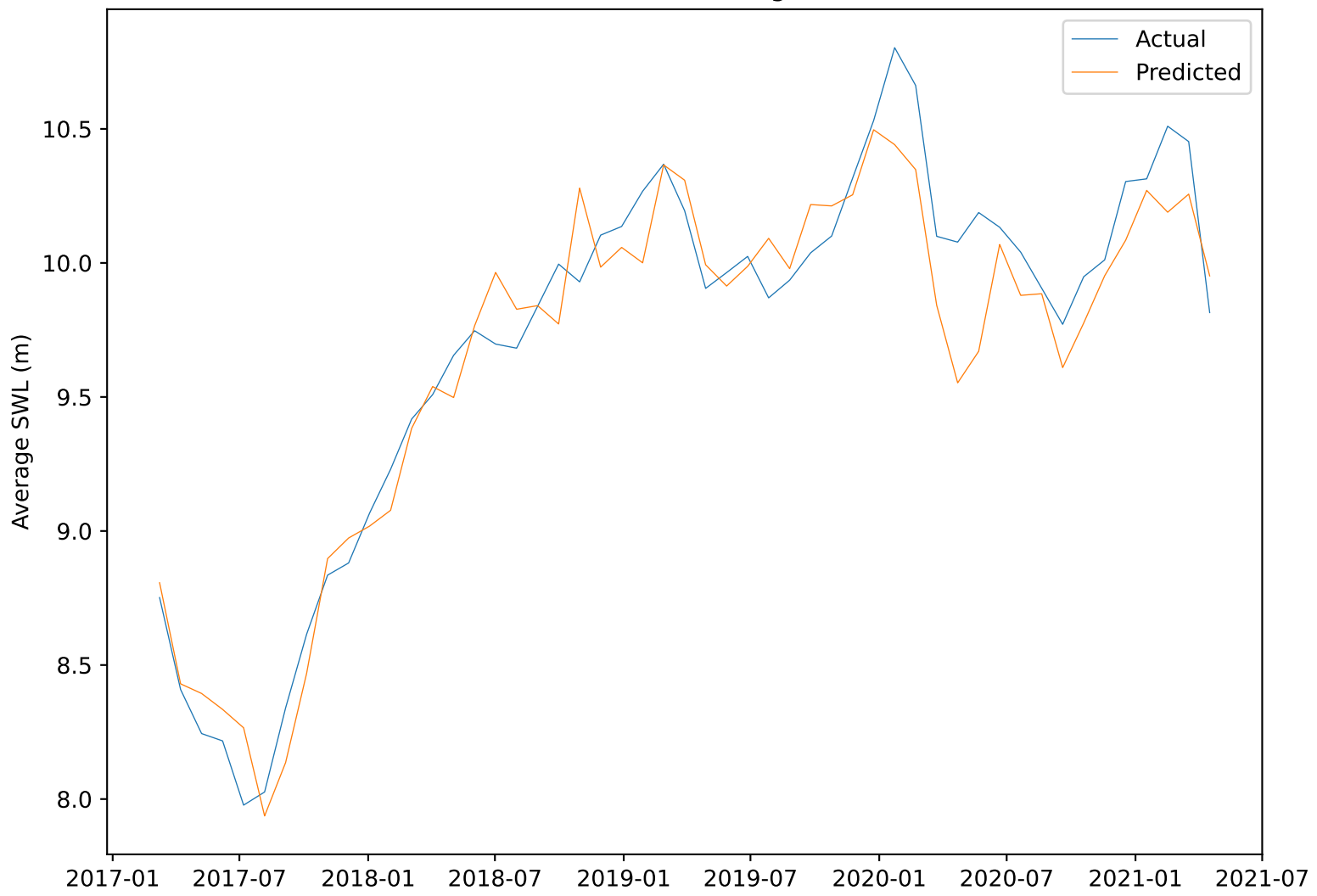
Model Scalability



SVR Model: Training and Testing Sets



SVR Model: Testing Set



SVR Model: Training and Testing Sets

