

<><> Time Stamp <><>

Code started: 05/10/2022 - 14:57:22

Total Run Time: 9.044 s

<><> Bore Information <><>

Bore ID: GW036872.1.1

Region: Coastal

Bore Coordinates: (-30.923963, 153.044423)

Agency: WaterNSW

Drilled Date: 01/08/1990

Bore Depth: 30.5 m

Drilled Depth: 30.5 m

Reference Elevation: nan m

Time Series Reference Elevation: nan m

Land Surface Elevation: nan m

Silo Grid Point Coordinates: (-30.9, 153.05)

<><> Model Output <><>

Averaged Period: 30 day(s)

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

<><> Model Inputs <><>

Data Range: 01/05/2010 - 31/08/2021

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 Rainfall (mm)

<><> Data Quality <><>

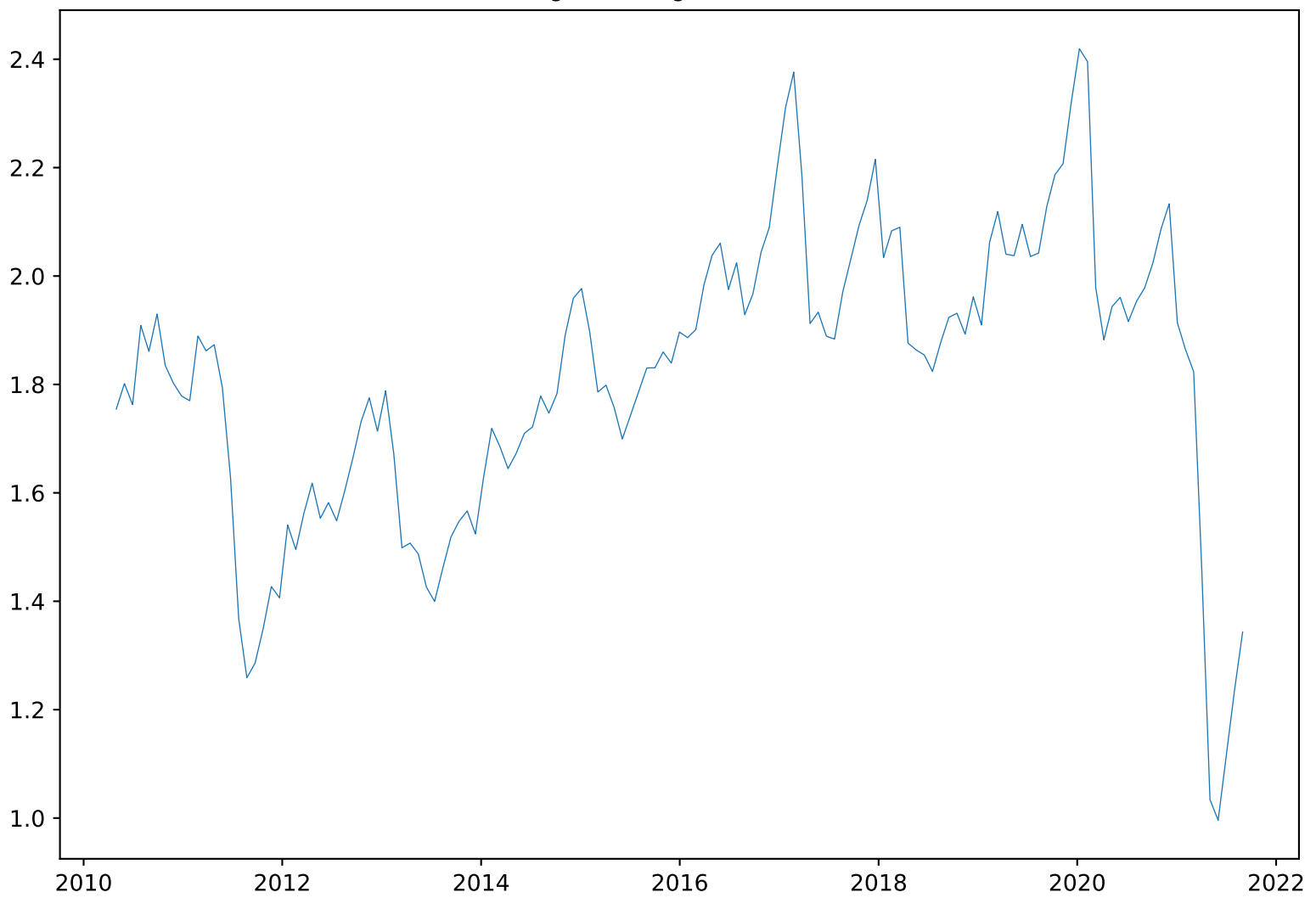
Interpolation Method: Spline

Quality Code: A, Number: 3434, Percentage: 82.33%

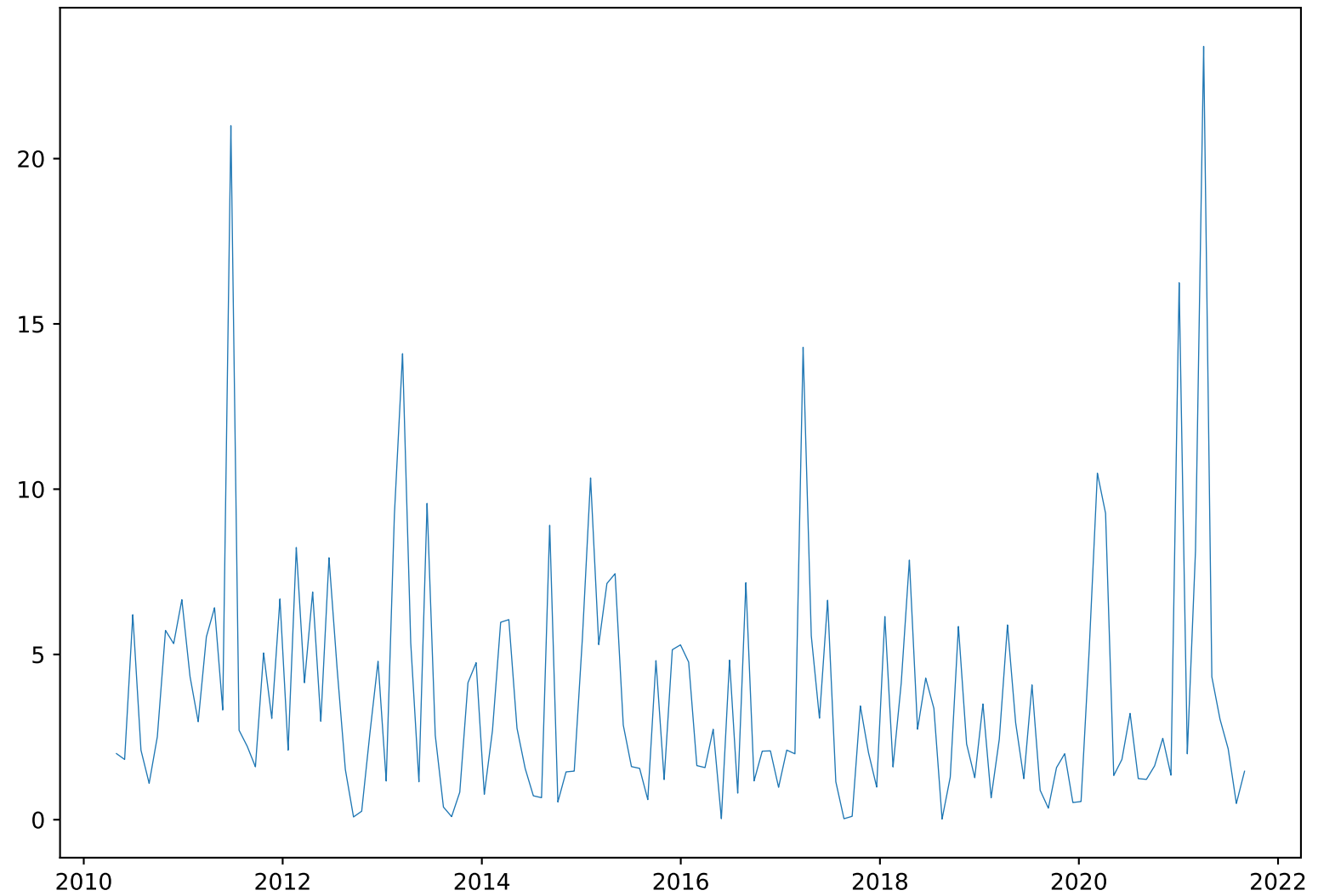
Quality Code: B, Number: 645, Percentage: 15.46%

Quality Code: C, Number: 92, Percentage: 2.21%

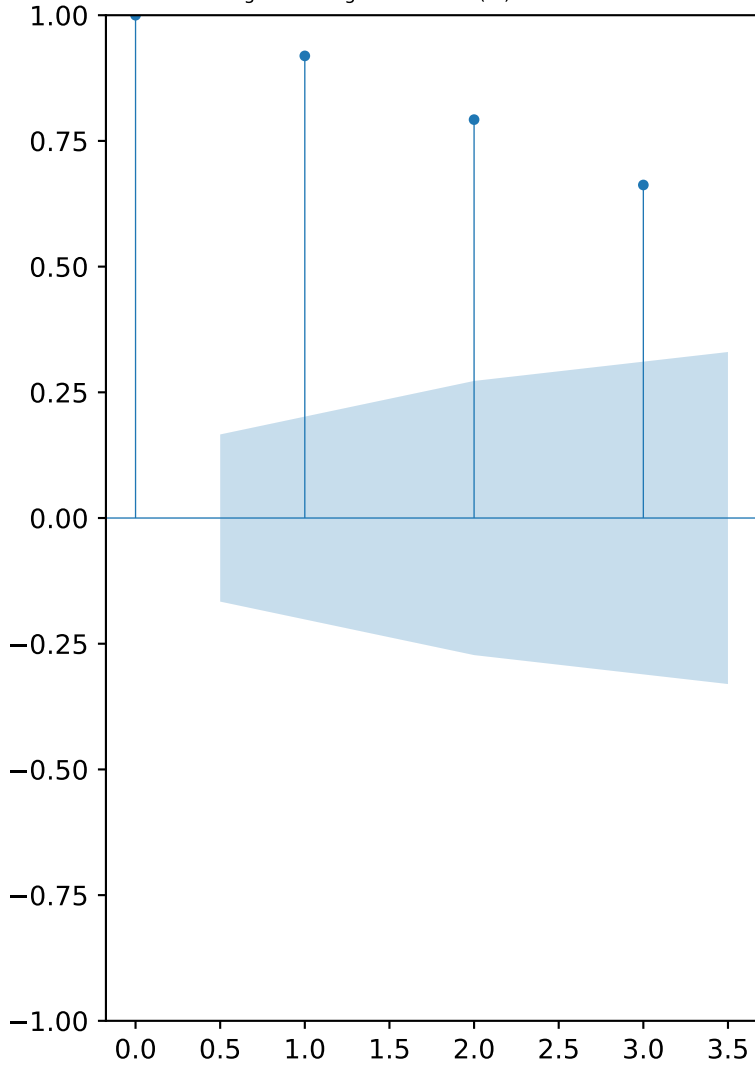
Average Standing Water Level (m)



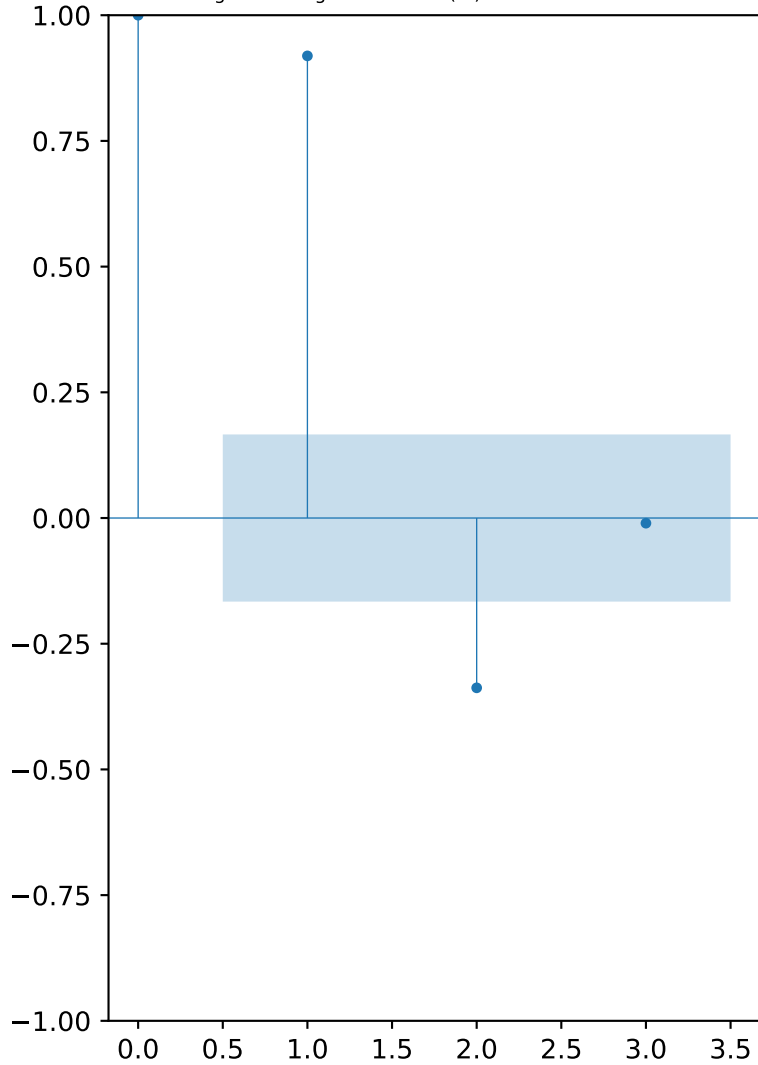
Average Rainfall (mm)



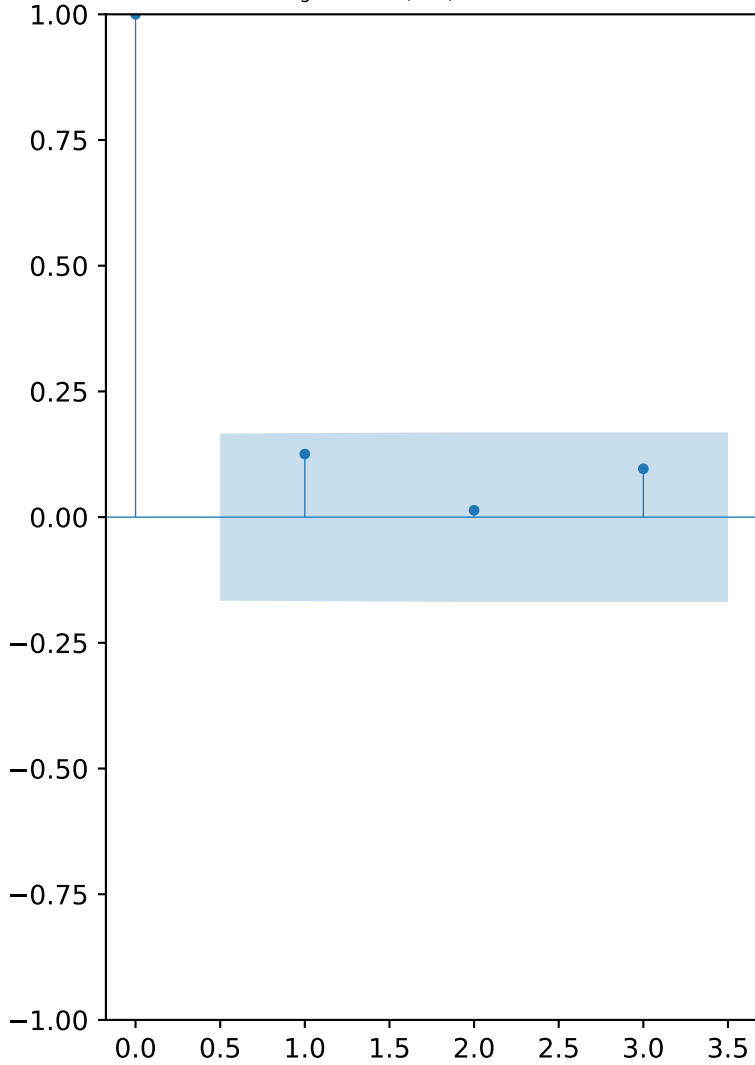
Average Standing Water Level (m) - Autocorrelation



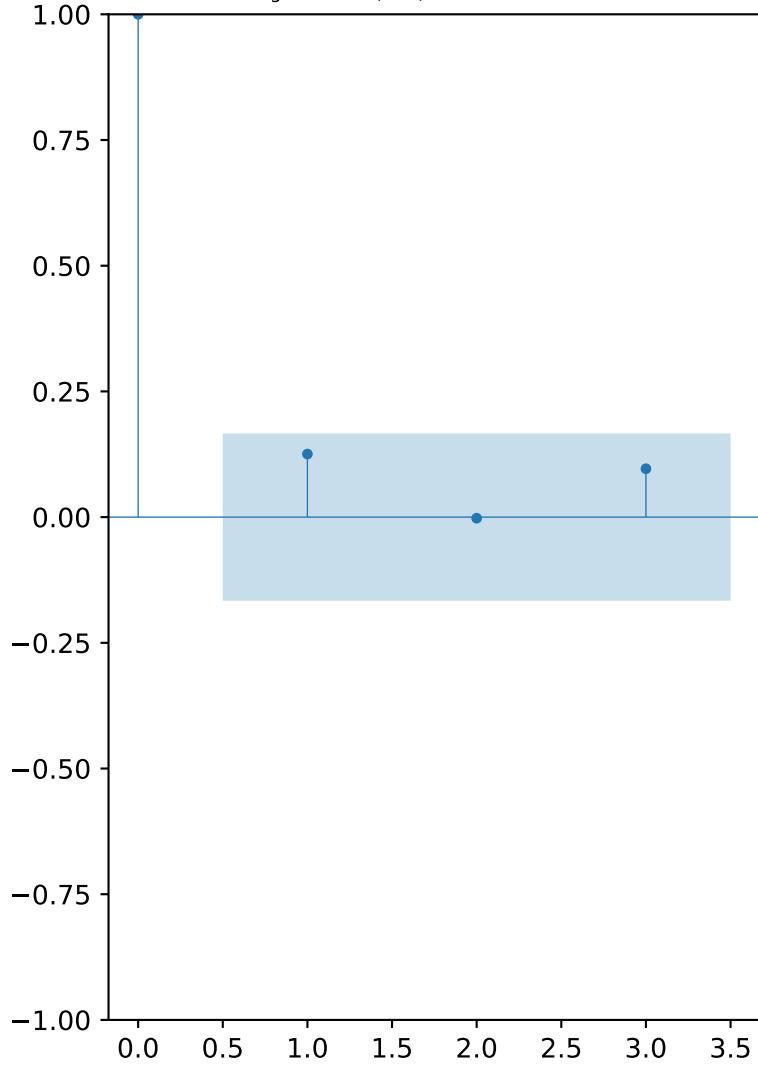
Average Standing Water Level (m) - Partial Autocorrelation



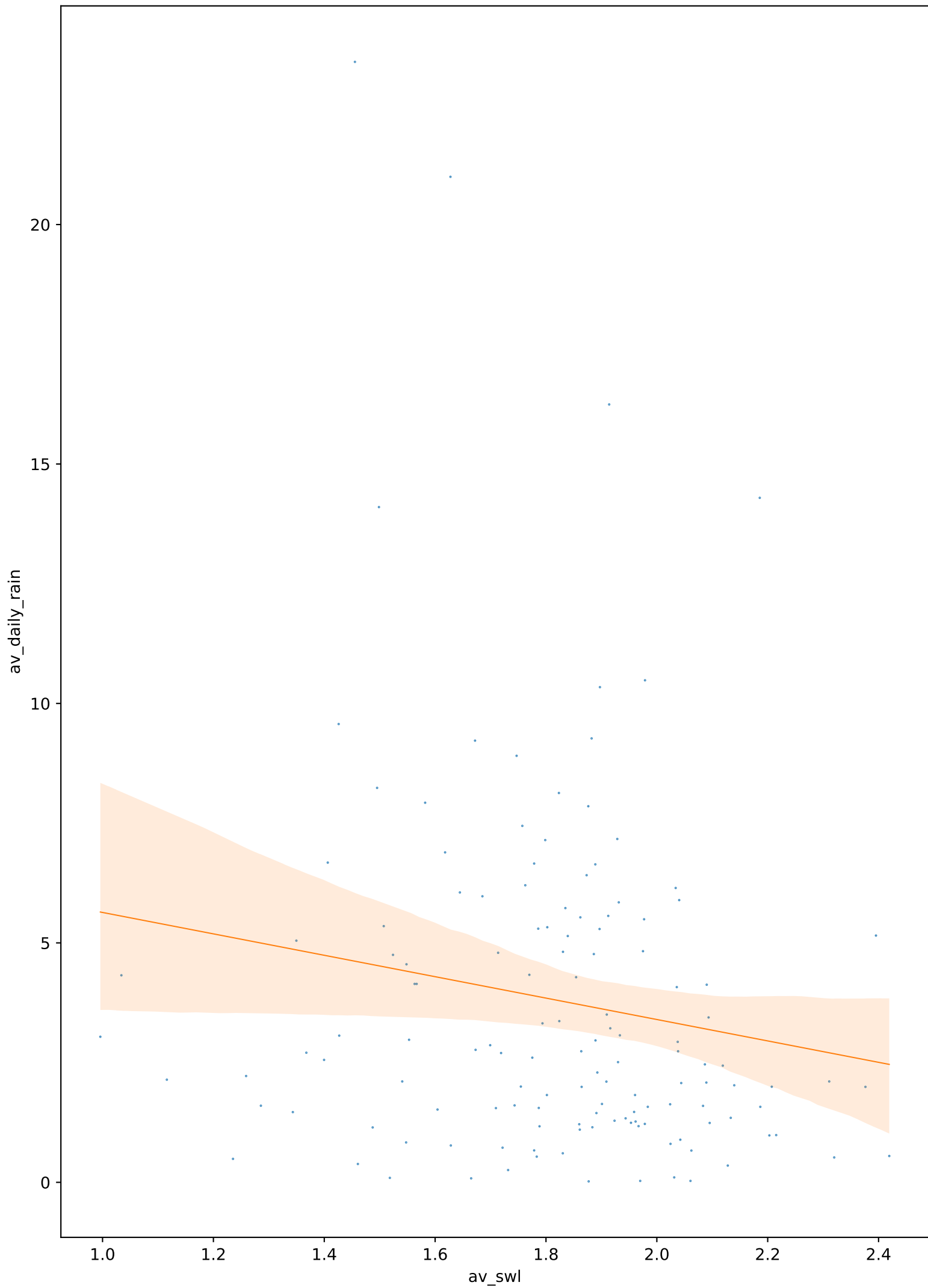
Average Rainfall (mm) - Autocorrelation



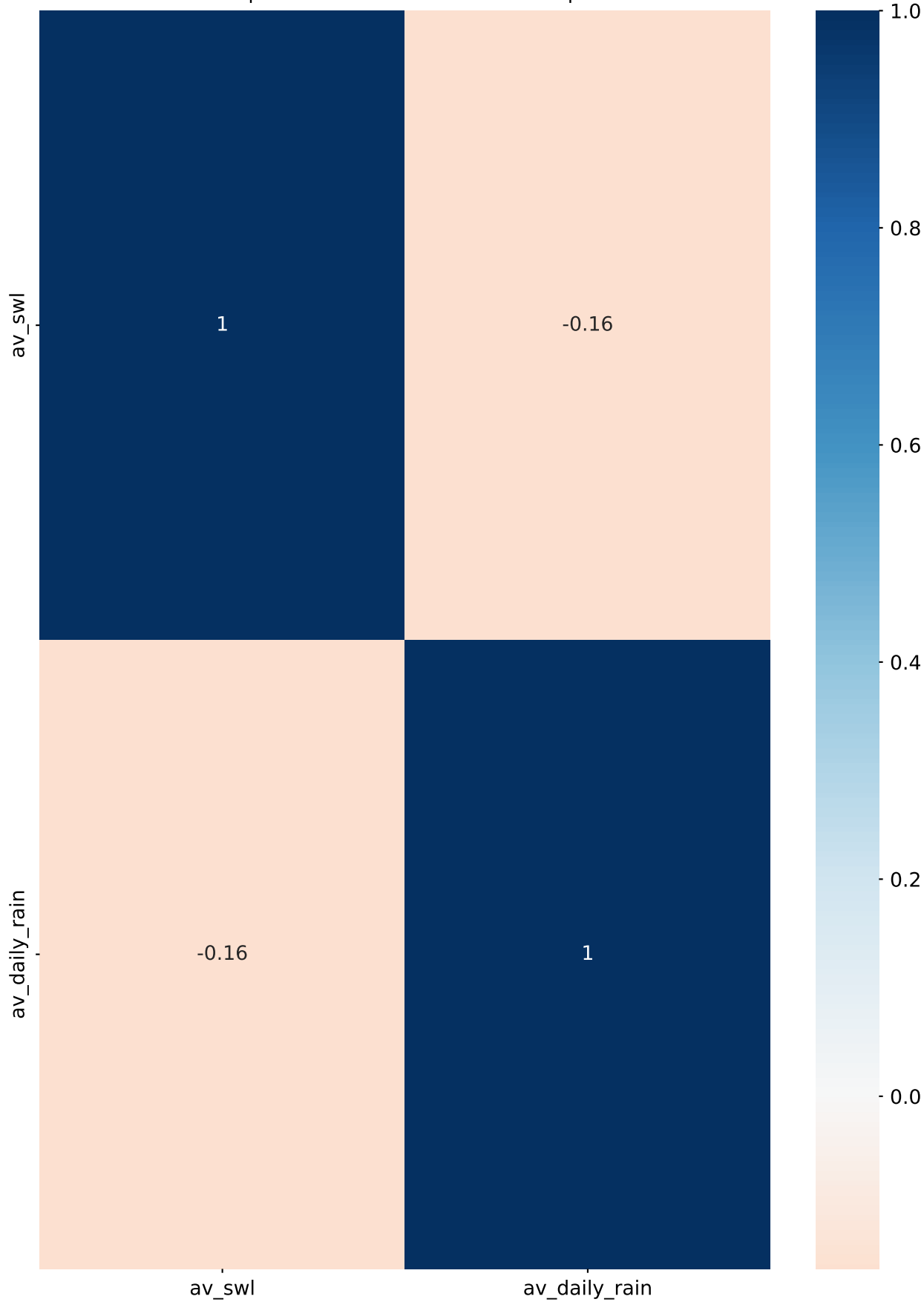
Average Rainfall (mm) - Partial Autocorrelation



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): (108, 3, 2)
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_231"

Layer (type)	Output Shape	Param #
=====		
lstm_251 (LSTM)	(None, 64)	17152
dense_528 (Dense)	(None, 32)	2080
dense_529 (Dense)	(None, 32)	1056
dense_530 (Dense)	(None, 1)	33
=====		
Total params: 20,321		
Trainable params: 20,321		
Non-trainable params: 0		

<><> Training Loss <><>

Epoch: 10, Loss: 0.027808360755443573
Epoch: 20, Loss: 0.0186370387673378
Epoch: 30, Loss: 0.02030717022716999
Epoch: 40, Loss: 0.01714925654232502
Epoch: 50, Loss: 0.012934568338096142
Epoch: 60, Loss: 0.012315220199525356
Epoch: 70, Loss: 0.01644894666969776
Epoch: 80, Loss: 0.013572501949965954
Epoch: 90, Loss: 0.01276190485805273
Epoch: 100, Loss: 0.017354078590869904

<><> Validation Loss <><>

Epoch: 10, Loss: 0.00571411894634366
Epoch: 20, Loss: 0.012617222033441067
Epoch: 30, Loss: 0.010387114249169827
Epoch: 40, Loss: 0.009122180752456188
Epoch: 50, Loss: 0.008086971007287502
Epoch: 60, Loss: 0.0074301124550402164
Epoch: 70, Loss: 0.0086166150867939
Epoch: 80, Loss: 0.006370489485561848
Epoch: 90, Loss: 0.005267314147204161
Epoch: 100, Loss: 0.006230167578905821

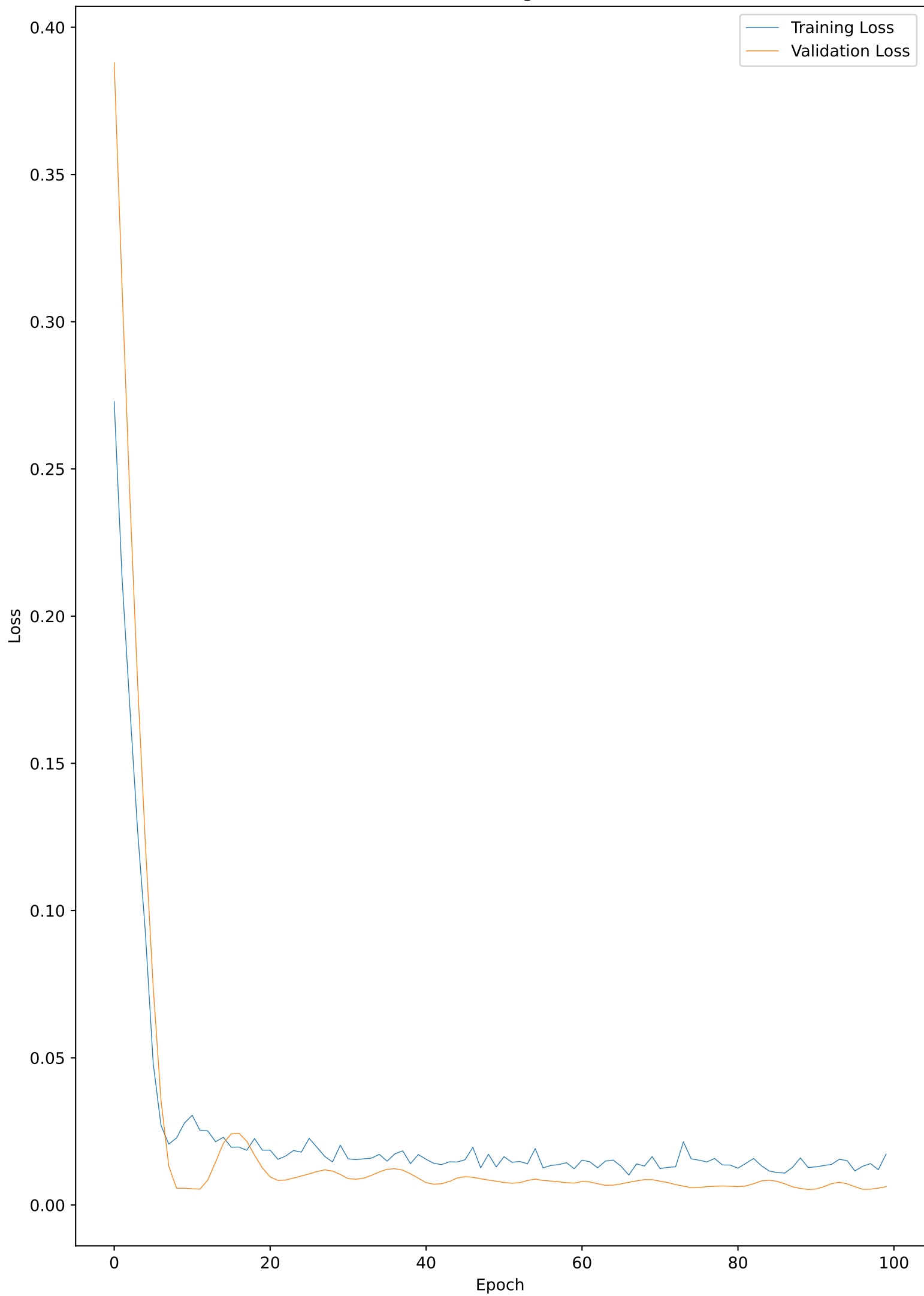
<><> Training Set Scores <><>

Train Root Mean Squared Error: 0.08489
Train Mean Squared Error: 0.00721
Train Normalised Root Mean Squared Error: 0.10814
Train Coefficient of Determination: 0.71111
Train Normalised Nash Sutcliffe Efficiency: 0.77586
Train Mean Absolute Error: 0.06646
Train Pearson's Correlation Coefficient: 0.93297
Train Index of Agreement: 0.87405
Train Kling-Gupta Efficiency: 0.53001
Train Mean Bias Error: -0.00462
Train Mean Absolute Percentage Error: 0.05418

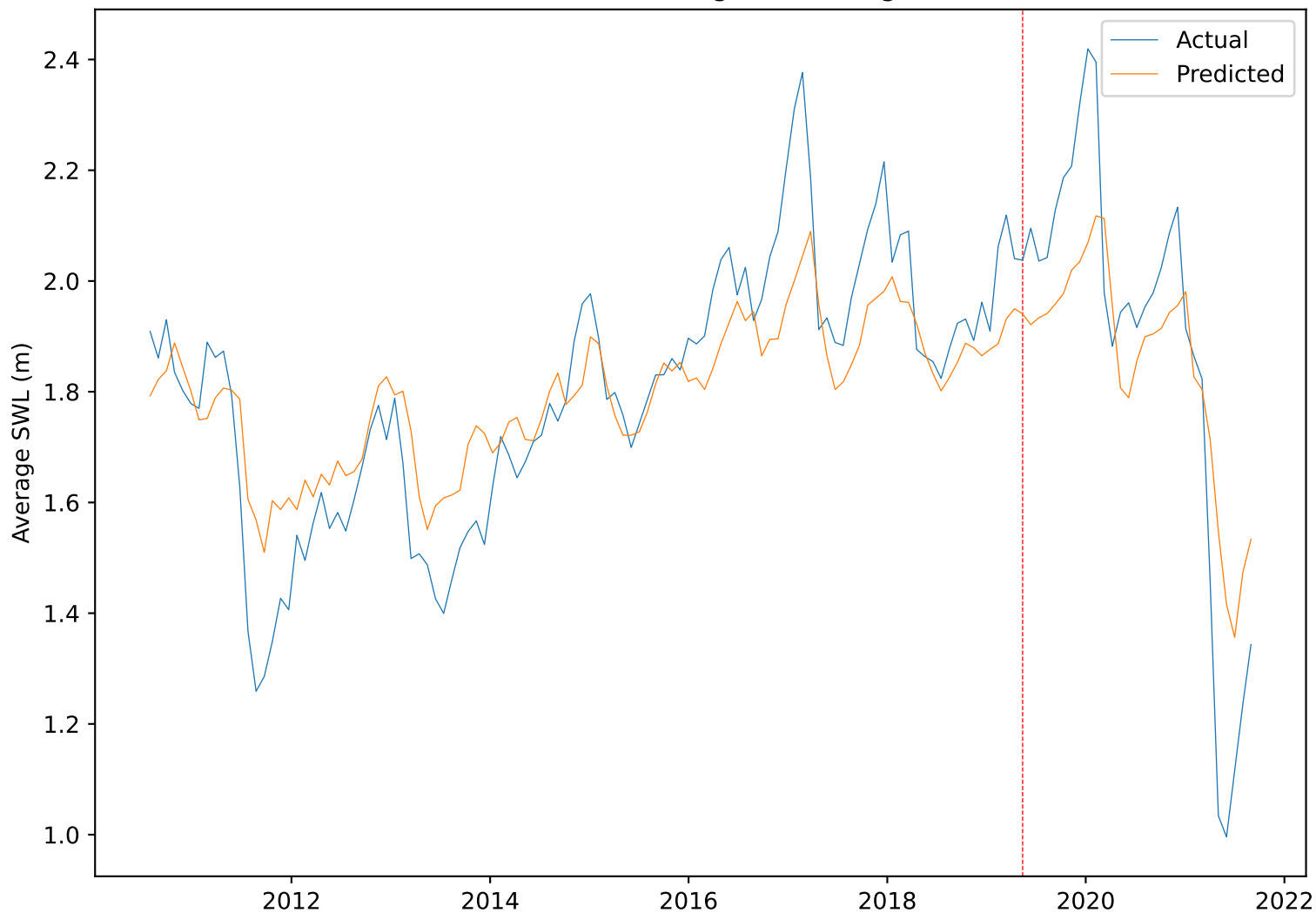
<><> Test Set Scores <><>

Test Root Mean Squared Error: 0.14853
Test Mean Squared Error: 0.02206
Test Normalised Root Mean Squared Error: 0.14853
Test Coefficient of Determination: 0.70503
Test Normalised Nash Sutcliffe Efficiency: 0.77222
Test Mean Absolute Error: 0.12486
Test Pearson's Correlation Coefficient: 0.94154
Test Index of Agreement: 0.86991
Test Kling-Gupta Efficiency: 0.51612
Test Mean Bias Error: -0.01777
Test Mean Absolute Percentage Error: 0.11091

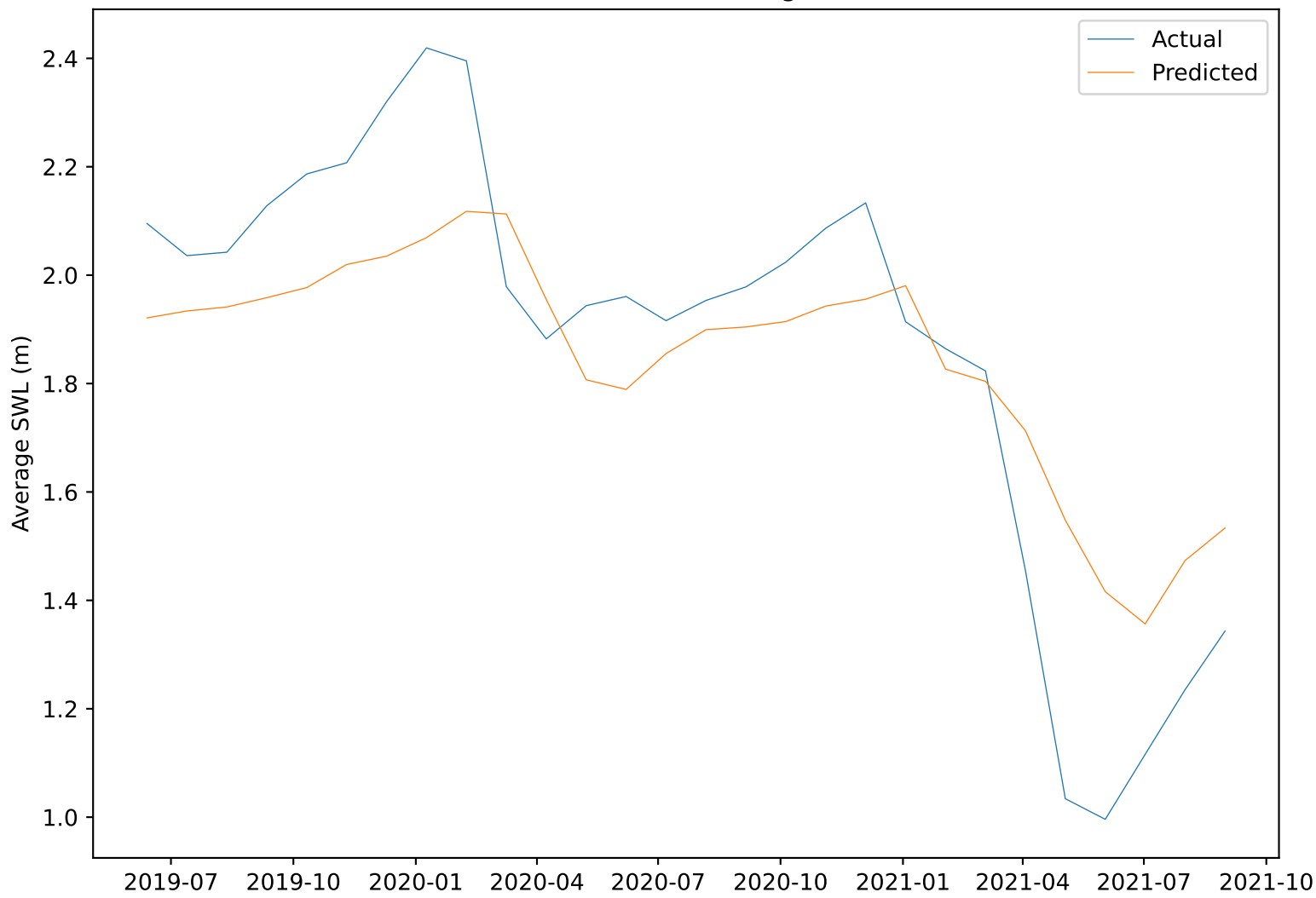
LSTM Learning Curves



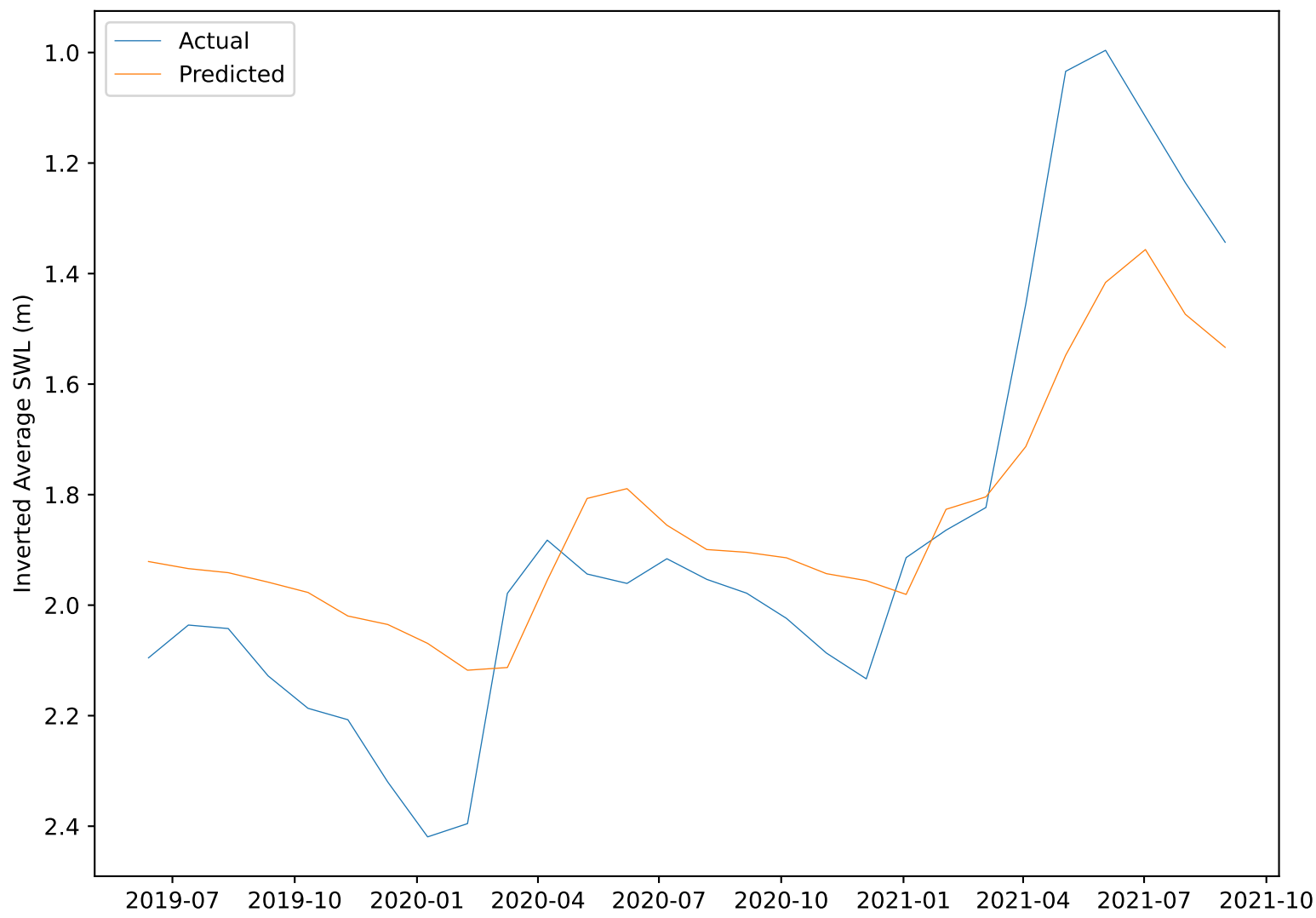
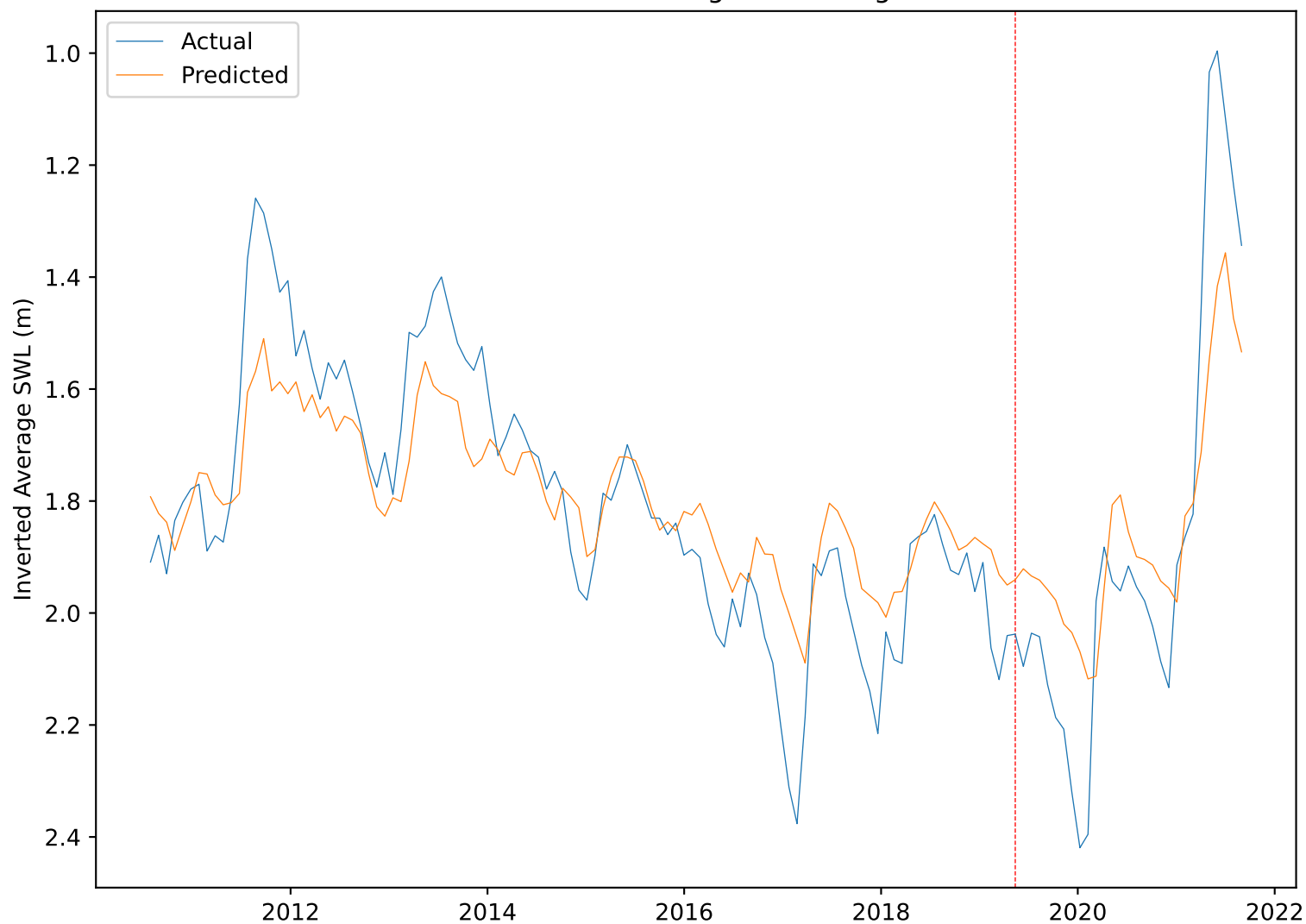
LSTM Model: Training and Testing Sets



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: 15
Input/Support Vector Size: 6

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

Epoch: 8,	Loss: 0.0019374427545810011
Epoch: 16,	Loss: 0.00567416371292689
Epoch: 24,	Loss: 0.004521279978539594
Epoch: 32,	Loss: 0.003903370531878808
Epoch: 40,	Loss: 0.0036151893188993423
Epoch: 48,	Loss: 0.003431399024793989
Epoch: 56,	Loss: 0.003419250432910341
Epoch: 64,	Loss: 0.003429137211266223
Epoch: 72,	Loss: 0.0033985229589354182
Epoch: 80,	Loss: 0.003339700692594195

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

Epoch: 8,	Loss: 0.02183136536234781
Epoch: 16,	Loss: 0.02568272768919654
Epoch: 24,	Loss: 0.027524519166806392
Epoch: 32,	Loss: 0.026476606243362417
Epoch: 40,	Loss: 0.02449853479390369
Epoch: 48,	Loss: 0.024530166551195564
Epoch: 56,	Loss: 0.02066925464506738
Epoch: 64,	Loss: 0.021481066193390567
Epoch: 72,	Loss: 0.010073164262955065
Epoch: 80,	Loss: 0.007383241501958614

<><> Training Set Scores <><>

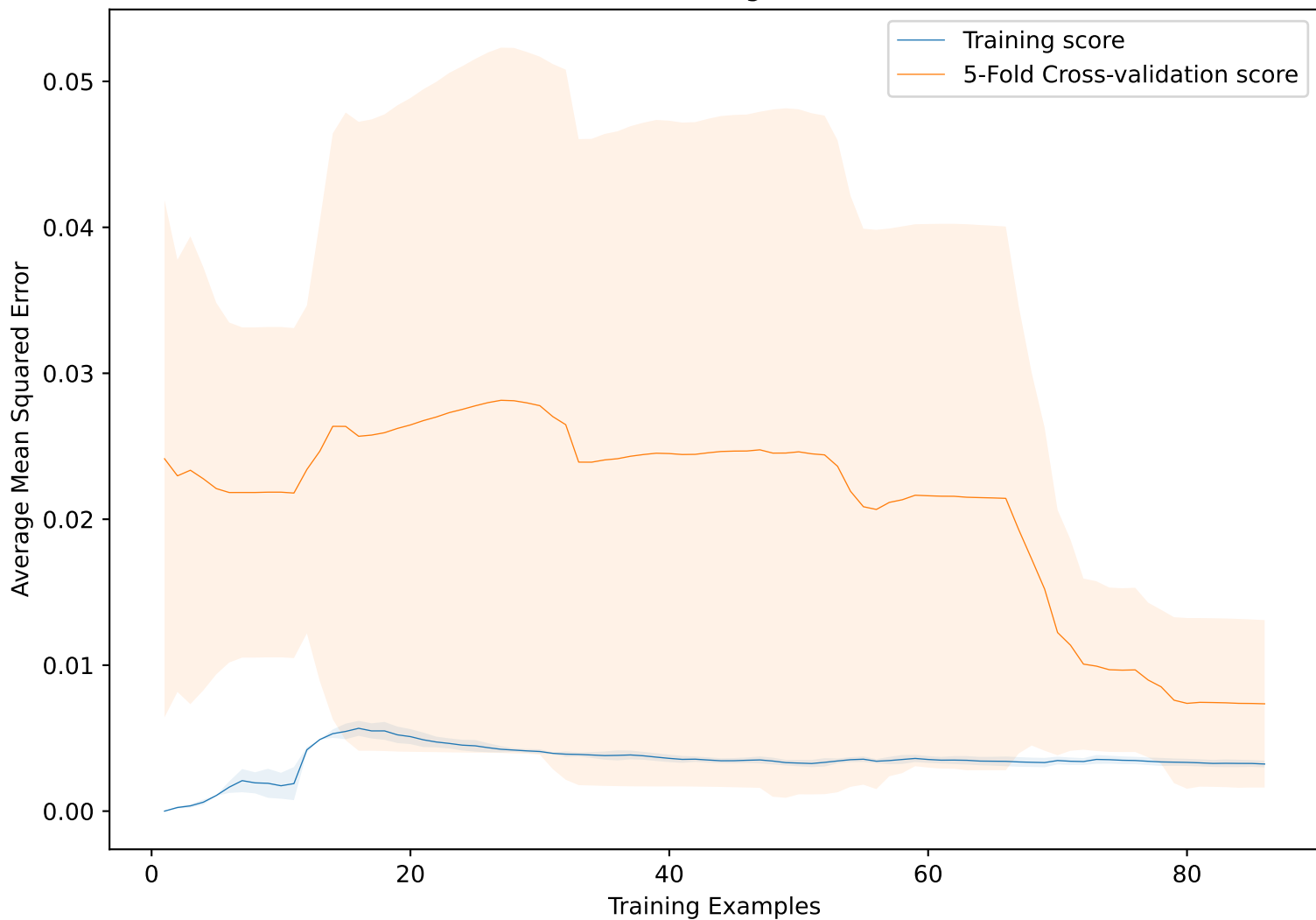
Train Root Mean Squared Error: 0.05559
Train Mean Squared Error: 0.00309
Train Normalised Root Mean Squared Error: 0.07081
Train Coefficient of Determination: 0.87615
Train Normalised Nash Sutcliffe Efficiency: 0.8898

Train Mean Absolute Error: 0.04567
Train Pearson's Correlation Coefficient: 0.94196
Train Index of Agreement: 0.96243
Train Kling-Gupta Efficiency: 0.82777
Train Mean Bias Error: -0.0028
Train Mean Absolute Percentage Error: 0.03693

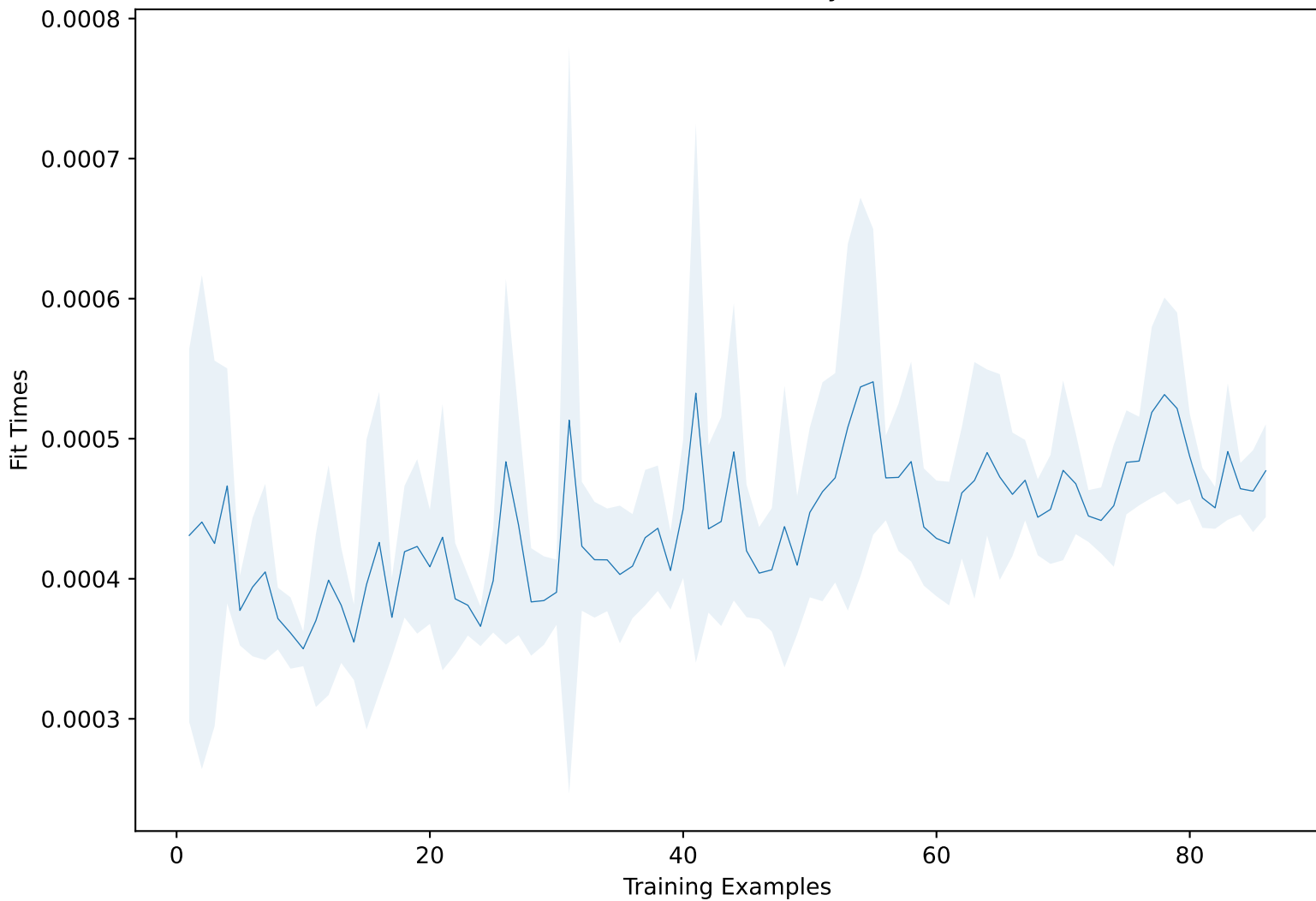
<><> Test Set Scores <><>

Test Root Mean Squared Error: 0.13422
Test Mean Squared Error: 0.01801
Test Normalised Root Mean Squared Error: 0.13422
Test Coefficient of Determination: 0.75913
Test Normalised Nash Sutcliffe Efficiency: 0.80589
Test Mean Absolute Error: 0.09757
Test Pearson's Correlation Coefficient: 0.91287
Test Index of Agreement: 0.90876
Test Kling-Gupta Efficiency: 0.63993
Test Mean Bias Error: 0.02182
Test Mean Absolute Percentage Error: 0.09586

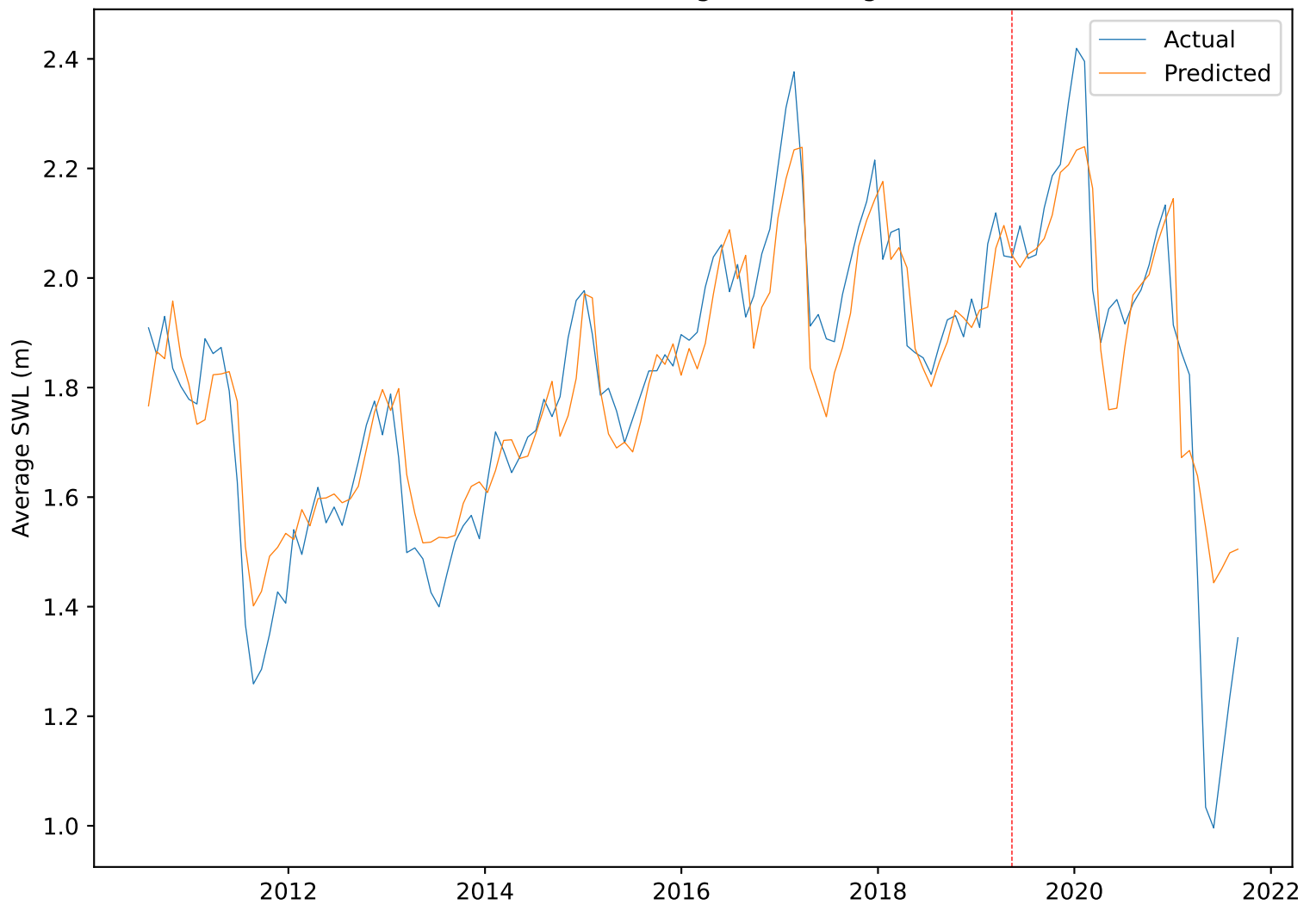
SVR Learning Curve



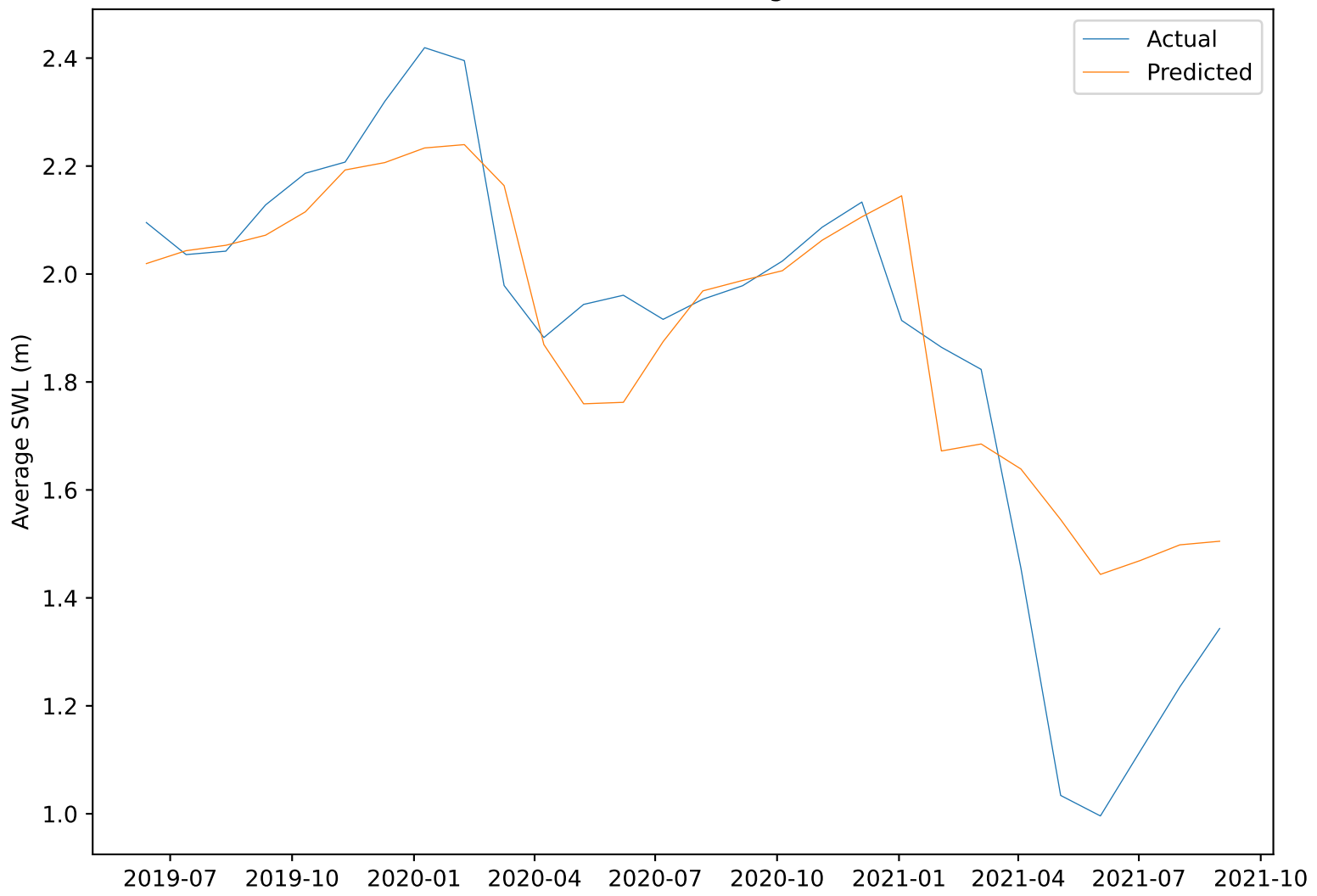
Model Scalability



SVR Model: Training and Testing Sets



SVR Model: Testing Set



SVR Model: Training and Testing Sets

